Washington State Department of Transportation

Memorandum

February 5, 2018

TO: Terminal Design Manual Holders

FROM: Jeff Carpenter
Director, Development Division
(360) 705-7231

Nicole McIntosh
Director, Terminal Engineering
(206) 515-3701

SUBJECT: Terminal Design Manual – Updated Approval Authority

Background

The Terminal Design Manual (TDM) first published in 2012 for use by Washington State Department of Transportation (WSDOT) Ferries Division engineering personnel. It provides guidelines, policies, procedures, and methods for developing and documenting the design of improvements to the Washington State Ferries terminal facilities. To provide consistency in project development documentation across WSDOT divisions, the Assistant State Design Engineer approved several Ferries Division scoping and design documents.

The desired documentation consistency is established and the approval authority is revised, effective December 1, 2017, as shown in the following table. The Assistant State Design Engineer will continue to provide assistance and review of specific approval documents, as well as, meet quarterly with the Ferries Division engineering and project staff to support their project delivery efforts.

Ferry Project Document Approvals

(Effective December 1, 2017)

Project Phase	Document	Approval*
Scoping	Design Decision Summary	WSF EM[1]
	DEAT (Project Specific)	ASDE
Design	TDM Design Deviations	**WSF EM[1]**
	Design Deviations (Highway DM)	ASDE
	Corridor/Project Analysis (TDM)	ASDE
	Evaluate Upgrades	**WSF EM**
	Proprietary Items	**WSF EM**
	Maximum Extent Feasible (MEF)[2]	**ADA Compliance Manager**
	Design Approval[2]	**WSF EM**
	Project Development Approval[2]	**WSF EM**
	Buy America Exclusion Determination	**WSF EM** / FHWA
	State Supplied Materials	**WSF EM** / HQ CPDM

***BOLD** approvals are changes to the 2016 Terminal Design Manual
[1]-ASDE Concurs
[2]-Except for vehicle access road elements outside of terminal property. Region approval required (TDM 500.04).
ASDE - Assistant State Design Engineer
WSF EM - Washington State Ferries Engineering Manager
TDM – Terminal Design Manual (M 3082.05)

ACTIONS REQUIRED

Washington State Ferries Division
Update the Terminal Design Manual (M3082) to reflect the Approval Authorities indicated in the table above. Schedule quarterly meetings with HQ Design Office as needed.

Development Division
Meet with Ferries Division engineering management and project staff as needed. Perform process reviews as needed.

cc: Jay Alexander
Mike Cotten
Steve Roark
Genevieve Rucki
Darrell McCallum
Larry Watkinson
Scott Zeller

Washington State
Department of Transportation

Washington State Ferries

WSF Terminal Design Manual

M 3082.05

April 2016

Division 1 – Manual Overview
Division 2 – Project Development
Division 3 – General Design Criteria
Division 4 – Terminal Buildings
Division 5 – Landside Development
Division 6 – Waterside Development
Division 7 – Miscellaneous
Division 8 – CADD Standards and Procedures
Appendices

Ferries Division
Terminal Engineering Department

Americans with Disabilities Act (ADA) Information

Materials can be made available in an alternate format by emailing the WSDOT Diversity/ADA Affairs Team at wsdotada@wsdot.wa.gov or by calling toll free, 855-362-4ADA (4232). Persons who are deaf or hard of hearing may make a request by calling the Washington State Relay at 711.

Title VI Notice to the Public

It is Washington State Department of Transportation (WSDOT) policy to ensure no person shall, on the grounds of race, color, national origin, or sex, as provided by Title VI of the Civil Rights Act of 1964, be excluded from participation in, be denied the benefits of, or be otherwise discriminated against under any of its federally funded programs and activities. Any person who believes his/her Title VI protection has been violated may file a complaint with WSDOT's Office of Equal Opportunity (OEO). For Title VI complaint forms and advice, please contact OEO's Title VI Coordinator at 360-705-7082 or 509-324-6018.

To get the latest information on WSDOT publications, sign up for individual email updates at www.wsdot.wa.gov/publications/manuals.

Foreword

The *Terminal Design Manual* M 3082 is for use by Washington State Department of Transportation Ferries Division engineering personnel. It provides guidelines, policies, procedures, and methods for developing and documenting the design of improvements to the Washington State Ferries terminal facilities. It may not be appropriate or applicable to ferry terminal facilities outside of Washington State.

The *Terminal Design Manual* M 3082 supplements the engineering analyses and judgment that must be applied to Improvement and Preservation projects. It does not apply to Maintenance projects. The *Terminal Design Manual* M 3082 provides uniform procedures for documenting and implementing design decisions. The manual is intended to provide guidelines that result in the most efficient balance between capital and operating investments and that adhere to operational strategies, and vehicle level of service standards.

The design environment changes rapidly, often without warning to the practitioner. To track every change, and to make improvements based upon each change, is not feasible. The intent of this manual is to provide guidance on a consistent approach to WSF ferry terminal design.

Flexibility is permitted to encourage independent design tailored to individual situations. However, when flexibility is applied to a proposed design and the critical criteria do not comply with the *Terminal Design Manual* M 3082, additional documentation is required to record the decision- making process.

The addition of new or modified design criteria to the *Terminal Design Manual* M 3082 through the revision process does not imply that existing features are deficient or inherently dangerous. Nor does it suggest or mandate immediate engineering review or the initiation of new projects.

The *Terminal Design Manual* M 3082 emphasizes cost-effective, environmentally conscious, and context sensitive design. Designers are encouraged to view the ferry terminal system beyond the vehicular movement context, so guidance regarding the use of the ferry system by transit, pedestrians, motorcyclists and bicyclists is included.

The complexity of transportation design requires the designer to make fundamental trade-off decisions that balance competing considerations. Although this adds to the complexity of design, it acknowledges the unique needs of specific projects and the relative priorities of various projects and programs. Improvements must necessarily be designed and prioritized in light of finite transportation funding.

Updating the *Terminal Design Manual* M 3082 is an ongoing process and revisions are issued regularly. Comments, questions, and improvement ideas are welcomed. Use the comment form on the following page or the online version at the Design Policy Internet Page: www.wsdot.wa.gov/design/policy

/s/ Nicole McIntosh	/s/ Pasco Bakotich III
Nicole McIntosh, P.E. Director of Terminal Engineering	**Jeff Carpenter, P.E.** Director and State Design Engineer, Development Division

Comment Form

From: _____ _____ _____ _____	Date: _____ Phone: _____

To: WSDOT Ferries Division
Terminal Engineering Mail Stop TB83
2901 3rd Ave., Ste 500 Seattle, WA 98121-1042

Subject: WSF *Terminal Design Manual* M 3082 Comment

Comment (marked copies attached):

Contents

Division 1 Manual Overview

Chapter 100 Manual Description 100-1
100.01 Purpose 100-1
100.02 Presentation and Revisions 100-1
100.03 Manual Applications 100-2
100.04 Manual Use 100-2
100.05 Manual Organization 100-3

Division 2 Project Development

Chapter 200 Capital Project Scoping 200-1
200.01 General 200-1
200.02 References 200-1
200.03 Preservation Projects 200-3
200.04 Improvement Projects 200-6
200.05 Scoping Procedures 200-10
200.06 Predesign Studies 200-23
200.07 Level of Service 200-24

Chapter 205 External Project Scoping and Review Requirements 205-1
205.01 General 205-1
205.02 References 205-1
205.03 Security Scoping and Project Review Requirements 205-2
205.04 Information Technology and Intelligent Transportation Systems Scoping and Project Review Requirements 205-3
205.05 Operations Scoping and Project Review Requirements 205-6

Chapter 210 Design Matrix Procedures 210-1
210.01 General 210-1
210.02 Selecting a Design Matrix 210-1
210.03 Using a Design Matrix 210-2

Chapter 220 Design Documentation, Approval and Process Review . . . 220-1
220.01 General . . . 220-1
220.02 References . . . 220-2
220.03 Definitions . . . 220-3
220.04 Design Documentation . . . 220-6
220.05 Project Development . . . 220-8
220.06 Design Approval . . . 220-11
220.07 Project Development Approval . . . 220-12
220.08 Combined Design Approval/Project Development Approval . . . 220-14
220.09 FTA Triennial Review . . . 220-14
220.10 Design Drawing Production . . . 220-15
Chapter 230 Quality and Constructability . . . 230-1
230.01 General . . . 230-1
230.02 References . . . 230-1
230.03 Definitions . . . 230-3
230.04 Roles and Responsibilities . . . 230-5
230.05 Project Management Plan . . . 230-8
230.06 Quality Control . . . 230-9
230.07 Quality Assurance . . . 230-10
230.08 Quality Control/Quality Assurance (Consultant Designed Projects) 230-14
230.09 Quality Control/Quality Assurance (Structures) . . . 230-15
230.10 Project Goal Requirements . . . 230-21
230.11 Advertisement . . . 230-21
230.12 Limited Public Works Contracts . . . 230-24

Division 3 General Design Criteria

Chapter 300 Accessibility . . . 300-1
300.01 General . . . 300-1
300.02 References . . . 300-2
300.03 Definitions . . . 300-4
300.04 Policy . . . 300-4
300.05 ADA Requirements by Project Type . . . 300-5
300.06 Terminal Facilities . . . 300-7
300.07 Staff Facilities at Terminals . . . 300-16
300.08 Site Design Considerations . . . 300-18
300.09 Gangways . . . 300-20
300.10 Pedestrian Features with DOT Rights-of-Way . . . 300-21
300.11 Documentation . . . 300-21
300.12 People First Language . . . 300-22

Chapter 310 Security 310-1
310.01 General 310-1
310.02 References 310-1
310.03 Design Considerations 310-2
310.04 MARSEC Levels 310-2
310.05 Vessel Security 310-3
310.06 Passenger Security Screening Area 310-3
310.07 Security Rooms 310-3
310.08 Toll Plaza and Vehicle Holding Area 310-4
310.09 Waterside Structures 310-5
310.10 Access Control / Restricted Areas / TWIC 310-6
310.11 Closed Circuit Television 310-6
310.12 Panic Buttons 310-6
310.13 Signage 310-7
310.14 Sensitive Security Information (SSI) 310-7
Chapter 320 Environmental Considerations 320-1
320.01 General 320-1
320.02 References 320-2
320.03 Determining the Environmental Documentation 320-2
320.04 Design Process and Permit Interaction 320-3
320.05 Environmental Commitments Meeting 320-4
320.06 Environmental Review and Permitting 320-4
320.07 Environmental Considerations 320-8
320.08 Land Use 320-14
320.09 Air Quality 320-15
320.10 Noise 320-17
320.11 Water Quality 320-18
320.12 Propwash, Vessel Wakes, and Sedimentation 320-19
320.13 Ecosystems and Protected Species 320-20
320.14 Earth (Geology and Soils) 320-22
320.15 Hazardous Materials 320-23
320.16 Traffic/Congestion 320-24
320.17 Visual Quality 320-25
320.18 Tribal Resources and Treaty Rights 320-25
320.19 Cultural, Historical, and Archaeological Resources 320-26
320.20 Park and Recreation Lands 320-27
320.21 Department of Natural Resources Lands 320-27
320.22 Resource Agency and Tribal Coordination 320-28

Chapter 330 Marine 330-1
330.01 General 330-1
330.02 References 330-3
330.03 Design Specifications Matrix 330-5
330.04 Design Considerations 330-5
330.05 Vessels 330-11
330.06 Tidal Information 330-16
330.07 Slips 330-21
330.08 Berthing and Mooring Criteria 330-27
330.09 Wave, Flood, and Coastal Storm Loading 330-29
Chapter 340 Civil 340-1
340.01 General 340-1
340.02 References 340-3
340.03 Design Considerations 340-3
340.04 Project Datum 340-6
340.05 Site Preparation 340-7
340.06 Grading and Erosion Control 340-8
340.07 Roadway Design and Channelization 340-9
340.08 Pavement Design 340-12
340.09 Traffic Control 340-15
Chapter 350 Buildings 350-1
350.01 General 350-1
350.02 References 350-2
350.03 Design Considerations 350-4
350.04 Building Structures 350-6
350.05 Building Foundations 350-9
350.06 Building Utilities 350-10
350.07 Building Permits 350-12
Chapter 360 Electrical 360-1
360.01 General 360-1
360.02 References 360-1
360.03 Design Considerations 360-2
360.04 Wiring and Protection 360-6
360.05 Wiring Methods and Materials 360-10
360.06 Equipment 360-14
360.07 Lighting 360-18

Division 4 Terminal Buildings

Chapter 400 Passenger Buildings 400-1
400.01 General 400-1
400.02 References 400-3
400.03 Design Considerations 400-3
400.04 Passenger Building Spaces 400-4
400.05 Circulation, Structure, and Envelope Multipliers 400-5
400.06 Facility Entry 400-5
400.07 Customer Information 400-6
400.08 Ticketing and Queuing 400-7
400.09 Passenger Waiting Areas 400-8
400.10 Passenger Conveniences 400-8
400.11 Passenger Security Screening Area 400-10
400.12 Lost and Found 400-10
400.13 Attendant Control Station 400-10
400.14 Passenger Control Point 400-10
400.15 Luggage Cart and Wheelchair Storage 400-11
400.16 Security Interview Room 400-11
400.17 Restrooms and Water Fountains 400-12
400.18 Janitor Storage 400-13
400.19 IT Equipment Network Room 400-13
400.20 Terminal Electrical Room 400-14
400.21 Elevator Machine Room 400-15
400.22 Retail, Concessions, and Lease Space 400-15

Chapter 410 Circulation and Passenger Waiting 410-1
410.01 General 410-1
410.02 References 410-2
410.03 Design Considerations 410-3
410.04 Passenger Waiting Areas 410-4
410.05 Passenger Circulation 410-19
410.06 Boarding/Departing Routes 410-20

Chapter 420 Passenger Amenities, Business Case 420-1
420.01 Elements of the Business Case 420-1
420.02 Special Topics 420-4

Chapter 430 Terminal Supervisor Buildings 430-1
430.01 General 430-1
430.02 References 430-2
430.03 Design Considerations 430-3
430.04 Terminal Supervisor Building Spaces 430-4

Chapter 440 Maintenance Buildings, Enclosures, and Support Areas . . 440-1
440.01 General . . . 440-1
440.02 References . . . 440-3
440.03 Design Considerations . . . 440-3
440.04 Terminal Maintenance Building . . . 440-5
440.05 Vessel Maintenance Building . . . 440-8
440.06 Miscellaneous Structures, Enclosures, and Support Areas . . . 440-11
Chapter 450 Architecture . . . 450-1
450.01 General . . . 450-1
450.02 References . . . 450-2
450.03 Design Considerations . . . 450-2
450.04 Building Code Requirements . . . 450-4
450.05 Building Permits . . . 450-4
450.06 WSF Architectural Guidelines . . . 450-5
450.07 LEED® Certification . . . 450-10
450.08 Public Art Requirements . . . 450-11
Chapter 460 Landscape Architecture . . . 460-1
460.01 General . . . 460-1
460.02 References . . . 460-2
460.03 Design Considerations . . . 460-2
460.04 Pedestrian Pavement / Hardscape: . . . 460-3
460.05 Landscaping . . . 460-4
460.06 Lighting . . . 460-9
460.07 Site Furnishings . . . 460-9
460.08 Signage and Informational Kiosks . . . 460-10
460.09 Public Art . . . 460-10
Chapter 470 Public Art . . . 470-1
470.01 General . . . 470-1
470.02 References . . . 470-1
470.03 Public Art Requirements . . . 470-2
470.04 Use of Funds for Art . . . 470-2
470.05 Criteria for Public Art . . . 470-3
470.06 Process and Project Delivery Plan . . . 470-5
470.07 Approvals . . . 470-6
470.08 Documentation . . . 470-6

Division 5 Landside Development

Chapter 500 Access, Approaches, and Exits 500-1
500.01 General 500-1
500.02 References 500-2
500.03 Design Considerations 500-3
500.04 Vehicle Access Road 500-4
500.05 Vehicle Exits 500-8
500.06 HOV and Transit Access 500-9
500.07 Pedestrian Access and Exits 500-10
500.08 Bicycle Access and Exits 500-11
500.09 Perimeter Fences and Gates 500-12

Chapter 510 Toll Plaza 510-1
510.01 General 510-1
510.02 References 510-3
510.03 Design Considerations 510-3
510.04 Toll Plaza Elements 510-5
510.05 Determining Number of Toll Booths 510-10
510.06 Operational Strategies 510-12
510.07 Toll Plaza Signage 510-13

Chapter 520 Vehicle Holding and Support Areas 520-1
520.01 General 520-1
520.02 References 520-2
520.03 Design Considerations 520-3
520.04 Vehicle Holding 520-4
520.05 Motorcycle/Bicycle Access and Holding 520-11
520.06 Outdoor Passenger Waiting Area 520-12
520.07 Passenger Amenities 520-12
520.08 Landscaping 520-14

Chapter 530 Parking 530-1
530.01 General 530-1
530.02 References 530-2
530.03 Design Considerations 530-3
530.04 Parking Program Elements 530-4
530.05 Parking Area Design 530-4
530.06 Employee Parking 530-5
530.07 Passenger Parking 530-6
530.08 Miscellaneous Parking 530-7

Chapter 540 HOV and Transit 540-1
540.01 General 540-1
540.02 References 540-2
540.03 Design Considerations 540-2
540.04 Transit Facilities 540-3
540.05 Commuter Rail 540-7
540.06 HOVs and Taxis 540-7
Chapter 550 Site Circulation 550-1
550.01 General 550-1
550.02 References 550-2
550.03 Design Considerations 550-2
550.04 Public Access 550-4
550.05 Vertical Circulation 550-6
550.06 Vehicle Circulation 550-7
550.07 Building Circulation 550-9
Chapter 560 Site Utilities 560-1
560.01 General 560-1
560.02 References 560-1
560.03 Design Considerations 560-2
560.04 Potable Water 560-5
560.05 Fire Protection 560-7
560.06 Sanitary Sewer 560-9
560.07 Stormwater 560-10
560.08 Natural Gas 560-13
560.09 Site Power 560-13
560.10 Site Lighting 560-13
560.11 Communications 560-13
Chapter 570 Signage and Wayfinding 570-1
570.01 General 570-1
570.02 References 570-2
570.03 Design Considerations 570-3
570.04 Signage and Wayfinding Types 570-3
570.05 Signage Functions 570-7
570.06 Signage Manuals 570-18
570.07 Signage by Location 570-19
Chapter 580 Sustainability/Low Impact Development 580-1

Division 6 Waterside Development

Chapter 600 Trestle 600-1
600.01 General 600-1
600.02 References 600-4
600.03 Design Considerations 600-5
600.04 Trestle Components 600-8
600.05 Trestle Civil Design 600-11
600.06 Trestle Structural Design 600-11
600.07 Bulkhead Structural Design 600-14
600.08 VTS Bridge Seat Structural Design 600-15
600.09 Trestle Utilities 600-16

Chapter 610 Vehicle Transfer Span 610-1
610.01 General 610-1
610.02 References 610-3
610.03 Design Considerations 610-4
610.04 VTS Components (H-Span) 610-8
610.05 VTS Gradients 610-11
610.06 Structural Design Criteria 610-13
610.07 VTS Piped Utilities 610-23
610.08 Mechanical Design Criteria 610-25
610.09 Electrical Design Criteria 610-36

Chapter 620 Passenger Overhead Loading 620-1
620.01 General 620-1
620.02 References 620-4
620.03 Design Considerations 620-6
620.04 OHL Components 620-10
620.05 Structural Design Criteria 620-14
620.06 OHL Utilities 620-16
620.07 Mechanical Design Criteria 620-18
620.08 Electrical Design Criteria 620-31
620.09 Architectural Design Criteria 620-36

Chapter 630 Wingwalls 630-1
630.01 General 630-1
630.02 References 630-3
630.03 Design Considerations 630-4
630.04 Design Criteria 630-5
630.05 Wingwall Alternatives 630-8
630.06 Miscellaneous Design 630-9

Chapter 640 Fixed Dolphins 640-1
640.01 General 640-1
640.02 References 640-2
640.03 Design Considerations 640-3
640.04 Design Criteria 640-4
640.05 Fixed Dolphin Alternatives 640-6
640.06 Miscellaneous Design 640-7
Chapter 650 Floating Dolphins 650-1
650.01 General 650-1
650.02 References 650-2
650.03 Design Considerations 650-3
650.04 Design Criteria 650-4
650.05 Stability 650-9
650.06 Anchor System 650-10
650.07 Fender System 650-10
650.08 Towing System 650-10
650.09 Miscellaneous Design 650-10

Division 7 Miscellaneous

Chapter 700 Maintenance 700-1
Chapter 710 Overweight Vehicle Check 710-1
Chapter 720 Scour 720-1
Chapter 730 Bridge Rating 730-1

Division 8 CADD Standards and Procedures

Division 8 CADD Standards and Procedures 800-1
801 Introduction 800-2
801.01 Purpose and Scope 800-2
801.02 Procedure for Revisions and Updates 800-2
802 WSF CADD Software 800-3
802.01 General 800-3
802.02 File Sharing/Delivery 800-3
803 MicroStation Resource and Support Files 800-4
803.01 Fonts 800-4
803.02 Line Styles 800-5
803.03 Pen Table 800-6
803.04 Color Table 800-8
803.05 Seed Files 800-9

804 Project Naming 800-18
804.01 Project Naming Convention 800-18
805 Directory Structure 800-19
805.01 Project Directory 800-19
806 File Names 800-20
806.01 File Extensions 800-20
806.02 File Naming 800-22
807 Plan Sequence 800-27
807.01 Plan Sequence List 800-27
808 Drawing List 800-28
808.01 Drawing List Example 800-28
809 Drafting Standards 800-29
809.01 Plan Sheet Size 800-29
809.02 Permit and Repair Letter Sheet Layout 800-33
809.03 WSF Borders 800-33
809.04 WSF Monuments 800-37
809.05 Referencing Note 800-40
809.06 Sheet Numbering 800-41
809.07 Text 800-42
809.08 Recommended Scales 800-43
809.09 Addendums, Revisions and Change Orders 800-44
809.10 Preliminary Stamps 800-44
809.11 Element Symbology 800-44
809.12 Civil and Right-of-Way Level Symbology 800-44
809.13 Existing Architectural Level Symbology 800-45
809.14 Architectural Demolition Symbology 800-46
809.15 Proposed Architectural Symbology 800-48
809.16 Existing Electrical Symbology 800-50
809.17 Electrical Demolition Symbology 800-51
809.18 Proposed Electrical Symbology 800-52
809.19 General Sheet Symbology 800-53
809.20 Existing Landscape Symbology 800-54
809.21 Landscape Demolition Symbology 800-56
809.22 Proposed Landscape Symbology 800-58
809.23 Existing Mechanical Symbology 800-60
809.24 Mechanical Demolition Symbology 800-61
809.25 Existing Security Symbology 800-63
809.26 Security Demolition Symbology 800-63
809.27 Proposed Security Symbology 800-64

809.28 Existing Structural Symbology 800-64
809.29 Structural Demolition Symbology 800-66
809.30 Proposed Structural Symbology 800-68
809.31 Abbreviations 800-69
809.32 Standard Drawings 800-88
809.33 Updating Project Basemaps 800-89

810 Plan Submittals 800-90
810.01 Submittals Scheduling 800-90
810.02 Submittal Border Example 800-90
810.03 Review Submittals 800-91
810.04 Final Submittals 800-91
810.05 Design File Archiving 800-91
810.06 As-Built Drawings 800-92

811 Environmental Permit Standards 800-93
811.01 Permit Drawing Checklist 800-93
811.02 Format of Drawings 800-94

812 General Plan Sheets 800-97

813 Civil Plan Sheet Series 800-98

814 Structural Plan Sheet Series 800-99

815 Fluid Power Hydraulic Plan Sheet Series 800-100

816 Electrical Design Drawing Series 800-101

817 Mechanical Design Drawing Series 800-104

Appendices

Appendix A	Acronyms and Abbreviations	A-1
Appendix B	Definitions	B-1
Appendix C	Comment Review Form	C-1
Appendix D	Quality Audit Sign-Off Sheet	D-1
Appendix E	Quality Control Color Code	E-1
Appendix F	Project Management Plan	F-1
Appendix G	Checking Process Flow Chart	G-1
Appendix H	DQC Sign-Off Sheet	H-1
Appendix I	Deliverables Expectation Matrices	I-1
Appendix J	Project Status Report	J-1
Appendix K	PS&E Turn-In QA/QC Process	K-1
Appendix L	Review Checklist Templates	L-1
Appendix M	Step-by-Step Instructions on Submitting Plans for Advertisement	M-1
Appendix N	Environmental Compliance Plan	N-1
Appendix O	Vessel Data for Terminal Design	O-1
Appendix P	Route Information	P-1
Appendix Q	Terminal Reference Data	Q-1
Appendix R	Terminal Site Plans	R-1
Appendix S	Terminal Building Programs	S-1
Appendix T	Terminal Signage Plan	T-1
Appendix U	Design/Project Development Approval Templates	U-1
Appendix V	Memorandum of Understanding Arts in Public Places Washington Arts Commission and Washington State Department of Transportation	V-1
Appendix W	Trestle Pavement Depths	W-1
Appendix X	Terminal Tidal Information	X-1
Appendix Y	Vacant	Y-1
Appendix Z	Terminal Vertical Datums	Z-1
Appendix AA	Vehicle Transfer Span Gradients	AA-1

Exhibits

Exhibit 200-1	Equivalent Projects for Determination of Preliminary and Construction Engineering Soft Cost Markups
Exhibit 200-2	LOS by Route – Percent of Sailings Filled
Exhibit 205-1	Typical Information Technology Room Layout
Exhibit 210-1	Matrix 1: Waterside Preservation
Exhibit 210-2	Matrix 2: Upland Preservation
Exhibit 210-3	Matrix 3: Terminal Facility Buildings Preservation
Exhibit 210-4	Matrix 4: Improvement Projects
Exhibit 220-1	Design Matrix Documentation Requirements
Exhibit 220-2	Approvals (1 of 2)
Exhibit 220-3	PS&E Process Approvals
Exhibit 220-4	WSF Terminals Design Documentation Package (DDP) Checklist
Exhibit 220-5	Evaluate Upgrade (EU) Documentation Contents List
Exhibit 220-6	Deviation Request and Project Analysis Contents List
Exhibit 230-1	Project Roles and Responsibilities
Exhibit 230-2	Project Goals Requirements
Exhibit 230-3	Documents/ Information In Need for Capital Construction Project Work Order(s)
Exhibit 300-1	WSF ADA Tollbooth Design
Exhibit 320-1	Federal Permits and Approvals
Exhibit 320-2	State Permits and Approvals
Exhibit 320-3	Local Permits and Approvals
Exhibit 320-4	Systemwide and Programmatic Permits
Exhibit 320-5	Environmental Considerations Matrix

Exhibit 330-1	Vashon Ferry Terminal Slip 1
Exhibit 330-2	Example Marine Structures Layout
Exhibit 330-3	Structural Design Specifications Matrix
Exhibit 330-4	Design Vessels
Exhibit 330-5	Vessel Conditions
Exhibit 330-6	Vessel Diagrams
Exhibit 330-7	WSF Ferry Terminal Vessel Utilities
Exhibit 330-8	WSF Ferry System Routes and Terminal Locations
Exhibit 330-9	General Arrangement of Terminal Tidal Datums, Design Water Levels and Vertical Project Datum
Exhibit 330-10	Terminal Tidal Datums
Exhibit 330-11	Terminal Design Tidal Ranges
Exhibit 330-12	Existing Slips
Exhibit 330-13	Typical Slip Layout – Single Slip
Exhibit 330-14	Typical Slip Layout - Two Parallel Slips
Exhibit 340-1	Kingston Ferry Terminal Layout
Exhibit 340-2	Example Terminal Layout – Site Design
Exhibit 340-3	Terminal Horizontal and Vertical Datums
Exhibit 350-1	Example Site Layout - Terminal Buildings
Exhibit 350-2	Building Utility Design Specifications Matrix
Exhibit 360-1	Control Wire and Cable Labeling
Exhibit 360-2	Electrical Equipment Labeling Convention
Exhibit 360-3	Grounding Electrode Conductor for Alternating Current Systems
Exhibit 360-4	Conductor Insulation Requirements
Exhibit 360-5	Indoor Illumination Requirements
Exhibit 360-6	Outdoor Illumination Requirements
Exhibit 400-1	Clinton Ferry Terminal Passenger Building
Exhibit 400-2	Example Passenger Building Layout
Exhibit 400-3	Passenger Building Spaces
Exhibit 400-4	Certified Folder Display
Exhibit 400-5	Electronic Fare System Kiosks
Exhibit 400-6	Passenger Convenience Sizing Guidelines
Exhibit 400-7	Passenger Conveniences at Edmonds Ferry Terminal
Exhibit 400-8	Passenger Conveniences at Anacortes Ferry Terminal
Exhibit 400-9	Location of Passenger Restrooms by Terminal
Exhibit 400-10	Clinton Ferry Terminal IT Equipment Network Room
Exhibit 400-11	Clinton Ferry Terminal Electrical Room
Exhibit 400-12	Example Retail Facilities at WSF Terminals
Exhibit 400-13	Cheesecake Café at Anacortes Ferry Terminal
Exhibit 400-14	Café Appassionato at Seattle Ferry Terminal

Exhibit 410-1	Vashon Terminal Building Passenger Waiting Area
Exhibit 410-2	Example Passenger Waiting Area Layout within Passenger Building
Exhibit 410-3	WSF Route Type Designation
Exhibit 410-4	Arrival Patterns for Walk-on Passengers
Exhibit 410-5	Arrival Patterns for Drive-on Passengers
Exhibit 410-6	Walk-on Passengers Using Terminal Waiting Areas
Exhibit 410-7	Drive-on Passengers Using Terminal Waiting Areas
Exhibit 410-8	Sizing Passenger Waiting Areas for Walk-on Passengers
Exhibit 410-9	Sizing Passenger Waiting Areas for Drive-on Passengers
Exhibit 410-10	Calculation of Passenger Waiting Area Size
Exhibit 410-11	Estimated Turnstile Requirements for 2030
Exhibit 410-12	Turnstile Processing Capacity – Sample Calculation
Exhibit 420-1	Life Cycle Cost (NPV)
Exhibit 430-1	Clinton Ferry Terminal/Terminal Supervisor Building
Exhibit 430-2	Example Layout for Terminal Supervisor Building
Exhibit 430-3	Terminal Supervisor Building Spaces
Exhibit 430-4	Vashon Ferry Terminal Supervisor Office
Exhibit 440-1	Kingston Ferry Terminal Outbuildings
Exhibit 440-2	Example Layout for Maintenance Buildings and Enclosures
Exhibit 440-3	Example Layout for Terminal Maintenance Building
Exhibit 440-4	Clinton Terminal Maintenance Building
Exhibit 440-5	Typical Dock Bull
Exhibit 440-6	Example Layout for Vessel Maintenance Building
Exhibit 440-7	Vashon Ferry Terminal Vessel Rope/Linens Locker
Exhibit 440-8	Vashon Ferry Terminal Breathing Pack Bottle Storage
Exhibit 440-9	Oil Boom Containers
Exhibit 440-10	Manlift in Use at WSF Terminal
Exhibit 440-11	Miscellaneous Structures, Enclosures, and Support Areas
Exhibit 440-12	Anacortes Terminal Traffic Attendant Booth
Exhibit 440-13	Vashon Ferry Terminal Oil Spill Response Kit
Exhibit 440-14	Vashon Ferry Terminal Damage Assessment Kit
Exhibit 440-15	Seattle Ferry Terminal Garbage and Recycling Area
Exhibit 440-16	Bainbridge Island Ferry Terminal Emergency Generator and Enclosure
Exhibit 440-17	Bainbridge Island Ferry Terminal VTS HPU Enclosure
Exhibit 440-18	Clinton Ferry Terminal Backflow Preventer Enclosures
Exhibit 450-1	Edmonds Ferry Terminal Building
Exhibit 450-2	Limits of Overhead Loading
Exhibit 450-3	Terminal Jurisdiction and Zoning Designation
Exhibit 450-4	Bird Deterrent

Exhibit 460-1 Edmonds Terminal Incorporated into Surrounding Landscape
Exhibit 460-2 Example Terminal Entry Plazas
Exhibit 460-3 Example Waterfront Promenade
Exhibit 460-4 Landscaping Planters at the Seattle Ferry Terminal
Exhibit 460-5 Example Plantings
Exhibit 460-6 Pedestrian Walkways Along the Water
Exhibit 460-7 Biorentention Area Near Edmonds Ferry Terminal
Exhibit 460-8 Site Furnishings at Edmonds Ferry Terminal

Exhibit 470-1 Examples of Public Art

Exhibit 500-1 Clinton Ferry Terminal Access
Exhibit 500-2 Railroad Crossing at Edmonds Terminal
Exhibit 500-3 Exit Lanes at Seattle Ferry Terminal
Exhibit 500-4 Pedestrian Bridge at Seattle Ferry Terminal
Exhibit 500-5 Exit Gates at Seattle Ferry Terminal
Exhibit 500-6 Pedestrian Gates at Seattle Ferry Terminal

Exhibit 510-1 Seattle Ferry Terminal Toll Plaza
Exhibit 510-2 Example Toll Plaza Layout
Exhibit 510-3 WSF Toll Booth Tariff Line Striping
Exhibit 510-4 WSF Toll Booth Layout
Exhibit 510-5 Seattle Ferry Terminal Concrete Barrier
Exhibit 510-6 Seattle Ferry Terminal Toll Booths, Canopy, and Departure Zone

Exhibit 520-1 Seattle Ferry Terminal Vehicle Holding Area
Exhibit 520-2 Existing Vehicle Holding Area Data by Terminal
Exhibit 520-3 Upland Vehicle Holding at Bremerton Ferry Terminal
Exhibit 520-4 Over-water Vehicle Holding at Port Townsend Ferry Terminal
Exhibit 520-5 Mukilteo Ferry Terminal Vehicle Holding Lane on Shoulder
Exhibit 520-6 Vashon Island Ferry Terminal Holding Lanes
Exhibit 520-7 Bainbridge Island Ferry Terminal Motorcycle and Bicycle Holding Area
Exhibit 520-8 Seattle Ferry Terminal Motorcycle Access Lane
Exhibit 520-9 Seattle Ferry Terminal Passenger Amenities in Holding Area
Exhibit 520-10 Pet Area at Seattle Ferry Terminal

Exhibit 530-1 Anacortes Ferry Terminal Parking Facilities
Exhibit 530-2 Seattle Ferry Terminal Parking Facilities
Exhibit 530-3 Parking Program Elements
Exhibit 530-4 Systemwide Employee Parking by Terminal
Exhibit 530-5 Edmonds Ferry Terminal Accessible Drop-off Area

Exhibit 540-1 Bus Pull Out – Near Mukilteo Ferry Terminal
Exhibit 540-2 Bus Stop – Near Edmonds Ferry Terminal
Exhibit 540-3 Bus Turnaround at Vashon Terminal
Exhibit 540-4 Commuter Train at Edmonds Terminal

Exhibit 550-1 Site Circulation Features
Exhibit 550-2 Example of Waterfront Promenade
Exhibit 550-3 Pedestrian Bridge at Seattle Ferry Terminal
Exhibit 550-4 Accessible OHL Ramp at Bainbridge Ferry Terminal
Exhibit 550-5 Bainbridge Island Ferry Terminal Motorcycle and Bicycle Holding Area
Exhibit 550-6 Seattle Ferry Terminal Garbage and Recycling Area

Exhibit 560-1 Sanitary Sewer Service at Existing Terminals
Exhibit 560-2 Standards for Design Calculations

Exhibit 570-1 Sample WSF Signage Types
Exhibit 570-2 Variable Message Signs
Exhibit 570-3 Interior Directional Signage
Exhibit 570-4 Exterior Directional Signage
Exhibit 570-5 Identification Signs
Exhibit 570-6 Informational Signs, Displays, and Kiosks
Exhibit 570-7 Signs Required for Law Enforcement
Exhibit 570-8 Regulatory Signs
Exhibit 570-9 WSF Policy Signs
Exhibit 570-10 ADA Signage
Exhibit 570-11 Security Signage
Exhibit 570-12 MUTCD Sign Type References
Exhibit 570-13 Interior Building Signage
Exhibit 570-14 Exterior Building Signage
Exhibit 570-15 Terminal Approach Signage
Exhibit 570-16 Entrance and Exit Signage
Exhibit 570-17 Toll Booth Lane Status Indicators
Exhibit 570-18 Toll Booth Signage
Exhibit 570-19 Vehicle Holding Lane Signage
Exhibit 570-20 Parking Signage
Exhibit 570-21 Multimodal Signs
Exhibit 570-22 Site Utility Signage
Exhibit 570-23 Common Trestle Signage
Exhibit 570-24 Trestle Signage at Vashon Ferry Terminal
Exhibit 570-25 Trestle Signage at Edmonds Ferry Terminal
Exhibit 570-26 Trestle Oil Spill Containment Boom Signage
Exhibit 570-27 Security Signage on the Vehicle Transfer Span Gate Arm
Exhibit 570-28 Vehicle Transfer Span Signage at Vashon Terminal
Exhibit 570-29 Passenger Overhead Loading Signage at Kingston Terminal

Exhibit 570-30 Passenger Overhead Loading Signage at Edmonds Terminal
Exhibit 570-31 Passenger Overhead Loading Security Signage
Exhibit 570-32 Slip and Wingwall Signage
Exhibit 570-33 Fixed and Floating Dolphin Signage

Exhibit 600-1 Clinton Trestle Substructure
Exhibit 600-2 Example Trestle Plan
Exhibit 600-3 Example Trestle Cross Section
Exhibit 600-6 Bridge Seat Data for WSF Terminals
Exhibit 600-7 Bainbridge Island Terminal H-Span Bridge Seat
Exhibit 600-8 Clinton Trestle Stormwater Trench Drain
Exhibit 600-9 Trestle Cross Section - Trench Drain
Exhibit 600-10 Clinton Trestle Utility Corridor and Light Poles
Exhibit 600-11 Vashon Island Utility Enclosure
Exhibit 600-12 Bainbridge Island Utilities Mounted on the Outside of Trestle
Exhibit 600-13 Vashon Island Utilities Suspended Under the Trestle

Exhibit 610-1 Bainbridge Island Hydraulic Transfer Span (H-Span)
Exhibit 610-2 Hydraulic Transfer Span (H-Span)
Exhibit 610-3 Bainbridge Island Vehicle Transfer Span (H-Span)
Exhibit 610-4 Bainbridge Island Hydraulic Apron
Exhibit 610-5 Bainbridge Island Bridge Lift Hydraulic Cylinder and Foundation
Exhibit 610-6 Bainbridge Island VTS Security Gates
Exhibit 610-7 Maximum and Minimum VTS Gradients
Exhibit 610-8 Fixed (Non-Moving) Bridge Design Limit States
Exhibit 610-9 Movable Bridge Design Limit States
Exhibit 610-10 Fixed (Non-Moving) Bridge Design Load Combinations
Exhibit 610-11 Movable Bridge Design Load Combinations
Exhibit 610-12 Seattle Single Cable-Operated Transfer Span
Exhibit 610-13 Water Line on VTS
Exhibit 610-14 Sewer Line Connection
Exhibit 610-15 Mechanical Load Combination Descriptions
Exhibit 610-16 Mechanical Load Combinations
Exhibit 610-17 Summary of Transfer Span Control System
Exhibit 610-18 Bridge Control Station and Attendant Control Station

Exhibit 620-1 Edmonds OHL Structures
Exhibit 620-2 Overhead Loading at Existing Terminals
Exhibit 620-3 Example OHL Structures Plan
Exhibit 620-4 Pedestrian Transfer Span Dimensions
Exhibit 620-5 Edmonds Loading Cab and Hydraulic Apron
Exhibit 620-6 OHL Apron Dimensions
Exhibit 620-7 Edmonds OHL Emergency Egress Stairs
Exhibit 620-8 OHL Utility Mounts
Exhibit 620-9 Cab and Apron Range of Motion
Exhibit 620-10 Cab and Apron Speed of Operation
Exhibit 620-11 Hydraulic Tubing Support Guidelines
Exhibit 620-12 Typical OHL Control System
Exhibit 620-13 PLC Cabinet
Exhibit 620-14 PLC Panel View Screen
Exhibit 620-15 Operator Control Station
Exhibit 620-16 Auxiliary Hydraulic Pump
Exhibit 620-17 OHL Illumination Requirements
Exhibit 620-18 Kingston Weather Screened OHL

Exhibit 630-1 Typical Wingwalls
Exhibit 630-2 Typical Wingwall Layout and Components
Exhibit 630-3 Material Unit Weights (in air) for Structural Loading
Exhibit 630-4 Load Combinations
Exhibit 630-5 Type I Impact Berthing Velocities and Energies
Exhibit 630-6 Type III Impact Berthing Velocity and Energy
Exhibit 630-7 Wingwall Ground Anchors
Exhibit 630-8 Wingwall Fog Light

Exhibit 640-1 Typical Fixed Dolphins
Exhibit 640-2 Typical Fixed Dolphin Components
Exhibit 640-3 Material Unit Weights (in air) for Structural Loading
Exhibit 640-4 Load Combinations and Load Factors
Exhibit 640-5 Type I Impact Berthing Velocities and Energies
Exhibit 640-6 Lopez Fixed Dolphin
Exhibit 640-7 Fixed Dolphin Navigational Aids
Exhibit 640-8 Fixed Dolphin Maintenance Ladder

Exhibit 650-1	Typical Floating Dolphin
Exhibit 650-2	Typical Floating Dolphin Components
Exhibit 650-3	Standard Floating Dolphin Characteristics
Exhibit 650-4	Material Unit Weights (in air) for Structural Loading
Exhibit 650-5	Load Combinations and Load Factors
Exhibit 650-6	Load Factors for Permanent Loads, Yp
Exhibit 650-7	Type I Impact Berthing Velocities and Energies
Exhibit 650-8	Floating Dolphin Navigational Aids
Exhibit 650-9	Floating Dolphin Cell Hatch
Exhibit 650-10	Floating Dolphin Portable Ladder

Exhibit 800-1	Font Table for Font 50
Exhibit 800-2	Line Styles
Exhibit 800-3	First section of pen table – Element Criteria
Exhibit 800-4	First section of pen table – Output Actions
Exhibit 800-5	Text Substitutions for WSDOT.tbl
Exhibit 800-6	Color Table
Exhibit 800-7	Coordinate readout for Civil & General Plans
Exhibit 800-8	Coordinate Readout for Structural, Electrical, Mechanical, & Architectural Plans
Exhibit 800-9	Initial View Attributes Settings
Exhibit 800-10	Dimension Custom Symbol
Exhibit 800-11	Dimension Extension Line
Exhibit 800-12	Dimension Placement
Exhibit 800-13	Dimension Terminator
Exhibit 800-14	Dimension Terminator Symbols
Exhibit 800-15	Dimension Text
Exhibit 800-16	Dimension Tool Settings
Exhibit 800-17	Dimension Units
Exhibit 800-18	Dimension Units
Exhibit 800-19	Dimension Unit Format
Exhibit 800-20	Unit Format for Angular Dimensions
Exhibit 800-21	Typical Project File Directory
Exhibit 800-22	Plan sheet layout for WSF Standard Drawings
Exhibit 800-23	Discipline Designators
Exhibit 800-24	File Naming for WSF Standard Drawings
Exhibit 800-25	Example Drawing List (From Excel Template)
Exhibit 800-26	Sheet layout for WSF Design Plan drawings
Exhibit 800-27	Sheet layout for WSF grid system
Exhibit 800-28	Plan sheet layout for WSF Perm and Repair Letter Drawings
Exhibit 800-29	Standard Title Block and Borders
Exhibit 800-30	Consultant Logo Title Block
Exhibit 800-31	Standard Elevation Sheet Layout
Exhibit 800-32	Site Monuments
Exhibit 800-33	Reference File Attachment
Exhibit 800-34	Placement of text (Derived using formula shown in the section on “Text Size”)

Exhibit 800-35 Drawing Scales
Exhibit 800-36 Existing Architectural Symbology
Exhibit 800-37 Architectural Demolition Symbology
Exhibit 800-38 Proposed Architectural Symbology
Exhibit 800-39 Existing Electrical Symbology
Exhibit 800-40 Electrical Demolition Symbology
Exhibit 800-41 Proposed Electrical Symbology
Exhibit 800-42 General Sheet Symbology
Exhibit 800-43 Existing Landscape Symbology
Exhibit 800-44 Landscape Demolition Symbology
Exhibit 800-45 Proposed Landscape Symbology
Exhibit 800-46 Existing Mechanical Symbology
Exhibit 800-47 Mechanical Demolition Symbology
Exhibit 800-48 Proposed Mechanical Symbology
Exhibit 800-49 Existing Security Symbology
Exhibit 800-50 Security Demolition Symbology
Exhibit 800-51 Proposed Security Symbology
Exhibit 800-52 Existing Structural Symbology
Exhibit 800-53 Structural Demolition Symbology
Exhibit 800-54 Proposed Structural Symbology
Exhibit 800-55 Standard Drawing Diagram
Exhibit 800-56 Project Plan Development & Updating Basemaps Flow Chart
Exhibit 800-57 Submittal Border Example

Division 1 Manual Overview

Chapter 100 Manual Description 100-1
100.01 Purpose 100-1
100.02 Presentation and Revisions 100-1
100.03 Manual Applications 100-2
100.04 Manual Use 100-2
100.05 Manual Organization 100-3

Chapter 100 Manual Description

100.01 Purpose
100.02 Presentation and Revisions
100.03 Manual Applications
100.04 Manual Use
100.05 Manual Organization

100.01 Purpose

Under the Engrossed State House Bill (ESHB) 2358, the WSDOT Ferries Division (referred to as Washington State Ferries or WSF) was tasked with developing terminal design standards that choose the most efficient balance between capital and operating investments, and that adhere to operational strategies, and vehicle level of service standards.

The WSF *Terminal Design Manual* was developed by the Terminal Engineering Department of Washington State Ferries, in collaboration with other departments within the agency. In keeping with the intent of ESHB 2358, the manual provides guidelines for the design of ferry terminal facilities, which continue to support the overall mission of the agency to provide safe, secure, efficient, reliable, and environmentally sound marine transportation for people and goods throughout Puget Sound.

100.02 Presentation and Revisions

The *Terminal Design Manual* is available on the Internet. The manual can be accessed electronically through the:

- WSDOT Home Page:
  www.wsdot.wa.gov/ferries
- Design Policy Web Page:
  www.wsdot.wa.gov/design/policy
- Engineering Publications Web Page:
  www.wsdot.wa.gov/publications/manuals/index.htm

The online version of the manual enables you to conduct a word search of the entire manual. Opening an individual chapter is faster, but a word search is limited to that chapter.

The *Terminal Design Manual* is continually revised to reflect changing processes, procedures, regulations, policies, and organizations. Feedback from users is encouraged to improve the manual for everyone. Comments may be submitted by any method that is convenient for you. There is a comment form in the front of the manual, or comments may be made via the contact names on the Design Policy Internet page (see link above). Note that the Design Policy Internet page includes a link to an errata page, which provides a list of known technical errors in the manual. Manual users are encouraged to view this page on a regular basis.

A contents section lists all chapters and the major headings of the sections/pages. The exhibits section lists all the exhibits in the manual and provides their page numbers.

Most chapters include a list of references, including laws, administrative codes, manuals, and other publications, which are the basis for the information in the chapter. Definitions for acronyms and abbreviations and specialized vocabulary used in the chapters are included in Appendix A and Appendix B, respectively.

100.03 Manual Applications

The *Terminal Design Manual* is provided to encourage the use of standard designs throughout WSF terminal facilities. The *Terminal Design Manual* is also used to:

- Interpret current design principles as they apply to ferry terminal design.
- Choose the most efficient balance between capital and operating investments.

The *Terminal Design Manual* is designed to allow for flexibility in design for specific and non- standard situations. For non-standard circumstances, the manual provides mechanisms for documenting the reasons for the choices made.

100.04 Manual Use

The *Terminal Design Manual* is intended for the design of department-owned terminal facilities. This manual does not address design of or modifications to existing department-owned vessels. If the guidance provided in this manual is not used on a project, it is considered a deviation and appropriate documentation and approvals are required (see Chapter 220).

The *Terminal Design Manual* example layout exhibits are developed around a single hypothetical ferry terminal facility. Chapters 330, 340 and 350 include example site layouts for the marine structures (Exhibit 330-2), landside elements (Exhibit 340-2), and terminal buildings (Exhibit 350-1), respectively. Each of these example layouts identifies the prominent terminal elements associated with that chapter - marine structures, landside elements, or terminal buildings - and references the corresponding chapters detailing the terminal elements identified. For example, Exhibit 330-2 covers marine structures and provides references to the trestle, vehicle transfer span, passenger overhead loading, wingwalls, and fixed and floating dolphin chapters.

100.05 Manual Organization

The *Terminal Design Manual* is divided into the following divisions and appendices:

Division 1 – Manual Overview: Describes the purpose, application, organization, and use of the *Terminal Design Manual*.

- **Chapter 100 – Manual Description:** Chapter content and resources within the *Terminal Design Manual*.

Division 2 – Project Development: Discusses the project scoping process, and how scoping decisions impact design.

- **Chapter 200 – Capital Project Scoping:** Outlines project scoping procedure including the requirements for a predesign study.
- **Chapter 205 – External Project Scoping and Review Requirements:** Describes requirements and information to be provided by and to WSF sections external to Terminal Engineering during project scoping projects.
- **Chapter 210 – Design Matrix Procedures:** Includes design matrices used to determine which design elements need to be considered in a project and how to document the design decisions.
- **Chapter 220 – Design Documentation, Approval, and Process Review:** Discusses building the Project File (PF) and the Design Documentation Package (DDP) and recording the recommendations and decisions that lead to a project by presenting the documents from the planning, scoping, programming, and design phases.
- **Chapter 230 – Quality and Constructability:** Includes expectations for design deliverables, quality assurance/quality control, and constructability reviews. Also details federal requirements and contract documents.

Division 3 – General Design Criteria: Provides design criteria that is common to numerous elements within a ferry terminal.

- **Chapter 300 – Accessibility:** Summarizes federal ADA accessibility requirements for transportation projects involving pedestrian facilities.
- **Chapter 310 – Security:** Discusses Maritime Security (MARSEC) levels, vessel security requirements, security functions, secure areas within a terminal, access control, and the handling of sensitive security information in design documents.
- **Chapter 320 – Environmental Considerations:** Provides an overview of potential environmental impacts and environmental regulatory obligations as they relate to ferry terminal design.
- **Chapter 330 – Marine:** Identifies the major marine structures associated with a ferry terminal and the general criteria necessary for their design. Includes vessel routes and terminal locations, vessel and tidal data, slip requirements, and berthing and mooring criteria. Also discusses long lead time items, corrosion mitigation, scour and mudline, and geotechnical requirements for marine structures.
- **Chapter 340 – Civil:** Identifies the major civil elements associated with a ferry terminal and general criteria necessary for their design. Discusses project datum, site preparation, grading and erosion control, roadway design and channelization, paving, and traffic control.

- **Chapter 350 – Buildings:** Identifies the main buildings at WSF terminal facilities along with the codes and requirements for design of the building structures, building foundations, and building utilities.
- **Chapter 360 – Electrical:** Summarizes content provided in the stand alone *WSF Terminal Design Standards, Specification, and Procedures - Electrical Engineering* manual (*Electrical Engineering Manual*).

Division 4 – Terminal Buildings: Provides design criteria for the terminal buildings – passenger buildings, terminal supervisor buildings, maintenance building, enclosures and support areas – in addition to architecture, landscape architecture and public art critera.

- **Chapter 400 – Passenger Buildings:** Identifies building spaces associated with passenger functions and amenities and provides guidance for their design.
- **Chapter 410 – Circulation and Passenger Waiting:** Describes the level of service standards for passenger circulation within the terminal building as well as provides guidance for designers on the sizing requirements for the passenger waiting areas.
- **Chapter 420 – Passenger Amenities, Business Case:** Describes the approach to developing a business case for the inclusion of passenger amenities such as retail and concessions at a terminal.
- **Chapter 430 – Terminal Supervisor Buildings:** Identifies building spaces typically located within the terminal supervisor building and provides guidance for their design.
- **Chapter 440 – Maintenance Buildings, Enclosures and Support Areas:** Identifies building spaces typically located within the terminal and vessel maintenance buildings along with support areas, including storage areas and utility enclosures.
- **Chapter 450 – Architecture:** Discusses architectural considerations associated with the design of WSF terminal buildings including building code requirements, building permits, WSF architectural guidelines, and LEED certification.
- **Chapter 460 – Landscape Architecture:** Discusses the landscape architecture components of a ferry terminal including pedestrian paving/hardscape, landscaping, site lighting, and site furnishings.
- **Chapter 470 – Public Art:** Describes the public art requirement associated with public government buildings and provides guidance on meeting this requirement.

Division 5 – Landside Development: Landside development includes design criteria for all terminal elements other than the marine structures and the terminal buildings.

- **Chapter 500 – Access, Approaches and Exits:** Describes design considerations for ferry terminal access, approaches, and exits.
- **Chapter 510 – Toll Plaza:** Provides design guidelines for approach zone and queuing area, toll lanes, tollbooths, and departure lanes.
- **Chapter 520 – Vehicle Holding and Support Areas:** Describes the guidelines for sizing and locating the vehicle holding areas.
- **Chapter 530 – Parking:** Summarizes the types of parking associated with WSF facilities along with guidelines for the design of these areas.

- **Chapter 540 – HOV and Transit:** Provides guidance and information for designing high-occupancy vehicle and transit facilities.
- **Chapter 550 – Site Circulation:** Includes criteria for pedestrian, bicycle, and vehicular circulation within a ferry terminal.
- **Chapter 560 – Site Utilities:** Provides guidelines for potable water, fire protection, sewer, stormwater, natural gas, power, lighting, and communications utilities.
- **Chapter 570 – Signage and Wayfinding:** Provides guidance on sign functions, sign types and sign placement within a ferry terminal.
- **Chapter 580 – Sustainability/Low Impact Development:** *<future chapter>*

Division 6 – Waterside Development: Waterside development applies to specific structural, mechanical, and electrical elements that are associated with vessel berthing and loading.

- **Chapter 600 – Trestle:** Provides civil and structural guidelines for the trestle which provides vehicle access from the landside to the vehicle transfer span.
- **Chapter 610 – Vehicle Transfer Span:** Design guidelines for the structural, mechanical, and electrical elements of the VTS.
- **Chapter 620 – Passenger Overhead Loading:** Provides guidance on the design of the OHL fixed spans, pedestrian transfer span, overhead loading cab, and drilled shafts.
- **Chapter 630 – Wingwalls:** Provides guidance on the design of wingwalls, the primary structures used to stop and hold vessels in place for loading, unloading and overnight tie- up.
- **Chapter 640 – Fixed Dolphins:** Design guidelines for fixed dolphins used to guide ferries into the berthing area, provide a leaning surface during loading and unloading, protect adjacent properties or other WSF structures, and provide mooring for overnight tie-up.
- **Chapter 650 – Floating Dolphins:** Provides guidance on the design of floating dolphins used to guide ferries into the berthing area, provide a leaning surface during loading and unloading, and provide separation between ferry slips for protection of the vessels from one another.

Division 7 – Miscellaneous: Includes design information on a variety of topics that are not specific to WSF terminal elements but that may be relevant to their design.

This section covers the following topics:

- **Chapter 700 – Maintenance:** *<future chapter>*
- **Chapter 710 – Overweight Vehicle Check:** *<future chapter>*
- **Chapter 720 – Scour:** *<future chapter>*
- **Chapter 730 – Bridge Rating:** *<future chapter>*

Division 8 – CADD Standards and Procedures: Provides instruction and guidance for the preparation of contract drawings.

Appendices: Includes acronyms, abbreviations, definitions, and a variety of reference information relevant to WSF terminal facilities.

- **Appendix A – Acronyms and Abbreviations:** An alphabetical listing of acronyms and abbreviations within the *Terminal Design Manual* along with their definitions.
- **Appendix B – Definitions:** An alphabetical listing of key ferry terminal vocabulary used in the *Terminal Design Manual* along with definitions for the terms.
- **Appendix C – Comment Review Form:** The standard document used to capture and communicate all comments generated from a PS&E or Constructability review process.
- **Appendix D – Quality Audit Sign-Off Sheet:** The standard form used to document the quality audit process.
- **Appendix E – Quality Control Color Code:** Identifies the established color code used in the quality control process.
- **Appendix F – Project Management Plan:** A formal approved document that defines how a project is executed, monitored and controlled.
- **Appendix G – Checking Process Flow Chart:** Identifies the checking process for all PS&E documents for contract advertisement and associated calculations, permit documents, and documents to be presented to the public prepared by Terminal Engineering.
- **Appendix H – DQC Sign-Off Sheet:** The cover sheet accompanying all quality review/check documents that contains signatures of all individuals that contributed to the quality process.
- **Appendix I – Deliverables Expectations Matrices:** Matrices developed for use on Terminal Engineering Projects that attempt to demonstrate components of what may be required within each different project type. There are four deliverables expectation matrices, one each for H-Span, Wingwall, Dolphin, and Toll Booth/ Terminal Building Projects.
- **Appendix J – Project Status Report:** A status report produced weekly for all projects that will be, or have been, advertised in the following 90 days.
- **Appendix K – PS&E Turn-In QA/QC Process:** Process and checklist for turning contracts into the Contract Ad and Award office for advertisement and bid opening.
- **Appendix L – Review Checklist Templates:** Discipline specific checklists used as a guide for the PS&E review process.
- **Appendix M – Instructions for Advertisement:** The step by step process which project managers are to follow when preparing to submit a package for Advertisement.
- **Appendix N – Environmental Compliance Plan:** WSF's Environmental Compliance Plan developed to ensure projects are designed, constructed and maintained in accordance with environmental commitments made through the environmental documentation and permitting process.
- **Appendix O – Vessel Fleet Information:** WSF vessel fleet particulars used in the design of marine structures.

- **Appendix P – Route Information:** A collection of data for each terminal including terminal history, facility statistics, geographic data, and terminal contact information.
- **Appendix Q – Terminal Reference Data:** A summary of reference data by terminal including state route, NHS or non-NHS roadway designation, functional class code, control section, legislative district, congressional district, area designation (urban/rural), and other miscellaneous information.
- **Appendix R – Terminal Site Plans:** Aerial photos and color illustrations depicting the site layout and key features for each of WSF's existing terminals.
- **Appendix S – Terminal Building Programs:** Matrices identifying the existing terminal building spaces at each of WSF's facilities along with the anticipated future requirements and preliminary sizing guidelines.
- **Appendix T – Terminal Signage Plan:** Draft signage plan for the Southworth Ferry Terminal.
- **Appendix U – Design/Project Development Approval Templates:** Cover Sheet Templates for Design and Project Development Approval efforts described in Chapter 220.
- **Appendix V – Memorandum of Understanding Arts in Public Places Washington Arts Commission and Washington State Department of Transportation Copy of the Memo of Understanding between WSDOT and the Washington Arts Commission:** contains the Memo of Understanding between WSDOT and WAC regarding incorporating art in public projects. See also Chapter 470.
- **Appendix W – Trestle Pavement Depths:** Depth of the pavement on WSF Trestles.
- **Appendix X – Terminal Tidal Information:** Describes the means, methods and sources for developing Exhibit 330-11 Terminal Tidal Datums and Exhibit 330-12 Design Tidal Ranges.
- **Appendix Y – Vacant**
- **Appendix Z – Terminal Vertical Datums:** tabulates the elevations (referenced to NAVD 88 and to MLLW) of all of the vehicle transfer span bridge seats located at the nineteen terminals and the Eagle Harbor Maintenance Facility.
- **Appendix AA** – Tabulates data used to determine vehicle transfer span gradients.

Division 2 Project Development

Chapter 200 Capital Project Scoping 200-1
200.01 General 200-1
200.02 References 200-1
200.03 Preservation Projects 200-3
200.04 Improvement Projects 200-6
200.05 Scoping Procedures 200-10
200.06 Predesign Studies 200-23
200.07 Level of Service 200-24
Chapter 205 External Project Scoping and Review Requirements 205-1
205.01 General 205-1
205.02 References 205-1
205.03 Security Scoping and Project Review Requirements 205-2
205.04 Information Technology and Intelligent Transportation Systems Scoping and Project Review Requirements 205-3
205.05 Operations Scoping and Project Review Requirements 205-6
Chapter 210 Design Matrix Procedures 210-1
210.01 General 210-1
210.02 Selecting a Design Matrix 210-1
210.03 Using a Design Matrix 210-2
Chapter 220 Design Documentation, Approval and Process Review . . . 220-1
220.01 General 220-1
220.02 References 220-2
220.03 Definitions 220-3
220.04 Design Documentation 220-6
220.05 Project Development 220-8
220.06 Design Approval 220-11
220.07 Project Development Approval 220-12
220.08 Combined Design Approval/Project Development Approval 220-14
220.09 FTA Triennial Review 220-14
220.10 Design Drawing Production 220-15

Chapter 230 Quality and Constructability 230-1
230.01 General 230-1
230.02 References 230-1
230.03 Definitions 230-3
230.04 Roles and Responsibilities 230-5
230.05 Project Management Plan 230-8
230.06 Quality Control 230-9
230.07 Quality Assurance 230-10
230.08 Quality Control/Quality Assurance (Consultant Designed Projects) 230-14
230.09 Quality Control/Quality Assurance (Structures) 230-15
230.10 Project Goal Requirements 230-21
230.11 Advertisement 230-21
230.12 Limited Public Works Contracts 230-24

Chapter 200 Capital Project Scoping

200.01 General
200.02 References
200.03 Preservation Projects
200.04 Improvement Projects
200.05 Scoping Procedures
200.06 Predesign Studies
200.07 Level of Service

200.01 General

This chapter provides an explanation of and the procedures for WSF capital project scoping, which is a requirement of the Washington State Office of Financial Management (OFM). The OFM plays a central role in budget planning, policy development, and fiscal development for the executive branch (Governor) and prepares the executive budget proposals to the Legislature and monitors enacted budget implementation.

Project scoping is the initial phase of project development for WSDOT capital projects. Projects are identified for scoping via various terminal asset preservation priorities and transportation policy goals developed in the WSF Capital Plan. The project scoping phase consists of developing a project's description, schedule, and cost estimate. The intent is to make design decisions early in the project development process that focus the scope of the project. A Scoping File is completed for all projects prior to the submittal of the capital project request to the legislature and is retained by the Terminal Engineering Capital Scoping Lead. The Project Summary documents, which are an integral component of the Scoping File, are included in the Design Documentation Package as described in Chapter 220.

See Chapter 205 for project scoping and review requirements for terminal projects that will be designed and/or administered external to the Terminal Engineering department.

200.02 References

(1) Federal/State Laws and Codes

23 Code of Federal Regulations (CFR) 635.411, Material or product selection

2010 ADA Standards for Accessible Design

RCW 47.06.140 *Transportation facilities and services of statewide significance — Level of service standards*

RCW 47.28.030 *Contracts – State forces – Monetary limits – Small businesses, minority, and women contractors – Rules*

RCW 47.28.035 *Cost of project, defined*

RCW 47.60.327 *Operational strategies for asset utilization*

RCW 47.60.340 *Vessel maintenance and preservation program — Report*

RCW 47.60.345 *Life-cycle cost model on capital assets*

RCW 47.60.365 *Terminal design standards*

RCW 47.60.385, *Terminal improvement project funding requests — Predesign study — New vessel acquisition planning*

RCW 47.60.550, *Parking or holding area for ferry patrons in conjunction with municipal off-street parking facilities*

(2) Design Guidance

Office of Financial Management, Predesign *Manual*

WSDOT Policy Documents Index, including those listed below:
wwwi.wsdot.wa.gov/publications/policies

- Secretary's Executive Order 1052 *Project Risk Management and Risk Based Estimating*
- Instructional Letter IL 4071 *Use of Risk-Based Project Estimates for Budgeting and Project Management*

WSDOT technical manuals, including those listed below:
www.wsdot.wa.gov/publications/manuals/index.htm

- *Bridge Design Manual LRFD* M 23-50
- *Bridge Inspection Manual* M 36-64
- *Bridge List* M 23-09
- *Cost Estimating Manual for WSDOT Projects* M 3034
- *Design Manual* M 22-01
- *Emergency Relief Procedures Manual* M 3014
- *Environmental Procedures Manual* M 31-11
- *Geotechnical Design Manual* M 46-03
- *Highway Runoff Manual* M 31-16
- *Hydraulics Manual* M 23-03
- *Local Agency Guidelines* M 36-63
- *Plans Preparation Manual* M 22-31
- *Project Control and Reporting Manual* M 30-26
- *Right of Way Manual* M 26-01
- *Standard Plans* M 21-1
- *Transportation Structures Preservation Manual* M 23-11
- *Utilities Accommodation Policy* M 22-86
- *Utilities Manual* M 22-87

WSDOT Administrative manuals, including those listed below:
www.wsdot.wa.gov/publications/manuals/index.htm

- *Advertisement and Award Manual* M 27-02
- *Electronic Engineering Data Standards* M 3028

WSDOT Engineering Applications, including those listed below:
www.wsdot.wa.gov/design/projectdev/engineeringapplications

- *Bid Tabs*
- *EBASE* (see *User's Guide for Construction Engineering Percentages and Calculation Order*)
- *Microstation*
- *Standard Items*
- *Unit Bid Analysis*

Terminal Engineering Intranet Pages, including those listed below:
wwwi.wsdot.wa.gov/ferries/terminalengineering/default.htm

- *Cost Estimating*
- *Life Cycle Cost Model*
- *Programmatic Scoping*

200.03 Preservation Projects

(1) Legal Definitions

Preservation projects are defined under the law in RCW 47.60.005, the relevant definition states: (8) "Preservation project" has the same meaning as used in budget instructions developed by the office of financial management.

The Washington State Office of Financial Management (OFM) plays a central role in budget planning, policy development, and fiscal development for the executive branch (Governor) and prepares the executive budget proposals to the Legislature and monitors enacted budget implementation. OFM has statutory authority to provide all state agencies with a complete set of instructions for submitting biennial budget requests.

OFM issues the budget instructions which are relevant to Terminal capital projects:

- Transportation Budget Instructions (including addendums)
- Capital Budget Instructions

The OFM Transportation Budget Instructions pertain to most transportation capital projects other than transportation buildings. The OFM Transportation Capital Facility Budget Instructions are applicable to transportation buildings including Ferry Terminals.

Preservation projects are defined in accordance with RCW 47.60.005(5) and (8). A preservation project:

- Extends the life of existing assets (terminals and vessels) by replacing existing systems of the asset that are determined to be at the end of their structural, mechanical or electrical lives.

- May upgrade the systems needing to be replaced for structural, mechanical or electrical reasons so long as the replacements for existing systems do not significantly change the program use of an asset (i.e., replacing two worn out wooden dolphins of a vessel slip at a terminal with two steel dolphins so long as the upgraded steel dolphins do not significantly change the throughput capacity of the terminal).
- Generally has little effect on future operating programs and budgets, except for reductions in maintenance costs and the deferred preservation backlog.

Appropriations made for preservation projects must be spent only on preservation and only when warranted by the condition of the asset – RCW 47.60.335(2). See RCW 47.60.005(8) qualified by RCW 47.60.005(5), RCW 47.60.335(2) and (3), RCW 47.60.345(1)(a) through (d) and (2) and RCW 47.60.355(1) for a more detailed definition of what constitutes the preservation of ferries.

Terminal Preservation project budget requests are based on the *Life Cycle Cost Model* (LCCM) as mandated by RCW 47.60.345. The full text is as follows:

1. *The department shall maintain a life-cycle cost model on capital assets such that:*
   a) *Available industry standards are used for estimating the life of an asset, and department-adopted standard life cycles derived from the experience of similar public and private entities are used when industry standards are not available;*
   b) *Standard estimated life is adjusted for asset condition when inspections are made;*
   c) *It does not include utilities or other systems that are not replaced on a standard life cycle; and*
   d) *It does not include assets not yet built.*
2. *All assets in the life-cycle cost model must be inspected and updated in the life-cycle cost model for asset condition at least every three years.*
3. *The life-cycle cost model shall be used when estimating future terminal and vessel preservation needs.*
4. *The life-cycle cost model shall be the basis for developing the budget request for terminal and vessel preservation funding.*

(2) Life Cycle Cost Model

As reiterated in Sections 200.03 and 200.04(1), the *Life Cycle Cost Model* (LCCM) is used as the basis for capital terminal preservation funding requests. Therefore, if an asset is excluded from the LCCM, does not exist or is not due for replacement, the project must be classified as an improvement project as described in Section 200.05.

The year due for replacement is the year which falls in the biennium for which construction will begin. For example, if the year due for replacement is 2015, then construction will begin in the 2013-2015 biennium. However, for those situations where design and possibly construction work will require a longer duration than a biennium, the project may begin in a previous biennium. The year due for each existing terminal asset is calculated via inspection and condition rating results and is provided in the LCCM. For larger preservation projects, particularly trestles, preliminary

engineering may begin several biennia prior to the actual due date if warranted by design, environmental review, and permitting requirements. In addition, in some circumstances, some assets may be replaced prior to the year due if the asset is an integral part or connected to another asset. A business case analysis will be performed to determine appropriate year to replace systems when year due dates do not line up. For example, if the condition of an existing timber trestle warrants replacement, then the pavement on the structure will also be replaced as it would be impossible for it to remain undisturbed or be moved during construction activities.

(3) Asset Management

An alternative Asset Management system based on economic life considerations and optimum replacement year of assets is under development at the direction of the Legislature. Asset management is intended to augment the current life-cycle approach to preservation funding requests by incorporating risk into the formula to determine the year due. Once completed, at the discretion of the legislature and governor, the Asset Management system will utilized as the basis for capital preservation funding requests.

(4) Vital and Non-Vital Assets

The terminal LCCM divides assets into two categories:

- *Vital* (Category 1): Includes main and auxiliary slips and security items. These are considered the most essential items for preservation funding.
- *Non-Vital or Other* (Category 2): Includes tie-up slips and upland assets such as parking lots and terminal buildings.

Whether or not an asset is considered vital or non-vital, when the year due for replacement approaches, a scoping project will be identified and a scoping file completed for the replacement of the asset. If the Asset Management System described above is approved for use, the vital and non-vital distinction will become less relevant by incorporating the risk of failure into the model.

(5) Security Preservation Projects

Security preservation (and improvement) projects differ from other scoping projects due to the sensitive nature of the assets involved. Any information contained within a security scoping file is considered confidential and may not be released without the consent of the Company Security Officer of WSF Security. This requirement applies to stand-alone security projects, and projects which contain a security component.

See Chapter 205 for scoping requirements for security projects that will be designed external to the Terminal Engineering department.

(6) Stormwater Retrofits

Water quality in the Puget Sound is a priority. As a result, the retrofitting of storm water systems may be included in appropriate preservation (or improvement) projects where construction of the detention, treatment or low impact development facility could occur in the same contract. Specifically, if feasible, scoped paving and trestle projects will have a storm water retrofit component.

(7) Design Matrix Requirements

Although the main purpose of a preservation project may be based on the requirements of the LCCM, the design matrices requirements described in Chapter 210, unless a Design Deviation is granted, must also be followed. For instance, a parking lot pavement may be due for replacement, and in the process, the adjacent pedestrian facilities must be retrofitted using Americans with Disabilities Act (ADA) design requirements.

200.04 Improvement Projects

(1) Legal Definitions

Improvement projects are defined in RCW 47.60.005 as having the same meaning as used in budget instructions developed by the Office of Financial Management (OFM). According to the OFM Transportation Budget Instructions 2009-11, Issued May 2008, improvement projects are defined as follows:

Improvement projects primarily achieve a program goal, such as changing or improving the characteristics of an existing asset to meet new program requirements, or creating a new asset through construction, lease, and/or purchase. This category is less concerned with life extension of an asset, and includes projects ranging from building new assets to significant renovation of existing assets. Improvement projects may also improve conditions, accommodate changes in service or clientele, or increase or maintain federal reimbursement. Improvement projects must be tied to the statewide results areas and strategies, as well as organizational and program goals, objectives strategies, and activities:

- Certain types of capital spending may not be categorized as preservation, and therefore are categorized as improvements. This includes projects for utilities or other systems that are not replaced on a standard life cycle; assets not yet built, especially new vessel acquisitions; and master plans, right-of-way acquisitions, other non-preservation items – RCW 47.60.005(5) and RCW 47.60.345(1)(c) and (d).
- Additionally, each improvement project includes an allocation of system-wide and administrative capital program costs that are separately identifiable from direct project costs – RCW 47.60.335(3).
- Finally, if a project meets both the improvement and preservation definitions, it is classified as an improvement project – RCW 47.60.005(5).

(2) Call for Projects Procedure

During the months of October and November of odd numbered years prior to the Scoping Kickoff Meeting, a *Call for Projects* will be issued by the Terminal Engineering Capital Scoping Lead asking that potential terminal improvement projects be identified and submitted by WSF stakeholders, such as the Operations, Security, Information Technology and other departments. Several main categories of improvement projects will be considered:

- Americans with Disabilities Act (ADA)
  - Retrofits
  - Improvements

- Terminal Facility Improvements
  - Public
  - Employee
  - Building
- Operational Enhancements
  - Mobility Improvements;
  - Improvements to the Eagle Harbor Maintenance Facility
  - Improved dwell time, and throughput/processing
- Regulatory or Code Requirement Projects
  - Upgrading structures to current seismic codes
  - Conforming to US Coast Guard requirements
  - Other regulatory or code requirements
- Safety Improvements
  - Vessel
  - Vehicular
  - Pedestrian or Bicycle
  - Terminal or Vessel Personnel
- Maintenance expenditure reduction initiatives
  - Interim preservation
  - Replacements of Systems and Utilities not included in the Life Cycle Cost Model
  - Scour reduction
- Environmental Enhancements
  - Excluding storm water retrofits unless included in other projects
  - Creosote removal
  - Eel grass replenishment
  - Energy Savings
  - Other environmental improvements or initiatives
- Security Improvements
  - Conforming to U.S. Department of Homeland Security (DHS) requirements;
  - State and local security requirements
  - Other security improvements
- Improvement project included as part of the *Long Range Plan* (LRP)
- External commitments and agreements

In response to the *Call for Projects*, the proposal for a scoping project shall, at a minimum include draft purpose, need and benefit statements, as described in Section 200.05. If the project is anticipated to be funded by an external grant, this information **must** be included. In addition, for those projects that are justified by regulatory or code requirements, the actual regulation or code must be included (a notice from a regulatory agency informing WSF of a pending regulation will suffice), or the submittal will be returned. Improvement projects with a regulatory requirement basis will be prioritized over those improvements with a business case basis.

(3) Scoping Project Kickoff Meeting

After the *Call for Projects*, the respondents and other stakeholders will be invited to the *Scoping Kickoff Meeting*. The purpose of this meeting is to discuss and vet proposed scoping projects. Those projects which are determined to be sufficiently justified and therefore warrant further investigation will be assigned a scoping Project Manager and a scoping budget allocated.

(4) Justification

Before a proposed improvement project may be scoped (as well as some preservation projects) it must be justified on a monetary, regulatory/Homeland Security, safety, seismic and/or operational/business case basis. Depending on the type of project the following supporting documentation, which may, at least partially, be contained in the Need and Benefits Statements as described in Section 200.06(1) is required:

(a) Americans with Disabilities Act (ADA) Projects

- Describe the ADA deficiency and how it was determined to be in non-compliance, including complaints received from staff or the public.
- Reference the standards that will be used to correct the deficiency.

(b) Terminal Facility Improvements

- Describe how the proposed project will benefit the public, such as increasing the capacity of a restroom.
- Describe how the proposed project will benefit the terminal employee, such as decreasing time lost due to ergonomic issues or response times.
- Describe why improvements to a building or other structure are necessary and the benefits.
- Include any potential cost savings.

(c) Operational Enhancements

- Describe how on-loading, off-loading or vessel crossing times, such as better aligning a slip, will be improved.
- Describe how improvements to the Eagle Harbor Maintenance Facility will result in more efficient or effective maintenance operations.
- Describe how a traffic signal may improve the dwell time related to off-loading a vessel.

Describe how overhead loading will improve dwell time by separating the pedestrian/ vehicles movements from all occurring on the vehicle transfer span;

- Include any potential cost or operational time savings

Examples of Operational Enhancements include, but are not limited, to the following:

- Variable Messages signs located on the tollbooths and throughout the facility
- Operational/web cameras
- Signalization to improve off-loading/loading efficiencies
- OHL to improve off-loading/loading efficiencies, improve ADA accessibility, eliminate vehicle/pedestrians conflicts

- Two dedicated lanes of access to toll plazas
- Canopies above vehicle toll plazas
- Automated lane assignment technology within terminal holding area which automatically direct traffic to assigned lanes
- Load management system with pre-assigned vehicles to be loaded at specific locations on the ferry
- Separate controlled transit access to holding area/terminal building
- Digital GPS clocks which synchronize time keeping devices at the terminals and vessels
- Vehicle Queue Detection

(d) Regulatory or Code Requirement Projects

- Provide a specific regulatory or code reference;
- Provide specific communications with regulatory agencies on proposed or upcoming changes to requirements

(e) Safety Improvements

- Discuss specific safely issues, such as (but not limited to) the following:
  - Vehicle/pedestrian conflicts
  - Obstacles in the Pedestrian assessable route
  - Vehicular conflict points
  - Collision locations;
- Describe how the project will improve safety;
- Include and summarize accident data or other supporting documentation;
- Include any potential cost savings

(f) Seismic Retrofits

- Describe deficiency and potential consequences such as catastrophic failure;
- Cite applicable seismic code(s)

(g) Maintenance expenditure reduction initiatives

- Describe recurrent maintenance issues;
- Include any potential cost savings

(h) Environmental Enhancements

- Describe the environmental deficiencies to be improved;
- Describe how the proposed project will improve the environment;
- Cite any applicable environmental regulations or laws;
- Describe short and long term benefits, including cost savings

(i) Security Improvements

- Cite U.S. Department of Homeland Security (DHS) or other agency requirements;
- Include any potential or actual grant information available

(j) Improvement project included as part of the Long Range Plan (LRP)

- Cite the fact that the project is included in the Long Range Plan;
- Cite the justification within the LRP for its inclusion

(k) External commitments and agreements

- Cite the agreement and its reasons for being implemented

(l) Dolphin Projects

- Develop dolphin configuration Justify alterations from current configuration, such as replacing a floating dolphin with 2 fixed dolphins
- Document Operation's concurrence

(m) Construction projects to be completed by entirely by Eagle Harbor or other state forces

- Must be within legal monetary limits per RCW 47.28.030
- Develop 2 estimates for comparison:
  - Work by contractor
  - Work by Eagle Harbor or other state forces
- If work by Eagle Harbor or other state forces is determined to be less expensive, complete Public Interest Finding – Agency Force (WSDOT Form 140-050) and obtain approval signatures.

Any expectations to the above requirements must be discussed with and found agreeable by the Terminal Engineering Director.

(5) Design Matrices for Improvement Projects

Although the main purpose of a preservation project may be based on the requirements of the LCCM, the design matrices requirements described in Chapter 210 must also be followed unless a Design Deviation is granted. See Chapter 210 regarding the Design Matrix requirements for certain improvement projects. If an improvement project does not fall into a specific improvement project type, contact HQ Design for guidance in developing a project specific design matrix.

200.05 Scoping Procedures

(1) Project Summary Forms

Whether a project is classified as a preservation or improvement, with the exception of Limited Public Works project (under $35,000 in estimated direct construction costs), the deliverables for all scoped capital projects include the Project Summary Forms. The scoping Project Manager is responsible for completing this form with input from designers as needed. The following is a guide concerning conventions for properly completing the elements of these forms.

(a) Project Definition Form

1. Project Description Statement

The Project Description Statement is the opening statement in the Project Summary Form. It describes what the project will accomplish and how it will be accomplished. It does not include opinions. Generally, preservation projects are simpler to describe:

This project will preserve the Anacortes Terminal holding lanes, custom compound holding lanes, terminal building employee parking, exit lanes, replace traffic loops that will be destroyed by excavation activities, and other pavement facilities by reconstructing the pavement section to full depth. A 1200' ADA compliant pervious cement concrete sidewalk between the toll booths and bottom of the holding lanes, which replace an ADA deficient HMA walkway, will also be constructed.

In the above example, those assets which will be preserved are identified with other incidental or design matrix required work described. Improvement projects are often more difficult to describe as there may be more than one option available than may be determined at a 5-15 percent design level:

This project will either construct one fixed outer deepwater steel dolphin or a single donut fender, subject to an impact energy analysis, to provide protection to both WSF vessels and Marina structures near the Bremerton Ferry Terminal. The base cost assumes the more expensive outer deepwater dolphin will be constructed.

As the above example shows, when a project outcome includes more than one option, it is advisable to note which option is being requested in the budget.

2. Project Need Statement

The Project Need Statement justifies why the project is needed. Preservation projects, which are based on the *Life Cycle Cost Model*, are almost always supported by inspections and/or report recommendations:

The current pavement condition, based on the 2007 Inspection and Resurfacing Report, is poor and beginning to fail. Some ADA facilities, which are required to be upgraded when work is performed on adjacent pavements, are currently below standards.

The Project Need Statement for improvement projects must present the motivation for the work to be performed:

The new Bremerton marina breakwater creates a potential hazard for WSF vessels landing in Slip 2 under adverse wind and tide conditions. In February 2008 a telegraph operated vessel hit the breakwater causing damage to both the breakwater and the vessel. The lack of protection for WSF vessels and the marina leave both the vessel and the marina vulnerable in a typical vessel landing.

Note both Need Statements compliment the Project Descriptions presented in the preceding section.

3. **Project Benefit Statement**

   The Project Benefit Statement describes the benefits expected by completing the project, including monetary savings anticipated for either the capital or operating budget. The benefits from preservation projects usually involve preserving the asset or the function of the asset:

   The project will preserve the upland holding, traffic lanes and other pavement facilities, therefore extending the life of the assets, and improve ADA accessibility.

   The benefits of improvement projects vary from project to project. The following example relates improvements to both safety and ferry operations:

   The placement of either a single fixed dolphin or donut fender system will protect both the vessels and the marina during Slip 2 vessel landings especially in adverse weather conditions. The added protection will also remove the restriction placed on telegraph controlled vessels operating out of Slip 2 which will increase terminal reliability.

   Note both Benefit Statements compliment the Project Description and Need Statements presented in the preceding sections.

(b) Project Impacts Form

Almost all terminal engineering projects impact ferry operation, the traveling public, local communities, other government agencies or possibly tribal entities. Many impacts will affect multiple stakeholders. For successful project completion, it is essential in scoping to identify these impacts, including costs and durations, and mitigation strategies. The Project Impact and Mitigation Strategy Statements, as well as impact cost and duration, will relate to the issues that will arise during the life of a project, and better enable these be mitigated accordingly.

1. **Operational Impacts –** Many projects will impact normal terminal and/or vessel operations. Temporary lane, building or slip closures are issues that will require close coordination with operations staff. In addition, additional terminal staff may be necessary to complete a terminal project, such as construction flagging support, and the project is responsible for providing the funds to do so. Besides providing additional staff, other mitigation measures may also involve scheduling work to occur during off-peak times of day, week or year. If by doing so, it must be noted if a local agency noise variance request will need to be sought. Operations staff, assigned to support Terminal Engineering projects, must be consulted during the scoping phase regarding both impacts and mitigation strategies. The scoping estimate shall include costs associated with operational costs.

2. **Impacts to the Travelling Public –** Some projects will impact the travelling public by creating delays. During scoping, the durations and costs must be identified. For example, if a toll booth is closed; more time may be required to process vehicles into the holding lanes, therefore delaying departure times. As a result, it may be necessary to notify the public in advance through public involvement or outreach efforts. The project is responsible for paying for these efforts, and funding needs to be identified in advance. The scoping Project Manager is responsible for contacting the WSDOT Transportation Planning Office for input regarding any project that is anticipated to significantly impact traffic around the terminal.

3. **Impacts to Local Communities, Agencies and Tribes –** Certain projects may impact more than just ferry operations or patrons. Lane or toll booth closures may create traffic impacts in ferry served communities. Local agencies may have utility, noise or other issues that must be addressed or require agreements. Tribal entities may have archeological interests or treaty rights that must be respected. These impacts are to be noted, along with durations and costs in the scoping documents. In identifying these impacts operations support staff, tribal liaisons, archeologists and other interested parties must be consulted during the scoping phase to reduce the risk of major obstacles being discovered later on.

(c) Project Considerations Form

1. **Preliminary Environmental Review –** Although permitting and associated considerations will be identified by Environmental staff in the *Environmental Review Summary*, the scoping project engineer is still responsible for relating other issues that may not be directly related to regulatory requirements. For example, for in-water work, the fish window will limit construction work to certain times of the year, or an eel grass bed may be present in the project vicinity. Coordination and the need for environmental involvement during design or construction phases, as needed, should also be addressed. These considerations are to be addressed in the scoping documents as an aide to planning purposes.

2. **Potential Tribal or Archeological Impacts –** Tribal interests are not just limited to impacts. Tribal treaty rights must be recognized and noted in the scoping documents. For example, increasing over-the-water coverage, due to the potentially negative impact on subsistence fishing may require tribal consultation and agreement. The scoping project manager must consult the Terminal Engineering Tribal Liaison for assistance in identifying these matters.

   For archeological impacts, note whether soil disturbance, including upland excavation or geotechnical work, will occur during design and/or construction of the project.

3. **Potential Railroad Impacts –** Two WSF terminals are located adjacent to Burlington Northern owned passenger and freight rail lines. The Edmonds Ferry terminal is bisected by rail tracks and the Mukilteo Ferry Terminal is located near the same rail line to the north. Any work that impacts or requires rail road approval or agreements, including Burlington Northern provided flagging, at these two terminals must be noted in the scoping documents. Elsewhere this field will state "non-applicable".

4. **Potential Utility Impacts –** WSF terminal facilities have numerous utilities located both upland and on the trestles. Most utilities within the ferry terminal properties are owned by WSF. For projects outside the terminal facility, utilities are owned by both private and public entities. These utilities and any known issues must be noted in the scoping documents. In particular, it is important to investigate the possibility that utilities will conflict with the proposed work. A field visits and review of as-builts are therefore recommended, and the photos, notes and plans generated must be included in the scoping file.

For marine projects, these underwater utilities are known or suspected to exist at the following terminals:

- Bremerton
  - Submarine Power Cable
- Edmonds
  - Drainage Easement (maintained by the city)
- Fauntleroy
  - Sanitary Sewer Line
- Friday Harbor
  - Sanitary Sewer Line
- Kingston
  - Wastewater Outfall
- Orcas
  - Submarine Power Cable
- Seattle
  - Sanitary Sewer Line

Note the above utilities in the scoping document and state that further investigation is required by the project team.

5. **Potential Maintenance Impacts –** Most, if not all, capital construction products will require periodic maintenance. The Terminal Engineering Maintenance Program Director and Facility Engineers must be consulted during the scoping phase to verify whether the proposed feature, as scoped, is acceptable from a maintenance point of view. Any input must be noted in the scoping files. In addition, if known, as justification for preservation and improvement projects, expected maintenance expenditure reductions will be noted and backup provided.
6. **Predesign Decisions –** Note any design decisions that have been determined during scoping. If a pre-design study is required then note so here.
7. **Potential Regulatory Impacts –** Note any potential regulatory impacts that have been identified during scoping, if any, including local building codes.
8. **Potential Engineering Services Impacts –** Note any impacts, such as the necessity for multiple or project dedicated subject matter experts, including use of Region or headquarters staff.
9. **Workforce Requirements –** List specialized workforce requirements, including archeologists, biologists, structural, electrical or mechanical engineers, architects etc.
10. **Public Involvement –** Summarize public involvement to date, and anticipated during the design and/or construction of the project, including the use of standard notification procedures and community outreach in the event of a full or partial terminal closure.
11. **Commitments –** Summarize commitments made to the project by others and/or commitments made to others, such as WSF operations or a local agency, by the project.

(d) Design Decisions Summary Form

1. **Terminal Elements –** The Terminal Elements section lists a number of typical components found in terminal projects.
2. **Design Matrix Selection –** The design matrix selected by the scoping team, its publication date, and the justification of its use (if needed), will be documented on the Design Decisions form. If the project does not fit into any of the design matrix rows in Chapter 210, a project specific matrix may need to be developed. Consult with Assistant State Design Engineer assigned to WSF.
3. **Additional Project Information –** Any additional information, such as water or pile depths, may be recorded in this section of the Design Decisions form.
4. **Safety Deficiencies and Mitigation Strategy –** Safety Deficiencies are documented in this section. Include any accident or incident histories. The mitigation strategy, such as using a safer system or installing safety redundancy measures, will detail and justify the proposed fix or solution to the deficiency. Seismic deficiencies are also being noted in this section.
5. **Operational Deficiencies and Mitigation Strategy –** Operational Deficiencies are documented in this section. The mitigation strategy, with an emphasis on the quantitative, should detail and justify the proposed fix or solution to the deficiency.
6. **Environmental Deficiencies and Mitigation Strategy –** Environmental Deficiencies are documented in this section. The mitigation strategy, based on a business case analysis with an emphasis on the regulatory requirements, will detail and justify the proposed fix or solution to the deficiency. It must not contradict the Environmental Review Summary (ERS) described below.
7. **Additional Deficiencies and Mitigation Strategy –** Additional Deficiencies are documented in this section. The mitigation strategy will detail and justify the proposed fix or solution to the deficiency. Unless addressed elsewhere, known and potential ADA issues, including temporary impacts during construction, should be discussed in this section.

(e) Environmental Review Summary

Once the WSF Scoping Project Manager has completed the scoping deliverables, including the Project Summary Forms, scoping level project estimate, 5-15 percent preliminary design and supporting documentation, the package is delivered to the Capital Scoping Lead, which will then directly give the packet to the Terminal Engineering Environmental Group for review. The Environmental Review Summary (ERS), which includes identifying permit requirements, will be completed at that time.

(2) Scoping Estimate

(a) Estimate Summary and Components

A scoping level estimate is required for each project scoped as defined and described in the *Cost Estimating Manual for WSDOT Projects* M 3034 publication. For WSF Terminal projects, a special *Terminal Engineering Estimating Spreadsheet*, available from the Terminal Engineering Chief Estimator, will be used. A *Basis of Estimate Form*, which documents and justifies estimate costs and assumptions is also required.

The following describes typical components of a scoping level cost estimate.

(b) Estimate Summary

The estimate summary is placed as the first page of the estimate. It includes the base construction estimate, and the miscellaneous item allowance. Soft costs are also tabulated. Additional design and construction expenditures, such as public involvement and operations costs, and right of way funds needed are also shown. The cost box on the Project Definition form described above must match these results.

1. **Section Report –** This report lists all the Standard Item Table section subtotals for the project estimate. WSDOT *Standard Items* are to be used whenever possible.
2. **Component Estimate Summary –** The Component Estimate Summary lists subtotals and prorates costs for major estimate components such as structures, buildings, or other assets. Each major structure cost, including retaining walls and berthing structures, should be captured in a single column.
3. **Section Tabs –** This worksheet lists bid items for the project. WSDOT *Standard Items* and non-standard items may be utilized. The units of measurement, cost per unit, quantities, source of unit pricing and justifications are displayed for each bid item. State whether quantities were determined from CADD files, scaling, field measurements or some other means on these tabs.
4. **Lump Sum Breakdowns –** Most Lump Sum bid items must be broken down to determine a basis of cost. Source or justification for pricing must also be included. For larger calculations, the lump sum may be displayed on a separate sheet. State whether quantities were determined from CADD files, scaling, field measurements or some other means on these tabs.
5. **Additional Estimate Components –** All projects are unique, therefore there may be additional estimate components needed to provide an accurate picture of how quantities were calculated or assumptions made to determine a project estimate. This additional information must be included as well.

(c) Basis of Estimate

A *Basis of Estimate Form*, which documents and justifies estimate costs and assumptions, is required for all scoping projects. The primary estimating methodologies, design assumptions, cost basis, allowance, assumptions made, exclusions, exceptions, risks, quality assurance measures, reconciliation and the estimating teams are all recorded. Several attachments, such as reference and deliverables, may also be included.

A Terminal Engineering specific *Basis of Estimate Form* has been created and is available on request from the lead scoping engineer.

(d) Soft Costs

Soft costs are items added to an estimate to cover intangible costs other than the actual construction work done or property acquired on a project. For WSDOT estimates, soft costs include miscellaneous item allowances (60 percent or lower design level only), Preliminary Engineering costs, Construction Engineering costs, Construction Change Order Contingency and other costs not associated with the actual construction work identified to be completed or property to be acquired. Many of these soft costs are the product of markups determined by the size of the project and the type of work to be completed.

1. **Miscellaneous Item Allowance –** The Miscellaneous Item Allowance is a markup added to the estimated construction cost to account for those items of work that have either not yet been identified or were too minor to consider for the level of estimate in question. The *Cost Estimating Manual for WSDOT Projects* includes guidance dependent upon the level of estimate for the markup to be applied to the base construction cost. Typically a planning level estimate would have a Miscellaneous Item Allowance between 30 percent and 50 percent, whereas a scoping level estimate, which is better defined, would be marked up between 20 percent and 30 percent. At WSF, the standard procedure is to use the lower range (or below) unless a higher percentage can be justified by either calculating it directly per the method described in the Terminal Engineering estimating template spreadsheet, citing project complexity, higher than usual environmental or tribal mitigation costs, experimental features, missing data that cannot be obtained at the scoping level, or some other factor that is anticipated to lead to higher costs.

   An alternate method assigns allowances and uncertainty percentages per each individual bid item in the estimate. This allows the allowance to be justified and defensible. See the Capital Scoping Lead for assistance with this method.

2. **Preliminary Engineering and Construction Engineering –** Currently, the W Capital Program has not published guidance concerning the soft cost markups for Preliminary Engineering and Construction Engineering. Therefore, standard WSF Terminal Engineering practice is to compare the scoped project to similar highway I or P projects in the *Cost Estimating Manual for WSDOT Projects* and the *EBASE User's Guide*, respectively. For projects that are a mix of work types, such as one including trestle preservation and storm water retrofit work, a weighted average, as shown in the WSDOT *EBASE User's Guide* is used. The following is a rough guide to analogous projects:

Type of Work	Analogous Subprogram	Analogous Category	Notes
Building Work	P3 Other Facilities	PD Rest Area	For Building Projects above $1M use 15% for Preliminary Engineering
Electrical or Mechanical Work	P3 Other Facilities	PH Major Drain Electrical	For Electrical or Mechanical Projects above $5M use 15% for Preliminary Engineering
Paving Work	P1 Roadway Preservation	Paving Safety Restoration	Includes chip seal and pavement repair projects
Seismic Retrofit	P2 Structures Preservation	PC Catastrophic Reduction	For Subprogram W1, seismic retrofits are considered improvements
Storm Water Retrofit*	I4 Environmental Retrofit	IK Storm Water Runoff	For Storm Water Retrofit Projects above $2M use 15% for Preliminary Engineering
Storm Water System Preservation*	P3 Other Facilities	PH Major Drain Electrical	For Storm Water System Preservation Projects above $5M use 15% for Preliminary Engineering
Structures Improvement	I1 Mobility or I2 Safety	IA Urban, IA Rural or IE Collision Prevention	Dependant on need to be addressed.
Structures Preservation	P2 Structures Preservation	PB Structures Preservation	
Upland Projects Outside WSF Facility			Treat as highway project

*Not a Stand-alone Alone WSF Project Type

Equivalent Projects for Determination of Preliminary and Construction Engineering Soft Cost Markups
Exhibit 200-1

For projects below $100,000 in construction costs, a bottom-up preliminary engineering phase estimate is required, including a design contingency that matches the miscellaneous item allowance percentage. The scoping engineer is directed to consult with Capital Scoping Lead in those situations where a project does not fit any of the above criteria or is an upland project outside the WSF facility. The use of a percentage higher than listed in the tables shall only be allowed with the concurrence of the Director of Terminal Engineering.

3. **Change Order Contingency –** The Construction Change Order Contingency is always 4 percent per the WSDOT *Plans Preparation Manual*.

4. **Right of Way Acquisition –** Often, at the scoping level, a designer will consult an online county assessor's database to determine the cost to purchase a parcel of property. However, WSDOT Right-Of-Way staff will still need to investigate the property, negotiate with the property owner, demolish existing structures and perform other work to acquire the parcel. A typical markup of 15-20 percent should be used above the cost of the property.

(e) Additional Project Expenses

1. **Preliminary Engineering Phase –** Additional Design Expenses, which are above and beyond typical design engineering expenses, involve additional funding to the Preliminary Engineering phase to pay for operations support, permit fees, environmental studies beyond the scope of a typical project, and public relations

costs, which are described below. Monies for tribal and other agreements may also be included in this phase or the Construction Phase. These need to be justified, calculated and noted on the Estimate Summary Form.

2. **Construction Phase –** The construction phase may include additional "below-the-line" items that are typically not included in the cost to administer a construction project. These may or may not be fully identified at the scoping level, but an effort must be made to determine these costs as far as possible. These should be noted on the Project Estimate Summary with supporting calculations as necessary. Some examples, not meant to be exhaustive, are given as follows.

   a. **Public Art Requirement –** Per RCW 43.17.200 Building Improvement projects must include a minimum of one-half of one percent formula, to be applied to architecture and engineering fees, total building cost and equipment costs to pay for public art. New buildings and building additions, per RCW 43.17.200, are subject to this requirement. See WAC 30-40-050 and Appendix V for additional information.

   b. **WSF Operations Construction Support –** WSF Operations will often provide flagging, per standing labor agreements, and other support services. These must be identified with input from operations. Typically these required funds are calculated and justified based on the Full Time Equivalent (FTE's) required. Consult Program Management Staff to determine the monthly cost of 1 FTE to be used for this estimated cost.

      Construction support may also involve providing Passenger Only (PO) service or re-routing the vessels to another terminal. Terminal Operations support staff must be contacted to provide a cost estimate based on time, equipment and fuel costs.

      In the estimate, WSF Operations Construction Support is accounted for as 800-level "non-bid items". See the *EBASE User's Guide* for more information.

   c. **Utility Payments –** For projects outside the WSF facility, such as a traffic signal or luminaire installation, the organization responsible for administrating the project may be required to pay the utility bill until the responsibility for maintaining the new construction is turned back to the region. Contact region utilities staff to determine this amount.

      In the estimate, utility payments are accounted for as 700-level "non-bid items". See the *EBASE User's Guide* for more information.

   d. **Work by WSF Eagle Harbor Maintenance or other WSDOT Forces –** Some work on a project may be performed with less expense by WSF Eagle Harbor Maintenance or WSDOT Highway Maintenance forces. The threshold for work by state forces is currently set at $60,000 or less. In the past, as set by legislation (see RCW 47.28.030), this limit has been higher. Contact Program Management Staff to verify the threshold. The cost is calculated by determining time, equipment and materials costs with representatives from the organization that will perform the work. Public Interest Finding - Agency Force (DOT Form 140-050) must be completed and signed by the applicable approving authority.

Dividing the construction of any project by state forces into units of work or classes of work to give the appearance of compliance with the monetary limits above is prohibited per RCW 47.28.035.

In the estimate, work by WSF Eagle Harbor Maintenance or other WSDOT forces are accounted for as 800-level "non-bid items". See the *EBASE User's Guide* for more information.

e. **Work by State Forces from other Agencies –** Project support may be provided by other agencies, such as the Washington State Patrol or local law enforcement. The cost is calculated by determining costs with representatives from the organization that will perform the work.

In the estimate, work by state forces from other agencies are accounted for as 700-level "non-bid items". See the *EBASE User's Guide* for more information.

f. **Equipment and furnishings supplied by WSF –** Equipment and furnishings, particularly for building and security projects, may be provided by WSF. These costs will be validated by including the costs of the equipment, furnishings, and labor to install.

In the estimate, equipment and furnishings supplied by WSF are accounted for as 800-level "non-bid items". See the *EBASE User's Guide* for more information.

g. **State supplied materials –** Rather than supplied by a contractor, some materials used on projects, such as steel pile pipe and hydraulic equipment, may be used on a contract. For scoping projects, future availability must be verified as state supplied material is less expensive than from other sources.

If no labor by state forces, including Eagle Harbor, is involved, then no monetary limit exists; otherwise the limit is as discussed in above in (d.) *Work by WSF Eagle Harbor Maintenance or other WSDOT Forces*.

In the estimate, state supplied materials are accounted for as 800-level "non-bid items". See the *EBASE User's Guide* for more information.

h. **Agreement Funds –** Many different types of agreements may be made with utility companies, local agencies, property owners, tribes and others that will involve the transfer of funds for mitigation purposes, services, utility work, local street improvements and other matters. For scoping, these must be identified as far as possible and supporting documentation provided.

In the estimate, agreement funds are accounted for as 700-level "non-bid items". See the *EBASE User's Guide* for more information.

i. **Consultant Services –** For projects designed by consultant forces, who may be called upon during the construction contract to provide advice or other services, or projects involving special inspectors, such as required by some local agencies for building projects, additional "below-the-line" items must be added for each agency or firm involved.

In the estimate, funds for consultant services are accounted for as 700-level "non-bid items". See the *EBASE User's Guide* for more information.

j. **Permit Requirements—Environmental Monitoring –** Some projects, particularly marine projects involving pile driving, require regulatory environmental monitoring for endangered species and marine mammals. For scoping efforts, this amount may be based on expenditures from previous projects. In addition, bid items to compensate the contractor for the resultant shutdown times incurred must be added to the construction estimate.

In the estimate, funds for environmental monitoring, if the work is to be performed by WSDOT forces, are accounted for as 800-level "non-bid items". Otherwise, the funds are accounted for as 700-level "non-bid items". See the *EBASE User's Guide* for more information.

(3) Supporting Documentation and Approvals

(a) Scoping documentation

A preliminary checklist for scoping projects will be provided by Capital Scoping Lead prior to project scoping. Scoping documentation, beyond the Project Summary Forms, Environmental Review Summary and Project Scoping Cost Estimate discussed above, are listed below. This includes, but is not limited, the following:

- Risk Analysis, per WSDOT Secretary's Executive Order E 1053, is required for all projects. If no risks are identified, document in the Basis of Estimate.
- Vicinity Map or Ariel Photo is recommended for projects where elements are easily identified at the scale of the drawing or photo.
- Conceptual Plans, by discipline, at the 5-15 percent design level for applicable projects and as-builts. These can be markups or CAD drawings as needed.
- Specialist recommendations, such as surfacing reports, geotechnical reports, traffic study results or others as applicable.
- Field visit notes and photos as applicable
- *Life Cycle Cost Model* details and condition ratings for preservation projects
- Meeting notes and minutes
- Prior scoping results noted if applicable
- Email or other correspondences.
- Review and concurrence forms
- Project Schedule information
- Structural or other calculations
- ADA needs
- Stormwater needs
- Other documentation, such as bridge inspection reports, as needed

(b) Approvals and Concurrences

Scoping projects must be reviewed and concurrence received, as applicable, from or delegated by the following as noted:

- Director of Terminal Engineering (all projects—via signatures on project scoping forms)
- Design Engineering Manager (all projects—via signature on Design Decisions form)
- Assistant State Design Engineer assigned to WSF (all projects—via signature on Design Decisions form)
- Environmental Engineering Manager (all projects—via signature on Environmental Review Summary)
- Architectural/ Facilities (as applicable)
- Electrical Group Manager (as applicable)
- Mechanical Group Manager (as applicable)
- Structures Group Manager (as applicable)
- Terminal Maintenance Manager (as applicable)
- Tribal Liaison (All in-water projects and projects that increase over-the-water coverage)
- Operations (all projects)—via signature on Operational Impacts form.
- Security (as applicable)
- Cultural Resources Specialist (all projects)
- Other concurrences as needed

(4) Scoping Level of Design

Typically the level of design for most scoping projects is at the 5-15 percent design level. Major quantities and items of work are identified at this level. In some situations, where a project was shelved and then re-scoped, a higher level of design may be used.

(5) Quality Assurance Procedure

Upon completion of a scoping effort, a scoping packet with the scoping forms, estimate and other deliverables will be submitted to the Capital Scoping Lead for review. The time for review will vary depending upon project complexity and size. The comments generated by this review will then be returned to the project manager for response and to address any changes needed.

(6) Project Risk

As mentioned above, per WSDOT Secretary's Executive Order E 1053, a risk analysis is required for all projects. For scoping projects, with a total project cost below $10M, the risk analysis is qualitative. For scoping projects, with a total project cost above $10M, a quantitative risk analysis is conducted using a Self-Modeling Risk Spreadsheet provided by the department. The results of the Self-Modeling Risk Spreadsheet will be used to establish the project's risk reserve. Regardless of phase for the risk occurrence, the risk reserve will be established in the construction phase for budgetary purposes.

(7) Project Delivery Method Selection Guidance

For all Projects, scoping teams must follow the *Project Delivery Method Selection Guidance*, to determine the optimal delivery method for the project. These project delivery methods include Design-Bid-Build, Design-Build, and General Contractor/ Construction Manager. Management concurrence is required.

200.06 Predesign Studies

(1) Legal Requirements

(a) Preservation Projects

Per RCW 47.60.355, vessel and terminal preservation project's funding requests shall only be for assets in the *Life Cycle Cost Model* (LCCM). Terminal and vessel preservation funding requests that exceed five million dollars per project must be accompanied by a predesign study as required by the Office of Financial Management (OFM).

(2) Improvement Projects

Per RCW 47.60.385, Terminal improvement project funding requests must adhere to the capital plan, include route-based planning, and be submitted with a predesign study that:

1. Includes all elements required by the office of financial management;
2. Separately identifies basic terminal elements essential for operation and their costs;
3. Separately identifies additional elements to provide ancillary revenue and customer comfort and their costs;
4. Includes construction phasing options that are consistent with forecasted ridership increases;
5. Separately identifies additional elements requested by local governments and the cost and proposed funding source of those elements;
6. Separately identifies multimodal elements and the cost and proposed funding source of those elements;
7. Identifies all contingency amounts;
8. Identifies any terminal, vessel, or other capital modifications that would be required as a result of the proposed capital project;
9. Includes planned service modifications as a result of the proposed capital project, and the consistency of those service modifications with the capital plan; and
10. Demonstrates the evaluation of long-term operating costs including fuel efficiency, staffing, and preservation.

Section 4 of Chapter 506, Laws of 2007 (SHB 2366) states: *"The office of financial management shall design and implement a modified predesign process for any space request to lease, purchase, or build facilities that involve (a) the housing of new state programs, (b) a major expansion of existing state programs, or (c) the relocation of state agency programs."*

(3) Modified Predesign Studies

In compliance with the legal requirements cited above, modified predesign studies are required for a ferry terminal improvement projects with a total project cost of $5M or below. Guidance for the modified predesign study, which does not include all sections included in a full predesign study, is contained in the OFM issued *2009-11 Transportation Predesign Manual*. No guidance is issued regarding funding requirements for modified predesign studies. Current practice is to allocate ten percent of the preliminary engineering budget, as scoped, to the fulfillment of this requirement.

(4) Full Predesign Studies

Full predesign studies are required for all ferry terminal projects with a total project cost over $5M. Per OFM guidance, the funding standard for full predesign studies is dependence upon both the project cost and the level of complexity. Current practice is to allocate this calculated amount of the preliminary engineering budget, as scoped, to the fulfillment of this requirement. The spreadsheet developed by Chief Estimator for scoping projects automatically calculates this amount once the level of complexity is identified.

200.07 Level of Service

Per RCW 47.06.140, the legislature has declared ferry transportation facilities to be of statewide significance. WSDOT has been tasked with setting level of service (LOS) standards. The Department was directed to consider the necessary balance between providing for the free interjurisdictional movement of people and goods and the needs of local communities using these facilities. When setting the level of service standards for state ferry routes, the Department may allow for a standard that is adjustable for seasonality.

In June 2009, WSF published the Long Range Plan which re-establishes level of service standards in the vehicle holding areas. The recommended LOS measure proposed in this plan sets a maximum daily percent of sailings at vehicle capacity. This measure focuses primarily on vehicle service during peaks and towards maximizing utilization of excess capacity by implementing strategies that redistribute demand prior to investing capacity improvements.

Exhibit 200-2 below summarizes the vehicle LOS standards found in the *Long Range Plan*. For each existing route, the standards have been divided between Level 1 Standards and Level 2 Standards. The LOS Standards have been further divided into three months of the year to reflect the variations in seasonal ridership, especially on the recreational routes.

The percentages in the table represent the number of sailings at full vehicle capacity on a given day compared to the total number of sailings in that day. For example, given the Seattle - Bremerton route in the month of January, Level 1 Standards are in effect when 25 to 50 percent of the sailings are full in a given day. Level 2 Standards are in effect when 50 percent or more of the sailings are full in a given day. Route-specific improvements are not recommended below 25 percent.

Route	Level 1 Standards (Consider targeted strategies to spread demand and improve customer experience)			Level 2 Standards (Assets are being used efficiently, consider additional investment)		
	January	May	August	January	May	August
Point Defiance - Tahlequah	25%	25%	30%	50%	50%	60%
Point Townsend - Coupeville	25%	30%	35%	75%	75%	85%
Mukilteo - Clinton	25%	25%	30%	65%	65%	75%
Fauntleroy - Vashon	25%	25%	30%	50%	50%	60%
Fauntleroy - Southworth	25%	25%	30%	50%	50%	60%
Seattle - Bremerton	25%	25%	30%	50%	50%	60%
Edmonds - Kingston	25%	25%	30%	65%	65%	75%
Seattle - Bainbridge	25%	25%	30%	65%	65%	75%
Anacortes - San Juan Islands	25%	30%	35%	65%	75%	85%
Anacortes - Sidney	N/A	50%	50%	N/A	100%	100%

LOS by Route – Percent of Sailings Filled
Exhibit 200-2

The 25 percent standard reflects a situation in which all peak sailings are filled to capacity, but other sailings are not, indicating opportunities to spread demand through adaptive management strategies. Recreational routes might expect to be able to achieve a higher percent of sailings filled due to customer flexibility in travel times. A large percentage of sailings filled on a given route is indicative of congestion and overloaded sailings.

Level 1 Standards indicate the point at which additional pricing and operational strategies might be needed. This standard should not be viewed as a minimum criterion to be achieved before adaptive management strategies are deployed (i.e. strategies that have system wide benefits should be considered independent of a route's performance against LOS standards). Rather, it should be an indicator of when WSF might consider more targeted adaptive management strategies to alleviate congestion and spread demand to sailings where capacity exists.

Level 2 Standards indicate when additional service might be needed. This standard should not automatically be a trigger for additional investment. It should be used as an indicator that identifies when existing assets are being used most effectively and WSF might begin considering additional investment (e.g. adding more sailings and more holding capacity).

Vehicle ridership and capacity information is available to designers through the WSF Planning Department. If a terminal is operating within Level 1 Standards, refer to targeted efficiency strategies in Section 510.06 (additional operational adaptive management strategies are discussed in the *Long Range Plan*). If a terminal is operating within Level 2 Standards, refer to vehicle holding lane sizing as discussed in Chapter 520.

For further reading, see *Part 6 Ferry Capacity* of the *Transit Cooperative Research Program (TCRP) Report 100: Transit Capacity and Quality of Service Manual*, 2nd Edition.

Chapter 205 External Project Scoping and Review Requirements

205.01 General
205.02 References
205.03 Security Scoping and Project Review Requirements
205.04 Information Technology and Intelligent Transportation Systems Scoping and Project Review Requirements
205.05 Operations Scoping and Project Review Requirements

205.01 General

This chapter describes requirements and information to be provided by and to WSF sections external to Terminal Engineering during project scoping, as described in Chapter 200, and during the preliminary engineering phase with respect to constructability reviews as described in Chapter 230. The goal is to reduce duplication of effort and avoid potential conflicts by allowing all stakeholders to understand the plans and requirements of other sections.

For additional information refer to the following chapters:

Chapter	Subject
200	Capital Project Scoping
210	Design Matrix Procedures
220	Design Documentation, Approval, and Process Review
230	Quality and Constructability
310	Security
350	Buildings
360	Electrical
560	Site Utilities

205.02 References

(1) Design Guidance

WSDOT Administrative manuals, including those listed below:
www.wsdot.wa.gov/publications/manuals/index.htm

- *Advertisement and Award Manual* M 27-02
- *Electronic Engineering Data Standards* M 3028

WSDOT Engineering Applications, including those listed below:
www.wsdot.wa.gov/design/projectdev/engineeringapplications

- EBASE

205.03 Security Scoping and Project Review Requirements

(1) General

Chapter 310 includes a general discussion of security requirements and Chapter 560 contains additional information pertaining to utility design. Security projects differ from other projects due to the sensitive nature of the assets involved. Any information contained within a security documents is considered confidential and may not be released without the consent of the Company Security Officer of WSF Security.

Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security.

Sensitive Security Information (SSI) is that information defined in 49 CFR Part 1520 but also includes any information not specifically mentioned in Part 1520 but marked as "Sensitive Security Information" or "SSI". Typically, if a document or contract includes SSI information, then the entire project is considered SSI. See Section 310.14 for additional details.

All contractors and vendors must comply with security credentialing requirements. Contract agreements and provisions will need to contain the requirements that contractor or vendor personnel meet these requirements.

All security projects will contain provisions to ensure accurate as-built plans are generated.

(2) Security Scoping Procedures

Some security projects are designed by Terminal Engineering staff. Scoping for these projects shall follow the requirements of Chapter 200. During scoping, projects that will not be designed by Terminal Engineering staff need to provide the following information to the Terminal Engineering Scoping Engineer who will coordinate with Security personnel. This information should be as specific as possible without compromising security confidentiality requirements. It is not necessary to describe the function if SSI would be compromised.

- General information concerning proposed location of physical infrastructure to be installed, such as conduit and other supporting equipment;
- Space requirements for proposed security items in IT Equipment rooms (see Section 310.07(4));
- Proposed size, location and type of security fencing and gates to be installed;
- Proposed size, location and type of buildings and other structures to be constructed;
- Any proposed equipment installation that will substantially impact the terminal electrical power system;
- Proposed installation of HVAC or other systems required to support security features;
- Identified performance and heat load issues

Early during the scoping process described in Chapter 200, once it has been determined which proposed improvement and preservation projects will advance, the Terminal Engineering Scoping Engineer will schedule a meeting with the Company Security Officer to summarize and discuss proposed scoped projects. Emphasis will be placed on the issues identified above. Any projects that are identified as being of interest to the security concerns will be noted. The scoping project managers will be informed of the issues, and the need to include the Security section in reviews of the proposed project, and budget resources accordingly.

(3) Security Project Review Procedures

Security and Terminal Engineering design project managers shall include and budget for at least two project reviews by external reviewers, including Terminal Engineering, Security, and Information Technology staff. Operations liaisons assigned to Terminal Engineering will also be included. These reviews will be subject to the security confidentiality requirements discussed above.

Projects designed by Terminal Engineering personnel shall follow the review requirements as described in Chapter 230.

In addition, all projects should include requirement for vendor/contractor and/or project inspector produced as-builts.

205.04 Information Technology and Intelligent Transportation Systems Scoping and Project Review Requirements

(1) General

Chapter 560 addresses communications systems and supporting infrastructure. Communication systems include Information Technology (IT) and Intelligent Transportation Technology (ITS). ITS applies to highway system features approaching the terminal as well as terminal site features, and can include reservations systems.

All Information Technology and Intelligent Transportation Systems projects will contain provisions to ensure accurate as-built plans are generated.

(2) Information Technology Scoping Procedures

Some information technology projects may be designed by Terminal Engineering staff or by Region staff. Scoping for these projects shall follow the requirements of Chapter 200. During scoping, projects that will not be designed by Terminal Engineering staff need to provide the following information to the Terminal Engineering Scoping Engineer:

- General information concerning proposed location of physical infrastructure to be installed, such as conduit and other supporting equipment;
- Space requirements for proposed information technology items in IT Equipment rooms;
- Any proposed equipment installation that will substantially impact the terminal electrical power system;
- Proposed installation of HVAC or other systems required to support IT features (heat loads);
- Identified performance issues.

Early during the scoping process described in Chapter 200, once it has been determined which proposed improvement and preservation projects will advance, the Terminal Engineering Scoping Engineer will schedule a meeting with the delegated representative of the Information Technology section to summarize and discuss proposed scoped projects. Emphasis will be placed on the issues identified above. Any projects that are identified as being of interest to the security concerns will be noted. The scoping project managers will be informed of the issues, and the need to include the Information Technology section in reviews of the proposed project, and budget resources accordingly.

(3) Intelligent Transportation Systems Scoping Procedures

ITS, including reservations systems, projects are designed by or in coordination with the Region. For this reason, ITS projects shall follow the requirements of Chapter 200. As Operations liaisons assigned to Terminal Engineering will be involved in these projects, they will be informed of any potential conflicts through their typical review and involvement in those projects.

(4) Information Technology Project Review Procedures

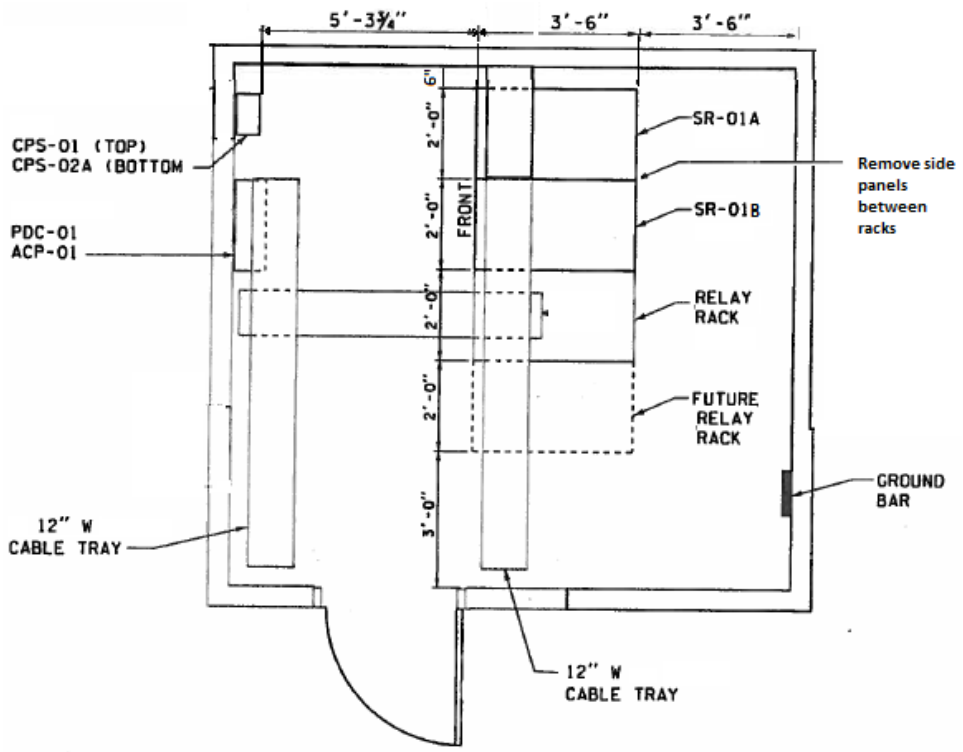
Information Technology and Terminal Engineering design project managers shall include and budget for at least two project reviews by external reviewers, including Terminal Engineering, Security, and Information Technology staff. Operations liaisons assigned to Terminal Engineering will also be included.

(a) Information Technology Room Scoping and Design

The following guidelines are included for Information Technology Room scoping and design:

- Information Technology section must approve final decisions on room size, equipment installs and support.
- Minimum 48” inches from the front of the rack to front of any equipment mounted to the wall to allow installation of large equipment like servers and UPS’s.
- Minimum 36” inches from the rear of the rack to front of any equipment mounted to the wall.
- Minimum 36” inches to between the last rack and the wall preferably nearest to the door to allow for equipment installation and egress.
- Approximately 6” inches between the wall and the first rack to allow for rack door swing and room to install equipment.
- If possible the front of racks should be closest to the door for ease of installation.
- Fire resistant plywood should be installed on the wall to allow for mounting equipment and punch downs.
- Air Conditioners shall be installed and sized using projected heat loads of equipment.
- Cable trays to be installed across the top of the racks from one side of the room to the other. Also any wire penetrations to the front or back should be tied in using cable trays.

- Lights shall be at a minimum installed in front of and behind the racks with little obstruction (e.g. cable trays or other cables).
- In most cases three racks should be installed, two standard racks and one relay rack, relay rack should be the last rack allowing for the most access to three sides.
- Installation of racks side by side should have the internal panels removed to allow for cabling between racks.
- Square footage based on number or racks, minimum dimensions 12 feet deep by 8 feet wide (2 racks) or 10 feet wide (3 racks) though best practice would be to allow for future expansion (2 feet per additional rack).
- Door to swing outward.



Typical Information Technology Room Layout
Exhibit 205-1

(5) Intelligent Transportation Systems Project Review Procedures

ITS, including reservations systems, projects designed by or in coordination with the Region will follow standard Region review practices. The project teams will be informed to include Terminal Engineering, Security, and Information Technology staff. Operations liaisons assigned to Terminal Engineering will also be included.

205.05 Operations Scoping and Project Review Requirements

(1) General

Almost all Terminal Engineering, Security and Information Technology projects impact ferry operations to varying extents. Operations liaisons and other staff are involved in the development of these projects.

All related projects will contain provisions to ensure accurate as-built plans are generated.

(2) Operations Involvement in Project Scoping

Many terminal projects are designed by Terminal Engineering staff. Scoping for these projects shall follow the requirements of Chapter 200. During scoping, projects that will not be designed by Terminal Engineering staff need to provide the following information to the Terminal Engineering Scoping Engineer:

- General information concerning proposed location of physical infrastructure to be installed, such as conduit and other supporting equipment;
- Proposed size, location and type of security fencing and gates to be installed;
- Proposed size, location and type of buildings and other structures to be constructed;
- Any proposed equipment installation that will substantially impact the terminal electrical power system;
- Proposed installation of HVAC or other systems required to support security features;
- Identified performance and heat load issues;
- Space requirements for proposed information technology items in IT Equipment rooms;
- Identified performance issues.

The Terminal Engineering Scoping Engineer will develop a process involving Contract and Legal Services to identify any work at the facility to be performed by a vendor or through a Limited Public Works contract to obtain the above information.

(3) Operations Involvement in Project Reviews

Operations liaisons assigned to Terminal Engineering are involved in and shall follow the review requirements as described in Chapter 230. Security, Information Technology and Terminal Engineering design project managers shall include and budget for at least two project reviews by. Operations liaisons assigned to Terminal Engineering will also be included.

Chapter 210 Design Matrix Procedures

210.01 General
210.02 Selecting a Design Matrix
210.03 Using a Design Matrix

210.01 General

Chapter 200 provides guidance for the scoping of capital terminal preservation and improvement projects. The design matrices in this chapter are used to identify the project type and the associated design elements to be addressed. Design variances can be allowed. This chapter addresses matrices for Preservation as well as common types of improvement projects. Atypical Improvement projects, less frequently funded, will be evaluated on a project-by-project basis in consultation with the Assistant State Design Engineer (ASDE). Coordinate with the Design Engineering Manager, the WSF ADA Coordinator and the ASDE on the scope of these projects particularly regarding ADA analysis and inclusion.

The Preservation design matrices are broken into three tables to coincide with the location and/or the type of facility found in the *Life Cycle Cost Model* (LCCM) Inventory Identification Scheme; in or over water, on land, and buildings. The Improvement matrix was developed to address the most common improvement matrix projects.

A design matrix is used to determine which design elements need to be considered in a project. See Chapter 220 for documentation requirements.

When a project requires work beyond the limits of the terminal area, such as Preservation or Improvement work along an existing state route, consult the WSDOT *Design Manual* M 22-01 (DM) for applicable design guidance and criteria.

210.02 Selecting a Design Matrix

For Preservation projects, selection of a design matrix is based on the location of the facility:

- Waterside
- Upland
- Buildings

For Improvement projects, design matrix use is subject to ASDE discretion, and may not apply to all projects.

210.03 Using a Design Matrix

The design matrices are shown in Exhibits 210-1 through 210-4. The definitions presented in this chapter are meant to provide clarification of terminology used in the WSF *Terminal Design Manual*. There is no assurance that these terms are used consistently in references outside the WSF *Terminal Design Manual*.

(1) Project Type

For project types not listed in the design matrices (such as unstable slopes, traffic signals, or work outside the terminals), consult the Headquarters (HQ) Design Office for guidance.

In the design matrices, row selection is based on Project Type. The Project Summary Form (see Section 200.05) defines the purpose and needs for the project and describes the project.

Note: Some projects may fall under two or more project types. For example, pavement replacement (Matrix 2) may be combined with utility work (Matrix 4). If the main purpose of a project is preservation, but some requirements are covered under the improvement matrix, the project is still classified as a preservation project.

Preservation Project Types are:

(a) Waterside: Terminal facilities located in or over the water.

Transfer Span/Tower Mechanical/Electrical – Work on transfer span/tower/ headframe mechanical and/or electrical systems that have reached the end of their useable service life identified in the LCCM prevent failure of the lifting systems. May include utility work. Does not include structural work but may be combined with a Transfer Span/Tower Rehabilitation project.

Transfer Span/Tower Rehabilitation – Work on a transfer span/tower that has reached the end of the useable service life identified in the LCCM to repair elements to prevent further corrosion, wearing, and/or preserve the structural integrity. May include utility work. Does not include electromechanical work but may be combined with a Transfer Span/Tower Mechanical/Electrical project.

Transfer Span/Tower Replacement – Work on a transfer span/tower to replace elements that have reached the end of the useable service life identified in the LCCM. May include utility work. May include mechanical, electrical and structural work.

Bridge Seat Rehabilitation – Work on a bridge seat that has reached the end of the useable service life identified in the LCCM to preserve or restore operational or structural capacity. May include utility work. ***Note:*** use *Matrix 4: Improvement Projects* when seismic retrofit is only design element.

Bridge Seat Replacement – Work on a bridge seat to replace elements that have reached the end of the useable service life identified in the LCCM. May include utility work.

Overhead Loading Electrical/Mechanical – Work on the overhead loading systems that have reached the end of its useable service life identified in the LCCM to preserve elements to prevent electromechanical failure of the lifting systems. May include utility work. Does not include structural work but may be combined with an Overhead Loading Rehabilitation project.

Overhead Loading Rehabilitation – Work on overhead loading fixed and moveable structures that have reached the useable service life identified in the LCCM to preserve or restore operational or structural capacity. Does not include electromechanical work but may be combined with an Overhead Loading Electrical/Mechanical project.

Overhead Loading Replacement – Work on overhead loading fixed and moveable structures to replace elements that have reached the end of the useable service life identified in the LCCM. Includes structural, electrical and mechanical work.

Landing Aids Wingwalls – Work on wingwalls that have reached the end of the useable service life identified in the LCCM to repair or preserve the structural integrity of the wingwalls.

Landing Aids Dolphins – Work on dolphins that have reached the end of the useable service life identified in the LCCM to repair or preserve the structural integrity of the dolphin. May include dredging.

Trestle Rehabilitation – Work on a trestle that has reached the end of the useable service life identified in the LCCM to preserve or restore the trestle's operational or structural capacity. May include substructure and/or superstructure work. May include utility work. Does not include pavement rehabilitation, but may be combined with that type of project. For trestle projects requiring environmental mitigation, see *Matrix 4: Improvement Projects*. May include seismic retrofit. ***Note:*** use *Matrix 4: Improvement Projects* when seismic retrofit is only design element.

Trestle Replacement – Work on a timber trestle to replace elements that have reached the end of the useable service life identified in the LCCM. This work may also impact or require the replacement of components, such as pavement, electromechanical systems, utilities and buildings that have not reached the end of their useable service life but cannot be removed and re-installed on a new trestle. For trestle projects requiring environmental mitigation, see *Matrix 4: Improvement Projects*.

Trestle Pavement Rehabilitation – Work to preserve or restore the existing pavement surface by removing and replacing pavement that has reached the end of the useable service life identified in the LCCM to protect the underlying structure. This work serves to protect the underlying trestle deck from damage.

Bulkhead Rehabilitation – Work on bulkhead elements that have reached the end of the useable service life identified in the LCCM to preserve or restore the structural capacity. May include work directly on the bulkhead and/or rip rap placement if feasible.

Bulkhead Replacement – Work on a bulkhead to replace elements that have reached the end of the useable service life identified in the LCCM. May include replacing the bulkhead in-kind or with rip rap if feasible.

Tie-up Slip – Work on a tie-up slip to preserve or restore the structural integrity of the slip, or replace elements, such as electromechanical systems, gangways, tie-up slip dolphins and/or wingwalls that have reached the end of the useable service life identified in the LCCM. May include dredging.

(b) Upland: Terminal facilities located on the land side

Pavement Rehabilitation – Work that preserves the existing pavement surface that has reached the end of its useable service life identified in the LCCM by overlaying or milling-and-filling at regular intervals to protect the public investment. Does not include trestle pavement rehabilitation.

Pavement Replacement – Work that replaces deteriorated pavement that has reached the end of its useable service life identified in the LCCM with a full depth Hot Mix Asphalt (HMA), Portland Cement Concrete Pavement (PCCP), pervious cement concrete pavement, or other pavement surface as described in Chapter 340 to protect the public investment and enhance the ridership experience.

Chip Seal – Work that resurfaces the existing HMA pavement surface that has reached the end of its useable service life identified in the LCCM with a chip seal to protect the public investment.

Gravel Regrading – Work that regrades the existing gravel surface that has reached the end of its useable service life identified in the LCCM at regular intervals to protect the public investment.

Security – Work on security features to repair, upgrade, or replace elements that have reached the end of its useable service life identified in the LCCM.

Toll Plaza Rehabilitation – Work that rehabilitates existing toll plaza elements that have reached the end of its useable service life identified in the LCCM to protect the public investment. Does not include, but may be combined with pavement preservation projects. See Chapter 510 for more information.

Toll Plaza Replacement – Work on toll plazas to replace elements that have reached the end of its useable service life identified in the LCCM. Does not include, but may be combined with pavement preservation projects.

(c) Buildings: Terminal facility buildings Preservation

Rehabilitation/Remodel

Terminal Building – Work that rehabilitates or remodels existing building elements that have reached the end of its useable service life identified in the LCCM to protect the public investment. This work can include repairs to foundations (not including seismic work), building utilities, building code upgrades such as accessibility, restroom capacity, structural, energy compliance, wiring, grounding, breaker/fuse boxes, HVAC, elevators, and other electrical systems.

Toll Booth – Work that rehabilitates toll booth elements that have reached the end of its useable service life identified in the LCCM to protect the public investment.

Auxiliary Facilities – Work that rehabilitates or remodels existing public auxiliary facilities, such as restroom buildings, that have reached the end of its useable service life identified in the LCCM. This work can include repairs to foundations (not including seismic work), building utilities, building code upgrades such as accessibility, restroom capacity, structural, energy compliance, wiring, grounding, breaker/fuse boxes, HVAC, elevators, and other electrical systems.

Superstructure-Seismic – Work that upgrades the existing building superstructure that has reached the end of its useable service life identified in the LCCM to current seismic code to protect the public investment and safety in the event of a seismic event. If the structure has not reached the end of its usable service life, the work is classified as an improvement project and *Matrix 4: Improvement Projects* is to be used.

Staff Facilities – Work that remodels or rehabilitates staff facilities that have reached the end of its useable service life identified in the LCCM. This work can include repairs to foundations (not including seismic work), building utilities, building code upgrades such as accessibility, restroom capacity, structural, energy compliance, wiring, grounding, breaker/fuse boxes, HVAC, elevators, and other electrical systems.

Roofing – Work involving the replacement or major repair of building roofs that have reached the end of its useable service life identified in the LCCM.

Retail Accommodations – Work that remodels or rehabilitates retail accommodations, including vending, that have reached the end of its useable service life identified in the LCCM.

Exterior Siding – Work that replaces exterior building siding. If the structure has not reached the end of its usable service life, the work is classified as an improvement project.

Interior Remodel – Work that includes the remodel of existing facilities. If the structure has not reached the end of its usable service life, the work is classified as an improvement project.

Replacement

Terminal Building – Work that replaces existing terminal buildings that have reached the useable service life identified in the LCCM where rehabilitation is not cost-effective.

Toll Booth – Work that replaces existing toll booths that have reached the useable service life identified in the LCCM where rehabilitation is not cost-effective.

Auxiliary Facilities – Work that replaces existing auxiliary building facilities that have reached the useable service life identified in the LCCM where rehabilitation is not cost-effective.

Security Facilities – Work on security facilities to repair, upgrade, or replace elements that have reached the useable service life identified in the LCCM.

Staff Facilities – Work that replaces existing staff facilities that have reached the useable service life identified in the LCCM where rehabilitation is not cost-effective.

(d) Improvement Project Types

Improvement projects apply to non-LCCM items or work, or work on LCCM elements which have not reached the end of their usable service life and that are not incidental to preservation projects (such as replacing pavement or utilities that are demolished during a trestle replacement project). Consult Terminal Engineering Management regarding final determination between classification of Improvement and Preservation during scoping.

ADA Compliance (Site) – Work that improves accessibility within the terminal site by bringing the facility in compliance with current Americans with Disabilities Act (ADA) based upon accessibility criteria from the US Access Board's "Revised Draft Guidelines for Accessible Public Rights of Way" (PROWAG) standards. (See Chapter 300 for more information.)

ADA Compliance (Building) – Work that improves accessibility at or within the terminal building(s) based upon accessibility criteria from the Department of Justice's "2010 ADA Standards for Accessibility Design." (See Chapter 300 for more information.)

ADA Compliance (Passenger Vessel Loading) – Work that improves accessibility at the vessel loading based upon accessibility criteria from the Access Board's "Proposed Passenger Vessels Accessibility Guidelines". (See Chapter 300 for more information.)

Additional Slip – Work which adds an additional operating or tie-up slip at the terminal.

Develop New Terminal Facility – Work to develop a new terminal facility.

Environmental Mitigation/Retrofit – Work mandated by environmental permit conditions, generally associated with a larger preservation or improvement project. Also includes hazardous materials or waste abatement where applicable.

Hazardous Abatement – Work to remove or mitigate hazardous materials, such as asbestos or mold, where applicable.

Illumination System Replacement and Upgrades – Work that replaces structurally deficient luminaires, when needed, and upgrades conventional lighting systems to energy-efficient LED systems.

Intelligent Transportation Systems (ITS) – Improvements of Intelligent Transportation Systems, including those supporting reservations systems.

Security Improvements – Work that upgrades facility, passenger and/or employee security based on current security requirements.

Seismic Retrofit – Work that brings non-building structure(s) to current seismic code.

Systems and Utilities Improvements – Standalone project. Work that brings systems, such as illumination, signal, and/or utilities to current code, upgrades existing systems and/or utilities, or adds systems and/or utilities to the terminal facility. Work could pertain to a specific utility or system.

(2) Design Elements

The column headings on a design matrix are Design Elements. Not all potential design elements have been included in the matrices.

The design elements that are included are based on the LCCM, knowledge gained from past projects, and typical project design elements encountered on the WSF Terminal designs.

If using a design element that is not covered in this manual, use an approved manual or guidance on the subject and document the decision and the basis for the decision.

The following elements are shown on the design matrices.

(a) Matrix 1 – Waterside Preservation

ADA – Address ADA issues such as pedestrian handrails, landing requirements, cross or running slope on pedestrian walkways, and publically accessed gangways, including overhead loading systems. Ensure ADA parking stalls are laid out as per the *Standard Plans* and other WSDOT ADA references. Project shall be in compliance with The Americans with Disabilities Act. (See Chapter 300 for compliance requirements.)

Basic Safety – Safety Elements protect the public and WSF employees from injury or loss of life by upgrades and/or repairs including, but not limited to the following:

- Signing Improvements
- Illumination Improvement
- Pavement Marking Delineations/Channelization Improvements
- Vehicle/Pedestrian Guardrail Upgrades
- Eliminating Trip Hazards
- Installing bicycle friendly road features
- Signalization
- Electrical grounding repairs
- Replacing worn wire ropes on mechanical transfer span systems
- Addressing Ergonomic Issues
- Spot Safety Improvements

(See Chapter 200 for more information.)

Does not include rescue ladders and life rings.

Basic Safety work must fall within the scope of a project to be considered for inclusion to a project.

Seismic – Address Seismic deficiencies by bringing structure(s) to current code. (See Division 6 – Waterside Development for more information.)

Code upgrade (Electrical/Mechanical) – Work to upgrade transfer spans, OHL to current codes. Does not include operational enhancements. (See Chapters 610 and 620 for more information.)

Dolphin Configuration – (See Chapters 200, 640 and 650 for more information.)

Utilities – Terminal Waterside Facilities Only: Natural Gas Lines, Water Lines, Sewer Lines, Communications systems. (See Chapters 600, 610, and 620 for more information.) Does not include fire protection, electrical, lighting, storm sewer or drainage features. See Section 200.05 for list of known or suspected in-water utilities at various terminals.

Railings/Barrier – Upgrading rails and barriers to latest standards, including AASHTO and ADA. (See Chapters 600 and 610 for more information.)

Maintenance Issues – Coordinate with maintenance for project scope.

Programmable Logic Controller – Element controls for the electromechanical system of vehicle transfer span and passenger overhead loading systems. May require HQ Design approval if specifying a proprietary item (See Chapters 610 and 620 for more information.)

Replace Mechanical Components – Replacement of worn or deficient mechanical system components to protect life and safety of operators and the traveling public. (See Chapters 610 and 620 for more information.)

Replace Electrical System Components – Replacement of worn or deficient electrical system components to protect life and safety of operators and the traveling public. (See Chapters 610 and 620 for more information.)

Vessel Sewer/Water – Only supplied to boats at certain terminals (See Chapter 200 under Project Impacts Form for more information.)

Fire Protection – Install or upgrade trestle fire protection system. (See Chapter 560 for more information.)

Power Upgrade – Power to Boats and Terminal facilities (See Chapters 360 and 560 for more information.)

Lighting – Provide exterior lighting per established criteria for vehicles, pedestrians and operations requirements. Does not include interior lighting. (See Chapters 360 and 560 for more information.)

Corrosion Protection – Includes cathodic protection for steel piles; corrosion resistance coatings. (See Chapter 600 for more information.)

Control Systems – Gate control (see Chapter 500), fire protection (see Chapter 560), relays (See Chapter 360), and signal/vehicle controls (See Chapter 360 and Division 5). Does not apply to Programmable Logic Controllers.

Operational Enhancements – (See Chapter 200 for more information.)

Stormwater – Per requirements of the most recent edition of the WSDOT *Highway Runoff Manual* (HRM) (See Chapters 340 and 600 for more information.)

Signing/Striping/Channelization – Addresses traffic flow or pavement marking issues. See Chapter 340 and the WSDOT *Design Manual* for more information.)

Rip Rap – A foundation or sustaining wall of stones placed together used for armoring of beaches and scour protection when needed. Consider replacing bulkheads with rip rap. (See Chapter 600 for more information.)

Maintenance Access – Elements associated with access to maintenance appurtenances and functionality.

Rescue Ladder and Life Rings – Safety elements per Requirements of RCWs. (See Chapter 200 for more information). Not included as a basic safety element.

Dredging – Involves dredging of operating and tie-up slips to accommodate larger vessels and/or preserve the use of the slip for the current vessel class operating at the terminal. The need for this work is only evaluated on dolphin and tie-up slip preservation projects.

Lane Width – Holding Lanes, Traffic Lanes, Turning Radius, Bicycle Lanes and pedestrian use areas. (See Chapter 340 for more information on lane width requirements.)

(b) Matrix 2: Upland Preservation

ADA – Address ADA issues such as cross or running slope on pedestrian walkways. Ensure ADA parking stalls are laid out per the *Standard Plans* and other WSDOT ADA References. (See Chapter 300 for further information.)

Basic Safety – Safety Elements protect the public and WSF employees from injury or loss of life by upgrades and/or repairs including, but not limited to the following:

- Signing Improvements
- Illumination Improvement
- Pavement Marking Delineations/Channelization Improvements
- Vehicle/Pedestrian Guardrail Upgrades
- Eliminating Trip Hazards
- Installing bicycle friendly road features
- Signalization
- Electrical grounding repairs
- Addressing Ergonomic Issues
- Spot Safety Improvements

(See Chapter 200 for more information.)

Basic Safety work must fall within the scope of a project to be considered for inclusion.

Lane Width – Holding Lanes, Ferry Highway Shoulder Holding Lanes, Traffic Lanes, Turning Radius, Bicycle Lanes and pedestrian use areas. (See Chapter 340 for more information on lane width requirements.)

Traffic Calming – Speed bumps, raised pavement markers, signing, traffic islands/ circles, curbing, bulb outs. See Chapter 340 and WSDOT *Design Manual* Chapter 1510 for more information.

Sidewalk – Replacement of ADA non-compliant sidewalk. Installation of new sidewalks to provide an ADA compliant path to the toll booths from the terminal building at those facilities where the terminal building ticket booth is not manned year round so ADA/senior discounted fares may be purchased.

Also may include installation of curb ramps so disabled patrons may access sidewalks. (See Chapter 300 for ADA Compliance and the WSDOT *Standard Plans* for current design guidance.) Does not include elevated walkways or overhead loading.

Security or Intelligent Transportation Systems – Systems supporting the function of the design feature.

Utilities (power supply) – Includes illumination systems. (See Chapter 560 for more information.)

Utilities (sanitary sewer) – (See Chapter 560 for more information.)

Utilities (other) – Water, Gas, Communications, including phone and data work. Does not include electrical or sanitary sewer work. (See Chapter 560 for more information.)

Fencing – Security, Fare Evasion and Fall Protection Fencing. (See Chapter 500 and the WSDOT *Standard Plans* for more information.)

Stormwater – Per requirements of the most recent edition of the WSDOT *Highway Runoff Manual* (HRM) (See Chapters 340 and 560 for more information.)

Guardrail/Handrail – Replacing deficient or upgrading obsolete vehicular or pedestrian handrail (fall protection). May also include the placement of additional guardrail, subject to analysis. See the WSDOT *Design Manual* for roadway guardrail requirements, and Chapter 300 for pedestrian guardrail requirements.

Barrier – Replacing or installing protective concrete barrier at toll booth or other upland roadway locations. (See Chapters 500 and 510 for more information.)

Bicycle – Includes replacing bicycle hazardous roadway features, and may include installing bicycle lanes and storage facilities (See Chapter 500 for more information.

Pedestrian – Installation of crosswalks, overhead walkways and/or other pedestrian facilities. (See Chapter 340 and Division 5 for more information.) May include addressing safety, circulation or wayfinding issues outside of a building. Does not include safety, circulation or wayfinding issues, or sidewalk project elements or pedestrian accommodations within buildings.

Alignment – See WSDOT *Design Manual* (See Chapter 340 for more information.)

Signing/Striping/Channelization – Address Pavement Marking and/or Channelization Issues. See *Standard Plans*, *Design Manual*, and MUTCD. Does not include barrier or guardrail work. (See Chapters 340 and 570 for more information.)

Operational Enhancements – (See Chapter 200 for more information.)

Maintenance Issues – Coordinate with maintenance for project scope.

Toll Booth Approach Pads – Replace asphalt toll booth approach pads with Portland cement concrete pavement. Does not apply to toll booth building foundations. (See Chapters 340 and 510 for more information.)

(c) Matrix 3: Terminal Facility Buildings

ADA – Address ADA issues such as ramp slopes, access, visual paging, signing, safety, circulation or wayfinding issues, and other pedestrian accommodation requirements (See Chapters 300, 350 and Division 4 for more information.)

Enclosure/Energy Upgrade – Installation of energy-saving features for new construction or code upgrades for building rehabilitation such as lighting, HVAC, windows, doors and insulation.

Exterior Siding – Replace, paint or repair exterior building siding. (See Chapter 350 and Division 4 for more information.)

Roofing – Replace or repair building roofs. (See Chapter 350 and Division 4 for more information.)

Superstructure-Seismic – Address seismic deficiencies by bringing structure(s) to current code. (See Chapters 350 and 450 for more information.)

Interior Remodel – Flooring, tiling, drywall, and ceiling work. (See Chapter 350 and Division 4 for more information.)

Retail Accommodations – Replace, rehabilitate or repair public retail accommodations, including vending. (See Chapter 400 for more information.)

Operational Enhancements – See Chapter 200 for explanation concerning these project elements.

Maintenance Issues – Consult and work with terminal maintenance team to reduce ongoing or high maintenance expenditures and other issues.

Hazardous Abatement – Abate building hazards such as, but not limited to, lead paint, asbestos and mold.

(d) Matrix 4: Improvement Projects

ADA – Address ADA issues such as ramp slopes, access, visual paging, signing, safety or circulation or wayfinding issues, and other pedestrian accommodation requirements. (See Chapters 300, 350 and Division 4 for more information.)

Basic Safety – Safety Elements protect the public and WSF employees from injury or loss of life by upgrades and/or repairs including, but not limited to the following:

- Signing Improvements
- Illumination Improvement
- Pavement Marking Delineations/Channelization Improvements
- Vehicle/Pedestrian Guardrail Upgrades
- Eliminating surface discontinuities
- Installing bicycle friendly road features
- Signalization
- Electrical grounding repairs
- Addressing Ergonomic Issues
- Spot Safety Improvements

(See Chapter 200 for more information.)

Basic Safety work must fall within the scope of a project to be considered for inclusion to a project.

Bicycle – Includes replacing bicycle roadway features, and may include installing bicycle lanes and storage facilities (See Chapter 500 for more information.

Building Access Ramps and Stairs – Replacement of non-ADA compliant building access ramps and stairs. May include installation of elevators (if applicable).

Energy Upgrades – Installation of energy saving lighting (i.e. LED) technology or other features.

Fencing – Security, Fare Evasion and Fall Protection Fencing. (See Chapter 500 and the WSDOT *Standard Plans* for more information.)

Gangways and OHL Systems – Work to upgrade non-ADA compliant gangways and OHL systems used for passenger loading.

Guardrail – Replacing deficient or upgrading obsolete vehicular guardrail or pedestrian handrail (fall protection). May also include the placement of additional guardrail, subject to analysis. See the WSDOT *Design Manual* for roadway guardrail requirements, and Chapter 300 for pedestrian handrail requirements.

Hazardous Abatement – Abate hazards such as, but not limited to, creosoted materials, contaminated soils, lead paint, asbestos and mold.

Intelligent Transportation Systems – Systems supporting the function of the design feature.

Lighting – Upgrade facility lighting to current standards.

Maintenance Issues – Consult and work with terminal maintenance team to reduce ongoing or high maintenance expenditures and other issues.

Operational Enhancements – (See Chapter 200 for more information.)

Pedestrian – Installation of crosswalks, overhead walkways and/or other pedestrian facilities. (See Chapter 340 and Division 5 for more information.) May include addressing safety, circulation or wayfinding issues.

Does not include sidewalk project elements or pedestrian accommodations within buildings.

Permit Mitigation Condition Requirements – Address permit mitigation condition requirements. Generally applies to over water coverage, beach cleanup or eel grass restoration.

Security Systems – Systems support the function of the design feature.

Seismic – Address Seismic deficiencies by bringing structure(s) to current code. (See Division 6 for more information.)

Sidewalk – Replacement of ADA non-compliant sidewalk, or installation of new sidewalks to provide an ADA compliant path to the toll booths from the terminal building at those facilities where the terminal building ticket booth is not manned year round so ADA/senior discounted fares may be purchased.

Also may include installation of curb ramps so disabled patrons may access sidewalks. (See Chapter 300 for ADA Compliance and the WSDOT *Standard Plans* for current design guidance.) Does not include elevated walkways.

Signing – Address traffic or pedestrian signing or way finding issues. See *Standard Plans*, *Design Manual*, MUTCD. (See Chapters 340 and 570 for more information.)

Striping/Channelization – Addresses traffic flow or pavement marking issues. See Chapter 340 and the WSDOT *Design Manual* for more information.)

Stormwater – Per requirements of the most recent edition of the WSDOT *Highway Runoff Manual* (HRM) (See Chapters 340 and 560 for more information.)

Utilities (power supply) – Includes power supply for illumination systems and emergency standby generators, and installation of infrastructure supporting the installation Electric Vehicle Charging stations. (See Chapter 560 for more information.)

Utilities (sanitary sewer) – (See Chapter 560 for more information.)

Utilities (other) – Water, Gas, Communications, including phone and data work. Does not include electrical or sanitary sewer work. (See Chapter 560 for more information.

(3) Design Element inclusion within a Project Type

If an "X" is indicated in a matrix cell the box for a Design Element for a Project Type, it should be included as part of the scope of the project. If the matrix cell for a Design Element is empty for a Project Type, it is not necessary to consider for inclusion as part of the project scope.

(4) Design Variances

The two types of design variances are evaluate upgrades (EU) and deviations. (See Chapter 220 regarding the Design Variance Inventory System (DVIS).) For design elements that are not variances to a design standard see Chapter 220 on how to document design decisions.

(a) Evaluate Upgrade (EU)

An EU in a matrix cell indicates that WSF has determined the design element is an item of work that is to be justified for inclusion in the project. For an existing element that does not meet or exceed the specified design level, an evaluation is required to determine the impacts and cost-effectiveness of including the element in the project. The EU analysis must support the decision to upgrade that element. (See Chapter 220 regarding documentation.)

(b) Deviation

A deviation is required when an existing or proposed design element differs from the specified design level for the project or when considering not including a specified element as indicated by an "X" in the matrix for the type of preservation project. (See Chapter 220 regarding documentation.)

See the following pages for Design Matrices 1–4

⇩ Project Type Design Elements ⇨	ADA	Basic Safety	Seismic[1]	Code upgrade (Electrical/Mechanical)	Dolphin Configuration	Utilities	Railings/Barrier	Maintenance Issues	Programmable Logic Controller	Replace Mechanical Components	Replace Electrical Components	Vessel sewer/water	Fire Protection	Power Upgrade	Lighting	Corrosion Protection	Control Systems	Operational Enhancements	Storm Water	Signing/Striping/ Channelization	Rip Rap	Maintenance Access	Rescue Ladder/Life Rings	Dredging	Lane Width
1-1 Transfer Span/Tower																									
1-1a Mechanical/Electrical		EU		X		EU		EU	X	X	X	EU		EU	EU		X					EU			
1-1b Rehabilitation	EU	X	EU	EU		EU	X	EU	EU	X	X	EU	EU			EU	EU			X		EU			
1-1c Replacement	X	X	X	X		X	X	EU	X			EU	EU	EU	EU	X	X	X		X		X			
1-2 Bridge Seat																									
1-2a Rehabilitation			EU			EU		EU								EU					EU				
1-2b Replacement			X			X		EU								X					EU				
1-3 Overhead Loading																									
1-3a Electrical/Mechanical		EU		X		EU		EU	X	X	X	EU		EU	EU		X					EU			
1-3b Rehabilitation	EU	X	EU	EU		EU	X	EU	EU	EU	EU		EU		EU	EU	EU	EU				EU			
1-3c Replacement	X	X	X	X		X		EU	X				EU	EU	X	X	X	X				X			
1-4 Landing Aids																									
1-4a Wingwalls			EU					EU							EU	EU						X	X		
1-4b Dolphins					EU			EU							EU	EU						X		EU	
1-5 Trestle																									
1-5a Rehabilitation	EU	X	EU			EU	EU	EU				EU	EU		EU	EU		EU	EU	EU	EU	EU	X		EU
1-5b Replacement	X	X	X			X	X	EU				EU	EU		X	X		X	X	X	EU	X	X		X
1-5c Pavement Rehabilitation	X	X					EU	EU										EU	EU	EU					
1-6 Bulkhead																									
1-6a Rehabilitation			EU			EU		EU				EU				EU			EU		EU				
1-5b Replacement			X			X		EU				EU				X			EU		EU				
1-7 Tie-up Slip	EU	X	X	EU	EU	EU		EU	EU	EU	EU	EU		EU		EU	EU	EU						EU	

Design Matrix Notes:

A blank cell indicates that the element is not applicable.

X Design Analysis required

EU Evaluate Upgrade justification to full design level.

Notes

(1) If only element of work, and the structure has not reached its LCCM due date, see Matrix 4: Improvement Projects

Matrix 1: Waterside Preservation

Exhibit 210-1

⇩ Project Type / Design Elements ⇨	ADA	Basic Safety	Lane Width	Traffic Calming	Sidewalk	Security or ITS Systems (Non-LCCM)	Utilities (power supply)	Utilities (sanitary sewer)	Utilities (other)	Fencing	Stormwater	Guardrail	Barrier	Bicycle	Pedestrian	Alignment	Signing/Striping/ Channelization	Operational Enhancements	Maintenance Issues	Concrete Toll Booth Pads
2-1 Pavement																				
2-1a Rehabilitation	X	X	EU	EU	EU						EU	X	EU				EU	EU	EU	X
2-1b Replacement	X	X	EU	EU	X					EU	X	X	X			EU	EU	EU	EU	X
2-1c Chip Seal		X																	EU	
2-2 Gravel Regrading		X																	EU	
2-3 Security		EU				X	EU		X	X								X	EU	
2-4 Toll Plaza																				
2-4a Rehabilitation	X	X	EU	EU	X	EU	X			EU		X	EU		EU		EU	EU	EU	X
2-4b Replacement	X	X	X	X	X	X	X	EU	EU	EU	X	X	X	EU	X	X	X	X	EU	X

Design Matrix Notes:

☐ A blank cell indicates that the element is not applicable.

X Design Analysis required

EU Evaluate Upgrade justification to full design level.

Matrix 2: Upland Preservation
Exhibit 210-2

⇩ Project Type Design Elements ⇨	ADA	Enclosure/Energy upgrade	Exterior Siding	Roofing	Superstructure-Seismic	Interior Remodel	Retail Accommodations	Operational Enhancements	Maintenance Issues	Hazardous Abatement
3-1 Rehabilitation/Remodel										
3-1a Terminal Building	X(1)	EU(5)	EU	EU	EU(8)	EU	EU	EU	X	EU(7)
3-1b Toll Booth	X(2)	EU	EU	EU		EU		EU	X	
3-1c Auxiliary Facilities	X(1)	EU(5)	EU	EU	EU(8)	EU	EU	EU	X	EU(7)
3-1dSuperstructure-Seismic		EU(5)	EU	EU	EU(6)	EU		EU	X	EU(7)
3-1e Staff Facilities	X(1)	EU(5)	EU	EU	EU(8)	EU			X	EU(7)
3-1f Roofing				X					X	EU
3-1g Retail Accommodations	X(1)	X(5)				EU	X	EU	X	EU(7)
3-1h Hazardous Abatement		EU	EU	EU					X	X
3-1i Exterior Siding		EU	X						X	EU(7)
3-1ij Interior Remodel	X(1)	X(5)				X(5)	EU	EU	X	EU(7)
3-2 Replacement										
3-2a Terminal Building	X(4)	X(9)	X(9)	X(9)	X(6)	X(9)	EU	X	EU	
3-2b Toll Booth	X(3)	X(9)	X(9)	X(9)	X(6)	X(9)		X	EU	
3-2c Auxiliary Facilities	X(4)	X(9)	X(9)	X(9)	X(6)	X(9)	EU(7)	X	EU	
3-2d Security Facilities	X(4)	X(9)	X(9)	X(9)	X(6)	X(9)		X	EU	
3-2e Staff Facilities	X(4)	X(9)	X(9)	X(9)	X(6)	X(9)		X	EU	

Design Matrix Notes:

☐ A blank cell indicates that the element is not applicable.

X Design Analysis required

EU Evaluate Upgrade justification to full design level.

Notes for Matrix 4: Improvement Projects

(1) Upgrade ADA to Maximum Extent Feasible (MEF)

(2) One ADA Toll Booth per Operations; Other Existing Toll Booths must be ADA Supervisor Accessible to MEF

(3) One ADA Toll Booth per Operations; Other Toll Booths must be ADA Supervisor Accessible

(4) Full ADA compliance

(5) Upgrade to IBC and/or State energy code in areas of work

(6) Design to Seismic Standards

(7) Evaluate the Necessity of this work

(8) Upgrade structure to meet current seismic standards

(9) Design to IBC and State energy code

Matrix 3: Terminal Facility Buildings Preservation

Exhibit 210-3

⇩ Project Type																										
Design Elements ⇨	ADA	Basic Safety	Bicycle	Building Access Ramps and Stairs	Energy Upgrades	Fencing	Gangways and OHL Systems	Guardrail	Hazardous Abatement	ITS Systems	Lighting	Maintenance Issues	Operational Enhancements	Pedestrian	Permit Mitigation Condition Requirements	Security Systems	Seismic	Sidewalk	Signing	Striping/Channelization	Stormwater	Utilities (power supply)	Utilities (sanitary sewer)	Utilities (other)
4-1 ADA Compliance (Site)	X(1)	X(7)	EU					EU(6)				EU	EU	EU				X(1)	X(8)					
4-2 ADA Compliance (Buildings)	X(1)	EU		X(1)				X(6)				EU	EU	EU					X(8)					
4-3 ADA Compliance (Passenger Vessel Loading)	X(1)	X					X(1)	X(6)				EU	EU	EU					X(8)					
4-4 Additional Slip	X(9)	X		EU	EU	EU	EU	X		X	X		X	EU(9)		X	X		X					
4-5 Develop New Terminal Site	X(1)	X	X	X	X	X	X	X	EU(5)	X	X	X	X	X	X	X	X	X	X	X	X	X(11)	X	X
4-6 Environmental Mitigation/Retrofit(10)					X(5)				X						X									
4-7 Hazardous Abatement									X															
4-8 Illumination System Replacement & Upgrades		X			X						X	X(4)			X(5)				X			X(4,11)		
4-9 Intelligent Transportation Systems	EU(2)	EU	EU		X(5)					X		X(4)	X	EU	X(5)				X	EU		X(4,11)		X(4)
4-10 Security Improvements		EU				X					EU	X(4)	X		X(5)	X						X(4,11)		X(4)
4-11 Seismic Retrofit												X(4)			X(5)		X(3)							
4-12 Systems & Utilities Improvements		EU			EU						EU	EU			X(5)						EU	X(4,11)	EU	EU

Design Matrix Notes:

- ☐ A blank cell indicates that the element is not applicable.
- X Design Documentation Required
- EU Evaluate Upgrade justification to full design level.

Notes for Matrix 4: Improvement Projects

(1) Full ADA compliance

(2) Upgrade impacted ADA pedestrian features to Maximum Extent Feasible (MEF)

(3) Design to current Seismic Standards

(4) Evaluate the Necessity of this work

(5) If Applicable

(6) Applies to fall protection only

(7) Applies to removal of surface discontinuities

(8) Applies to accessibility signing only

(9) Applies to new slip only

(10) May apply to Trestle Replacement or Trestle Rehabilitation Projects

(11) Evaluate for support of Electrical Vehicle Charging Stations, including conduits installation.

Matrix 4: Improvement Projects

Exhibit 210-4

Chapter 220 Design Documentation, Approval and Process Review

220.01 General
220.02 References
220.03 Definitions
220.04 Design Documentation
220.05 Project Development
220.06 Design Approval
220.07 Project Development Approval
220.08 Combined Design Approval/Project Development Approval
220.09 FTA Triennial Review
220.10 Design Drawing Production

220.01 General

The Project File (PF) contains the documentation for planning, scoping, programming, design, approvals, contract assembly, utility relocation, needed right of way, advertisement, award, construction, and maintenance review comments for a project. A Project File is completed for all projects and is retained by the office responsible for the project. Responsibility for the project may pass from one office to another during the life of a project, and the Project File follows the project as it moves from office to office. Refer to the *Project File checklist* for documents to be preserved in the project file.

The Design Documentation Package (DDP) is a part of the Project File and is completed for all projects. It documents and explains design decisions and the design process that was followed. The DDP is retained in a permanent retrievable file for a period of 75 years, in accordance with the Washington State Department of Transportation (WSDOT) records retention policy. See Exhibit 220-4 for the WSF DDP checklist for documents to be preserved in the DDP.

With the exception of the DDP, the Project File may be purged when retention of the construction records is no longer necessary.

For operational changes and local agency and developer projects, design documentation is also needed. It is retained by the office responsible for the project, in accordance with WSDOT records retention policy. All participants in the design process are to provide the appropriate documentation for their decisions.

For emergency projects, also refer to the *Emergency Relief Procedures Manual* M 3014. It provides the legal and procedural guidelines for WSDOT employees to prepare all necessary documentation to respond to, and recover from, emergencies and disasters that affect the operations of the department.

220.02 References

(1) Federal/State Laws and Codes

23 CFR 635.111 *Tied bids*

23 CFR 635.411 *Material or product selection*

RCW 47.28.030 *Contracts – State forces – Monetary limits – Small businesses, minority, and women contractors – Rules*

RCW 47.28.035 *Cost of project, defined*

RCW 47.60.327 *Operational strategies for asset utilization*

RCW 47.60.340 *Vessel maintenance and preservation program — Report*

RCW 47.60.345 *Life-cycle cost model on capital assets*

RCW 47.60.365 *Terminal design standards*

RCW 47.60.385 *Terminal improvement project funding requests — Predesign study — New vessel acquisition planning*

(2) Design Guidance

WSDOT Directional Documents Index, including the one listed below:
wwwi.wsdot.wa.gov/publications/policies/default.htm

- Secretary's Executive Order E 1053 *Project Risk Management and Risk Based Estimating*
- Instructional Letter IL 4071 *Risk-Based Project Estimates for Inflation Rates, Market Conditions, and Percentile Selection*
- Executive Order E 1010 *Certification of Documents by Licensed Professionals*

WSDOT technical manuals, including those listed below:
www.wsdot.wa.gov/publications/manuals/index.htm

- *Terminal Design Manual* M 3082
- *Emergency Relief Procedures Manual* M 3014
- *Environmental Manual* M 31-11
- *Plans Preparation Manual* M 22-31
- *Project Control and Reporting Manual* M 3026
- *Roadside Classification Plan* M 25-31
- *Bridge Design Manual LRFD* M 23-50
- *Bridge Inspection Manual* M 36-64
- *Bridge List* M 23-09
- *Cost Estimating Manual for WSDOT Projects* M 3034
- *Design Manual* M 22-01
- *Geotechnical Design Manual* M 46-03
- *Highway Runoff Manual* M 31-16
- *Hydraulics Manual* M 23-03
- *Local Agency Guidelines* M 36-63

- *Right of Way Manual* M 26-01
- *Standard Plans* M 21-1
- *Transportation Structures Preservation Manual* M 23-11
- *Utilities Accommodation Policy* M 22-86
- *Utilities Manual* M 22-87

WSDOT Administrative manuals, including those listed below:
wwwi.wsdot.wa.gov/publications/manuals

- *Advertisement and Award Manual* M 27-02
- *Electronic Engineering Data Standards* M 3028

WSDOT Engineering Applications, including those listed below:
www.wsdot.wa.gov/design/projectdev/engineeringapplications

- Bid Tabs
- EBASE
- Standard Items
- Unit Bid Analysis

Terminal Engineering Intranet Pages, including those listed below:
wwwi.wsdot.wa.gov/ferries/terminalengineering/default.htm

- Cost Estimating
- *Life Cycle Cost Model*
- *Programmatic Scoping*

Multimodal Transportation Planning

- www.wsdot.wa.gov/planning

(3) Supporting Information

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, 2011

Mitigation Strategies for Design Exceptions, FHWA, July 2007. This publication provides detailed information on design exceptions and mitigating the potential adverse impacts to highway safety and traffic operations.

220.03 Definitions

Consider To think carefully about, especially in order to make a decision. No backup documentation is required.

Design Approval Documented approval of the design criteria, which becomes part of the Design Documentation Package. This approval is an endorsement of the design criteria by the designated representative of the approving organization as shown in Exhibit 220-2.

Design Criteria Standards or design level that designers should meet in designing some system or device. If the specified standards cannot be met a *deviation* may be required.

Design Variance A recorded decision to differ from the design level specified in the WSF *Terminal Design Manual*, such as an evaluate upgrade (EU) not upgraded, or

a deviation. EUs leading to an upgrade are documented but are not considered to be variances. A project analysis may also constitute a design variance if that analysis leads to a decision to use a design level or design classification that differs from what the WSF *Terminal Design Manual* specifies for the project type.

Design Variance Inventory (DVI) A list of design elements that will not be improved in accordance with the WSF *Terminal Design Manual* or (where applicable) WSDOT *Design Manual* criteria designated for the project. Only approved variances should be included on this list.

Design Variance Inventory System (DVIS) A database application developed to generate the DVI form. The DVIS also provides query functions, giving designers an opportunity to search for previously granted variances. The DVIS was started in the early 2000s and does not identify prior variances. The WSF *Terminal Design Manual* is constantly being refined and guidelines change over time. What may have been a design variance previously may not be a deviation today. Previously approved design variances do not carry forward and must be revisited as described in Section 220.04(5). The DVIS database is intended for internal WSDOT use only, and WSDOT staff access it from the left margin of this website: wwwi.wsdot.wa.gov/design

Desirable Design criteria that are recommended for inclusion in the design. Document conditions when a desirable value is not met.

Deviation A documented decision granting approval at project-specific locations to differ from the design level specified in the WSF *Terminal Design Manual* (see Chapter 210 and Exhibit 220-1).

Document (verb) The act of including a short note to the Design Documentation Package that explains a design decision.

Evaluate Upgrade (EU) A decision-making process to justify an upgrade to an existing design element as designated in the design matrices. Documentation is required (see Exhibit 220-1).

HQ Washington State Department of Transportation Headquarters organization.

Justify Preparing a memo to the DDP identifying the reasons for the decision: a comparison of advantages and disadvantages of all options considered. A more rigorous effort than document.

Minimum The lowest design value allowed without a deviation.

Maximum The highest design value allowed without a deviation.

Practical Design An approach to making project decisions that focuses on the need for the project and looks for the cost-effective solutions. It engages local stakeholders at the earliest stages of defining scope to ensure their input is included at the right stage of project design. Decision-making focuses on maximum benefit to the system, rather than maximum benefit to the project. Focusing on the specific project need minimizes the scope of work for each project. The goal is to allow more needs to be addressed system wide by reducing spending on lesser priority items on each project. Practical design is an important component in implementing WSDOT's strategic plan:

- Innovation and solutions are encouraged
- No compromises to safety
- Community engagement is important to making decisions
- Collaboration ensures a wide array of perspectives

By using practical design, project decisions will build the most efficient solutions for the state's transportation needs as a whole.

Project Analysis Documentation that justifies a change in design level and/or decisions to include, exclude, or modify design elements specific to a project only (also see Chapter 210).

Project Change Request Form (PCRF) A form used to document and approve revisions to project scope, schedule, or budget from a previously approved Project Definition (see Project Summary). Include copies in the Design Documentation Package.

Project Development Approval Final approval of all project development documents by the designated representative of the approving organization prior to the advertisement of a capital transportation project. Includes original and updated Design Approval documents.

Project File (PF) A file containing all documentation and data for all activities related to a project (see Sections 220.01 and 220.04).

- **Design Documentation Package (DDP)** The portion of the Project File, including Design Approval and Project Development Approval, that will be retained long term in accordance with WSDOT document retention policies. Depending on the scope of the project, it contains the Project Summary and some or all of the other documents discussed in this chapter. Required and applicable components are listed in Exhibit 220-4. Technical reports and calculations are part of the Project File but are not designated as components of the DDP. Include estimates and justifications for decisions made in the DDP (see Section 220.04(2)). The DDP explains how and why the design was chosen and documents approvals (see Section 220.06).

Project Summary A set of electronic documents consisting of the Project Definition (PD). Project Impacts Form, Project Considerations Form, Design Decision Summary (DDS), and Environmental Review Summary (ERS). The Project Summary is part of the design documentation required to obtain Design Approval and is ultimately part of the design documentation required for Project Development Approval (see Section 220.07).

- **Project Definition (PD)** An electronic document that records the purpose and need of the project, along with program level and design constraints. (See Section 200.05(1)a).
- **Project Impacts Form** Describes the impact the project will have on the traveling public, local communities, other government agencies or possibly tribal entities (See Section 200.05(1)b).
- **Project Considerations Form (PCF)** Describes project considerations including Environmental, Tribal, Railroad, Utility and Maintenance considerations (See Section 200.05(1)c).

- **Design Decision Summary (DDS)** An electronic document that records major design decisions regarding roadway geometrics, roadway and roadside features, and other issues that influence the project scope and budget. (See 200.05(2)d)
- **Environmental Review Summary (ERS)** An electronic document that records the environmental classification (class of action) and considerations (consequences of action) for a specific project. (See 200.05(2)e)

Scoping Phase The first phase of project development for a specific project, the scoping phase follows identification of the need for a project and precedes detailed project design. It is the process of identifying the work to be done and developing a cost estimate for completing the design and construction. The Project Summary, engineering and construction estimates, and possibly several technical reports (geotechnical, surfacing, bridge condition, and so on) are developed during this phase.

220.04 Design Documentation

(1) Purpose

Design documentation records the evaluations and decisions by the various disciplines that result in design recommendations. Design assumptions and decisions made prior to and during the scoping phase are included. Changes that occur throughout project development are documented. Required justifications and approvals are also included.

(2) Design Documents

The DDP portion of the PF preserves the decision documents generated during the design process. In each package, a summary (list) of the documents included is required.

The design documents to be included in the DDP are listed in Exhibit 220-4.

A Design Variance Inventory (DVI) is needed for all projects that have design variances. The DVI lists all EUs not upgraded and deviations as indicated by the design matrices. Record variances that result from a project analysis in the DVI. Use the Design Variance Inventory System (DVIS) database to record and manage individual design variances identified during project development. The DVIS database can be accessed from this website: wwwi.wsdot.wa.gov/design

Project Summary documents are required for most projects. Exceptions will be identified by the HQ Capital Program Development and Management Office.

(3) Certification of Documents by Licensed Professionals

Many original technical documents must bear the certification of the responsible licensee (see Executive Order E 1010).

(4) Evaluate Upgrade (EU) Documentation and Approval

In special cases, projects may need to address design elements, which are shown as blank cells in a design matrix (see Exhibit 220-1). These special cases must be coordinated with the appropriate Assistant State Design Engineer (ASDE) and the HQ Capital Program Development and Management. When this is necessary, document the reasons for inclusion of that work in the project.

Matrix Cell Contents	Design Element Meets Specified Design Level	Document to File	Record in DVIS
Blank cell in design matrix	Element not considered for project type	No	No
Cell Entry			
Evaluate Upgrade (EU)	Yes	DDP	No
	No	DDP	Yes

DDP = Design Documentation Package

Design Matrix Documentation Requirements
Exhibit 220-1

The EU process justifies whether an item of work will or will not be done, through analysis of factors such as operational necessity, systemic needs, benefit/cost, route continuity, collision reduction potential (if applicable), environmental impact, and economic development. Document all EU decisions to the DDP using Exhibit 220-5 as a guide for the content. The cost of the improvement must always be evaluated when making EU decisions.

If a particular scoped item of work was identified as an EU, per the appropriate matrix, and the project has already been scoped and funding provided, contact the appropriate ASDE to discuss what documentation will be required.

EU examples on the Internet can serve as models for development of EU documentation. The approval authority for EUs is HQ Design.

(5) Deviation Documentation and Approval

Deviation requests are stand-alone documents that require enough information and project description for an approving authority to make an informed decision of approval or denial. Documentation of a deviation contains justification and is approved at the appropriate administrative level. Submit the request as early as possible because known deviations are to be approved prior to Design Approval.

Deviation approval is at HQ Design Office level.To prepare a deviation request, use the list in Exhibit 220-6 as a general guide for the sequence of the content. The list is not all-inclusive of potential content and it might include suggested topics that do not apply to a particular project.

When applying for deviation approval, it is necessary to provide two explanations. The first identifies the design element and explains why the design level specified in the design matrices was not or cannot be used. The second provides the justification for the proposed design. Justification for a deviation is to be supported by at least two explanations, which may include the following:

- Collision history and analysis
- Benefit/cost analysis
- Operational and or ridership considerations
- Engineering judgment*
- Environmental issues
- Route continuity

*Engineering judgment may include a reference to another publication, with an explanation of why that reference is applicable to the situation encountered on the project

Reference an approved project analysis or other approved study, if one exists, as supporting justification for design deviations dealing with route continuity issues (see Chapter 1100 of the WSDOT *Design Manual*).

When several design variances are proposed in a corridor, and they have similar contributing factors or are intertwined in their effects on each other, they can sometimes be handled in a single project analysis. Coordinate this approach with the ASDE assigned to WSF.

If the element meets current AASHTO guidance adopted by FHWA, such as *A Policy on Geometric Design of Highways and Streets*, but not WSF *Terminal Design Manual* or *Design Manual* M 22-01 criteria, it is a deviation from the WSF *Terminal Design Manual* that requires review from HQ Design Office but WSF is the approval authority. The following documentation is required for a deviation that meets AASHTO guidance:

- Identify the design element.
- Explain why the design level specified in the design matrices was not used.
- Explain which AASHTO guidance was used, including the title of the AASHTO guidance, the publication date, and the chapter and page number of the guidance.

Once a design variance is approved, it applies to that project only. When a new project is programmed at the same location, the subject design element is to be reevaluated, and either the subject design element is rebuilt to conform to the applicable design level or a new deviation is developed, approved, and preserved in the DDP for the new project. Check the DVIS for help in identifying previously granted deviations. Keep in mind that the WSF *Terminal Design Manual* is continually evolving. What may have met guidelines once may not meet current guidelines.

Notes:

- For projects with a proposed sidewalk width that is less than shown in the *Standard Plans* or in the WSDOT *Design Manual*, but still meets or exceeds federal ADA guidelines, as opposed to an ADA Maximum Extent Feasible (MEF) document, a deviation will need to be prepared by the project team and approved by the HQ Design Office.
- Deviations from WSF *Terminal Design Manual* criteria, but meet other standards or codes, such as building or electrical codes, require HQ Design Office approval.

For design deviation examples, see: www.wsdot.wa.gov/design/projectdev

220.05 Project Development

In general, WSF initiates the development of a specific project by preparing the Project Summary. The project coordination with other disciplines and interests (such as WSF Operations, Real Estate Services, Roadside and Site Development, Utilities, and Environmental) is started in the project scoping phase and continues throughout the project's development. WSF coordinates with state and federal resource agencies and local governments to provide and obtain information to assist in developing the project.

The project is developed in accordance with all applicable Directives, Instructional Letters, Supplements, and manuals; the WSF Long Range Plan; the Washington State Highway System Plan; approved planning studies; and the Project Summary documents.

WSF develops and maintains documentation for each project. The Project File (PF)/ Design Documentation Package (DDP) includes documentation of project work, including planning; scoping; public involvement; environmental action; design decisions; approvals; calculations; right of way acquisition; permit requirements/ documentation; Plans, Specifications, and Estimates (PS&E) development; project advertisement; and construction. Refer to Chapter 230 and the *Plans Preparation Manual* for more information on PS&E documentation.

All projects involving a federal action require National Environmental Policy Act (NEPA) documentation. WSDOT uses the Environmental Classification Summary (ECS) form for USDOT concurrence/approval on the environmental class of action (EIS, EA, DCE or CE). The environmental approval levels are shown in Exhibit 220-2.

Upon receipt of the ECS approval for projects requiring an EA or EIS under NEPA, WSF proceeds with environmental documentation, including public involvement, appropriate for the magnitude and type of the project.

Design Approval and approval of right of way plans are required prior to acquiring property. Recent changes to federal law (23 USC 108) allow for acquisition of right of way using federal funds prior to completion of NEPA. However, WSDOT LP, ESO, and Real Estate Services are working with FHWA to prepare procedures for this early acquisition as this manual was going to press. (See the April 2, 2013, memorandum on early acquisition policy for more information.)

The ASDE works with the WSF on project development and is part of the FTA Triennial process reviews on projects as described in Section 220.08.

(1) Scoping Phase

Development of the project scope is the initial phase of project development. This effort is prompted by WSF's *Life Cycle Cost Model* (LCCM)/Asset Management System for preservation projects, and the *Long Range Plan* or *Call for Projects* for improvement projects. The project scoping phase consists of determining a project's description, schedule, and cost estimate. The intent is to make design decisions early in the project development process that focus the scope of the project, keeping in mind the guidance provided by the matrices where applicable. During the project scoping phase, the Project Summary documents are produced. For projects not covered by a matrix line from Chapter 210, a project-specific matrix can be developed and approved by HQ Design Office at this phase.

(2) Project Summary

The Project Summary (see Chapter 200) provides information on the results of the scoping phase; links the project to WSF's LCCM and Long Range Plan; and documents the design decisions, the environmental classification, and agency coordination. The Project Summary is developed and approved before the project is funded for design and construction, and it consists of Project Definition, Project Impacts, Project Considerations, Design Decision Summary, and Environmental Review Summary documents. The Project Summary database contains specific online instructions for completing the documents.

(a) Project Definition (PD)

The PD identifies the various disciplines and design elements that are anticipated to be encountered in project development. It also states the purpose and need for the project, the program categories, and the recommendations for project phasing. The PD is completed early in the scoping phase to provide a basis for full development of the Environmental Review Summary, Design Decision Summary, schedule, and estimate. If circumstances necessitate a change to an approved PD, process a Project Change Request Form (PCRF) for approval by the appropriate designee.

For all improvement projects and for preservation projects over $5 Million, the scope is subject to the results of the Pre-Design Study and may result in a PCRF.

(b) Project Impacts

Almost all terminal engineering projects impact ferry operation, the traveling public, local communities, other government agencies or possibly tribal entities. Many impacts will affect multiple stakeholders. For successful project completion, it is essential in scoping to identify these impacts, including costs and durations, and mitigation strategies. The Project Impact and Mitigation Strategy Statements, as well as impact cost and duration, will relate to the issues that will arise during the life of a project, and better enable these be mitigated accordingly.

(c) Project Considerations

Addional project impacts may or may not include identification of potential maintenance impacts; initial predesign decisions; regulatory impacts;engineering services/workforce requirements and impacts; public involvement; and commitments made to the project to others, or commitments by others to the project.



(d) Design Decision Summary (DDS)

The DDS generally provides the design matrix used to develop the project, as well as the design variances, other terminal features, and any design decisions made during the scoping of a project. See Chapter 200 for more detail. The information contained in this form is compiled from various databases of departmental information, field data collection, and evaluations made in development of the PD and the ERS. Design decisions may be revised throughout the project development process based on continuing evaluations.

The appropriate ASDE concurs with the Design Decisions for all projects requiring a DDS. The WSF Design Engineering Manager approves the DDS when confident there will be no significant change in the PD or estimated cost. Schedule, scope, or cost changes require a Project Change Request Form to be submitted and approved by the appropriate designee, in accordance with the *Project Control and Reporting Manual*.

(e) Environmental Review Summary (ERS)

The ERS lists the potential required environmental permits and approvals, environmental classifications, and environmental documentation. If there is a change in the PD or DDS, the information in the ERS must be reviewed and revised to match the rest of the Project Summary. The ERS is prepared during the scoping phase and is approved by WSF. For actions classified under NEPA, the approved ERS becomes the

ECS when the project is funded and moves to design. If the NEPA class of action is a CE, PCE or DCE, WSF may revise the ECS as appropriate (usually during design). The ECS serves as the NEPA environmental documentation for CE/PCE/DCE projects. WSF approves the ECS and sends it to FTA/FHWA for its approval (DCE only). During design and permitting, revisions may need to be made to the ERS and be reapproved by WSF. The ERS/ECS database includes fully integrated help screens that provide detailed guidance. Contact your region Environmental Office for access. (See the *Environmental Procedures Manual* and Chapter 200 for more detail.)

220.06 Design Approval

When the Project Summary documents are complete, a predesign study has been completed if required, and WSF is confident that the proposed design adequately addresses the purpose and need for the project, a Design Approval may be pursued and granted at this early stage. Early approval is an option at this point in the design phase and is likely most relevant to larger projects with longer PE phases because it provides early, approved documentation that locks in design policy for three years. This is a benefit for longer PE phases in that it avoids design changes due to policy updates during that time and provides consistency when purchasing right of way or producing environmental documentation.

If early Design Approval is not beneficial for a subject project, the typical items (below) that are part of this package are required in the combined Design Approval/ Project Development Approval Package. Design Approval may occur prior to NEPA approval. Approval levels for design and PS&E documents are presented in Exhibits 220-2 through 220-3.

The following items are typically provided for Design Approval:

- Stamped cover sheet (See Appendix V for template)
- A reader-friendly 1 or 2 page memo that describes the project and contains:
  - Project Description, including existing conditions
  - Design Criteria
  - Environmental Permit List
  - Operations Plan
  - Current Cost Estimate with Design Level indicated
  - TEIS Milestones
- Project Summary documents
- Project analysis (if applicable)
- Design Variance Inventory (if apllicable for known design variances (EU's not upgraded, deviations) at this stage)
- Slip Layout or Site Plan and Elevation Plan
- Channelization or intersection plans, Alignment plans and profiles (if applicable)
- Approved Predesign Study (if applicable)
- TDM Chapter 210 Design Matrix used with row(s) highlighted (if applicable)
- ASDE-approved Project Specific Design Matrix used (if applicable)
- Project Delivery Method Selection (PDMS) Memo for all projects

Design Approval is entered into the Design Documentation Package and remains valid for three years or as approved by the HQ Design Office. Evaluate policy changes or revised design criteria that are adopted by the department during this time to determine whether these changes would have a significant impact on the scope or schedule of the project. If it is determined that these changes will not be incorporated into the project, document this decision with a memo from WSF Project Development Engineer that is included in the DDP. For an overview of design policy changes, consult the Detailed Chronology of *Design Manual* Revisions: www.wsdot.wa.gov/design/policy/default.htm

(1) Alternative Project Delivery Methods

Design Approval applies to projects delivered using alternative means, including design-build projects, general contractor/construction manager (GC/CM) projects, and projects completed by state forces. Design documentation begins in the project scoping phase and continues through the life of the design-build project. This documentation is thus started by WSDOT and is completed by the design-builder. Since Design Approval is related to project scoping, this milestone shall be accomplished prior to issuing a Design-Build Request for Proposal (RFP) (see Exhibit 110-1 in the WSDOT *Design Manual* M 22-01). However, the design-builder shall refer to the Request for Proposal (RFP) for direction on approval milestones.

220.07 Project Development Approval

When all project development documents are completed and approved, Project Development Approval is granted by HQ Design Office. The Project Development Approval becomes part of the DDP. (See Section 220.04. Exhibits 220-2 through 220-3 provide approval levels for project design and PS&E documents.)

The following items must be approved prior to Project Development Approval:

- Stamped cover sheet (project description) —See Appendix V for template Required environmental documentation
- Design Approval Package documents (and any supplements)
- Updated Design Variance Inventory (all project design variances)
- Approved Deviations and Evaluate Upgrades, if applicable
- Cost estimate EBASE Report Printouts: Summary Report, Fund Report (Federally or multi-program funded projects only), Group Report (multi-Control Section projects only), and Item Report

Project Development Approval is required prior to Advertisement and remains valid for three years if Ad is delayed. Evaluate policy changes or revised design criteria that are adopted by the department during this time to determine whether these changes would have a significant impact on the scope or schedule of the project. If it is determined that these changes will not be incorporated into the project, document this decision with a memo from WSF Design Engineering Manager that is included in the DDP.

All permits do not need to be received for Project Development Approval to be granted. However, all permits need to be identified. If a permit has not been returned at the time of Project Development Approval, provide the anticipated approval date. For permits that will be obtained by the Contractor, such as Building Permits or Noise Variances, state "To Be Obtained by Contractor".

(1) Alternative Project Delivery Methods

For projects delivered using alternative methods, such as design-build, the design-builder shall refer to the project RFP for specification on final and intermediate deliverables and final records for the project. Project Development Approval is required prior to project completion.

It is a prudent practice to start the compilation of design documentation early in a project and to acquire Project Development Approval before the completion of the project. At the start of a project, it is critical that WSF project administration staff recognize the importance of all required documentation and how it will be used in the design-build project delivery process.

(2) Proprietary Items

Designers need to obtain approval of all project specific proprietary items required for a project as early as possible. These items must be approved by HQ Design prior to the project being advertised. See the *Plans Preparation Manual* Section 700.01(5) for documentation requirements. Include a copy of the approval memo in the DDP.

The Designer needs to be aware that specific items may be found in an approved WSF Programmatic Proprietary document. Provide a copy of the approved Blanket approval highlighting materials used for a specific project and include this in the DDP.

(3) Buy America and Buy American Act

The Designer needs to be aware that *Buy America* and *Buy American Act* requirements will be required for any steel materials permanently incorporated into a project that has any amount of Federal funding. See the *Plans Preparation Manual* Section 700.05 for further information about Buy America requirements and required documentation. Consult with Capital Program Development and Management Office if there is any question regarding source of funding. Include required General Special Provisions when preparing the PS&E for the project.

For procurement of equipment required for Department of Homeland Security (DHS) purposes, and the funding is provided by the Port Security Grant Program, *Buy American Act* requirements are to be followed. There requirements apply to more items than foreign made steel. Note that the *Buy American Act* is not necessarily the same as "Buy American" requirements in other federal legislation.

The Federal Highway Administration (FHWA) (see Appendix Y) deems product to be manufactured predominantly of steel or iron if the product consists of at least 90 percent steel or iron content by cost when it is delivered to the job site (which includes sites wherever precast concrete products are manufactured) for installation. The project team is responsible for making this determination with the concurrence of the ASDE.

Federal Transit Administration's (FTA) Buy America policies may be found at this Link.

HQ Design ASDE needs to concur with all documentation for *Buy America* and *Buy American Act* requirements prior to obtaining Project Development Approval. Include a copy of the concurrence, calculations and justifications in the DDP.

220.08 Combined Design Approval/Project Development Approval

For smaller or short duration design projects, a project team may elect to seek a combined Design Approval and Project Development Approval. For these situations, address the bulleted items in Sections 220.06 and 220.07 to the Assistant State Design Engineer assigned to WSF. A combined Design Approval/Project Development Approval stamped cover sheet template is included in Appendix V.)

A reader-friendly 1 or 2 page memo that describes the project and contains is also required and will contain the following:

– Project Description, including existing conditions

– Design Criteria

– Environmental Permit List

– Operations Plan

– Current Cost Estimate with Design Level indicated

– TEIS Milestones

220.09 FTA Triennial Review

The review is done to provide reasonable assurance that projects are prepared in compliance with established policies and procedures and that adequate records exist to show compliance with state and federal requirements. Process reviews are conducted by FTA staff with the Region Director of Operations approving the final report.

The review occurs every three years. It is essentially an audit of how the state is managing Federal funds and involves checking management systems and documentation. The reviewers look at 27 areas:

1. Program Management
2. Grant Administration
3. Selection and Eligibility
4. Financial Management
5. Intercity Bus
6. Rural Transportation Assistance Program
7. Satisfactory Continuing Control
8. Maintenance
9. Procurement
10. Disadvantaged Business Enterprise
11. Buy America
12. Debarment and Suspension
13. Lobbying
14. Planning and Coordination
15. Title VI
16. Americans with Disabilities Act (ADA)
17. Charter Bus
18. School Bus
19. Drug Free Workplace
20. Drug and Alcohol Program
21. Equal Employment Opportunity

22. National Transit Database
23. Public Comment on Fare and Service Changes
24. Half Fare
25. Safety and Security
26. Intelligent Transportation Systems Architecture
27. American Recovery and Reinvestment Act

Findings are documented with a letter from FTA to the grantee, listing what was done and what the findings contained.

WSF takes action to correct any findings and a letter is sent to FTA confirming the steps taken to address the findings.

220.10 Design Drawing Production

(1) WSF CADD Standards

WSF uses the WSDOT *Plans Preparation Manual* M 22-31 as a guideline for preparing PS&E documents. However, the WSDOT *Plans Preparation Manual* applies primarily to roadway-type projects and does not adequately address the specific needs and variey of projects performed by WSF. Division 8 supplements the WSDOT *Plans Preparation Manual* and provides instruction and guidance for the preparation of contract drawings using Bentley's MicroStation® and Autodesk's AutoCAD® Computer-Aided Design and Drafting (CADD or CAD) software, which is used on all WSF projects.

Special exceptions to the use of MicroStation are those projects tht include within their scope the construction of shoreside buildings. WSF depends on the WSDOT Architectural Department or Consultant to provide the building design services necessary to complete that protion of the contract. In projects that incorporate items of work other than architecture, there will be a "design limit of five feet beyond the perimeter of the architectural work that will mark the boundary where the architectural and other discipline work will coincide.

(2) Expectations for Consultant Design Drawing Production

The following is a list of expectations for consultants that provide electronic CADD files as part of their participation in WSF design projects:

- Unless otherwise notified the WSDOT's SFTP server will be used to transfer electronic files between all consultants and WSF during the project.
- WSF will provide the plan sheet borders for all projects. The format will be MicroStation.
- WSF will provide MicroStation line, font and symbology resource files for the consultant to use during the project.
- Drafting will be done 1:1 in the master files (.mst files).
- WSF will provide the CADD background information that it has on hand for each design project in MicroStation format.

- Consultants will post a maximum of two progress prints between submittal milestones. The date for these posting will be identified by the WSF Project Manager. (These are only meant to be "snap shots" of where we are with the project.)
- Backgrounds produced during the life of the contract will be placed on the SFTP server for use a minimum of three weeks prior to review submittal.
- Backgrounds will be frozen two weeks prior to review submittal.
- A table of contents for each discipline will be submitted a minimum of one week prior to any submittal.
- Electronic files for submittal shall be in both MicroStation and PDF format.
- Upon completion of the project the consultants will be responsible for submitting MicroStation files of the ad copy and addendum sheets.

(3) Architectural Drawings

AutoCAD is the standard industry drafting software used for architectural drawings. Since MicroStation is the primary CAD program used at WSDOT/WSF, the following divisions applies:

- For buildings constructed on trestles, MicroStation will be used for the trestle and AutoCAD will be used for the building design.
- For upland buildings, AutoCAD will be used to a 5' perimeter from the outer expanse of the building. Everything beyond will be displayed using MicroStation.

Item	Approval Authority		
	WSF	HQ	FHWA
Program Development			
Work Order Authorization		X	
Public Hearings			
Environmental Documentation	X		
Environmental Document			
Environmental Classification Summary (ECS) NEPA			X
Class I NEPA (EIS)		[3]	X
SEPA (EIS)		X	
Class II NEPA – Categorical Exclusion (CE)* (Per MOU)	X[18]		
Class II NEPA – Documented Categorical Exclusion (DCE)	[2]		X
SEPA – Categorical Exemption (CE)	X		
Class III NEPA – Environmental Assessment (EA)		[3]	X
SEPA Environmental Checklist and Determination of Non-Significance (DNS)	X		
Design			
Final Project Definition		X[4]	
Final Design Decision Summary	X[2]	X[1]	
Environmental Review Summary	X		
Design Approval		X	
Project Development Approval		X	
OFM Approved Predesign Study	[17]	[17]	[17]
Building Architectural Elements	[15]	[15]	[15]
Intersection or Channelization Plans	X[5]		
Right of Way Plans or Sundry Site Plans	[6]	X	
Monumentation Map	X		
Pavement Determination Report		X[7]	
Resurfacing Report		X[7]	
Signal Permits	X[8]		
Geotechnical Report		X[7]	
Tied Bids	X[9]		
Bridge Design Plans (Bridge Layout)	X		

Table is continued on the following page, which contains the notes.

Approvals (1 of 2)
Exhibit 220-2

Item	Approval Authority		
	WSF	HQ	FHWA
Design (continued)			
Hydraulic Report		X[10]	
Signalization Plans	X[13]		
Illumination Plans	X		
Intelligent Transportation System (ITS) Plans	X[13]		
Project Change Request Form	X[12]	X[12]	
Work Zone Transportation Management Plan/Traffic Control Plan	X[13]		
Public Art Plan	X[11][14]	X[14]	
ADA Maximum Extent Feasible Document (see Chapter 300)	X[2]	X	
Work Zone Transportation Management Plan/Traffic Control Plan	X[13]		
Public Art Plan	X[11][14]	X[14]	
ADA Maximum Extent Feasible Document (see Chapter 300)	X	X	
Project Delivery Methods			
Combining Two or more Project PINs into a Single Contract	X[16]		
Staging Projects (Breaking Single Projects into one or more Contracts)	X[16]		
Design-Build Determination	X[16]	X	

X Normal procedure *If on the preapproved list

Notes:

[1] Approved by Assistant State Design Engineer.

[2] Final review and concurrence required at WSF level prior to submittal to approving authority.

[3] Final review and concurrence required at HQ prior to submittal to approving authority.

[4] Approved by HQ Capital Program Development and Management Office.

[5] Include channelization details. Approval required by Region Traffic.

[6] Certified by the responsible professional licensee

[7] Submit to HQ Materials Laboratory for review and approval.

[8] Approved by RegionTraffic.

[9] See 23 CFR 635.111.

[10] See the *Hydraulics Manual* for approvals levels.

[11] Applies to WSF with a Landscape Architect.

[12] Consult HQ Capital Program Development and Management Office for clarification on approval authority.

[13] Local Municipality or Region Traffic Engineer or designee.

[14] The State Bridge and Structures Architect reviews and approves the public art plan (see WSDOT *Design Manual* Chapter 950 for further details on approvals).

[15] Approval by Local Jurisdictional Control and WSDOT Facilities Office

[16] Approval by WSF Terminal Engineering Program Manager, Design Engineering Manager and Director.

[17] Approval by WSF Executive Management and Office of Financial Management (OFM) thru HQ Capital Program Development and Management Office (in that order)

[18] If on the preapproved list

[19] The above requirements do not necessarily apply for other funding sources, including the FTA and DHS. Contact WSF Program Management for assistance.

Approvals (2 of 2)
Exhibit 220-2 (continued)

Item	Approval
M/WBE/DBE/training goals* **	HQ Office of Equal Opportunity
Right of way certification for state-funded projects	HQ Real Estate Services Office
Work performed for public or private entities*	WSF[1]
State force work*	WSF, Capital Program Development and Management Office[2]
Use of state-furnished stockpiled materials*	WSF, Capital Program Development and Management Office[2]
Work order authorization	WSF, Capital Program Development and Management Office
Ultimate reclamation plan approval through DNR	WSF
Proprietary item use*	HQ Design Office
Mandatory material sources and/or waste sites*	WSF[3]
Nonstandard bid item use*	WSF
Incentive provisions	HQ Construction Office
Nonstandard time for completion liquidated damages*	HQ Construction Office
Interim liquidated damages*	Statewide Travel and Collision Data Office

Notes:

[1] This work requires a written agreement

[2] Use of state forces is subject to dollar limitations found in Chapter 200

[3] Document for all projects

References:

**Plans Preparation Manual*

***Advertisement and Award Manual*

PS&E Process Approvals

Exhibit 220-3

Document	Required within DDP
Stamped Cover Sheet	X [3] [DA] [PDA]
Reader friendly memo describing the project	X [DA][5]
Project Summary Documents (Scoping Forms)	X [DA]
Environmental Review Summary	X [DA]
Current Cost estimate EBASE Reports with Design Level Indicated, (also include concurrence from Terminal Engineering Chief Estimator in DDP only)	X [DA] [PDA]
Combined Site and Vicinity Map	X
Design Criteria Memo	X [DA]
OFM Approved Predesign Study	[1] [DA]
Corridor or Project Analysis	[1] [DA]
Approved, Stamped Channelization plans, Intersection Plans or Interchange Plans	[1] [DA]
Approved Design Approval Package (If separate from Project Development Approval) [DA]	[1*]
Approved Project Development Approval Package (If separate from Design Approval) [DA]	[1*]
Combined Desig Approval/Project Development Approval Package [DA]	[1*]
Approved Deviations	[1] [DA]
Approved Evaluate Upgrades	[1] [DA]
Slip Layout Plans with Captain's Concurrence Documentation (Berthing Structure Projects only)	[1] [DA]
Site Plans and Elevation Plans	X [DA]
ADA Maximum Extent Feasible Documentation	[1] [PDA]
PCRF Forms	[1]
Approved Stamped Hydraulic Report	[1], [4]
Approved Right of Way Plans	[1]
Design Matrix (highlight/identify appropriate row(s))	X [DA]
Design Parameters (roadway only)	[1]
Design Parameters (Include back-up Calculations)	[1], [2]
Design Variance Inventory System (printed forms)	[1] [DA] [PDA]
Added Work not covered by the matrix	[1]
Decisions for project components for which there are no WSF Terminals guidance	[1]
Alignment and Profile plans, Roadway Sections	[1] [DA]
NEPA Approvals and Documentation (if required)	[1] [PDA]
SEPA Approvals and Documentation (if required)	X [PDA]
Environmental Permits (list)	X[DA]
Environmental Commitments – From Environmental Commitment Database	[1] [PDA]
Traffic Analysis	[1]
Collision History	[1]
Capacity Determination (roadway and building)	[1]
Approved Stamped Geotechnical Reports	[1]
Approved Stamped Surfacing Reports	[1]
Signing, delineation, and Illumination	[1]
ITS	[1]
Signal Permit	[1]

X - To Be Included

Table is continued on the following Page. Part 2 of 2 contains the notes.

WSF Terminals Design Documentation Package (DDP) Checklist (1 of 2)
Exhibit 220-4

Document	Required within DDP
Clearzone Inventory	[1]
Barrier Length of Need Calculations	[1], [2]
Impact Attenuator Systems	[1]
School Bus Stops/Interaction	[1]
Pedestrian Facilities	[1]
Project Delivery Method Selection (PDMS) Memo	[1], [6]
Shared Use Paths	[1]
Roadway Bicycle Facilities	[1]
Aesthetic Visual Elements	[1]
Structural Calculations	[1], [2]
Retaining Walls	[1]
Roadside Restoration/Enhancement	[1]
Access Control	[1]
Road Approaches/Access permits	[1]
Fencing	[1]
Railroad Issues	[1]
Utilities Involvement (list)	[1]
Franchises (list)	[1]
Agreements (list)	[1]
HOV Operational issues	[1]
Travelers Services	[1]
Park and Ride considerations	[1]
Transit flyer stops	[1]
Monumentation/Record of Survey	[1]
Local Agency Coordination	[1]
Concurrence Letters	[1]
Letters of Understanding	[1]
Approved Public Art plan	[1]
Memo summarizing Public Involvement	[1]
Approved Proprietary Item Requests	[1] [DA] [PDA]
Buy America/Buy American Act Exclusion Determination, including calculations/ justifications and ASDE Concurrence—Federal Projects Only	[1] [DA] [PDA]

X - To Be Included

Notes:

[1] If Applicable

[1*] Design Documentation Package will include either separate Design Approval and Project Development Approval submittals, or a combined submittal (generally for smaller projects. See Section 220.08 above.

[2] If calculations indefinitely retained by Terminal Engineering Library, include calculation check sheet only and note location of retained records.

[3] See Appendix U for Cover Sheet Example

[4] Consult the hydraulics office as a full report may not be necessary, but a memorandum to the design file may suffice. If the report will be included in the Terminal Engineering Library, only a stamped cover sheet is needed to be included in the DDP

[5] Required for Combined DA/PDA

[6] Required for all projects greater .

[DA] Required for Design Approval—send copy along with request

[PDA] Required for Project Development Approval—send copy along with request

WSF Terminals Design Documentation Package (DDP) Checklist (2 of 2)
Exhibit 220-4 (continued)

1. Design Element Upgraded when required in the Matrix
   (a) Design element information
      - Design element
      - Location
      - Matrix number and row

   (b) Cost estimate[1]

   (c) B/C ratio[2]

   (d) Summary of the justification for the upgrade[3]

2. Design Element Not Upgraded when Indicated in the Matrix
   (a) Design element information
      - Design element
      - Location
      - Matrix number and row

   (b) Existing conditions
      - Description
      - Collision Summary
      - Operational Elements
      - Advantages and disadvantages of leaving the existing condition unchanged

   (c) Design using the WSF *Terminal Design Manual* or WSDOT *Design Manual* criteria
      - Description
      - Cost estimate[1]
      - B/C ratio[2]
      - Advantages and disadvantages of upgrading to the level indicated in the matrix

   (d) Selected design, if different from existing but less than the level indicated in the matrix
      - Description
      - Cost estimate[1]
      - B/C ratio[2]
      - Advantages and disadvantages of the selected design

   (e) Summary of the justification for the selected design[3]

Notes:

[1] An estimate of the approximate total additional cost for the proposed design. Estimate may be based on experience and engineering judgment.

[2] Include only when B/C is part of the justification. An approximate value based on engineering judgment may be used.

[3] A brief (one or two sentence) explanation of why the proposed design was selected.

Evaluate Upgrade (EU) Documentation Contents List
Exhibit 220-5

1. Overview
   (a) The safety or improvement need that the project is to meet
   (b) Description of the project as a whole
   (c) Highway classification and applicable design matrix number and row
   (d) Funding sources
   (e) Evidence of deviations approved for previous projects (same location)
   (f) Predesign study (if applicable)

2. Design Alternatives in Question
   (a) Existing conditions and design data
      - Location in question
      - Rural, urban, or developing
      - *Approved corridor study*
      - Environmental issues
      - Right of way issues
      - Number of lanes and existing geometrics
      - Current and 20-year projected ADT
      - Design speed, posted speed, and operating speed
      - Percentage of trucks
      - Terrain Designation
      - Managed access or limited access

   (b) Collision Summary and Analysis
   (c) Operational and or ridership considerations
   (d) Design using the WSF *Terminal Design Manual* or *Design Manual* M 22-01 criteria
      - Description
      - Cost estimate
      - B/C ratio
      - Advantages and disadvantages
      - Reasons for considering other designs

   (e) Other alternatives (may include “No-build” alternative)
      - Description
      - Cost estimate
      - B/C ratio
      - Advantages and disadvantages
      - Reasons for rejection

   (f) Selected design requiring justification or documentation to file
      - Description
      - Cost estimate
      - B/C ratio
      - Advantages and disadvantages

3. Concurrences, Approvals, and Professional Seals

Deviation Request and Project Analysis Contents List
Exhibit 220-6

Chapter 230 Quality and Constructability

230.01 General
230.02 References
230.03 Definitions
230.04 Roles and Responsibilities
230.05 Project Management Plan
230.06 Quality Control
230.07 Quality Assurance
230.08 Quality Control/Quality Assurance (Consultant Designed Projects)
230.09 Quality Control/Quality Assurance (Structures)
230.10 Project Goal Requirements
230.11 Advertisement
230.12 Limited Public Works Contracts

230.01 General

This chapter provides an explanation of and the procedures for WSF Terminal Engineering Quality Control, Quality Assurance and Constructability Reviews. It will explain how the applicable project procedures, practices, and/or plans are to be followed to meet requirements; and identifies the organizational structure of the staff responsible for performing quality activities and verifying compliance. The fact that the Team includes many members from many disciplines reinforces the need for a consistent plan to maintain quality. The quality plan will address quality control procedures for Terminal Engineering including WSDOT staff members, consultant team members, on-call team members, and others involved in the preparation of plans and design documents.

Capital projects with an estimated construction value less than $100,000 dollars are not required to follow every procedure outlined within this chapter. Formal approval of an exemption from certain steps of the controls outlined in this chapter should be sought from the Design Engineering Manager and documented within the project documentation as outlined in Chapter 220.

230.02 References

(1) Federal/State Laws and Codes

23 Code of Federal Regulations (CFR) 635.411, Material or product selection

RCW 39.04.155 *Small works roster contract procedures — Limited public works process — Definition*

RCW 47.28.030 *Contracts – State forces – Monetary limits – Small businesses, minority, and women contractors – Rules*

RCW 47.28.035 *Cost of project, defined*

RCW 47.60.327 *Operational strategies for asset utilization*

RCW 47.60.365 *Terminal design standards*

RCW 47.60.385 *Terminal improvement project funding requests — Predesign study — New vessel acquisition planning*

(2) Design Guidance

Office of Financial Management, *2009-11 Transportation Predesign Manual*

WSDOT Policy Documents Index, including those listed below:

- Secretary's Executive Order E 1032 *Project Management*
- Secretary's Executive Order E 1053 *Project Risk Management and Risk Based Estimating*
- Instructional Letter IL 4071 *Risk-Based Project Estimates for Inflation Rates, Market Conditions, and Percentile Selection*

WSDOT technical manuals, including those listed below:
www.wsdot.wa.gov/Publications/Manuals/index.htm

- *Bridge Design Manual LRFD* M 23-50
- *Bridge Inspection Manual* M 36-64
- *Bridge List* M 23-09
- Cost Estimating Manual for WSDOT Projects M 3034
- *Design Manual* M 22-01
- *Emergency Relief Procedures Manual* M 3014
- *Environmental Manual* M 31-11
- *Geotechnical Design Manual* M 46-03
- *Highway Runoff Manual* M 31-16
- *Hydraulics Manual* M 23-03
- *Local Agency Guidelines* M 36-63
- *Plans Preparation Manual* M 22-31
- *Project Control and Reporting Manual* M 3026
- *Right of Way Manual* M 26-01
- *Standard Plans* M 21-1
- *Transportation Structures Preservation Manual* M 23-11
- *Utilities Accommodation Policy* M 22-86
- *Utilities Manual* M 22-87

WSDOT Administrative manuals, including those listed below:
www.wsdot.wa.gov/publications/manuals/index.htm

- *Advertisement and Award Manual* M 27-02
- *Electronic Engineering Data Standards* M 3028

WSDOT Engineering Applications, including those listed below:
www.wsdot.wa.gov/design/projectdev/engineeringapplications

- *Bid Tabs*
- EBASE
- *Standard Items*
- *Unit Bid Analysis*

Terminal Engineering Intranet Pages, including those listed below:
www.wsdot.wa.gov/ferries/terminalengineering/default.htm

- Cost Estimating
- *Life Cycle Cost Model*
- Programmatic Scoping

230.03 Definitions

Advertisement or Ad or AD – the WSDOT process of contractor bid solicitation.

Award – The formal decision to accept the lowest responsible and responsive bidder.

Checks – Checks are systematic and detailed inspections of project documents to verify they meet specified requirements – i.e. fit for purpose, accuracy, correctness, completeness, etc. Checks are established as a second set of eyes and are performed by a technically qualified individual other than the document's originator. The checking process requires the use of the color coding system. The three basic checks are:

- 100 percent document check
- Spot check of selected or critical items of a document
- Input/output check for spreadsheets or pre-validated software

Checkprints – Checkprints are copies of original project documents used for the checking process. Marked-up checkprints are to be maintained in the project files for support documentation. (Scanned copies are acceptable.)

Comment Review Form – The Comment Review Form (CRF) is the standard document used to capture and communicate all comments generated from a PS&E or Constructability review process. This form is a MS Excel file. See Appendix C.

DQC Sign-Off Sheet – The Document Quality Control (DQC) Sign-Off Sheet is the cover sheet accompanying all quality review/check documents that contains signatures of all individuals that contributed to the quality process.

Project Documents – A project document is any document or data used during the course of a project up to and including the final deliverable. This includes but is not limited to drawings; specifications; calculations; schedules; estimates; reports; graphics; public communications; Work Orders and Task Orders, documents or data received from other WSDOT departments, outside agencies, or consultants.

Project Engineer – The supervisor of the Project Manager.

Project Management Plan – A formal, approved document that defines how the project is executed, monitored, and controlled. It may be in summary or detailed form and may be composed of one or more subsidiary management plans and other planning documents.

Quality – Quality means consistently meeting the needs of the customers and project objectives while developing the full potential of the people contributing to the project delivery.

Quality Assurance – Quality assurance refers to those actions, procedures and methods to be employed at management levels and under the jurisdiction of the Project Engineer to observe and assure that prudent quality control procedures are in place, are being carried out, and that the desired result of quality professional services and construction products are being achieved.

Quality Audit – Quality Audits are performed internally after each Quality Control Review to ensure and document that all QC requirements were performed in accordance to this document. The Quality Manager/Project Manager or designee conducts the audit. Once the audit is passed, a Quality Audit Documentation Form is issued indicating the process was completed. The Quality Audit Documentation Form is shown in Appendix D. Following the Quality Audit, a review package is ready for internal-external or external reviews.

Quality Control – Quality control refers to those actions, procedures, and methods that are to be routinely employed at the production and administrative levels, and under the jurisdiction of the Senior Marine Engineer during the development of work products to produce the desired quality professional services.

Quality Plan – The project plan established by the Project Manager that defines the schedule and scope for all checking and review activities on the project. The Quality Plan is included in the Project Management Plan (PMP).

Reviews – Reviews are intended to assess performance, conduct and/or progress of project documents; verify work is conceptually correct, complete, logical, coordinated, has followed the required procedures, and/or has used the correct requirements; and assess value engineering opportunities. Reviews are established as a second set of eyes and are performed by a technically qualified individual other than the document's originator who may or may not be associated with the project. The types of reviews are:

- Permit Review
- PS&E Review (Interdisciplinary coordination review of PS&E documents during development – i.e. 30 percent, 60 percent and 90 percent)
- Constructability Reviews
- Threshold Review (items supporting project elements, i.e. Risk, CEVP/CRA estimates, VE studies, etc.)
- PS&E Turn-In QA/QC (pre-submittal checklist prior to submittal to the Contract Ad and Award office for advertisement and bid opening).

Value Engineering (VE) – Value engineering is defined by the Society of American Value Engineers as the art of developing a plan to maximize value while minimizing cost. It is a systematic, multi-discipline approach designed to optimize the value of each dollar spent. As a management tool, it complements rather than replaces other cost-reduction and/or cost control techniques. The objective is to satisfy the required function at the lowest cost consistent with performance requirements, reliability, and maintainability. Value engineering has the potential to reduce construction costs if it is performed early during the design phase by experienced staff, and the resulting recommendations are implemented in a timely manner to prevent costly construction delays.

230.04 Roles and Responsibilities

Checks	
Originator (Designer)	The qualified individual responsible for the development of a document in its original form. Responsible for: • Developing project document in accordance with all applicable criteria. • Accuracy, completeness, and correctness, including format, spelling, grammar, mathematical accuracy, etc. of both inputs and outputs before releasing a project document for required Checking. • Identifying and making accessible all input, reference, and backup materials for the Checker's use. • Resolving and incorporating/correcting Checking comments. • Following completion of the original document, signing (not initialing), dating and making a copy of the document (checkprint), adding and completing the DQC sign-off sheet, and issuing the deliverable to the Project Manager, or appropriate individual, for continuation of the quality control process.
Checker (Peer Designer or Supervisor)	The qualified individual assigned to check a project document generated by an Originator. Checkers must have equal or greater experience than the Originator. Responsible for: • Checking the document against: 1) the established inputs and requirements; 2) applicable procedures, standards, and codes; and 3) good practice and judgment. • Color code the document in accordance with the established color code – see Appendix E. • Resolving any significant corrections, additions or deletions that potentially void a portion of the work before continuing with the checking process. Irreconcilable differences between the Originator and Checker must be referred to the Project Manager for resolution. • Initialing the checkprints at the completion of the checking, or signing and dating the DQC sign-off sheet in the space marked "CHECKER" and returning the checkprint(s) to the appropriate individual for continuation of the quality control process. The Checker must not be unduly influenced by personal opinion about the presentation or approach of the document, nor change it simply to do it his or her way. However, the document must be able to be interpreted by the Checker without further explanation. • Coordinating with the Backchecker to resolve any disagreements. Irreconcilable differences shall be referred to the Project Manager and/or discipline Supervisor (Structural or Electrical/Mechanical), as appropriate, for resolution.
Backchecker (Originator)	The qualified individual assigned will verify whether or not the Checking comments are appropriate, and make changes that should be incorporated/corrected in the final project document. Wherever possible the Backchecker should be the Originator. Responsible for: • Reconciling the Checker's comments to the project document. • Changes initiated by the Backchecker are to be made directly on the checkprint in accordance with the color code, and should have full concurrence with the Originator and Checker. • Coordinating with the Checker to resolve any disagreements. Irreconcilable differences shall be referred to the Project Manager and/or discipline Supervisor (Structural or Electrical/Mechanical), as appropriate, for resolution. • At completion of the backcheck, signing and dating the original document and the DQC sign-off sheet in the space marked "BACKCHECKER" and forwarding the project document to the appropriate individual for continuation of the quality control process.

Project Roles and Responsibilities
Exhibit 230-1

Checks (continued)	
Updater (Originator)	The qualified individual assigned to update the original project document to accommodate reconciled revisions by the Checker and Backchecker. Wherever possible the Updater should be the Originator or should be supervised by the Originator. Wherever practicable the Originator should be notified in advance of any changes to the original project document. Responsible for: • Updating the original project document in accordance with the reconciled checkprints. • Indicating the original has been updated by marking the corrections, additions or deletions of the checkprint in accordance with the color code. • At completion of the update: – Signing and dating the DQC sign-off sheet or in the space marked “UPDATER”. – Forwarding the project document to the appropriate individual for continuation of the quality control process.
Rechecker (Checker)	The qualified individual assigned to verify that corrections have been made to the original project document by the Updater in accordance with the backchecked checkprints. Wherever possible, the Rechecker should be the Checker. Responsible for: • At the completion of the recheck: – Sign and date the DQC sign-off sheet in the space marked “RECHECKER” – Return the project document to the appropriate individual for continued processing
Project Manager	The qualified individual to make decisions regarding resolution of irreconcilable differences from the checking process in consultation and coordination with applicable discipline supervisors, and how the resulting from the checking process will be incorporated into the project. Responsible for: 1. Providing direction for checking documents per the Quality Plan included in the Project Management Plan. 2. Identifying how the project will proceed based on changes from the checking process. 3. Preparing an action plan to address resolution of irreconcilable differences from the checking process. 4. Assembling all QA/QC documentation for the project files.

Project Roles and Responsibilities
Exhibit 230-1 (continued)

Reviews	
Originator (Designer)	The qualified individual responsible for the development of a document in its original form. Responsible for: • Developing project document in accordance with all applicable criteria. • Accuracy, completeness, and correctness, including format, spelling, grammar, mathematical accuracy, etc. of both inputs and outputs before releasing a project document for required Review. • Identifying and making accessible all input, reference, and backup materials for the Reviewer's use. • Resolving and incorporating/correcting Review comments. • Following completion of the original document, signing (not initialing), dating and making a copy of the document, adding and completing the DQC sign-off sheet, and issuing the deliverable to the Project Manager, or appropriate individual, for continuation of the quality control process.
Reviewer(s) (Project Manager; Designers; Construction; Maintenance; Operations; Department Directors)	The qualified individual(s) assigned to review a project document generated by an Originator. Responsible for: • Reviewing the project document(s) to verify; the concept is appropriate and/or the information provided on which other work will be based is conceptually correct; the work is appropriately coordinated with other disciplines; and good practice and judgment are incorporated. • Record review findings using the CRF or memorandum. • Discussing review findings with Originator. • Signing (not initialing) the signing and dating the DQC sign-off sheet in the space marked "REVIEWER" and returning the reviewed document to the appropriate individual for continuation of the quality control process.
Project Manager	The qualified individual to make decisions regarding how the reviews will be incorporated into the project. Responsible for: • Providing direction for reviews in the Quality Plan included in the Project Management Plan. • Identifying how the project will proceed based on the review comments. • Preparing an Action Plan to address review findings and recommendations and to indicate compliance or non-compliance along with appropriate explanations. • Assembling all QA/QC documentation for the project files.

Project Roles and Responsibilities
Exhibit 230-1 (continued)

230.05 Project Management Plan

The Project Management Plan defines the project performance baseline—the project deliverables, schedule and budget plans—and the management methods used by the project team to deliver the project. Until a Project Management Plan (PMP) is approved, only 10 percent of the Preliminary Engineering phase budget will be authorized.

The project performance baseline documents the project team's detailed goals for the performance of the project within the scope, schedule, and budget parameters established by WSF Terminal Engineering.

- **Scope** – the deliverables to be produced by the project team.
- **Schedule** – the logical sequence of work and related milestones.
- **Budget** – the allocation for the project.
- **Risk** – potential risks to the project.

The Project Management Plan includes the Risk Management , Change Management, Communication Management , Quality Management , and Transition and Closure plans. These plans help align the team toward uniform goals and describe how the team will:

1. Manage risk events and change,
2. Ensure quality requirements are met,
3. Identify how, when and who will need and receive what project information,
4. Plan for an effective transition or closure.

A Project Management Plan is required for all WSF projects with an estimated construction value (not including tax, contingencies, below-the-line items (other than state supplied materials and equipment), and construction engineering) greater than $100,000.

The WSF Terminal Engineering Project Management Plan Template can be found in Appendix F.

230.06 Quality Control

All PS&E documents for contract advertisement and associated calculations, permit documents, and documents to be presented to the public prepared by Terminal Engineering shall be checked (see checking roles and responsibilities in Section 230.04). All documents shall be checked with the goal of completing as much checking as possible by or on the 90 percent review submittal. Checking shall be performed by each discipline of its own documents, the timing in accordance with the project's Quality Plan as defined in the PMP. A flow chart of the checking process can found in Appendix G.

(1) Checking

Checking is comprised of:

- Verifying scope
- Verifying design criteria
- Verifying geometry
- Verifying conformance with Geotechnical criteria
- Verifying conformance with Environmental regulations
- Verifying accuracy of calculations and data
- Verifying accuracy of information conveyed
- Verifying consistency between the calculations and drawings
- Verifying accuracy of Plans and Specifications
- Verifying each item is shown on the Plans
- Verifying each item is described in the Specifications
- Verifying each item is included in summary of quantities
- Verifying each item is accounted for in the project cost estimate
- Verifying the existence and approval of proprietary items (see the *Plans Preparation Manual* Section 700.05(20) for more information)
- Verifying that, if project has federal funds, Buy America and Buy American requirements have been met (see Chapter 220 for more information)
- Verifying that all State Force Work and State Supplied Material requirements have been met. (see the *Plans Preparation Manual* Section 700.05(29) and RCW 47.28.030)

(2) Checking Documentation

All checked documents (checkprints) shall be coded using the standard Quality Control Color Code – See Appendix E. Checked documents shall be accompanied by a copy of the DQC Sign-Off Sheet. The Sign-Off Sheet shall contain signatures and dates of all responsible parties. A template of the DQC Sign-Off Sheet is included in Appendix H.

230.07 Quality Assurance

All Terminal Engineering prepared documents shall receive at least one review. The review shall be performed in accordance with project's Quality Plan as defined in the PMP.

For PS&E, permitting and public communication documents it is imperative that coordination occurs between all the documents and disciplines that are involved to ensure accuracy and consistency of the project's scope.

(1) Review Types

(a) Permit Review

1. Prior to the permit submittal, all documents shall be checked to ensure the project information and scope is adequately reflected, including geotechnical reports and type, size and location determinations. This review is interdisciplinary.
2. During the 90 percent review or earlier, all documents shall be checked to ensure the PS&E package complies with all relevant laws, agreements, permit conditions and commitments.
3. After checking, an Environmental Commitment Meeting shall be held for each project to discuss the document review as described in Section 230.07(3) below. This meeting will also ensure the relevant environmental commitments are contained within the specifications, including permits attached as appendices. More on incorporating environmental commitments into WSDOT contracts may be found in Appendix N.

(b) PS&E Review

This is an interdisciplinary review of the Plans, Specifications and Estimate and shall be performed at the 30 percent, 60 percent, and 90 percent submittal phases of the project. This review involves looking at the PS&E documents between and within respective disciplines for interdisciplinary coordination discrepancies at the interfaces, for errors and omissions, and for constructability. These reviews are scalable to the size of the project. If a Project Manager would like to omit any of these reviews, approval from the Design Engineering Manager is required.

1. **Deliverables Expectations Matrices**

   The level of detail and development expected at 30 percent, 60 percent and 90 percent packages vary depending on the type of project. Deliverables Expectations Matrices have been developed to guide the designer and manager to calibrate expectations on what is required within each set. Detailed requirements within each discipline, presented along the timeline of project development milestones, can be found within each matrix including:

   - Purpose
   - Decisions required
   - Project management expectations
   - Environmental
   - Tribal outreach
   - Geotechnical
   - Traffic and Operations
   - Civil
   - Architectural
   - Structural
   - Electrical
   - Construction

Four different expectation matrices have been developed for use for Terminal Engineering Projects in an attempt to demonstrate components of what may be required within each different project type. The project types are H Span, Wingwall, Dolphin and Toll Booth/Terminal Building Projects. Please see Appendix I.

The Project Manager should choose one of the four that best represents the scope of a particular project and alter to suit.

2. **Staff performing reviews**

Staff reviewing these packages are as follows (but not limited to):

- Construction Manager
- Construction Support Engineer
- Chief Inspector
- Office Engineer
- Marine Project Engineer(s)
- Maintenance Engineer
- Facility Engineer(s)
- Structural Supervisor
- Maintenance/Electrical Supervisor
- Architect
- Environmental Staff
- Chief Estimator
- Plan Reviewer(s)
- Operations Liaison
- Regional Representative (if applicable)

(c) Constructability Reviews

This is a review of the PS&E documents as they compare to the actual site conditions and may optionally be performed on site. The Constructability Review shall be performed at the 60 percent and 90 percent submittal phases of a project. Ideally, all discipline designers and the Chief Inspector shall be represented at an on-site meeting to walk through the project site – plans in hand – to identify and discuss coordination issues, gaps, errors and omissions, sequencing and surprises.

At the discretion of the Project Manager, an independent Constructability Review may be performed by an industry professional that focuses on issues from the Contractor's perspective.

(d) Threshold Review

This is a review of a project's supporting elements such as the Risk Worksheet, CEVP, CRA, Value Engineering, etc. This review shall be performed to verify the reasonableness of the element's magnitude and its potential impact to the project. This process and review shall be performed in accordance with Executive Order E 1053 and Project Delivery Memo 07.01.

(e) Estimate

The 90 percent and earlier estimates will be submitted to the Chief Estimator to review and comment prior to finalization in EBASE. Included within that submittal will be backup documentation that includes the basis of unit bit prices and Lump Sum item back up calculations. For the 90 percent estimate, when applicable, the Project Manager will request the CADD team or the designers to review quantities.

(f) PS&E Turn-In QA/QC

The Project Status Report (PSR) is produced weekly for all projects that will be advertised in the next 90 days and projects that are currently being advertised. All the checkboxes on the report must be cleared before a project is allowed to be advertised by the WSDOT Contract Ad and Award Office in Olympia. The Project Status Report includes the following:

- Ad Date, Award Date and Addendum Deadline Date
- Status of Design and Project Development (Design Documentation Package) Approval
- Contract Working Days
- Engineer's Estimate Dollar Range
- Number of Plan Sheets
- List of all Applicable Permits and Agreements
- Utility Conflicts and Relocations Status
- Existence of Federal Funds and Federal Contract Provisions required by funding source (typically DHS, FHWA or FTA)
- NEPA/SEPA Status
- Special Provision Approval Status
- Funds Request and Work Order Approval Status
- Proprietary Item Issues and Approvals
- Right-Of-Way Certification Status
- MWBE/DBE/Training Goals Request and Determination Status

Note that some of the above may not be applicable to a particular project.

A copy of the Project Status Report can be found in Appendix J. A copy of the PS&E Turn-In QA/QC process can be found in Appendix K.

(2) Review Documentation

Reviewers shall utilize the discipline specific review checklists as a guide for the review process. This ensures a comprehensive check of all documents and project aspects through the course of the multiple review process. The checklists assist in review direction to verify similar elements and potential gaps within other disciplines.

Checklist templates are included in Appendix L. Electronic copies of the checklist templates are found at: G:\Proj\Z-PM_Standards\QAQC\A-QAQC Template. Templates may be modified to suit project specific requirements.

Reviewed documents shall be accompanied by a copy of the DQC Sign-Off Sheet. The Sign-Off Sheet shall contain signatures and dates of all responsible parties.

PS&E and Constructability reviews shall utilize the Comment Review Form (CRF) to capture and organize all generated comments and associated responses. A review meeting shall be held to discuss and resolve outstanding issues that involve more than one discipline.

Review documentation for a project's risk based elements (CEVP, CRA, etc.) consist of development and implementation of the project's Risk Management and Change Management plans, in accordance with Executive Order E 1053 and Project Delivery Memo 07.01. A copy of Executive Order E 1053 can be found at www.wsdot.wa.gov/publications/fulltext/cevp/1053policy.pdf. A Risk Management Plan template can be found on the WSDOT Project Management Online Guide webpage: www.wsdot.wa.gov/Projects/ProjectMgmt/OnLine_Guide/Tools/Risk_Management_Plan.xls

Note that this template is for projects that do not meet the requirements for a CRA and CEVP workshop. For CRA or CEVP risk plans contact the Strategic Analysis and Estimating Office.

(3) Review Meetings

Review meetings shall be scheduled so that the design team and reviewers can discuss, coordinate and resolve outstanding issues resulting from a review. The intent of the review meeting is to discuss only outstanding issues that impact more than one discipline or issues that can be resolved between designers and reviewers, not perform a line-by-line review of each comment. Resolution shall be recorded on the CRF.

The review meeting shall be scheduled after all comments have been consolidated and distributed to the designers, and the designers have had a period of time to review the comments.

(4) Comment Review Form

The Comment Review Form (CRF) shall be distributed to all reviewers for PS&E and Constructability reviews. The form shall be filled out by each reviewer to capture comments. All comments shall be consolidated by the project manager to one master form for each review, i.e. 30 percent, 60 percent, 90 percent. The master form shall be distributed by the project manager to all designers for their reply to comments. All replies shall be consolidated by the project manager to the master form and distributed to the reviewers. The reviewers shall verify all comments were addressed during subsequent submittal reviews.

If comments/responses are not incorporated into the documents (plans/specifications/estimate) as described, the reviewer shall elevate the issue to the Project Manager.

A copy of the CRF is included in Appendix C. An electronic copy of the CRF template is included at this link.

The electronic master CRF developed for each review shall be saved in the project's design folder under: \Design\D600 Review\611 Comments.

(5) DQC Quality Audit

The Project Manager shall audit the project files to ensure the checking and reviewing procedures were followed through the course of the project. The Project Manager shall demonstrate the completion of the Quality Audit by completing and signing the Quality Audit Sign-Off Sheet. A copy of Quality Audit Sign-Off Sheet is included in Appendix D.

DQC Sign-Off Sheets, checkprints, Comment Review Forms and all other quality checking and review documents shall be included in the Design Project File and archived.

230.08 Quality Control/Quality Assurance (Consultant Designed Projects)

(1) Consultant PS&E-Projects on WSF Right-of-Way

PS&E prepared by consultants will follow a similar QC/QA procedure as found in Sections 230.06 and 230.07 for WSF prepared PS&E's, and, as a minimum, shall include the following elements:

1. **WSF Project Manager's Responsibilities**
   - Review Scope of Work.
   - Negotiate contract and consultant's Task Assignments.
   - Coordinate/Negotiate changes to Scope of Work.
2. **WSF Design Reviewer's Responsibilities**
   - Initiate a project start-up meeting with the Consultant to discuss design criteria, submittal schedule and expectations, and also to familiarize himself/herself with the Consultant's designers.
   - Early in the project, review consultant's design criteria, and standard details for consistency with WSDOT/WSF practices and other designs in the project.
   - Review and concur with consultant prepared material in support of and obtain Design Approval and Project Development Approval from WSDOT Assistant State Design Engineer Assigned to WSF.
   - Review and concur with consultant prepared deviations from WSF Terminal Design Criteria. The Reviewer will then obtain approval from WSDOT Assistant State Design Engineer assigned to WSF.
   - Obtain approval for the use of proprietary items in the project. Check for the use of proprietary items in the following locations:
     – Plan Sheets
     – Estimates (Summary of Quantities)
     – Special Provisions

     See Division 7 of the *Plans Preparation Manual* for more information regarding proprietary items. Please note that, absent proprietary item use request approval, listing a single product followed by the phrase "or approved equal" is not allowed. Current WSDOT blanket approvals may be found at the following location: www.wsdot.wa.gov/Design/ProjectDev/BlanketApprovals.htm.
   - Adding variances into the Design Variance Inventory System Database.
   - After Design Approval and again after Project Development Approval have been granted; review the project file for consistency and completeness.
   - Identify resources needed to complete work.
   - Reach agreement early in the design process regarding structural concepts and design methods to be used
   - Identify who is responsible for specific tasks or deliverables and when all intermediate constructability, Plans, and PS&E review submittals are to be made

- Monitor progress
- Facilitate communication, including face-to-face meetings with consultants and/or other WSF Disciplines
- Verify that the Consultant's design has been checked by the Consultant's checker at the 100 percent submittal. The checker's calculations should be included in the designer's calculations set.
- Review Consultant's design calculations and plans for completeness and conformance to WSF design practice. The plans shall be checked for constructability, consistency, clarity, and compliance. Also, selectively check dimensions and elevations.
- Review Plans, Special Provisions, and Estimate, including the EBASE File.
- Resolve differences
- Review and submit updates for the Project Status Report

230.09 Quality Control/Quality Assurance (Structures)

(1) General

The purpose of the QC/QA procedure is to improve the quality of the structural designs and plans. The key element to the success of the process is effective communication between all Disciplines and stakeholders.

The goals of the QC/QA procedure are:

- Designed structures that improve public safety and meet state regulations
- Designed structures which meet the requirements of:
  - Structural Design Criteria established in this *Terminal Engineering Design Manual*
  - The WSDOT *Bridge Design Manual LRFD* M 23-50
  - AASHTO *LRFD Bridge Design Specifications*
  - Current structural engineering practices
- Designed structures that are aesthetically pleasing, constructible, durable, economical, inspectable, and require little maintenance.
- Design contract documents that meet the customer's needs, schedule, budget and construction staging requirements.
- Structural design costs are minimized.
- An organized and indexed set of design calculations for the Project File. Design criteria and assumptions are included in the front after the index.
- Plan quality is maximized.
- The QA/QC procedure allows for change, innovation, and continuous improvement.
- The goals are listed in order of importance. If there is a conflict between goals, the more important goal takes precedence.

The Supervisor determines project assignments and the QC/QA process to be used in preparation of the structural design. The intent of the QC/QA process is to facilitate plan production efficiency and cost-effectiveness while assuring the structural integrity of the design and maximizing the quality of the structural contract documents.

The WSF Structures Group QC/QA procedure is a component of the general WSDOT template for project management process.

(2) Design/Check Procedures

(a) PS&E Prepared by WSF

1. **Design Team**

   The design team usually consists of the Designer(s), Checker(s), and Structural Detailer(s) who are responsible for preparing a set of contract documents on or before the scheduled due date(s) and within the budget allocated for the project.

   The QC/QA procedures may vary depending on the type and complexity of the structure being designed, and the experience level of the design team members. More supervision, review, and checking may be required when the design team members are less experienced. In general, it is a good practice to have some experienced designers on every design team.

   All design members should have the opportunity to provide input to maximize the quality of the design plans.

2. **Designer Responsibility**

   The designer is responsible for the content of the contract plan sheets, including structural analysis, completeness and correctness.

   During the design phase of a project, the Designer will need to communicate frequently with the Supervisor, other disciplines and other Stakeholders, such as operations. This includes acquiring, finalizing or revising roadway geometrics, soil reports, and hydraulic recommendations, mechanical and electrical requirements. Constructability issues may also require that the Designer communicate with the Construction Group. The Designer may have to organize face-to-face meetings to resolve constructability issues early in the design phase.

   The Designer shall advise the supervisor as soon as possible of any scope and project cost increases and the reasons for the increase. The Supervisor will then notify the Project Manager if the delivery schedule will have to be changed. The Project Manager is responsible for communicating and obtaining necessary approvals from management.

   The Designer is responsible for project planning which involves the following:

   - Determine scope of work, identify tasks and plan order of work.
   - Prepare design criteria that are included in the front of the design calculations. Compares tasks with WSF office practice and AASHTO bridge design specifications.
   - Prepare justification for deviation from WSF Terminal Design Standards *Bridge Design Manual LRFD* M 23-50 standards, or AASHTO standards

- Prepare materials and seek ASDE Project Design Approval and Project Design Approval as described in Chapter 220.
- Prepare justification for the use of proprietary items in the contract
- Prepare justification for the use of state force work on the project
- Meet with the Project Manager and other project Stakeholders early and as often as necessary in the design process to resolve as many issues as possible before proceeding with final design and detailing.
- Identify coordination needs with other Designers, Permit Coordinators and the Project Manager.
- Early in the project the structure sheet numbering system should be coordinated with the CADD Group and the Project Manager.
- At least monthly or as directed by the Design Supervisor:
  - Update Project Schedule and List of Sheets
  - Estimate percent complete
  - Estimate time to complete
  - Work with the Supervisor to adjust resources, if necessary.
- Develop preliminary quantities for all cost estimates after the Preliminary Plan stage.
- Near end of project, the designer shall:
  - Develop quantities
  - Coordinate all final changes, including review comments received
  - Meet with WSF staff and other project stakeholders at the constructability review/round table review meetings to address final project coordination issues.
  - The designer should inform the Supervisor of any areas of the design, which should receive special attention during checking and review.
  - Prepare the QA/QC Checklist, and obtain signatures/initials as required. This applies to all projects regardless of type or importance.

The design calculations are prepared by the designer and become a very important record document. Design calculations will be a reference document during the construction of the structure and throughout the life of the structure. It is critical that the design calculations be user friendly. The design calculations shall be well organized, clear, properly referenced, and include numbered pages along with a table of contents. See Section (3) Design/Check Calculation File for directions in organizing the calculations.

The design calculations shall be archived in the Project File. Computer files should be archived for use during construction, in the event that changed conditions arise. Archive-ready design and check calculations shall be bound and submitted to the Supervisor concurrently with the turn-in of the 100 percent PS&E Submittal. Calculations shall be available for reference within the WSF Structures Group until completion of construction. After construction they shall be sent to the WSF Terminal Engineering Library to be cataloged into the WSF library.

The Designer is responsible for resolving construction problems referred to the Structures Group during the life of the contract.

3. **Checker Responsibility**

The Checker is responsible to the Supervisor for "quality assurance" of the structural design, which includes checking the design, plans and specifications to assure accuracy and constructability. The Supervisor works with the Checker to establish the level of checking required. The checking procedures for assuring the quality of the design will vary from project to project. Following are some general checking guidelines:

a. **Design Calculations**

Design Calculations may be checked by either of two methods:

- Design calculations may be checked with a line by line review and initialing by the checker. If it is more efficient, the checker may choose to perform his/her own independent calculations.
- Iterative design methods may be best checked by review of the designer's calculations, while standard and straight-forward designs may be most efficiently checked with independent calculations. All the Designer and Checker calculations shall be placed in one design set.

Revision of design calculations, if required, is the responsibility of the designer.

b. **Structural Plans**

The Checker's plan review comments are recorded, following the requirements of the Quality Assurance section above, on a copy of the structural plans, including details and bar lists, and returned to the Designer for consideration. These check prints are a vital part of the checking process, and shall be preserved. If the Checker's comments are not incorporated, the Designer should provide justification for not doing so. If there is a difference of opinion that cannot be resolved between the Designer and Checker the Supervisor shall resolve any issue. Check prints shall be submitted to the Supervisor at the time of 90 percent and 100 percent PS&E turn-in.

If assigned by the Supervisor, a Structural Detailer shall perform a complete check of the geometry using CADD or hand calculations.

Revision of plans, if required, is the responsibility of the Designer.

c. **Quantities and Bar List**

The checker shall check the bar list. The Checker shall provide an independent set of quantity calculations. These together with the Designer's quantity calculations shall be placed in the project file.

Resolution of differences between the Designer and Checker shall be completed before the PS&E submittal.

d. **Additional Checking Responsibilities**

- Perform a structural/constructability review of the plans.
- Review and concur with Structure Preliminary Design.
- Review unique project special provisions and Standard Specification modifications relating to structures. Verify the Standard Specification supplemented by the Special Provisions completely address the required work.

4. **Structural Drafter Responsibility**

The Structural Drafter is responsible for the quality and consistency of the contract plan sheets. The Structural Drafter shall ensure that the CADD drafting standards are upheld and will:

- Ensure CADD Standards are per WSF CADD Standards
- Provide necessary and adequate information to ensure the contract plans are accurate, complete, readable and constructible
- Detail plan sheets in a consistent manner and follow accepted detailing practices
- Check plans for geometry, reinforcing steel congestion, consistency, and verify control dimensions
- Check for proper grammar and spelling
- Maintain an ongoing understanding of bridge construction techniques and practices

5. **General Structures Plan Stamping and Signature Policy**

This policy applies to plans produced by both WSF personnel and consultants. The stamping and signing of Structures Plans is the final step in the QC/QA procedure. It signifies a review of the plans and details by those in responsible charge of the Structure Plans. At least one licensed structural engineer shall stamp and sign each contract plan sheet. (Except berthing structures do not require a licensed Structural Engineer, only a licensed PE who is knowledgeable in the design of structures.)

For contract plans prepared by WSF structural engineering staff by a licensed Civil or licensed Structural Engineer, the Structures Supervisor and the licensed Civil or licensed Structural Engineer co-seal and sign the plans.

For contract plans prepared by consultant, the consultant principal and the licensed Civil or licensed Structural Engineer co-seal and sign the plans.

The contract plans not prepared by a licensed Civil or licensed Structural Engineer, the Structures Supervisor who is a licensed Structural Engineer shall stamp those plans.

(3) Design/Check Calculation File

(a) File of Calculations

- The WSF Structures Office maintains a file of all pertinent design/check calculations for documentation and future reference.

(b) Procedures

- After an assigned project is completed and the structure is built, the designer shall turn in a bound file containing the design/check calculations for archiving. The front cover should have a label identifying the project date, contract number, PS&E number, project name and structure designation(s).

(c) File Inclusions

The following items should be included in the file:

1. **Index Sheets**
   - Number all calculation sheets and prepare an index by subject with the corresponding sheet numbers.
   - List the name of the project, charge number, designer/checker initials, date (month, day and year), and Supervisor's initials.
2. **Design Calculations**
   - The design calculations should include design criteria, design assumptions, loadings, structural analysis, one set of moment and shear diagrams, and pertinent computer input and output data (reduced to 8½" x 11" sheet size).
   - The design criteria, design assumptions, and special design features should follow in that order behind the index.
   - Construction Estimate Calculations
3. **Special Design Features**
   - Brief narrative of major design decisions or revisions and the reasons for them.
4. **Construction Problems or Revisions**
   - Not all construction problems can be anticipated during the design of the structure; therefore, construction problems arise during construction, which will require revisions. Calculations for revisions made during construction should be included in the design/check calculation file when construction is completed.

(d) File Exclusions

The following items should not be included in the file:

1. Geometric calculations
2. Irrelevant computer information
3. Prints of Office Standard Sheets
4. Irrelevant sketches
5. Voided sheets

6. Preliminary design calculations and drawings unless used in the final design
7. Test hole logs
8. Quantity calculations

230.10 Project Goal Requirements

Four weeks prior to AD, voluntary Minority/Minority Business Enterprise (MWBE) goals for state funded projects, or mandatory Disadvantaged Business Enterprise (DBE) and Training Goals are requested from the WSDOT Headquarters Office of Equal Opportunity. The Project Manager is responsible for this request, which includes a form for MWBE or DBE Goals, 90 percent Estimate in the form of the EBASE Summary and Item Reports, and a copy of the 90 percent special provisions. This requirement does not apply to projects with an Engineer's Estimate less than $100,000. However, for purposes of record keeping and reporting, all projects shall submit a goals request.

The criteria for Project Goals Requirements are as follows:

Funding Type		Criteria	Goal Requirements
State Only		>$100,000 engineer's estimate	voluntary MWBE goals inserted in GSP
Federal Only	FHWA	>$100,000 engineer's estimate	require DBE goals
		>=50 working days	require OJT goals
	FTA	>$100,000 engineer's estimate	actual DBE goal = 0, with voluntary goal inserted in GSP
State and Federal		use only federal criteria	use only federal goal requirements

Project Goals Requirements
Exhibit 230-2

230.11 Advertisement

All Project Managers must follow the AD Process when preparing to submit a package for Advertisement. The document containing this template can be found in Appendix M.

The Director of Terminal Engineering will approve the decision to advertise terminal construction projects. In some cases, such and when all permits have not been received by the Advertisement Date but Advertisement must not be delayed due to the potential to miss the in-water work window, WSDOT Headquarters approval may also be required to proceed with Advertisement. See Appendix 1 of the WSDOT *Advertisement and Award Manual* for additional information on Risk Levels and required procedures, notifications and approvals to proceed with Advertisement.

No project may be Advertised without Design Approval and Project Development Approval granted (see Chapter 220) or with any outstanding proprietary item or cultural resource issues. In addition, seven weeks before advertisement, ensure WSF Program Management has received the documents or information listed in the following table to process construction work order(s) promptly. If all documents are submitted, WSF Program Management will submit work orders to CAPS queue five weeks before advertisement. Please expect a 2-week delay for holiday seasons.

Document/Information	FHWA Funded	FTA Funded	State Funded
Grant Obligation Verification	a. May be submitted with Work Order; but should submit all related documents for Work Order Creation.	Need. Please also submit all related supportive documents for Work Order Creation.	N/A
Design Approval	Required by a.	N/A	N/A
Project Development Approval	Required by a.	N/A	N/A
Included in STIP	Required by a.	Required by a.	N/A
NEPA Approval	Required by a.	Required by a.	N/A
Biological Assessment	Required by a.	Required by a.	N/A
Section 106	Required by a. if necessary	If necessary	N/A
RW Certificate	Required by a. If necessary	If necessary	N/A
DBE plan	N/A	Required by a. **	N/A
Plan Milestones	Need	Need	Need
Locked EBASE Reports	Need	Need	Need
Budget Authorization >= WOA request	Required	Required	Required
Task Setup in TRAINS	Required if necessary	Required if necessary	Required if necessary

Note: All documents are electronic copies saved to corresponding folders at G:/Admin/WOA/00New.

** A Disadvantaged Business Enterprise (DBE) plan is required by FTA obligation for a construction project specific goal if it is not included in your organization's goal.

Documents/ Information In Need for Capital Construction Project Work Order(s)
Exhibit 230-3

(1) Approval Process for Project Specific Special Provisions

In the *Plans Preparation Manual* Section 630, Project Specific Provisions, states:

> "Approval of project specific specifications that alter *Standard Specifications* for Road, Bridge, and Municipal Construction (WSDOT Spec book) is required prior to inclusion in your contract. All project specific specifications are to be sent, along with justification, to the State Construction Engineer for concurrence and approval."

In conjunction with the above guidance, below is the process for approval of all project specific special provisions. This applies to any and all special provisions that supplement or revise the current edition of the WSDOT *Standard Specifications*, make changes to State-wide or WSF General Special Provisions (GSPs), or are created as stand-alone special provisions.

As a matter of good practice, it is almost always more desirable to rely upon a state General Special Provision or Region General Special Provision (RGSP), Amendment or Standard Specification than a stand-alone special provision.

(a) Provision Approval Process

The process below is sequential, requiring resolution and approval at each step before proceeding to the next.

1. The designer shall coordinate with the PS&E reviewers for content and format correctness in the writing of project specific provisions and revisions to GSPs.
2. The designer shall then send the special provision, depending on the discipline to which it is related, to the Marine Project Engineer, Structural Supervisor or the Electrical Supervisor for approval.
3. The designer will then send the PE/Supervisor approved special provision to both the Design Engineering Manager and the Construction Manager for review and approval.
4. A minimum of two weeks prior to Ad (allow more time for larger or complex projects), following approval by the Managers, the entire special provisions document shall be submitted to the Assistant State Construction Engineer (ASCE) assigned to WSF for final review and final approval. The purpose of this final review is to ensure uniformity with WSDOT contracting practices, policies and philosophies. The following exceptions should be noted:
   - For Division 1 General Requirements, Sections 1-02, 1-03, and 1-08 require approval by the ASCE. Other Sections of Division 1 require WSF Design Engineering Manager approval only.
   - Architectural project specific special or technical provisions require approval by the WSDOT Equipment and Facilities Office Project Delivery Manager or designee.

(2) General

The Project Manager is responsible for formatting and moving the special provisions through the approval process in a timely manner. A copy of each approval and each associated special provision shall be placed in the project file folders.

Subject to approval of the WSF Design Engineering Manager, an approved project specific special, used on a previous project may not require WSDOT Headquarters approval identified above.

All project specific special provisions require approval at the WSF Manager level prior to submitting the final approval request to Headquarters.

Final Approvals are required before going to Ad.

When submitting for Final Approval of special provisions, please ensure that they are understood in context for the project as a whole. This will help the final approving authority respond in a more efficient, informed, and timely manner.

- Provide the names of the Project Engineers and Managers who have reviewed and approved the special provision.
- Include background information as to why you are proposing a new special provision or modifying an existing special provision.
- Submit the entire compiled project special provisions and Table of Contents with project specific files highlighted for easier visual reference.

(3) Advertisement Duration

The minimum duration time a project is advertised through the WSDOT Headquarters Ad and Award Office is as follows:

Engineer's Estimate	Duration
< $50,000 (State Funds)	2 weeks
< $50,000 (Federal Funds)	3 weeks
$50,000 – $1,000,000	3 weeks
$1,000,000 – $3,000,000	4 weeks
> $3,000,000	6 weeks

Excluding holiday weeks, the Advertisement (Ad) Date is always on a Monday and the Bid Opening Date is always on a Wednesday. The final PS&E package is due in WSDOT Headquarters Ad and Award Office by noon on the Wednesday preceding the Ad Date.

230.12 Limited Public Works Contracts

State funded projects with an engineer's estimate below $35,000 may be advertised as Limited Public Works projects, subject to the approval of the Director of Terminal Engineering.

Per RCW 39.04.155, the breaking of any project into units, or accomplishing any projects by phases, is prohibited if it is done for the purpose of avoiding the maximum dollar amount of a contract that may be let using the small works roster process or limited public works process.

These projects are not advertised through the typical HQ Ad and Award process. The process for preparing a Limited Public Work contract includes the following:

- At the time of the request for the construction work order is submitted for approval, the project manager will contact HQ Ad and Award office and request a list of bidders.
- The project manager will notify WSF Contracts and Legal Services Office and request an internal project number which will serve as the contract number.
- After the above steps have been satisfactorily completed, and the work order approved, the Terminal Engineering Construction Office will solicit bids via fax. Ad duration is typically one week.
- Upon completion of the work order the Terminal Engineering Construction Office can proceed with the solicitation of bids from the list of bidders via fax.

Division 3 General Design Criteria

Chapter 300 Accessibility 300-1
300.01 General 300-1
300.02 References 300-2
300.03 Definitions 300-4
300.04 Policy 300-4
300.05 ADA Requirements by Project Type 300-5
300.06 Terminal Facilities 300-7
300.07 Staff Facilities at Terminals 300-16
300.08 Site Design Considerations 300-18
300.09 Gangways 300-20
300.10 Pedestrian Features with DOT Rights-of-Way 300-21
300.11 Documentation 300-21
300.12 People First Language 300-22
Chapter 310 Security 310-1
310.01 General 310-1
310.02 References 310-1
310.03 Design Considerations 310-2
310.04 MARSEC Levels 310-2
310.05 Vessel Security 310-3
310.06 Passenger Security Screening Area 310-3
310.07 Security Rooms 310-3
310.08 Toll Plaza and Vehicle Holding Area 310-4
310.09 Waterside Structures 310-5
310.10 Access Control / Restricted Areas / TWIC 310-6
310.11 Closed Circuit Television 310-6
310.12 Panic Buttons 310-6
310.13 Signage 310-7
310.14 Sensitive Security Information (SSI) 310-7

Chapter 320 Environmental Considerations 320-1
320.01 General 320-1
320.02 References 320-2
320.03 Determining the Environmental Documentation 320-2
320.04 Design Process and Permit Interaction 320-3
320.05 Environmental Commitments Meeting 320-4
320.06 Environmental Review and Permitting 320-4
320.07 Environmental Considerations 320-8
320.08 Land Use 320-14
320.09 Air Quality 320-15
320.10 Noise 320-17
320.11 Water Quality 320-18
320.12 Propwash, Vessel Wakes, and Sedimentation 320-19
320.13 Ecosystems and Protected Species 320-20
320.14 Earth (Geology and Soils) 320-22
320.15 Hazardous Materials 320-23
320.16 Traffic/Congestion 320-24
320.17 Visual Quality 320-25
320.18 Tribal Resources and Treaty Rights 320-25
320.19 Cultural, Historical, and Archaeological Resources 320-26
320.20 Park and Recreation Lands 320-27
320.21 Department of Natural Resources Lands 320-27
320.22 Resource Agency and Tribal Coordination 320-28
Chapter 330 Marine 330-1
330.01 General 330-1
330.02 References 330-3
330.03 Design Specifications Matrix 330-5
330.04 Design Considerations 330-5
330.05 Vessels 330-11
330.06 Tidal Information 330-16
330.07 Slips 330-21
330.08 Berthing and Mooring Criteria 330-27
330.09 Wave, Flood, and Coastal Storm Loading 330-29

Chapter 340 Civil 340-1
340.01 General 340-1
340.02 References 340-3
340.03 Design Considerations 340-3
340.04 Project Datum 340-6
340.05 Site Preparation 340-7
340.06 Grading and Erosion Control 340-8
340.07 Roadway Design and Channelization 340-9
340.08 Pavement Design 340-12
340.09 Traffic Control 340-15
Chapter 350 Buildings 350-1
350.01 General 350-1
350.02 References 350-2
350.03 Design Considerations 350-4
350.04 Building Structures 350-6
350.05 Building Foundations 350-9
350.06 Building Utilities 350-10
350.07 Building Permits 350-12
Chapter 360 Electrical 360-1
360.01 General 360-1
360.02 References 360-1
360.03 Design Considerations 360-2
360.04 Wiring and Protection 360-6
360.05 Wiring Methods and Materials 360-10
360.06 Equipment 360-14
360.07 Lighting 360-18

Chapter 300 Accessibility

300.01 General
300.02 References
300.03 Definitions
300.04 Policy
300.05 ADA Requirements by Project Type
300.06 Terminal Facilities
300.07 Staff Facilities at Terminals
300.08 Site Design Considerations
300.09 Gangways
300.10 Pedestrian Features with DOT Rights-of-Way
300.11 Documentation
300.12 People First Language

300.01 General

Pedestrian travel is a vital transportation mode. It is used at some point by nearly everyone and is a critical link to everyday life for many. Designers must be aware of the various physical needs and abilities of pedestrians in order to ensure facilities provide universal access.

Section 504 of the *Rehabilitation Act* and the *Americans with Disabilities Act of 1990* (ADA) require pedestrian facilities to be designed and constructed so they are readily accessible to and usable by persons with disabilities. This chapter provides accessibility criteria for the design of site pedestrian, buildings and passenger loading facilities that meet applicable state and federal standards.

The pedestrian facilities included in a terminal project are determined during the scoping phase based on identified accessibility deficiencies, and additional accessibility and other factors in the terminal building, passenger loading areas, and other factors.

When developing pedestrian facilities within a limited amount of right-of-way or restrictive terrain, designers can be faced with multiple challenges. It is important that designers become familiar with the ADA accessibility criteria to be able to balance accessibility needs with the physical limitations found at terminal sites in order to ensure equal access use by everyone.

Similar to the roadway and structural infrastructure, pedestrian facilities (and elements) require periodic maintenance in order to prolong the life of the facility and provide continued usability. Title II of the ADA requires that public entities ensure that all necessary features be accessible and maintained in operable working condition for use by individuals with disabilities.

300.02 References

(1) Federal/State Laws and Codes

ADA (28 CFR Part 35, as revised September 15, 2010)

23 CFR Part 652 *Pedestrians and Bicycle Accommodations and Projects*

49 CFR Part 27 *Nondiscrimination on the Basis of Disability in Programs or Activities Receiving Federal Financial Assistance* (Section 504 of the *Rehabilitation Act* of 1973 implementing regulations)

RCW 35.68 *Sidewalks, gutters, curbs and driveways – All cities and towns*

RCW 35.68.075 *Curb ramps for persons with disabilities – Required – Standards and Requirements*

RCW 46.04.160 *Crosswalk (definition)*

RCW 46.61 *Rules of the Road*

RCW 47.24.020 *City streets as part of state highways – Jurisdiction, control*

(2) Design Guidance

Manual on Uniform Traffic Control Devices for Streets and Highways, USDOT, FHWA; as adopted and modified by WAC 468-95 *Manual on uniform traffic control devices for streets and highways*" (MUTCD)
www.wsdot.wa.gov/publications/manuals/mutcd.htm

Revised Draft Guidelines for Accessible Public Rights-of-Way (PROWAG), November 23, 2005, U.S. Access Board. The current best practices for evaluation and design of pedestrian facilities in the public right of way per the following FHWA Memoranda:

- www.fhwa.dot.gov/environment/bikeped/prwaa.htm
- www.fhwa.dot.gov/civilrights/memos/ada_memo_clarificationa.htm
- www.access-board.gov/prowac/draft.htm

Design Manual M 22-01

Standard Plans for Road, Bridge, and Municipal Construction M 21-01

1991 ADA Standards for Accessible Design, U.S. Department of Justice (USDOJ); consists of 28 CFR parts 35 and 36 and the ADA Accessibility Guidelines for Buildings and Facilities (ADAAG), July 1991, U.S. Access Board. (For buildings and on-site facilities; usable if construction or alteration occurs prior to March 15, 2012.)
www.access-board.gov/ada/

2010 ADA Standards for Accessible Design, USDOJ, 2010; consists of 28 CFR parts 35 and 36 and the ADA and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities (ADA-ABAAG; also referred to as the 2004 ADAAG), July 23, 2004, U.S. Access Board. (For buildings and on-site facilities; usable if construction or alteration occurs after September 15, 2010, but required if construction or alteration occurs on or after March 15, 2012.)
www.access-board.gov/ada

ADA Standards for Transportation Facilities, USDOT, 2006; consists of 49 CFR parts 37 and 38 and the ADA and ABA Accessibility Guidelines for Buildings and Facilities (ADA-ABAAG; also referred to as the 2004 ADAAG), July 23, 2004, U.S. Access Board. (For transit, light rail, and similar public transportation facilities.) www.access-board.gov/ada

Proposed Passenger Vessels Accessibility Guidelines. Published in the Federal Register on June 25, 2013. This document contains scoping and technical requirements for accessibility to passenger vessels by individuals with disabilities. The requirements are to be applied during the design, construction, additions to, and alteration of facilities and elements on passenger vessels to the extent required by Federal agencies under the Americans with Disabilities Act of 1990 (ADA). www.access-board.gov/pvag/nprm.htm

"Electronic and Information Technology Accessibility Standards (Section 508)", December 21, 2000, U. S. Access Board www.access-board.gov/sec508/standards.htm

"Design Guidance, Accommodating Bicycle and Pedestrian Travel: A Recommended Approach" USDOT Policy Statement 2001 www.fhwa.dot.gov/environment/bikeped/design.htm

(3) Supporting Information

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, Current version

WSDOT *Field Guide for Accessible Public Rights of Way*, 2010 www.wsdot.wa.gov/publications/fulltext/Roadside/ADA_Field_Guide.pdf

Guide for the Planning, Design, and Operation of Pedestrian Facilities, AASHTO, 2004. Provides guidance on the planning, design, and operation of pedestrian facilities along streets and highways. Specifically, the guide focuses on identifying effective measures for accommodating pedestrians on public rights of way. It can be purchased through the AASHTO website.

Highway Capacity Manual, Transportation Research Board (TRB), 2000

WSDOT Pedestrian Facilities Guidebook: Incorporating Pedestrians Into Washington's Transportation System, OTAK, 1997 www.wsdot.wa.gov/publications/manuals/fulltext/m0000/pedfacgb.pdf

Pedestrian Facilities Users Guide – Providing Safety and Mobility, FHWA, 2002. Provides useful information regarding walkable environments; pedestrian crashes and their countermeasures; and engineering improvements for pedestrians. http://drusilla.hsrc.unc.edu/cms/downloads/PedFacility_UserGuide2002.pdf

Roadside Manual M 25-30 WSDOT

"Special Report: Accessible Public Rights-of-Way – Planning & Designing for Alterations," Public Rights-of-Way Access Advisory Committee, July 2007 www.access-board.gov/prowac/alterations/guide.htm

WSDOT *Understanding Flexibility in Transportation Design* – Washington, 2005
www.wsdot.wa.gov/research/reports/600/638.1.htm

WSDOT *Washington State Bicycle and Pedestrian Plan*
www.wsdot.wa.gov/bike/bike_plan.htm

300.03 Definitions

Accessible – Usable by persons with disabilities (ADA compliant).

Americans with Disabilities Act of 1990 (ADA) – The ADA is a civil rights law that identifies and prohibits discrimination based on disability. Title II of the ADA requires public entities to design new pedestrian facilities or, in some cases, alter existing pedestrian facilities to be accessible to and usable by people with disabilities.

Construction Impact Zone – The area in which an alteration to an existing facility takes place (also known as the project footprint). The curb ramps serving an altered crosswalk (marked or unmarked) are considered to be within the construction impact zone. Note that paving a crosswalk (overlay or inlay) is considered an alteration of the crosswalk.

Maximum Extent Feasible (MEF) – From the U.S. Department of Justice, 28 CFR Part 36.402, Alterations. The phrase "to the maximum extent feasible" applies to "the occasional case where the nature of an existing facility makes it virtually impossible to comply fully with applicable accessibility standards through a planned alteration."

This phrase also refers to a stand-alone piece of design documentation that WSDOT uses to record its reasons for not being able to achieve full ADA compliance in alteration projects (called a Maximum Extent Feasible document).

300.04 Policy

(1) General

It is WSDOT policy to provide pedestrian facilities at all ferry terminal buildings, ferry terminal sites, waterside facilities, and along and across sections of state routes or city streets as an integral part of the transportation system. US Department of Transportation and WSF policy is that bicycle and pedestrian facilities be given full consideration in the planning and design of new construction and reconstruction of Terminal Improvement or Preservation projects, except where bicycle and pedestrian use is prohibited.

(2) Jurisdiction

When proposed projects extend beyond WSF terminal limits, per the terminal sundry site plan, and into public rights of way see *Design Manual* Section 1510.04 for further information on ADA compliance requirements.

(3) Maintenance

As noted in Section 300.01, Title II of the ADA requires that a public entity maintain in operable working condition those features of facilities and equipment that are required to be readily accessible to and usable by persons with disabilities.

300.05 ADA Requirements by Project Type

Wherever pedestrian facilities are intended to be a part of the transportation facility, federal regulations (28 CFR Part 35) require that those pedestrian facilities meet ADA guidelines. All new construction or alteration of existing WSF transportation facilities must be designed and constructed to be accessible to and usable by persons with disabilities. US Department of Transportation is one of the federal agencies designated by the Department of Justice to ensure compliance with the ADA for transportation projects.

See Chapter 210 for more information regarding project ADA requirements.

(1) New Construction Projects

New construction projects address the construction of a new roadway, terminal site, or other transportation facility where none existed before. For these projects, pedestrians' needs are assessed and included in the project. All pedestrian facilities included in these projects must meet the accessibility criteria when built.

(2) Alteration Projects

Any project that has the potential to affect the usability of a pedestrian facility is classified as an alteration project. Alteration projects include, but are not limited to, renovation; rehabilitation; reconstruction; historic restoration; resurfacing of circulation paths or vehicular ways; or changes or rearrangement of structural parts or elements of a facility. Where existing elements or spaces are altered, each altered element or space within the limits of the project shall comply with the applicable requirements for new construction to the maximum extent feasible. For additional information on existing buildings and facilities, see Section 202 of the *2010 ADA Standards for Accessible Design*.

The following are some examples of project types that are classified as alteration projects and can potentially trigger ADA requirements:

- Pavement rehabilitation or replacement
- Transfer Span rehabilitation or replacement
- Overhead Loading rehabilitation or replacement
- Trestle rehabilitation or replacement or trestle pavement rehabilitation
- Tie-up slips
- Toll Plaza rehabilitation or replacement
- Illumination/Signing/Way Finding
- Rehabilitation or replacement of a terminal building, tollbooth, auxiliary facility, staff facilities, retail accommodations, interior remodeling

In addition the following project types around a terminal that are classified as alteration work can potentially trigger ADA requirements (See *Design Manual* Section 1510):

- HMA overlay or inlay
- Traffic signal installation or retrofit
- Roadway widening
- Sidewalk improvements
- Raised channelization

The following are not considered alterations:

- Spot pavement repair
- Liquid-asphalt sealing, chip seal (BST), or crack sealing
- Lane restriping that does not alter the usability of the shoulder

If there is uncertainty as to whether a project meets the definition of an alteration project, consult with the WSDOT ADA Compliance Manager.

The following apply to alteration projects:

- All new pedestrian facilities included in an alteration project that are put in place within an existing developed right of way must meet applicable accessibility requirements to the maximum extent feasible.
- All existing pedestrian facilities disturbed by construction of an alteration project must be replaced. The replacement facilities must meet applicable accessibility requirements to the maximum extent feasible.
- An alteration project shall not decrease or have the effect of decreasing the accessibility of a pedestrian facility or an accessible connection to an adjacent building or site below the ADA accessibility requirements in effect at the time of the alteration.
- Within the construction impact zone of an alteration project, any existing connection from a pedestrian access route to a crosswalk (marked or unmarked) that is missing a required curb ramp must have a curb ramp installed that meets applicable accessibility requirements to the maximum extent feasible. (See *Design Manual* Section 1510.09(2) for curb ramp accessibility criteria.)
- A crosswalk served by a curb ramp must also have an existing curb ramp in place on the receiving end unless there is no curb or sidewalk on that end of the crosswalk (RCW 35.68.075). If there is no existing curb ramp in place on the receiving end, an accessible curb ramp must be provided. This requirement must be met regardless of whether the receiving end of the crosswalk is located within the project's limits.
- Within the construction impact zone of an alteration project, evaluate all existing curb ramps to determine whether curb ramp design elements meet the accessibility criteria. (See *Design Manual* Section 1510.09(2) for curb ramp accessibility criteria.) Modify existing curb ramps that do not meet the accessibility criteria to meet applicable accessibility requirements to the maximum extent feasible. This may also trigger modification of other adjacent pedestrian facilities to incorporate transitional segments in order to ensure specific elements of a curb ramp will meet the accessibility criteria.
- Within the construction impact zone of an alteration project that includes Hot Mix Asphalt (HMA) overlay (or inlay) of an existing roadway and does not include reconstruction, realignment, nor widening of the roadway, evaluate all existing marked and unmarked crosswalks. (See *Design Manual* Section 1510.10(2) for crosswalk accessibility criteria.) If it is not possible to meet the new construction requirements for crosswalks, document this in the DDP.
- Within the construction impact zone of an alteration project that includes reconstruction, realignment, or widening of the roadway, evaluate all existing crosswalks (marked or unmarked) to determine whether crosswalk design elements

meet the accessibility criteria. (See *Design Manual* Section 1510.10(2) for crosswalk accessibility criteria.) Modify crosswalk slopes to meet new construction requirements to the maximum extent feasible.

- It may not always be possible to fully meet the applicable accessibility standards during alterations of existing facilities. If such a situation is encountered, consult with the WSDOT

ADA Compliance Manager to develop a workable solution to meet the accessibility requirements to the maximum extent feasible. If it is determined to be virtually impossible to meet the accessibility criteria, document the decision via a Maximum Extent Feasible (MEF) document. Cost is not to be used as a justification for not complying with the accessibility criteria. Physical terrain or site conditions that would require structural impacts, environmental impacts, or unacceptable impacts to the community in order to achieve full compliance with the accessibility criteria are some of the factors that can be used to determine that the maximum extent feasible is achieved. For any deficient element that does not match the preceding description, document the decision via a Maximum Extent Feasible (MEF) document.

- The MEF document will be reviewed by the appropriate Assistant State Design Engineer (ASDE) and the WSDOT ADA Compliance Manager. If acceptable, the MEF document will be approved and included in the DDP.

300.06 Terminal Facilities

At each ferry site there may be a number of buildings and other facilities located within or nearby the ferry dock that are available to passengers waiting to board or disembark from a ferry, and for WSF staff to carry out daily tasks in the operation and maintenance of ferry services.

Accessibility at each of these buildings or facilities is related to the users and detailed below.

(1) Basic Accessibility Criteria

Provide accessible circulation paths and pedestrian accessible routes at all WSF terminal buildings and facilities that are for public use to meet the following design element requirements:

(a) Accessible Routes

Circulation routes in and around the terminal building allow pedestrians to move about the building and between the ferry vessel. Provide accessible routes at a terminal building to coincide with or be located in the same area as general circulation paths. Where circulation paths are interior, required accessible routes are interior also. Additionally, accessible vertical interior circulation must be in the same area as stairs and escalators, not isolated in the back of the facility. The accessible route must also include those areas where concessions and vending for newspaper, food services, restrooms, etc are found in a terminal. For additional information on the requirements of a circulation path see *Design Manual* Section 1510.06.

See Section 206 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Where required, including site arrival points, within a site, multi-story buildings and facilities
- Spaces and elements
- Employee work areas
- Location
- Entrances
- Doors, doorways, and gates
- Elevators
- Security barriers

See Section 402 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to components of an accessible route:

- Walking surfaces, see Section 300.06(1)(j)
- Doors, doorway, and gates, see Section 300.06(3)
- Ramps, see Section 300.06(6)
- Curb ramps, see *Design Manual* Section 1510.09
- Elevators, see Section 300.06(11)

(b) Floor and Ground Surfaces

See Section 302 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- General surface requirements
- Carpet or carpet tile
- Openings in the floor or ground surface

(c) Changes in Level

See Section 303 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- General level requirements
- Vertical differences between two surfaces
- Beveled edges

(d) Turning Space

See Section 304 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Surfaces
- Size
- Door swing

(e) Clear Floor or Ground Space

See Section 305 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Surfaces
- Size
- Knee and toe clearances
- Position
- Approach
- Maneuvering clearances

(f) Knee and Toe Clearance

See Section 306 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Toe clearances
- Knee clearances

(g) Protruding Objects

See Section 307 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Protrusion limits
- Post-mounted objects
- Vertical clearances
- Required clear width

(h) Reach Ranges

See Section 308 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- General reach ranges
- Forward reach
- Side reach

(i) Operable Parts

See Section 309 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Clear floor space
- Height
- Operation

(j) Walking Surfaces

See Section 403 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Floor or ground surfaces, see Section 300.06(1)(b)
- Slope
- Changes in level, see Section 300.06(1)(c)
- Clearances, including clear width at a turn and passing spaces
- Handrails

(2) Entrances

Entrances, including the doors, doorways, and gates shall be ADA compliant and shall be on an accessible route.

See Section 206.4 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Public entrances
- Parking structure entrances
- Entrances from tunnels or elevated walkways
- Transportation facilities

(3) Doors, Doorways, and Gates

Doors, doorways, and gates that are part of an accessible route shall be accessible.

See Section 206.5 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Entrances
- Rooms and spaces

See Section 404.1 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- General requirements

(a) Manual Doors, Doorways, and Manual Gates

See Section 404.2 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Revolving doors, gates, and turnstiles
- Double-leaf doors and gates
- Clear width
- Maneuvering clearances
- Thresholds
- Doors or gates in series
- Door and gate hardware
- Closing speed
- Door and gate opening force
- Door and gate surfaces
- Vision lights

(b) Automatic and Power-Assisted Doors and Gates

See Section 404.3 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Clear width
- Maneuvering clearance
- Thresholds
- Doors and gates in series
- Controls
- Break out opening

(4) Toilet Rooms

Toilet rooms are provided at each terminal building for public and employee use. The number and types of accessible water closets and toilet compartments is discussed in Chapter 400. In addition to the accessibility requirements below for the various toilet room elements found in a terminal building, there may be local jurisdiction building requirements to consider when designing this room. Any dispenser provided in the toilet room shall meet the reach and toes requirements in Section 300.06(2).

See Section 603 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Clearances for turning space, overlap, and door swing
- Mirrors
- Coat hooks
- Shelves

(5) Water Closets and Toilet Compartments

See Section 213 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- General requirements
- Toilet rooms
- Plumbing fixtures and accessories, including toilet compartments, water closets, urinals, lavatories, mirrors, coat hooks, and shelves

Any dispenser provided in a water closet or toilet compartment shall meet the reach and toes requirements in Section 300.06(2). See Section 604 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Location
- Clearance, such as size and overlap
- Seats
- Grab bars, see Section 300.06(5)(d)
- Flush controls, hand operated or automatic
- Dispensers

(a) Toilet Compartments

See Section 604.8 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

1. Wheelchair Accessible Compartments
   - Size
   - Doors
   - Approach
   - Toe clearance
   - Grab bars, see Section 300.06(5)(d)
2. Ambulatory Accessible Compartments
   - Size
   - Doors
   - Grab bars, see Section 300.06(5)(d)
   - Coat hooks
   - Shelves

(b) Urinals

See Section 605 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Height and depth
- Clear floor space
- Flush controls

(c) Lavatories and Sinks

Any dispenser provided shall meet the reach and toes requirements in Section 300.06(2). Locate soap and towel dispensers so that they are conveniently usable by a person at the accessible lavatory. See Section 606 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Clear floor space
- Height
- Faucets
- Exposed pipes and surfaces

(d) Grab Bars

See Section 609 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Cross section, circular or non-circular
- Spacing
- Position of grab bars
- Surface hazards
- Fittings
- Installation
- Structural strength

(6) Ramps

Ramps are comprised of one or more ramp segments interconnected by level landings. See Section 405 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Slope
- Cross slope
- Floor and ground surfaces
- Clear width
- Rise
- Landings, including slope, width, length, change in direction, doorways
- Handrails, see Section 300.06(8)
- Edge protection, including extended ground or floor surface, and curb or barrier
- Wet conditions

(7) Stairways

See Section 504 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Treads and risers
- Tread surface
- Nosings
- Handrails are to be placed on both sides of stairs. Handrails are to be continuous within the full length of each stair flight. Inside handrails on switchback or dogleg stairs are to be continuous between flights. Fasten handrails so they do not rotate within their fittings.
- Wet conditions

(8) Handrails

See Section 505 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Continuity
- Height
- Clearance
- Gripping Surface
- Handrail cross section, circular or noncircular
- Surfaces
- Fittings
- Handrail Extensions top and bottom of stairs or ramps

(9) Drinking Fountains

See Section 211 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- General requirements
- Minimum number
- More than minimum number

See Section 602 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Clear floor space
- Operable parts
- Spout height
- Spout location
- Water flow

(10) Signs

See Section 216 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- General requirements
- Designations
- Directional and informational signs
- Means of egress
- Parking
- Entrances
- Elevators
- Toilet rooms
- TTYs
- Check-out aisles

Provide visual paging information for all electronic sign systems in consultation with WSDOT's ADA Manager. See *Electronic and Information Technology Accessibility Electronic and Information Technology Standards, Subpart B* for specific information on information technology requirements.

See Section 703 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- General requirements
- Raised characters
- Braille
- Installation and height
- Visual characters
- Pictograms
- Symbols of accessibility

(11) Elevators

Provide a elevator as the accessible route at such locations as a pedestrian overhead loading, or within a site, facility, or a ferry terminal building, when a pedestrian accessible route access cannot be provided. See Section 206.6 of the *2010 ADA Standards for Accessible Design* for more information.

See Section 407 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- General requirements
- Elevator landing requirements
- Elevator door requirements
- Elevator car requirements

(12) Public Telephones

See Section 217 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- General requirements
- Wheelchair accessible telephone
- Volume controls
- TTYs
- Shelves for portable TTYs

See Section 704 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Wheelchair accessible telephone
- Volume control telephones
- TTYs
- TTY shelf

(13) Automatic Teller Machines and Fare Machines

See Section 220 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- General requirements

See Section 707 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Clear floor or ground space
- Operable parts
- Privacy
- Speech output
- Input
- Display screen
- Braille instructions

(14) Picnic Tables, Tables and Counters

Picnic tables, tables and counters provided for passengers to use while waiting to board a ferry shall be accessible. See Section 902 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Clear floor or ground space
- Height

(15) Benches

Benches provided for seating at tables or for passengers to sit at while waiting to board a ferry shall be accessible. See Section 903 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Clear floor or ground space
- Size
- Height
- Structural strength
- Wet locations

(16) Check-Out Aisles and Sales and Service Counters

See Section 227 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Check-out aisles
- Altered check-out aisles
- Counters
- Queues and waiting lines

See Section 904 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Approach
- Check-out aisles
- Sales and service counters
- Security glazing

(17) Fire Alarms

See Section 215 and 702 of the *2010 ADA Standards for Accessible Design* for specific information.

(18) Pet Area

Where a pet area is provided at a terminal facility, provide an accessible route from the terminal building to the pet area. Provide curb ramps where required and ensure reach and toes requirements found in Section 300.05(2) to the bag dispensers and garbage cans for the disposal of pet waste.

(19) Accessible Means of Egress

All ferry terminal buildings, either public or employee accessible, shall have accessible means of egress when an emergency occurs. For detailed information on accessible means of egress see Section 207 of the *2010 ADA Standards for Accessible Design*.

300.07 Staff Facilities at Terminals

Staff facilities are located within the Terminal Supervisor's Building, the Passenger Building, the tollbooths, and the overhead loading area and may include employee offices & work spaces, employee amenities, storage areas, and security areas. For more details on staff facilities, see Chapters 430 and 440.

Although staff facilities used exclusively by employees for work are not required to be fully accessible, consider designing such areas to include non-required turning spaces, and provide accessible elements whenever possible. Under the ADA, employees with disabilities are entitled to reasonable accommodations in the workplace; accommodations can include alterations to spaces within the facility. Designing employee work areas to be more accessible at the outset will avoid more costly retrofits when current employees may become temporarily or permanently disabled, or when new employees with disabilities are hired.

See Sections 203.9 and 206.2.8 of the *2010 ADA Standards for Accessible Design* for additional specific information.

(1) Accessible Design Criteria

Accessible requirements for employee work areas include:

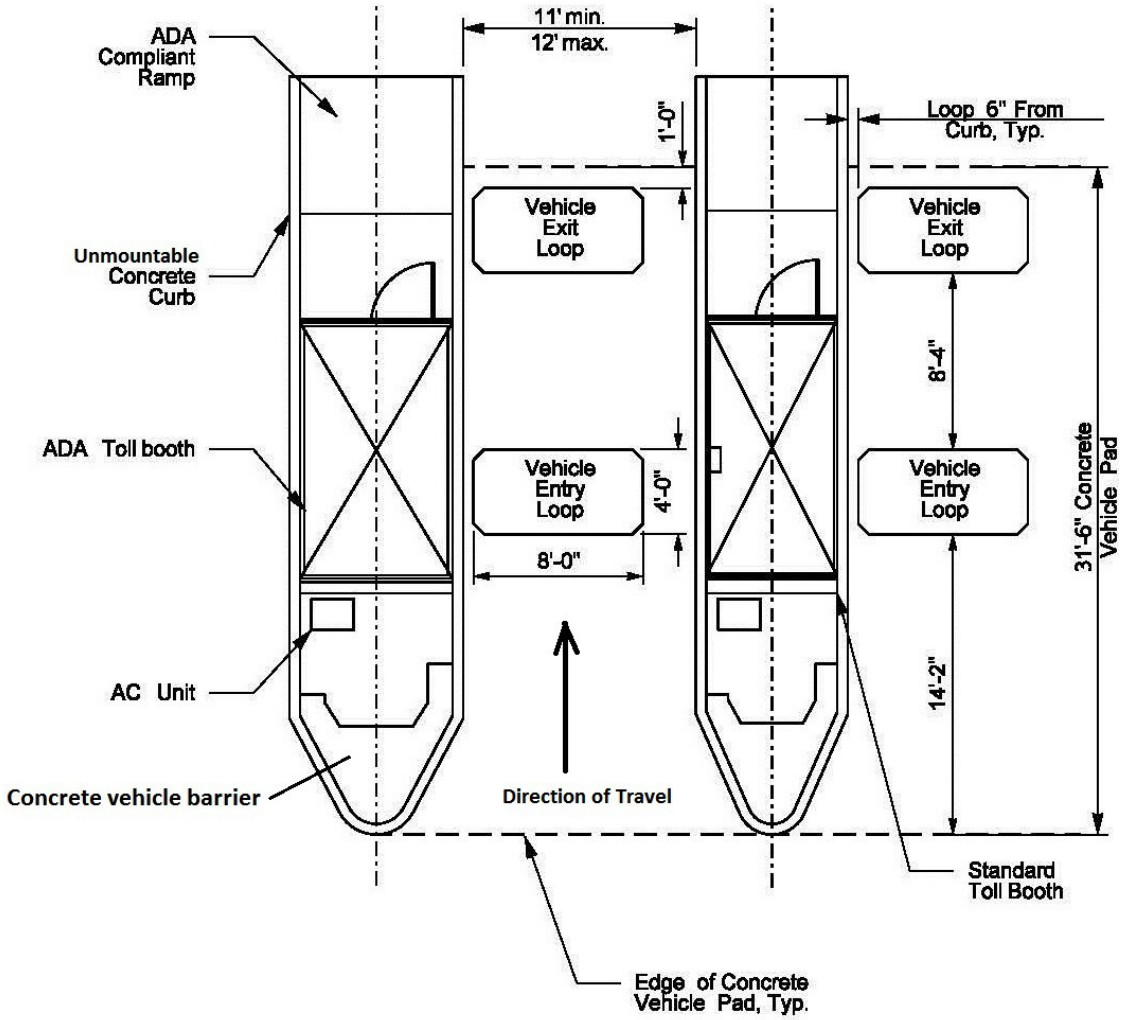
- Provide common use circulation paths with accessible routes that meet Section 300.06(1)
- Provide accessible doorways complying with requirements of Section 300.06(3)
- Provide accessible ramps complying with requirements of Section 300.06(6)
- Provide toilet rooms complying with requirements of Section 300.06(4)
- Provide curb ramps complying with the requirements in *Design Manual* Chapter 1510
- Provide elevators where needed complying with requirements of Section 300.06(11)
- Provide an accessible means of egress complying with requirements of Section 300.06(19)
- Where employee work areas have audible fire alarm coverage see Section 300.06(17)

(2) Tollbooths

Provide one tollbooth at each terminal location that is ADA accessible for employees with disabilities to work in. See Exhibit 300-1 for a typical layout of an ADA accessible tollbooth. Design the tollbooth using the Basic Accessibility Criteria found in Sections 300.06(1)(a) thru (j).

Many of the tollbooth floors are elevated above the toll lane of the vehicle for worker safety purposes. This can result in employee accessibility issues. Provide accessibility to all tollbooths to the maximum extent feasible so that an employee with disabilities can approach, enter and exit the work area. Accessibility requirements include:

- Turning clearances on the PAR approaching the tollbooth entrance
- The ramp into the tollbooth structure
- Doorway width



WSF ADA Tollbooth Design
Exhibit 300-1

300.08 Site Design Considerations

(1) Accessibility for Ticket Purchases

Toll plazas are utilized at many WSF terminals to collect fares for vehicles and their passengers before entering the vehicle holding area or from "walk-on" passengers. Tollbooths are structures strategically located within the toll plaza area and are staffed by WSF personnel to collect toll fees prior to boarding a ferry.

Persons who "walk-on" to the ferry may need to purchase a ticket at the vehicle tollbooth. Provide a pedestrian circulation path from the vehicle drop-off point, terminal, or parking area to a designated tollbooth to allow individuals with a disability to purchase a ticket.

Where applicable, at the tollbooth provide an accessible location out of the tollbooth driving lane where the ticket transaction can be completed. This area shall be covered to provide weather protection to the individual purchasing the ticket. The transaction area shall comply with the Basic Accessibility Criteria found in Sections 300.06(1)(a) thru (g).

Also, where applicable and needed, provide a pedestrian circulation path from the tollbooth transaction area to the passenger loading/queuing area or entrance to the terminal building. The pedestrian circulation path shall comply with the requirements found in *Design Manual* Section 1510.06.

If the passenger queuing area or overhead loading transfer span are elevated from the entrance or boarding or disembarking areas, provide an accessible ramp or elevator for the pedestrian access route, see Section 300.06. Stairs are not a pedestrian access route.

(2) Vehicle Holding Lanes

Vehicle holding lanes are provided at ferry terminals to await loading onto a ferry. As ferry terminals are rehabilitated or replaced, provide a 12-foot holding lane for ADA accessibility to the maximum extent possible that will provide a pedestrian accessible path from alongside the holding lanes to any other location within the ferry terminal. Coordinate with WSDOT ADA Compliance Manager and WSF Operations early to determine where to provide an ADA accessible holding lane.

Within the holding area provide accessible features to reach amenities such as a concession, pet area, or a restroom.

(3) Bicycle Access

The presence of bicyclists can be found at each terminal facility. Providing a route from the roadway to the ferry vessel can be challenging based upon the site constraints and number of bike riders at each terminal. Basic considerations when accommodating bicyclists include:

- Entry to the Terminal site:
- Where to purchase ticket
- Holding Area
- Pavement Markings
- Signing

The width of a bike lane is 4 feet minimum, see *Design Manual* Section 1520.

Locate drainage inlets and manhole covers to avoid bike lanes. When a drainage feature is within the bike lane provide drainage inlet grates that have openings narrow enough and short enough that bicycle tires will not drop into the grates. Replace existing grates that are not bicycle-safe with grates designed for bicycles: a WSDOT vaned grate, herringbone grate, or other grate with an opening perpendicular to the direction of travel, 4 inches or less center to center.

(4) Parking Spaces

See Section 208 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- General requirements
- Minimum number of accessible spaces, including van spaces
- Location

See Section 502 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- General requirements
- Vehicle spaces
- Access aisle
- Width
- Length
- Marking
- Location
- Floor or ground surfaces
- Vertical clearances
- Identification
- Relationship to accessible routes

See the *Roadside Manual* M 25-30 and the *Standard Plans* M 21-01 for more additional parking space design guidance.

(5) Passenger Loading Zones and Bus Stops

Early coordination with the local Transit Agency is required when locating a bus shelter near a terminal building. Typically, improvements of the circulation path to the terminal building or to the boarding and alighting area are completed by WSF and the shelter is provided and installed by the transit agency. Complete the agreement on what improvements are to be completed by WSF as early as possible. Provide accessible routes to these areas; see Section 300.05 for more information.

See Section 209 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Type

(a) Passenger Loading Zones

See Section 503 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Vehicle pull-up space
- Access aisle, including width, length, and marking
- Floor and ground surfaces
- Vertical clearances

(b) Bus Stop Boarding and Alighting Areas

See Section 810.2 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Surface
- Dimensions
- Connection
- Slope

(c) Bus Shelters

See Section 810.3 of the *2010 ADA Standards for Accessible Design* for specific information pertaining to:

- Minimum clear floor or ground space entirely within the shelter
- An accessible route connecting a bus shelter to a boarding and alighting area

300.09 Gangways

A gangway is a variable-sloped pedestrian walkway consisting of one or more runs. Gangways that are part of a passenger boarding system are required to comply with the requirements of Section 300.08. The elevated pedestrian circulation path between the terminal building and the ferry vessel which facilitates the loading and unloading of walk-on passengers via a route separate from the vehicle route is referred to as "passenger overhead loading" (see Chapter 620 for details). The movable portion of this walkway that raises and lowers onto the passenger deck of the ferry vessel is the "pedestrian transfer span". At terminals where there is no passenger overhead loading, passenger loading takes place via the vehicle transfer span (see Chapter 610 for details).

See Section V410 of the *Proposed Passenger Vessels Accessibility Guidelines* for specific information pertaining to:

- Slope - Refer to Exemption 5 regarding passenger boarding via the vehicle transfer span.
- Cross Slope
- Surfaces
- Clear Width
- Transition Plates
- Landings
- Handrails
- Edge Protection, includes extended deck surface, and curb or barrier
- Wet conditions

Provide emergency egress stairs for the fixed overhead walkway in the vicinity of the shore side end of the pedestrian transfer span. Include a Platform lift complying with IBC Section 1007.5

300.10 Pedestrian Features with DOT Rights-of-Way

WSDOT *Design Manual* Chapter 1510 provides policy for all other pedestrian features found within WSDOT rights-of-way or WSF leased property. A WSF designer needs to be aware of the various pedestrian features found in *Design Manual* Chapter 1510 to ensure accessibility design is incorporated for those areas outside the WSF terminal building limits.

Below is a list of ADA features found in *Design Manual* Chapter 1510 that a designer can reference for more details:

- Pedestrian Circulation Paths: *Design Manual* Section 1510.06
- Pedestrian Access Routes: *Design Manual* Section 1510.07
- Sidewalks: *Design Manual* Section 1510.08
- Curb Ramps: *Design Manual* Section 1510.09
- Crosswalks: *Design Manual* Section 1510.10
- Raised Medians/Traffic Islands: *Design Manual* Section 1510.11
- Pedestrian Push Buttons at Signals: *Design Manual* Section 1510.12
- At-Grade Railroad Crossings: *Design Manual* Section 1510.13
- Pedestrian Grade Separations (Structures): *Design Manual* Section 1510.14
- Other Pedestrian Facilities: *Design Manual* Section 1510.15
- Illumination and Signing: *Design Manual* Section 1510.16
- Work Zone Pedestrian Accommodation: *Design Manual* Section 1510.17
- Shared used paths are discussed in *Design Manual* Chapter 1515.

300.11 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist found in Chapter 220.

300.12 People First Language

"People First Language" is the practice of framing how you speak about people with disabilities by respectfully putting the person before the disability. Disabilities are not persons and they do not define persons, so do not replace person-nouns with disability-nouns. Using People First Language—putting the person before the disability—and eliminating old and prejudicial descriptors is not political correctness; instead, it demonstrates good manners, respect, and the Golden Rule.

Say/Write:	Instead of:
Person with a disability	Handicapped/Disabled person
He has a cognitive disability	He is mentally retarded
He has a psychiatric/mental disability	He is crazy….he is insane.
She has autism	She is autistic
He has Down Syndrome	He is Down's.
She has epilepsy/seizures	She has fits.
He has a physical disability	He is crippled/handicapped/lame
He has mobility limitations	He is mobility impaired
She uses a wheelchair	She is confined to a wheelchair
He is deaf/he is non-vocal	He is deaf mute/he is deaf and dumb
He has a brain injury	He is brain damaged
She has a congenital disability	She has a birth defect
She does not have a disability	She is normal
He has a disability	He suffers from/is afflicted by a disability
Accessible Parking	Handicapped Parking

Chapter 310 Security

310.01 General
310.02 References
310.03 Design Considerations
310.04 MARSEC Levels
310.05 Vessel Security
310.06 Passenger Security Screening Area
310.07 Security Rooms
310.08 Toll Plaza and Vehicle Holding Area
310.09 Waterside Structures
310.10 Access Control/Restricted Areas/TWIC
310.11 Closed Circuit Television
310.12 Panic Buttons
310.13 Signage
310.14 Sensitive Security Information (SSI)

310.01 General

This chapter provides general guidelines for requirements from WSF Terminal Security personnel. Contact the WSF Company Security Officer (CSO) with any questions pertaining to security issues. For international terminals (Anacortes and Sidney) contact the local United States Customs and Border Protection (CBP) office to determine project specific requirements.

The *Terminal Design Manual* discusses secure terminal areas throughout the manual. Refer to the following chapters to find information on these secure areas:

Chapter	Subject
330	Marine
400	Passenger Buildings
430	Terminal Supervisor Buildings
570	Signage and Wayfinding
610	Vehicle Transfer Span
620	Passenger Overhead Loading

310.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

19 CFR, U.S. Customs and Border Protection, Department of Homeland Security; Department of the Treasury

33 CFR Chapter 1, Coast Guard Department of Homeland Security

33 CFR *Subchapter H Maritime Security*

33 CFR Part 165.1317 *Security and Safety Zone; Large Passenger Vessel Protection, Puget Sound and adjacent waters, Washington*

49 CFR Part 15 *Protection of Sensitive Security Information*

49 United States Code (USC) Chapters 401-501, Aviation and Transportation Security Act

International Port Security Program (ISPS Code)

Maritime Transportation Security Act (MTSA)

(2) Design Guidance

Design and Engineering Standards CG-521, United States Coast Guard (USCG)

Ferry Terminal Design Standards for Passenger Processing Facilities, United States Customs and Border Protection (USCBP)

310.03 Design Considerations

(1) Materials Specification

Utilize materials that are in accordance with the requirements of the WSDOT *Standard Specifications* and WSF *General Structural Notes* and *Regional General Special Provisions*. Consider the material requirements of federally funded projects including the requirement for American-made steel. Make use of WSF stockpiles of materials where possible.

(2) Proprietary Items

WSF uses competitively acquired products to fulfill the requirements of a contract wherever feasible to help achieve the lowest price, the best quality, and the most efficient use of resources. There are instances in which competitive bidding may not or cannot be provided and a specific proprietary product is allowed. Refer to Section 220.07(2) for limitations on the use of proprietary items.

310.04 MARSEC Levels

The United States Coast Guard (USCG) has a three-tiered system of Maritime Security (MARSEC) levels consistent with the Department of Homeland Security's Homeland Security Advisory System (HSAS). MARSEC Levels are designed to provide a means to easily communicate pre-planned scalable responses to increased threat levels. The Commandant of the

U.S. Coast Guard sets MARSEC levels commensurate with the HSAS. Because of the unique nature of the maritime industry, the HSAS threat conditions and MARSEC levels will align closely, though they will not directly correlate. It is the responsibility of the CSO to notify WSF of MARSEC level changes by issuing a Declaration of Security (DOS) to each terminal manager.

MARSEC levels are set to reflect the prevailing threat environment to the marine elements of the national transportation system, including ports, vessels, facilities, and critical assets and infrastructure located on or adjacent to waters subject to the jurisdiction of the U.S.

1. **MARSEC Level 1** means the level for which minimum appropriate security measures shall be maintained at all times. MARSEC 1 generally applies when HSAS Threat Condition Green, Blue, or Yellow are set.
2. **MARSEC Level 2** means the level for which appropriate additional protective security measures shall be maintained for a period of time as a result of heightened risk of a transportation security incident. MARSEC 2 generally corresponds to HSAS Threat Condition Orange.

3. **MARSEC Level 3** means the level for which further specific protective security measures shall be maintained for a limited period of time when a transportation security incident is probable, imminent, or has occurred, although it may not be possible to identify the specific target. MARSEC 3 generally corresponds to HSAS Threat Condition Red.

Consider the ability to adjust to changing MARSEC Levels in terminal design. Coordinate with the CSO for current security procedures and requirements in addition to potential new requirements that are expected over the design life of the terminal.

310.05 Vessel Security

Per 33 CFR Part 165.1317, "there is established a large passenger vessel security and safety zone extending for a 500-yard radius around all large passenger vessels located in the navigable waters of the United States in Puget Sound, WA, east of 123°30' West Longitude. [Datum: NAD 1983]." Consider requirements of the moving security zone, established by Captain of the Port Puget Sound, as follows:

- Vessels within 500 yards must operate at minimum speed necessary to maintain safe course and respond to directions of the WSF Watch Officer or on-scene official patrol officer.
- Vessels and persons are prohibited from approaching within 100 yards (underway) unless authorized by WSF or the on-scene patrol officer.
- Vessels and persons are prohibited from approaching within 25 yards of any WSF vessel docked at a terminal, without authorization.

310.06 Passenger Security Screening Area

Provide provisions in the passenger building for a passenger screening area that may be used during elevated security threat levels. Include provisions for power and communication outlets at this location. Coordinate with the CSO at the time of design for additional design recommendations associated with potential passenger screening requirements. Refer to Section 400.11 for more information.

310.07 Security Rooms

The following building spaces incorporated at WSF facilities serve security related functions. Refer to Chapter 430 for more information regarding the locations of these building spaces.

(1) Vessel and Terminal Security (VATS) Room

Provide an onsite office area for homeland security personnel and Washington State Patrol officers while security troopers are on duty at the ferry terminal, as needed. Coordinate with WSP and/or WSF Security in the early planning stages of design to determine if a VATS office is required. Allow enough space within the VATS room for two work stations with the exception of the Seattle terminal which requires four. Work stations include space for a computer, fax, copier, radio equipment, lockers, and telephone.

(2) Security Interview Room

Provide a security interview room for use by law enforcement personnel to conduct interviews and investigations at the following terminals:

- Seattle
- Fauntleroy
- Clinton

The need for security interview rooms is based partially on ridership and the response time of local police officers. Provide room with space to accommodate four persons with two table top check stations, computer, fax, copier, and telephone.

(3) Chemical Drug and Alcohol Testing

Provide a room for WSF Management to conduct chemical drug and alcohol testing. This room can be an employee-only restroom that is able to be temporarily closed to others so that testing can be conducted privately. Ideally, locate this restroom away from public areas and inside the terminal supervisor building.

(4) IT Equipment Network Room

The IT equipment network room is the central hub for terminal and revenue video monitoring, network ethernet, intercom dispersion and amplification, telephone interfacing, and terminal security and access equipment. Provide a location for network, phone, EFS and security equipment. Provide space for a minimum of two full size floor standing equipment racks with adequate room on either side of each rack for servicing equipment and enough room to provide an air conditioning unit sized to keep equipment at an ambient room temperature not to exceed 68 degrees Fahrenheit. Larger terminals such as Seattle, Bainbridge, Kingston, etc may require additional rack space. Consult WSF IT personnel for additional information.

The IT equipment network room also includes any needs for security equipment storage. Consider proving space to store portable security equipment that could be required for higher MARSEC level screening. Refer to Chapter 560 for additional design guidelines.

The IT equipment network room is designated as a critical restricted area (refer to Section 310.10).

310.08 Toll Plaza and Vehicle Holding Area

(1) Toll Plaza

There are no special security requirements associated with the toll plaza area. The toll booths serve as a revenue collection function and not a security function.

(2) K-9 Screening of Vehicles

The Washington State Patrol (WSP) is currently utilizing explosive sniffing K-9's at some terminals to screen vehicles within the holding area. Additional design requirements to accommodate these K-9's are not required.

(3) WSP Facility Parking

Parking spaces for WSP personnel is related to the number of work stations provided in the VATS room. Provide between 2 and 4 parking spaces based on terminal VATS requirements.

(4) Radiation Detectors

The use of radiation detection for vehicle screening purposes is not a WSF requirement. Radiation detectors are only used at WSF international terminals (i.e. Sydney and Anacortes) as mandated by U.S. Customs and Border Protection. Consult with the CSO and U.S. Customs and Border Protection Officials for design requirements.

(5) Fencing

Fencing is not required for security purposes at WSF terminals. During MARSEC Level 3 events, terminals facilities are required to be secure per USCG requirements. Fencing, when provided, can assist terminal personnel in meeting this requirement. In general, fencing provides a greater level of security, aids in emergency management, and can provide a means for revenue control.

Consider providing fencing at terminals where these factors are of concern. Refer to Section 500.09(2) for guidelines on revenue control fencing. Additionally, consider providing fencing in areas shown to have higher crime rates.

Design fencing, at a minimum, per the WSDOT *Design Manual* Chapter 560 for Type 3 fencing. Fencing may be required to be of custom type depending on intended function. At international terminals, coordinate with the WSF CSO and the local United States Customs and Border Protection (USCBP) office to determine project specific requirements.

310.09 Waterside Structures

(1) Trestle

There are no WSF security requirements associated with trestles. However, local city ordinances may have restrictions that apply to trestles. Contact the local jurisdiction to determine if any such ordinances/restrictions apply.

(2) Vehicle Transfer Span

Vehicle transfer spans require a security gate where vessels tie up overnight (refer to Chapter 330 for locations of WSF tie-up slips). The area seaward of the VTS gate is considered a critical restricted area when the gate is closed. Additional information on the type and location of VTS security gates is provided in Chapter 610.

(3) Passenger Overhead Loading

Pedestrian transfer spans require a security gate. The pedestrian transfer span is designated as a critical restricted area from the gate to the water outside of vessel loading and unloading. A TWIC card is required for access to a critical restricted area. Additional information on the type and location of OHL security gates is provided in Chapter 620.

(4) Wingwalls and Dolphins

There are no WSF security requirements associated with the wingwalls and dolphins.

310.10 Access Control / Restricted Areas / TWIC

Provide an access control system at the terminal. Design the access control system to be compatible and integrated with the Vigilos ESM software system. The access control system includes the following devices:

(1) Electronic Door Locks

Doors outfitted with these devices will be accessible by the use of an authorized employee proxy card ID, keypad or combination of both. Install these devices for rooms/areas that are considered a "Secure Area". The access control system will monitor activities at all doors equipped with the electronic door locks and unusual events will be reported to the system operator.

(2) Key Locks

Install standard key type locks at all doors including those with and without electronic door locks.

(3) Intrusion Detection

Design all doors equipped with electronic door locks to report opening to the access control system. Provide closed circuit television cameras inside the buildings which include motion detection for intrusion when the buildings are unoccupied. In addition, provide motion detectors and silent alarms in secure areas to report intrusions to the access control system.

(4) Security Gates

Provide heavy duty steel security gates at each vehicle transfer span. Allow these gates to be capable of manual operation via an authorized employee proxy card ID.

(5) Roll Gates

Provide roll gates or doors at the vehicle transfer span and at the egress from the overhead loading near the passenger building.

310.11 Closed Circuit Television

Include a closed circuit television (CCTV) system at the terminal. This system is used for surveillance of public areas. WSF currently utilizes a Vigilos Enterprise Security Management (ESM) software system to manage its video and card access control systems. Design the CCTV to be compatible and integrated with the Vigilos ESM software system. Details of the CCTV system are considered SSI information. Coordinate with the WSF CSO if additional information is required for design.

310.12 Panic Buttons

Install panic buttons at the vehicle toll booths, passenger sales area, seller's safe room, and the supervisor's business and accounting room. Connect these to the terminal supervisor office for use by WSF agents in the event of an emergency at the toll booths.

310.13 Signage

The following security-related signage is incorporated at WSF terminals:

- MARSEC Level Signs are required at the entrance to the terminals in front of the toll booths.
- Signs indicating public areas are subject to video monitoring
- All vehicles subject to security screening and inspection
- Signage at the OHL transfer span stating that once loading has begun, the captain's permission is required to disembark the vessel.
- Terminal and vessel public areas are subject to video monitoring
- No Loitering/ Public Nuisance signs. Violators are subject to arrest.
- Employee Access Only
- Restricted Area
- No Trespassing
- Signs adjacent to trestle ladders

Refer to Chapter 770 for additional information.

310.14 Sensitive Security Information (SSI)

Sensitive Security Information (SSI) is that information defined in 49 CFR Part 1520 but also includes any information not specifically mentioned in Part 1520 but marked as "Sensitive Security Information" or "SSI". SSI includes all information obtained or developed in the conduct of security activities the disclosure of which the Transportation Security Administration, Department of Homeland Security has determined would be detrimental to the security of transportation.

SSI requires special handling to protect its secure nature. Plans and specifications containing SSI information require special headers and footers denoting the sensitivity of the information contained within the documents. Designers and contractors developing and handling SSI documents are required to sign a Non-Disclosure Agreement obligating them to protect this information from unauthorized disclosure. Refer to 49 CFR Part 1520 for the marking and handling of SSI documents.

Typically, if a document or contract includes SSI information, then the entire project is considered SSI. SSI projects can be more costly to design and construct due to the added requirements placed on a contractor for protecting the sensitive information. Hence it may be desirable to separate SSI work into a separate contract.

Chapter 320 Environmental Considerations

320.01 General
320.02 References
320.03 Determining the Environmental Documentation
320.04 Design Process and Permit Interaction
320.05 Environmental Commitments Meeting
320.06 Environmental Review and Permitting
320.07 Environmental Considerations
320.08 Land Use
320.09 Air Quality
320.10 Noise
320.11 Water Quality
320.12 Propwash, Vessel Wakes, and Sedimentation
320.13 Ecosystems and Protected Species
320.14 Earth (Geology and Soils)
320.15 Hazardous Materials
320.16 Traffic/Congestion
320.17 Visual Quality
320.18 Tribal Resources and Treaty Rights
320.19 Cultural, Historical, and Archaeological Resources
320.20 Park and Recreation Lands
320.21 Department of Natural Resources Lands
320.22 Resource Agency and Tribal Coordination

320.01 General

This chapter provides an overview of potential environmental impacts and environmental regulatory obligations as they relate to ferry terminal design. This chapter does not provide National Environmental Policy Act (NEPA) or State Environmental Policy Act (SEPA) level analysis, but rather provides a qualitative assessment of the major environmental elements that could pose substantial issues for future ferry terminal development. Refer to the *Environmental Manual* M 31-11 and WSF *Terminal Engineering Environmental Approvals and Permitting Procedures Manual* for a more detailed discussion of environmental issues and requirements.

This chapter briefly discusses potential environmental impacts including land use, air quality, noise, water quality, propwash, vessel wakes and sedimentation, ecosystems and protected species, earth, traffic, Tribal resources and treaty rights, cultural, historical and archaeological resources, park and recreational lands, and Department of Natural Resources Lands. Further environmental impact analysis will be required on a project-by-project basis.

This chapter is included in the *Terminal Design Manual* for use as a reference throughout the design process to ensure that:

- Environmental conditions are complied with (all required permits are obtained and all permit conditions, such as in-water work windows or construction BMPs, are adhered to).
- Environmental commitments that have been made to agencies, local governments, or Tribes (mitigation assurances for specific impacts) are captured in project design.
- There is an understanding that design changes could result in additional environmental conditions or commitments, which in turn could impact permitting, scheduling and project costs.

320.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

16 USC Chapter 31 *Marine Mammal Protection*

16 USC Chapter 35 *Endangered Species*

23 CFR 771.117 *FHWA Categorical exclusions*

40 CFR 1508.4 *Categorical exclusion*

Directional Memo ESO-2011-01, Complete Permit Application Drawing Guidance
National Historic Preservation Act, Archaeological and cultural resources Executive Order 05-05, Archeological and cultural resources

Executive Order 13186, Responsibilities of federal agencies to protect migratory birds
National Environmental Policy Act (NEPA), U.S. Environmental Protection Agency

RCW 27.34.200 *Archaeology and historic preservation – Legislative declaration*

State Environmental Policy Act (SEPA), Washington State Department of Ecology
WAC 25-12 *Advisory council on historic preservation*

(2) Design Guidance

Environmental Manual M 31-11

Traffic Noise Analysis and Abatement Policy and Procedures, WSDOT, 2006

Noise Policy and Procedures, WSDOT 2011

(3) Supporting Information

WSDOT *Ferries Division Final Long-Range Plan* (Long-Range Plan), WSDOT, 2009

Greenhouse Gas Inventory, WSDOT, 2007

The Washington Climate Change Impacts Assessment, the Climate Impacts Group, University of Washington, 2009

Terminal Engineering Environmental Approvals and Permitting Procedures Manual, WSF

WSF *Environmental Compliance Plan*

320.03 Determining the Environmental Documentation

The Environmental Review Summary (ERS) provides the first indication of what form the project environmental documentation will take. The ERS is generally developed as part of the Project Summary, which is prepared during the scoping phase of all projects in the construction program. However, the environmental section should be consulted during the design process in case any rules, regulations, or laws have changed since initial scoping. The *Environmental Manual* M 31-11 has detailed instructions on how to prepare the ERS. The ERS allows environmental staff and designers to consider, at an early stage, potential impacts and mitigation, and required permits. Refer to Chapter 200 for more information regarding the ERS.

Based on the environmental considerations identified during preparation of the ERS, WSDOT projects are classified for NEPA/SEPA purposes to determine the type of environmental documentation required. Projects with a federal nexus (using federal funds, involving federal lands, or requiring federal approvals or permits) are subject to NEPA and SEPA. Projects that are state-funded only follow SEPA guidelines. Since many WSDOT projects are prepared with the intent of obtaining federal funding, NEPA guidelines are usually followed. The *Environmental Manual* M 31-11 provides detailed definitions of the classes of projects. It lists the types of work typically found in each class, FHWA/federal agency concurrence requirements, and procedures for classifying and, if necessary, reclassifying the type of environmental documentation for projects.

Projects subject to NEPA are classified as Class I, II, or III as follows:

- Class I projects require preparation of an EIS because the action is likely to have significant adverse environmental impacts.
- Class II projects are Categorical Exclusions (CE) or Documented Categorical Exclusions that meet the definitions contained in 40 CFR 1508.4 and 23 CFR 771.117. These are actions that are not likely to cause significant adverse environmental impacts. Per 40 CFR 1508.4 these projects do not require an environmental assessment or an environmental impact statement. 23 CFR 771.117 defines which actions meet criteria for CEs and the level of NEPA approval required by the Administration.
- Class III projects require an Environmental Assessment (EA) because the significance of the impact on the environment is not clearly established.

SEPA has a similar, but not identical, system. SEPA recognizes projects that are categorically exempt, projects that require an EIS, and projects that do not require an EIS. WSF projects that are CEs under NEPA (Class II) may not be categorically exempt under SEPA.

If the project is not exempt under SEPA, WSF must issue a threshold determination and then prepare a SEPA Checklist or EIS. The threshold determination may be a Determination of Non-significance (DNS) or a Determination of Significance (DS) requiring an EIS. WSDOT may adopt a NEPA EA Finding of No Significant Impact (FONSI) to satisfy the requirements for a DNS.

320.04 Design Process and Permit Interaction

WSF projects are subject to a variety of federal, state, and local environmental permits and approvals that might be required based on the information known at that stage. As a project design develops, additional permits and approvals may be identified.

Environmental permits and approvals require information prepared during the design phase to demonstrate compliance with environmental rules, regulations, and policies. Typically the designer provides design information for permit submittals at the 30 percent Design milestone. To avoid delays in project delivery, it is necessary for the designer to understand and anticipate this exchange of information. The timing of this exchange often affects design schedules, while the permit requirements can affect the design itself. In complex cases, the negotiation over permit conditions can result in iterative designs as issues are raised and resolved. Environmental permits and approvals can be determined, and application started with 15 percent design information.

The interaction of design and permitting increases in complexity as the project type becomes more complex. Table 500-1 of the *Environmental Manual* M 31-11 provides a comprehensive list of the environmental permits and approvals that may be required for WSDOT projects. For each permit or approval, the responsible agency is identified, the conditions that trigger the permit are listed, and the statutory authority is cited. Consult the region or HQ Environmental Office at each stage of the project design to review the permits and approvals that might be required based on the project design. WSF *Terminal Engineering Environmental Approvals and Permitting Procedures Manual* provides a comprehensive step-by-step approach to environmental permitting and approvals.

320.05 Environmental Commitments Meeting

WSDOT Project Delivery Memo #09-01, *Incorporating Environmental Commitments into WSDOT Contracts*, requires that an Environmental Commitments Meeting take place at the 60 percent Design milestone with Construction, Environmental and Plan Review Offices and any other support group deemed necessary by the Design Office. The intent of this memorandum is to:

1. Recommend steps for a successful Environmental Commitments Meeting
2. Describe deliverables resulting from the Environmental Commitments Meeting
3. Identify resources Regions can use during the Environmental Commitments Meeting
4. Identify roles and responsibilities so regions can successfully incorporate environmental commitments into contracts.

WSF maintains an environmental compliance plan to ensure projects are designed, constructed and maintained in accordance with environmental commitments made through the environmental documentation and permitting process. As part of this compliance plan, the Terminal Engineering environmental staff will work collaboratively with the Terminal Engineering Design and Constructions staff to ensure that all permit conditions are incorporated into contract provisions and copies of all permits are included in the contracts. Permits are typically included as an appendix to the special provisions. For additional information, refer to the WSF *Environmental Compliance Plan* in Appendix N.

320.06 Environmental Review and Permitting

(1) Environmental Review

The environmental review process for WSF projects is guided by provisions of the NEPA and the SEPA, and guidance by the United States Department of Transportation (USDOT) and the WSDOT with regard to those laws. Understanding and anticipating what permits and approvals may be required for a particular project, along with how long it is likely to take to obtain said permits/approvals, will assist the designer in project delivery. The following paragraphs summarize some of the common federal, state and local permits and approvals that may apply to ferry terminal projects. Refer to the *Environmental Manual* M 31-11 for a comprehensive discussion of permits and approvals.

(2) Federal Permits and Approvals

Exhibit 320-1 identifies some of the federal permits and approvals commonly required for WSF projects along with their responsible agencies. Where quantifiable, a typical time range to obtain these permits/approvals is provided.

Permits/Approvals with Timelines	Responsible Agency
National Environmental Policy Act (NEPA)	Federal Highway Administration/Federal Transit Administration, WSDOT
Endangered Species Act (ESA): 3 to 9 months	NOAA Fisheries, U.S. Fish and Wildlife Service
National Historic Preservation Act – Section 106	Department of Archaeology and Historic Preservation/State Historic Preservation Officer
Clean Water Act – Section 404: 6 to 12 months	U.S. Army Corps of Engineers, Environmental Protection Agency, U.S. Coast Guard
Rivers and Harbors Act - Section 10: 6 to 12 months	U.S. Army Corps of Engineers
Section 4(f) of USDOT Act – See NEPA	United States Department of Transportation
Marine Mammal Protection Act (MMPA): 6 to 12 months	NOAA

Federal Permits and Approvals
Exhibit 320-1

(3) State Permits and Approvals

Exhibit 320-2 identifies some of the state permits and approvals commonly required for WSF projects along with their responsible agencies. Where quantifiable, a typical time range to obtain these permits/approvals is provided.

Permit	Responsible Agency
State Environmental Policy Act (SEPA): 30 days to 2 years	Department of Ecology
Clean Water Act – Sections 401 and 402	Department of Ecology
Coastal Zone Management Certificate: 30 days	Department of Ecology
Aquatic Lands Use Authorization	Department of Natural Resources
Hydraulic Project Approval: 45 days	Department of Fish and Wildlife
National Pollution Discharge Elimination System Construction Stormwater Permit	Department of Ecology
National Pollution Discharge Elimination System Industrial and/or Municipal Permits	Department of Ecology
Governor's Executive Order 05-05	Department of Archaeology and Historic Preservation and the Governor's Office of Indian Affairs

State Permits and Approvals
Exhibit 320-2

(4) Local Permits and Approvals

Exhibit 320-3 identifies some of the local permits and approvals commonly required for WSF projects. Local permits and approvals will vary by ferry terminal depending on the statutory authority for the terminal location.

Permits and Approvals
SMP Shoreline Substantial Development Permit: 120 days
SMP Conditional Use Permit or Variance
Special Use Permit
SMP Exemption
Clearing and Grading Permits
(not required within WSF right of way)
Building Permit
Land Use Permit
Street Use Permit
Noise Variance
Height Variance
Detour and Haul Road Agreements
Well Decommissioning

Local Permits and Approvals
Exhibit 320-3

(5) Local Programmatic Shoreline Permit Exemptions

WSF has several existing programmatic shoreline permit exemptions with local jurisdictions at existing WSF terminals. As these permit exemptions change over time, coordinate with the WSF Environmental Manager for current permits and additional details.

(6) Federal /State Systemwide and Programmatic Permits

WSF has several existing systemwide and programmatic permits with the U.S Army Corps of Engineers (Corps), the Washington Department of Fish and Wildlife (WDFW), and Washington State Department of Ecology (Ecology) that cover certain activities at WSF facilities. The activities covered under these permits change as existing permits expire and new permits are obtained. Activities covered by these permits at the time of the *Terminal Design Manual* publication, along with the corresponding permitting agencies, are included in Exhibit 320-4.

Coordinate with the WSF Environmental Manager for current information on systemwide and programmatic permits along with their conditions and expiration dates.

(7) Permit Drawing Requirements

Many permits have associated permit drawings that are required as part of the permit package. These often include type, size and location (TS&L) information for various design features.

Permit drawings and their requirements differ from standard WSF design drawing requirements. Refer to Directional Memo ESO-2011-01, Complete Permit Application Drawing Guidance, for additional information.

Permitted Activities	Permitting Agency		
	CORPS	WDFW	ECOLOGY
Repair/Replace Rub Timbers	X	X	X
Repair/Replace Polyethylene Panels	X	X	X
Repair/Replace Cross-bracing, Stringers, Other Overwater Wood	X	X	X
Repair/Replace Dolphin Panels	X	X	X
Repair/Replace Hanger Bars	X	X	X
Repair/Replace Dolphin-Fender Pile Lashing	X	X	X
Repair/Replace Anchor Chains	X	X	X
Repair/Replace Counterweights/Cables	X	X	X
Repair/Replace Pontoons	X	X	X
Repair/Replace Transfer Spans and Parts Thereof	X	X	X
Repair/Replace Components of Floating Dolphins	X	X	X
Repair/Replace Cathodic Protection Anodes		X	X
Replace Piles	X	X	X
Sediment Test Boring	X	X	X
Deck and Drain Cleaning		X	X
Deck Overlay Replacement		X	X
Cleaning, Washing, Marine Growth Removal		X	X
Painting, Prep. Cleaning, Washing, Abrasive Blasting, Marine Growth Removal		X	X
Special Provisions			
Fish Windows	X	X	X
Saltwater Vegetation Protection Window		X	
Filtered Paint Prep Washing Window		X	
Pre-construction Notification		X	
Post-construction Notification	X		
Annual Reporting Date		X	

Systemwide and Programmatic Permits
Exhibit 320-4

320.07 Environmental Considerations

Exhibit 320-5 provides guidance to the designer regarding potential environmental impacts to be considered during the design process. This matrix provides a checklist of environmental issues commonly related to the design of each terminal element. An "X" on the matrix indicates that the noted environmental issue should be considered in the design of the corresponding terminal element. A blank cell indicates that the noted environmental issue typically is not linked to (or impacted by) the design of the corresponding terminal element. This matrix is intended as a design aid only. No design documentation is required in connection with this matrix.

Note that improving conditions for one environmental element may have a negative impact on other elements. For example, increasing the percentage of terminal development on land will likely have a positive influence on overwater coverage, but may have a negative impact on such constraints as waterfront access, traffic, noise, and visual quality. Environmental improvements may also have a significant impact on cost and/or operations.

The paragraphs that follow describe in more detail some of the key issues and mitigation strategies associated with the environmental considerations in Exhibit 320-5 and how they may pertain to WSF projects.

⇩ Environmental Considerations	General Design Criteria							Terminal Building Design				Site Design									Waterside Development						
Design Elements ⇨	Site Layout / Location	Site Preparation, Grading and Erosion Control	Roadway Design & Channelization	Paving	Traffic Control	Operations & Maintenance	Construction	Buildings & Enclosures	Architecture	Landscaping	Public Art	Access, Approaches & Exits	Toll Plaza	Vehicle Holding & Support Areas	Parking	HOV & Transit	Circulation	Site utilities	Stormwater	Signage & Wayfinding	Trestle	Bulkhead	Vehicle Transfer Span	Passenger Overhead Loading	Wingwalls	Fixed Dolphins	Floating Dolphins
Land Use																											
Compliance with local comprehensive plans, zoning maps and shoreline master programs	X	X	X	X				X	X	X				X	X	X			X	X	X	X					
Change in land use	X					X								X	X	X			X								
Benefit or detriment to local economy	X		X		X	X								X	X	X	X										
Air Quality																											
Number of idling vehicles (ferry traffic backup/queuing)	X		X		X	X	X					X		X	X	X	X							X			
Construction BMPs (dust control, diesel engine emissions, etc.)		X					X			X									X								
Use of vessels that maximize fuel efficiency and minimize vessel emissions						X																					
Noise																											
Compliance with local noise ordinances (limit construction noise levels on nights and weekends)				X		X	X																				
Pile driving (pile material, installation method, use of pile driving pads and noise attenuators)							X														X	X	X	X	X		
Ferry operations (noise from loading/unloading & vessel engines)				X	X	X							X	X							X		X				
Proximity of terminal to residential areas	X																										

X = Environmental issue commonly linked to noted design element.

Environmental Considerations Matrix
Exhibit 320-5

⇩ Environmental Considerations	General Design Criteria							Terminal Building Design				Site Design									Waterside Development						
Design Elements ⇨	Site Layout / Location	Site Preparation, Grading and Erosion Control	Roadway Design & Channelization	Paving	Traffic Control	Operations & Maintenance	Construction	Buildings & Enclosures	Architecture	Landscaping	Public Art	Access, Approaches & Exits	Toll Plaza	Vehicle Holding & Support Areas	Parking	HOV & Transit	Circulation	Site utilities	Stormwater	Signage & Wayfinding	Trestle	Bulkhead	Vehicle Transfer Span	Passenger Overhead Loading	Wingwalls	Fixed Dolphins	Floating Dolphins
Water Quality																											
Construction BMPs		X	X				X			X								X	X		X	X	X	X	X	X	
Erosion control		X				X	X			X									X			X					
LIDs (e.g. pervious pavement, vegetated strips/swales, etc – refer to Chapter 580)			X	X		X				X				X	X				X		X						
Area of upland disturbance	X	X	X	X		X	X	X		X		X	X	X	X	X	X	X	X								
Increase in impervious area	X		X	X		X		X		X		X		X	X	X	X										
Dredging / filling	X			X		X	X														X	X	X	X	X	X	
Propwash, Vessel Wakes, and Sedimentation																											
Impact on intertidal aquatic habitat	X	X					X												X		X	X		X	X	X	X
Impact on beach as recreation resource	X					X															X	X		X			
Impact on ability of beach to dissipate wave energy	X									X											X	X					
Ecosystems and Protected Species																											
Loss of habitat	X		X			X	X			X				X	X				X		X	X	X	X	X	X	X
Overwater coverage (shading impacts)	X											X		X	X						X	X	X	X	X	X	X
Distance in shadow for migrating fish	X																				X			X			X
LIDs (e.g. light-emitting glass blocks & grating, solar tubes, minimize nearshore overwater coverage, etc – refer to Chapter 580)	X		X	X										X	X						X			X			

X = Environmental issue commonly linked to noted design element.

Environmental Considerations Matrix
Exhibit 320-5

⇩ Environmental Considerations	General Design Criteria							Terminal Building Design				Site Design									Waterside Development						
Design Elements ⇨	Site Layout / Location	Site Preparation, Grading and Erosion Control	Roadway Design & Channelization	Paving	Traffic Control	Operations & Maintenance	Construction	Buildings & Enclosures	Architecture	Landscaping	Public Art	Access, Approaches & Exits	Toll Plaza	Vehicle Holding & Support Areas	Parking	HOV & Transit	Circulation	Site utilities	Stormwater	Signage & Wayfinding	Trestle	Bulkhead	Vehicle Transfer Span	Passenger Overhead Loading	Wingwalls	Fixed Dolphins	Floating Dolphins
Ecosystems and Protected Species (continued)																											
Changes to harbor line	X																				X					X	X
Underwater noise impacts from steel pile driving							X														X	X	X	X	X	X	
Length of shoreline used by ferry terminal	X																				X	X					
Distance from ferry operations to nearshore (wake-wash and propeller scour)	X																				X		X	X			
Dredging / filling	X					X															X	X					X
Earth (Geology and Soils)																											
Identification of geologically hazardous areas and risks																											
• Erosion	X	X				X	X			X									X			X					
• Liquefaction	X							X													X	X	X	X	X	X	X
• Storm surges	X																				X	X					
Hazardous Materials																											
Identified hazardous materials in project area (type, location and extent)	X	X	X			X	X	X		X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Likelihood of additional unidentified hazardous materials	X	X	X				X	X		X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Risks associated with known and anticipated hazardous materials (added cost, construction delays, etc)	X	X	X				X	X		X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X

X = Environmental issue commonly linked to noted design element.

Environmental Considerations Matrix
Exhibit 320-5

⇩ Environmental Considerations	General Design Criteria							Terminal Building Design				Site Design									Waterside Development						
Design Elements ⇨	Site Layout / Location	Site Preparation, Grading and Erosion Control	Roadway Design & Channelization	Paving	Traffic Control	Operations & Maintenance	Construction	Buildings & Enclosures	Architecture	Landscaping	Public Art	Access, Approaches & Exits	Toll Plaza	Vehicle Holding & Support Areas	Parking	HOV & Transit	Circulation	Site utilities	Stormwater	Signage & Wayfinding	Trestle	Bulkhead	Vehicle Transfer Span	Passenger Overhead Loading	Wingwalls	Fixed Dolphins	Floating Dolphins
Traffic / Congestion																											
Implementation of reservation system to reduce traffic	X		X		X	X						X	X	X	X	X				X							
Adequate holding sizing (vehicle holding area, shoulder holding lanes, off-site parking)	X	X	X	X	X	X	X			X				X	X			X	X	X	X						
Coordination of signals and operational measures / ITS					X	X														X							
Affect on access to residences and businesses	X		X		X	X						X		X			X			X							
Loading and offloading procedures (pedestrians & vehicles)					X	X						X	X	X		X	X			X			X	X			
Visual Quality																											
Compatibility of terminal with surrounding area's character	X							X	X	X	X				X		X		X	X				X			
Blockage of waterfront views (building height/location; tree height)	X							X	X	X					X		X				X			X			
Incorporation of landscaping to screen/soften views of structures and help reduce scale	X							X	X	X					X							X					
Incorporation of public art	X							X	X		X									X							
Visibility of lighting from surrounding areas	X							X	X	X				X		X	X	X			X			X	X	X	
Tribal Resources and Treaty Rights																											
Cultural, Historical, and Archaeological Resources																											
Impact on cultural, historical, and archaeological resources	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Impact on fishing for Tribes with U&A rights (negotiate MOA with Tribes as needed)	X																		X		X	X	X	X	X	X	X

X = Environmental issue commonly linked to noted design element.

Environmental Considerations Matrix
Exhibit 320-5

⇩ Environmental Considerations	General Design Criteria								Terminal Building Design				Site Design									Waterside Development				
Design Elements ⇨	Site Layout / Location	Site Preparation, Grading and Erosion Control	Roadway Design & Channelization	Paving	Traffic Control	Operations & Maintenance	Construction	Buildings & Enclosures	Architecture	Landscaping	Public Art	Access, Approaches & Exits	Toll Plaza	Vehicle Holding & Support Areas	Parking	HOV & Transit	Circulation	Site utilities	Stormwater	Signage & Wayfinding	Trestle	Bulkhead	Vehicle Transfer Span	Passenger Overhead Loading	Wingwalls	Fixed Dolphins	Floating Dolphins
Park and Recreation Lands																											
Impact on existing park and recreation lands	X		X	X			X	X		X		X		X	X		X		X			X				
Area available for open space/restoration	X									X									X								
Department of Natural Resources Lands																											
Revisions to harbor lines	X																				X	X	X	X	X	X	X
Resource Agency and Tribal Coordination																											
Consistency/conformity with existing agency & Tribal plans	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

X = Environmental issue commonly linked to noted design element.

Environmental Considerations Matrix
Exhibit 320-5

320.08 Land Use

(1) Existing Land Use

Land uses at ferry terminal locations include recreational, residential and commercial. The communities in which the ferry terminals reside are linked in varying degrees to the economic conduit that the ferry system provides. In some cases this economic relationship has been an important factor in the land use development of the community.

Local comprehensive plans, zoning maps and shoreline master programs designate the ferry terminals as ferry terminal facility, commercial, industrial or urban waterfront that allow the location of the terminal facilities. The establishment of ferry terminal facilities predates the Growth Management Act and Shoreline Management Act.

(2) Changes in Land Use

Improvements and operation of the ferry system can affect land uses in several ways. When there is a change in the size or location of a terminal facility, there would be near-term changes to properties being used. There may also be medium term changes in the local area, if the economy realizes benefit or detriment from the changes to the terminals. In addition, changes in ferry service can also affect local land use to the extent that the ferry service provides access to properties, facilitating movement of money and goods in the local economy.

The WSF ferry system plan, the Long-Range Plan, takes account of the critical interaction between local land use and the provision of ferry services. This is accomplished by:

- Relying on adopted comprehensive plans as the land use basis for ferry planning;
- Using local and regional data sets and tools in technical analyses;
- Developing ferry strategies and programs to align with adopted State and local transportation and land use goals; and
- Involving local and regional entities in plan-making.

Strategies that have been developed in the Long-Range Plan are not expected to change the land uses of any of the ferry communities with possible exception of Mukilteo, where the terminal may be relocated. At Mukilteo, if feasible, the terminal will be relocated to an abandoned industrial property to allow active, urban waterfront commercial uses at the current terminal location.

320.09 Air Quality

(1) Regulation

Air quality in the Puget Sound region is regulated by the U.S. Environmental Protection Agency (EPA), Ecology, and the Puget Sound Clean Air Agency (PSCAA). Under the Clean Air Act, EPA has established the National Ambient Air Quality Standards (NAAQS), which specify maximum concentrations for carbon monoxide, particulate matter (PM10 and PM2.5), ozone, sulfur dioxide, lead, and nitrogen dioxide. In, addition, the state has recently established statutory requirements regarding green house gas emission reductions for state agencies. The Puget Sound Clean Air Agency's 2005 Air Quality Data Summary indicates that, with the exception of fine particulate matter (PM2.5) and ozone, criteria air pollutants concentrations are well below levels of concern for the region. Particulate matter includes small particles of dust, soot, and organic matter suspended in the atmosphere. Particulates less than 100 micrometers in diameter are measured as total suspended particulates. Most diesel engine emissions are in the PM2.5 size range, while road and construction dust is often in the larger PM10 range. Most transportation related fine particulate emissions come from diesel engine emissions, which release fine particulates both directly, mostly as carbon compounds and indirectly in the form of sulfur dioxide, a gas that reacts in the atmosphere to form sulfate particulates.

Near the Puget Sound, PM2.5 and PM10 concentrations tend to be highest in fall and winter during periods of air stagnation and high use of wood for heat. Current monitored levels of PM2.5 violated recently adopted (2006) federal standards in Pierce County. Other air pollutants of concern for transportation projects include mobile source air toxics and greenhouse gases.

Ozone is a highly toxic combination of oxygen atoms and is a major component of the complex chemical mixture that forms photochemical smog. Ozone is not produced directly, but is formed by a reaction between sunlight, nitrogen oxides (NOx), and volatile organic compounds (VOCs). Ozone primarily is a product of regional vehicular traffic, point source emissions, and fugitive emissions of the ozone precursors. Tropospheric (ground-level) ozone, which results from ground-level precursor emissions, is a health risk, while stratospheric (upper-atmosphere) ozone, which is produced through a different set of chemical reactions that only require oxygen and intense sunlight, protects people from harmful solar radiation.

In the Puget Sound area, the highest ozone concentrations occur from mid-May until mid- September, when urban emissions are trapped by temperature inversions followed by intense sunlight and high temperatures. Approximately thirty percent of nitrogen oxides and volatile organic compounds come from mobile sources. Maximum ozone levels generally occur between noon and early evening, after nitrogen oxides and volatile organic compounds have had time to mix and react under sunlight, and at locations several miles downwind from the sources. Light northeasterly winds producing these conditions contribute to high ozone concentrations near the Cascade foothills, to the south and southeast of the Seattle-Tacoma Metropolitan Area.

Automobiles, ferry vessels, and other vehicles using fossil fuel also emit greenhouse gases, primarily carbon dioxide. Greenhouse gases trap solar energy in the atmosphere, warming the earth's surface. While greenhouse gases occur naturally in the atmosphere

(without them the average temperature of the earth would be below freezing), human activities over the last century have released additional greenhouse gases.

Currently, approximately 49 percent of all greenhouse gas emissions in Washington State are from transportation, including on-road and off road vehicles, ferry vessels, rail transport, and air travel. WSF vessels burn approximately 17 million gallon of diesel fuel annually. Based on the *2007 WSDOT Greenhouse Gas Emissions Inventory,* these 17 million gallons account for approximately 69 percent of WSDOT's green house gas emissions. In the 2009-11 biennium, this amount is expected to be reduced to about 15 million gallons as a result of fuel conservation efforts.

(2) Effects on Air Quality

The operation of the ferry system affects air quality and greenhouse gas emissions through both the emissions of passenger vehicles using the system and through the operation of the system itself.

(a) Potential Emissions Reductions from Passenger Vehicles

Air quality improvements are anticipated in the communities near terminals where the proposed reservation system will be implemented. Emissions from passenger vehicles using the ferry system will be reduced by shortening the cues of idling vehicles. Currently, vehicle cues frequently extend far beyond the toll booths at many terminals during peak travel periods. Vehicles beyond the toll booths are encouraged, but not required, to shut-off vehicle engines. It is unknown whether passengers will modify their sailing time to use the reservation system or will choose to drive around to travel at their preferred time. Air emissions will be affected if travelers elect to drive around southern Puget Sound to reach their destination.

In addition to the savings from passenger vehicles, implementation of the reservation system is expected to reduce the number of vessels needed to meet projected demand, and consequently avoid fleet emissions that would occur if vessels and vessel sailings were added to meet projected demand, as proposed under previous long range system planning efforts.

(b) Potential Emissions Reductions from the Ferry System

The Long-Range Plan delays the installation of transit-related improvements to the terminals until increased walk-on ridership is realized, and maintains the current cost pricing ratio between vehicles and passengers. The delay to terminal transit improvements, and not changing the pricing strategy, will likely delay the shift of ferry ridership from single occupancy vehicles to alternative modes of transit. This assumption is based on the ease of use, accessibility and cost factors that affect transportation choices. If this assumption is accurate, then it may be difficult for the ferry system to contribute to statutory per capita vehicle miles traveled and greenhouse gas reduction targets. Delaying a greater shift to transit will also delay the realization of potential reductions in criteria pollutants associated with transit use. The proposed new vessels are designed to maximize fuel efficiency and will meet new EPA standards for emissions control. The replacement of the fleet's oldest vessels with vessels that meet current EPA standards is expected to reduce emissions of criteria pollutants from the fleet.

320.10 Noise

(1) Noise Regulation

As more people choose to live along the shores of the Puget Sound, noise from the loading of ferries and their engines has become a greater concern for residents near ferry terminals. The regulation of noise typically is the responsibility of state and local governments through noise limits established by local ordinances and state regulations. For example, many cities and counties have established ordinances that limit construction noise levels at night and on weekends. It may be possible to obtain a noise variance from the jurisdictional authority in cases where the existing regulations would have a major detrimental impact on the project (note that Island County does not issue noise variances). WSDOT also evaluates traffic and transit noise as part of the NEPA/SEPA process when new terminals are constructed or substantial improvements are made. The Federal Highway and Federal Transit Administrations provide criteria for evaluating noise impacts from transportation sources. Refer to the *2006 WSDOT Traffic Noise Analysis and Abatement Policy*; *2011 WSDOT Traffic Noise Policy and Procedures*; and *Environmental Manual* Section 446.07(2). WSDOT uses these and other applicable criteria to evaluate proposed projects during project-level environmental reviews.

(2) Noise Effects

Terminal preservation and improvements identified in the Long-Range Plan may have significant noise related impacts during construction (e.g. pile driving, demolition, materials hauling, etc).

During project development and implementation, it is WSDOT's practice to work with the applicable cities and counties to minimize noise related construction impacts, as is practicable, and ensure compliance with local ordinances. Implementation of the Long-Range Plan is unlikely to cause noticeable changes to the noise levels associated with system operations. WSDOT studies indicate that the loudest source of noise at the terminals during operations is from passenger vehicle loading and unloading. Reducing vehicle noise may require noise barriers in front of homes (blocking scenic views) or converting the fleet to different vessel types, which is beyond the resources of the department. Noise compatible land use is another approach and involves cities and counties limiting new building permits and remodel approvals near ferry terminals, or requiring the incorporation of noise reduction standards in new or remodeled homes, thus transferring potential noise mitigation responsibility to owners and developers. Consider placement of speakers for terminal PA systems and their effect on noise levels in the vicinity of the terminal.

320.11 Water Quality

(1) Water Quality Issues

Stormwater runoff from highways and other paved surfaces (such as ferry terminals) has been shown to contain a range of pollutants including particulates and solids, nitrogen and phosphorus compounds, heavy metals, and oil and grease. These pollutants are directly related to vehicular use of the paved facilities and have the potential for adverse impacts on water resources that they drain into. Potential impacts resulting from these pollutants depend on a number of variables including: rainfall duration and intensity, the number of dry days preceding intense rainfall, surrounding land uses, air quality, vegetation types, spills on roadways, improperly disposed waste and fluids, maintenance activities, and health of the surrounding ecosystem.

Additional threats to water quality at WSF terminals include: hydraulic fluid leaks/ spills; sewage line cracks; contamination from fecal coliform/pet waste areas; and uncontrolled runoff from garbage and hazardous waste areas. Implement designs that address these environmental concerns. Provide containment around hydraulic lines and terminal hydraulics. Provide designated pet areas which either biologically treat pet waste or drain runoff to a treated stormwater outlet. This is necessary due to increasing Total Maximum Daily Load (TMDL) requirements with respect to fecal matter. Equip pet areas with pet waste collection stations (trash receptacles and plastic baggies for pet waste). Cover garbage, recycle and hazardous waste areas; collect runoff from these areas and route to a treated stormwater outlet. Refer to Section 560.07 for information on stormwater design.

(2) Water Quality Regulation

Several policies and regulations directly affect water quality and focus on the impacts of growth and development. These include the Federal Clean Water Act, the state's Water Pollution Control act, the Growth Management Act and Shoreline Management Act. Washington State Department of Ecology has established detailed water quality criteria (Chapter 173-201A WAC) intended to protect a variety of designated uses of state waters. Stormwater is regulated by Ecology through stormwater management regulations for construction and operations of facilities, and Ecology is responsible for implementing the National Pollutant Discharge Elimination System (NPDES) for shoreside actions. In addition, the WDFW have regulatory authority over specific activities such as ferry terminal cleaning, painting, general maintenance and repair, piling removal or replacement and marine geotechnical sediment test boring, through Hydraulic Project Approvals (HPA).

Ecology has issued a new WSDOT Municipal Stormwater General Permit that covers stormwater discharges from ferry terminals, and is scheduled to issue a new Industrial Stormwater General Permit that will cover stormwater discharges from ferry maintenance facilities. These permits have or will increase the performance requirements over the previous permits.

(3) Water Quality Impacts

Proposed demand management strategies are expected to minimize the holding area needed at the terminals. Consequently, this is expected to reduce or avoid the need for addressing additional pollution loading surfaces in the system.

During construction, implementation of a Temporary Erosion and Sediment Control (TESC) plan will typically be required. A Stormwater Pollution Prevention Plan (SWPPP) will outline the details of the proposed TESC measures and personnel responsible for their implementation.

Construction work will incorporate measures to reduce the potential for soil erosion and offsite sediment transport, risk of accidental spills, and risk of surface water contamination resulting from dewatering of excavations. A Spill Prevention, Control, and Countermeasures (SPCC) Plan will be implemented during construction to reduce and control any accidental spills or leaks from construction equipment. Include an SPCC Plan bid item in all contracts. BMPs will need to be implemented during construction of onshore terminal facilities, to prevent adverse impacts on surface water or ground water from the spill or leaching of hazardous materials, and for construction of in-water facilities.

320.12 Propwash, Vessel Wakes, and Sedimentation

Human activities on and near the shoreline can affect coastal sediments in a number of ways. Bulkheads and other shoreline armoring, and modifications to rivers and creeks, can cut off sources of sediment to the beach. Structures built out into and beyond the intertidal zone can affect the transport of sediment along the beach. Propwash and vessel wakes can cause shoreline erosion and affect nearby bottom slope and bottom sediments. These and other effects can lead to several adverse consequences:

- The availability of the beach as valuable intertidal aquatic habitat can be reduced.
- The value of the beach as a recreational resource can be reduced.
- The performance of the beach in dissipating wave energy can be reduced, leading to the potential for increased storm wave damage to upland infrastructure.

For this reason, it is important to consider the effect of any proposed project on the sources and transport of coastal sediments. Vessels slips should be located so as to avoid any adverse impacts due to propwash and vessel wakes.

All Waterside Development structural foundations shall be designed taking into account the impacts of erosion or scour, sediment transport and sediment deposition. See Chapter 330 for additional discussion regarding scour due to propeller wash.

320.13 Ecosystems and Protected Species

(1) Ferry System Ecosystem and Habitat

Puget Sound contains a wide variety of deepwater and nearshore habitats. These include rocky shores, sandy beaches, coastal lagoons, kelp and seagrass beds, large estuaries and salt marsh wetlands. Where sunlight penetrates the nearshore environment eelgrass, seaweed and plankton grow (typically from 0 feet MLLW to -30 feet MLLW with the most productive area between 0 feet MLLW and -20 feet MLLW). The eelgrass, seaweed and plankton provide important shelter and food for numerous invertebrates, herring, juvenile salmon and other fish, and diving birds.

The upland habitats adjacent to the terminals include urban city center, small towns, suburban and rural environments. A few of the more rural terminals still have remnant second or third generation stands of the Puget Trough coniferous forests that historically dominated the region.

(2) Protected Species

(a) Endangered Species Act

The Endangered Species Act (ESA) of 1973 provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. The lead federal agencies for implementing ESA are the U.S. Fish and Wildlife Service (FWS) and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS).

Species listed as endangered or threatened under the Endangered Species Act (ESA) in Puget Sound, and that could occur at WSF ferry terminals or along routes include the Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*), bull trout (*Salvelinus confluentus*), Steller sea lion (*Eumetopias jubatus*), marbled murrelets (*Brachyramphus marmoratus marmoratus*), and Southern Resident Puget Sound killer whale (*Orcinus orca*). The other listed whale and sea turtle species are typically found in off-shore coastal areas and are rare or absent in the ferry terminal areas.

ESA consultation is conducted on projects that are federally funded, permitted or on federal lands. Almost all WSF terminal construction projects entail either federal funding or federal permitting. Permitting by the Corps under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbor Act is required when projects involve some level of dredging or filling of navigable waters.

(b) Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) of 1972 calls for an ecosystem approach to natural resource management and conservation. The MMPA prohibits the take (i.e., hunting, killing, capture, and/or harassment) of marine mammals, and enacts a moratorium on the import, export, and sale of marine mammal parts and products. The primary authority to manage the Act belongs to the FWS and the U.S. National Oceanic and Atmospheric Administration (NOAA). The two agencies may issue permits under MMPA to persons, including federal agencies, that authorize the taking or importing of specific species of marine mammals.

In 1994, MMPA was amended to establish an expedited process by which citizens and agencies of the U.S. can apply for an authorization to incidentally take small numbers of marine mammals by "harassment", referred to as Incidental Harassment Authorizations or IHAs. WSF has obtained IHAs for relatively short-term activities that might inadvertently harass marine mammals. Most IHAs to date have involved the incidental harassment of marine mammals by noise.

(c) Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) of 1918 enacted legislation making it unlawful to pursue, hunt, take, capture, kill or offer for sale native migratory birds. The responsibilities of Federal agencies to protect migratory birds are set forth in Executive Order 13186. The U.S. Fish and Wildlife Service is the lead agency for migratory birds.

(3) In-Water Work Windows

In-water work windows are established by the WDFW. The dates are dependent on endangered species indigenous to the vicinity of the project site, which are to be identified by the U.S. Fish and Wildlife Service and others, in compliance with the Endangered Species Act together with permit conditions to be determined.

The time during which in-water demolition may occur may be as much as 7 months or as little as 1 month during a given year and typically falls between mid-July and mid-February. The start and end dates of the in-water work window are to be determined prior to the start of project construction.

WSF currently holds general HPAs which allow for minor maintenance activities at the existing ferry terminals. Projects falling under these current HPAs would not require additional approval from the WDFW.

(4) Ecosystem and Protected Species Impacts

Implementation of a reservation system may reduce the terminal area "foot-print" requirements of the ferry system both on land and over water, thereby reducing the quantity and scale of terminal improvements projected for the future. The result is a reduction of likely impacts to aquatic and terrestrial natural and cultural resources. Typical impacts from improvements to terminals include shading from overwater structures, underwater noise impacts from steel pile driving, and changes to the harbor line.

WSF follows a tiered approach for minimizing adverse impacts to protected wildlife, fish and their habitats. Through project design, construction scheduling and implementation planning, WSF first seeks to avoid potential adverse impacts to protected species and their habitat. If impacts are unavoidable, WSF works to minimize the magnitude and duration of the impacts to the extent feasible. Remaining impacts that are considered significant and adverse are mitigated to the extent feasible and in accordance with local, state and federal regulations.

WSF conducts in-water pile driving to maintain the safety of key facilities at ferry terminals. WSF/WSDOT is performing independent research and working jointly with other states and resource agencies to identify how noise works underwater, how fish, marine mammals and diving birds are affected by the noise, and what mitigation, if any, may be warranted. WSF/WSDOT also analyzes wake-wash and propeller scour of new vessels to identify and minimize impacts to the shore and nearshore habitat. Maximum vessels speeds are identified for transit near shorelines identified as sensitive to erosion.

320.14 Earth (Geology and Soils)

(1) Geologic Hazards

The Puget Sound region is geologically active. Numerous small earthquakes occur in the region annually. Periodically, larger earthquakes occur which, like the Nisqually earthquake of 2001, have the potential to damage manmade structures. The region also has areas with naturally occurring steep slopes or saturated unconsolidated soils. The steep bluffs along Puget Sound are susceptible to erosion from gravity, storm surges, and stormwater runoff. Liquefaction occurs when water-saturated sandy or silty soil loses strength during earthquake shaking (similar to quicksand). A related phenomenon, lateral spreading, occurs when liquefied soil moves laterally imparting additional forces on structure foundations. These can cause major structural failure if not properly accounted for. Liquefaction and lateral spreading only occur in water-saturated cohesionless soil of a particular gradation and composition. They can have a significant impact on bridges and other large structures, which may require expensive retrofitting or replacement to meet current seismic (earthquake) standards.

The Washington State Department of Natural Resources (DNR) has developed *Liquefaction Susceptibility and Site Classification Maps* which outline areas where liquefaction is most likely to happen. State and local governments develop hazard mitigation plans and delineate geologically hazardous areas as required by the Growth Management Act.

How climate change may affect the likelihood or impact of erosion and liquefaction is not yet well understood. However, with an expected rise in sea-level and increase in frequency of severe storm events, as described in *The Washington Climate Change Impacts Assessment* (The Climate Impacts Group, University of Washington, 2009), erosion along the shoreline would be expected to increase.

(2) Geologic Risks and Mitigation

Terminals already identified as having erosion related problems include Fauntleroy (erosion) and Southworth (bluff erosion). Terminals that may be susceptible to seawall problems from storm surges include Mukilteo, Seattle and Fauntleroy.

The current DNR maps indicate that several WSF terminals are within moderate to high liquefaction susceptibility areas. And, based on the age of the facilities, some of the ferry terminal structures do not meet current design standards for earthquake or liquefaction. The susceptibility of the area to erosion, storm surge damage, liquefaction and sub-standard design of existing structures will have to be taken into consideration during development of any terminal improvement project. Soils that are susceptible

to liquefaction may require retrofit measures such as ground stabilization, selection of deeper foundations, different types of foundations, and/or selection of appropriate structural systems to accommodate anticipated displacements.

For the construction of new terminals, relocated terminals, and relocated terminal elements, geologic risks (and associated cost impacts) can be mitigated by conducting geotechnical borings and other subsurface investigation during the preliminary design phase.

320.15 Hazardous Materials

(1) Regulations

Procedures for reporting, handling, removing, treatment, and/or disposal and transport of contaminated soil, ground water, and marine sediment will follow guidance in the *Environmental Manual* M 31-11 and all other appropriate regulations. Workers are required to have special training to handle hazardous materials. Special handling procedures and disposal locations are required depending on the type and classification of the hazardous material.

(2) Potential Effects

The presence of hazardous materials within the project area will increase exposure to risk and potential liability associated with site cleanup. The encounter of contaminated materials may increase project costs and/or result in construction delays.

Potential hazardous materials include but are not limited to the following:

- Underground and above ground storage tanks
- Electrical transformers and other oil-filled equipment containing regulated substances
- Petroleum products in the soil and groundwater
- Asbestos-containing materials
- Lead-based paint
- Polychlorinated biphenyls (PCBs)
- Heavy Metals
- Mercury
- Creosote-treated timber and piles

(3) Mitigation

Identify areas of environmental concern located within and adjacent to the project area and assess the potential effects of construction on contaminants that may be present. Conduct subsurface investigations and pre-characterization of potentially contaminated soil, groundwater and marine sediments as warranted. This will enable designers to anticipate project impacts and to factor in the potential need to address hazardous materials into project development decisions.

Where feasible, minimize construction in and disturbance of areas of known and suspected contaminated materials. This may involve relocating certain terminal elements and/or modifying the design and construction techniques (foundation type, utility depth, extent of over-excavation, etc.) to reduce the amount of disturbance of contaminated materials.

Where contaminated materials are encountered, employ the following strategies as applicable and as required:

- Develop a site specific health and safety plan with regard to contaminated material exposure.
- Utilize 40-hour trained personnel in the vicinity of the proposed work.
- Develop and implement TESC, SWPP, and SPCC plans to ensure proper control of surface and ground water during construction.
- Implement site specific measures to minimize risks of exposure to contaminated materials. These may include use of construction zone setbacks, restricting public access, and prompt removal of any contaminated material.
- Conduct a comprehensive survey of on-site structures to determine the presence of hazardous building materials including asbestos and lead-based paint in accordance with applicable federal, state, and local requirements.
- Remove underground storage tanks, including oil/water separators in accordance with Ecology requirements; similarly, remove any contaminated soils associated with the tanks in accordance with applicable requirements.
- Stockpile suspected contaminated materials on-site for sampling, testing and appropriate analyses for profiling and disposal.
- Store, sample and treat dewatering fluids in temporary storage tanks as required.
- Line and cover stockpiles to prevent runoff or drainage to the surface.
- Remove pilings preserved with creosote according to WSF BMPs and DNR standard practices.
- Conduct hauling of any contaminated material by licensed transport.
- Provide hazardous materials lockers for storage of waste oil and other hazardous materials. See Section 440.06 for more information on hazardous materials lockers.

320.16 Traffic/Congestion

Normal operation of auto ferries has an effect on congestion and circulation on local streets, and access to residents and businesses as a result of queuing on road shoulders, vehicle off-loading, parking, pedestrians and traffic safety measures in the communities where the terminals are located. Inadequate terminal sizing and configuration negatively affects traffic related impacts to the community.

(1) Potential Effects

The proposed reservation system is expected to reduce the traffic impacts on the local communities of vehicles queuing for the ferries. Implementation of the plan will result in minor increases in system capacity and efficiency. This will be accomplished by replacing some of the retiring vessels with vessels that are slightly larger. This vessel substitution increases normal vehicle carrying capacity on the Anacortes/

San Juan Islands route, Mukilteo/Clinton, Seattle/Bremerton, Fauntleroy/Vashon/Southworth, and Point Defiance/Tahlequah routes. The increase in vessel offload traffic of the replacement vessels is expected to be minimal on most routes. On routes with potentially significant increases in offload traffic, WSF will evaluate the potential traffic impacts to determine if mitigation measures are necessary.

To reduce the current traffic congestion and safety concerns caused by vehicles queuing on Fauntleroy Avenue near the Fauntleroy terminal, a reservation system is being considered for the route pending future legislative action.

In the project development process, WSF works with the communities where the terminals are located to identify potentially significant traffic related impacts. WSF minimizes traffic related impacts to the communities by adequate sizing of terminals and their holding areas, configuring terminals to maintain pedestrian and vehicle safety, and by coordinating signalization and operational measures.

320.17 Visual Quality

Visual perception and experience are important components of environmental quality. It is important to consider the visual resources of the affected environment and the degree of change in those visual resources that would occur as a result of the proposed project. The affected visual environment contains multiple landscape components that include topographic features (e.g. mountains and valleys) and land cover. Land cover includes water, vegetation, and the constructed environment. Landscapes can be categorized in distinctive units of similar visual resources based on patterns created by dominance, scale, diversity, and the continuity of elements in the landscape. The terminal design should be compatible with the surrounding area's character by sensitive consideration of scale, building materials, and landscaping. Landscaping may be incorporated to screen and/or soften views of structures and help reduce the scale of the proposed improvements. Locate lighting to avoid direct visibility from surrounding neighborhoods and public streets. Where this cannot be avoided, provide screening to shield or filter the light source.

320.18 Tribal Resources and Treaty Rights

(1) Tribal Treaty Rights and Access to Harvest

Almost all WSF terminal construction projects entail either federal funding or federal permitting. Permitting by the Corps under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act is required when projects involve some level of dredging or filling of navigable waters. All terminal projects are also located in or adjacent to the Usual and Accustomed (U&A) fishing grounds of one or more treaty Tribes. Tribal treaty fishing rights consist of several components, including a right to share in the allowable harvest of fish with non-Tribal fishers *(USA v. Washington 1974)*, and rights to fish, gather and hunt in the traditional U&A areas of each Tribe – a right to engage in specific activities in specific places.

The federal courts have decided that where the issuance of a 404 permit has more than a de minimis or discountable effect on the exercise of the right to fish, gather or hunt in a U&A area, the affected Tribe(s) may object to the issuance of the permit on the grounds that the Tribe(s) has a superior right to fish or gather in the area and

may not be displaced by the dredging or filling of that area without their consent *(Muckleshoot, Suquamish v. Hall 1988)*. A project may not have significant impact on the environment, no adverse effect, may be NEPA/SEPA exempt, and not covered by a nationwide permit or a programmatic permit, but it may still have more than de minimis effect on the right to fish because a Tribal fisher may have fished in the area one time in the past as asserted by a Tribe or group of Tribes.

As a federal agency, the Corps has a fiduciary obligation to honor Treaty Rights. This relationship has resulted in the Corps requiring extensive analysis of adverse impact(s) to federally adjudicated Treaty rights. When the impact(s) cannot be successfully mitigated the Corps has required a mitigated settlement to be negotiated with the Treaty Tribe(s). The successful mitigated settlement agreement has taken the form of a Memorandum of Agreement (MOA). If required, an MOA would be negotiated with the Treaty Tribe(s), and could include funding for fisheries enhancement, salt water environment enhancement, or a cash settlement. When the Corps is given evidence of such agreement it then will move forward with issuance of a permit. An increase in overwater coverage at any of the existing terminals could also result in the same requirements.

(a) Potential Effects (Mukilteo Terminal Example)

The proposed terminal improvement at Mukilteo, which would involve a relocation of the terminal, may have the potential to impact Treaty U&A fishing grounds, and to relocate the Mukilteo terminal from its current location would require a Corps permit. Under these conditions the project team would need to determine if potential for impacts exists. If this is the case, then mitigation options would need to be assessed and it determined if a MOA is required.

320.19 Cultural, Historical, and Archaeological Resources

(1) Regulations

Cultural, historical and archaeological resources are regulated under federal, state and local laws. Section 106 of the National Historic Preservation Act requires any project that has a federal nexus (involves federal funding, federal permits or is on federal lands) to consider the effects of the project on historic or cultural resources. Section 106 also requires consultation with Federally Recognized Tribes, the State Historic Preservation Officer, Certified Local Governments, interested stakeholders, and the public. The Department also affords protection to historic sites, and requires that they be avoided unless the impact of the project is determined to be de minimis or there is no prudent or feasible alternative to using the site.

In Washington State, WAC 25-12, RCW 27.34.200, and Governor Executive Order 05-05 provide protection to historic sites and specify requirements for obtaining archaeological excavation permits. SEPA and NEPA require that impact to historic and cultural resources be evaluated in the environmental review process. In addition, local governments often maintain historical and cultural resource lists within their jurisdictions, and commonly have ordinances protecting these resources.

(2) Potential Effects

WSDOT completed an inventory of all WSF terminal buildings in 2009, and found none eligible for inclusion on the National Register of Historic Places under Section 106 of the National Historic Preservation Act of 1966. Based on this inventory proposed terminal projects that involve modifying the existing structures are not anticipated to impact any significant historical structural resources, such as docks, dolphins, or terminal structures. However, such construction may impact the integrity of significant historic properties adjacent to or near ferry terminals, and such impacts must be considered during the planning process.

Ground disturbing activities may impact unknown archaeological properties, even at previously developed terminal locations. All WSF projects require review by the WSF Cultural Resources Specialist. The WSF CRS is the qualified person in the agency to make decisions as to the level of review necessary for any project.

320.20 Park and Recreation Lands

(1) Regulations

Park and recreation resources are valued and vital to the health and livability of communities. Section 4(f) of USDOT Act of 1966 requires that transportation projects avoid, minimize or mitigate impacts to public parks and recreation areas as well as historic sites. Compliance with Section 4(f) is ensured in the SEPA/NEPA process of projects.

(2) Potential Effects

Some of the ferry terminals are located in or adjacent to parks and recreation lands, and therefore improvement projects at the terminals could have the potential to impact these areas. Actual impacts to and mitigation for parks recreational lands will be evaluated at the individual project level.

320.21 Department of Natural Resources Lands

(1) Operation Effects on Aquatic Land Management

State aquatic lands are under the jurisdiction of the Department of Natural Resources. The aquatic lands that have been reserved for landings, wharves, streets, and other conveniences of navigation and commerce are demarcated by harbor lines. A change in shape or size of the aquatic land used for ferry terminals operations could require revisions to the harbor line. Article XV of the Washington State Constitution describes the requirements for harbor line revisions. It takes between 12 and 18 months and three public hearings to revise a harbor line.

Implementation of the plan may require harbor line revisions at terminals where preservation or capital improvements are programmed. Identification of needed harbor line revisions will occur at the individual project level.

320.22 Resource Agency and Tribal Coordination

(1) Development Process

In addition to the groups and processes used in the public outreach section of the WSF *Long Range Plan* 2009, Federal and State resource agencies with jurisdictions and funding authorities were briefed on the plan in a letter and meeting to take their comments and input. The resource agencies agreed that WSF should include a planning level environmental analysis in the plan. The agencies that were represented at the meeting were the Federal Transit Administration, National Marine Fishery Services, WDFW, Washington Department of Natural Resources, Puget Sound Clean Air Agency, and Washington Department of Ecology.

Letters were also sent to Puget Sound Tribes to brief them about the plan. Each participating agency and Tribe received a copy of the draft plan for review and comment. In addition, meetings were held with the Swinomish tribe, Suquamish Tribe, and Lummi Nation, to solicit comments and input.

The *Long-Range Plan* must demonstrate consistency with or conformity to any of the following existing plans:

- Terminal master plan documents
- Referenced Biological Assessment
- Project Specific Biological Assessments for ferry terminals
- Clinton Eelgrass Mitigation and Monitoring
- Eelgrass Surveys at ferry terminals
- Tribal U&A in the Puget Sound
- Local or Regional land use or comprehensive plans
- Local Shoreline Master Programs
- Regional Transportation Plans
- TIP/SIP (Transportation Improvement Program/State Implementation Plan
- WSDNR harbor lines
- Edmonds Crossing EIS and ROD
- Mukilteo Multimodal Final EIS
- New 144 Auto Ferry, SEPA Checklist
- Environmental Discipline Reports and Technical Memoranda for various ferry terminal projects.

330.01 General
330.02 References
330.03 Design Specifications Matrix
330.04 Design Considerations
330.05 Vessels
330.06 Tidal Information
330.07 Slips
330.08 Berthing and Mooring Criteria
330.09 Wave, Flood, and Coastal Storm Loading

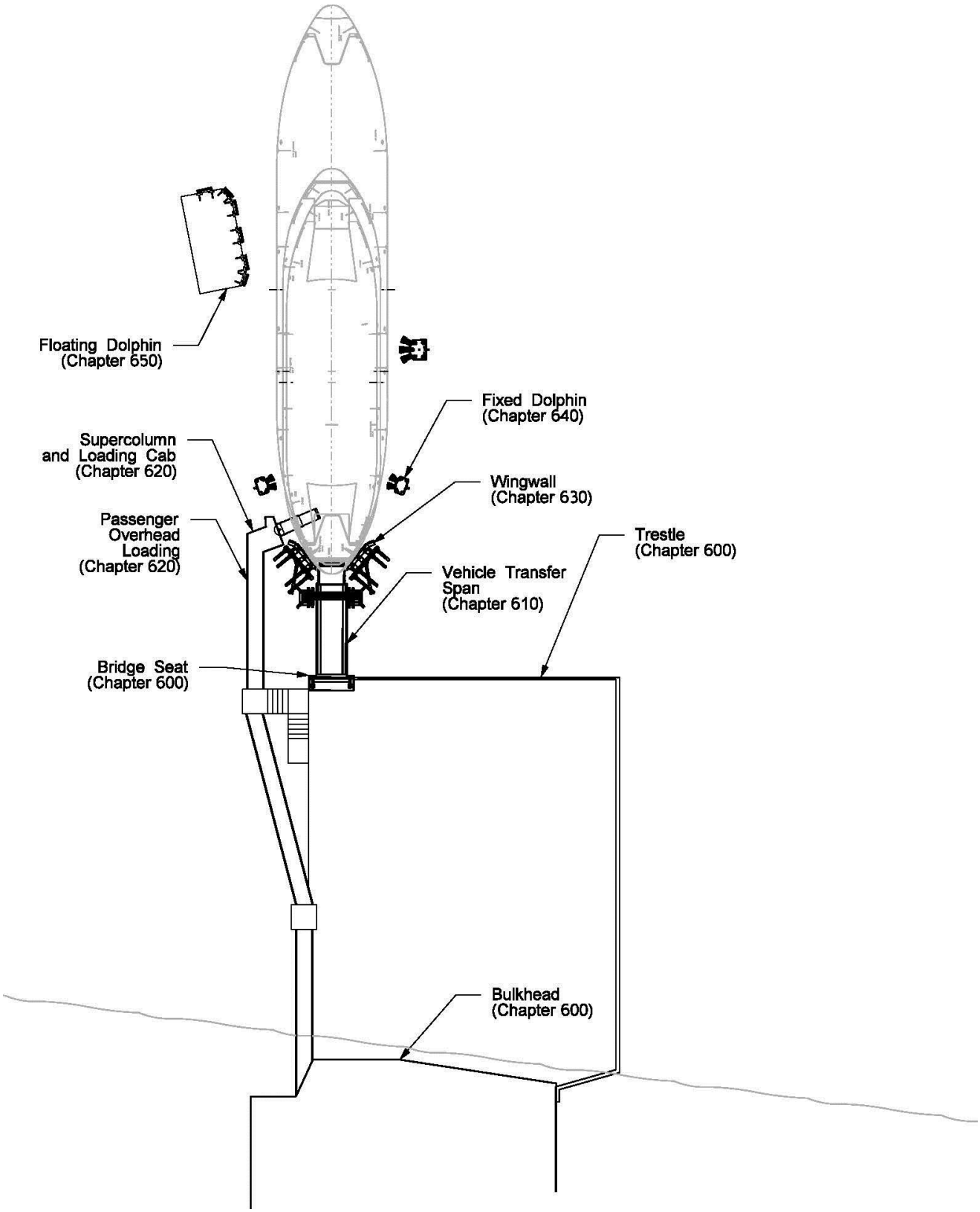
330.01 General

This chapter identifies the major marine structures associated with a ferry terminal along with the specifications used for their design. Refer to Exhibit 330-2 for a sample layout of the marine structures and the chapters covering their design.

This chapter also provides guidelines for designing the ferry terminal slip berthing structures (wingwalls, fixed dolphins, and floating dolphins) in addition to vessel and tidal information relevant to their design. Wingwall and dolphin design are discussed in more detail in Chapters 630, 640, and 650.



Vashon Ferry Terminal Slip 1
Exhibit 330-1



Example Marine Structures Layout
Exhibit 330-2

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
630	Wingwalls
640	Fixed Dolphins
650	Floating Dolphins

330.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

28 CFR Part 35 *Nondiscrimination on the Basis of Disability in State and Local Government Services*

33 CFR Part 66 *Private Aids to Navigation*

33 CFR Part 154 *Facilities Transferring Oil or Hazardous Material in Bulk*

33 CFR Part 165.1317 *Security and Safety Zone; Large Passenger Vessel Protection, Puget Sound and adjacent waters*

49 CFR Part 39 *Transportation for Individuals with Disabilities – Passenger Vessels*

49 CFR Part 661 *Buy America Requirements – Surface Transportation Assistance Act of 1982, as amended*

WAC 296-56 *Safety Standards – longshore, stevedore and related waterfront operations*

WAC 296-56-60115 *Other protective measures*

WAC 296-876 *Ladders, portable and fixed*

RCW 47.28.030 *Contracts — State forces — Monetary limits — Small businesses, veteran, minority, and women contractors — Rules — Work on ferry vessels and terminals, ferry vessel program*

(2) Design Codes and Specifications

AASHTO LRFD *Bridge Design Specifications* (AASHTO LRFD), American Association of State Highway and Transportation Officials, Washington, D.C.

AASHTO *Guide Specifications for LRFD Seismic Bridge Design* (AASHTO Guide), American Association of State Highway and Transportation Officials, Washington, D.C.

AASHTO *Guide Specifications for Bridges Vulnerable To Coastal Storms*, American Association of State Highway and Transportation Officials, Washington, D.C.

AASHTO LRFD *Movable Highway Bridge Design Specifications* (AASHTO Movable), American Association of State Highway and Transportation Officials, Washington, D.C.

AASHTO LRFD *Guide Specifications for the Design of Pedestrian Bridges* (AASHTO Pedestrian), American Association of State Highway and Transportation Officials, Washington, D.C.

ASCE *Minimum Design Loads for Buildings and Other Structures, ASCE/SEI 7-10*, 2010, American Society of Civil Engineers, Reston, VA.

ASCE *Seismic Design of Piers and Wharves, ASCE/COPRI 61-14*, 2014, American Society of Civil Engineers, Reston, VA.

ASCE *Flood Resistant Design and Construction, ASCE/SEI 24-14*, 2014, American Society of Civil Engineers, Reston, VA.

FEMA *Coastal Construction Manual: Principles and Practices of Planning, Siting, Designing, Constructing, and Maintaining Residential Buildings in Coastal Areas, FEMA P-55*, 2011, Federal Emergency Management Agency, Washington D.C.

Bridge Design Manual LRFD, M 23-50

Design: Moorings, Unified Facilities Criteria (UFC) 4-159-03, October 2005, Department of Defense, Washington D.C.

Design: Piers and Wharves, UFC 4-152-01, July 28, 2005, Department of Defense, Washington D.C.

International Building Code, International Code Council, Washington D.C.

General Special Provisions, Washington State Department of Transportation, Olympia, WA.

Design Manual M 22-01

Plans Preparation Manual M 22-31

Private Aids to Navigation, WSF Terminal Engineering Library

Region General Special Provisions, WSF

General Structural Notes, WSF

Safety Management System (SMS) Manual, United States Coast Guard (USCG)

Shoreline Master Program (SMP) Handbook, Washington State Department of Ecology

Standard Specifications for Road, Bridge, and Municipal Construction (*Standard Specifications*) M 41-10

(3) Supporting Information

Life Cycle Cost Model (LCCM), WSF

330.03 Design Specifications Matrix

Terminal Structure	AASHTO LRFD Specifications[1]	AASHTO LRFD Movable Bridge Design Specs	International Building Code	WSF *Terminal Design Manual* [2]	Washington Administrative Code 296-56
Bulkhead	X				
Trestle	X			X	
Transfer Span & Apron	X	X		X	
Gangway/Gangplank	X	X		X	
Fixed Pedestrian OHL	X			X	
Movable Pedestrian OHL	X	X	X	X	
Terminal Buildings & Toll Booths			X	X	
Ladders/Stairs - Employee			X		X
Stairs - Public			X		
Guardrail/Railing – Employee	X		X		X
Guardrail/Railing – Public	X		X		
Wingwalls				X	
Dolphins				X	

[1] AASHTO LRFD Specifications include the following:

Guide Specifications for LRFD Seismic Bridge Design, *LRFD Bridge Design Specifications*, and *LRFD Guide Specifications for the Design of Pedestrian Bridges*

[2] WSF *Terminal Design Manual* guidelines are intended to supplement design codes where applicable.

Structural Design Specifications Matrix
Exhibit 330-3

330.04 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible.

Additionally, 49 CFR Part 39 prohibits owners and operators of passenger vessels from discriminating against passengers on the basis of disability, requires vessels and related facilities to be accessible, and requires owners and operators of vessels to take steps to accommodate passengers with disabilities.

Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessel security requirements, and additional information pertaining to marine design. Below are links to relevant sections by topic. Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for Transportation Worker Identification Certification (TWIC) and Sensitive Security Information (SSI).

- MARSEC Levels: 310.04
- Vessel Security: 310.05
- Waterside Structures: 310.09
- Access Control/Restricted Areas/TWIC: 310.10
- Signage: 310.13

(3) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

(4) Operations and Maintenance

Consult with WSF Operations and Terminal Engineering Maintenance for consideration of the following operations and maintenance issues:

- Minimize repair and maintenance required during the design life.
- Specify paint colors on the darker side to help reduce oxidation process.
- Provide bird deterrence as necessary
- Accommodate navigational aids as required
- Consider construction methods and phasing impacts to vessel and terminal operations.
- Provide corrosion protection of steel piles as required to achieve the design life specified in the *Life Cycle Cost Model* (LCCM).
- Accommodate accessibility for repair crews
- Accommodate inspection access for federal regulations

Note that bird deterrence can include bird wire and bird point systems, but structures can also be designed so as to not provide nesting opportunities for birds.

Additionally, design structures and facilities so that maintenance activities can be completed in compliance with OSHA/WISHA requirements.

(5) Vessel Restraint

WSF has been investigating the development of a vessel restraint system as one means of reducing fuel consumption while the vessel is docked and unloading and loading passengers and vehicles. Currently, vessel captains apply significant engine thrust pushing the vessel against the wingwalls and dolphins to ensure the vessel does not drift away from these structures. By developing a mechanical means to hold the vessel in position, this thrust can be reduced and significant fuel and cost savings can be achieved. One system currently under study is a vacuum-based automated mooring technology.

Where vessel restraint has been identified to be a feasible and cost-effective component of a slip's infrastructure, incorporate the appropriate system into the berthing aid arrangement.

(6) Proprietary Items

WSF uses competitively acquired products to fulfill the requirements of a contract wherever feasible to help achieve the lowest price, the best quality, and the most efficient use of resources. There are instances in which competitive bidding may not or cannot be provided and a specific proprietary product is allowed. Refer to Section 220.07(2) for limitations on the use of proprietary items.

(7) Long Lead Time Items

Consider potential long lead time items for the contractor to procure in both the design and the construction schedules. Many long lead time items will be shop-fabricated and assembled off-site prior to delivery for installation. Include a thorough shop drawing preparation submittal and review process for these items. Also the requirement of Federal Funding Partners to buy American-produced steel to meet the Buy America requirements per 49 CFR Part 661 for steel products may require additional time due to the mill rolling schedules of the various domestic steel manufacturers. This procurement process could take anywhere from six to nine months. Other strategies to accommodate long lead times include advanced purchase, using WSF stock, and delay of the contract to allow for procurement.

Typical long lead time items include:

- Steel pipe piles
- Precast prestressed concrete piles
- Precast prestressed concrete deck members
- Marine fenders
- UHMW polyethylene rubbing faces
- Wingwall timbers
- Hydraulic lift cylinders, pumps and valves for the VTS and OHL systems
- Sheaves and blocks
- Hoist motors
- Steel chains for floating dolphins

(8) Design Life

Design life is based on the current *Life Cycle Cost Model* (LCCM) as required by the Washington State Office of Financial Management (OFM). Refer to Table 1 for the design life of new structures (as of 2007) and Table 2 for design life of structures prior to 2007, in the 2010 *Life Cycle Cost Model* Update (2010 LCCM) for information on when existing marine structures and their systems are due for replacement. Confirm design lives given below are consistent with the current LCCM. Replacement life may be reduced due to functional obsolescence. Replacement life of berthing structures also may be reduced due to damage from vessel impact.

(9) Corrosion Mitigation

Corrosion is the primary factor in the life span reduction of a structure in the marine environment. For those structural components that rely on steel to provide strength, develop a corrosion protection program (including coatings and/or reserve material) to meet their design lives as set forth in the LCCM. Provide a plan for preserving the corrosion protection system for the design life of the structure. Base design on the following estimated corrosion loss rates for bare steel:

- Atmospheric zone: 0.004 inch per year
- Splash zone: 0.006 inch per year
- Tidal zone: 0.004 inch per year
- Submerged zone: 0.003 inch per year
- Other zones: 0.001 inch per year

Consider the site- and structure-specific corrosion protection methods below for use in the design, based on life cycle costs.

(a) Reinforced Concrete Shafts and Cast-in-place Concrete Piles

- Use a minimum 3-inch concrete cover for reinforcing steel.
- Use standard WSDOT Class 4000P concrete mix.
- Use epoxy-coated steel reinforcement.

(b) Steel Pipe Piles

- Coat all piles in accordance with the pile coating system specified in the current WSF Region General Special Provisions covering painting of steel piling. The bottom 20 feet of pile may be uncoated
- The minimum required design thickness of the piles shall be shown in the Contract Plans for the various corrosion zones listed above.
- Coatings will be maintained based on the results of required inspections performed every two years.

(c) Steel Framing

- Coat all steel accordance with the coating system specified in the current WSDOT *Standard Specifications* as supplemented by the WSF Region General Special Provision covering painting of steel.

(d) Cast-in-place and Precast Concrete

- All cast-in-place superstructure members (including pilecaps) that are not prestressed shall meet the serviceability requirements of Paragraph 5.7.3.4 of AASHTO LRFD *Bridge Design Specifications*. Use an exposure factor γ_e of 0.60.
- Precast prestressed structures shall be designed for zero net tension for service load combinations which include dead load and live load.
- In non-prestressed concrete, the concrete cover shall be 3 inches for all reinforcing steel. For prestressing steel in its effective zone, 2 inches of concrete cover is allowed. Prestressing is not fully effective at the end of a beam and therefore the cover should be 3 inches at the end of the beam or panel.
- Use standard WSDOT concrete mixes.
- Use epoxy-coated steel reinforcement.

(10) Scour and Mudline Elevations

Determine mudline elevations for structural and geotechnical design from line soundings and predicted scour over the life of the structure. Consider the effects of pile removal activities (including clam shelling of timber piles and pile stubs) and scour coincident with or adjacent to the piles or shafts in establishing the design mudline elevations for the structures at the start and end of their design life. Consider the effects of changing design mudline elevations on the performance of the structures (in terms of strength and displacement) over their design life. In general, when clam shelling occurs at the location of new piles, discount the top five feet of soil based on the assumption it is disturbed. Scour is caused by ferry vessel propeller wash and tidal currents. The estimated scour depths are a function of soil properties and past scour at the locations of the structures. The pile removal activities and scour effects are not additive (i.e., when clam shelling and scour both occur, use the maximum discounted soil depth). If a more accurate analysis of scour is warranted the WSF Maintenance group has annual records at all slips available for review.

Consult the WSDOT Geotechnical Branch to review these guidelines and to determine whether less or more soil should be discounted based on the soils at the location of the structure under consideration.

(11) Geotechnical Requirements

Design geotechnical elements in accordance with the Geotechnical Recommendations provided by the WSDOT Geotechnical Branch. The Geotechnical Recommendations will typically include:

- Site-specific seismic design
- Liquefaction and lateral spreading
  - Slope stability
  - Downdrag forces
  - Axial capacity of foundation elements
  - Input data for L-Pile lateral analysis
  - Group reduction factors due to pile spacing
  - Lateral forces for bulkhead design
  - Constructability recommendations including type and capacity of pile driving equipment and use of cutting shoes.

(12) Materials Specification

Utilize materials that are in accordance with the requirements of the WSDOT *Standard Specifications* and WSF *General Structural Notes* and *Region General Special Provisions*.

Make use of WSF stockpiles of materials where possible; however Buy America and Buy American requirements need to be addressed before approval to use stockpiled materials is allowed. Early consultation with HQ Design ASDE is recommended. State force labor limits also apply (refer to RCW 47.28.030 for more information).

For material requirements of federally funded projects including the requirement for American-made steel refer to 49 CFR Part 661. See Section 220.07(3) Buy America and Buy American, for additional information.

(13) Miscellaneous Considerations

Use standard WSF structures where appropriate.

(14) Right of Way and Sundry Site Plans

Right of Way Plans are the official state documents used as the basis to acquire real estate and other property rights for roadways. It is the responsibility of the region to prepare plans for the acquisition of rights of way (R/W), including easements, permits, and any substantiating documentation necessary for completion of the plans. Verification of ownership of existing R/W is also required.

A Sundry Site Plan is used to map property that cannot be shown on a Right of Way Plan such as ferry terminals, wetlands mitigation sites, park and ride lots, stockpile sites, and stormwater retention or other reclamation sites.

Both Right of Way Plans and Sundry Site Plans convey legal information regarding property boundaries. Right of Way Plans are typically based on roadway alignments whereas Sundry Site Plans are not based on roadway alignments. When the boundaries of an existing ferry terminal are modified, the corresponding Right of Way Plans and Sundry Site Plans must also be modified. The Sundry Site Plan contains all terminal property information with the exception of property on highway right of way. Refer to the WSDOT *Plans Preparation Manual* for additional information regarding Right of Way and Sundry Site Plans. To obtain title reports or determine if any acquisition, easements, leases or right of entry agreements may be needed for the project, contact the WSDOT regional or headquarters Real Estate group.

WSDOT has decision authority on state right of way in unincorporated areas and within cities below a specified population as set forth in the WSDOT *Design Manual*. WSDOT also maintains decision authority in limited access areas. Obtain approval through the local WSDOT region and the HQ Right of Way Office for modifications to state right of way in unincorporated areas. Coordinate with both WSDOT and the local jurisdiction for improvements and any associated permit requirements within incorporated areas.

(15) DNR Leased Property

WSF leases offshore state-owned land through the Washington State Department of Natural Resources (DNR) at several existing terminals. A DNR authorization to use state-owned aquatic lands is required if projects will occur on or over state-owned

aquatic lands. The use of this land is through a DNR authorization that serves as a legal contract that outlines the terms and conditions of use and conveys certain property rights to the user (WSF) in exchange for rent. WSF/WSDOT is responsible for contacting the DNR early in the design process to determine any requirements for attaining or altering existing leases. Coordinate with the WSDOT Right of Way Branch on issues regarding DNR leased property.

330.05 Vessels

(1) Design Vessels

Exhibit 330-4 provides a summary of the design vessels for each of the WSF ferry terminals. Design vessels are broken out into two categories.

- Use Category I includes vessels that will typically use the terminal. These vessels will be used during all operating conditions and will be moored overnight at terminals that have mooring facilities.
- Use Category II includes vessels that will be utilized as substitutes for Category I vessels during planned maintenance activities. Vessels will be infrequently moored overnight at terminals that have mooring facilities.

Terminal	Jumbo Mark II	Jumbo	Super	Olympic	Issaquah 100/ Issaquah 124	Evergreen State	Hiyu	Kwa-di Tabil
Anacortes			I	I	I	II		II
Bainbridge Island	I	II						
Bremerton		I	I	I	I			
Clinton				I	I			
Coupeville								I
Edmonds	I	I	II	II	II			
Fauntleroy					I	I		II
Friday Harbor			I	I	I	I	II	II
Kingston	I	I	II	II	II			
Lopez			I	I	I	I	II	II
Mukilteo			II	I	I	II		II
Orcas			I	I	I	I	II	II
Point Defiance						II	II	I
Port Townsend								I
Seattle	I	I	I	I	I			
Shaw			I	I	I	I	II	II
Southworth					I	I		II
Tahlequah						II	II	I
Vashon					I	I		II

Design Vessels
Exhibit 330-4

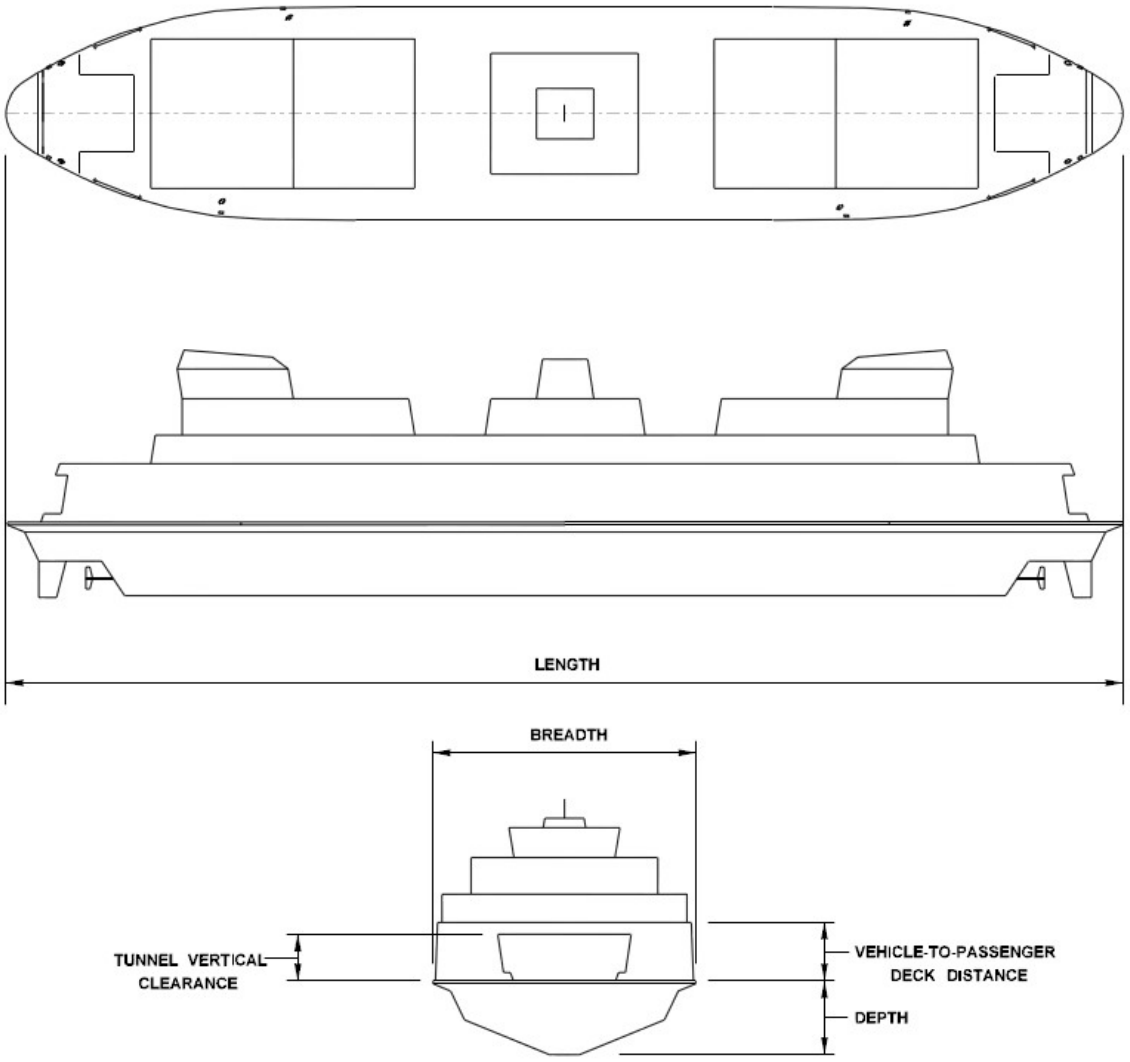
(2) Vessel Particulars

Refer to Appendix O and Exhibit 330-6 for design vessel particulars. Design particulars are the dimensional, capacity and other properties of the design vessel, especially those that are required for the design of the facilities and structures the vessel uses. These include the vessel's displacement, length, beam, draft, freeboard, passenger capacity and vehicle capacity. The displacement is a function of the vessel's weight, the capacities of its fuel and water tanks as well as its passenger and vehicle capacities. While the vessel's length and beam are independent of the displacement, the draft is directly proportional and the freeboard is inversely proportional to the displacement. The vessel's draft is critical to the design of a slip to ensure adequate clearance between the vessel's keel and engines and the slip's mudline. The freeboard is a primary factor in the design of tide-dependent structures such as the vehicle transfer span, overhead loading, and tie-up slip gangplank systems as well as the wingwall and dolphin rubfaces.

Some particulars will vary as a result of the different levels of loading a vessel is subject to. The most common condition used for design is termed the Operational Vessel (or Heavy Vessel) which is defined as tanks at full capacity and the full capacity of vehicles and passengers for which the vessel is designed and licensed. However, a vessel will frequently be empty of vehicles and passengers and have either full or partially full tanks. This condition is termed the Lay-up Vessel and results in the highest freeboard which, when coupled with the highest design tide, gives the maximum vessel deck elevation. The following table Exhibit 330-5 illustrates the two loading conditions and their uses in the design of terminal facilities. Operations staff will provide guidance as to which loading condition(s) are to be used for the design of particular facilities.

Loading Condition	Definition	Design Elements
Operational Vessel	Full Tanks Full Passenger Load Full Vehicle Load	Operating Slip Landing Aid Design Energy Low Tide Operational Range Operating Slip Mudline Elevation
Lay-up Vessel	Half-full or Full Tanks No Passengers No Vehicles	Tie-up Slip Landing Aid Design Energy High Tide Operational Range Tie-up Slip Mudline Elevation Night Tie-up Mooring Range

Vessel Conditions
Exhibit 330-5



Vessel Diagrams
Exhibit 330-6

(3) Vessel Utilities

Exhibit 330-7 identifies the type of vessel utilities provided at each WSF terminal. Refer to utility criteria below for utilities to be provided. See Chapter 560 Site Utilities for additional information.

Terminal	Potable Water	Sewer Pump-out	Solid Waste	Shore Power	Vessel Backfeed	Fueling Method
Anacortes	X	X	X	X	X	Truck
Bainbridge Island	X			X	X	Pier 15
Bremerton	X			X	X	Truck
Clinton	X			X	X	Truck
Coupeville				X	X	Truck
Edmonds	X	X	X	X	X	Pier 15
Fauntleroy	X	X	X	X	X	Truck
Friday Harbor	X	X	X	X	X	Truck
Kingston	X			X	X	Pier 15
Lopez				X	X	N/A*
Mukilteo	X	X	X	X	X	Truck
Orcas				X	X	N/A*
Point Defiance	X	X	X	X	X	Truck
Port Townsend	X	X	X	X	X	Truck
Seattle	X	X	X	X	X	Pier 15
Shaw				X	X	N/A*
Southworth	X			X	X	Truck
Tahlequah				X	X	Truck
Vashon	X			X	X	Truck

*No fueling takes place at terminal. Vessels are fueled by truck in Anacortes or Friday Harbor.

WSF Ferry Terminal Vessel Utilities
Exhibit 330-7

(a) Potable Water

Provide one domestic water line per slip for filling freshwater tanks. Most vessel freshwater systems utilize 4-inch pipe. Size the shore-side freshwater fill piping to be consistent with the terminal service piping, usually 1½-inch or 2-inch. The vessels will be provided with the necessary fittings to connect to the size provided on the transfer span. Connect to the municipal system. See Section 560.04 Potable Water for additional information.

Incorporate in each transfer span domestic water line a backflow preventer in a heated enclosure or room near the transfer span hinge line. As an alternative, the backflow preventer may be protected from freezing with heat tape and insulation.

(b) Sewer Pump-out

Provide one 4-inch sewer pump out per slip. Connect to municipal system. Verify discharge rate with respect to the existing system capacity with local sewer district. See also Section 560.04 Sanitary Sewer for additional information.

(c) Solid Waste

Consider combining vessel solid waste collection area with terminal building garbage collection area. Provide vehicular service access to the collection area(s).

(d) Shore Power

Provide one 200-amp, 480-volt service connection per slip. Terminals designed for Jumbo and Jumbo Mark II design vessels require two 200-amp, 480-volt service connections per slip. See Section 560.09 Site Power for additional information.

(e) Shore Power Backfeed

Provide one vessel shore power backfeed per slip.

(f) Fuel

Vessel fueling is either via truck delivery or takes place at Pier 15 off of Harbor Island. All of the island terminal vessels are fueled in Anacortes with the exception of the inter-island vessel which is fueled via truck at Friday Harbor. Refer to the USCG Safety Management System (SMS) procedures for vessel fueling requirements. Containment booms are required where fueling operations occur.

(4) Vessel Routes and Terminal Locations

Exhibit 330-8 identifies the existing WSF ferry system routes and corresponding terminal locations. Appendix P and Appendix Q contain additional route and terminal reference data.



WSF Ferry System Routes and Terminal Locations
Exhibit 330-8

(5) Vessel Security and Safety Zones

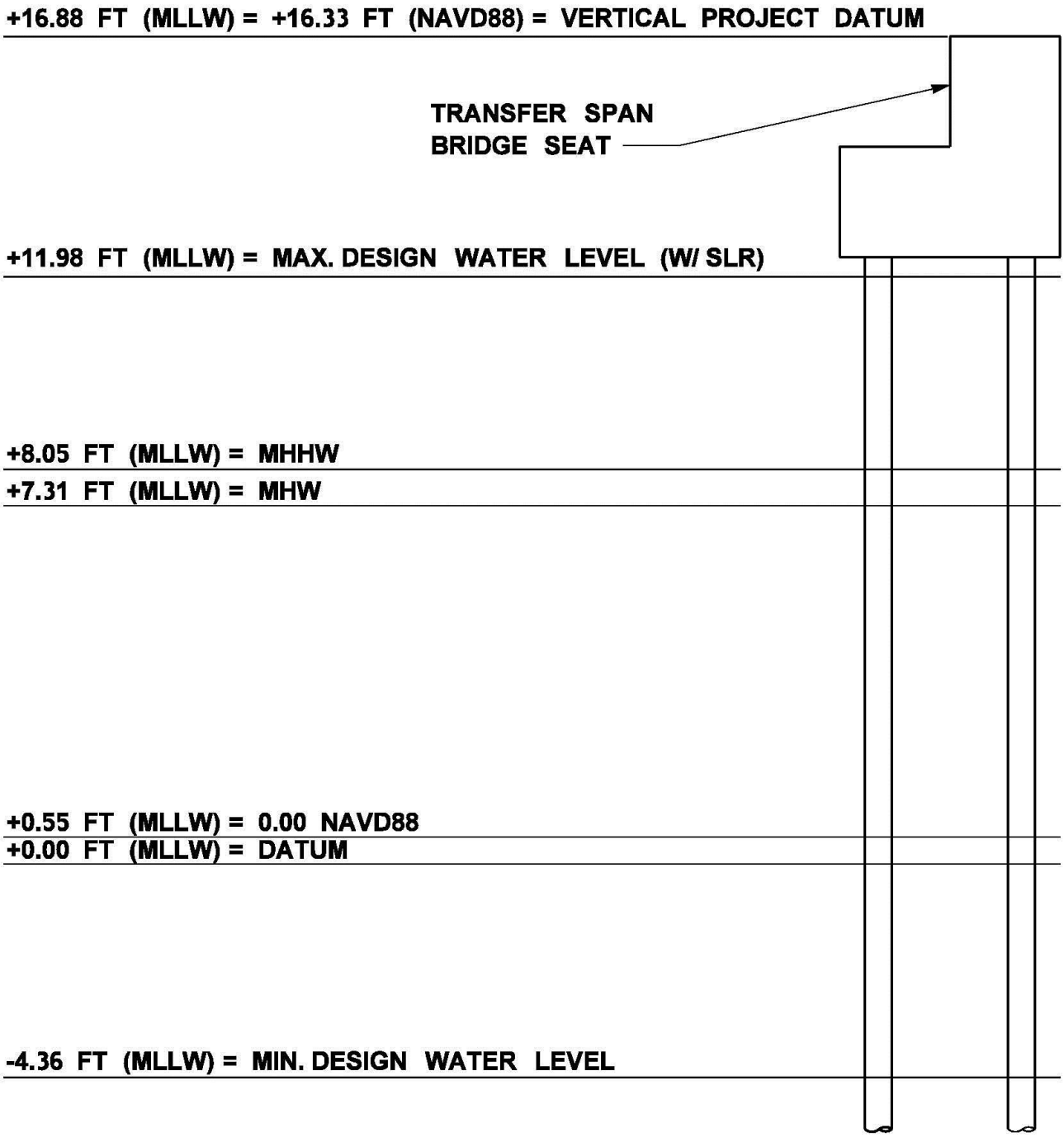
Per 33 CFR Part 165.1317, "there is established a large passenger vessel security and safety zone extending for a 500-yard radius around all large passenger vessels located in the navigable waters of the United States in Puget Sound, WA, east of 123°30' West Longitude. [Datum: NAD 1983]." Consider requirements of the moving security zone, established by Captain of the Port Puget Sound, as follows:

- Vessels within 500 yards must operate at minimum speed necessary to maintain safe course and respond to directions of the WSF Watch Officer or on-scene official patrol officer.
- Vessels and persons are prohibited from approaching within 100 yards (underway) unless authorized by WSF or the on-scene patrol officer.
- Vessels and persons are prohibited from approaching within 25 yards of any WSF vessel docked at a terminal, without authorization.

330.06 Tidal Information

(1) Terminal Tidal Datums

The general arrangement of terminal tidal datums is illustrated in Exhibit 330-9. Tidal datums are tabulated in Exhibit 330-10. The North American Vertical Datum of 1988 (NAVD 88) datums were determined from a survey of the terminals by the WSDOT GeoMetrix Geodetic Survey Office. Mean High Water (MHW) and Mean Higher High Water (MHHW) were calculated using VDatum 3.2 software provided by the National Oceanic and Atmospheric Administration (NOAA). Elevations for NAVD 88, MHW, and MHHW are given with respect to the datum MLLW = 0.00 feet. Coordinates used to determine datums correspond to each terminal's main slip bridge seat as tabulated in Exhibit 340-3. See Appendix X for additional information.



(Values are from Anacortes Ferry Terminal. For values at other terminals see Exhibits 330-11, 330-12, and 340-3)

General Arrangement of Terminal Tidal Datums, Design Water Levels and Vertical Project Datum
Exhibit 330-9

Datums:
MHHW: Mean Higher High Water
MHW: Mean High Water
NAVD 88: North American Vertical Datum of 1988
MLLW: Mean Lower Low Water

Terminal	MLLW (Datum) (Feet)	NAVD88 (Feet)	MHW (Feet)	MHHW (Feet)
Anacortes	0.00	0.55	7.31	8.05
Bainbridge Island	0.00	2.51	10.52	11.31
Bremerton	0.00	2.50	10.86	11.74
Clinton	0.00	2.05	10.23	11.10
Coupeville	0.00	1.12	7.78	8.59
Edmonds	0.00	2.05	10.07	10.93
Fauntleroy	0.00	2.52	10.67	11.55
Friday Harbor	0.00	0.49	7.08	7.72
Kingston	0.00	2.05	10.14	10.99
Lopez	0.00	0.53	7.11	7.82
Mukilteo	0.00	2.06	10.19	11.05
Orcas	0.00	0.58	7.11	7.88
Point Defiance	0.00	2.49	11.06	11.94
Port Townsend	0.00	1.11	7.86	8.55
Seattle	0.00	2.33	10.49	11.36
Shaw	0.00	0.53	7.14	7.84
Southworth	0.00	2.52	10.69	11.58
Tahlequah	0.00	2.49	11.01	11.89
Vashon	0.00	2.53	10.66	11.53

Terminal Tidal Datums
Exhibit 330-10

(2) Design Tidal Ranges

Design tidal ranges are tabulated in Exhibit 330-11. They were developed using NOAA-verified tide data from the past 17 years. The use of verified tide data means that the effects of storm surge, atmospheric pressure and other weather effects are included with the predicted astronomical effects.

Maximum Design Water Levels include a medium estimate of Sea Level Rise (SLR) of 13 inches and are intended for all structures including those with 50 and 75-year design lives. Structures with 50-year design lives include berthing structures (wingwalls and dolphins). Structures with 75-year design lives include vehicle and pedestrian loading structures (trestles, vehicle transfer spans, and overhead loading systems). Structures with design lives shorter than 50 years need not include SLR. Design Water Levels are referenced to the datum MLLW = 0.00 feet. See Section 330.06(3) and Appendix X for additional information.

Terminal	Design Tidal Range (Feet MLLW)		
	Minimum Water Level	Maximum Water Level	Maximum Water Level (Incl. SLR)
Anacortes	-4.36	10.90	11.98
Bainbridge Island	-4.98	14.60	15.68
Bremerton	-4.88	15.18	16.26
Clinton	-4.83	14.16	15.24
Coupeville	-4.46	11.60	12.68
Edmonds	-4.83	14.02	15.10
Fauntleroy	-4.93	14.89	15.97
Friday Harbor	-4.09	10.90	11.98
Kingston	-4.88	14.16	15.24
Lopez	-4.05	10.79	11.87
Mukilteo	-4.83	14.16	15.24
Orcas	-3.92	10.44	11.52
Point Defiance	-4.93	15.33	16.41
Port Townsend	-4.36	11.60	12.68
Seattle	-4.88	14.60	15.68
Shaw	-4.32	10.44	11.52
Southworth	-4.83	14.89	15.97
Tahlequah	-4.93	15.33	16.41
Vashon	-4.93	14.89	15.97

Terminal Design Tidal Ranges
Exhibit 330-11

(3) Sea Level Rise

Sea level rise (SLR) due to climate change will continue to modify terminal tidal levels in the 21st century. At present the rate of future sea level rise can only be estimated.

In Puget Sound WSDOT projects an estimated medium change in sea level of 6 inches (with a range of 3 to 22 inches) by the year 2050 and an estimated medium change in sea level of 13 inches (with a range of 6 to 50 inches) relative to 2000 by the year 2100. These estimates are based on the reference document Climate Impacts Vulnerability Assessment Report Appendix A (November 2011) (see Appendix X). More recent research by the National Academy of Sciences Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future (2012) projects an estimated change in sea level of 24 inches (with a range of 4 to 56 inches) relative to 2000 by the year 2100.

Design all marine structures (with either a 50 or a 75-year design life) to accommodate a medium estimate of SLR of 13 inches. Provide a plan to adapt or replace the marine structures to accommodate a high estimate of 50 inches in a worst-case SLR scenario. As more information becomes available regarding projected SLR refer to Appendix X to adjust the Design Tidal Ranges accordingly. Adjustments may be necessary on a biennial basis.

Another phenomenon related to climate change is the increase in significant wave height and storm surge due to more intense storms. According to the Climate Impacts Vulnerability Assessment Report Appendix A, significant wave height events on the Washington coast are projected to increase approximately 2.8 inches per year through the 2020's. However, because this value is based on extrapolation of past data, not on modeling, there is low confidence in this value. In addition, the projected increase within Puget Sound is unknown. Therefore, the effects of increases in wave height and storm surge have not been accounted for in the Design Tidal Range.

330.07 Slips

(1) General

A ferry slip is a specialized docking facility, consisting of wingwalls and dolphins that guide and hold a vessel, and vehicle and pedestrian structures that provide access to and from the vessel. This chapter discusses the three types of slips at WSF's facilities: main, auxiliary and tie-up. Main slips are those intended for regular every-day use. Auxiliary slips are used less frequently for special service and for backup during maintenance and/or repair of a main slip. Both main and auxiliary slips may also be used for overnight moorage. Main and auxiliary slips are served by a vehicle transfer span. Tie-up slips are used for overnight moorage and are served by a gangplank that is generally used only by WSF personnel.

Exhibit 330-12 identifies the existing slips at each ferry terminal. Refer to Appendix R for existing terminal plans showing the slip locations.

Terminal	Slip Number and Function			
	1	2	3	4
Anacortes	Main	Main	Tie-up	Tie-up
Bainbridge Island	Main	Auxiliary	Tie-up	-
Bremerton	Main	Auxiliary	-	-
Clinton	Main	Auxiliary	-	-
Coupeville	Main	-	-	-
Edmonds	Main	-	-	-
Fauntleroy	Main	-	-	-
Friday Harbor	Main	Tie-up	-	-
Kingston	Main	Main	Tie-up	
Lopez	Main	-	-	-
Mukilteo	Main	-	-	-
Orcas	Main	-	-	-
Point Defiance	Main	-	-	-
Port Townsend	Main	Auxiliary	-	-
Seattle	Main	Auxiliary	Main	-
Shaw	Main	-	-	-
Southworth	Main	-	-	-
Tahlequah	Main	-	-	-
Vashon	Main	Main	Tie-up	-

Existing Slips
Exhibit 330-12

(2) Slip Layout

(a) Slip Spacing and Orientation

Slip spacing and orientation are functions of several factors including: geometry of existing or planned overhead loading, size of existing or planned trestle, route approach geometry, environmental (wind, tide and current) conditions, and vessel size. Parallel slip spacings have varied from 132.75 feet at Seattle, to 135 feet at Bainbridge Island, Anacortes, and Kingston. At Clinton, the distance between the south Slip 1 and the bridge seat constructed for a future Slip 3 is 145 feet.

The current standard distance of 145 feet between operating slips assumes the slips are parallel to each other. This spacing is required to allow different vessel approach angles depending on the wind and tidal condition while providing a safe buffer between vessels that are either approaching or departing adjoining operating slips. It also accommodates a dual overhead loading system.

A parallel slip configuration may reduce the number of marine berthing structures required, which can reduce capital costs. For example, at the Seattle Terminal, one double-sided floating dolphin is utilized between Slips 2 and 3 for the off-shore navigational/berthing structure rather than providing several single-sided dolphins to support each operating slip.

When providing double-sided dolphins between parallel slips, consult with WSF to determine the appropriate slip spacing and dolphin width.

The alignment of the slips can have an effect on the turning radius for vehicle access to or egress from the vessels. Providing slips in a parallel alignment allows the use of common terminal holding area and exit lanes facilities. Refer to Chapter 340 for channelization requirements in the holding areas.

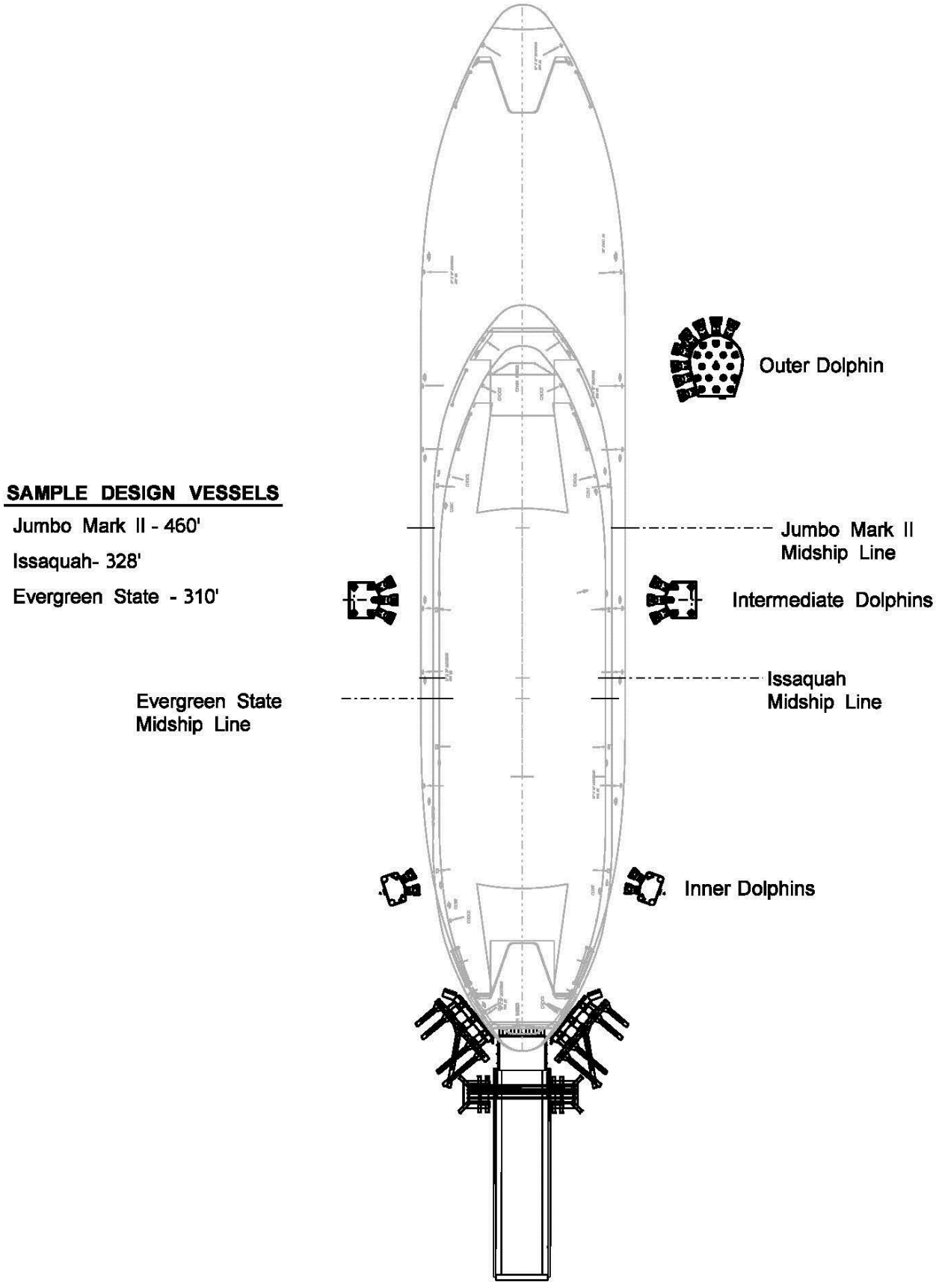
(b) Dolphin Locations

Consult with WSF Operations staff to determine the location of fixed and floating dolphins.

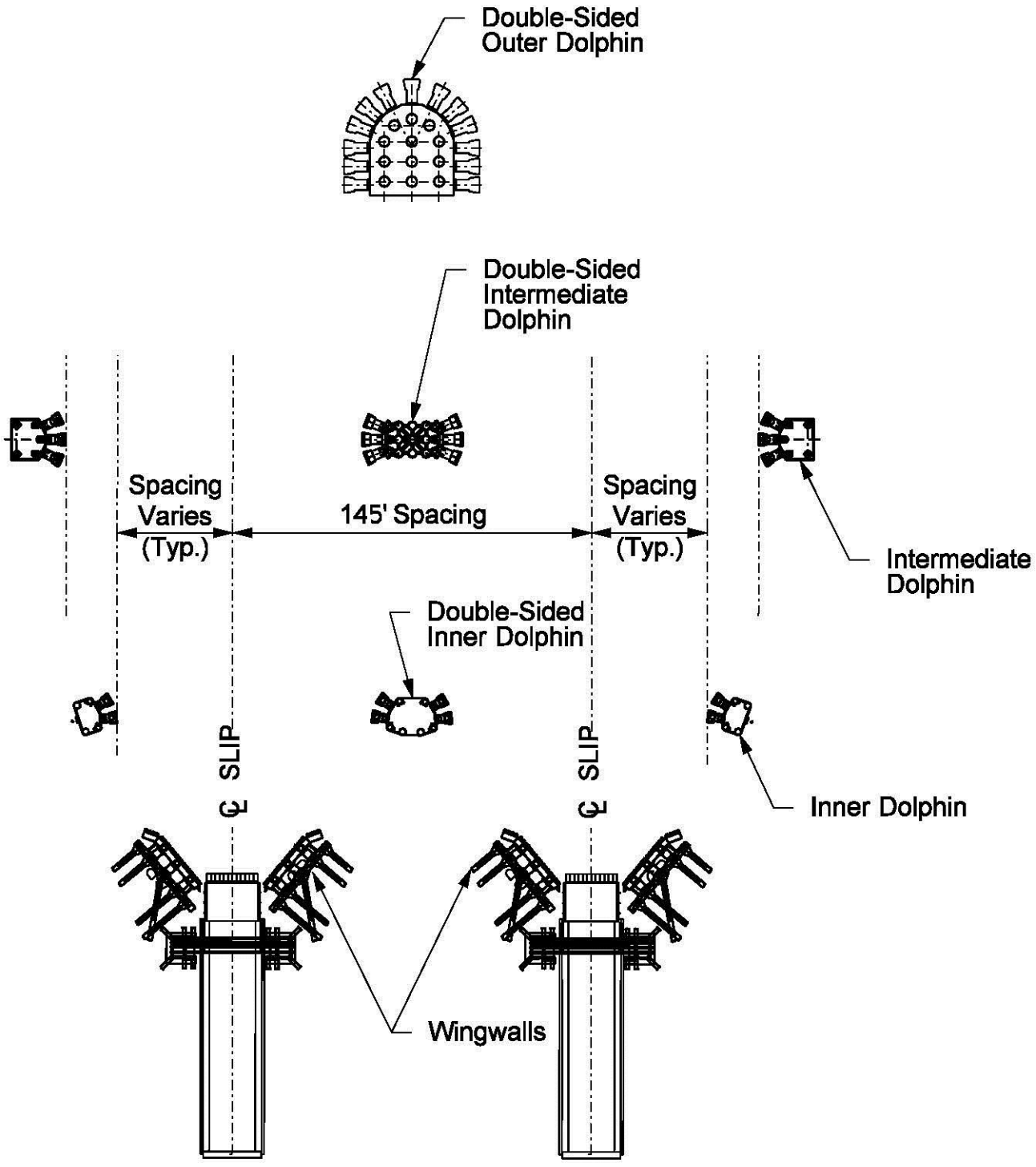
- The ideal layout of dolphins is the layout that most economically accommodates all design vessel sizes and operational requirements. This may consist of the “six pack” arrangement: one inner, one intermediate, and one outer dolphin on each side of the slip. More commonly, the intermediate and outer dolphins on one side may be combined and positioned such that vessels approaching from that side of the slip are better able to turn into the slip (the number may also be reduced for operational, wind and current, vessel assignment, geotechnical, or other reasons).
- The outer dolphins are the primary berthing and mooring structures for the longer vessels using the slip. They are typically located approximately 55 to 75 feet from the slip centerline and 240 to 300 feet from the apron (located seaward a sufficient distance to ensure the contact point is beyond the vessel’s midship line).
- The intermediate dolphins are the berthing and mooring structures for shorter vessels using the slip. They are typically located approximately 50 to 65 feet from the slip centerline and 160 to 200 feet from the apron (located seaward a sufficient distance to ensure the contact point is beyond the vessel’s midship line).

- The inner dolphins serve primarily to protect other structures and are not used for mooring and tie-up. They are typically located approximately 40 to 45 feet from the slip centerline and 50 to 60 feet from the apron. They are located in such a position that a vessel that is contacting an intermediate or outer dolphin will be approximately 2 to 3 feet away from the inner dolphin (to prevent a levering action that could pull the vessel out of the slip).
- At some locations a concrete floating dolphin will take the place of one or more fixed dolphins. Floating dolphins are typically used where the water depth exceeds about 50 feet. Floating dolphins are often preferred by vessel captains for their energy-absorbing capacity and their large surface area. They may be feasible in shallower water where their mooring anchors will not come in contact with vessel bottoms.
- Where two slips are adjacent, a double-sided dolphin may serve both slips.

While these are general guidelines, all of the dolphins for a slip are located in close consultation with the users (i.e., the vessel captains) and are based on their needs. These include: vessel characteristics, customary approach and departure angles and velocities, the wind and current environment, overhead loading and other operational features, and crew preferences.



Typical Slip Layout – Single Slip
Exhibit 330-13



Typical Slip Layout - Two Parallel Slips
Exhibit 330-14

(c) Redundancy

As can be observed in Exhibit 330-12, some terminals have a single operating slip whereas others have multiple operating slips. The number of operating slips is typically a function of the ferry ridership and number of destinations served by a given terminal. When only one operating slip exists at any facility, the reliability and dependability of the service is at a higher risk. Equipment breakdowns, unforeseen damage to the marine structures/transfer span and preventive/routine maintenance all have an effect on the reliability of service. Where multiple slips are present, it is common to provide a higher degree of structural reliability in one slip to function during extreme circumstances such as seismic conditions.

(d) Navigation

Coordinate with WSF Operations in design of slip location, orientation and layout. It may be advantageous to rotate slips from the "standard" parallel orientation based on site and/or environmental conditions including wind, waves and current.

Each WSF ferry terminal presents unique navigational challenges for the ferry vessel depending on available water depths, waves, currents, wind conditions, and adjacent structures or obstacles to navigation. Consult with WSF Operations regarding these challenges and develop the slip layout to best address the challenge given the capabilities of the design vessel(s).

(3) Slip Depth

Adequate water depth within the slip is required to ensure that any vessel can operate in the slip safely and with minimal environmental impact to the surrounding area. Of primary importance is protecting the vessel hull from contacting the sea floor or from creating excessive plumes of sediment that could damage the propulsion system. Secondarily, adequate depth is needed to prevent plumes from drifting and settling on adjacent environmentally sensitive areas (e.g., eelgrass beds).

Research suggests that a minimum mudline elevation of -30 feet MLLW at the throat of the slip will ensure that all vessel classes can safely operate at any terminal at the lowest tide. In practice numerous slips with less extreme low tides and with shallower-drafted vessels can operate safely with a shallower slip mudline. For example, tie-up slips that accommodate Lay-up vessels (i.e., vessels carrying no passengers or vehicles) may be safely operable with a mudline elevation in the range of -22 to -28 feet MLLW. Operations staff will provide assistance in determining the appropriate design vessel(s).

While historically dredging has been used to create a channel for newly constructed slips, alternatives should be explored when feasible due to the extensive permitting process required for dredging projects. Where dredging is the only alternative, careful consideration should be given to proper design of the depth and side slopes to ensure the dredged slip remains stable.

(4) Emergency Use

<Pending development – future manual update>

(5) Private Aids to Navigation

Navigation aids located on marine structures (including the navigation lights and fog horns on the outer dolphins and warning buoys, but excluding the wingwall fog lights) are regulated by the U.S. Coast Guard in accordance with 33 CFR Part 66. Coordinate all additions or modifications to the aids with Terminal Engineering Maintenance staff.

330.08 Berthing and Mooring Criteria

(1) Berthing and Mooring Structures

Wingwalls and dolphins are the primary berthing and mooring structures within each slip. They are subject to dynamic forces from vessel impacts during berthing and, to a lesser extent, to static forces from wind and/or currents on vessels moored to them. Bow lines attached to the transfer span bridge seat are used during operations as a safety measure (to prevent the vessel from drifting out of the slip should it lose power), and to secure the bow for overnight moorage.

Operating slip wingwalls are subject to a variety of impacts ranging from a typical landing at an approach velocity of approximately 1.5 knots to harder landings due to a variety of causes including low visibility, high winds and/or currents, and vessel malfunction. Tie-up slip wingwalls are typically designed for a lower approach velocity of 1.0 knots since these landings are less frequent and not dependent on the service schedule.

Under normal operating conditions, there are only light impacts on the dolphins. However, dolphins are designed for reasonable impacts resulting from difficult landing conditions, such as strong winds and/or currents. Difficult landing conditions may bring the vessel in contact with one or more dolphins during the berthing operation.

See Sections 630.04, 640.04, and 650.04 for additional information on design criteria (including design loads) for wingwalls and dolphins.

(2) Design Vessel Impact

WSF uses the following four classifications of berthing events to categorize damage to wingwalls and dolphins based on the technical report titled *Ferry Landing Design, Phase I: Final Technical Report* WA-RD 253.2 by Charles T. Jahren and Ralph Jones (1993), design reports titled "Edmonds Ferry Terminal Dolphin Replacements," and "Kingston Ferry Terminal Dolphin Replacements," and a Master's thesis titled *The End Berthing Simulation Model* by Douglas R. Playter (1994):

(a) Type I: No Damage

A fender system should perform adequately for most berthing events for its entire service life. Repairs are limited to normal maintenance.

(b) Type IIA: Repairable Damage (No Impact to Operations or Damage to Vessel)

A fender system may see minor damage from hard berthing events, which can be repaired without impacting Operations. These repairs are generally limited to replacement of isolated portions of the structure that can be assembled or prepared off-site and installed in a limited time period. The system may need to be analyzed to identify methods of repair that minimize downtime for the structure.

(c) Type IIB: Repairable Damage (Impact to Operations)

A fender system may be damaged by unusually hard berthing events. Repairs are limited to replacement of a portion of the system. The system may be analyzed to identify probable repair requirements, and contingency plans may be made to accelerate the repair process.

(d) Type III: Catastrophic Damage

A fender system and its supporting structure may fail during a catastrophic occurrence. If the structure yields sufficiently, deceleration forces are limited as the vessel is brought to a stop. This will limit injuries and vessel damage. An example of a catastrophic occurrence is a propulsion failure as the vessel applies reverse thrust to stop.

The design philosophy and design criteria for berthing and mooring structures (wingwalls and dolphins) are in general accordance with the above event classifications. In practice all wingwalls and dolphins are designed for Type I events. Wingwalls are also designed for a Type III event to ensure the vehicle and pedestrian-loaded towers and transfer span located shoreward of the wingwalls are protected from damage.

Type II events are not explicitly designed for although details have been developed to ensure repairs are achievable as quickly as possible. These include bolted connections that make replacement of fenders and fender panels relatively easy and limited embedment of the fender piles to facilitate repositioning following displacement. Stockpiling of replacement components and development of a biennial on-call wingwall and dolphin repair contract are two ways that repairs can be accomplished as quickly as possible.

(3) Day Tie-up

Day tie-up is accomplished by a pair of lines used to secure the shore-end bow of the vessel during off-loading and loading operations. It is typically augmented with positive thrust by the vessel against the wingwalls and an outer dolphin to minimize movement of the vessel with respect to the vehicle transfer span apron and the overhead loading apron. Each line consists of a shackle attached to the apron curb and a length of nylon tie-up line that is secured to the vessel cleat. These items are typically furnished and installed by the Eagle Harbor Maintenance staff.

(4) Overnight Vessel Moorage

Determine if a slip will be used for overnight moorage, as identified in and by Operations. Moorage is considered a Type I event. Include the following for slips that will be used for overnight moorage:

- Outfit the wingwalls and intermediate and outer dolphins with wire rope mooring pendants to accommodate the proposed design vessels.
- Position mooring pendants so that vessels can be safely secured at night.

330.09 Wave, Flood, and Coastal Storm Loading

(1) Flood Design Loads

Include wave, flood, and coastal storm loading in the design of trestle, building, transfer span, and overhead loading structures. It is intended that the designed terminal structures will remain operational after the 100-year flood event.

Develop the loads and verify that the structure will be able to resist these loads. Loading shall include hydrodynamic loads, hydrostatic loads, debris impact loads, and breaking wave loads. Loads on exposed building structures, deck slabs, pile caps, piling, and underdeck structures such as utilities shall be determined and the capacity of these structures to resist these loads checked.

Loading shall be based on ASCE 7-10 and ASCE 24-14, and supplemented with FEMA P-55, Volume 2, Chapter 8.5 for all projects requiring a building permit. Consult with Terminal Engineering staff for the ASCE 24-14 design class for any buildings included in the project.

Loading shall be based on the AASHTO LRFD *Bridge Design Manual* and supplemented with the AASHTO Guide Specifications for Bridges Vulnerable to Coastal Storms for structures not requiring a building permit.

Establish the Base Flood Elevation in accordance with the local county and the Federal Emergency Management Agency (FEMA).

Adjust for Sea Level Rise based on an increase in tide level of 0.14 inch per year.

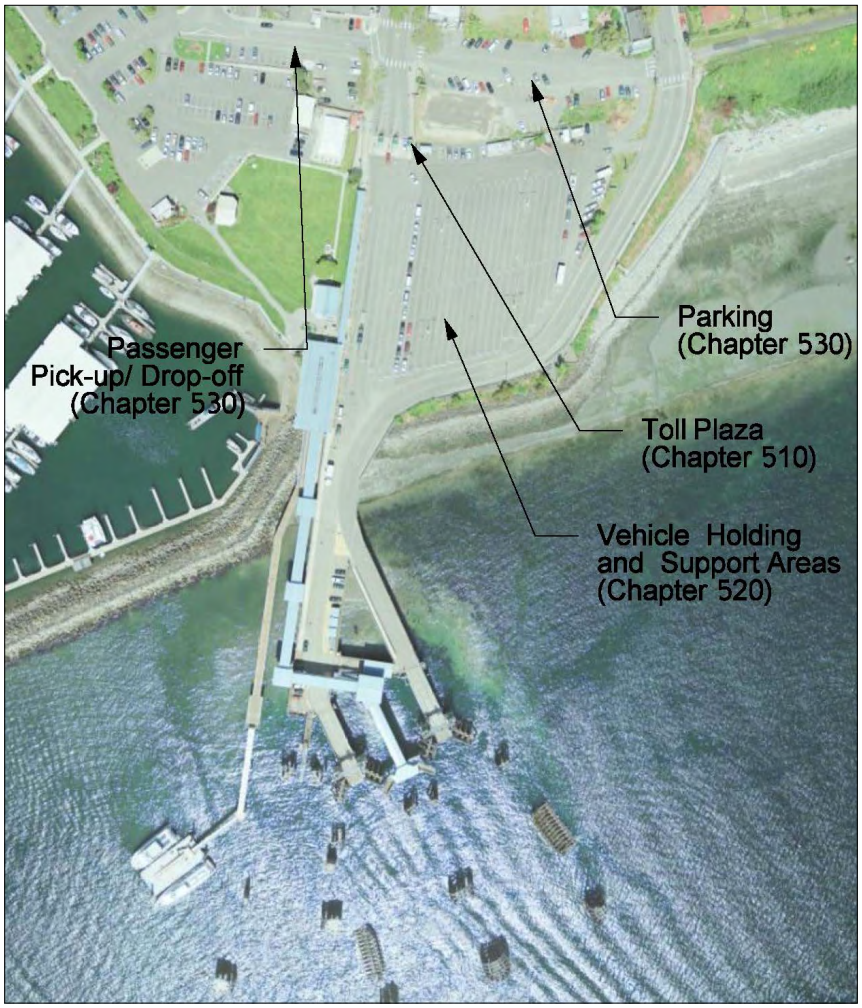
Provide a basis for selection of the average velocity of water in feet per second.

For debris impact loading determine the size of debris and potential impact force based on discussion with WSF or on a site-specific study at new terminals.

340.01 General
340.02 References
340.03 Design Considerations
340.04 Project Datum
340.05 Site Preparation
340.06 Grading and Erosion Control
340.07 Roadway Design and Channelization
340.08 Pavement Design
340.09 Traffic Control

340.01 General

This chapter identifies the major civil elements associated with a ferry terminal. Civil elements include: toll plaza, vehicle holding and support areas, parking, HOV and transit, access approaches and exits, bicycle and pedestrian access, site circulation, site utilities, and signage and wayfinding. Exhibit 340-1 is an aerial photo showing the site layout of WSF's Kingston Ferry Terminal. Refer to Exhibit 340-2 for an example terminal layout depicting the civil elements and the chapters covering their design.

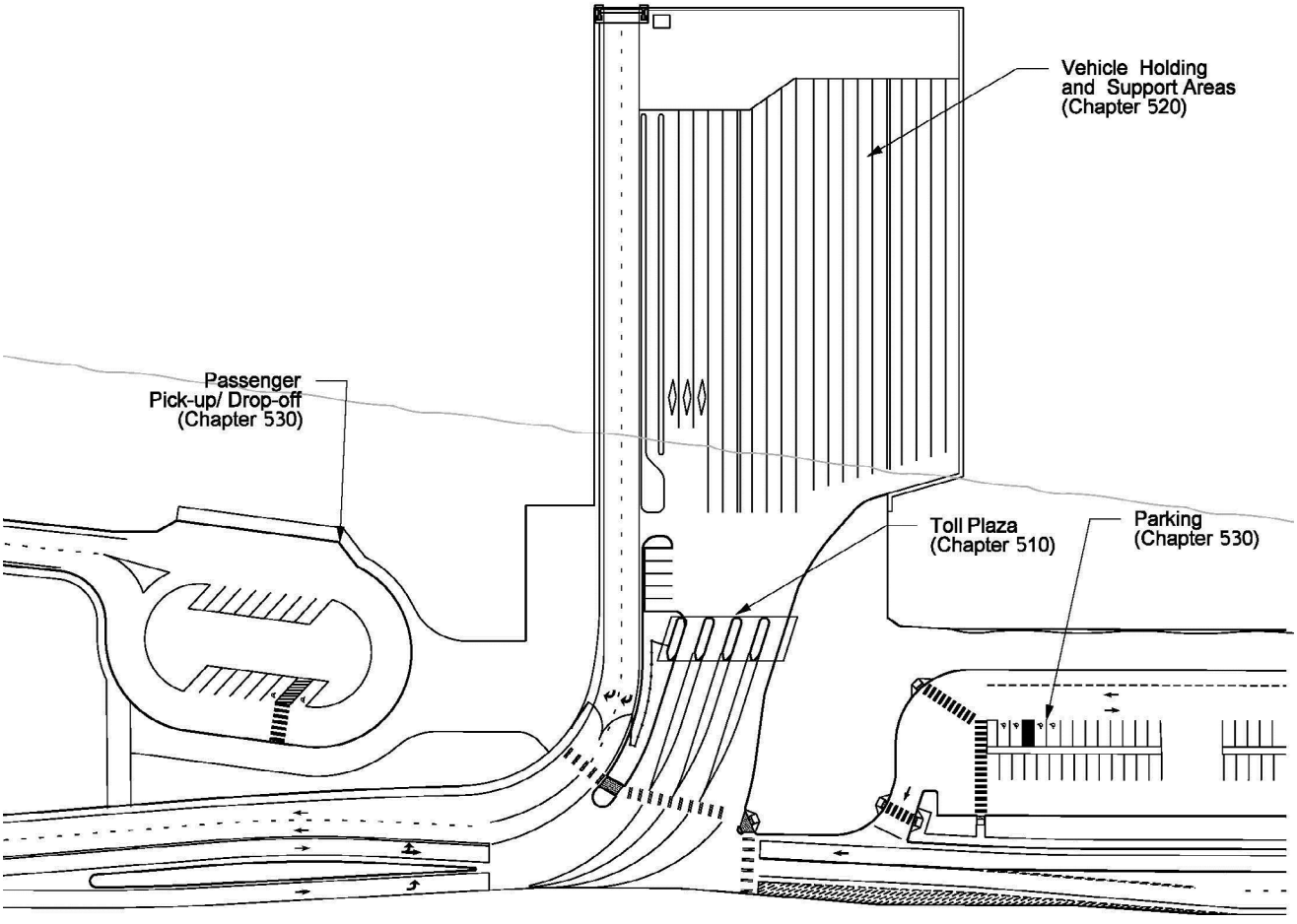


Kingston Ferry Terminal Layout
Exhibit 340-1

This chapter also provides guidelines on project datum, site preparation, grading and erosion control, roadway design and channelization, paving, and traffic control.

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
500	Access, Approaches and Exits
510	Toll Plaza
520	Vehicle Holding and Support Areas
530	Parking
540	HOV and Transit
550	Site Circulation
560	Site Utilities
570	Signage and Wayfinding
580	Sustainability/Low Impact Development



Example Terminal Layout – Site Design
Exhibit 340-2

340.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

49 CFR Part 39 *Transportation for Individuals with Disabilities – Passenger Vessels*

RCW 47.28.035 *Cost of project, defined*

WAC 332-130-060 *Local geodetic control survey standards*

(2) Design Guidance

Design Manual M 22-01

Highway Runoff Manual M 31-16

Hydraulics Manual M 23-03

Pavement Policy

Plans Preparation Manual M 22-31

Standard Plans for Road, Bridge, and Municipal Construction M 21-01

(3) Supporting Information

Guide for Design of Pavement Structures, AASHTO

Manual on Uniform Traffic Control Devices (MUTCD), FHWA

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO

NCHRP Report 659 - Guide for Geometric Design of Driveways Transportation Research Board

340.03 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible.

Additionally, 49 CFR Part 39 prohibits owners and operators of passenger vessels from discriminating against passengers on the basis of disability, requires vessels and related facilities to be accessible, and requires owners and operators of vessels to take steps to accommodate passengers with disabilities.

Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessel security requirements, and additional information pertaining to civil design. Below are links to relevant sections by topic. Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for TWIC and SSI.

- MARSEC Levels: 310.04
- Vessel Security: 310.05
- Toll Plaza and Vehicle Holding: 310.08
- Access Control/Restricted Areas/TWIC: 310.10
- Panic Buttons: 310.12
- Signage: 310.13
- Sensitive Security Information: 310.14

(3) Environmental

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

(4) Operations and Maintenance

Involve WSF Operations and Maintenance staff throughout the design process and provide opportunities for review of the project drawings and specifications. Ensure that required maintenance activities can be performed in compliance with OSHA/WISHA guidelines.

Below are some operations and maintenance issues to consider:

- Minimize repair and maintenance required during the design life.
- Confirm location of existing utilities within the project limits and take appropriate measures to keep existing utilities operational, as required. Refer to Chapter 200 for some major utilities at various terminals which warrant special note.
- Address traffic control, construction staging, and phasing issues during design to minimize impact on existing operations.

(5) Materials Specification

Utilize materials that are in accordance with the requirements of the *Standard Specifications* M 41-10 and WSF *General Structural Notes* (See Structures Group for a copy and explanation of use) and *Regional General Special Provisions*. Consider the material requirements of federally funded projects including the requirement for American-made steel. Make use of WSF stockpiles of materials where possible.

(6) Right of Way and Sundry Site Plans

Right of Way Plans are the official state documents used as the basis to acquire real estate and other property rights for roadways. It is the responsibility of the region to prepare plans for the acquisition of rights of way (R/W), including easements, permits, and any substantiating documentation necessary for completion of the plans. Verification of ownership of existing R/W is also required.

A Sundry Site Plan is used to map property that cannot be shown on a Right of Way Plan such as ferry terminals, wetlands mitigation sites, park and ride lots, stockpile sites, and stormwater retention or other reclamation sites.

Both Right of Way Plans and Sundry Site Plans convey legal information regarding property boundaries. Right of Way Plans are typically based on roadway alignments whereas Sundry Site Plans are not based on roadway alignments. When the boundaries of an existing ferry terminal are modified, the corresponding Right of Way Plans and Sundry Site Plans must also be modified.

The Sundry Site Plan contains all terminal property information with the exception of property on highway right of way. Refer to the WSDOT *Plans Preparation Manual* M 22-31 for additional information regarding Right of Way and Sundry Site Plans. To obtain title reports or determine if any acquisition, easements, leases or right of entry agreements may be needed for the project, contact the WSDOT regional or headquarters Real Estate group.

WSDOT has decision authority on state right of way in unincorporated areas and within cities below a specified population as set forth in the *Design Manual* M 22-01. WSDOT also maintains decision authority in limited access areas. Obtain approval through the local WSDOT district/region for modifications to state right of way in unincorporated areas. Coordinate with both WSDOT and the local jurisdiction for improvements and any associated permit requirements within incorporated areas.

(7) DNR Leased Property

WSF leases offshore state-owned land through the Washington State Department of Natural Resources (DNR) at several existing terminals. A DNR authorization to use state-owned aquatic lands is required if projects will occur on or over state-owned aquatic lands. The use of this land is through a DNR authorization that serves as a legal contract that outlines the terms and conditions of use and conveys certain property rights to the user (WSF) in exchange for rent.

WSF/WSDOT is responsible for contacting the DNR early in the design process to determine any requirements for attaining or altering existing leases. Coordinate with the WSDOT Right of Way Branch on issues regarding DNR leased property.

340.04 Project Datum

A datum is a geometrical quantity (or set of quantities) that serves as a reference, forming the basis for computation of horizontal and vertical control surveys in which the curvature of the earth is considered. Adjusted positions of the datum, described in terms of latitude and longitude, may be transformed into State Plane Coordinates.

Establish the Project Datum (horizontal and vertical) to be used for design drawings at the onset of the project. Note that all engineering work (mapping, planning, design, right of way, and construction) for WSDOT projects, excluding WSF projects, is based on a common datum.

(1) Horizontal

WAC 332-130-060 states, "The datum for the horizontal control network in Washington shall be NAD83 (1991) [the North American Datum of 1983] as officially adjusted and published by the National Geodetic Survey of the United States Department of Commerce and as established in accordance with Chapter 58.20 RCW. The datum adjustment shall be identified on all documents prepared; i.e., NAD83 (1991)."

(2) Vertical

The North American Vertical Datum of 1988 (NAVD88) as defined by the National Geodetic Survey (NGS) is the official civilian datum for surveying and mapping activities in the United States. WSDOT has adopted this datum. WSF uses an adjusted vertical datum of Mean Lower Low Water (MLLW) which is based on localized tidal elevations. The MLLW datum is adjusted every 20-25 years based on the current National Tidal Datum Epoch (NTDE). See Section 330.06 Tidal Information for Terminal Tidal Datums, Design Tidal Ranges and a discussion of Sea Level Rise. The Table below provides elevations at the top of a Bridge Seat (Typically Slip 1) from both the NAVD88 and MLLW referenced datum. See Appendix Z for additional information.

A common point has been selected at each terminal for the purpose of establishing horizontal and vertical datums. This point is located at the intersection of the Slip 1 centerline and the shoreward edge of the steel cover plate at the bridge seat. See Exhibit 340-3 for the horizontal and vertical datums for this point at each terminal. See also Appendix Z for photos of the surveyed points.

Terminal	Northing (Feet)	Easting (Feet)	Latitude	Longitude	NAVD88 (Feet)	MLLW (Feet)
Anacortes	555118.59	1193345.95	48 30 25.590 N	122 40 39.900 W	16.33	16.88
Bainbridge Island	231594.00	1227009.97	47 37 21.210 N	122 30 35.433 W	15.85	18.36
Bremerton	210152.60	1198069.99	47 33 43.215 N	122 37 30.497 W	14.89	17.39
Clinton	359334.35	1269055.96	47 58 30.246 N	122 20 58.503 W	15.50	17.55
Coupeville	428258.52	1191534.48	48 09 27.400 N	122 40 21.769 W	13.07	14.19
Edmonds	300486.63	1259178.33	47 48 47.641 N	122 23 06.212 W	14.71	16.76
Fauntleroy	194761.33	1254308.36	47 31 23.446 N	122 23 46.095 W	13.22	15.65
Friday Harbor	567584.98	1112106.53	48 32 07.602 N	123 00 51.109 W	16.44	16.93
Kingston	294447.80	1232044.95	47 47 42.465 N	122 29 41.759 W	16.00	18.05
Lopez	579546.06	1144138.17	48 34 14.275 N	122 53 00.063 W	18.15	18.67
Mukilteo	349711.97	1279904.40	47 56 57.378 N	122 18 16.383 W	15.33	17.39
Orcas	589759.04	1129781.00	48 35 51.188 N	122 56 37.623 W	18.36	18.94
Point Defiance	116178.98	1223430.66	47 18 21.642 N	122 30 50.876 W	16.18	18.67
Port Townsend	411277.07	1169980.50	48 06 40.875 N	122 45 33.326 W	15.45	16.56
Seattle	223419.72	1268887.33	47 36 09.098 N	122 20 21.889 W	16.32	18.65
Shaw	584895.60	1133024.81	48 35 04.089 N	122 55 47.412 W	12.34	12.86
Southworth	191480.18	1229538.68	47 30 45.947 N	122 29 45.876 W	16.14	18.65
Tahlequah	125719.27	1225240.57	47 19 56.164 N	122 30 27.632 W	15.24	17.73
Vashon	190530.46	1237485.87	47 30 38.255 N	122 27 49.840 W	16.58	19.11

Terminal Horizontal and Vertical Datums
Exhibit 340-3

(3) Datum Conversion

Many reference drawings used for design purposes, such as as-built drawings for utilities prepared by local municipalities, are prepared using different datums. The datum of all reference drawings should be verified and converted to the Project Datum prior to use. When using existing WSF drawings, make note of the tidal epoch and convert elevations to the Project Datum as required.

340.05 Site Preparation

Specify site preparation activities including but not limited to clearing, grubbing, cut, fill, demolition, and existing utility protection, demarcation and/or relocation in order to create favorable site conditions which facilitate construction activities. If necessary, remove existing roadway to accommodate new roadway sections. Roadway sections are determined by surfacing reports produced by the region materials lab (NW Region for East Sound and Olympic Region for West Sound). Refer to the WSDOT *Plans Preparation Manual* M 22-31 for Site Preparation Plans.

Consider the following with regard to site preparation activities:

- Specify clearing and grubbing activities that minimize disturbance to existing vegetation, especially trees. Consider protecting trees and other vegetation to be removed with construction fencing or other means.

- To the extent feasible, select grades that balance the overall quantity of cut and fill for the project.
- Minimize excavation in soils where contamination is known or expected to exist.
- Minimize excavation in areas with known archaeological issues, such as the Mukilteo Ferry Terminal. During the early stages of design, consult with WSDOT Cultural Resources staff whenever planning work in such a location.
- The extent of removal of existing structures may depend on environmental mitigation, with consideration to current over-water coverage and contaminated materials such as creosote coated timber piles.
- Consider in-water work window limitations for any necessary in-water demolition work.
- Specify means and methods to be incorporated such that on-street transportation relating to site demolition is minimized.
- Adhere to all project permit conditions.

340.06 Grading and Erosion Control

Site grading and erosion control are interrelated. Proper grading can reduce the extent of erosion control measures required during and after construction.

(1) Grading

Grade the site in such a manner that surface water does not accumulate in areas other than designated sediment traps. Provide smooth transitions to buildings and other structures. Grade the site such that pedestrian paths of travel are accessible. Avoid, wherever possible, the use of walls or other earth retaining structures to prevent abrupt changes in elevation and provide smooth transitions between site elements.

(2) Erosion Control

The *Highway Runoff Manual* (HRM) M 31-16 defines the thresholds that require projects to develop temporary erosion and sediment control (TESC) and spill, prevention, control, and countermeasure (SPCC) plans. TESC and SPCC plans are required to identify and minimize project risks associated with sediment and pollutants impacting soil, air, and water quality. Project parameters such as soil type, precipitation, topography, drainage patterns, groundwater, sensitive areas, vegetation preservation, and schedule all affect the TESC and SPCC plans.

During construction, protect known wetlands with high visibility (orange construction) fencing.

All paving projects shall include the cleaning of existing drainage structures as part of the work.

Employ available Best Management Practices (BMPs) as appropriate to construction activities. Design site drainage to prevent erosion of soils and to prevent flooding up to the design storm event. Consider utilizing areas of existing vegetation to remove sediment from runoff before it flows into the receiving water body. Refer to the HRM and *Standard Plans* M 21-01 for more information regarding erosion control BMPs.

Erosion control measures may include, but are not limited to the following:

- Matting
- Construction road stabilization
- Dewatering structures and holding tanks
- Erosion Control Blankets
- Sediment traps
- Silt fencing, wattles
- Storm drain inlet protection, storm drain outlet protection

Stabilize embankments and prevent movement of soil stockpiles with soil covering measures where necessary. Protect adjacent properties by retaining sediment onsite through use of structural and source control measures as necessary (in essence, prevent the transport of soil and debris onto adjacent streets).

Sensitive areas, such as wetlands, shall be protected from intrusion by installing high visibility orange temporary construction fencing.

(3) Material Selection

Utilize materials for grading and erosion control that conform to *Standard Specifications* M 41-10. Where feasible, specify that onsite soil be used or reused. Where significant concrete demolition is required, consider reusing crushed concrete.

340.07 Roadway Design and Channelization

(1) General

Design roadways approaching terminals to accommodate both local and ferry traffic, maintaining local access to the waterfront. Signing and striping is to delineate terminal traffic. Consider designing the roadway to provide overflow queuing of ferry traffic, thereby reducing traffic backups onto adjacent roadways (refer to *Design Manual* for design width of ferry holding lanes on roadway shoulder). Consider use of controlled intersections and strategic timing of signalized intersections, where appropriate, to further improve traffic flow.

Safely segregate vehicles, pedestrians, and bicyclists. Be aware of vertical clearance and clear zone requirements when sizing and laying out elements within the adjacent roadways and terminal area. Bicyclists may be combined with vehicular traffic outside the terminal boundaries, but a separate bicycle lane is recommended where significant bicycle traffic is anticipated.

Consider whether bicycle volumes warrant adding a separate bicycle gate at the terminal entrance.

Identify the agency with jurisdiction over each segment of roadway being designed. Roadway design and channelization requirements vary between roadways within the terminal limits (WSF jurisdiction) and roadways outside the terminal limits which may be governed by either WSDOT or a local municipality. WSDOT has decision authority in unincorporated areas and within cities below a specified population as set forth in the *Design Manual* M 22-01.

(a) WSF

Design terminal roadways in accordance with the *Design Manual* M 22-01, as supplemented by the WSF *Terminal Design Manual* guidelines. Where any discrepancy exists, the WSF *Terminal Design Manual* takes precedence.

Refer to Chapter 500), Chapter 510, and Chapter 750 for additional information on roadways within the ferry terminal.

(b) WSDOT

Design WSDOT roadways outside the ferry terminal limits in accordance with the *Design Manual* M 22-01. Submit separate WSDOT Channelization Plans for WSDOT approval. Work with the WSDOT regional office for Channelization Plan submittal and approval requirements during the 30 percent Design stage.

Intersection modifications may require modifications to the Right of Way and/or Sundry Site Plan which can be a long lead time item.

Coordinate with WSDOT for design information including but not limited to:

- Design vehicle
- Highway classification
- Highway design speeds
- Lane widths and other geometrics

(c) Local Municipalities

Coordinate with local municipality for standards pertaining to their roadways. Design of these roadways is subject to approval by the local municipality. Note that WSDOT has decision authority in unincorporated areas and within cities below a specified population as set forth in the *Design Manual* M 22-01.

(2) ADA Accessibility

Design routes of travel to comply with ADA requirements and accommodate both abled and disabled persons. Refer to Chapter 300 for further information.

(3) HOV Access

If specified in the scoping process, design terminals to promote the use of HOV travel options which may include HOV lanes, motorcycle and bicycle lanes, carpool parking, transit facilities/bus circulation, and access to commuter rail.

(4) Emergency Access

Provide access for emergency vehicles including fire and medical aid to the terminal facilities and for preferential loading to the vessel. Coordinate with the local Fire Chief for emergency access requirements. Accommodate fire truck turning requirements in design of terminal roadways.

(5) Vertical Clearance Requirements

When crossing the vehicle holding and exit lanes, the minimum clearance under the OHL system is 16.0 feet with 16.5 feet being desirable. All ferry vessels serving WSF terminals have a tunnel height of 16 feet or less. If any OHL structure is proposed to cross a state route outside the terminal facility per the terminal sundry site plan or a city street, the minimum clearance must meet highway standards (WSDOT and AASHTO). Refer to the *Design Manual* M 22-01 for vertical clearance requirements for bridges.

(6) Design Vehicles

The design vehicle within WSF terminal facilities (beginning at the toll plaza) is a WB-62 (a semitrailer truck with an overall wheelbase of 62 feet) tractor trailer. For parking lots and loading dock areas use the largest design vehicle appropriate to the largest vehicle that is anticipated to use the facility.

Design adjoining roadways using the design vehicle per the *Design Manual* M 22-01.

(7) Vehicle Turning Analyses

Coordinate with WSF Operations staff to determine critical operational maneuvers to be analyzed using turn simulation software (such as AutoTURN®) to verify the design. At a minimum, confirm the following:

- Passenger vehicles are able to enter any of the toll lanes and pass through to any of the holding lanes.
- Two lanes of passenger vehicles are able to load and unload from each vehicle transfer span at once.
- Design vehicle (WB-62) is able to enter any of the toll lanes and pass through to a more limited number of "truck" holding lanes (to be specified by WSF Operations). A smaller design vehicle, the use of which is to be documented, for parking and loading dock areas is acceptable.
- Design vehicle is able to load and unload from each vehicle transfer span (only one lane of traffic required to load at a time).
- Largest anticipated vehicle (typically a WB-67) is able to make required movements with some encroachment outside designated lanes.
- Emergency vehicles are able to access all critical locations of the site as identified by the local Fire Chief.
- BUS (single unit bus) is able to make all necessary movements.

Note: A deviation is required for terminals designed to use the exit lanes for the loading of larger vehicles. Service vehicles are exempt from this deviation requirement, but a separate service vehicle entrance lane should be considered at new terminals.

(8) Controlled Intersections

A signal warrant must be satisfied for each proposed signalized intersection prior to its installation. MUTCD, Part 4, defines a signal warrant as a threshold condition that, if found to be satisfied as part of an engineering study, shall result in analysis of other traffic conditions or factors to determine whether a traffic control signal or other improvement is justified.

Refer to *Design Manual* M 22-01 for additional controlled intersection requirements.

(9) Approvals

Below is a list of potential approvals required for roadway design and channelization.

- WSDOT Channelization Plans
- Design Approval
- Project Development Approval
- WSDOT Signal Warrant
- WSDOT Sundry Site Plan modifications
- WSDOT Right of Way modifications

340.08 Pavement Design

(1) General

Pavement design is determined by different limiting factors including traffic loading, soils characteristics, weather, performance records, and cost/benefit analysis. Refer to the WSDOT *Pavement Policy* for additional information regarding paving. For the civil design criteria, paving is typically divided into the following categories:

(a) Roadway

The roadway portion of the paving includes exit lanes and the toll plaza, vehicle access lanes, and roadways and intersections outside the terminal boundary.

(b) Parking

The parking portion of the paving includes such areas as passenger drop-off, short-term and ADA parking, commuter parking, and WSF employee parking.

(c) Transit Facilities

The transit facility portion of the paving includes transit centers and other areas with high transit use.

(d) Toll Booths

Toll booth paving refers to a short swath of Portland Cement Concrete Pavement (PCCP) adjacent to the toll booth windows, which is subject to added wear due to the continuous starting and stopping of vehicles. Refer to Chapter 510 for toll booth pavement limits.

(e) Holding Lanes

The holding lanes portion of the paving includes the entrance lanes to the toll booths from the adjacent roadway as well as the service lane, holding lanes, and all other areas of the trestle.

(f) Hardscape

Hardscape paving includes all paved portions of the site designed for pedestrian traffic, except overhead walkways and standard crosswalks. It is inclusive of all sidewalks and promenades.

(2) Material Selection

For pavement areas within the terminal, pavement sections and materials will be used as described below. For areas outside the terminal facility, the project designer will contact the WSDOT region materials laboratory for surfacing recommendations. The boundary is defined by the sundry site plan.

For projects with work outside the facility, consult project geotechnical, paving and traffic reports for data and recommendations that may influence pavement design. A WSDOT resurfacing and/or pavement design report specifying paving requirements for the roadways outside WSF facilities is typically prepared for terminal projects by the WSDOT region materials lab. WSDOT HQ approves the pavement design. Refer to *Design Manual* Chapter 620 Design of Pavement Structure for additional information.

Ferry terminals have low (less than 5000) Average Daily Traffic (ADT) counts with a small (less than 5 percent) truck traffic percentage. For this reason, at ferry terminals the designer is instructed to use the pavement sections given below.

In an effort to reduce stormwater collection and treatment systems, consider incorporating permeable pavement in select areas of terminal pavement design. Since the suitability of permeable cement concrete pavements is dependent upon the percolation rate of the subgrade material, this type of pavement should not be used without concurrence from the WSDOT region materials laboratory. Refer to Chapter 580 for a discussion of low impact pavement design options.

Following are some general paving recommendations for areas within the facility. For all hot mix paving applications, specify Hot Mix Asphalt (HMA) Class ½", Performance Grade (PG) 64-22, and an Equivalent Single Axle Load (ESAL) of 0.5 million in the project contract documents.

Material lift thickness and material property requirements are per the requirements of the *Standard Specifications* M 41-10. In areas with moderate to severe alligator cracking as described in the WSDOT *Pavement Surface Condition Rating Manual*, repair subgrade as needed.

(a) Roadway

For work inside WSF right of way, use 0.50’ thick compacted sub-grade (generally Method B per *Standard Specifications* Section 2-04.3(14)B) topped with a 0.50’ deep crushed rock base course and overlain by 0.50’ thick HMA, or pervious cement concrete pavement per WSDOT Materials Lab recommended design section(s). Pervious cement concrete pavement sections will also need to be sized according to hydraulic design considerations. Native embankment may need to be recompacted as well. If there is a history of rutting or shoving a bump in binder grade to PG 70-22 should be considered.

Use HMA over trestles to pave trestle roadway lanes. Match existing pavement section depth. New concrete trestle pavement requirements will be per the recommendations of the structures group supervisor.

For work outside WSF right of way, use pavement per WSDOT Materials Laboratory recommended design section(s).

(b) Parking

For reconstruction or pavement repair, use 0.50’ thick compacted sub-grade (generally Method B per *Standard Specifications* Section 2-04.3(14)B) topped with a 0.35’ deep crushed rock base course and overlain by 0.25’ thick HMA Consider the use of pervious pavement in onsite parking areas. Native embankment may need to be recompacted as well.

For resurfacing work, use a WSDOT recommended bituminous surface treatment.

(c) Transit Facilities

Due to heavier loading conditions, use 0.75’ thick Portland cement concrete pavement (PCCP), including dowel bars, instead of HMA where busses stop or wait. PCCP shall be placed over 0.50’ deep crushed rock base course over 0.50’ thick compacted sub-grade (generally Method B per *Standard Specifications* Section 2-04.3(14)B). Native embankment may need to be recompacted as well.

(d) Toll Booths

Use PCCP between the toll booths due to added wear caused by the frequent starting and stopping of vehicles at the toll booth windows. Use the same pavement section as described above for Transit Facilities. Refer to Chapter 510 for additional toll booth requirements.

(e) Holding Lanes

Use HMA over trestles to pave trestle holding lanes. Match existing pavement section depth. New concrete trestle pavement requirements will be per the recommendations of the structures group supervisor.

For upland holding lanes, in general, use the same pavement section as described above for Roadways.

(f) Hardscape

Design hardscape portions of the paved areas to support pedestrian traffic in addition to maintenance and emergency vehicles, as required. As is the case for sidewalk sections at the Anacortes and Coupeville terminals, there may be potential to incorporate pervious pavement in some hardscape areas. Design sidewalks with consideration to *Standard Plans* M 21-01 and *Standard Specifications* M 41-10. Design sidewalks to be ADA compliant. Refer to Chapter 300 for additional information.

(3) Approvals

Below is a list of approvals that may be necessary for paving activities.

- Building Permit, as administered by the local municipality
- Highway paving (outside WSF right of way) requires pavement approval by WSDOT HQ Materials Lab.
- Bituminous surface treatment requires pavement approval by WSDOT HQ Materials Lab.

340.09 Traffic Control

Traffic Control is intended to promote safety and efficiency by providing the orderly movement of all road users on streets, highways, bikeways, and private roads open to public travel. Traffic control is accomplished through the implementation of traffic control devices. Traffic control devices notify users of regulations and provide warning and guidance needed for the uniform and efficient operation of all elements of the traffic stream. Traffic control devices include signs, barricades, gates, markings, and traffic signals.

Refer to Chapter 570 and the MUTCD for further design information.

(1) Temporary Traffic Control

The Work Zone Traffic Control Plan (WZTCP) is prepared by WSF and approved by WSDOT and the local municipality as appropriate. The WZTCP is viewed as a working document that may change with operational requirements and permit conditions. It can be modified by the contractor with WSDOT approval. Consult WSF Operations both in preparation of traffic control plan and when making modifications during construction. Coordinate with local municipality and refer to *Design Manual* Chapter 1010 for additional guidance on temporary traffic control.

In addition to the aforementioned guidelines, consider the following guidance specific to WSF terminals:

- Spotters, equipped with 2-way radio communications equipment, shall be used for all operations involving the backing of trucks.
- Traffic pylons and or cones are commonly used at WSF terminals in place of traffic barrels due to the low speeds and limited space available. Refer to *Standard Plans* M 21-01 and *Standard Specifications* M 41-10 for addition guidelines.

(2) State Force Provided Traffic Control

- Accommodating pedestrians within the work zone may be needed, such as busloads of children at the Vashon Island Ferry Terminal.
- The dollar value of State Force work for a given project, which includes State provided traffic control, is limited by the requirements of RCW 47.28.035. Refer to Chapter 200 and WSDOT *Plans Preparation Manual* Division 7, Other Contract Considerations for more guidance on this topic.

(3) Permanent Traffic Control

Design traffic control devices so that features such as size, shape, color, composition, lighting, and contrast are combined to draw attention to the devices; that size, shape, color, and simplicity of message combine to produce a clear meaning; that legibility and size combine with placement to permit adequate time for response; and that uniformity, size, legibility, and reasonableness of the message combine to command respect.

Design placement of traffic control devices to be within the road user's view so that adequate visibility is provided. To aid in conveying the proper meaning, position traffic control devices appropriately with respect to the location, object, or situation to which it applies. Locate traffic control device such that a road user has adequate time to make the proper response in both day and night conditions. Place traffic control devices in a uniform and consistent manner. Avoid use of devices that are not necessary to the control of traffic as they can create confusion and clutter. Refer to *Standard Plans* M 21-01 and *Standard Specifications* M 41-10 for addition guidelines.

350.01 General
350.02 References
350.03 Design Considerations
350.04 Building Structures
350.05 Building Foundations
350.06 Building Utilities
350.07 Building Permits

350.01 General

This chapter provides guidelines for building structures at WSF terminals including the passenger and employee buildings, maintenance buildings, shelters, and toll booths. Refer to Chapter 710 (Toll Plaza) for more detailed information on toll booth design. Exhibit 350-1 shows an example building layout for the key buildings associated with a ferry terminal.

For additional information related to terminal buildings refer to the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
360	Electrical
400	Passenger Buildings
430	Terminal Supervisor Buildings
440	Maintenance Buildings, Enclosures and Support Areas
450	Architecture
510	Toll Plaza
560	Site Utilities
570	Signage and Wayfinding
600	Trestle

350.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

49 CFR Part 39 *Transportation for Individuals with Disabilities: Passenger Vessels*

International Building Code (IBC), International Code Council

International Fire Code (IFC)

National Electric Code (NEC)

International Mechanical Code (IMC)

National Fire Protection Association (NFPA), Life Safety Cod (NFPA-101)

RCW 39.35D *High-Performance Public Buildings*

WAC Title 51 *General Administration, department of (building code council)*

WAC 296-46B *Electrical Safety Standards, Administration and Installation*

Washington State Energy Code

(2) Design Guidance

ASCE 7, Minimum Design Loads for Buildings

ASCE 31-03, Seismic Evaluation of Existing Buildings

ASCE 41-06, Seismic Rehabilitation of Existing Buildings

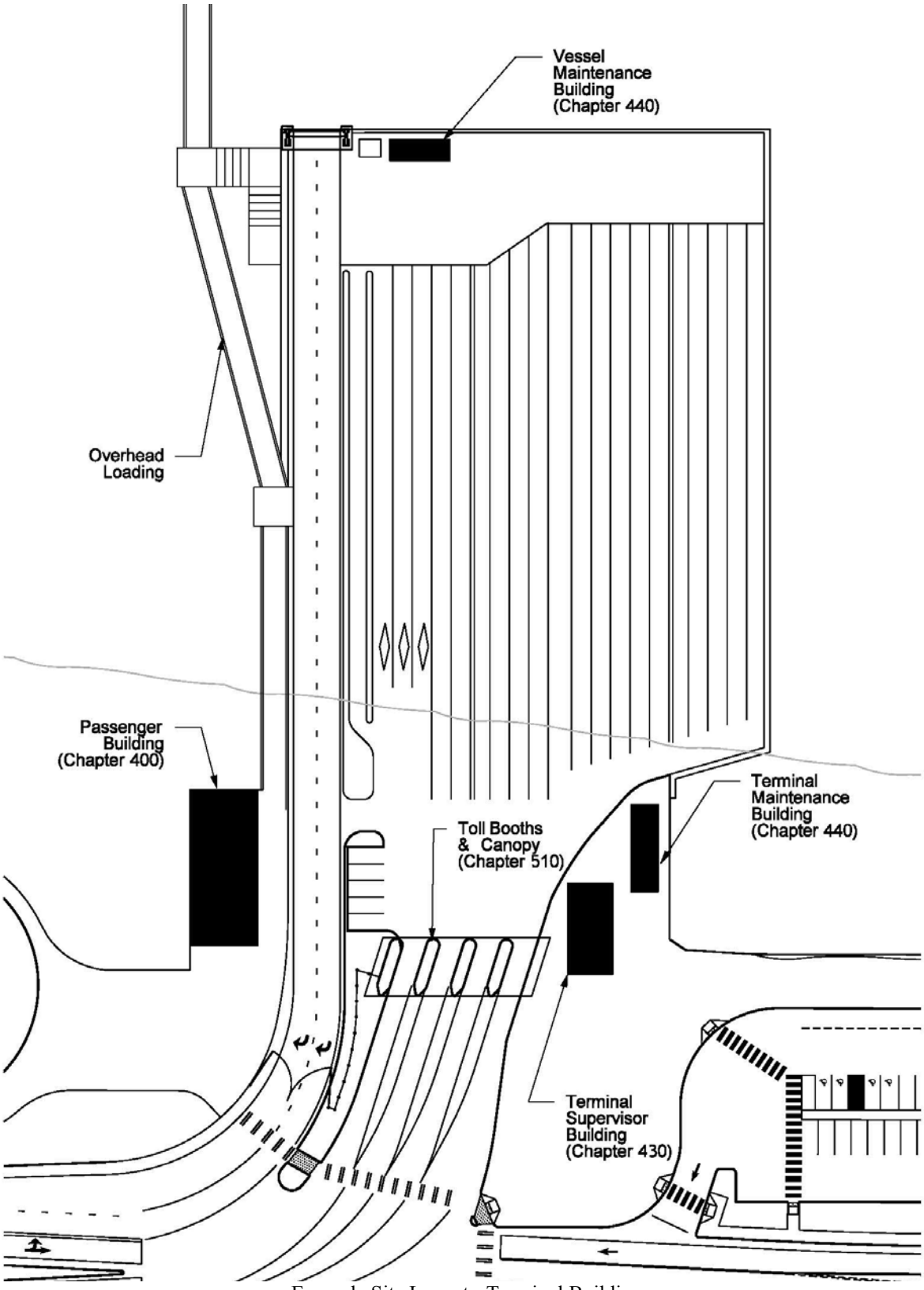
General Special Provisions, Washington State Department of Transportation, Olympia, WA. www.wsdot.wa.gov/Publications/Manuals/GSP.htm

Leadership in Energy and Environmental Design for New Construction (LEED-NC), U.S. Green Building Council

Plans Preparation Manual M 22-31, WSDOT

Standard Plans M 21-01, WSDOT

Standard Specifications M 41-10, WSDOT



Example Site Layout - Terminal Buildings
Exhibit 350-1

Example Site Layout - Terminal Buildings
Exhibit 350-1

350.03 Design Considerations

New terminal buildings are to adhere to the building codes of the local municipality and any other codes in place at the time of permit application. The *International Building Code* (IBC) is the primary reference for WSF terminal building design.

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible. Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessel security requirements, and additional information pertaining to building design. Below are links to relevant sections by topic. Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for TWIC and SSI.

- MARSEC Levels: Section 310.04
- Vessel Security: Section 310.05
- Security Rooms: Section 310.07
- Signage: Section 310.13

(3) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

Significant environmental considerations related to the design of WSF buildings include, but are not limited to:

- Shoreline
- Zoning (local jurisdiction)
- *Washington State Energy Code*

(4) Electrical

Refer to Chapter 360 for general electrical design criteria pertaining to buildings. Below are links to relevant sections by topic.

- Wiring and Protection: Section 360.04
- Wiring Methods and Materials: Section 360.05
- Equipment: Section 360.06

(5) Building Signage and Wayfinding

Refer to Chapter 570 for requirements.

(6) Building Architecture

Refer to Chapter 450 for requirements.

(7) Design Life

Base design lives on the current *Life Cycle Cost Model* (LCCM) as required by the Washington State Office of Financial Management (OFM). Confirm design lives given below are consistent with the current LCCM. Refer to Appendix E of the 2007 Life Cycle Cost Model Update (2007 LCCM) for information on when existing structures and their systems are due for replacement. Replacement life may be reduced due to functional obsolescence.

- New Terminal Buildings: 50 years
- New Toll Booths and Storage Buildings: 30 years
- Retrofitted Terminal Buildings: The preferred life is 50 years similar to new terminal buildings. Retrofitted terminal buildings may be less as a result of a Business Case Analysis and acceptance of the local building code officials.
- Retrofitted toll booths and storage buildings: The preferred life is 30 years similar to New Toll Booth and Storage Buildings. Retrofitted toll booths and storage buildings may be less as a result of a Business Case analyses and acceptance of the local building code officials.

(8) Materials Specification

Utilize materials that are in accordance with the requirements of the WSDOT *Standard Specifications* and WSF *General Structural Notes* and *Regional General Special Provisions*. Consider the material requirements of federally funded projects including the requirement for American-made steel. Make use of WSF stockpiles of materials where possible.

(9) Proprietary Items

WSF uses competitively acquired products to fulfill the requirements of a contract wherever feasible to help achieve the lowest price, the best quality, and the most efficient use of resources. There are instances in which competitive bidding may not or cannot be provided and a specific proprietary product is allowed. Refer to Section 220.07(2) for limitations on the use of proprietary items.

(10) Operations and Maintenance

Involve WSF Operations and Maintenance staff throughout the design process and provide opportunities for review of the project drawings and specifications. Ensure that required maintenance activities can be performed in compliance with OSHA/ WISHA guidelines.

Below are some operations and maintenance issues to consider:

- Minimize repair and maintenance required during the design life.
- Confirm location of existing utilities within the project limits and take appropriate measures to keep existing utilities operational, as required. Refer to Chapter 200 for some major utilities at various terminals which warrant special note.
- Address traffic control, construction staging, and phasing issues during design to minimize impact on existing operations.

(11) Building Seismic Design

Design WSF terminal buildings for "no collapse". WSF terminal buildings are not considered essential public facilities with regard to seismic codes.

Coordinate design of a building supported on a trestle with the local building department to determine a design approach that will conform to the intent of the building code. Based on past project experience, the following items may be pertinent to design of a building supported on a trestle:

a. Create a seismic analysis model that consists of the combined trestle and building structures to account for the total structure response.

b. Evaluate the design response spectrum for both the 1,000-year AASHTO event and the local building code-specified event. In some cases the difference between the spectra may be minor.

c. Evaluate building story drift limitations for a building structure supported on a relatively flexible non-building structure. Story drift limitations may apply to only the building structure.

350.04 Building Structures

(1) New Buildings

Design the structural system of new buildings based on building function and dimensions. Consider the applicable building codes, zoning restrictions, material use, and material cost during initial design of the structural system. Use uniform layout of structural members to facilitate repetitive member sizes.

Consider the type of floor system desired when designing the floor height. Provide adequate space for the structure to accommodate raised floors, utilities, suspended ceilings and other internal components.

(a) Building Location

The location of terminal buildings is determined on a site specific basis. Consider the following items when determining where to locate buildings.

1. **Terminal Buildings Located On Land**
   a. **Pros:**
      - Reduced overwater footprint
      - Passenger drop-off/pick-up near terminal building
   b. **Cons:**
      - View blockage
      - Aging population walking long distances to/from the building
      - Elevated walkway cost
2. **Terminal Buildings Located Overwater**
   a. **Pros:**
      - Passengers located near vessel interface reduces load time
   b. **Cons:**
      - Elevator on trestle (shaft depth and hydraulics over water)
      - Increased overwater footprint
      - Larger trestle area

(b) Design Codes

Washington State has adopted the *International Building Code* (IBC) under WAC Title 51. Design new structures in accordance with the IBC, WAC Title 51, and as amended by the local municipal codes. Note that Seattle has adopted its own modified building code, the Seattle Building Code (SBC).

(c) Interior

Provide interiors with natural ventilation in accordance with the IBC or mechanical ventilation in accordance with the *Uniform Mechanical Code* (UMC).

Provide ceiling heights in compliance with the IBC.

Design interior finishes in compliance with IBC and WSF standards.

(d) Exterior

Design the exterior envelope for all structures to ensure weather tightness, minimize maintenance, maximize building longevity, and be architecturally compatible with the surrounding environment. Minimize bird perch area and provide bird deterrence as necessary. Refer to Chapter 450 for additional guidance.

Design exterior walls to withstand all loads, including but not limited to gravity loads, lateral loads (i.e., wind and seismic forces) and thermal induced loads, in accordance with WAC 51 (Washington State Building Code). Design envelope construction in compliance with the *Washington State Energy Code*.

(e) LEED® Certification

All public buildings having an area greater than 5,000 square feet are required to be designed, constructed and certified to at least the LEED® Silver standard. Refer to Chapter 450 for additional information.

(2) Retrofitted Buildings

Modifications to existing buildings such as changing the type of roof or roofing material, adding new equipment, and removing load-bearing walls are common examples of renovation measures that require structural design.

(a) Design Codes

Design any addition or alteration to existing buildings to comply with the applicable requirements for new construction or IBC as agreed upon with the local building official. Areas of the structure that are not altered as part of the new construction are not required to comply with the code requirements of the new structure.

(b) Seismic Retrofit

Design additions and alterations to comply with the requirements of IBC Chapter 34. Additional requirements are as follows:

- Approval of the local building department may be required depending on the retrofit scheme.
- Seismic retrofit of interior fixtures and equipment will be required as part of any seismic retrofit.

(c) Historic Buildings

The National Historic Preservation Act regulates historic sites. Through Section 106 of the Act, any project that has a federal nexus (involves federal funding, federal permits or is on federal lands) is required to consider the effects of the project on historic or cultural resources. Section 4(f) of the National Department of Transportation Act also affords protection to historic sites. In Washington State, WAC 25-12, RCW 27.34.200 and Executive Order 05-05 provide protection to historic sites. WSDOT completed an inventory of all WSF terminal buildings, and found none eligible for inclusion on the National Register of Historic Places under Section 106 of the National Historic Preservation Act of 1966.

350.05 Building Foundations

This section provides guidelines for building foundation systems in areas not subject to scour or water pressure by wind and wave action.

Conduct foundation and soil investigations conforming to the IBC. Soil investigations are required when the classification, strength or compressibility of the soil are suspect or where a load-bearing value superior to that specified in the applicable code is specified. Soil tests are required in locations of expansive soil and in locations where the groundwater is within 5 feet of the lowest floor level. Design footings and foundations to be built on undisturbed soil, compacted fill material, or controlled low-strength material (CLSM).

Place all load-bearing walls on continuous concrete footing bonded integrally with the exterior wall footings.

Design pier and pile foundations to support building structures if the soils are not strong enough to support the loads. A foundation investigation is required to determine the basis of design and installation of pier and pile foundations. Include in the investigation and report:

- Pile types, bearing capacity, and lateral resistance
- On-center spacing
- Driving criteria
- Installation procedures
- Field inspection and reporting procedures
- Pile load test requirements
- Durability of materials
- Designation of bearing stratum
- Reduction for group action, where necessary.

For additional information regarding foundations refer to the IBC and the WSDOT Geotechnical Department.

350.06 Building Utilities

This section provides guidance and design requirements for building utilities specific to WSF projects. For information regarding trestle and site utilities, refer to Chapters 600 and 560.

Building Utility	International Building Code	WSDOT *Utilities Manual*	WSDOT *Standard Specifications*	Uniform Plumbing Code	International Fire Code	Local Gas Standards	WSF Electrical Design Standards
Potable Water	X	X	X	X			
Fire Protection[1]	X		X	X	X		
Sewer	X	X	X				
Natural Gas	X	X	X			X	
Mechanical[1]	X	X	X	X	X		
Electrical	X						X

[1] Coordinate fire protection and fire protection equipment with local Fire District and Fire Chief as early as possible in the design phase.

Building Utility Design Specifications Matrix
Exhibit 350-2

(1) Potable Water

Supply domestic water to the passenger building and the terminal supervisor building. Design all materials to meet the requirements of the WSDOT *Standard Specifications* and the local water district standards, or whichever is more stringent and more appropriate.

Design the plumbing and drainage systems for terminal buildings to include water service, domestic hot and cold water, sanitary and storm drainage as necessary. Connect the water service to an approved municipal water main. Size the connecting pipe based on the peak water demand of the plumbing system. Provide water meters and/or reduced pressure backflow preventers as required.

Size the domestic water service connection to each facility for the total peak demand. Provide each service with a main shutoff valve and backflow preventer immediately inside the structural wall of the building and a pressure-reducing valve when city pressure at the lowest point of use inside the structure is higher than 60 pounds per square inch (psi). Provide water hammer arresters for long pipe runs and branches with flush valves.

Include water heaters or tankless water heaters for facilities having lavatories, showers, and service sinks. Size all hot water pipes serving more than a single fixture for the simultaneous fixture demand with a minimum pipe size of 3/4 inch. Arrange all pipes in a systematic manner and provide for thermal expansion and drainage. Insulate all hot water pipes. To facilitate maintenance, provide isolation valves for all branches.

(2) Fire Protection

Design the fire protection system in accordance with the IFC and the NFPA. Provide fire water service for building fire protection including fire hydrants and building sprinkler systems. Provide the following fire water services:

- Fire water service to the passenger building sprinkler system
- Fire water service to the terminal supervisors building sprinkler system
- Fire water service to maintenance buildings located on the trestle

Consult the local water district for available water pressure information and fire flow requirements.

Design all materials to meet the requirements of the WSDOT *Standard Specifications* and the local water district standards.

(3) Sewer

Provide service lines from the passenger building and terminal supervisor building to the site sewer system. Consult the local sewer district for additional development standards that apply to sanitary sewer improvements outside the WSF project site.

Run gravity lines from all drains in mop sinks, lavatories, water closets, and other miscellaneous drains/sanitary waste to existing public sanitary sewers. If gravity runs cannot be accomplished, provide sewage ejector pits for drains/sanitary waste lines.

(4) Plumbing

Design plumbing equipment and systems in accordance with the provisions of the IBC and the International Plumbing Code. The number of required plumbing fixtures is based on building classification and occupancy. Separate facilities for each gender are not required in structures with a total occupant load of 15 or less. Refer to the IBC for additional requirements.

Design all water closets, urinals, and lavatories to be wall-hung and supported by standard chair supports. Service sinks are to be of stainless steel or monolithic precast terrazzo equipped with a stainless steel rim guard. Water coolers are to be wall mounted and have a bubbler of vandal-proof design. Design fixtures for persons with disabilities per Chapter 300 and as follows:

- In facilities having more than one toilet (for each gender), install plumbing fixtures in one toilet for each gender to accommodate persons with disabilities in wheelchairs where required.
- In facilities having only one toilet, install plumbing fixtures to accommodate persons with disabilities in wheelchairs in accordance with ANSI codes and the applicable provisions of the IBC.

(5) Mechanical

Design mechanical appliances, equipment and systems in accordance with the International Mechanical Code and the International Fuel Gas Code. Provide all HVAC systems with digital controls.

Design elevators and their components in accordance with ASME A17.1. Design elevators for a harsh waterfront environment. Specify elevators that are ADA accessible and have ability to accept a gurney. Provide stainless steel finishes in public areas. Dual elevators are strongly advised in high traffic areas.

(6) Natural Gas

Provide natural gas service based on mechanical design requirements. Consider gas service to the terminal supervisor office and the passenger building for heating. Stub-outs for future concessions may be provided as needed. Design parameters are set forth by Puget Sound Energy (PSE). Refer to Chapter 560 for additional information.

350.07 Building Permits

Building permits are required for the main terminal buildings including passenger buildings, maintenance buildings, toll booths, and the terminal supervisor building. Building permits are not required for the overhead loading structure.

The Structure and Mechanical Design of Overhead Loading Structures shall be per AASHTO design criteria. Egress and accessibility issues shall be designed per the IBC and the requirements of Chapter 300. Permitting limits shall be coordinated with the local Building Official.

Chapter 360 Electrical

360.01 General
360.02 References
360.03 Design Considerations
360.04 Wiring and Protection
360.05 Wiring Methods and Materials
360.06 Equipment
360.07 Lighting

360.01 General

This chapter provides general design criteria for the electrical design of WSF facilities. Refer to Chapter 610 (Vehicle Transfer Span) and Chapter 620 (Passenger Overhead Loading) for more detailed information on the electrical design criteria Vehicle Transfer Spans and Passenger Overhead Loading facilities.

Chapter	Subject
350	Buildings
610	Vehicle Transfer Span
620	Passenger Overhead Loading

360.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

Federal, State and Local Building Codes

Life Safety Code, NFPA-101

National Electrical Testing Association (NETA)

The Occupational Safety and Health Act (OSHA)

WAC 296-45 *Washington Safety Standards for Electrical Workers*

WAC 296-46B *Washington Safety Standards – Installing Electrical Wires and Equipment*

WAC Title 51, *Enterprise services, department of (building code council)*

Washington Industrial Safety and Health Act (WISHA)

Washington State Energy Code

(2) Design Guidance

Standard Plans M 21-01, WSDOT

Standard Specifications M 41-10, WSDOT

Plans Preparation Manual M 22-31, WSDOT

National Electric Code (NEC)

360.03 Design Considerations

(1) Materials Specification

Utilize materials that are in accordance with the requirements of the WSDOT *Standard Specifications*, WSDOT *General Special Provisions*, WSF *General Structural Notes*, and *Regional General Special Provisions*. Consider the material requirements of federally funded projects including Buy America requirements.

Electrical specifications and special provisions which are project specific shall be edited to contain only requirements relevant to the project they are provided for. Use WSDOT and *Regional General Special Provisions* whenever possible

Provide electronic copies of the specifications, in the file format which the specifications were developed, for each required project deliverable (e.g. 30 percent, 60 percent, 90 percent, and Final).

(2) Design Drawings

Electrical drawings for WSF Terminal Engineering shall be arranged in the order given in Section 816 of Division 8. If additional drawings are needed in a category, the sheet number should remain the same on the left side of the decimal and increase sequentially on the right side of the decimal (see the first two sheets as an example).

Provide electronic copies of the drawings, in the file format which the drawings were developed, for each required project deliverable (e.g. 30 percent, 60 percent, 90 percent, and Final).

(a) Electrical Symbols and Abbreviations

The Electrical Symbols and Abbreviations sheets shall be project specific and show only items relevant to the project they are provided for.

(b) Electrical Onelines

On power distribution onelines, in addition to showing the equipment ratings, show equipment location and interconnecting conduit and wire sizes.

(c) Site Power Distribution Block Diagram

The onelines for demolition and new work on projects that include site power distribution shall include block diagrams showing conduit interconnections of equipment, junction boxes, and manholes that are part of the work done on the project.

(d) Site Communications Block Diagram

The onelines for demolition and new work on projects that include site communication system shall include block diagrams showing the conduit interconnections of equipment, junction boxes, and manholes for the work done on the project.

(e) Communications Drawings

Communications drawings shall include telephone, paging, IT networks, radio, and other similar communications systems that are included in the project.

(3) UL Label

All electrical components shall be approved or listed and labeled by Underwriters Laboratories Inc. (UL) or other testing laboratory accredited by the State of Washington.

(4) Power Outages and Temporary Power

Power outages are defined as interruptions in normal power for longer than 15 minutes. Anticipate the number and length of power outages required for the project. If possible, specify in the Special Provisions the number, length and time of day when power outages can occur. Outages and interruptions must be coordinated with WSF Operations at all locations, and US Customs at Anacortes and Friday Harbor, to determine the need for temporary power. Projects at Terminals where facilities are to remain open during all or part of construction often require temporary power.

(5) Network and Communications Systems

Interruptions in network and communications service must be coordinated with WSF Operations, IT, and Security in advance. At Ferry Terminals open to the public during construction, the electrical design shall indicate interruptions in network and communications service shall occur during non-business hours and shall be coordinated a minimum of 48-hours in advance.

(6) Proprietary Items

WSF uses competitively acquired products to fulfill the requirements of a contract wherever feasible to help achieve the lowest price, the best quality, and the most efficient use of resources. There are instances in which competitive bidding may not or cannot be provided and a specific proprietary product is allowed. Refer to Section 220.07(2) for limitations on the use of proprietary items.

(7) Electrical Identification

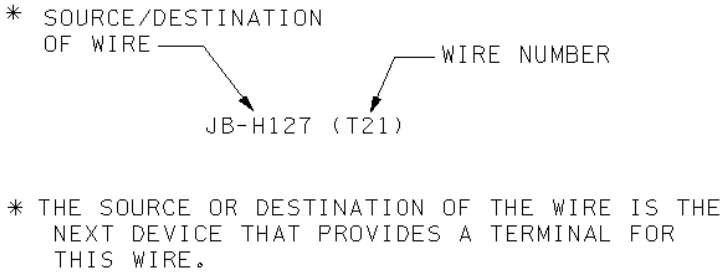
(a) Conduit

A metal conduit identification tag, stamped or engraved with the raceway number from the Contract Drawings, shall be installed on both ends of all accessible conduits. The tags shall be located in vaults and junction boxes for underground conduits and adjacent to each termination point for above ground conduits. Underground conduits shall have a continuous line warning tape located directly above the conduit(s).

Inside buildings, conduits that terminate at surface mounted equipment shall have identification tags. Conduits concealed above ceilings or in walls are not required to have conduit tags. Conduits for auxiliary systems (e.g. Fire alarm, telecommunications, etc.) shall have wraparound colored bands to identify the system.

(b) Wire and Cable

Heat shrink tubing wire and cable markers shall be installed on each conductor in panelboards, switchboards, transformers, gutters, pull boxes, outlets and junction boxes, etc. and at load connections. Identify with panelboard or switchboard designation and branch circuit or feeder number for power and lighting circuits. Identify control wiring with source/destination of wire or cable and the control wire number indicated in the schematic and interconnection diagrams. All identifications shall be typewritten.



Control Wire and Cable Labeling
Exhibit 360-1

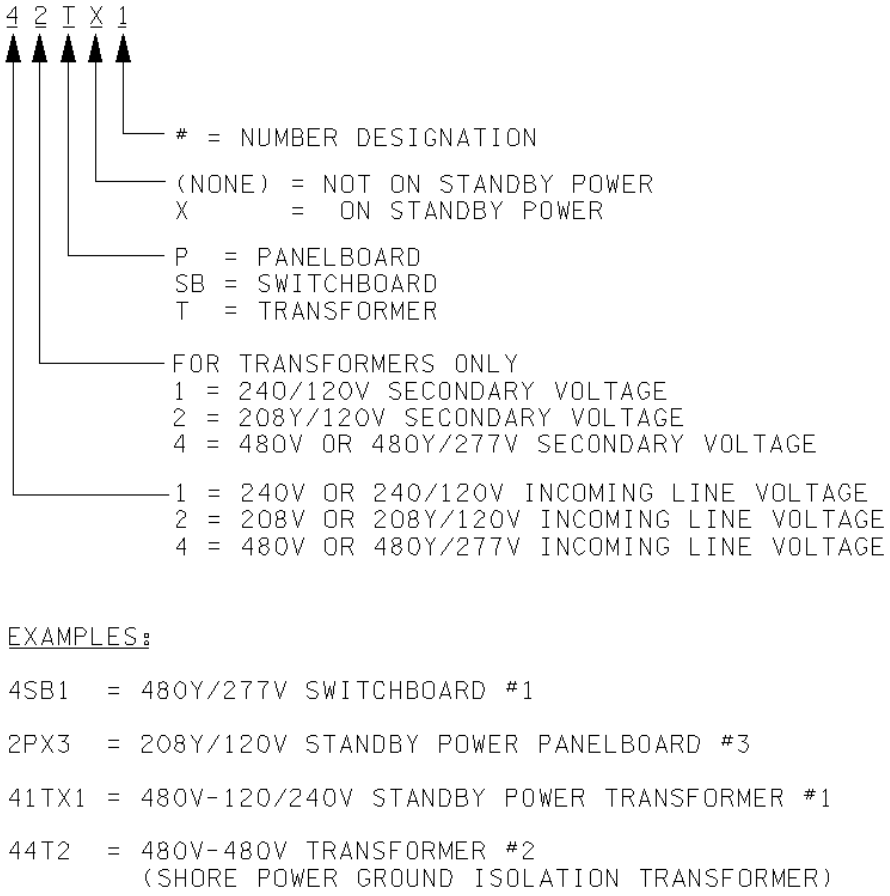
(c) Boxes and Vaults

Engraved nameplates shall be installed on all above ground junction and pull boxes and welded bead labels on all in-ground junction, pull boxes, and vaults. Box labels and nameplates shall denote the box number as indicated in the Plans and box type. Box types shall be “PWR” for power, “COMM” for communications and “CTRL” for control.

In buildings, junction box, pullbox or outlet boxes covers shall have adhesive plastic labels when mounted below 8-feet and permanent waterproof marker when mounted above 8-feet.

(d) Equipment

Equipment identification labels shall be developed following the convention shown in Exhibit 360-2.



Electrical Equipment Labeling Convention
Exhibit 360-2

Engraved nameplates with the device or equipment designation, voltage, power source designation and Contract Number shall be provided for all major electrical equipment. The following is an example of an electrical equipment nameplate:

PANEL 4P1
VOLTAGE: 480Y/277V
SOURCE: SWITCHBOARD 4SB1
CONTRACT: 5555

360.04 Wiring and Protection

(1) Calculations

The following calculations are required for all electrical designs for WSF Terminal Engineering projects. Include the final calculation in the Design File and submit to WSF Terminal Engineering in printed format. Provide all calculations with sufficient documentation so that it is clear how each result was derived.

Provide electronic copies of all project calculations, in the file format which the calculations were done, for each required project deliverable (e.g. 30 percent, 60 percent, 90 percent, and Final).

(a) Load Studies

Complete load studies for each new power distribution component (i.e., panelboards, switchboards, engine-generators, etc.) provided as part of the design and for each existing power distribution component where new load is added.

Load studies can be calculated using recorded peak demand information as permitted by NEC 220.35.

(b) Arc Flash and Short Circuit Current

Model the electrical system using SKM PTW Arc Flash software. Calculate incident energy and flash boundary values and select appropriate PPE. Provide Arc Flash labels for all panels. Provide fault reports for each bus. Provide SKM PTW Arc Flash electrical system model software files for the project.

(c) Voltage Drop

Prepare steady-state voltage drop calculations for each feeder and branch circuit over 100 feet in length. The maximum allowable voltage drop on any single feeder or branch circuit is 3 percent. The maximum total voltage drop for any load including feeder and branch circuit is 5 percent. Use the load calculated in the load study for the load used in the calculation of voltage drop. It is acceptable to assume that voltage is adjusted to normal on the secondary of transformers using taps.

Prepare motor starting voltage drop calculations for all motors 5-horsepower and above. The maximum acceptable voltage dip from any motor starting is 15 percent. Provide solid-state reduced voltage motor starters to limit voltage dip as required.

(d) Lighting

Prepare light level calculations for all new lighting provided as part of the design. Take into consideration any existing light fixtures that are to remain. Include in the light level calculation report all the information and calculation results necessary to verify the design complies with the lighting criteria. Lighting calculations shall be performed using AGI32. Provide AGI32 lighting calculation software files for the project.

(2) Services

The information in this section supplements Article 230 of the National Electrical Code and Section 9-29.24 Service Cabinets of the *Standard Specifications*. Additional requirements and information are provided that pertains specifically to WSF Terminal Engineering work.

(a) Service Ratings

For WSF work, use electrical services rated 480Y/277V, 3-phase, 4-wire unless otherwise permitted by the WSF Terminal Engineering Electrical Supervisor.

(b) Modified Type E Service Cabinets (600 Amperes and Below)

Use a Modified Type E Service Cabinet for services rated less than or equal to 600 amps. A Type E Service Cabinet detailed on WSDOT Standard Plan for 240/480V service rated up to 200A. The WSDOT Type E Service Cabinet is modified for WSF Terminal Engineering work so that it is compatible with 480Y/277V, 3-phase, 4-wire services up to 600 amps.

Modified Type E Service Cabinets house the following components:

- Power utility revenue meter base
- I-Line panelboard, service rated
- The following items are optional depending on project conditions:
- 120/240V or 208Y/120V panelboard
- Strip heater and thermostat
- Lighting contactor
- Convenience receptacle

(c) Service Equipment (Above 600 Amperes)

Provide service equipment above 600 amps as an indoor switchboard unless otherwise permitted by the WSF Terminal Engineering Electrical Supervisor.

(d) Ground-Fault Protection of Equipment

Provide ground-fault protection of equipment solidly grounded wye electrical services with service disconnect rated 1000 amps or more in accordance with Section 230.95 of the NEC.

When ground-fault protection of equipment is required on the main circuit breaker, furnish all feeder breakers in the same panel with an overcurrent trip rating greater than the ground fault trip rating of the main circuit breaker with ground fault protection. Coordinate the ground fault protection on the main and feeder breakers so that a ground fault on a feeder circuit will not trip the main unless there is a failure of the ground fault protection on that feeder circuit.

(3) Grounding

The information in this section supplements Article 250 of the NEC. Additional requirements and information is provided that pertains specifically to WSF Terminal Engineering work.

The purpose of grounding is to protect people, property, and equipment from short-circuits, ground-faults, insulation failure, lightning strikes, overvoltages, etc. Provide grounding for electrical services and separately derived systems, with the exception of shore power systems.

(a) Services

Bring the neutral conductor to the service cabinet or service disconnect enclosure and terminate on a neutral bus or lug. Ground the neutral at the service disconnect by a "main bonding jumper" between the neutral bus or lug and the ground bus.

Ground the neutral at the transformer if required by the serving utility.

(b) Grounding Electrode System

Provide a grounding electrode system for each service, separately derived system, and building. Locate the grounding electrode system as close as possible to the source of the system being grounded. Separately derived systems may share a grounding electrode system only if they are immediately adjacent, in the same building, or if they are located on the trestle.

The minimum requirements for a grounding electrode system are as follows:

- Copper-clad ground rods, 1/2 inch in diameter and 10 feet long or 3/8 inch in diameter and 8 feet long, installed in accordance with the NEC.
- Grounding electrode system for services with at least four ground rods installed around the perimeter of the service equipment.
- Grounding electrode system for separately derived systems consisting of at least two ground rods.
- Provide separation between ground rods of 6 feet minimum.
- Install each ground rod in a ground well. Ground wells are to be WSDOT Type 1 junction boxes in accordance with WSDOT Standard Plan Section J.
- Interconnect ground rods with #4/0 bare copper cable, direct buried not less than 30 inches below finished grade.
- Grounding electrode conductors are to be stranded copper with type XHHW or USE insulation.

The grounding electrode conductor between the grounding electrode system and the service equipment or separately derived system ground bus is to be an insulated conductor, installed in conduit and sized not smaller than indicated in Exhibit 360-3. Do not consider the exceptions permitted in the NEC when sizing service and derived system ground electrode conductors.

2 or smaller	8
1 or 1/0	6
2/0 or 3/0	4
Over 3/0 through 350	2
Over 350 through 600	1/0
Over 600 through 1100	2/0

Grounding Electrode Conductor for Alternating Current Systems
Exhibit 360-3

(c) Grounding Separately Derived Systems on Over Water Structures or in Buildings

Multiple separately derived systems located on the trestle and transfer spans or in buildings may be grounded from a common grounding electrode conductor. Size the common grounding electrode conductor in accordance with Exhibit 360-3, based on the largest derived phase conductor of the systems being grounded.

(d) Equipment Ground Conductor

An equipment ground conductor is to be installed in all conduits. Specify stranded copper equipment ground conductors with type XHHW insulation outdoors and THHN/THWN insulation in buildings. Design the equipment ground conductor to ground all metal that encloses electrical conductors or equipment such as cabinets, boxes, and raceway. Size equipment ground conductors according to Table 250.122 of the NEC.

(e) Grounding Boxes and Enclosures

Design all junction boxes, pull boxes, equipment enclosures, etc. with copper ground lugs or terminals for a bonding jumper to ground the box or enclosure sized according to Table 250.122 of the NEC.

(f) Raceway Grounding

Ground all metallic raceways. Ground conduits using grounding end bushings.

(g) Supplemental Grounding for Light Standards

Provide supplemental grounding at light standards. Foundations for these standards are to be installed with a bare #6 copper wire that is connected to the reinforcing cage with an approved acorn clamp or cadweld and routed to connect to the pole at the grounding lug. Size the light standard foundation based on the site soil conditions in addition to the height of the standard, quantity, weight and configuration of the luminaires.

(h) Shore Power Systems

When ferries are connected to shore power, the shipboard electrical distribution system is ungrounded to prevent highly corrosive leakage currents from seeking a path back to a grounded service transformer through the underwater body. Ground isolation is provided by a 480V to 480V, delta-delta transformer. The shore power receptacle side of the transformer is to be ungrounded. Run the ungrounded shore power feeds through a readable network connected meter and equip with ground fault detection relays providing alarm indication of ground faults. Check with the WSF Terminal Engineering Electrical Supervisor for the current ground fault detection design.

360.05 Wiring Methods and Materials

(1) Conductors for General Wiring

The information in this section supplements Article 310 of the National Electrical Code. Additional requirements and information are provided that pertain specifically to WSF Terminal Engineering work.

(a) Conductor Material

All conductors are to be stranded copper.

(b) Insulation

Use Exhibit 360-4 to determine conductor insulation requirements. Where any part of a wire run is installed underground, provide the conductors with USE insulation for the entire length of the cable run, from terminal to terminal.

Installation Type and Location	Insulation Type
Secondary Distribution Wiring	
Underground	USE
Aboveground Outdoors	XHHW
Indoors	THHN/THWN
Control Wiring	
Underground	XHHW
Aboveground Outdoors	XHHW
Indoors	THHN/THWN
Signal Wiring	
All Locations	Flame Retardant PVC
Internal Wire for Custom Panels and Cabinets	
Outdoors	XHHW
Indoors	THHN/THWN
Multi-Conductor Power and Control Cable Installed for Flexibility	
Exposed	SOOW
In Conduit	Flexible Type TC

Conductor Insulation Requirements
Exhibit 360-4

(c) Signal Cable

Cable for electronic circuits to instrumentation, metering, and other signaling and control equipment is to be two or three conductor instrument cable twisted for magnetic noise rejection and protected from electrostatic noise by a total coverage shield.

(d) Splices

1. **600V Cable**

   Make splices using a compression type butt splice, copper or high conductivity copper alloy sleeve, insulated with 600-volt rated heavy wall or medium wall heat shrinkable tubing with adhesive liner to provide a watertight seal.

2. **Control Wiring**

   Splice control wiring on terminal blocks.

(e) Terminations

1. **Terminals**

   Terminations on terminals are to use solderless copper, single-cycle compression, ring type cable lugs. Cable lugs for 250 kcmil and larger wire are to be two hole flat.

2. **Circuit Breaker**

   Terminations on circuit breakers are to be directly on the circuit breaker lugs.

3. **Motor Leads**

   Connections on 480V motors are to consist of crimp-on lugs bolted together and insulated with 600V heat shrink caps.

4. **Spares**

   Spare conductors are be terminated with heat shrink caps, coiled, and identified as spares.

(2) Junction Boxes

This section covers requirements for junction and pull box installations on WSF Terminal Engineering projects.

(a) Size

Size boxes in accordance with Article 314 of the NEC. Oversize boxes with terminals, if required, to provide wire bending space at the terminals in accordance with Article 312 of the NEC.

(b) In-Ground Junction Boxes

In-ground junction boxes are to conform to WSDOT Standard Plan Section J and Section 8-20.3(6) and 9-29.2 of the *Standard Specifications* except as listed below:

- Junction boxes placed in the roadway, roadway shoulders, parking areas, and other areas subject to vehicular traffic are to be traffic bearing with a bolt down lid and rated for HS-25 loading. In all other areas, boxes are to be rated for H-20 loading.
- Type 3 junction boxes are to be furnished with a two-door lid.

(c) Vaults

Use pre-cast vaults as manufactured by Utility Vault Company or approved equal. Vaults placed in the roadway, roadway shoulders, parking areas, and other areas subject to vehicular traffic are to be rated for HS-25 loading. Vaults in all other locations are to be rated for H-20 loading. Access lids are to be bolt down type and have spring assisted galvanized diamond plate cover with locking latch for vaults in non-vehicular traffic areas. Access lids for vaults in vehicle traffic areas are to be round cast iron type.

(d) Exposed Outdoor Junction Boxes

Junction and pull boxes over water or facing a roadway or driveway are to be NEMA Type 4 cast iron. Equip cast iron boxes with overlapping covers, external mounting lugs, internal mounting buttons for back plates or grounding lugs/bars, a neoprene gasket, and a stainless steel retention cable for the cover.

Outdoor junction and pull boxes not required to be cast iron are to be NEMA 4X Stainless Steel.

(e) Indoor Junction Boxes

Indoor boxes (larger than switch, receptacle, or fixture type) are to be constructed of sheet steel and galvanized after fabrication.

Indoor, dry, finished locations use NEMA 1.

Indoor, dry, unfinished locations or areas designated for maintenance use NEMA 12.

Indoor, wet or damp locations use NEMA 4X.

(3) Raceways

This section covers requirements for electrical raceway installations on WSF Terminal Engineering projects.

(a) Underground Conduit

PVC conduit is to be installed for underground conduit. Specify schedule 40 conduit, with the exception that where trenching is permitted for roadway crossings, or where service lateral runs are installed, specify schedule 80 conduit. The same schedule and type of conduit is to be used for the entire length of the run from outlet to outlet.

Use Rigid Metal Steel Conduit (RMC) for all underground bends and elbows. Conduit stub-ups are to be Rigid Metal Steel Conduit from the exposed portion to and including the underground bend or elbow that turns the conduit horizontal. For conduit that enters the ground at a slope or bulkhead where there is no elbow or bend that turns the conduit horizontal, install at least 3-feet of Rigid Metal Steel Conduit underground

before transitioning to PVC Conduit. Paint Rigid Metal Steel Conduit emerging from underground with a protective coating of bitumastic, asphalt-based paint or a PVC coating extending from the transition (PVC to steel) coupling to 6 inches above grade.

(b) Exposed Outdoor Conduit

Rigid Metal (Steel) Conduit (RMC) is to be installed for exposed outdoor installations on shore. All conduit bodies, device boxes, and conduit fittings are to be steel or malleable iron with a hot-dipped galvanized finish. Support material and fittings are to be hot-dipped galvanized steel. Anchors, nuts, bolts, washers, and other hardware are to be stainless steel.

Rigid Metal Steel Conduit PVC-Coated (RMCP) are to be installed for all exposed outdoor installations on offshore structures. All conduit bodies, device boxes, and conduit fittings connected to RMCP conduit are to be PVC-coated steel or PVC-coated cast iron. Support material and fittings in direct contact with RMCP conduit are to be PVC-coated steel. Anchors, nuts, bolts, washers, and other hardware are to be stainless steel.

Liquidtight Flexible Metal Conduit (LFMC) are to be installed for all exposed outdoor installations where flexibility is needed. All fittings for LFMC conduit are to be PVC-coated steel or PVC-coated cast iron. Support material and fittings in direct contact with LFMC conduit are to be PVC-coated steel. Anchors, nuts, bolts, washers, and other hardware are to be stainless steel.

(c) Indoor Conduit

Electrical Metallic Tubing (EMT) conduit is to be used indoors in finished areas.

In areas where maintenance work is performed or other such areas where conduit may be subject to physical damage, RMC (Steel) is to be used.

Flexible metal conduit may be used indoors only. Flexible metal conduit may be used in locations requiring flexibility, for wiring between light fixtures, and fished between studs in interior wall, but is to not be used for general purpose raceways.

(d) Metal Wireway

Metal wireway and gutters may be used outdoors and indoors in unfinished areas. Outdoor wireway are to be NEMA 4X, indoor wireway are to be NEMA 1 in finished areas and NEMA 12 in unfinished areas.

(e) Surface Metal Raceway

Surface metal raceway may be used in toll booths. It is not to be used in other locations.

360.06 Equipment

(1) Switches

The information in this section supplements Article 404 of the National Electrical Code. Additional requirements and information are provided that pertains specifically to WSF Terminal Engineering work.

(a) Wall Switches

Wall switches are to be heavy-duty industrial grade.

(b) Disconnect Switches

Disconnect switches are to be Heavy Duty Safety Switches, 600V rated, non-fusible.

(c) Circuit Breaker Disconnects

Circuit breaker disconnects are to be enclosed molded case circuit breakers.

(d) Manual Transfer Switches (MTS)

Manual transfer switches are to be Double Throw Safety Switches, 600V rated, non-fusible, Type DTU.

(e) Enclosures

Enclosures for disconnect switches, circuit breaker disconnects, and manual transfer switches are to be NEMA Type 1 indoors in finished areas, NEMA 12 indoors in unfinished areas and NEMA Type 4X stainless steel outdoors.

(2) Automatic Transfer Switches (ATS)

This article covers automatic transfer switches (ATS) for connection of a utility provided power source and a standby engine-generator power source to designated loads.

(a) Enclosures

Enclosures for ATSs are to be NEMA Type 12 indoor and NEMA Type 4 outdoor.

(b) Neutral

ATSs are to be solid neutral or switched neutral depending on the power distribution system in which it is applied.

(c) Optional Features

ATSs are to include the following optional features:

- Auxiliary contacts consisting of one contact that is closed when the ATS is connected to the normal source and one contact that is closed when the ATS is connected to the standby source.
- ATSs installed outdoors are to be furnished with a strip heater and thermostat, wired to load terminals.
- Remote annunciation.

(3) Receptacles

The information in this section supplements Article 406 of the National Electrical Code. Additional requirements and information is provided that pertains specifically to WSF Terminal Engineering work.

(a) Convenience Receptacles

Convenience receptacles are to be heavy-duty specification grade, duplex grounding type rated 15A at 125V, NEMA 5-15R, ivory in color.

Indoor GFCI receptacles are to be heavy duty grade, 15A, 125VAC, NEMA 5-15R, ivory in color.

Outdoor and wet location GFCI receptacles are to be marine product, 15A, 125 VAC, GFCI receptacle, gray with PVC weatherproof while-in-use cover plate.

Isolated ground receptacles are to be similar to duplex receptacles except with the ground terminal insulated from the mounting yoke, hospital grade and orange in color.

(b) Shore Power Receptacles

Shore power receptacles are to be 200A, 600 VAC, 3-wire, 3-pole pin and sleeve receptacle with shell grounding, rain tight construction with clamp cover.

(4) Switchboards and Panelboards

The information in this section supplements Article 408 of the National Electrical Code. Additional requirements and information are provided that pertain specifically to WSF Terminal Engineering work.

(a) Bus Work

All bus work is to be copper.

Neutral busses should not be less than 100 percent rated.

Isolated ground panels are to have a 200 percent rated neutral bus.

(b) Switchboards

Main and feeder devices in switchboards are to be circuit breakers. All switchboards are to have a main circuit breaker unless otherwise permitted by the WSF Terminal Engineering Electrical Supervisor.

When ground fault protection is required on the main circuit breaker, all feeder breakers with trip rating greater than the ground fault trip rating of the main circuit breaker are to be furnished with ground fault protection. The ground fault protection on the main and feeder breakers are to be coordinated so that a ground fault on a feeder circuit will not trip the main unless there is a failure of the ground fault protection on that feeder circuit.

Distribution sections are to consist of group mounted circuit breakers.

Switchboard enclosures are to be NEMA 1 indoor and NEMA 3R outdoor on shore. Switchboards should not be installed outdoors on over water structures. For new construction, when a switchboard is to be installed on the trestle it should be installed in a ventilated electrical room inside a building.

(c) Panelboards

Panelboard enclosures are to be NEMA 1 indoor in finished areas, NEMA 12 indoor in unfinished areas and NEMA 4X stainless steel outdoors.

(5) Pipeline Freeze Protection (Heat Trace)

The information in this section supplements Article 427 – "Fixed Electric Heating Equipment for Pipelines and Vessels" of the National Electrical Code. Additional requirements and information are provided that pertain specifically to WSF Terminal Engineering work.

(a) Heat Trace Cable

Heat trace cable is to be self-regulating type with tinned copper braid.

(b) Heat Trace Monitoring and Control

A Heat Trace Monitoring and Control Panel are to be provided for heat trace installations. The Monitoring and Control Panel are to be a microprocessor-based unit with programmable heater ON, OFF and ALARM set points and indication for Low Temperature, High Temperature, Low Heater Current, High Heater Current, Ground Leakage Current, and Damaged RTD.

(c) Temperature Sensors

Temperature input to the Heat Trace Monitoring and Control Panel are to be from pipe wall sensing RTD(s).

(6) Motors and Motor Starters

The information in this section supplements Article 430 of the National Electrical Code. Additional requirements and information are provided that pertain specifically to WSF Terminal Engineering work.

(a) Motors

Efficiency – All motors are to be of the "energy efficient" or "energy saver" type when available. Design A and B polyphase motors are to comply with the minimum efficiencies required by the Washington State Energy.

Motor Enclosures – Motors installed outdoors or indoors in areas where maintenance activities are performed are to be Totally Enclosed type.

Motors – Motors in indoor finished areas are to be Open Drip-proof type.

(b) Motor Starters

Motor starters are to be combination type with Motor Circuit Protector (MCP) overcurrent protection device.

Motor starters are to be across the line starting type unless reduced voltage starting is necessary to reduce motor starting voltage dip. Across the line motor starters are to be NEMA rated.

The maximum acceptable voltage dip from any motor starting is 15 percent. Solid-state reduced voltage motor starters are to be provided to limit voltage dip as required.

Motor starters installed outdoors are to have NEMA 4X stainless steel enclosures.

Motor starters installed indoors are to have NEMA 12 painted steel enclosures.

(7) Generators

The information in this section supplements Article 445 of the National Electrical Code. Additional requirements and information are provided that pertain specifically to WSF Terminal Engineering work.

(a) Equipment

Generators are to be standby rated packaged engine-generator systems with diesel engine drives.

The installation shall be designed as an optional standby system as defined in Article 702 in the National Electrical Code.

Due to long lead times for procurement, consider advance purchase of the generator.

(b) Ratings

Generators are to be rated 480 Volts, 3-phase, 4-wire and sized to power all terminal facility loads; with the exception of the vessel shore power. Size the generator with a 10 percent surplus capacity. Prepare a generator sizing technical memorandum as the basis for design. The technical memorandum must receive the concurrence of the WSF Terminal Engineering Electrical Engineering Supervisor.

(c) Enclosures

Enclosures are to be outdoor, weather-protective, sound attenuating type. The overall sound rating (combined mechanical and exhaust noise) are not to exceed 75 dBA at 23 feet.

(d) Fuel Tanks

Fuel tanks are to be integral base type sized for 24-hour continuous full load operation of the engine-generator.

(e) Remote Annunciator Panel

A Generator Remote Annunciator Panel is to be provided for each engine-generator. Panels are to comply with NFPA 110, Level 1. Typically, the Generator Remote Annunciator Panel will be located in the Terminal Supervisor Office. Coordinate exact location with WSF Operations.

(f) Grounding

The generator neutral is to be connected to a grounding electrode system in accordance with Section 360.04.

(8) Transformers

The information in this article supplements Article 450 of the National Electrical Code. Additional requirements and information are provided that pertain specifically to WSF Terminal Engineering work.

(a) Windings

All transformers are to have copper windings.

(b) Outdoor, Dry-Type Transformers

Dry-type transformers installed outdoors are to have encapsulated core and coil assemblies.

(c) Temperature Ratings

For transformers 10kVA and below, the temperature rise is to be 115-degree C rise above a 40-degree C ambient. For transformers above 10kVA, the temperature rise is to be 150 degrees C above a 40-degree C ambient. The maximum temperature of the top of the enclosure is to not exceed a 35-degree C rise above a 40-degree C ambient.

(9) Mini Power-Zone

The information in this section covers Mini Power-Zone packages, which is a packaged power supply consisting of an incoming line main circuit breaker, a transformer section, and secondary power distribution panelboard.

Mini Power-Zone packages are to be provided with the following options:

- Bolt-on branch circuit breakers.
- NEMA 3R painted stainless steel enclosure for outdoor installations

360.07 Lighting

(1) General Requirements

The design of lighting systems shall be developed to provide:

- Safe working conditions, safe passage, and the identification of any hazards or obstruction, indoors and outdoors.
- Comfortable visibility conditions.
- Adequate light levels and color for safe and effective accomplishment of tasks to be performed.
- The most efficient and economical system practicable.
- Minimal light trespass and glare.

General illumination shall conform to the recommendations of *The Illumination Engineering Society of North America (IESNA) Lighting Handbook* except as modified by this article.

(2) Indoor Lighting Design Criteria

(a) Indoor Illumination

Indoor illumination shall be provided in accordance with Exhibit 360-5.

Light Level Chart			
Area Description	**Minimum Average Horizontal Illuminance (Footcandles)**	**Minimum Maintained Illuminance (Footcandles)**	**Distance Above Finished Floor (Inches)**
Agent's Office	30		30
Bicycle/Kayak Staging	10		0
Building Entrance		5	0
Communications	50		30
Computer	30		30
Conference Room	30		30
Corridors	5	1.2	0
Counting/Safe Room	50		30
Crew Quarters	20		30
Crew Room	30		30
Customs Check-In	30		30
Customs Offices	30		30
Deli/Pub	30		30
Dining	30		30
Electrical	30		30
Employee Break Room	15		30
Espresso/Fast Food	30		30
Food Storage	15		0
Lockers	15		0
Mechanical	20		0
News/Books/Gifts/ATM	50		30
Office/Admin/Training	30		30
Parking (Indoor)	5		0
Receiving/Service	20		0
Restrooms	General: 5 Vanity: 15 Plumbing: 15		General: 0 Vanity: 30 Plumbing: at top of fixture
Security Control	30		30
Service	20		30
Stairways	5		0
Storage/Janitors/Supply	10		30
Tickets	30		30
Travel Desk	50		30
Waiting	15		30
Water Valve	20		0

Indoor Illumination Requirements
Exhibit 360-5

(b) Uniformity

For indoor lighting, the maximum maintained horizontal illuminance level shall not be more than six times the average level and the minimum horizontal illuminance shall not be less than one-sixth the average level.

(c) Exit and Emergency Lighting

Exit and emergency lighting shall be provided in accordance with the Life Safety Code (NFPA 101). Emergency lighting shall also be provided on the outside of building to light steps or ramps for safe egress.

Emergency lighting shall be provided to operate in the event of failure of the normal power source. Emergency lighting fixtures provided to illuminate the means of egress shall be arranged to provided initial illumination that is not less than an average of 1 foot-candle and, at any point, not less than 0.1 ft-candle, measured along the path of egress at floor level. A maximum-to-minimum illumination uniformity ratio of 40-to-1 shall not be exceeded.

Exit signs shall be provided to mark each means of egress and shall use LED type lamps.

Key communications and Operations areas shall have emergency lighting sufficient to allow work to continue. Coordinate with the WSF Terminal Engineering Electrical Supervisor to determine which areas fall into this category.

Electrical Equipment rooms shall have emergency lighting to provide 3 ft-candles average at 30 inches above the floor with an average-to-minimum uniformity of 6-to-1.

Exit and emergency lighting shall provide a minimum operating time of 90 minutes. Additional operating time may be required at some locations. If batteries are used as the emergency lighting power source, they shall be long-life Nickel-Cadmium batteries.

(3) Outdoor Lighting Design Criteria

Outdoor illumination shall be provided in accordance with Exhibit 360-6.

Light Level And Uniformity Ratio Chart			
Area Description	Minimum Average Horizontal Illuminance (Footcandles)	Minimum Horizontal Illuminance (Footcandles)	Target Uniformity Ratio (Avg/Min)
Pedestrian walkways (flat)	3	1	
Pedestrian walkways (sloped, uneven, steps, or obstacles)	5		3:1
Transfer span pedestrian walkway (at Terminals without overhead loading)	5		3:1
Traffic ways	1		3:1
Traffic holding area	0.8		4:1
Traffic holding area where WSF personnel direct traffic		1	
Gangways	10	3	

Outdoor Illumination Requirements
Exhibit 360-6

Luminaires at locations accessible by vehicles shall not be mounted at heights greater than 40-feet so that WSF Maintenance is able to perform maintenance on the luminaires.

Luminaires at locations not accessible by vehicles shall not be mounted at heights greater than 16-feet so that maintenance can be performed from a step ladder.

If Generator power is available, Exit signs, site lighting and egress lighting shall be connected to standby panels in addition to Battery powered Emergency Lighting.

(4) Lighting Calculations

The light level calculation report, as described in Section 360.04(1)(d), shall include all the information and calculation results necessary to verify the design complies with the lighting criteria.

Average light levels for areas shall not be less than the values given in the above lighting criteria. Where a minimum maintained light level is listed for an area, the light levels shall not be lower than the value given at any point in the calculation point grid for that area.

The lighting system shall be designed to be as close as practical to the target uniformity ratio (typically within 5 percent). Lighting designs where the uniformity exceeds the target uniformity ratio require approval of the WSF Terminal Engineering Electrical Supervisor.

The location, arrangement, size, and spacing of all calculation point grids require approval of the WSF Terminal Engineering Electrical Supervisor.

Division 4 Terminal Buildings

Chapter 400 Passenger Buildings 400-1
400.01 General 400-1
400.02 References 400-3
400.03 Design Considerations 400-3
400.04 Passenger Building Spaces 400-4
400.05 Circulation, Structure, and Envelope Multipliers 400-5
400.06 Facility Entry 400-5
400.07 Customer Information 400-6
400.08 Ticketing and Queuing 400-7
400.09 Passenger Waiting Areas 400-8
400.10 Passenger Conveniences 400-8
400.11 Passenger Security Screening Area 400-10
400.12 Lost and Found 400-10
400.13 Attendant Control Station 400-10
400.14 Passenger Control Point 400-10
400.15 Luggage Cart and Wheelchair Storage 400-11
400.16 Security Interview Room 400-11
400.17 Restrooms and Water Fountains 400-12
400.18 Janitor Storage 400-13
400.19 IT Equipment Network Room 400-13
400.20 Terminal Electrical Room 400-14
400.21 Elevator Machine Room 400-15
400.22 Retail, Concessions, and Lease Space 400-15
Chapter 410 Circulation and Passenger Waiting 410-1
410.01 General 410-1
410.02 References 410-2
410.03 Design Considerations 410-3
410.04 Passenger Waiting Areas 410-4
410.05 Passenger Circulation 410-19
410.06 Boarding/Departing Routes 410-20
Chapter 420 Passenger Amenities, Business Case 420-1
420.01 Elements of the Business Case 420-1
420.02 Special Topics 420-4

Chapter 430 Terminal Supervisor Buildings 430-1
430.01 General 430-1
430.02 References 430-2
430.03 Design Considerations 430-3
430.04 Terminal Supervisor Building Spaces 430-4
Chapter 440 Maintenance Buildings, Enclosures, and Support Areas . . 440-1
440.01 General 440-1
440.02 References 440-3
440.03 Design Considerations 440-3
440.04 Terminal Maintenance Building 440-5
440.05 Vessel Maintenance Building 440-8
440.06 Miscellaneous Structures, Enclosures, and Support Areas 440-11
Chapter 450 Architecture 450-1
450.01 General 450-1
450.02 References 450-2
450.03 Design Considerations 450-2
450.04 Building Code Requirements 450-4
450.05 Building Permits 450-4
450.06 WSF Architectural Guidelines 450-5
450.07 LEED® Certification 450-10
450.08 Public Art Requirements 450-11
Chapter 460 Landscape Architecture 460-1
460.01 General 460-1
460.02 References 460-2
460.03 Design Considerations 460-2
460.04 Pedestrian Pavement / Hardscape: 460-3
460.05 Landscaping 460-4
460.06 Lighting 460-9
460.07 Site Furnishings 460-9
460.08 Signage and Informational Kiosks 460-10
460.09 Public Art 460-10
Chapter 470 Public Art 470-1
470.01 General 470-1
470.02 References 470-1
470.03 Public Art Requirements 470-2
470.04 Use of Funds for Art 470-2
470.05 Criteria for Public Art 470-3
470.06 Process and Project Delivery Plan 470-5
470.07 Approvals 470-6
470.08 Documentation 470-6

Chapter 400 Passenger Buildings

400.01 General
400.02 References
400.03 Design Considerations
400.04 Passenger Building Spaces
400.05 Circulation, Structure, and Envelope Multipliers
400.06 Facility Entry
400.07 Customer Information
400.08 Ticketing and Queuing
400.09 Passenger Waiting Areas
400.10 Passenger Conveniences
400.11 Passenger Security Screening Area
400.12 Lost and Found
400.13 Attendant Control Station
400.14 Passenger Control Point
400.15 Luggage Cart and Wheelchair Storage
400.16 Security Interview Room
400.17 Restrooms and Water Fountains
400.18 Janitor Storage
400.19 IT Equipment Network Room
400.20 Terminal Electrical Room
400.21 Elevator Machine Room
400.22 Retail, Concessions, and Lease Space

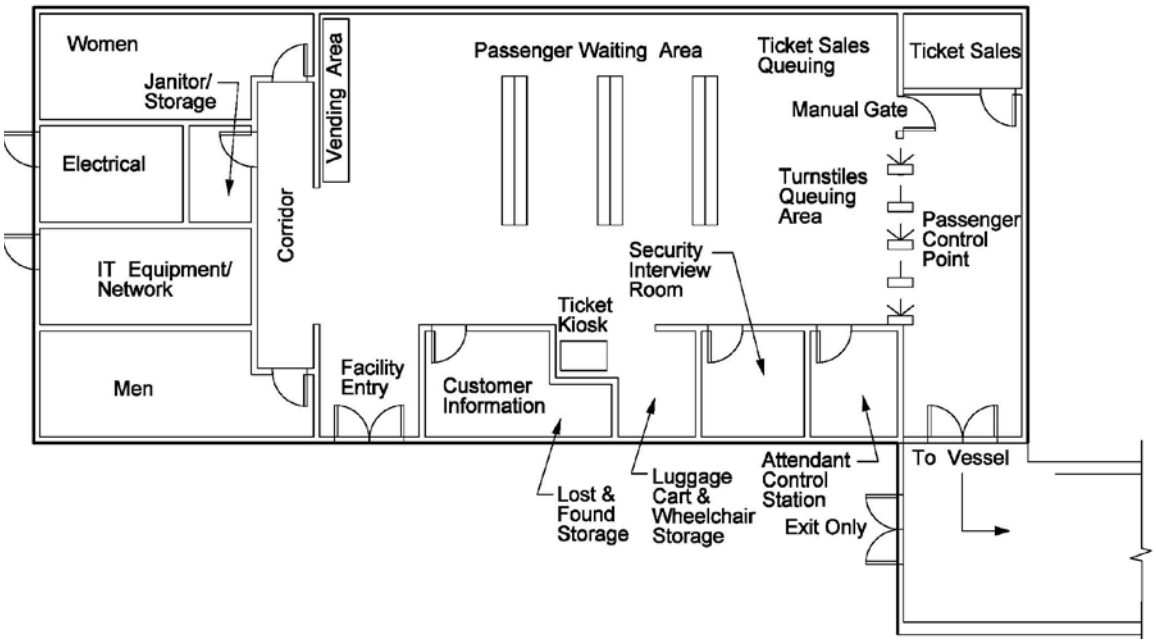
400.01 General



Clinton Ferry Terminal Passenger Building
Exhibit 400-1

This chapter identifies the spaces associated with passenger functions and provides guidance for the design of new and remodeled terminal facilities. Refer to Exhibit 210-3 for more information on design elements that apply to rehabilitation/remodel projects and replacement projects. Note that not all building spaces described in this chapter are required at each terminal. Refer to Appendix S for a list of existing and anticipated future building spaces by terminal.

Exhibit 400-2 gives an example layout for a passenger building. Actual passenger facility layouts will vary based on specific site features and project needs. As required, building spaces/functions described in other chapters may be accommodated in the passenger building. For example, passenger facilities may be combined with terminal supervisor facilities in a single building. Terminal supervisor building spaces are described in Chapter 430. Maintenance functions may also be included. Refer to Chapter 440 for a description of maintenance building spaces.



Example Passenger Building Layout
Exhibit 400-2

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
350	Buildings
360	Electrical
410	Circulation and Passenger Waiting
420	Passenger Amenities, Business Case
430	Terminal Supervisor Buildings
440	Maintenance Buildings, Enclosures and Support Areas
450	Architecture
470	Public Art
550	Site Circulation
560	Site Utilities

400.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

International Building Code (IBC), International Code Council, Washington D.C.

(2) Design Guidance

Enterprise Services Sizing Criteria

Enterprise Services Standard Plans

Pedestrian Planning and Design (1971), John Fruin, Metropolitan Association of Urban Designers and Environmental Planners, New York, NY.

WSDOT Facilities Office Standard Plans

(3) Supporting Information

Colman Dock Seattle Ferry Terminal Level of Service Determinations Existing Terminal Facilities (1998), prepared by Arai/Jackson for WSF, Seattle, WA.

Mukilteo Multimodal Terminal Master Plan Design Report (2004), Ferries Division, Washington State Department of Transportation, Seattle, WA.

400.03 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible. Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessel security requirements, and additional information pertaining to passenger building design. Below are links to relevant sections by topic. Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for TWIC and SSI.

- MARSEC Levels: 310.04
- Passenger Security Screening Area: 310.06
- Access Control/Restricted Areas/TWIC: 310.10
- Signage: 310.13
- Sensitive Security Information (SSI): 310.14

(3) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation. For projects that involve remodeling and renovation of existing buildings, consider the need for assessment of lead paints, asbestos and other hazardous materials.

(4) Buildings

Refer to Chapter 350 for general building design criteria pertaining to new and remodeled passenger buildings. Below are links to relevant sections by topic.

- Building Structures: 350.04
- Building Foundations: 350.05
- Building Utilities: 350.06

(5) Building Architecture

Refer to Chapter 450 for general architectural design criteria pertaining to the passenger building. Below are links to relevant sections by topic.

- Building Code Requirements: 450.04
- Building Permits: 450.05
- WSF Architectural Guidelines: 450.06

(6) Building Displays/Public Art

Refer to Chapter 470 for public art requirements pertaining to passenger buildings. Below are links to relevant section by topic.

- Public Art Requirements: 470.03
- Criteria for Public Art: 470.05

(7) Equipment and Storage Area Locations

When feasible, locate equipment and storage areas in close proximity to their required use. Take under consideration equipment and storage related issues such as access, noise, vibrations, emissions, odor, safety and environmental concerns. Depending on their function, these areas may be located either on land or over-water and may be within a multi-purpose building or standalone enclosure. Storage areas may be combined if they have compatible storage requirements.

400.04 Passenger Building Spaces

Locate the passenger building either on or near the trestle in the vicinity of the slips. Note that there may be environmental permitting challenges associated with placing new buildings on the trestle due to overwater coverage issues. Exhibit 400-3 identifies the building spaces that are typically associated with a passenger building. These spaces are described in more detail in the paragraphs that follow. Information on sizing requirements for these spaces is provided in Appendix S.

WSF passenger buildings are typically one level, but they may be two levels to accommodate site constraints and/or overhead loading. Exhibit 400-3 identifies the preferred level for locating building spaces in two-level passenger buildings.

Building Space	1st Floor[1]	2nd Floor[1]	Comments
Facility Entry		X	Locate near public access point
Customer Information		X	Locate near entry
Passenger Ticket Sales Area & Queuing		X	Separate from kiosk location
EFS Kiosk and Queuing		X	Separate from ticket sales area
Passenger Waiting Area		X	Upstream of control point
Passenger Conveniences		X	Phones, vending, etc.
Passenger Security Screening Area		X	Coordinate with CSO
Lost and Found		X	
Attendant Control Station		X	Locate near the turnstiles
Passenger Control Point		X	Typically at turnstiles
Luggage Cart and Wheelchair Storage		X	
Security Interview Room		X	
Restrooms		X	
Janitor Storage		X	Locate near restrooms
IT Equipment Network Room	X		Secure room
Terminal Electrical Room	X		May be located in TM Bldg[2]
Elevator Machine Room	X		For multi-level buildings
Retail, Concession, and Lease Space	X	X	Optional

[1] Indicates preferred level for multi-level building

[2] TM = Terminal Maintenance

Passenger Building Spaces
Exhibit 400-3

400.05 Circulation, Structure, and Envelope Multipliers

The individual building areas provided in Appendix S do not account for space requirements associated with terminal building circulation corridors, structural columns, and the building envelope (walls). Estimate these space requirements using a 25% multiplier on building spaces associated with the passenger building.

400.06 Facility Entry

Provide passengers with an easily accessible entry into the terminal building. Locate the facility entry for convenient access from the street, parking, pick-up/drop-off areas and other modes of transportation. Design facility entries to comply with ADA accessibility requirements as outlined in Chapter 300 (Accessibility). Refer to Chapter 550 (Site Circulation) for additional considerations.

400.07 Customer Information

Customer information is an essential part of ferry terminal design, especially in terminals with recreational routes. Provide the following areas near the facility entry for customer information.

(1) Customer Information Booth

This space is used for displaying brochures, fliers, public information, travel information, local transit, bus, light rail, and taxi information where applicable. Ferry schedules and information including maps, routes, and destinations may also be displayed. Provide adequate space for floor mounted and wall mounted display racks, a desk, and an attendant. Locate this area upstream from the passenger control point so that it is accessible to the public, preferably near the facility entry.

(2) Certified Folders/Brochures

This space is set aside for contracted vendors for placement and setup of display racks for disseminating informational brochures and maps or other public information. Provide an open area or open enclosure with ample wall space for brochure racks and/or floor standing racks. Locate near the facility entry. Provide accessibility to all information. WSF's Operations Business Development Manager is responsible for coordinating specific terminal requirements with Certified Folder.



Certified Folder Display
Exhibit 400-4

400.08 Ticketing and Queuing

Ticketing and queuing includes all passenger activity related to purchasing ferry tickets and lining up to board the vessel. The following spaces are allocated for ticketing and queuing functions.

(1) Passenger Ticket Sales Area

The passenger ticket sales area is occupied by a qualified employee for the purpose of selling fare media types to the general public. This is a booth or counter area typically located adjacent to the turnstiles. It is used for selling tickets and as an auditing function for the turnstile operations. This area includes the following: one ADA compliant work space; seller drop safe; security view monitor; and counter space to accommodate electronic fare system equipment, cash drawer, and small work area with desk calculator, sailing schedules and information, alerts, and update information.

(2) Electronic Fare System (EFS) Kiosk

The electronic fare system (EFS) kiosk is an automated stand alone device that dispenses pre-paid tickets when payment is made by a credit or debit card. Base the number of EFS kiosk units on a maximum queue length of 6 passengers with a wait time of no more than 3 minutes.

Discounted tickets (senior, disabled, youth, etc.) are not available through the EFS kiosks. Passengers wishing to purchase discounted tickets must purchase them at a ticket sales counter or at the toll booth in order to verify the passenger qualifies for a discounted ticket. Provide an ADA accessible path from the passenger building to the toll plaza to allow for pedestrian use of the toll booths when ticket sale counters are not provided inside the passenger building. Do not provide sidewalks to the toll plaza at terminals where ticket sales are conducted inside the passenger building year round. Refer to Chapter 300 for additional information.



Electronic Fare System Kiosks
Exhibit 400-5

(3) Ticket Sales Queuing

This space is for customers waiting to purchase tickets from a manned sales toll booth. Design ticket sales queuing area to accommodate waiting customers conveniently out of the way of passenger circulation including offloading and boarding passengers. Assume a queue length of 6 passengers. The ticket sales queuing area is not included in the passenger waiting area calculation and needs to be added in separately.

(4) EFS Kiosk Queuing

This space is for customers waiting to purchase tickets from an EFS kiosk. Design ticket queuing area to accommodate waiting customers conveniently out of the way of passenger circulation including offloading and boarding passengers. Assume a queue length of 6 passengers. The kiosk queuing area is included in the passenger waiting area calculation.

400.09 Passenger Waiting Areas

Passenger waiting refers to areas for passengers to sit and stand, both inside and outside the terminal building, when they are not actively buying tickets or retail items or walking through the terminal. Locate passenger waiting areas upstream of the passenger control point and as close as possible to the ferry slips to provide for boarding passengers as quickly as possible. Refer to Chapter 410 for more information including sizing of the passenger waiting areas.

400.10 Passenger Conveniences

Provide snack and newspaper vending as well as automatic teller machines (ATMs) for use by all transit users with the final quantity to be determined by WSF Operations. Locate passenger conveniences in areas that will not interrupt passenger circulation and out of the way of waiting passengers so they can be accessed during peak periods. The preferred location for passenger conveniences is within the passenger waiting area. Assume 50 to 100 square feet of area for conveniences. This is an add-on area, meaning that the square footage provided for passenger conveniences is in addition to the required waiting area calculated in Chapter 410. Note that the area for circulation around the passenger conveniences is already accounted for in the passenger waiting area size calculation.

Activity/Space	Recommended Area
Food and Snack Vending	9 sq ft (per unit)
Arcade Games	9 sq ft (per unit)
Newspaper and Magazine Vending	4 sq ft (per unit)
ATM Machine	16 sq ft (per unit)
Change Machine	6 sq ft (per unit)
Telephone Area	6 sq ft (per unit)

Passenger Convenience Sizing Guidelines
Exhibit 400-6



Passenger Conveniences at Edmonds Ferry Terminal
Exhibit 400-7



Passenger Conveniences at Anacortes Ferry Terminal
Exhibit 400-8

400.11 Passenger Security Screening Area

Security measures aimed at reducing risk and mitigating the consequences of actions that threaten the security of personnel, the facility, and the public have an impact on passenger processing. The Coast Guard has a three-tiered system of Maritime Security (MARSEC). These levels are designed to provide a means to easily communicate pre-planned scalable responses to increased threat levels.

Coordinate with the Company Security Officer (CSO) at the time of design for design recommendations associated with passenger screening requirements that may be required during elevated security threat levels. Screening would take place prior to the passenger control point. Beyond the passenger control point, there is a secure area with restricted access. Emergency egress from the secure area is provided with alarmed release mechanisms. Video surveillance is utilized as an integral part of the overall facility monitoring system. Concessions and general service deliveries are best located outside the secure area. Refer to Chapter 310 for additional information.

400.12 Lost and Found

This space provides secure storage for items left behind by passengers and employees. Locate lost and found near the facility entrance and near a staffed building space. The lost and found may be located in the terminal supervisor building.

400.13 Attendant Control Station

This space provides an attendant a view of the passenger control point and turnstile area for monitoring access and providing assistant to passengers entering the secure area.

400.14 Passenger Control Point

The passenger control point is located just prior to exiting the terminal building for passenger boarding. If the terminal has overhead loading, it is located just prior to the overhead loading. This location is often designated by turnstiles, an electronic door, or a gate. Access beyond the passenger control point is for passengers loading or unloading the ferry only. Allocate the following spaces for passenger control functions. Refer to Chapter 410 for additional information on turnstile requirements.

(1) Standard Turnstiles

The turnstiles are the customer control point and access to the ferries. They are for verification of transactions as well as control over time of boarding. Standard turnstiles are approximately 3 feet wide. Assume 17 passengers per minute are processed through each standard turnstile based on measurements at the Seattle terminal (actual processing rate may vary by terminal). The size and throughput of the facility determines the number of units.

(2) Paddle Turnstiles

Paddle turnstiles are an alternative to standard turnstiles and are used in conjunction with standard turnstiles. These units require a larger footprint than the standard turnstiles and require placement so that persons who have a mobility constraint have plenty of room for access. Paddle gates are approximately 4 feet wide and are used both for ADA access and for accommodating larger items such as luggage. Assume 9 passengers per minute through each paddle gate based on measurements at the Seattle terminal (actual processing rate may vary by terminal). The size and throughput of the facility determines the number of units. Refer to Chapter 300 for additional information pertaining to ADA requirements.

(3) Manual Gates

Include a manual gate at the control point to process groups of pre-paid passengers such as a bus load of school children. The manual gate is opened to allow an entire pre-paid group to pass through at once. Assume a manual gate width of 4 feet.

(4) Turnstile Queuing Area

The turnstile queuing area is for customers waiting to access a turnstile. Locate this area out of the way of passenger circulation including offloading and boarding passengers.

(5) Turnstile Mixing Area

The turnstile mixing area is located immediately downstream of the turnstiles and provides a transitional space between the turnstiles and the vessel loading corridor.

400.15 Luggage Cart and Wheelchair Storage

This space is intended for storing manual and electric wheelchairs, and luggage carts for passenger usage and ADA assistance. Provide sufficient space for the storage of two manual wheelchairs, one motorized wheelchair or scooter, and one four-wheeled luggage cart or hand cart. Locate this area in the vicinity of the passenger control point and passenger waiting area.

400.16 Security Interview Room

The security interview room is used by government security teams to interview passengers and conduct investigations. Security interview rooms are required at select terminals only. Refer to Chapter 310 for additional information and design guidance.

400.17 Restrooms and Water Fountains

Provide at least the minimum number of plumbing fixtures set forth in the *International Building Code* (IBC). For general requirements for plumbing design, refer to Chapter 350.

Circulation and access into and exiting the restrooms will vary with the capacity of the terminal. Smaller capacity restrooms require a door for privacy separation. Larger capacity restrooms may work more efficiently with a dog-leg open access. Larger restrooms require an operational dividing wall to provide functional separated use for the convenience of the public and janitorial staff during cleaning. Equip separation wall opening with a coiling door. Alternatively, larger terminals may contain two separate restrooms for each sex to allow for cleaning without removal of service, or a family restroom may be used. Refer to Chapter 450 for additional restroom design guidelines.

(1) Restrooms at Existing Terminals

Restrooms serving the terminal buildings and vehicle holding areas at existing WSF terminals are summarized in Exhibit 400-9. Restroom locations are shown in Appendix R.

Terminal	Restrooms within Terminal Building	Restrooms Adjacent to Vehicle Holding Area
Anacortes	Yes	Yes
Bainbridge Island	Yes	Yes
Bremerton	Yes	No
Clinton	Yes	No
Edmonds	Yes	Yes
Fauntleroy	Yes	No
Friday Harbor	Yes	Yes
Coupeville	Yes	No
Kingston	No	Yes
Lopez	No	No
Mukilteo	Yes	No
Orcas	No	Yes
Point Defiance	No	No
Port Townsend	Yes	No
Seattle	Yes	Yes
Shaw	No	Yes
Southworth	Yes	No
Tahlequah	No	No
Vashon	Yes	No

Location of Passenger Restrooms by Terminal
Exhibit 400-9

(2) Types of Restrooms

(a) Public Restrooms

Provide restrooms for passengers near the passenger waiting area. Locate restrooms upstream of the passenger control point in the non-secure area. Restrooms may also be located within the vehicle holding area to accommodate passengers driving onto the ferry.

Restrooms which are accessible to the general public can present maintenance and liability issues. Avoid locating restrooms where they are easily accessible to people who are not using the ferry terminal facilities.

(b) ADA Restrooms

Refer to Chapter 300 for requirements.

(3) Water Fountains

Where water fountains are provided, a minimum of one standard water fountain and one ADA water fountain (mounted at accessible heights) are required.

400.18 Janitor Storage

Include an area near the restrooms for storing toiletries, cleaning products, cleaning equipment (floor buffers, mop buckets, and case materials), recycle and waste bags and liners. Include shelving in the storage room.

400.19 IT Equipment Network Room

The IT equipment network room is the central hub for terminal and revenue video monitoring, network ethernet, intercom dispersion and amplification, telephone interfacing, and terminal security and access equipment. Provide a location for network, phone, EFS and security equipment. Provide space for a minimum of two full size floor standing equipment racks with adequate room on either side of each rack for servicing equipment and enough room to provide an air conditioning unit sized to keep equipment at an ambient room temperature not to exceed 68 degrees Fahrenheit. Larger terminals such as Seattle, Bainbridge, Kingston, etc may require additional rack space. Consult WSF IT personnel for additional information.

The IT equipment network room also includes any needs for security equipment storage. Consider proving space to store portable security equipment that could be required for higher MARSEC level screening. Refer to Chapter 560 for additional design guidelines.

The IT equipment network room is designated as a critical restricted area (refer to Section 310.10).



Clinton Ferry Terminal IT Equipment Network Room
Exhibit 400-10

400.20 Terminal Electrical Room

This restricted access room is used to house large high voltage main breaker controls and disconnects for the terminal operating components. Provide enough space to house several large electrical enclosures, metering and alarm systems. Refer to Chapter 360 for design guidelines.



Clinton Ferry Terminal Electrical Room
Exhibit 400-11

400.21 Elevator Machine Room

Provide a space to house hydraulic, mechanical, and electrical components for operation of an elevator system, where applicable. Utilize steel and concrete construction designed for containment.

400.22 Retail, Concessions, and Lease Space

Consider providing retail, concession, and lease space within the terminal building. Justification for providing these spaces includes a predesign study and a return on investment (ROI) business case analysis (refer to Chapter 420). Retail, concession, and lease space are add-on areas, meaning that the square footage provided for these spaces is in addition to the required passenger waiting area size calculated in Chapter 410. Consult with WSDOT Legal Services and Contracts Director for negotiations with prospective and existing tenants.

(1) Concessions

Consider providing passengers with a coffee cart in the passenger waiting area. A typical coffee cart requires 36 square feet.

(2) Retail and Lease Space

WSF categorizes retail by two types: retail without seating and retail with seating. Exhibit 400-12 shown below lists two successful retailers operating at WSF terminals and the approximate space provided for them.

Type of Retail	Name	Terminal	Space Provided
Retail w/o Seating	Cheesecake Café	Anacortes	650 sq ft
Retail with Seating	Café Appassionato	Seattle	850 sq ft

Example Retail Facilities at WSF Terminals
Exhibit 400-12

Use the following as guidance for sizing retail spaces:

- Provide a minimum area of 600 sq ft (actual areas to be negotiated with retail providers when possible).
- For retail requiring seating, provide space for ten passengers seated at tables (200 square feet based on 20 square feet per person).
- Provide utility stub-outs required by type of retail.
- Provide storage space in the proximity of the retailer.



Cheesecake Café at Anacortes Ferry Terminal
Exhibit 400-13



Café Appassionato at Seattle Ferry Terminal
Exhibit 400-14

Chapter 410 Circulation and Passenger Waiting

410.01 General
410.02 References
410.03 Design Considerations
410.04 Passenger Waiting Areas
410.05 Passenger Circulation
410.06 Boarding/Departing Routes

410.01 General

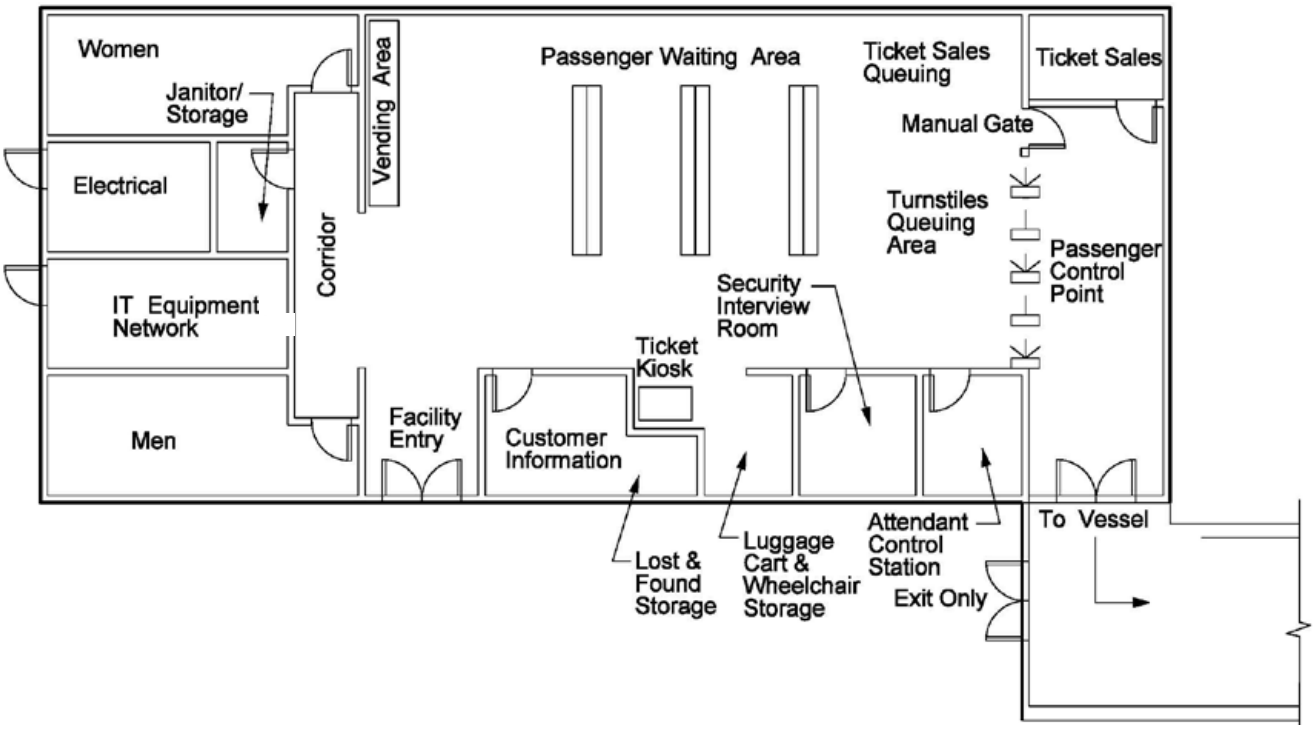
This chapter discusses passenger circulation and the process for sizing passenger waiting areas. Note that this process does not apply to the San Juan Island terminals (Lopez, Shaw, Orcas, and Friday Harbor) due to their highly seasonal demand and relatively low ridership during the winter season. Refer to Section 410.03(5) for more information on designing passenger waiting areas for terminals with highly seasonal demand.



Vashon Terminal Building Passenger Waiting Area
Exhibit 410-1

Exhibit 410-2 shows an example layout for a passenger waiting area within a passenger building. Actual passenger facility layouts will vary and should be coordinated with specific site features and project needs. For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
400	Passenger Buildings
450	Architecture
540	Site Circulation
620	Passenger Overhead Loading



Example Passenger Waiting Area Layout within Passenger Building
Exhibit 410-2

410.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

International Building Code (IBC), International Code Council, Washington D.C.

(2) Design Guidance

Pedestrian Planning and Design (1971), John Fruin, Metropolitan Association of Urban Designers and Environmental Planners, New York, NY.

Transit Capacity and Quality of Service Manual, 2nd Edition, Transportation Research Board, Washington, D.C.

(3) Supporting Information

Mukilteo Multimodal Terminal Master Plan Design Report (2004), Ferries Division, Washington State Department of Transportation, Seattle, WA.

Terminal Sizing Standards (2008), Ferries Division, Washington State Department of Transportation, Seattle, WA.

410.03 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible. Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessel security requirements, and additional information pertaining to passenger buildings. Below are links to relevant sections by topic. Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security.

- MARSEC Levels: 310.04
- Passenger Security Screening Area: 310.06
- Closed Circuit Television: 310.11
- Signage: 310.13

(3) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

(4) Buildings

Refer to Chapter 350 for general building design criteria pertaining to passenger buildings. Below are links to relevant sections by topic.

- Building Structures: 350.04
- Building Foundations: 350.05
- Building Utilities: 350.06

(5) Terminals with Seasonal Demand

Recreational terminals are characterized by their seasonal use, typically exhibiting much higher ridership in the summer months when passengers can wait comfortably outside. When designing waiting areas for these terminals, it is important to consider both the relative demand for the terminal and the frequency in which the indoor facilities will get used. The Anacortes terminal is the largest of the recreational terminals and is a major hub for four routes going to the San Juan Islands in addition to an international route to Sidney B.C. At the other end of the spectrum are the San Juan Island terminals (Lopez, Shaw, Orcas, and Friday Harbor) which have relatively low ridership except during the summer season.

Consider designing indoor passenger waiting areas at larger recreational terminals, such as Anacortes, for winter/shoulder season ridership levels (at LOS C). The surplus ridership during the summer season can be accommodated outdoors (refer to Section 410.04(14) for information on providing covered verses non-covered outdoor waiting areas). The sizing calculations for recreational terminals presented in Section 410.04 are designed to approximate this condition. However, the results should be compared against historic ridership data, where available.

Size indoor passenger waiting areas for smaller recreational terminals, namely the San Juan Island terminals, according to their winter demand with the idea of providing minimum weather protection. Summer ridership for the San Juan Island terminals is accommodated outdoors and is typically more of a staging and operational issue.

(6) Phasing of Passenger Waiting Areas

Although phasing of a passenger waiting area is likely to result in a higher cost per square foot, there are several circumstances in which phasing may be beneficial. In certain cases, phasing may reduce the risk of oversizing a facility, improve public perception, and/or allow a project with a funding shortfall to be constructed. If a passenger waiting area is to be phased, design the terminal building to allow for continued terminal operation during the expansion with minimal disruption to the remainder of the terminal building.

Unlike many terminal building spaces, appropriate sizing of the passenger waiting area is highly dependent on ridership and growth projections through the terminal design year. When high growth rates are projected approaching the design year, the passenger waiting area may be significantly oversized for the early years after terminal opening even if future ridership projections are accurate. Phasing of the terminal building may be a good option under this scenario, especially if there is inadequate funding for the proposed terminal building improvements.

410.04 Passenger Waiting Areas

Passenger waiting refers to areas for passengers to sit and stand, both inside and outside the terminal building, when they are not actively buying tickets or retail items or walking through the terminal. Locate passenger waiting areas as close as possible to the ferry slips to allow for boarding passengers to load as quickly as possible.

Passenger waiting areas accommodate walk-on passengers as well as drive-on passengers who have entered the terminal building after temporarily parking their vehicles in the vehicle holding area. The sizing of passenger waiting areas for these customers is based on three parameters: pedestrian level of service, design event methodology, and route type.

This section provides a planning level approach to sizing the passenger waiting areas. During detailed design, perform a more detailed calculation taking into account additional factors such as:

- Direction of travel: WSF currently does not collect fares for passengers traveling east-bound. Therefore, the size of the waiting areas for the western terminals may be smaller than the calculated value.
- Luggage/Backpacks: Consider providing additional space for passenger's luggage, especially at recreational terminals or where inter-city rail connections exist.

- Accessibility: Provide additional space for passengers in wheelchairs and for persons with mobility disabilities to sit.
- Consider other potential users of the terminal waiting area space such as users of a nearby transit station that has no indoor seating.

(1) Pedestrian Level of Service (LOS)

It is common industry practice to size terminal waiting areas based on a level of service (LOS) standard. Levels of service range from the highest, LOS "A" (most commodious) to "F" (crowded to the point of system breakdown), as categorized in "*Pedestrian Planning and Design*" by John F. Fruin, Ph.D. Higher levels of service result in larger, more comfortable, more expensive facilities. Lower levels of service exhibit smaller, less comfortable, and less expensive facilities.

WSF uses LOS C for sizing terminal building waiting areas and corridors. LOS C provides a balance between passenger comfort and capital expenditure and is considered an appropriate design objective for the peak sailing condition. LOS C translates into a space allotment of 8.5 square feet per passenger for standing and queuing, 13 square feet per passenger for seating (without tables) and 20 square feet per passenger for walking. Tables are not provided in the general passenger waiting areas. If a retail function requires seating at tables, include tables in the sizing of the retail function. Refer to Section 400.22 for retail area sizing recommendations.

(2) Design Event Methodology

The design of passenger waiting areas incorporates the "85th percentile" method commonly used in transportation analysis. A method based on statistical theory, the "85th percentile" covers 85 percent of all cases within a defined data set. For example, the 85th percentile busiest day for walk-ons would have a ridership as large as 85 percent of all days in the design year (15 percent of the days would have a higher ridership). The main benefit of utilizing this method is that facilities are not oversized for the great majority of the year.

Design passenger waiting areas for the *peak walk-on passenger sailing* on the 85th percentile busiest day in the design year. For the purpose of sizing the passenger waiting area, the *busiest day* is defined as the day with the highest total walk-on passengers. The "85th percentile" day equates to the 55th busiest day in the design year (365 – (0.85 x 365) = 55). The WSF Planning Department is responsible for identifying the design year which is typically twenty years out from the projected year of terminal opening.

Using current ridership data, determine the number of walk-on passengers for the peak sailing on the 55th busiest day. Escalate the determined value to the design year using projected growth rates. Use this projected walk-on passenger count in the passenger waiting area size calculation described in Section 410.04(5). In the case of the "85th percentile" (i.e. the 55th busiest day), the facility is adequately designed for 310 days of the year. Using this approach, the facility is undersized for 55 days of the year, meaning the facility operates at a lower level of service than LOS C during the peak periods on those days.

Coordinate with the WSF Planning Department to obtain ridership data and projected growth rates for existing terminals.

(3) Route Types

For the purpose of sizing passenger waiting areas, WSF ferry terminals are categorized by the type of route the terminal serves. Ferry routes and their corresponding ridership are divided into two distinct categories: commuter routes and recreational routes. An important distinction between these two route types is their associated passenger arrival trends (i.e. the amount of time passengers wait at the terminal prior to vessel departure).

Tailoring the design of the passenger areas to each route type is critical to achieving the most efficient balance between capital and operating investments. Exhibit 410-3 categorizes each terminal by its route type. Note that these categories summarize the typical characteristics of the terminal. Terminal traits may vary somewhat depending on time of day, week, and year.

(a) Commuter Routes

Commuter routes are generally busy year-round and exhibit minimal increases in traffic flow during the summer months. Commuter passengers ride the ferries on a regular basis and are familiar with the terminals. They tend to arrive close to the time of the vessel's scheduled departure, which results in a shorter wait time. The Bainbridge Island to Seattle route is a good example of a "commuter route." For a typical sailing from Bainbridge, approximately 55 percent of the walk-on passengers arrive within 10 minutes of the scheduled departure and all of the drive-on passengers arrive within 60 minutes of the scheduled departure. (Note that some of the highest ridership at commuter terminals occurs on summer weekends, holidays, and during special events when these terminals behave more like recreational routes. However, the passenger waiting area is only designed to accommodate the peak sailing for 85 percent of the days in the design year.)

Typical wait times are not only a function of route type but also vary with the frequency of sailings (headways). For this reason, the commuter ferry routes are further subdivided into Type 1 and Type 2 commuter routes, based on headway during the peak period. Type 1 commuter routes are defined as having headways of 30 minutes or less during the peak period. Type 2 routes have headways greater than 30 minutes during the peak period. Typically, Type 1 commuter routes have headways between 20 and 30 minutes and Type 2 commuter routes between 40 and 60 minutes.

(b) Recreational Routes

Recreational routes exhibit large increases in traffic flow during the summer months and are relatively quiet during the winter months. Recreational passengers may be unfamiliar with the terminal or are on a leisurely schedule, which results in longer wait times. The Anacortes - San-Juan Islands route is a good example of a "recreational route." For a typical sailing from Anacortes, only 10 percent of the walk-on passengers arrive within 10 minutes of the scheduled departure and all of the drive-on passengers arrive more than 60 minutes prior to the scheduled departure.

Headways for recreational routes are generally less frequent than commuter routes. Typically, WSF recreational routes have headways between 1½ and 3 hours, which plays a role in the longer wait times for these routes.

Commuter Route (Type 1)	Commuter Route (Type 2)	Recreational Route
		Anacortes
	Bainbridge Island	
	Bremerton	
Clinton		
	Edmonds	
Fauntleroy		
		Friday Harbor[1]
		Coupeville
	Kingston	
		Lopez[1]
Mukilteo		
		Orcas[1]
	Point Defiance	
		Port Townsend
	Seattle	
		Shaw[1]
Southworth		
	Tahlequah	
Vashon		

[1] The passenger waiting area sizing criteria described in Section 410.04 does not apply to the noted San Juan Island terminals due to their low ridership during periods with inclement weather. The majority of the passengers are accommodated outside at the San Juan Island terminals.

WSF Route Type Designation
Exhibit 410-3

(4) Passenger Arrival Patterns

Passenger arrival patterns describe the amount of time passengers wait at a terminal before a vessel's scheduled sailing. Passenger arrival patterns for both walk-on and drive-on passengers can be summarized by route type, as shown in Exhibits 410-4 and 410-5 below. These wait times are based on passenger arrival studies conducted at various WSF commuter and recreational facilities on days representative of the terminal type (e.g. commuter arrival patterns are based on weekday trends during prime commuting hours). These wait time estimates are intended for planning purposes only. A more detailed, terminal-specific study of passenger wait times is recommended prior to final design of the passenger waiting areas. It may also be possible to ascertain historic arrival patterns for a specific terminal through evaluation of point of sale data obtainable from the WSF Planning Department.

Drive-on passengers have the option of waiting in the vehicle holding area, the terminal building or a combination of the two. The longer drive-on passengers have to wait, the more likely they are to leave their cars in the holding area and access the terminal building.

Commuter Route Type 1	
Wait Time (min)	**Percent Arriving in Time Slot**
0-5	20%
5-10	45%
10-20	35%
20-30	0%
> 30	0%

Commuter Route Type 2	
Wait Time (min)	**Percent Arriving in Time Slot**
0-5	10%
5-10	45%
10-20	40%
20-30	5%
> 30	0%

Recreational Route	
Wait Time (min)	**Percent Arriving in Time Slot**
0-5	0%
5-10	10%
10-20	20%
20-30	20%
> 30	50%

Arrival Patterns for Walk-on Passengers
Exhibit 410-4

Commuter Route Type 1	
Wait Time (min)	**Percent Arriving in Time Slot**
0-30	100%
> 30	0%

Commuter Route Type 2	
Wait Time (min)	**Percent Arriving in Time Slot**
0-30	80%
> 30	20%

Recreational Route	
Wait Time (min)	**Percent Arriving in Time Slot**
0-30	0%
> 30	100%

Arrival Patterns for Drive-on Passengers
Exhibit 410-5

(5) Passenger Waiting Area Sizing Criteria

Size passenger waiting areas per the criteria listed below. These criteria have been developed by WSF based on passenger trends observed at existing WSF terminals.

(a) Walk-on Passengers

- 100 percent of passengers arriving 0-5 minutes prior to departure do not require inside or outside waiting space. These passengers pass right through the terminal building and board the vessel. (Passenger boarding typically commences 7 to 10 minutes prior to vessel sailing, so there is typically no remaining queue 5 minutes prior to boarding.)
- 100 percent of passengers arriving 5-10 minutes prior to departure require inside waiting space. Of these passengers, assume 100 percent stand.
- 100 percent of passengers arriving 10-20 minutes prior to departure require inside waiting space. Of these passengers, assume 85 percent stand and 15 percent sit.
- 50 percent of passengers arriving 20-30 minutes prior to departure require inside waiting space and 50 percent require outside waiting space. Of these passengers, assume 50 percent stand and 50 percent sit.
- 50 percent of passengers arriving more than 30 minutes prior to departure require inside waiting space and 50 percent require outside waiting space. Of these passengers, assume 25 percent stand and 75 percent sit.

(b) Drive-on Passengers

The majority of drive-on passengers never enter the terminal building. Most drive-on passengers remain in their vehicles or utilize amenities within the vehicle holding area. WSF recommends that drive-on passengers return to their vehicles a minimum of 20 minutes prior to a scheduled sailing in order to minimize pedestrian traffic in the holding area during vehicle unloading. Hence, any vehicle passengers utilizing the terminal building and arriving less than 30 minutes prior to departure are not likely to require any seating within the waiting area, especially in the critical (most crowded) period just prior to vessel boarding. No outside waiting is required for drive-on passengers at the terminal building. Assume the following when sizing the passenger waiting area.

- 5 percent of drive-on passengers arriving 0-30 minutes prior to departure require inside waiting space. Of these passengers, assume 100 percent stand.
- 5 percent of drive-on passengers arriving more than 30 minutes prior to departure require inside waiting space. Of these passengers, assume 25 percent stand and 75 percent sit. (Note that this 5 percent value represents only that portion of the drive-on passengers arriving in this interval that will still be in the terminal building at the critical period just prior to loading.)

(6) Calculate Passengers Using Terminal Waiting Areas

(a) Walk-on Passengers

Use Exhibit 410-6, as outlined in Steps 1 through 8 below, to estimate the number of walk-on passengers to be accommodated in the terminal building waiting areas. The designer populates/computes the highlighted cells, and the other cells are fixed.

1. Using current ridership data from the WSF Planning Department, determine the 85th percentile busiest day (the 55th busiest day in the year) based on total walk-on passengers.
2. Determine the number of walk-on passengers for the peak sailing occurring on the 55th busiest day identified in Step 1.
3. Estimate the 55th busiest day peak walk-on ridership for the design year by applying the projected walk-on growth rate for the route, as identified by the WSF Planning Department, to the value determined in Step 2. The design year is defined by WSF Planning and is typically 20 years out from the projected terminal year of opening. Note that growth rates for 2010 to 2020 and 2030 are available in the *Long Range Plan* Appendix F.
4. Identify the terminal route type based on Exhibit 410-3.
5. Based on the route type determined in Step 4, populate *Percent Arriving in Time Slot* (Column 2) in Exhibit 410-6 using the corresponding values from Exhibit 410-4.
6. Calculate the number of *People Waiting* (Column 3) by multiplying the peak sailing passenger volume determined in Step 3 by *Percent Arriving in Time Slot* (Column 2).

7. Calculate the number of *People Waiting Inside* (Column 6) by multiplying *People Waiting* (Column 3) by *Percent Inside* (Column 4).
8. Calculate the number of *People Waiting Outside* (Column 7) by multiplying *People Waiting* (Column 3) by *Percent Outside* (Column 5).

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Wait Time Before Boat Departs (min)	**Percent Arriving in Time Slot**	**People Waiting**	**Percent Inside**	**Percent Outside**	**People Waiting Inside**	**People Waiting Outside**
0-5			0%	0%		
5-10			100%	0%		
10-20			100%	0%		
20-30			50%	50%		
> 30			50%	50%		

Walk-on Passengers Using Terminal Waiting Areas
Exhibit 410-6

(b) Drive-on Passengers

Use Exhibit 410-7, as outlined in Steps 1 through 7 below, to estimate the number of drive-on passengers to be accommodated in the terminal building waiting areas. The designer populates/computes the highlighted cells, and the other cells are fixed.

1. Using current ridership data from the WSF Planning Department, determine the 85th percentile busiest day (the 55th busiest day in the year) based on total drive-on passengers.
2. Determine the number of drive-on passengers for the peak sailing occurring on the 55th busiest day identified in Step 1.
3. Estimate the 55th busiest day peak drive-on ridership for the design year by applying the projected drive-on growth rate for the route, as identified by the WSF Planning Department, to the value determined in Step 2. The design year is defined by WSF Planning and is typically 20 years out from the projected terminal year of opening. Note that growth rates for 2010 to 2020 and 2030 are available in the *Long Range Plan* Appendix F.
4. Identify the terminal route type based on Exhibit 410-3.
5. Based on the route type determined in Step 4, populate *Percent Arriving in Time Slot* (Column 2) in Exhibit 410-7 using the corresponding values from Exhibit 410-5.
6. Calculate the number of *People Waiting* (Column 3) by multiplying the peak sailing passenger volume determined in Step 3 by *Percent Arriving in Time Slot* (Column 2).

7. Calculate the number of *People Waiting Inside* (Column 6) by multiplying *People Waiting* (Column 3) by *Percent Inside* (Column 4).

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Wait Time Before Boat Departs (min)	**Percent Arriving in Time Slot**	**People Waiting**	**Percent Inside**	**Percent Outside**	**People Waiting Inside**	**People Waiting Outside**
0-30			5%	0%		N/A
> 30			5%	0%		N/A

Drive-on Passengers Using Terminal Waiting Areas
Exhibit 410-7

(7) Calculate Net Passenger Waiting Area

Use Exhibits 410-8 and 410-9, as outlined in Steps 1 through 4 below, to estimate the indoor and outdoor waiting area sizes for walk-on and drive-on passengers, respectively. (The steps below outline the process for computing *Indoor Waiting Areas*. The same process is used to calculate *Outside Waiting Areas*.) The designer populates/computes the highlighted cells, and the other cells are fixed.

The total indoor waiting area is the sum of the respective areas for the walk-on and drive-on passengers. For terminals serving multiple routes and with multiple main operating slips, size the total passenger waiting area to accommodate the sum of the waiting areas required for each route. If multiple routes operate from a single slip, size the waiting area for the route with the highest peak passenger volume. (Note that separate turnstiles may be required for different routes using the same slip. Coordinate with WSF Operations on turnstile requirements.)

1. Populate *People Waiting Inside* (Column 2) in Exhibits 410-8 and 410-9 using the corresponding values from Column 6 in Exhibit 410-6 and Exhibit 410-7, respectively.
2. Calculate *Inside Standing Area* (Column 5) by multiplying *People Waiting Inside* (Column 2) by Percent Standing (Column 3) by 8.5 sf per person (the space allotment for people standing at LOS C). (Column 5 = Column 2 x Column 3 x 8.5sf)
3. Calculate *Inside Sitting Area* (Column 6) by multiplying *People Waiting Inside* (Column 2) by Percent Sitting (Column 4) by 13 sf per person (the space allotment for people sitting at LOS C). (Column 6 = Column 2 x Column 4 x 13sf)
4. Calculate *Net Indoor Waiting Area* (Column 7) by adding *Inside Standing Area* (Column 5) and *Inside Sitting Area* (Column 6). (Column 7 = Column 5 + Column 6)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Wait Time Before Boat Departs (min)	**People Waiting Inside**	**Percent Standing** (8.5 sf/ person)	**Percent Sitting** (13 sf/ person)	**Inside Standing Area** (sf)	**Inside Sitting Area** (sf)	**Indoor Waiting Area** (sf)
0-5		0%	0%			
5-10		100%	0%			
10-20		85%	15%			
20-30		50%	50%			
> 30		25%	75%			
Total Net Indoor Waiting Area for Walk-on Passengers[1]						

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Wait Time Before Boat Departs (min)	**People Waiting Outside**	**Percent Standing** (8.5 sf/ person)	**Percent Sitting** (13 sf/ person)	**Outside Standing Area** (sf)	**Outside Sitting Area** (sf)	**Outdoor Waiting Area** (sf)
0-5		0%	0%			
5-10		0%	0%			
10-20		85%	15%			
20-30		50%	50%			
> 30		25%	75%			
Total Outdoor Waiting Area for Walk-on Passengers[2]						

[1] This is the net indoor passenger waiting area which does not include the 5-foot circulation corridor and the turnstile queuing and mixing zones discussed in Section 410.04(8). Passenger conveniences and seating for retail are also separate add-ons to the gross passenger waiting area (refer to Chapter 400).

[2] No add-ons are required for the outdoor waiting area (i.e. net outdoor waiting area = gross outdoor waiting area).

Sizing Passenger Waiting Areas for Walk-on Passengers
Exhibit 410-8

(1)	(2)	(3)	(4)	(5)	(6)	(7)
(min)	**People Waiting Inside**	**Percent Standing** (8.5 sf/ person)	**Percent Sitting** (13 sf/ person)	**Inside Standing Area** (sf)	**Inside Sitting Area** (sf)	**Indoor Waiting Area** (sf)
0-30		100%	0%		N/A	
> 30		25%	75%		N/A	
Total Indoor Waiting Area for Drive-on Passengers						

Sizing Passenger Waiting Areas for Drive-on Passengers
Exhibit 410-9

(8) Calculate Gross Indoor Passenger Waiting Area

The net indoor passenger waiting area calculated in Section 410.04(7) accounts for the area required for passengers to sit and stand. However, it does not account for all necessary circulation within the waiting area. It is assumed that the main corridor upstream of the turnstiles is accounted for in the net passenger waiting area for people to stand since waiting passengers will fill this corridor prior to loading. However, it is still necessary to have some ability for circulation throughout the waiting area just prior to boarding (referred to herein as *secondary circulation corridors*) when the terminal building is at its maximum occupancy and the main corridor is filled with people. It is also important to have space for passengers to queue in front of the turnstiles (*queuing area*) and to transition back into a normal traffic flow after they pass through the turnstiles (*mixing area*). The sizing of these areas is discussed below and illustrated in Exhibit 410-10.

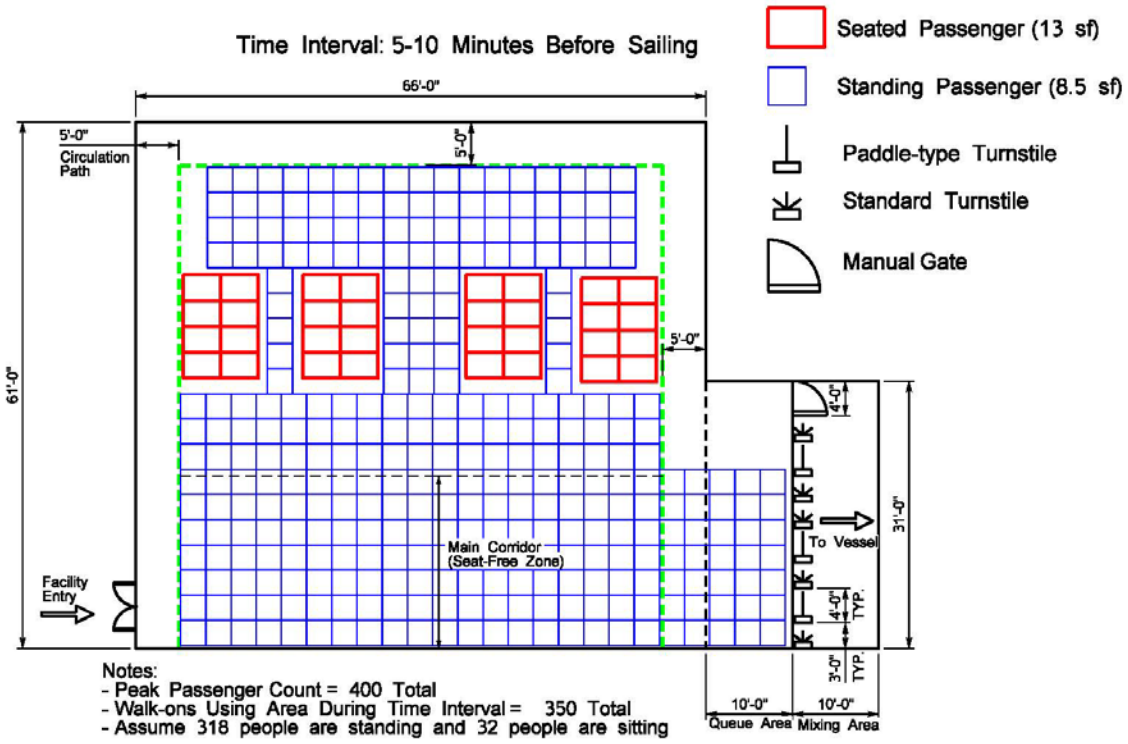
Exhibit 410-10 illustrates the passenger waiting area for two different time intervals of a Commuter Route Type 2 terminal. The peak occupancy occurs in the 5-10 minute range just prior to boarding. Using the process described below, all terminals will have the same degree of crowdedness at their peak occupancy. The degree of crowdedness at other time intervals will vary depending on the passenger arrival patterns (i.e. on the terminal type).

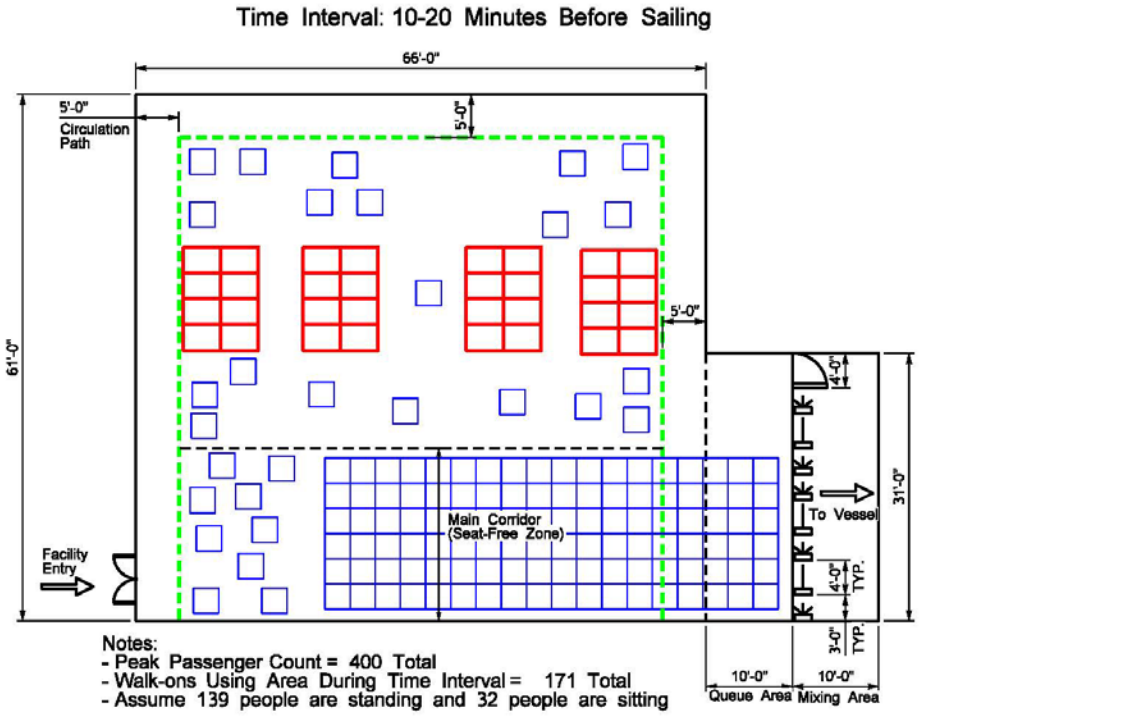
(a) Primary Circulation Corridor (included in net passenger waiting area)

Provide a circulation corridor upstream of the turnstiles along the length of the passenger waiting area. This corridor is the primary route between the terminal entrance and the turnstiles which lead to vessel boarding.

The main corridor is included in the *net passenger waiting area* calculation and doubles as a place for waiting passengers. However, this corridor must remain unobstructed and is therefore designated as a seat-free zone, meaning no seating may be placed within this corridor.

Design the main corridor with a minimum width equal to the combined width of all turnstiles required to process the *peak walk-on passenger sailing* on the 85th percentile busiest day in the design year in the scheduled vessel loading time for the terminal. The scheduled vessel loading time for WSF terminals ranges between 7 and 10 minutes. Coordinate with WSF Operations for the scheduled vessel loading time for specific terminals.





Calculation of Passenger Waiting Area Size
Exhibit 410-10

(b) Secondary Circulation Corridors (add-on to net passenger waiting area)

Include a 5-foot circulation corridor around three sides of the *net passenger waiting area* calculated in Section 410.04(7). This will allow passengers to access passenger conveniences such as vending, telephones, change machines and terminal exits when the building is at its maximum occupancy, in the 5-10 minute arrival period, just prior to boarding.

In order to estimate the length of this 5-foot corridor, approximate the net passenger waiting area as a square. The length of each side of the square then becomes the square root of the net passenger waiting area. Exhibit 410-10 illustrates the net passenger waiting area (shown within the green dashed line) with a 5-foot corridor around three sides.

(c) Queuing Area (add-on to net passenger waiting area)

Include a queuing area immediately upstream of the turnstiles which is the combined width of all the required turnstiles (primary plus redundant) by 10 feet deep (refer to *Turnstile Requirements* below). This queuing area provides passengers a place to congregate without interfering with passenger circulation and seating in the main passenger waiting area.

(d) Mixing Area (add-on to net passenger waiting area)

Include a mixing area immediately downstream of the turnstiles which is the combined width of all the required turnstiles (primary plus redundant) by 10 feet deep (refer to *Turnstile Requirements* below). This mixing area provides passengers a transitional space between turnstiles and the vessel loading corridor.

(e) Turnstile Requirements

Base primary turnstile quantities on the projected peak walk-on passenger sailing volume for the 100th percentile day (busiest sailing day) of the design year. The number of primary standard and paddle gates should be such that this peak passenger sailing volume can be processed within the scheduled vessel loading period for the terminal. Scheduled vessel loading times range between 7 and 10 minutes (coordinate with WSF Operations for terminal-specific values). Provide at least one primary standard turnstile and one primary paddle turnstile regardless of the peak passenger volume.

In addition to the primary turnstile requirements described above, provide one redundant standard turnstile and one redundant paddle turnstile which can be used when a primary turnstile is shut down for maintenance reasons. In addition, provide a single manual gate at each terminal. A redundant manual gate is not required. The number of required turnstiles is the combined total of the primary and redundant turnstiles and the manual gate.

1. **Standard Turnstiles**

   A standard turnstile is approximately 3 feet wide and has a processing speed of approximately 17 transactions per minute as measured by WSF Operations. This processing speed may be used for scoping purposes. Actual processing rates may vary by terminal and should be re-evaluated during the design phase.

2. **Paddle Turnstiles**

   A paddle turnstile is approximately 4 feet wide and has a processing speed of approximately 9 transactions per minute as measured by WSF Operations. This processing speed may be used for scoping purposes. Actual processing rates may vary by terminal and should be re-evaluated during the design phase. Paddle turnstiles meet ADA requirements and have the added benefit of accommodating passengers carrying larger items such as suitcases and backpacks.

3. **Manual Gates**

   A manual gate is approximately 4 feet wide. It is used to accommodate groups of pre-paid passengers such as a bus load of school kids. Since manual gates are used intermittently, they are not included in the passenger processing capacity of the terminal.

Exhibit 410-11 gives the projected 2030 peak passenger sailing walk-on values (100th percentile) by terminal (for those currently collecting passenger tolls) along with the respective turnstile requirements to process these passengers in the allotted vessel loading time. Exhibit 410-11 also gives the corresponding width for the queuing/mixing zone based on the overall turnstile and gate requirements. WSF is in the process of re-evaluating their toll collection strategy in terms of at which terminals tolls will be collected. The designer should confirm with WSF Operations at the time of design if there are any changes in passenger toll collection strategies over the design life of the terminal.

Terminal	2030 Peak Passenger Sailing (walk-ons)[1]	Primary 3' Standard Turnstiles (quantity)	Redundant 3' Standard Turnstiles (quantity)	Primary 4' Paddle Turnstiles (quantity)	Redundant 4' Paddle Turnstiles (quantity)	4' Manual Gate (quantity)	Queuing/Mixing Zone Width (ft)[2]
Anacortes	541	3	1	1	1	1	24
Coupeville	468	3	1	1	1	1	24
Edmonds	330	2	1	1	1	1	21
Fauntleroy - Southworth	96	1	1	1	1	1	18
Fauntleroy - Vashon	95	1	1	1	1	1	18
Mukilteo	190	1	1	1	1	1	18
Point Defiance	89	1	1	1	1	1	18
Port Townsend	453	3	1	1	1	1	24
Seattle - Bainbridge	1,582	8	1	2	1	1	43
Seattle - Bremerton	848	6	1	2	1	1	37
Vashon	60	1	1	1	1	1	18

[1] 2030 Peak Passenger sailing is based on the 100th percentile busiest day for walk-on passengers.

[2] Queuing/mixing zone width equals width of all primary and redundant turnstiles plus one manual gate.

Estimated Turnstile Requirements for 2030
Exhibit 410-11

Exhibit 410-12 gives an example calculation for passenger processing capacity provided by 4 standard turnstiles and 3 paddle turnstiles. Redundant turnstiles are not taken into account since they may be closed for maintenance purposes.

Turnstile Type	Transactions per Minute	Loading Time	Passengers Processed per Turnstile	Number of Turnstiles	Passengers Processed
Standard Turnstile	17	10	170	4	680
Paddle Turnstile	9	10	90	3	270
Total Passengers Processed During Loading Time					**950**

Turnstile Processing Capacity – Sample Calculation
Exhibit 410-12

(f) Passenger Conveniences (add-on to net passenger waiting area)

Passenger conveniences are an add-on value to the net passenger waiting area. Passenger conveniences are discussed in Section 400.10.

(g) Seating for Retail (add-on to net passenger waiting area)

Seating for retail is an add-on value to the net passenger waiting area. Seating for retail is discussed in Section 400.22.

(9) Minimum Waiting Area Size (excluding passenger amenities)

The described methodology for calculating waiting area size starts to break down for peak walk-on passenger volumes of 75 passengers and fewer, the actual number varying somewhat with terminal type. This is due in part to the relative size of the required circulation corridors compared to the area necessary for passengers to sit and stand. It is also a function of the minimum seating requirement described in Section 410.04(10) below.

For scoping purposes, use the greater of the calculated gross passenger waiting area size or 1,250 square feet. This excludes the San Juan Island terminals due to their comparatively low walk-on ridership volumes. The 1,250 square foot value is based on existing minimum functional passenger waiting area sizes at WSF and anticipated walk-on growth rates to 2030. This minimum waiting area size provides for the following: (1) the minimum seating requirement discussed in Section 410.04(10) below; (2) a 7-foot wide main corridor along the length of the seating area (accommodating one standard turnstile and one paddle turnstile); (3) a 5-foot corridor around three sides of the waiting area; (4) and a 18 foot wide by 10 foot deep mixing zone and queuing zone accommodating 2 standard turnstiles, 2 paddle turnstiles and 1 manual gate.

(10) Minimum Passenger Waiting Area Seating Requirements

Based on seating, terminal functionality, and anticipated growth rates for existing WSF terminals, WSF Operations recommends scoping new terminals and terminal retrofits to accommodate a minimum of 24 seats in the passenger waiting area. This excludes the San Juan Island terminals. Twenty-four seats equates to 25 percent of the minimum passenger waiting area size of 1,250 square feet described in Section 410.04(9) above.

(11) Wheelchair, Companion, and Priority Seating

Equip terminal seating areas with wheelchair and companion seating in accordance with applicable ADA regulations (refer to Chapter 300). At a minimum provide the following wheelchair spaces: one wheelchair space for 4-25 seats, two wheelchair spaces for 26-50 seats, and four wheelchair spaces for greater than 51 seats. Provide at least one companion seat (a seat adjacent to the wheelchair space, at the same elevation as the wheelchair space) for each wheelchair space. Companion seats are to be equivalent in size, quality, comfort, and amenities to the seating in the immediate area.

In addition to the required wheelchair and companion seating, consider providing one priority seat (for elderly and persons with mobility disabilities) for each wheelchair space provided. Where priority seating is provided, include signage displaying the "international symbol of accessibility" and the terms "Priority Seating".

(12) Winter Season Check on Passenger Waiting Area Size

Peak sailings typically occur during the summer months when passengers can wait comfortably outside the terminal building. During the winter season, waiting outside the terminal building is less desirable. Compare the total indoor waiting area computed in Step 4 of Section 410.04(7) to the space required for all walk-on passengers in the peak "winter" sailing to stand (use November through February data for determining the peak winter sailing). Use the greater of the two values for the terminal building indoor waiting area sizing calculation. Consult with the WSF Planning Department to obtain the highest walk-on passenger count for a single sailing during the November to February time period. Inside accommodations are not required for drive-on passengers as they can wait in their vehicles.

(13) Building Official and Fire Marshall Approval

Design approval by the local Building Official and Fire Marshall is required to obtain building permits for the terminal buildings. Coordinate passenger waiting area size and layout with the local Building Official and Fire Marshall to ensure that the passenger waiting area complies with all building codes (IBC), federal emergency egress code, and local fire code. Adjust waiting area size and layout as required.

(14) Passenger Waiting Area Features

Passenger waiting area features may include heating, semi-heating, ventilation, cover, weather screening, and views. The passenger waiting areas are divided into three different conditioning types: heated/semi-heated space, covered space (non-heated), and open space (non-covered, non-heated). Terminals which cater to recreational uses have a higher degree of outside use during their peak season (summer) than commuter route terminals and require less semi-heated and covered space.

As a general rule of thumb, design the total *covered* passenger waiting area (indoor and outdoor combined) to accommodate the design event (peak sailing on 55th busiest day) at LOS E which translates into a space allotment of 2.5 square feet per passenger for standing and queuing and 6 square feet per passenger for sitting. Any additional passenger waiting space need not be covered. The need for weather screening is highly dependent on wind exposure and is evaluated on a terminal by terminal basis in conjunction with the outdoor spaces.

It is difficult to quantify the incorporation of views into passenger waiting areas. Views enhance the customer experience and are a valuable asset of the terminal. The incorporation of views into the passenger waiting areas can also provide credits toward LEED® building certification as part of the Indoor Environmental Quality evaluation (refer to Section 450.07 for discussion of LEED® building certification).

410.05 Passenger Circulation

Passenger circulation refers to the travel paths through the terminal building used by passengers during loading and unloading and while accessing various terminal amenities.

(1) Primary Corridor Width for Passenger Terminal

The primary corridor width is the minimum required width for the walkways on the main travel path for boarding and departure within the terminal building. The minimum width for the primary corridor is based on the *85th percentile design event* (the 55th busiest day peak sailing for walk-on ridership in the design year) as described in Section 410.04(2). Drive-on passengers do not impact the passenger terminal corridor width because they are required to be in their vehicles 20 minutes prior to loading. Design the primary corridor within the passenger waiting area per Section 410.04(8). Additionally, the primary corridor width must comply with current ADA standards for width. Refer to Chapter 300.

(2) Vertical Circulation

Vertical circulation components include stairs and elevators. Refer to local building codes for design and placement of elevators and stairs. Provide elevators that are ADA accessible and are capable of accepting a gurney. Dual elevators are strongly advised in areas of high traffic to promote public accessibility and provide redundancy in the event that an elevator is down for service or repair. Design elevators for a harsh waterfront environment and provide stainless steel finishes when used in public areas. Space requirements for stairs and elevators are not included in the Circulation, Structure, and Envelope Multipliers.

(3) Circulation, Structure, and Envelope Multipliers

Account for space requirements associated with terminal building circulation corridors, structural columns, and the building envelope (walls). For scoping purposes, estimate these building space requirements through the use of percentage multipliers applied to specific terminal building areas. Terminal building areas and their associated multipliers are identified in Appendix S. Note that circulation corridors are already taken into account in the indoor passenger waiting area calculations performed in Section 410.04(8), so only a building structure and envelope multiplier of 7 percent applies to this area.

410.06 Boarding/Departing Routes

Boarding/departing routes are those designated routes between the pedestrian transfer span and the street or public way. Route walk-on passengers departing the ferry away from the boarding passengers and to public space as soon as possible. Minimize turning movements to the extent feasible along these routes.

Chapter 620 addresses the fixed and movable portions of the boarding/departing route which lie between the terminal building and the hinge point of the pedestrian transfer span. Boarding and departing routes within the terminal building are discussed in Section 410.05. All other portions of the boarding/departing routes, such as those providing access to the terminal building from the street, parking areas, and other transit facilities, are covered in Chapter 300 (Accessibility) and Chapter 550 (Site Circulation).

Chapter 420 Passenger Amenities, Business Case

420.01 Elements of the Business Case
420.02 Special Topics

420.01 Elements of the Business Case

(1) Approach

The purpose of the business case is to establish that spending decisions maximize the value to riders and other stakeholders. There are two general types of business cases, depending on the problem at hand:

1. *Simple cost-effectiveness*, when the project is needed to meet a regulatory requirement or to maintain core service, or when all the options provide equal value to stakeholders - in other words when "do-nothing" is not a viable option. The goal of the business case is to establish that the requirements are met at the least cost.
2. *Benefit/cost analysis*, when the project is not "must do" or when some alternative provide higher level of service to stakeholders than others.

In general, passenger amenities will fall into the latter category, which means it will be necessary to estimate whether the benefits outweigh the costs. Remember: costs and benefits should be defined from the perspective of riders and other stakeholders, not from the perspective of WSF.

(2) Problem Statement

Having a clear statement of the problem to be addressed is a critical step in the business case.

1. What service objective is being addressed? WSF should not generally spend resources outside its mission even if the project is cost-effective.
2. Identify how riders or other stakeholders will be affected by this decision, e.g., lower cost of operation, lower risk of missed/delayed trips, better safety, better comfort, etc.
3. Consider timing and do not exclude the "do-nothing" alternative in the problem statement. I.e., *"Is a rebuild or refurbishment of the trestle at Vashon cost-effective, and if so when,"* not, *"Should terminals rebuild or refurbish the trestle at Vashon."*

(3) Defining Alternatives

Define the alternatives to be considered, including the "do-nothing" alternative. It is tempting to include all variations on design as alternatives, but the precision of the analysis often does not support differentiating between similar alternatives. It is best to focus on the major categories: with a snack bar or without, with an enclosed waiting area or without.

(4) Data and Analysis

The next step is to collect data needed to support the benefit/cost assessment. Major categories include the following:

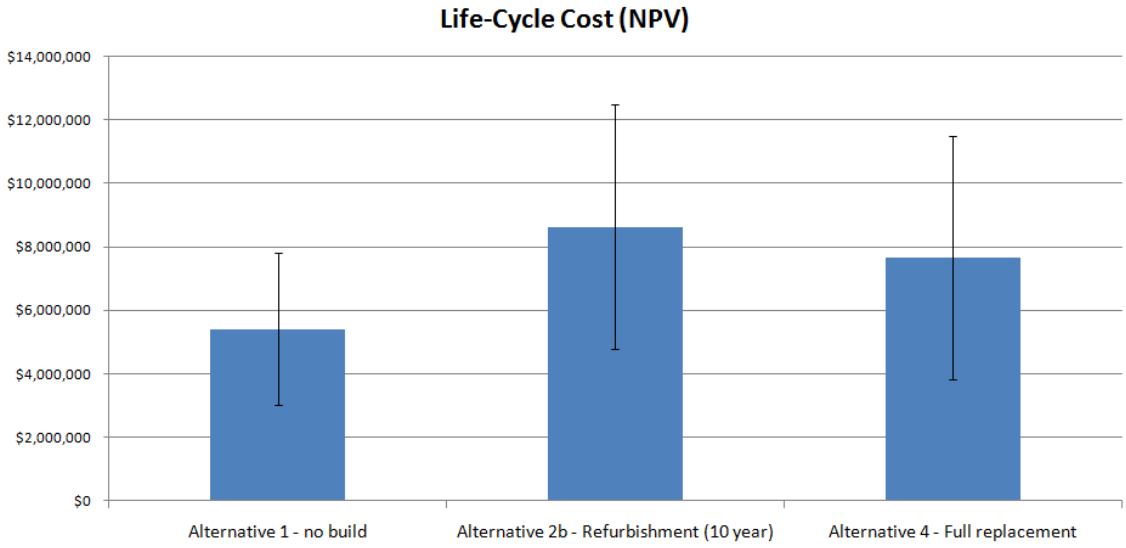
1. **Capital Cost** – This cost should include construction, design, contingencies and any operational costs required to do the work. For example, the cost to implement passenger only to minimize construction closure impacts.
2. **O&M Cost** – We are interested only in incremental O&M – how much will it change if we choose a particular alternative.
3. **Ridership Costs** – WSF has developed standard assumptions for quantifying the cost to riders when they are delayed or miss a sailing.
4. **Social Costs** – When considering amenities, this category of cost will often be the most important as well as the most difficult. See Quantifying Benefits below for suggestions.
5. **Revenue** – To calculate the benefit of retail development; work with Contracts and Legal Services to estimate potential lease payments.

Some costs will be expressed in terms of reductions or increases in risk. These should be included in the project life-cycle cost as expected value, i.e., probability × consequences.

The analytical approach can be a simple summation of the net cost/benefit of each alternative. In cases where uncertainty or risk play a major role, a Monte Carlo analysis may be helpful. (Refer to WSDOT's CEVP process for discussion of Monte Carlo.)

(5) Presentation of Results; Recommendations

The alternatives should be presented in terms of net present value or annualized life-cycle cost. All costs and benefits should be "dollarized" so the alternatives can be compared consistently. Include error bars or other estimates of the uncertainty in these estimates (see below for an example).



Life Cycle Cost (NPV)
Exhibit 420-1

In general, the recommended alternative should be the one with the lowest cost, where benefits are treated as negative costs. Where the uncertainty is high relative to the differences between alternatives, more design or other investigation may be needed. Be transparent about your assumptions. List them explicitly so they can be reviewed, challenged, and improved by others.

420.02 Special Topics

(1) Tips

1. **Use real dollars** – For analytical purposes, inflation is an unnecessary complication. Use current-year dollars for all costs and benefits, then discount using the real discount rate.
2. **The 80/20 rule is in effect** – Don't bother with highly precise cost estimates when the project is at a concept-level stage. You can usually make a decision with minimal engineering effort.
3. **Don't get hung up on the "window"** – It usually doesn't make much difference if you use a 30-year analysis or a 50-year analysis. It is often easier to think in terms of annual costs rather than NPV.
4. **When in doubt, estimate the range** – There will be parameters that are very difficult to evaluate. What is the benefit to riders of having individual seats instead of benches in the waiting area? You will never know the answer to this precisely. A good approach is to think about the range – the reasonable minimum and maximum values.

(2) Quantifying Benefits

1. One good way to estimate the benefit to riders of improved amenities is to ask, "How much would a typical passenger be willing to pay for this service?" For example, you might estimate that the typical passenger would pay between $0.10 and $0.50 per trip for a chair rather than a bench; if you multiply this by the number of passengers per year you have an estimate of the annual value. This is sometimes called the "reasonable person test."
2. For concessions, the question should be "Would a private interest build this concession if we let them?" In other words, will the concession be profitable.

Chapter 430 Terminal Supervisor Buildings

430.01 General
430.02 References
430.03 Design Considerations
430.04 Terminal Supervisor Building Spaces

430.01 General

This chapter identifies the spaces associated with terminal supervisor functions and provides guidance for their design. Note that not all building spaces described in this chapter are required at each terminal. Refer to Appendix S for a list of existing and anticipated future building spaces by terminal.

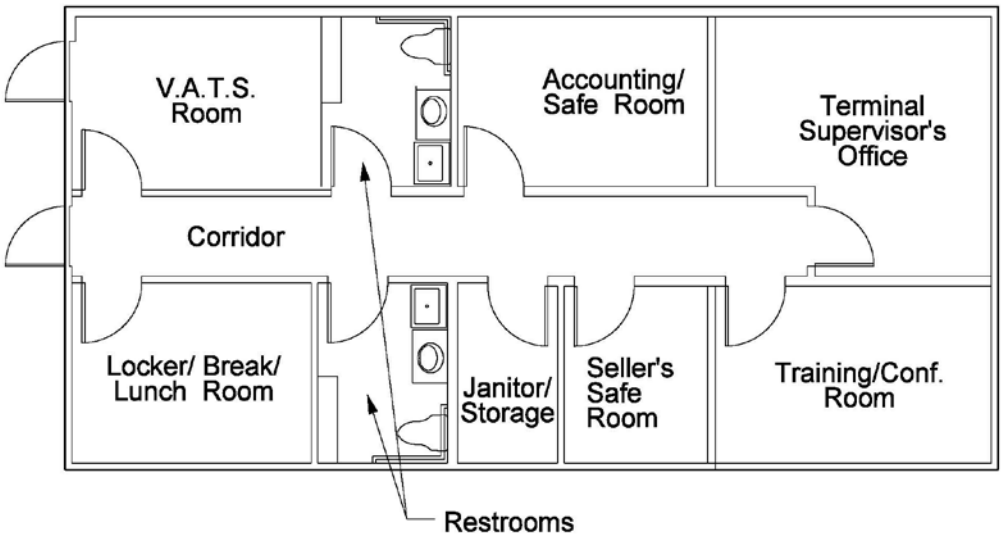


Clinton Ferry Terminal/Terminal Supervisor Building
Exhibit 430-1

Exhibit 430-2 gives an example layout for a terminal supervisor building. Actual terminal supervisor facility layouts will vary based on specific site features and project needs. As required, building spaces/functions described in other chapters may be accommodated in the terminal supervisor building. For example, passenger facilities may be combined with terminal supervisor facilities in a single building. Passenger building spaces are described in Chapter 400. Maintenance functions may also be included. Refer to Chapter 440 for a description of maintenance building spaces.

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
350	Buildings
400	Passenger Buildings
410	Circulation and Passenger Waiting
450	Architecture



Example Layout for Terminal Supervisor Building
Exhibit 430-2

430.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

International Building Code (IBC), International Code Council

(2) Design Guidance

Enterprise Services Sizing Criteria

Enterprise Services Standard Plans

WSDOT Facilities Office Standard Plans

(3) Supporting Information

Mukilteo Multimodal Terminal Master Plan Design Report (2004), Ferries Division, Washington State Department of Transportation, Seattle, WA.

430.03 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible. Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements. Section 300.06 addresses accessibility requirements relating to staff facilities at terminals.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessels security requirements, and additional information pertaining to building design. Below are links to relevant sections by topic. Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for TWIC and SSI.

- MARSEC Levels: 310.04
- Security Rooms: 310.07
- Access Control/Restricted Areas/TWIC: 310.10
- Panic Buttons: 310.12
- Signage: 310.13

(3) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation. For projects that involve remodeling and renovation of existing buildings, consider the need for assessment of lead paints, asbestos and other hazardous materials.

(4) Building Structures and Utilities

Refer to Chapter 350 for general building design criteria pertaining to terminal supervisor buildings. Below are links to relevant sections by topic.

- Building Structures: 350.04
- Building Foundations: 350.05
- Building Utilities: 350.06

(5) Circulation, Structure, and Envelope Multipliers

The building areas provided in Appendix S do not account for space requirements associated with building circulation corridors, structural columns, and the building envelope (walls). Estimate these space requirements using a 25% multiplier on building spaces associated with the terminal supervisor building.

(6) Building Architecture

Refer to Chapter 450 for general architectural design criteria pertaining to the terminal supervisor building. Below are links to relevant sections by topic.

- Building Code Requirements: 450.04
- Building Permits: 450.05
- WSF Architectural Guidelines: 450.06

(7) Location

When feasible, locate equipment and storage areas in close proximity to their required use. Take under consideration equipment and storage related issues such as access, noise, vibrations, emissions, odor, safety and environmental concerns. Storage areas may be combined if they have compatible storage requirements.

430.04 Terminal Supervisor Building Spaces

The terminal supervisor building should be located near the toll booths. Exhibit 430-3 identifies the building spaces that are typically associated with a terminal supervisor building. These spaces are described in more detail in the paragraphs that follow. Information on sizing requirements for these spaces is provided in Appendix S.

WSF terminal supervisor buildings are typically one level, but they may be two levels to accommodate site constraints and terminal needs. Exhibit 430-3 identifies the preferred level for locating building spaces in two-level terminal supervisor buildings or combined passenger/terminal supervisor buildings.

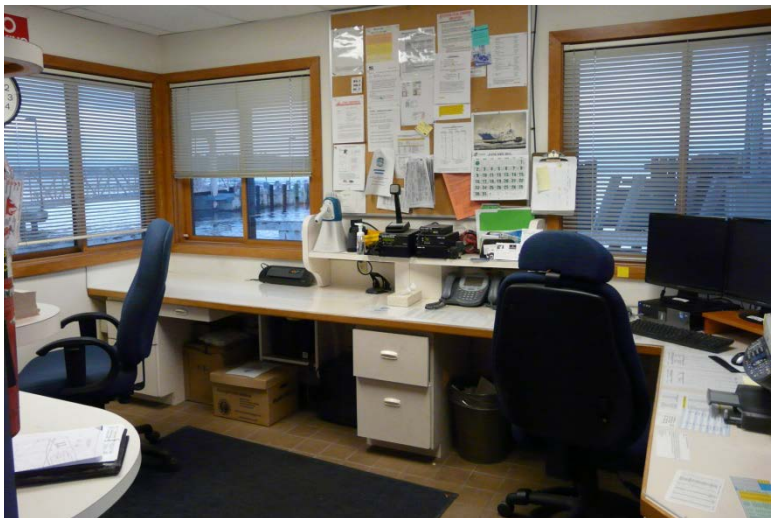
Building Space	1st Floor[1]	2nd Floor[1]	Comment
Terminal Supervisor Office		X	Optimize view of facility
Accounting/Safe Room		X	Locate near supervisor office
Seller Safe Room		X	Locate near supervisor office
Facility Engineer Office		X	Optional
Visiting Manager Office		X	Optional
Employee Restrooms	X	X	
Janitor Storage	X	X	Locate near restroom
VATS Room	X		Provide a separate entrance
Conference Room/Training Room/Library	X		
Employee Lunch/Break Room	X		
Employee Locker Room	X		
Overnight Employee Room	X		Anacortes, Seattle, Friday Harbor
Office Storage	X		
Shower Facility	X		Optional

[1] Indicates preferred level for multi-level building

Terminal Supervisor Building Spaces
Exhibit 430-3

(1) Terminal Supervisor Office

Provide an office for the terminal supervisor to conduct daily business surrounding operations for the route. This room serves as a communication hub for the terminal and can also be used for interaction with the public and interviews with staff. Provide space to keep log books, payroll documents, employee files, working schedules, supply orders, etc. Allow space for two working stations including computers, a copier, a fax, and a file cabinet. Provide enough counter space for ship to shore radio equipment, battery chargers, VMS display controller, and a security camera monitor.



Vashon Ferry Terminal Supervisor Office
Exhibit 430-4

(2) Accounting/Safe Room

Provide a secure room with access from the terminal supervisor office for accounting operations. Allow space for one work station, a large floor standing safe, a computer, a printer, a file cabinet, and a bill counter. Provide storage for stationary supplies and binders.

(3) Seller Safe Room

Provide a secure room with space for seller safes, a drop safe, and a work station. Assume the block of safes will occupy an area approximately 48.0" wide × 72" high × 24" deep. The actual quantity of safes required will be determined by WSF Operations requirements. This room provides WSF staff with an office to perform audit reports.

(4) Facility Engineer Office

Provide, when appropriate, an office for a visiting terminal maintenance engineer who is required to monitor and document all vendor activities in performing routine facility maintenance. Provide enough space for one work station, a fax machine, and a copier. Provide space with a network port and a telephone connection. This space is optional and may be combined with the visiting manager office.

(5) Visiting Manager Office

Provide space, where appropriate, for a visiting manager to work in remote locations or where events dictate a need for operations managers to be on site frequently. Provide space for two work stations including computers, a fax, and a copier. Add wall shelves to accommodate logs and binders. This space is optional and may be combined with the facility engineer office.

(6) Employee Restrooms

Provide the staff with two uni-sex employee restrooms. At least one restroom will have an inner toilet area and an outer room with a sink for UA testing. Design employee restrooms in accordance with the IBC and Section 450.06.

(7) Janitor Storage

Include an area near the restrooms for storing toiletries, cleaning products, cleaning equipment (floor buffers, mop buckets, and case materials), recycle and waste bags and liners. Include shelving in the storage room.

(8) Vessel and Terminal Security (VATS) Room

Provide an office area for use by homeland security personnel and Washington State Patrol officers while security troopers are on duty at the ferry terminal. Allow enough space for two work stations including computer, fax, copier, radio equipment and lockers. Provide a separate entrance into this area from outside.

(9) Conference Room/Training Room/Library

Provide a space for gatherings of terminal employees, advisory groups, managers, security teams, etc. Provide space to accommodate approximately six people seated at a table and video conferencing equipment. Room size may vary depending on the size and staffing requirements of the terminal. Also provide shelf space to accommodate a full set of Safety Management System (SMS) manuals, training videos, security sweep logs, night watch logs and fax machine. Ensure this room has controlled access for official use only.

(10) Employee Lunch/Break Room

Include a space for employees to take breaks. Provide a room for approximately four employees to gather for lunch with a table, chairs, refrigerator, microwave, sink, water dispenser, and counter space. Room size may vary depending on the size and staffing requirements of the terminal. This room can be combined with the employee locker room.

(11) Employee Locker Room

Include a space for employees to store personal items and foul weather gear. Determine the number of lockers based on the number of terminal staff during the summer season. The employee locker room may be combined with employee lunch/break room.

(12) Overnight Employee Room

Provide an overnight room with a restroom for employees who cannot get home from work or who cannot arrive to work in time for their shift. Ensure that the room has enough space for a single bed, end table, and emergency exit window. This room is only required to be provided at the Anacortes, Seattle, and Friday Harbor terminals.

(13) Office Storage

Include an area with cabinets and shelves to store office supplies, clerical supplies, forms, writing utensils, cartridges, batteries, flashlights and lanterns, medical supplies, receipt paper, and printer paper. Allow adequate space to store supplies which come in shipping boxes or cases, such as paper reams.

(14) Shower Facility

Consider providing shower facilities at terminals where space allows. Shower facilities help to encourage employees to utilize alternative modes of transportation, such as bicycling for their workday commutes. Provide the staff with a shower facility allowing space for a single shower stall and toilet. For terminals with overnight quarters (refer to (12) *Overnight Employee Room* above), locate the shower facility in the vicinity of the sleeping room.

Chapter 440 Maintenance Buildings, Enclosures, and Support Areas

440.01 General
440.02 References
440.03 Design Considerations
440.04 Terminal Maintenance Building
440.05 Vessel Maintenance Building
440.06 Miscellaneous Structures, Enclosures, and Support Areas

440.01 General

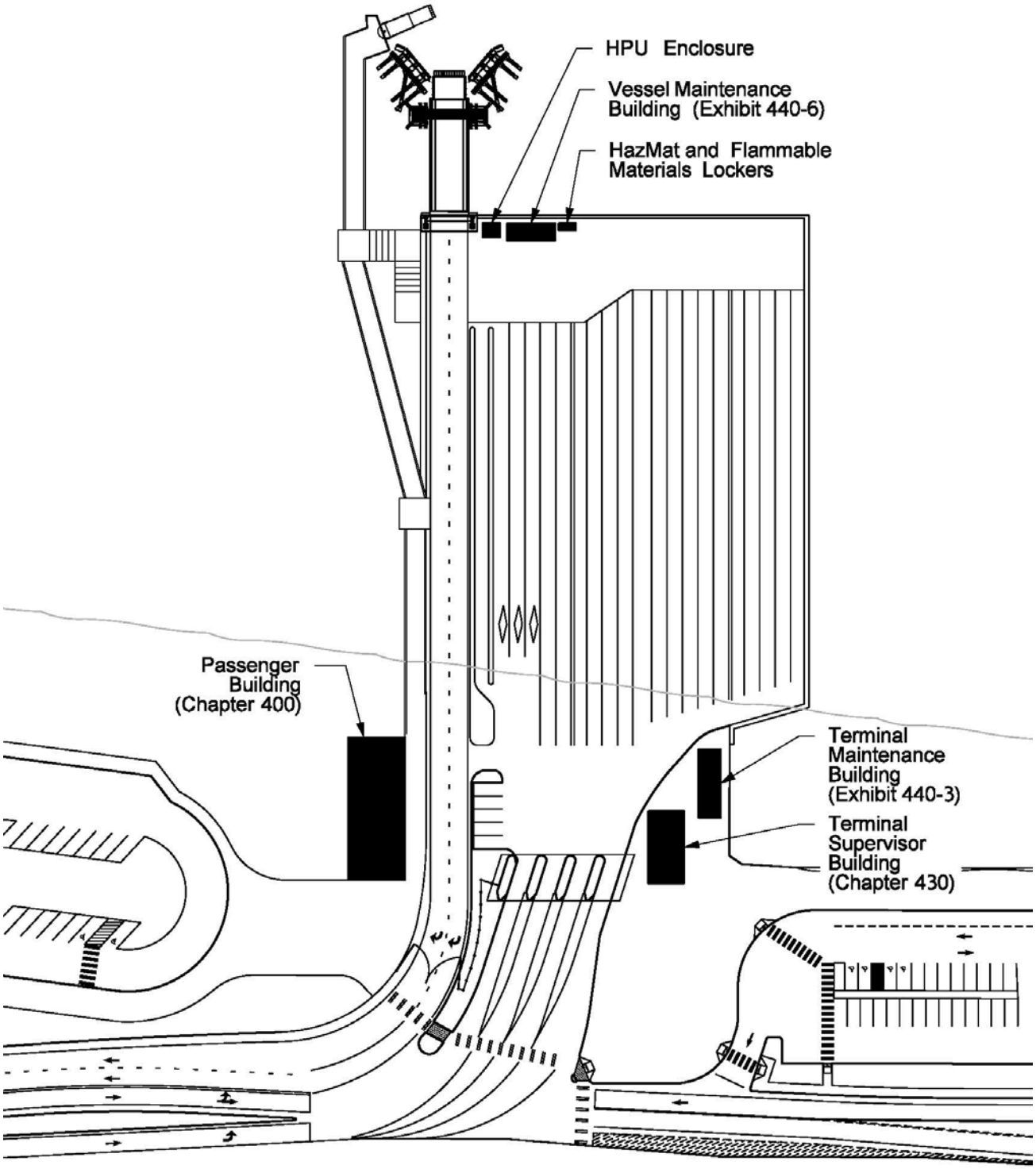
This chapter provides design guidelines for the terminal and vessel maintenance buildings, enclosures, and support areas, including storage areas and utility enclosures. Exhibit 440-2 provides a key to a sample layout for the terminal outbuildings, enclosures, and support areas. Some of the maintenance functions described in this chapter may be incorporated into the passenger building (refer to Chapter 400) and/or the terminal supervisor building (refer to Chapter 430).



Kingston Ferry Terminal Outbuildings
Exhibit 440-1

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
350	Buildings
400	Passenger Buildings
430	Terminal Supervisor Buildings
450	Architecture
510	Toll Plaza
560	Site Utilities
620	Passenger Overhead Loading



Example Layout for Maintenance Buildings and Enclosures
Exhibit 440-2

440.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

29 CFR Part 1910 Occupational Safety and Health Standards, Subpart H – Hazardous Materials International Building Code (IBC), International Code Council

(2) Design Guidance Enterprise Services Sizing Criteria Enterprise Services Standard Plans WSDOT Facilities Office Standard Plans

(3) Supporting Information

Mukilteo Multimodal Terminal Master Plan Design Report (2004), Ferries Division, Washington State Department of Transportation, Seattle, WA.

440.03 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible. Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements. Section 300.06 addresses accessibility requirements relating to staff facilities at terminals.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessels security requirements, and additional information pertaining to building design. Below are links to relevant sections by topic.

Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for TWIC and SSI.

- MARSEC Levels: 310.04
- Access Control / Restricted Areas / TWIC: 310.10
- Signage: 310.13

(3) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation. For projects that involve remodeling and renovation of existing buildings, consider the need for assessment of lead paints, asbestos and other hazardous materials.

(4) Building Structures and Utilities

Refer to Chapter 350 for general building design criteria pertaining to maintenance buildings, enclosures and support areas. Below are links to relevant sections by topic.

- Building Structures: 350.04
- Building Foundations: 350.05
- Building Utilities: 350.06

(5) Circulation, Structure, and Envelope Multipliers

The building areas provided in Appendix S do not account for space requirements associated with building circulation corridors, structural columns, and the building envelope (walls). Estimate these space requirements using a 7 percent building multiplier.

(6) Building Architecture

Refer to Chapter 450 for general architectural design criteria pertaining to the maintenance buildings and enclosures. Below are links to relevant sections by topic.

- Building Code Requirements: 450.04
- Building Permits: 450.05
- WSF Architectural Guidelines: 450.06

(7) Location

When feasible, locate equipment and storage areas in close proximity to their required use. Take under consideration equipment and storage related issues such as access, noise, vibrations, emissions, odor, safety and environmental concerns. Depending on their function, these areas may be located either on land or over-water and may be within a multi-purpose building or standalone enclosure. Storage areas may be combined if they have compatible storage requirements.

(8) Storage of Dangerous and Hazardous Materials

Design storage areas for dangerous and hazardous materials in compliance with all applicable codes and regulations. Applicable materials include, but are not limited to, used oil rags, oil drums, batteries, gasoline, and compressed oxygen. Refer to 29 CFR Part 1910 Subpart H for OSHA hazardous materials requirements.

(9) Heating and Cooling of Maintenance Spaces and Support Areas

Enclosed maintenance spaces, support areas and storage areas do not require cooling. Provide heating of these spaces, as needed, for the reasons noted below. Provide adjustable heat sources, controlled by a thermostat, which can be turned off if not required in the summer time.

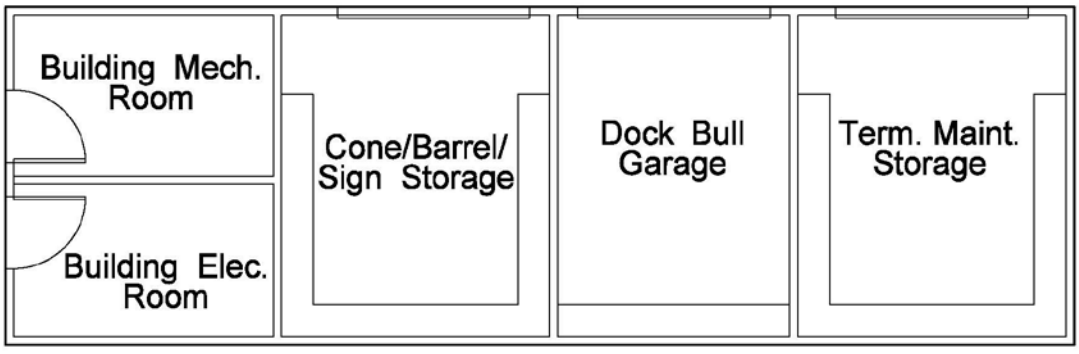
- For comfort in manned support spaces (e.g. OHL operator control station, vehicle/ traffic attendant booth, and traffic attendant office)
- To prevent freeze ups of the utilities or equipment.
- To ensure condensation does not occur on equipment or stored product (heat spaces above the dew point).

440.04 Terminal Maintenance Building

The terminal maintenance building is typically located near the vehicle holding area. The building spaces associated with the terminal maintenance building are:

- Terminal Maintenance Storage
- Cone/Barrel and Sign Storage
- Building Electrical/Mechanical Room
- Dock Bull Garage

These spaces are described in more detail in the paragraphs that follow. Information on sizing requirements for these spaces is provided in Appendix S . Exhibit 440-3 gives an example layout for a terminal maintenance building. Actual maintenance facility layouts will vary. Coordinate maintenance facility layout based on specific site features and terminal needs. Certain terminal maintenance functions such as terminal maintenance storage, cone/barrel and sign storage, and building electrical/mechanical may be incorporated into the passenger building or provided as standalone structures.



Example Layout for Terminal Maintenance Building
Exhibit 440-3



Clinton Terminal Maintenance Building
Exhibit 440-4

(1) Terminal Maintenance Storage

Provide a storage space for maintenance equipment and supplies such as leaf blowers, lawn mowers, pressure washers, garden hoses, shovels, salt, sand, deicer, etc. This storage area may also be used to store overflow items such as garbage bags, cleaning supplies, brooms, mop handles, etc. Provide the space with shelves. As much of this equipment is gasoline powered, this building/storage area may require special consideration or separation from other buildings.

(2) Cone/Barrel and Sign Storage

Provide an area for the storage of traffic direction equipment such as traffic cones, barrels and directional signage which are typically kept at each terminal. Provide the space with shelves on three sides and a lockable door (preferably a roll up type door).

(3) Building Electrical Room

This room is used to house the building circuit breaker panels and their conduit pathways. Provide enough space to house between 2 and 5 commercial sized wall mounted breaker panels. Refer to Chapter 360 for additional information.

(4) Building Mechanical Room

Provide space for building backflow preventer, hot water heater, furnace, heat exchanger and blower assembly for building HVAC, as well as building sprinkler valve assemblies, pumps, fire risers and equipment. Refer to Chapter 350 for additional information.

(5) Dock Bull Garage

Provide a space for housing the terminal dock bull tractor either on or near the trestle. The garage does not need to accommodate a dock bull trailer as pictured in Exhibit 440-5. Provide a concrete pad under the structure and shelves at the back for the storage of chains, tow straps, etc. Ensure that this area is covered, enclosed and secure. This space can be combined with the man lift storage.



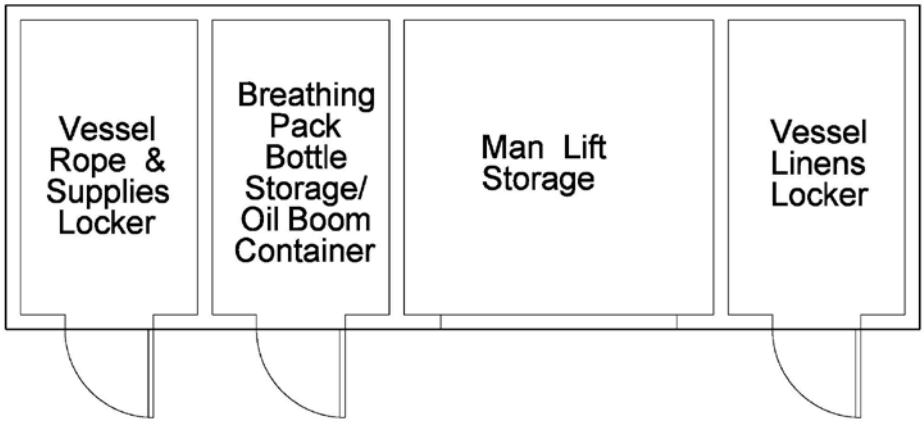
Typical Dock Bull
Exhibit 440-5

440.05 Vessel Maintenance Building

The vessel maintenance building is typically located near the slips. The building spaces typically associated with the vessel maintenance building include:

- Vessel Rope/ Supplies Locker
- Vessel Linens Locker
- Breathing Pack Bottle Storage
- Oil Boom Containers
- Man Lift Storage

These spaces are described in more detail in the paragraphs that follow. Information on sizing requirements for these spaces is provided in Appendix S. Exhibit 440-6 gives an example layout for a vessel maintenance building. Actual vessel facility layouts will vary and should be coordinated with specific site features and terminal needs. Certain vessel maintenance functions may be provided as standalone structures.



Example Layout for Vessel Maintenance Building
Exhibit 440-6

(1) Vessel Rope/Supplies Locker

Provide a locker to store replacement berthing lines and miscellaneous supplies not stored on the vessel including such items as sand, salt, garbage/recycle bags, toiletries and cleaning equipment. Locate the locker on the dock level and near the slips at terminals where vessels tie up at night.

Provide the space with shelves on three sides and a lockable door (preferably a roll up type door).

(2) Vessel Linens Locker

Provide a locker to store vessel linens (clean and dirty) for crew sleeping on the boat. Locate the locker on the dock level and near the slips at terminals where vessels tie up at night. Provide the space with shelves on three sides and a lockable door (preferably a roll up type door).





Vashon Ferry Terminal Vessel Rope/Linens Locker
Exhibit 440-7

(3) Breathing Pack Bottle Storage

Provide storage containers for replacement breathing pack bottles. Exhibit 440-8 provides an example of a typical breathing pack bottle storage container.



Vashon Ferry Terminal Breathing Pack Bottle Storage
Exhibit 440-8

(4) Oil Boom Containers

Provide a portable storage container (Connex) to house 2000 feet of floating harbor boom for emergency waterborne oil spill containment. Containers are mandated wherever fuel and oil is transferred. Place the container close to the transfer span or water for easy deployment.

(5) Man Lift Storage



Oil Boom Containers
Exhibit 440-9

Provide a space to store a scissor type man lift at terminals where vessels tie up. The man lift is used by vessel engineers and maintenance staff for replacing light bulbs and other maintenance in hard to reach areas. Provide a concrete pad under the structure. This space can be combined with the dock bull garage.



Manlift in Use at WSF Terminal
Exhibit 440-10

440.06 Miscellaneous Structures, Enclosures, and Support Areas

There are numerous miscellaneous structures, enclosures and storage areas that support WSF operations. The items discussed in this section are generally standalone structures/areas due to special locations needs (toll booths, hydraulic power unit enclosures, operator control station, etc), risk control (vessel hazmat storage locker, flammable materials locker, etc.), noise control (emergency generator) or other unusual constraints. Some of these spaces may be incorporated into a passenger building or maintenance building as space and location permits. Exhibit 440-11 identifies the miscellaneous structures, enclosures and support areas required. These spaces are described in more detail in the paragraphs that follow. Information on sizing requirements for these spaces is provided in Appendix S.

Structure, Enclosure or Support Area	Near Toll Booths	Near Slips	Vehicle Holding	Other / Variable
Operator Control Station (OHL) [1]		X		
Vehicle/Traffic Attendant Booth	X			
Traffic Attendant Office		X		
Vehicle/Passenger Staff Restroom			X	
Vessel HazMat Storage Locker		X		
Flammable Materials Locker		X		
Oil Spill Supply Barrel			X	
Oil Spill Response Kit			X	
Terminal Engineering Damage Assessment Kit		X		
Garbage and Recycling		X		
Cart Storage [2]		X		
Vendor Storage		X		
Service Transformer Area				X
Emergency Generator [3]				X
Isolation Transformers		X		
Transfer Span Electrical Enclosures		X		
Hydraulic Power Unit (HPU) Enclosures		X		
Backflow Preventer Enclosures		X		
Sewage/Stormwater Lift Station				X

[1] Locate near overhead loading

[2] Locate near garbage and recycling area

[3] Locate near main power

Miscellaneous Structures, Enclosures, and Support Areas
Exhibit 440-11

(1) Operator Control Station for Overhead Loading

Refer to Chapter 620 for requirements.

(2) Vehicle Toll Booths

Refer to Chapter 510 for requirements.

(3) Vehicle / Traffic Attendant Booth

Provide a booth or a small area for traffic attendants when their work station is in a remote location at a facility. This area provides a means for the attendant to retreat from inclement weather conditions and serves to store medical supplies, incident report forms, ferry information, and a hydration source. Provide sufficient space for one employee, a small medical kit, radio battery charger, ferry information, and some personal items.

(4) Traffic Attendant Office

Provide an office for the traffic attendants within the vehicle holding area at large terminals. This area provides a means for the attendants to retreat from inclement weather conditions and serves to store medical supplies, incident report forms, ferry information, and a hydration source.

Provide a desk and chair for each attendant and sufficient space for a small medical kit, radio battery charger, ferry information, and some personal items. Consider locating this office in the Terminal Supervisor Building where the attendant has access to a restroom and potentially other amenities such as an employee lunch room and locker room.



Anacortes Terminal Traffic Attendant Booth
Exhibit 440-12

(5) Vehicle/Passenger Staff Restroom

Consider providing restooms near the vehicle holding area for passengers and staff working in the vicinity. See Chapter 400 for more information on restroom design.

(6) Vessel Hazardous Materials Storage Locker

Provide a self-contained locker for the storage of hazardous materials including used oil rags, oil drums, light bulbs and batteries until they are picked up for disposal. Base the all metal, portable and lockable storage locker on WSF standard design. Locate the hazmat locker near the trestle such that hazardous material does not contaminate the storm drain system or scuppers. Consider locating hazmat storage locker in the garbage/recycling area.

(7) Flammable Materials Locker

Provide a self-contained flammable materials storage locker at the head of each slip to store gas cans for dock bulls and rescue boats and confiscated customers gas cans. Base on WSF standard design with shelving across the back for segregating cans by date.

(8) Oil Spill Supply Barrel

Provide a storage locker to store items needed to respond to a large spill event including:

- Oil-absorbent pads
- Oil-absorbent powder
- Oil-absorbent socks
- Disposable bags
- Disposable nitrile gloves
- Safety goggles

Provide the space with shelves on three sides and a lockable entry. Locate near the trestle.

(9) Oil Spill Response Kit

Provide an oil spill response kit to clean up minor oil spills. The spill response kit has enough materials (absorbent pads, chemicals, etc.) to respond to a small spill anywhere within the holding area.



Vashon Ferry Terminal Oil Spill Response Kit
Exhibit 440-13

(10) Terminal Engineering Damage Assessment Kit

Provide a storage locker containing equipment for Terminal Engineering Staff to perform damage assessment of the facilities. The locker is used to store the following items: lantern, claw hammer, 100’ tape, 25’ tape, plumb bob, dust masks, orange paint, hard hat, miscellaneous nails, cotton gloves (2 pairs), latex gloves (4 pairs), clipboard with paper, lumber crayon, duct tape, 7 ½” level, screwdrivers (phillips and regular), pliers (large needle nose, adjustable, linemans), crescent wrenches (8” and 12”), disposable camera, pry bar, 6’ wire, damage assessment team vest, personal floatation device (PFD), and a terminal damage assessment climbing harness.



Vashon Ferry Terminal Damage Assessment Kit
Exhibit 440-14

(11) Garbage and Recycling

Include a space to support the storage and transfer of vessel and terminal garbage and recycling. Provide adequate lighting and a fence around the garbage and recycling to secure the area. Allow for drive though access by locating lockable gates at either end of the area. Provide space for garbage dumpsters, recycle dumpsters, and a large trash compactor where applicable. The following terminals require trash compactors:

- Anacortes
- Fauntleroy
- Kingston
- Seattle

Design trash compactors so that the hydraulic systems are mounted to the compactor and do not require disconnecting of hydraulic hoses to be emptied. The intent is to prevent accidental hydraulic spills and leaks from repeated disassembly and reassembly of the hydraulic hoses that currently takes place.

Place dumpsters and trash compactors on a concrete pad in a location accessible by delivery truck. Provide a covered area for dumpsters or provide dumpsters with a hinged, watertight lid that closes automatically to prevent stormwater from collecting inside the dumpsters. Water leakage from dumpsters is considered contaminated runoff and requires treatment to meet department of ecology standards. Provide a means to contain any runoff from the garbage and recycling area and convey it to a stormwater treatment system that includes oil-water separation.



Seattle Ferry Terminal Garbage and Recycling Area
Exhibit 440-15

(12) Vendor Storage and Office Space

Vendor storage and office space is included in the Retail and Lease Space requirements discussed in Chapter 400.

(13) Service Transformer Area

Consult with the power company to ascertain their requirements for the transformers and associated access.

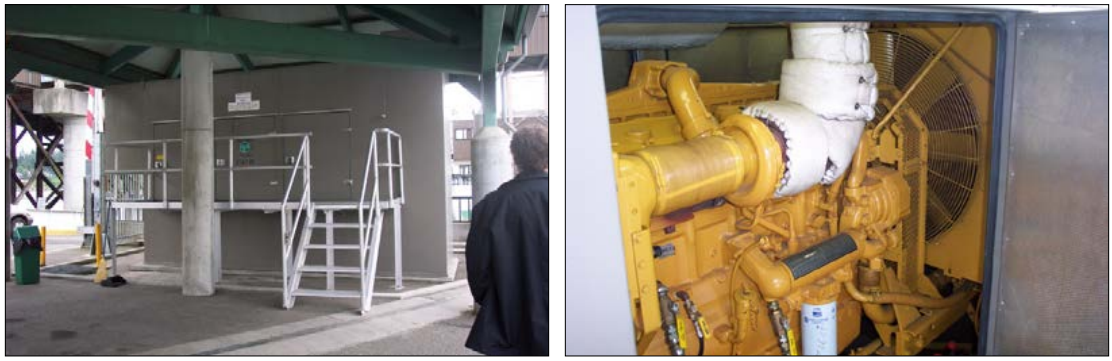
Service transformers are numbered and spaced according to the size of each terminal and function to provide electrical service from the local utility. Provide a secured or fenced area with adequate warning signage. Additionally, provide the following:

- Power company access
- Locate adjacent to the main switchboard area, where feasible.
- Clearance of 10 feet in the front and 3 feet at sides and back. If located adjacent to the main switchboard area, the clearance spaces can overlap

(14) Emergency Generator

The emergency generator supplies power to the entire terminal including vehicle transfer spans and overhead loading during a power outage. Backup power is also required in order for the Electronic Fare System to remain viable and function in real time during an outage. The generator is a standalone self-contained unit and requires a concrete pad and mounting suspension. It is often located on the perimeter of a facility and requires secure fencing or some form of enclosure. The emergency generator may be located in the terminal building if precautions are taken to address access, noise, vibrations and emissions issues. The emergency generator requires the following:

- Fuel truck access
- Maintenance access
- Space for portable load bank setup
- Location adjacent to the main switchboard area, where feasible
- Sound attenuating enclosure
- Load bank receptacles
- Size for entire facility load minus the shore power receptacles Refer to Chapter 360 for additional information.



Bainbridge Island Ferry Terminal Emergency Generator and Enclosure
Exhibit 440-16

(15) Isolation Transformers

Provide one isolation transformer per slip. These transformers are required in order to isolate the vehicle transfer spans from the rest of the electrical infrastructure of a terminal. Locate within close proximity of the vehicle transfer span. Refer to Chapter 360 for additional information.

(16) Transfer Span Electrical Enclosures

Locate the transfer span electrical enclosure near the slips. This provides electrical service to the pedestrian and vehicle transfer span(s). Refer to Chapter 360 for additional information.

(17) Hydraulic Power Unit Enclosures

Provide a separate hydraulic power unit (HPU) for each vehicle and overhead loading transfer span. Refer to Section 810.09(4) for information on HPU enclosures for vehicle transfer spans and Section 820.07(11) for information on HPU containment for overhead loading.



Bainbridge Island Ferry Terminal VTS HPU Enclosure
Exhibit 440-17

(18) Backflow Preventer Enclosures

Provide a backflow preventer and enclosure for vehicle transfer spans with water supply. Install backflow preventers where there is a safety/sanitary need to prevent liquid from reversing its course inside a flow system. Provide for one direction flow only. Locate backflow preventers near the slips. Refer to Chapter 560 for a description of the backflow preventer, enclosure, and a list of terminals with water/sewer supply at the slips.



Clinton Ferry Terminal Backflow Preventer Enclosures
Exhibit 440-18

(19) Sewage/Stormwater Lift Station

Provide a sewage/storm water lift station when gravity flow system is not adequate to move flows. Locate in isolated area with curbside access for servicing. Provide adequate access for a large crane or boom truck service vehicle. Refer to Chapter 560 for additional information regarding stormwater design at WSF Terminals.

450.01 General
450.02 References
450.03 Design Considerations
450.04 Building Code Requirements
450.05 Building Permits
450.06 WSF Architectural Guidelines
450.07 LEED® Certification
450.08 Public Art Requirements

450.01 General

This chapter identifies architectural considerations associated with the design of WSF terminal buildings. These include, but are not limited to: building code requirements, building permits, ADA requirements, WSF architectural guidelines, and LEED certification for any one buildings over 5,000 square feet.



Edmonds Ferry Terminal Building
Exhibit 450-1

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
350	Buildings
460	Landscaping
470	Public Art Requirements
570	Signage and Wayfinding

450.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

ADA (28 CRF Part 35, as revised September 15, 2010)

International Building Code (IBC), International Code Council

International Fire Code (IFC)

National Electric Code (NEC)

National Fire Protection Agency (NFPA), Life Safety Code (NFPA-101)

RCW 39.35D *High-Performance Public Buildings*

RCW 43.17.200 *Allocation of moneys for acquisition of works of art – Expenditures by arts commission - Conditions*

International Mechanical Code IMC)

Uniform Plumbing Code (UPC)

IECC/*Washington State Energy Code*

(2) Design Guidance

Leadership in Energy and Environmental Design for New Construction (LEED-NC), U.S. Green Building Council

Local Jurisdictions Historic Design Review Standards

Local Jurisdictions Waterfront Districts Standards

Local Jurisdictions Zoning Codes

450.03 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible. Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessel security requirements, and additional information pertaining to building design. Below are links to relevant sections by topic. Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for TWIC and SSI.

- MARSEC Levels: 310.04
- Security Rooms: 310.07
- Access Control/Restricted Areas/TWIC: 310.10
- Closed Circuit Television: 310.11
- Signage: 310.13

(3) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

(4) Buildings

Refer to Chapter 350 for general building design criteria. Below are links to relevant sections by topic.

- Building Structures: 350.04
- Building Foundations: 350.05
- Building Utilities: 350.06

(5) Proprietary Items

WSF uses competitively acquired products to fulfill the requirements of a contract wherever feasible to help achieve the lowest price, the best quality, and the most efficient use of resources. There are instances in which competitive bidding may not or cannot be provided and a specific proprietary product is allowed. Refer to Section 220.07(2) for limitations on the use of proprietary items.

(6) Signage and Wayfinding

Refer to Chapter 770 for requirements.

450.04 Building Code Requirements

Design new buildings to comply with codes in place at the time of permit application including local jurisdiction building related codes, municipal codes, the *International Building Code* (IBC) and any state-wide amendments, IECC/*Washington State Energy Code*, and the current adopted editions of Mechanical, Plumbing, and Electrical Codes. If there is a conflict between the specific codes stated in this section and a local agency, provide documentation in the DDP and an explanation for which code was used. The IBC addresses issues including, but not limited to, occupancy and egress requirements, building limitations on area and height, construction type, and fire protection of various elements.

The finish floor elevation for buildings placed on docks shall comply with FEMA base flood elevations.

450.05 Building Permits

Building permits are required for the terminal buildings including passenger buildings, maintenance buildings, toll booths, and the terminal supervisor building. Building permits are obtained from the local jurisdictional authority.

Building permits are not required for the overhead loading (OHL) structure, unless passengers stage within the OHL. For permitting purposes, the OHL structure begins at the fixed walkway ramp and not the transfer span (see Exhibit 450-2).



Limits of Overhead Loading
Exhibit 450-2

Local zoning and jurisdictional requirements apply to new development of a terminal facility and may apply to retrofits and modifications to a facility. Exhibit 450-3 identifies the governing jurisdiction and zoning designation for existing WSF terminals. Coordinate with the local jurisdictional authority for any permit requirements.

Terminal	Jurisdiction	Zoning Designation
Anacortes	City of Anacortes	Commercial Marine
Bainbridge Island	City of Bainbridge Island	Ferry Terminal District Overlay
Bremerton	City of Bremerton	Urban Renewal District
Clinton	Island County	State Highway ROW
Edmonds	City of Edmonds	Ferry ROW
Fauntleroy	City of Seattle	Single Family – 7500 sf
Friday Harbor	Town of Friday Harbor	Commercial
Coupeville	Island County	Park
Kingston	Kitsap County	Neighborhood Commercial
Lopez	San Juan County	Rural General
Mukilteo	City of Mukilteo	Downtown Business
Orcas	San Juan County	Village
Point Defiance	City of Tacoma	S-5
Port Townsend	City of Port Townsend	Historical Overlay
Seattle	City of Seattle	DH1/45
Shaw	San Juan County	Rural Farm Forest
Southworth	Kitsap County	RR/Residential Rural
Tahlequah	King County Dept of Development & Environmental Services	2.5 (RA)
Vashon	King County Dept of Development & Environmental Services	None (within ROW)

Terminal Jurisdiction and Zoning Designation
Exhibit 450-3

450.06 WSF Architectural Guidelines

(1) General

Design terminal buildings to integrate with the surrounding community. Incorporate low maintenance features, natural light, and views into the design. Develop building layouts with WSF Operations approval and incorporate building materials designed for a harsh marine environment conducive to heavy snow, wind, rain and corrosion. Provide slip resistant surfaces both inside and outside the buildings. Consider the use of recycled and renewable materials.

Comply with architectural requirements of jurisdictional authority which may include, but are not limited to: height restrictions, building orientation, period, style, theme, and color. Landscaping requirements may also apply (refer to Chapter 460).

(2) Building Envelope

Design the exterior envelope for all structures to ensure weather tightness, minimize maintenance, maximize building longevity, and be architecturally compatible with the surrounding environment. Minimize bird perch area and provide bird deterrence as necessary.

(a) Roofing

Provide a complete roofing system that is fully weatherproof. Where a low slope roof is required, provide roof parapets with roof drains and supplementary overflow drains or scuppers. Provide roof access through a roof access hatch, doorway or stairway. Provide screening for rooftop equipment. Provide fall restraint system as required for the roof access.

1. **Single-ply roofing**
   - Slope all roof surfaces at a minimum grade of ¼ inch per horizontal foot.
   - Design low slope roofs with single-ply membranes mechanically attached (wood and metal decks) or fully adhered (concrete decks) for waterfront exposure application.
   - Install walking pads from roof access point to and around all equipment that requires servicing. Install walkways a minimum of 6 feet from the roof edges.
   - Specify light gray roofing color unless required otherwise by local jurisdiction.
   - Require minimum membrane thickness of 60 mil.
2. **Metal roofing**

   Standing seam metal roofs are allowable for roof slopes over 3 inch of rise in 12 inch of run. Panels for lower slopes provide too much opening at the ends for bug and water intrusion. Metal roof panels are to be zinc-alum coated steel or aluminum with polyvinylidene fluoride (PVDF) coatings.
3. **Warranties**

   Specify roofing manufacturer's warranty for all roofs. Single-ply will be 20 year warranties. Metal roofing will have a 20 year material and labor warranty.

(b) Walls

- Exterior finish systems (EFS) are not recommended.
- Provide curtain wall window systems where exposed to wind driven rain. Storefront is adequate for areas protected from rain.
- Provide masonry walls that are either double wythe or have a continuous moisture barrier behind the veneer.

(c) Sealants

- Only install two part sealants on horizontal surfaces exposed to weather.
- Use bond breaker tape on all mortar joints behind caulking.

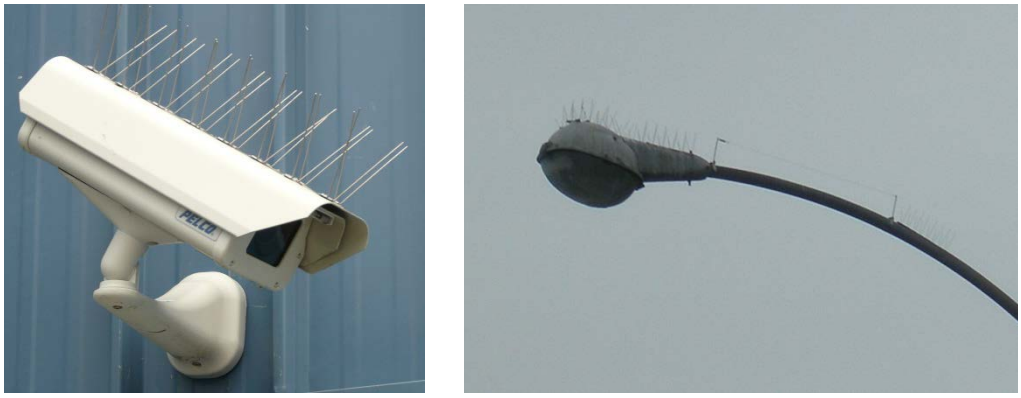
(d) Doors and Hardware

- Limit door height to 7 feet. Over-height glass doors are too heavy for auto openers.
- Provide proximity reader controls on all perimeter doors. Locate proximity readers and automatic opener devices adjacent to one another.
- Provide panic hardware as required by the *International Building Code*, NFPA 101, or the most restrictive local jurisdiction. Do not use pairs of doors with exposed vertical rods. Rim devices with removable mullions are acceptable.

- Specify locks and locksets that are compatible with Best Locks cores. Keying will be done by the State.
- Equip accessible route with pairs of doors to allow disabled/emergency access. At a minimum specify that one door be automatic with button push assisted opening in the accessible route. Automatic slider type doors are to be single leaf. No double acting doors. Bi-parting is allowable.
- Design electronic fair system (EFS) doors to work with code required exits/alarms.
- Overhead closers are preferred. Provide all closers with adjustments for latch and closing speeds, and back-check control.

(e) Bird Control

Keep bird perch area to a minimum in building design. Bird deterrents include: wire, sharp and dull sticks, hot wire, steep slope roof, and sprinkler system that could be tripped as needed. Note that solar powered whirly birds are expensive and were not found effective in trials at the Edmonds Terminal.



Bird Deterrent
Exhibit 450-4

(3) Building Interiors

(a) General Design

- Provide building interiors with natural ventilation in accordance with the IBC or mechanical ventilation in accordance with the *Uniform Mechanical Code* (UMC).
- Provide ceiling heights in compliance with the IBC.
- Design interior finishes in compliance with the IBC and the WSF *Terminal Design Manual* guidelines.
- Minimize bird perch area in building interior design for waiting areas.

(b) Floor Finish in Terminal Building

- Specify sealed concrete or terrazzo as the standard public area flooring. Concrete floors can be stained.
- Provide interior flush walk-off grate areas at entry doors. Connect grated area to sump drain.
- Provide an entry mat to collect tracked in water.

- Use vinyl composition tile (VCT) in staff offices, IT rooms, staff restrooms, and breakrooms.
- Light broom finished concrete on overhead walkways for both open-air and enclosed walkways.
- Use unglazed ceramic tile on public restrooms floors.

(c) Storage

- Separate janitor closets from electrical and mechanical rooms.
- Size janitor closets to store all cleaning supplies and equipment. This includes a floor cleaning machine.
- Provide dedicated storage areas for specialty equipment such as powered wheel chairs.

(d) Interior Doors and Hardware

- Verify hardware function with WSF Operations management. Specify commercial grade hardware.
- Provide office door hardware with lever handles. Provide all interior doors with closers. Specify stop and hold function with closers as requested by WSF Operations management.
- Provide accessible restroom doors with automatic openers with pushbuttons.
- Provide code restricted areas with warning knobs. Janitor rooms generally require 20 minute rating. To facilitate their closing, but discourage propping open, provide all janitor door closers with 180 degree hold open.
- Specify all doors on required exit corridors be rated 20 minute with self-closing devices and latching hardware.

(e) Exit Signage

- Use Universal mount, metal housing, green LED with diffusing lens.
- 90 minute NiCad battery back-up

(f) Fire Extinguisher

Cabinets are preferred to be recessed mount. Provide general signage high enough above cabinets to be visible from general public areas in occupied building condition.

(4) Restrooms

Design circulation and access into and exiting restrooms based on terminal capacity. Smaller capacity restrooms require a door for privacy separation. Larger capacity restrooms may work more efficiently with a dog-leg open access in place of doors. Larger restrooms require an operational dividing wall to provide functional separated use for the convenience of the public and janitorial staff during cleaning. Equip separation wall opening with a coiling door. Alternatively, larger terminals may contain two separate restrooms for each sex to allow for cleaning without removal of service.

(a) General

- Provide at least the minimum number of plumbing fixtures set forth in the IBC. Include ADA stall in code requirement for minimum number of stalls calculation.
- Use lighter color schemes to provide for a cleaner look.
- Where possible, provide plumbing chase walls with access for all fixtures.
- Provide natural light where possible. Use of a vertical clerestory is preferred to horizontal skylights due to bird maintenance concerns.
- Consider family restrooms at major terminals.

(b) Walls

- Use full height ceramic wall tile and cove base on ¼-inch cementitious backer board on ½-inch plywood on all restroom walls.
- Do not use special order tile or imported tile that incurs significant additional cost over domestic tile.

(c) Ceilings

- Use hard rock ceilings.
- Use recessed lights if the ceiling is below 8 feet.
- Do not provide open lens for light fixtures above 8 feet (bug catchers).
- Locate light fixtures where they can be easily accessed for light bulb changes. Clerestory ceiling lights should be easy to change from an 8-foot ladder.
- Provide storage space for ladder and light bulbs in the passenger building or terminal maintenance building.

(d) Floors

- Use ceramic unglazed tile for the floors, bed set with slope to drain.
- For multi-fixture restrooms, locate floor drains below sinks and water closet rows. A single floor drain is acceptable for small or single occupant restrooms.

(e) Fixtures

- Provide floor mounted urinals when possible.
- Waterless urinals are not an allowable fixture.
- Use individual porcelain sinks.
- Use 3.5 gallon blow-out water closets with minimum 2⅝ inch ball throat clearance. Wall mount is preferred. Wall needs to be designed structurally to support fixture.
- Provide hose bibs with lockable covers under lavatories in restrooms and in janitor closet.

(f) Countertops

- Use solid formed material for countertops.
- Do not use plastic laminate counter tops
- Provide one ADA compliant countertop per restroom

(g) Toilet Partitions

- Use embossed stainless steel partitions with honey-comb impregnated craft paper cores. The embossing deters vandalism.
- Floor mounting of toilet partitions is preferred. Ceiling hung units suffer misalignment from public abuse.

(h) Accessories

- Provide all public restrooms with a baby changing table.
- Use electric hand dryers. High output hand dryers, such as Excel Xlerator© are not acceptable due to noise. WSF discourages the use of paper towels due to disposal problems.
- Provide sanitary disposal bag dispensers at each female water closets.
- Provide a waste basket and a needle disposal receptacle in each restroom.
- Provide a Jumbo toilet paper dispenser typical at each water closet.
- Provide seat cover dispensers at each water closet.
- Provide coat hooks in each stall.
- Use wall mounted soap dispensers compatible with the type of soap currently available through state procurement contracts. No powder dispensers are allowed. Single unit reservoirs with multi point dispensers are not allowed (wrong product causes malfunctions of all units).

  When infrared heating is used have occupant sensor turn heat on. Place supply air above door height.

450.07 LEED® Certification

All public buildings having an area greater than 5,000 square feet as defined under RCW 39.59 are to be designed to incorporate the *U.S. Green Building Council's Leadership in Energy and Environmental Design Green Building Rating System* (LEED-NC). LEED® is an internationally recognized green building certification system, providing third-party verification that a building or facility was designed and built using strategies intended to improve environmental performance. Buildings are required to be designed, constructed and certified to at least the LEED® Silver standard.

The LEED® system is a point based system that requires the project team to submit documentation to prove performance in a series of six different categories: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources, Indoor Environmental Quality, and Innovation & Design Process. Prerequisites in each category receive no points and are mandatory for all projects. Example building and site features contributing to LEED accreditation and a sustainable design solution include the following:

- **Sustainable Sites**: alternative transportation, stormwater management, heat & light pollution reduction
- **Water Efficiency**: water use reduction, reuse of potable water and rainwater
- **Energy & Atmosphere**: use of renewable energy, high performance equipment
- **Materials & Resources**: use of recycled, regional, and rapidly renewable materials
- **Indoor Environmental Quality**: incorporation of views, daylighting, and natural ventilation
- **Innovation & Design Process**: educational programs, exceeding ADA requirements, exemplary performance for view, comprehensive master transportation plan, and use of LEED® accredited professional in design process.

Rehabilitation and remodel of existing facilities may qualify for the Washington State Quality Assurance Program if LEED silver rating is not attainable.

450.08 Public Art Requirements

RCW 43.17.200 requires that all state agencies allocate out of moneys appropriated for the original construction of any public building, an amount of one-half of one percent of the appropriation to be expended by the Washington state arts commission for the acquisition of works of art. The works of art may be placed on public lands, integral to or attached to a public building or structure. Refer to Chapter 470 for additional guidance and restrictions.

Chapter 460 Landscape Architecture

460.01 General
460.02 References
460.03 Design Considerations
460.04 Pedestrian Pavement/Hardscape
460.05 Landscaping
460.06 Lighting
460.07 Site Furnishings
460.08 Signage and Information Kiosks
460.09 Public Art

460.01 General

This chapter discusses the integration of landscape architecture at WSF terminal facilities. There can be many approaches to the design of site landscape elements and their materials. Beyond meeting functional and code requirements and maintenance considerations, it is important that they integrate with the surrounding context, the terminal buildings, and each other. The landscape elements, together with the terminal buildings, set an aesthetic tone and character for the terminal. Site landscape elements include: pedestrian pavement/hardscape, landscaping (existing vegetation, soils, irrigation, and plantings), site lighting, and site furnishings. Exhibit 460-1 shows the Edmonds Ferry Terminal, which was incorporated into the surroundings of an adjacent city park. Making use of existing landscaping and native features is a low cost and low maintenance method to make the ferry terminals more aesthetically pleasing to the public.



Edmonds Terminal Incorporated into Surrounding Landscape
Exhibit 460-1

Consider the following goals in landscape design:

- Providing safe, inviting, accessible routes to and through the site by both vehicular and pedestrian traffic.
- Enhancing views of the terminal from various vantage points.
- Providing low maintenance, high durability materials, furnishings and plantings.

- Providing function within the terminal in the form of lighting and site furnishings.
- Protecting the environment through reduction of impervious area, habitat enhancement, stormwater treatment, erosion control, etc.
- Connecting the terminal to the surrounding community. For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
320	Environmental Considerations
340	Civil
470	Public Art
530	Parking
560	Site Utilities
570	Signage and Wayfinding
580	Sustainability/Low Impact Development

460.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

International Building Code (IBC), International Code Council

(2) Design Guidance

28 CFR Part 35 *Nondiscrimination on the Basis of Disability in State and Local Government Services*

Design Manual M 22-01

RCW 43.17.200 *Allocation of moneys for acquisition of works of art – Expenditures by arts commission - Conditions*

Roadside Classification Plan M 25-31

Roadside Manual M 25-30

Standard Plans M 21-01

Standard Specifications M 41-10

460.03 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible. Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements.

(2) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

460.04 Pedestrian Pavement / Hardscape:

(1) General

Provide pedestrian pavements throughout the site that is safe, slip resistant, and accessible. Design pedestrian pavements using guidance in the *Roadside Manual* M 25-30, the *Design Manual* M 22-01, and the *Standard Plans* M 21-01. Additionally, design pedestrian surfaces to comply with ADA standards. Refer to Chapter 300 for guidelines.

Consider the use of pervious pavement to reduce stormwater runoff. Refer to Chapter 580 for information on pervious pavement design.

Where cast in place concrete is specified in pedestrian areas, ensure that concrete, reinforcement, scoring and jointing comply with WSDOT and ADA standards. Refer to the *Design Manual* Section 1510.05 for additional guidance.

(2) Terminal Pedestrian Entry Plazas

Pedestrian pavement materials and patterning in the terminal entry plazas serve to set the vocabulary of the rest of the site's pavement. Create a community space through the use of color and scoring as patterns in the hardscape. Provide the highest level of intricacy in pavement materials and patterning immediate to entries to help distinguish them from and, in conjunction with plantings and site furnishings, support their clear and immediate identification. Design scoring and jointing patterns in response to adjacent architecture and anticipated pedestrian traffic flows as well as site amenities. Design pavement in the terminal pedestrian entry plazas for occasional vehicle access, where applicable. Where vehicular access is needed for WSF or emergency and service vehicles, consider the use of removable bollards. Design removable bollards in accordance with the *Standard Plans* M 21-01 and the WSDOT *Design Manual* M 22-01.



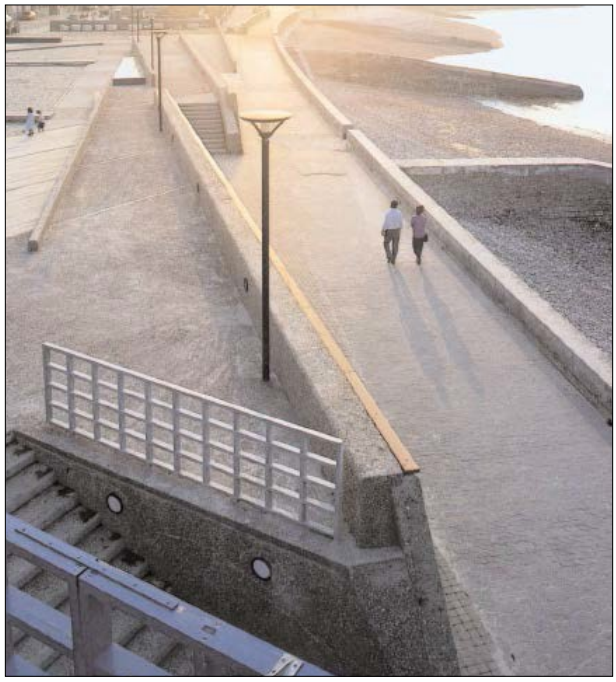
Example Terminal Entry Plazas
Exhibit 460-2

(3) Vehicle Holding, Parking, and Curbside Drop-off Areas

In areas where vehicles will be in close proximity to pedestrians - such as vehicle holding, parking, and curbside drop-off areas - use pavement materials or patterning to clearly indicate the hierarchy of pedestrian and vehicular spaces. Demarcate pedestrian only zones and designated pedestrian crossing zones. Provide well defined pedestrian walkways in parking lots and multi- modal stations from parking to building, ferry loading, transit centers, and commuter rail. Also consider the impacts of vegetation on a driver's sight distance where pedestrians and vehicles may interact. Avoid planting vegetation that may obscure a driver's vision at locations where vehicles are likely to cross a pedestrian's path. Provide clear and accessible walkways to concessions, restrooms, and pet areas. Refer to Chapter 340 for vehicular paving design criteria.

(4) Waterfront Promenades

Provide for maximum pedestrian accessibility along the waterfront without negatively impacting operations. Consider providing grade separation, where promenades cross the ferry loading and unloading zones. Design promenade pavement, where feasible, for occasional vehicle access.



Example Waterfront Promenade
Exhibit 460-3

460.05 Landscaping

(1) General

Landscaping can serve numerous functions at a terminal facility. These may include, but are not limited to: creating a visual esthetic (providing scale, color, texture, framed views, etc.); enhancing habitat; reducing impervious area; providing stormwater treatment; protecting facilities from sun and wind; screening parking and other unsightly areas; and blending the terminal with the surrounding community.

Landscaping at most WSF terminals is minimal due to the inherent maintenance requirements (irrigation, pruning, mowing, leaf cleanup, etc) and the limited availability of staff to perform said maintenance. Due to the increasing emphasis on environmental considerations, the implementation of landscaping is becoming more important. It is essential that the landscape architect coordinate closely with Terminal Facility Engineers Office or Terminal Maintenance Office on the design of all landscaping features to ensure that they are maintainable.

Design landscaped areas throughout the site for low maintenance with a plant palette consisting of native and adaptive species requiring relatively limited care and providing habitat enhancement wherever possible. Native species provide a relatively simple, wild aesthetic and a visual connection to the surrounding area. Utilize plant species size and form to provide pedestrian and urban scale. Design landscaping to promote open views for personal safety.

Consider the use of planters, especially where space is limited and/or the facilities are located on piers over the water. When designing with planters, take into account such factors as drainage, freeze protection, irrigation, and general exposure to the elements including sun, wind, and rain.



Landscaping Planters at the Seattle Ferry Terminal
Exhibit 460-4

Landscaping work is comprised of the following: protection of existing valued vegetation; preparation of site soils for planting; installation of irrigation (as required); planting and permanent erosion control.

(a) Existing Vegetation

When designing new terminals, protection of existing site vegetation can provide a valuable resource for purposes of ecology, facility function, and aesthetics. Wherever possible, restrict lay down areas to areas that will receive pavement or buildings in order to maintain the structure of the existing soils.

(b) Soil Preparation

Specify planting soil subgrade be scarified prior to the installation and integration of topsoil. Soil preparation in all planting areas is to be specified by Washington State Ferries. Specify structural soils under parking and pedestrian pavement.

(c) Irrigation System

Provide an automatic, water-conserving permanent irrigation system, as required, for survival of landscaping. Consider the use of a drip irrigation system where appropriate for the given site conditions. Whenever possible, select plant species that do not require irrigation for survival.

(d) Plantings

Provide plantings consisting of predominately native species in naturally occurring plant communities, designed to enhance the facility, and provide habitat value, seasonal interest and low maintenance. Specify plant species that are drought and disease resistant. Unless otherwise noted here or required by environmental permitting, provide plantings per WSDOT Roadside Classification Plan guidelines for Semiurban to Urban, Treatment Level 2.



Example Plantings
Exhibit 460-5

(e) Permanent Erosion Control:

Design terminal landscaping that incorporates permanent erosion control measures. Involve the WSDOT Regional Landscape Architect to determine appropriate grass seed mix design. Minimize areas that may cause increased stormwater runoff velocities. Refer to the WSDOT Design Manual and the WSDOT HRM for additional guidelines for permanent erosion control.

(2) Terminal Entrance

Utilize landscaping at the terminal entrance to provide a clear and welcoming experience and to help establish a sense of arrival by framing views of both the entry and its signage. Consider plantings that provide seasonal color and texture with plant masses – including trees, shrubs and groundcover – scaled appropriate to vehicle traffic and the design speed of the adjacent roadways. Incorporate trees and lower plantings to partially screen roadway and parking lot views from adjacent uses. Design landscaping in compliance with WSDOT clear zone and setback requirements (*Design Manual* Section 500.05) on WSDOT right-of-way. Refer to Section 500.05(4) for clear zone requirements within the WSF terminal boundaries.

(3) Terminal Pedestrian Entry Plazas

Consider providing landscaping at the edges of plazas comprised of native and adaptive evergreen and deciduous trees, low shrubs and groundcovers. Trees may be used to: frame the plazas; buffer the plazas from adjacent vehicular access routes and parking lots; provide screening; provide shade and protection from the wind; and contribute to the terminal's character. Utilize plantings within the plazas to provide color, soften the buildings, and generally help support a pedestrian scaled experience.

Specify shrubs with an ultimate maximum height of 36 inches and locate such that their ultimate maximum width does not exceed bed edges by more than 12 inches. Specify trees with an ultimate maximum height of 40 feet (unless further restricted by the local jurisdiction), a maximum width of 20 feet, and a non invasive root system.

(4) Vehicle Holding Area

Vehicle holding lanes located off highway right of way are typically subject to the local jurisdiction's landscaping requirements for parking lots and developments. WSF's preferred landscaping within the vehicle holding area consists of resilient low shrubs, ornamental grasses and vines. When possible, limit landscaping in the vehicle holding area to lower plantings around the perimeter and a pet area. Landscaping within or between vehicle holding lanes is undesirable due to its impact on the efficiency of WSF's sorting and loading operations.

(5) Parking and Curbside Drop-off

Consider landscaping parking areas to help screen views of vehicles in the parking lot, to provide shade, and to help reduce the apparent size and amount of impervious surface. Provide landscaping and screening of the perimeter using deciduous trees and planting beds. To protect view corridors, specify tree species that grow less than 30 feet high in waterfront areas, and less than 40 feet high elsewhere unless further restricted by the local jurisdiction. Specify tress have a minimum of 2.5-inch caliper at planting. Design planting beds to be a minimum of 5 feet wide.

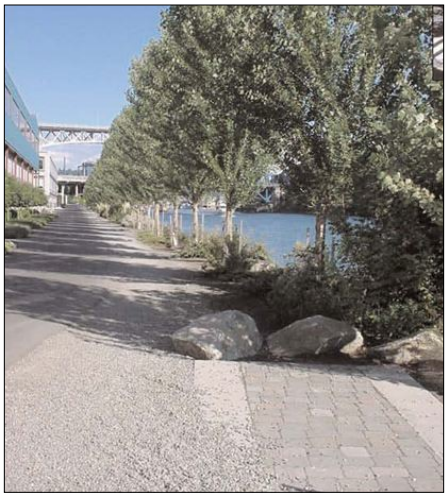
Where parking is allowed to overhang the landscaping beds, add an additional 2 feet to the width of the landscape bed. Landscaping should be drought resistant and/or be indigenous species.

Provide drip irrigation as necessary. Coordinate the locations of trees and light poles to ensure minimum required light levels. Refer to the *Roadside Manual* Chapter 630 for additional guidelines on landscaping in parking areas.

(6) Waterfront Promenades

A promenade along the project shoreline offers a unique experience for walking and seating beside the water's edge. When designing a waterfront promenade, consider locating site amenities to create periodic small informal resting and viewing places (pockets) at select points. Design amenities at the pockets to provide shade, scale and protection from winds as well as frame views out to and from the water. Select plant species for salt tolerance and general shoreline resilience. Provide overlooks at key, feasible locations. Design plantings at the pockets to maintain open view corridors to the water and for personal safety.





Pedestrian Walkways Along the Water
Exhibit 460-6

(7) Bioretention Areas

Design bioretention areas such as bioswales and biorention cells to incorporate naturalized wetland-type features, planted with native and adaptive water tolerant species. Specify plantings within the bioretention areas which meet the technical requirements for retention and treatment. For personal safety reasons and to maintain water views, provide lower growing species, primarily under 4 feet in height. Consider utilizing native trees, low shrubs and groundcovers to frame larger bioretention areas, help define these areas as distinct spaces, and provide habitat enhancement.



Biorentention Area Near Edmonds Ferry Terminal
Exhibit 460-7

460.06 Lighting

Incorporate vehicular and pedestrian scale lighting throughout the terminal designed to provide personal safety and promote an overall sense of security. Provide the highest level of lighting at entry areas, steps, and vehicular to pedestrian transition zones. For safety and aesthetic reasons, design lighting layout in response to anticipated pedestrian traffic flows as well as to adjacent architecture and amenities including tree grates, bollards, and seating. Clearly illuminate and mark pedestrian corridors outside of buildings. Lighting should be sufficient for security and identification without allowing light to trespass onto adjacent sites. Design lighting along waterfront to minimize impacts to the beach and the water. Prevent light spillage into the water, which can have adverse impacts to aquatic life. Additionally, consider the effects of lighting placement near the berths on night time navigation for captains approaching the dock. Refer to Section 560.10 and the WSDOT *Design Manual* Chapter 1040 Illumination for lighting design criteria.

460.07 Site Furnishings

Support overall site design language, particularly in pedestrian areas, with a repletion of site furnishings. Site furnishings include, but are not limited to: seating, bike racks, trash receptacles, decorative fencing, pedestrian railings, shelters, bollards, and mutt mitt dispensers (in pet area).



Site Furnishings at Edmonds Ferry Terminal
Exhibit 460-8

Consider the following when selecting and incorporating site furnishings:

- Select furnishings of the most durable quality reasonable considering budget.
- Provide seating that accommodates the elderly and disabled and discourages sleeping.
- Locate seating and trash receptacles in parking and passenger drop-off zones, vehicle holding areas, terminal pedestrian entry plazas, and key locations along pedestrian access routes.

- Use curbing and/or bollards to separate pedestrian and pet areas from adjacent vehicular zones.
- Locate bike racks in plaza areas near the passenger terminal building.
- Incorporate pedestrian guard rails along the waterfront, as necessary, to promote public safety. Design and site railings to limit obscuring water and other desirable views. Additionally, design railings to ADA Standards.

460.08 Signage and Informational Kiosks

Design signage and informational kiosks so that features such as size, shape, color, lighting, and contrast are combined to draw attention to the devices; that size, shape, color, and simplicity of message combine to produce a clear meaning; that legibility and size combine with placement to permit adequate time for response; and that uniformity, size, legibility, and reasonableness of the message combine to command respect. Refer to the *Standard Plans* M 21-01, the WSDOT *Sign Fabrication Manual* and Chapter 770 for additional information.

460.09 Public Art

RCW 43.17.200 requires that all state agencies allocate out of moneys appropriated for the original construction of any public building, an amount of one-half of one percent of the appropriation to be expended by the Washington State Arts Commission for the acquisition of works of art. The works of art may be placed on public lands, integral to or attached to a public building or structure. Refer to Chapter 470 for additional guidance and restrictions.

Chapter 470 Public Art

470.01 General
470.02 References
470.03 Public Art Requirements
470.04 Use of Funds for Art
470.05 Criteria for Public Art
470.06 Process and Project Delivery Plan
470.07 Approvals
470.08 Documentation

470.01 General

There has been a growing interest on the part of communities to use art within the transportation facilities of the Washington State Department of Transportation (WSDOT) including Washington State Ferries. Public art can be used to provide visual interest, make unique statements about community character, and create positive public response that will last over time.

Proponents for public art might be local agencies or engaged citizens' groups with interest in the outcome of a WSF project. The environmental and public involvement processes offer opportunities for community partnership on the visual and aesthetic qualities of a terminal.

While some local jurisdictions dedicate a percentage of their project budgets for art, in general WSDOT projects have no such dedicated funding. Section 40 of the State Constitution specifies that gas tax money must be used for a "highway purpose." Therefore, public art beyond WSDOT standard design is typically funded by other sources.

In July 1974, Washington State's Legislature established the Art in Public Places (AIPP) Program of the Washington State Arts Commission. The AIPP Program facilitates the acquisition of artwork with funds generated by new state-funded public building construction. The AIPP Program applies to the construction of WSF ferry terminal buildings.

The public art policy in this chapter is intended to provide guidance for budgeting, selecting, approving, acquiring, and locating public art for WSF projects.

A copy of the Memo of Understanding (MOU) between WSDOT and WAC regarding incorporating art in public projects is included in Appendix V.

470.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

23 CFR 752 *Landscape and Roadside Development*

RCW 43.17.200 *Allocation of moneys for acquisition of works of art – Expenditures by arts commission – Conditions*

RCW 43.17.210 *Purchase of art - Procedure*

RCW 43.46.090 *Commission as reflecting state's responsibility - Acquisition of works of art for public buildings and lands- Visual arts program established*

RCW 43.46.095 *State art collection Scenic Vista Act*

WAC 30-40 *Art in public places program*

(2) Supporting Information

Art in Public Places Handbook, Washington State Arts Commission

Design Manual M 22-01

470.03 Public Art Requirements

RCW 43.17.200 requires that all state agencies allocate out of moneys appropriated for the original construction of any public building, an amount of one-half of one percent (0.5 percent) of the appropriation to be expended by the Washington State Arts Commission (the Commission) for the acquisition of works of art. The one-half of one percent formula is to be applied to architecture and engineering fees, total building cost, and equipment costs. New buildings and building additions are subject to this requirement. See WAC 30-40 for additional information.

A public building, as it pertains to a ferry terminal, includes the following:

- Passenger terminal building (including foundation)
- Overhead loading structures which contain a passenger waiting area

A public building, as it pertains to a ferry terminal, does not include the following:

- OHL structures with no holding area (considered bridges)
- Terminal supervisor building/facilities
- Maintenance buildings
- Parking structures
- Pedestrian bridges
- Temporary structures

470.04 Use of Funds for Art

Percent-for-art moneys may be pooled from separate projects or augmented from external private and public funding sources to realize larger projects. Funds may be used within WSF's jurisdiction or on any public land, building or structure, including new and existing buildings, park lands, and structures which may include bridges and waterways.

The one-half of one percent funds for art may be used for expenses incurred in the design, fabrication and installation of works of art, artist's expenses and the Commission's administration expenses.

Funds for art may not be used for administrative expenses of the agency or architect or for expenses of the agency as agreed upon for the preparation and installation of the work, dedication, insurance, or for the maintenance of works of art.

470.05 Criteria for Public Art

Placement and composition of public art is unique and is to be evaluated on a case-by-case basis. Public art may be placed on public lands; integral to or attached to a public building or structure; detached within or outside a public building or structure; part of a portable exhibition or collection; or loaned or exhibited in other public facilities.

(1) Public Art Plan Criteria

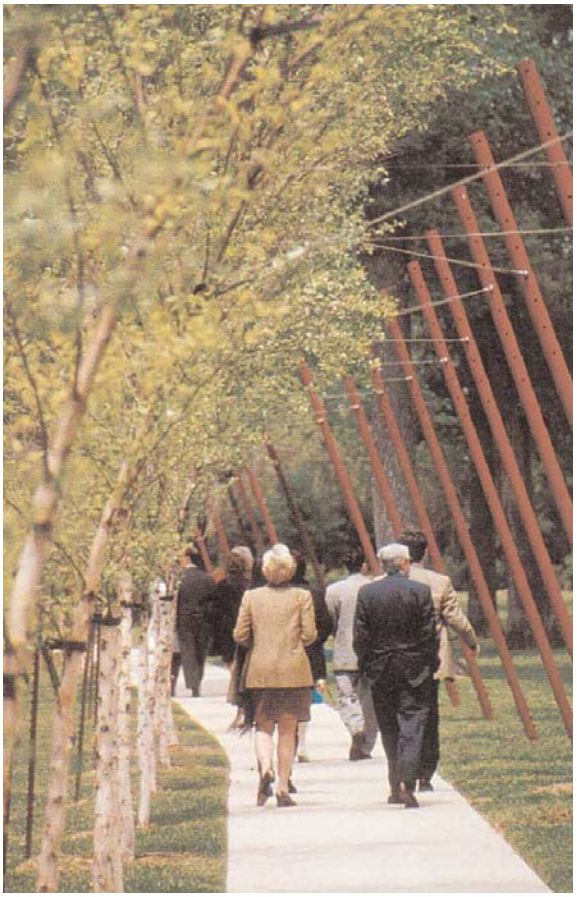
Prior to approval of public art, a public art plan is to be developed. Address and document the following criteria in the public art plan:

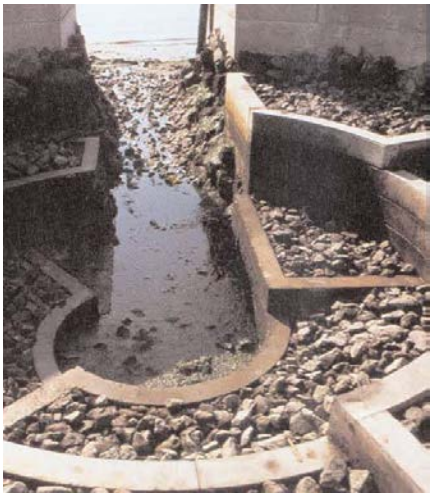
- The public art proponent, the funding source, and those responsible for the installation and maintenance of the proposed art. Provide for safe maintenance access, and establish agreements with local agencies for maintenance where appropriate. If there is a potential for vandalism, address this issue in the associated maintenance agreement.
- Whether public art resulted from the specific recommendation(s) of a planning-level study.
- Subject of the recommended art.
- Visibility: Art visible from adjacent roadways must contribute to the continuity and the view from the road. Art visible to the community or adjacent to the neighborhood side of a structure may have more flexibility in design than that visible from the main line.
- Safety and security: Public art must not negatively impact safety nor create an attractive nuisance.
- Potential for traffic distraction: Proposed art must not distract motorists. It must be appropriate for the speed and angle at which it will be viewed.
- Scale and context compatible with the surrounding landscape and land use.
- Contribution of the art to community character.
- Impact of the proposed art on social, cultural, and environmental features. In general, WSDOT would not approve the addition of art on a historic structure or within an ecologically sensitive area.
- Compliance with applicable laws, such as the Scenic Vistas Act and 23 CFR 752.
- Demonstrated responsible use of tax dollars and enhanced public trust in WSDOT judgment.

(2) Acceptable Public Art Features

The following are examples of types and locations of acceptable public art features:

- Concrete surface treatments (beyond WSDOT standard).
- Colored paving/colored pavers/scoring patterns (beyond WSDOT standard).
- Specially designed benches, trash cans, planters, or other street furnishings.
- Soft lighting and lighting fixtures.
- Small-scale sculptures or art pieces.
- Attachments to decorative railings, light poles, or fences.
- Decorative bus shelters.
- Tribal art





Tidal clock provides educational interest



Examples of Public Art
Exhibit 470-1

(3) Unacceptable Public Art Features

The following are examples of unacceptable public art features:

- Kinetic sculptures.

Wave organ turns tidal waters into sound

- Large sculptures (the size of a sculpture is relative to its context and location in the landscape).
- Art with highly reflective qualities or adverse colors.
- Art that is a distraction to drivers or out of context with the surroundings.
- Art with a topic/theme that could cause negative public reaction.
- Art that resembles a traffic control device.

470.06 Process and Project Delivery Plan

Begin the development and review of public art early in the WSDOT design process and conduct subsequent reviews during the course of its development. Do not include public art as a change order or addendum to a project without first having gone through the process described in this policy.

A public art plan is developed to incorporate public art into WSDOT projects. The public art plan is developed by WSF in coordination with the Art Selection Committee. The public art plan provides enough detail and description to convey the intent of the proposed art project. The plan documents how the proposed art meets the criteria listed in Section 470.05 and includes the following elements:

- Cover sheet with appropriate approval signatures (see Section 470.07).
- Project overview.
- Location of the proposed art.
- Scale drawings of the proposed art, including proposed materials and finishes.
- All criteria from Section 470.05, Criteria for Public Art, addressed and documented.
- Justification and recommendations for public art.

Include the public art plan in the Design Documentation Package (DDP) and consider including it in the Design Approval and Project Development Approval packages.

(1) Art Selection Committee

WSF designates its own Art Selection Committee. The Art Selection Committee consists of approximately 5 to 7 people representing the following, as deemed appropriate:

- Terminal Engineering Director
- WSF Project Manager
- Project Architect
- WSF Construction Representative
- WSF Maintenance Representative
- WSF Operations Representative
- Local Artist (required for AIPP Program funds)
- Member of Ferry Advisory Committee/Community Member

(2) Role of Art Selection Committee

The role of the art selection committee is as follows:

- Develop broad criteria and provide community context and concerns to the artist
- Recommend site options for project art
- Select an artist to create a proposal, provide comments, review and approve proposal

(3) Art Selection Timeline

The process of selecting an artist and accepting a proposal generally takes place over a 6 to 9 month time frame. The Commission is responsible for contracting and expending the one-half of one percent funds for art. WSF will comply with the terms of the interagency agreement as negotiated with the Commission. Once the selection process is completed, the artist generally has one year to fabricate and install the artwork.

470.07 Approvals

Involve the Art Selection Committee in the development of public art during the earliest possible phase of project development, ensuring that approvals happen smoothly and that WSDOT (and FHWA where applicable) are aware of the public art as soon as possible. Phases include the following:

- Initial Art Concept Review: input and approval.
- Selected Art Concept Review: input and approval.
- Final Proposed Art Review: input and approval.

(1) Approval Signatures

The public art plan cover letter includes the following appropriate approval signatures.

- Assistant State Design Engineer
- Terminal Engineering Director
- WSF Marine Project Engineer
- WSF Architect

470.08 Documentation

The public art plan, complete with approval signatures, is retained in the Design Documentation Package (DDP). Refer to Chapter 220 for additional information.

Division 5 Landside Development

Chapter 500 Access, Approaches, and Exits 500-1
500.01 General 500-1
500.02 References 500-2
500.03 Design Considerations 500-3
500.04 Vehicle Access Road 500-4
500.05 Vehicle Exits 500-8
500.06 HOV and Transit Access 500-9
500.07 Pedestrian Access and Exits 500-10
500.08 Bicycle Access and Exits 500-11
500.09 Perimeter Fences and Gates 500-12
Chapter 510 Toll Plaza 510-1
510.01 General 510-1
510.02 References 510-3
510.03 Design Considerations 510-3
510.04 Toll Plaza Elements 510-5
510.05 Determining Number of Toll Booths 510-10
510.06 Operational Strategies 510-12
510.07 Toll Plaza Signage 510-13
Chapter 520 Vehicle Holding and Support Areas 520-1
520.01 General 520-1
520.02 References 520-2
520.03 Design Considerations 520-3
520.04 Vehicle Holding 520-4
520.05 Motorcycle/Bicycle Access and Holding 520-11
520.06 Outdoor Passenger Waiting Area 520-12
520.07 Passenger Amenities 520-12
520.08 Landscaping 520-14

Chapter 530 Parking 530-1
530.01 General 530-1
530.02 References 530-2
530.03 Design Considerations 530-3
530.04 Parking Program Elements 530-4
530.05 Parking Area Design 530-4
530.06 Employee Parking 530-5
530.07 Passenger Parking 530-6
530.08 Miscellaneous Parking 530-7
Chapter 540 HOV and Transit 540-1
540.01 General 540-1
540.02 References 540-2
540.03 Design Considerations 540-2
540.04 Transit Facilities 540-3
540.05 Commuter Rail 540-7
540.06 HOVs and Taxis 540-7
Chapter 550 Site Circulation 550-1
550.01 General 550-1
550.02 References 550-2
550.03 Design Considerations 550-2
550.04 Public Access 550-4
550.05 Vertical Circulation 550-6
550.06 Vehicle Circulation 550-7
550.07 Building Circulation 550-9
Chapter 560 Site Utilities 560-1
560.01 General 560-1
560.02 References 560-1
560.03 Design Considerations 560-2
560.04 Potable Water 560-5
560.05 Fire Protection 560-7
560.06 Sanitary Sewer 560-9
560.07 Stormwater 560-10
560.08 Natural Gas 560-13
560.09 Site Power 560-13
560.10 Site Lighting 560-13
560.11 Communications 560-13

Chapter 570 Signage and Wayfinding 570-1
570.01 General 570-1
570.02 References 570-2
570.03 Design Considerations 570-3
570.04 Signage and Wayfinding Types 570-3
570.05 Signage Functions 570-7
570.06 Signage Manuals 570-18
570.07 Signage by Location 570-19
Chapter 580 Sustainability/Low Impact Development 580-1

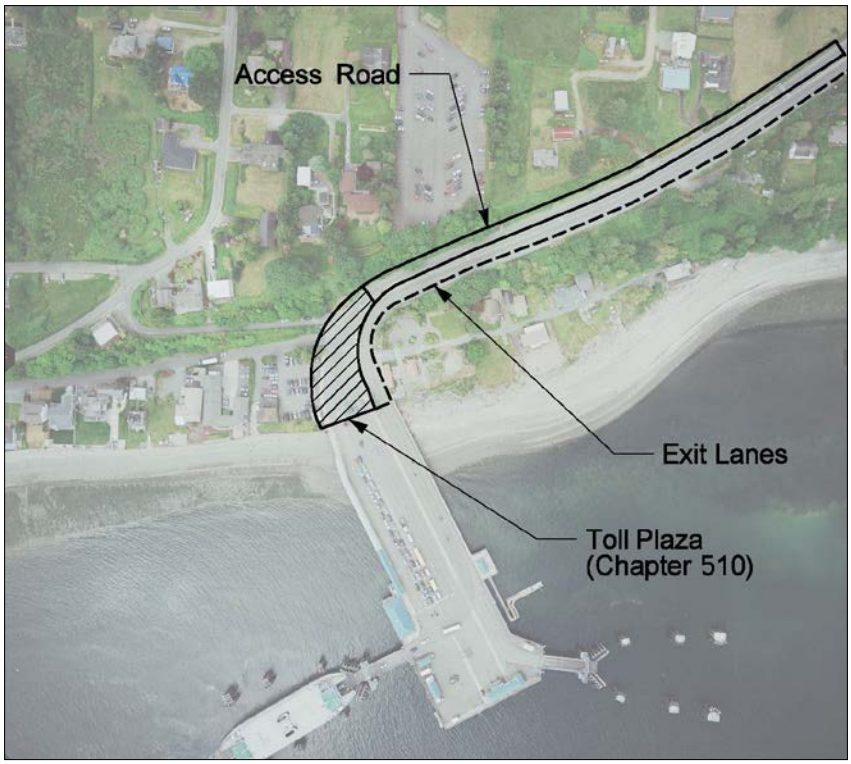
Chapter 500 Access, Approaches, and Exits

500.01 General
500.02 References
500.03 Design Considerations
500.04 Vehicle Access Road
500.05 Vehicle Exits
500.06 HOV and Transit Access
500.07 Pedestrian Bridges and Crossings
500.08 Bicycle Access and Exits
500.09 Perimeter Fences and Gates

500.01 General

This chapter identifies design elements related to access, approaches and exits for both vehicular and pedestrian traffic at WSF terminal facilities. Encourage design and placement of facilities to provide for safe access to terminals by various modes of transportation such as car, truck, bus, motorcycle, bicycle, and pedestrian travel.

Terminal vehicle access is divided into three areas: the access road, the toll plaza, and the exits. Exhibit 500-1 identifies the terminal access areas at the Clinton Ferry Terminal. This chapter addresses design considerations regarding terminal access roads and terminal exits. Refer to Chapter 510 (Toll Plaza) for design guidance regarding the toll plaza.



Clinton Ferry Terminal Access
Exhibit 500-1

The access road is typically a principal or minor arterial that all traffic must use to access the terminal. Typically, the access road begins outside WSF right of way and terminates at the entrance to the toll plaza.

The exits provide vehicles and other transportation modes a means to leave the WSF terminal. The exits typically reconnect to the access road.

Note that special conditions for access and exits exist at some WSF terminals and should be addressed on a case by case basis. At the Clinton terminal, for example, WSF maintains an interagency agreement with the county which allows use of a county road for terminal pick-up and drop-off.

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
340	Civil
350	Buildings
510	Toll Plaza
520	Vehicle Holding and Support Areas
540	HOV and Transit
570	Signage and Wayfinding

500.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

28 CFR Part 35 *Nondiscrimination on the Basis of Disability in State and Local Government Services*

RCW 46.61.165, *High-occupancy vehicle lanes*

RCW 47.24 *Jurisdiction, control*

WAC 468-510-010 *High occupancy vehicles (HOVs)*

(2) Design Guidance

Design Manual M 22-01

Standard Plans M 21-01

Traffic Manual M 51-02

(3) Supporting Information

Manual on Uniform Traffic Control Devices (MUTCD), FHWA

http://mutcd.fhwa.dot.gov/publications/publications.htm

A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO

500.03 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible.

Additionally, 49 CFR Part 39 prohibits owners and operators of passenger vessels from discriminating against passengers on the basis of disability, requires vessels and related facilities to be accessible, and requires owners and operators of vessels to take steps to accommodate passengers with disabilities.

Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessel security requirements, and additional information pertaining to terminal design. Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for TWIC and SSI.

(3) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

(4) Civil

Refer to Chapter 340 for general civil design criteria pertaining to terminal access, approaches and exits. Below are links to relevant sections by topic.

- Channelization: 340.07(1)
- Design Vehicles: 340.07(6)
- AutoTURN Analyses: 340.07(7)
- Paving: 340.08

(5) Railroad Crossings

When a roadway crosses a railroad at grade, design the road grade to prevent low-hung vehicles from damaging the rails or getting hung up on the tracks. The WSDOT *Design Manual* Chapter 1350 gives guidance on designing roadways at railroad crossings. At present, the Edmonds terminal is the only WSF terminal that has a railroad crossing at grade.



Railroad Crossing at Edmonds Terminal
Exhibit 500-2

500.04 Vehicle Access Road

The vehicle access road carries terminal traffic up to the WSF terminal property. Coordinate with WSDOT Region staff or the local jurisdiction, as applicable, for any projects that propose improvements outside WSF terminal boundaries as the Region or the local jurisdiction retains authority for changes to channelization, signing, signals, etc.

The Washington State Ferry System is an extension of the state highway system and as such many State Ferry System access roads are designated as state routes (or state route spurs). The state highway system is divided and classified according to the character and volume of traffic carried by the routes and distinguished by specific geometric design criteria.

The functional classifications (from highest to lowest) used on state highways are: principal arterial, minor arterial, and collector. The higher functional classes give more priority to through traffic and less to local access. National highway system (NHS) routes are usually designed to a higher level than non-NHS routes. Refer to Appendix Q for the state route and functional classifications of existing WSF terminal access roads. Appendix Q also identifies whether the access road is an NHS or a non-NHS roadway.

Design improvements on state routes in accordance with the WSDOT *Design Manual* where applicable as defined by RCW 47.24. When the vehicle access road is a state highway within an incorporated city or town is a portion of a city street, or the access road is a city or county road, develop the design features in cooperation with the local agency. See WSDOT *Design Manual* for guidance on geometric design data when a state highway within an incorporated city or town is a portion of a city street. State law provides WSDOT full authority on state routes that are located within limited access and in unincorporated areas. When state routes are within city limits, the authority given to WSDOT will vary according to RCW 47.24. Consult with local city or county staff regarding design requirements when inside city or county limits.

(1) Right of Way Acquisition

Access to new terminals and access improvements to existing terminals may require the acquisition of additional right of way or easements. Plans involving property for WSF are prepared by the Headquarters Right of Way Plans Section. Right of way acquisition can be an expensive and time consuming proposition and should be considered only after exploring other options such as obtaining easements. Consider impacts on project cost and project schedule when designing access improvements outside the existing WSF/WSDOT right of way boundaries.

Right of Way Plans are the official state documents used as the basis to acquire real estate and other property rights for roadways. It is the responsibility of the WSDOT Region to prepare plans for the acquisition of right of way, including easements, permits, and any substantiating documentation necessary for completion of the plans. Verification of ownership of existing right of way is also required.

A Sundry Site Plan is used to map property that cannot be shown on a Right of Way Plan such as ferry terminals, wetlands mitigation sites, park and ride lots, stockpile sites, and stormwater retention or other reclamation sites. All WSF terminal property is shown on a Sundry Site Plan.

Both Right of Way Plans and Sundry Site Plans convey legal information regarding property boundaries. Right of Way Plans are typically based on roadway alignments whereas Sundry Site Plans are not based on roadway alignments. Refer to the WSDOT *Plans Preparation Manual* for additional information regarding Right of Way and Sundry Site Plans. To obtain title reports or determine if any property acquisition, easements, leases or right of entry agreements may be needed for the project, contact the WSDOT regional and/or headquarters Real Estate group.

(2) Access Control

WSDOT controls access to the state's highways (with a few exceptions) in order to preserve the safety and efficiency of these highways as well as the public investment. All Washington State highways are distinguished as being either limited access or managed access highways. Control of access is accomplished by either acquiring rights of access from abutting property owners (limited access control) or by regulating access connections to the highway (managed access control). Until limited access rights have been acquired from abutting property owners, the route is a managed access highway. Managed access permits are issued either by a local authority (city or town) or by WSDOT. Refer to Chapter 520 of the WSDOT *Design Manual* for additional information on access control.

Access control along a ferry access route is important in order to limit the ability of ferry users to cut in line at the toll plaza and in ferry holding lanes upstream of the toll plaza. Limit multiple access points in the vicinity of the toll plaza and backup queuing area to the extent feasible. Where local roadways intersect with the designated ferry access road, provide informational and regulatory signage, striping and signals to limit intentional and accidental cutting in the ferry line (see Section 570.07(2) for examples of access control signage).

(3) Access Road Lanes

Extend or modify access from an existing state route to the terminal facility, as required. Access improvements may involve the full extension of an existing highway and/or the design of a frontage road or frontage road improvements. Frontage roads are generally not permanent state facilities. They are usually turned back to the local jurisdiction. Plan and design frontage roads as city streets or county roads in accordance with local design standards. Design roadways on WSDOT right of way in accordance with the WSDOT *Design Manual*. Refer to Section 430.08 for bicycle access requirements.

(a) Number of Lanes

The number of lanes along the access road will vary by terminal location, terminal throughput, and the existing roadway configurations. Where feasible and if ridership warrants, provide access roads with an HOV/priority vehicle bypass lane to allow HOVs and priority vehicles to bypass general holding that may back up onto the access road. Provide through lanes for local traffic where access roads are used by vehicles other than terminal traffic. Consider providing bike lanes adjacent to the roadway.

(b) Lane Widths

Lane widths for the access road are determined by WSDOT and local agency guidelines. Refer to the WSDOT *Design Manual* for basic criteria.

(c) Ferry Queuing Lanes

The vehicle access road serves to provide supplemental queuing in addition to the queuing in the approach zone of the toll plaza. Vehicles will typically queue along the shoulder of the access road during peak demand. The design of overflow ferry holding lanes along the access roadway shoulder (referred to herein as ferry queuing lanes) is not addressed in this manual since they are constructed on property outside WSF terminal boundaries.

The WSDOT *Design Manual* defines the shoulder width requirements for ferry holding along a roadway. On a state route, the preferred shoulder width is 10 feet but may be reduced to an 8-foot minimum.

The installation of ferry queuing lanes along the access road may be subject to considerations of existing driveways and public intersections that could be affected. In some locations, a traffic and safety study may be necessary to determine the feasibility of lengthening or adding new lanes on the shoulder.

(4) Design Speed

Vehicle access road design speeds will vary depending on the characteristics of the road and the surrounding environment. Refer to the WSDOT *Design Manual* for information regarding design speed. Take into account vehicle design speed and associated sight distances when designing pedestrian crossings along the access road.

(5) Posted Speed

Design the vehicle access roads so that the posted speed is less than or equal to the design speed. The posted speed of the access road may vary from the posted speed within the terminal area. Refer to of the WSDOT *Design Manual* and contact the local agency for information regarding posted speed.

(6) Clear Zone/Shy Distance Requirements

For roadways outside WSF terminal boundaries, design clear zone and shy distance requirements in compliance with WSDOT or local agency requirements as appropriate. Refer to Section 510.05(4) for requirements within the terminal boundaries.

(7) Intersections

An intersection may be necessary at the interface between the state highway and a frontage road (state highway spur) or the access road and the toll plaza area to provide for both local and ferry traffic movements. Design intersections and intersection improvements to comply with WSDOT or local agency guidelines and requirements as appropriate. Design intersections to minimize conflicts between pedestrians and vehicles entering/leaving the terminal. Refer to the WSDOT *Design Manual* Division 13 for additional design information.

(8) Signalization/Traffic Control

Design traffic control elements of the access road in accordance with standards developed in the WSDOT *Design Manual* Division 13 and the *Manual on Uniform Traffic Control Devices (MUTCD)*. Where the exit lanes of a terminal are controlled by a signalized intersection, consider providing traffic control devices, such as loop detectors, to maximize efficiency in offloading vessels. Also consider the addition of pedestrian features, such as push buttons for actuated intersections, to improve traffic flow. New installations of traffic signals outside WSF right of way require approval of a signal permit. Coordinate with the WSDOT Region's traffic staff and local city or county agencies where applicable.

(9) Signage and ITS Features

Incorporate signage and intelligent transportation systems along ferry access routes. Consider providing the following:

- Terminal wayfinding signage
- Highway advisory radio signage
- Ferry wait time signs and electronic message boards
- Ferry holding lane information
- Operational restrictions for ferry traffic
- Reservations system signage

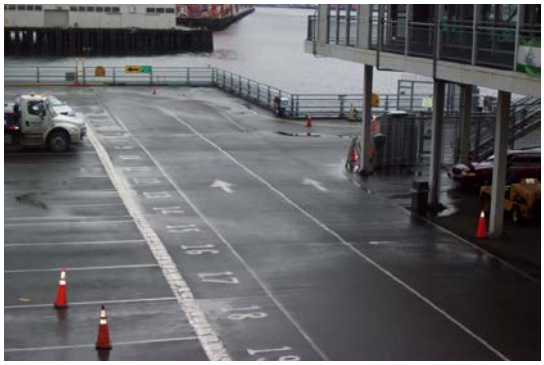
Addition of these features requires coordination with WSDOT Region's staff and/or local city agencies.

Signage informs customers that are unfamiliar with the terminal of ferry procedures and directs them to the correct locations. It also provides users with current information such as wait times, anticipated sailing times, route delays, and route closures. Appropriate use of signage provides for a more user friendly experience of the terminal. Refer to Section 570.07(2) for examples of signage along ferry terminal access routes.

500.05 Vehicle Exits

(1) Exit Lanes

Provide exit lanes that allow traffic to efficiently exit the terminal. Provide two exit lanes from the vessel slips to the vehicle exit point of the terminal. Design the lanes to a minimum width of 11 feet and a desirable width of 12 feet. For exit lanes located on a curve, refer to the WSDOT *Design Manual* Chapter 1240 for turning roadway widths. Provide dual exits, as necessary, to accommodate terminals serving multiple vessels and routes such as the Seattle Terminal. Dual exits help facilitate operations while multiple slips are occupied by vessels loading or offloading passengers.





Exit Lanes at Seattle Ferry Terminal
Exhibit 500-3

(2) Design Speed

Establish design sped at the desired operating speed. See the *Design Manual* M 22-01 for further guidance. The design speed determines the geometry of the roadway features to provide for public safety and overall functionality of the terminal.

(3) Posted Speed

The posted speed is required to be the desired operating speed. If the posted speed is less than 20 mph, a speed study justifying the need for the lower speed is required to be enforceable by police. At some terminals, employees request a posted speed below 20 mph for worker safety. The posted speed of the exit lanes may be different inside and outside the terminal boundaries, but it must always remain less than or equal to the design speed. Refer to the *Design Manual* M 22-01 and contact the local agency for information regarding posted speed.

(4) Clear Zone

The clear zone is the area between the edge of the traveled way and any obstruction. Design the exit lanes with a minimum 2-foot shy distance clear zone within the WSF terminal (i.e. on the Sundry Site Plan property). This distance can be reduced to a 1-foot minimum where warranted by site constraints. Document any site constraints that limit the clear zone distance in the clear zone inventory. Design the exit lane clear zone distances per the WSDOT *Design Manual* where they are located on WSDOT right of way.

(5) Exit Gates

Consider providing gates at the end of the vehicle exit lanes to prevent vehicles from accessing the terminal at a location other than the toll plaza. Exit gates may be employed for security purposes, revenue control and/or emergency management. Exit gate requirements such as height may vary depending on their intended function. Exit gates are currently only provided at the Anacortes and Seattle terminals. See Section 500.09 for additional gate design requirements.

(6) Sidewalk and Shoulder Requirements along Exit Lanes

Consider providing paved shoulders or sidewalks along the exit lanes at WSF terminals. Shoulders and/or sidewalks are not required; however, they can be used by pedestrians and may serve as a pedestrian access route. Although pedestrians are allowed to travel along the shoulder, the shoulder's main functions are to provide an area for disabled vehicles, a recovery area for errant vehicles, and positive drainage away from the roadway. Determine whether the roadway shoulders are of sufficient width and condition to permit travel for pedestrians and to meet ADA standards. Paved shoulders are preferable. A 4-foot wide shoulder is acceptable where pedestrian activity is minimal and where school and other pedestrian generators are not present. Wider shoulders are desirable along high-speed highways, particularly when truck volumes or pedestrian activities are high.

Longitudinal travel along shoulders with cross slopes greater than two percent can be difficult for people with disabilities. If pedestrians will use the shoulder frequently, consider a separate pedestrian access route where larger cross slopes are required. Provide an ADA accessible path where shoulders are intended as the primary access to the terminal by walk-on passengers. Refer to Chapter 300 for additional information.

500.06 HOV and Transit Access

Consider providing the following when designing for HOV and Transit access. Refer to Chapter 740 for additional information on HOV and transit design.

- Queue bypass lanes
- Transit drop-off /turn-around at the passenger terminal building
- Vanpool staging area near the passenger terminal building
- Direct connections to nearby park-and-ride lots and mass-transit facilities
- Circulator shuttle to transit connection areas
- Reservations system requirements

(1) Queue Bypass Lanes

A queue bypass lane allows HOVs to save time by avoiding standard holding lanes. Typical locations for queue bypasses are at signalized intersections, toll plazas or approaches, and locations with isolated main line congestion. In most cases, they are relatively low cost and easily implemented. Where feasible, include HOV bypasses, or make provisions for their future accommodation unless specific location conditions dictate otherwise. Refer to Chapter 520 (Vehicle Holding and Support Areas) and Chapter 540 (HOV and Transit) for additional guidelines on HOV Lanes in the holding areas.

(5) Service Schedule Coordination

Infrequent service at some terminals prevents efficient synchronizing of transit connections to ferry sailings. Coordinate local route departure times and frequencies to maximize terminal functionality.

500.07 Pedestrian Access and Exits

Pedestrian travel is a vital transportation mode. Pedestrian ridership accounts for a significant percentage of vessel passengers at WSF terminals. Designers must be aware of the various physical needs and abilities of pedestrians. The Americans with Disabilities Act of 1990 (ADA) requires that pedestrian facilities be designed and constructed such that they are readily accessible and usable by individuals with disabilities. Chapter 300 provides accessibility criteria for the design of pedestrian facilities that meet state and national standards.

Basic criterion for pedestrian access routes is contained in the WSDOT *Design Manual*. Reference the *Design Manual* for the design of pedestrian access routes at WSF terminals. The *Design Manual* includes:

- Basic Criteria for Pedestrian Accessible Routes
- Sidewalks and Shared Use Paths
- Pedestrian Bridges and Crossings

(1) Access from Parking Facilities, Transit, and Commuter Rail

Provide direct, accessible routes for walk-on passengers from offsite parking facilities, transit, commuter rail stations, and other nearby areas of public interest to the passenger terminal building/vessel boarding area. Provide pedestrian bridges and crossings, where feasible, to allow walk-on passengers access without interfering with vehicle access. Minimize at-grade crossings of the entrance and exit lanes. Take into account vehicle design speeds and associated sight distance when designing at-grade pedestrian crossings.

(2) Pedestrian Bridges

Pedestrian bridges are beneficial where at grade crossings would: interfere with ferry operations; provide significant concern for pedestrian safety; or would provide a direct route over a major physical barrier. Consider grade-separated crossings where:

- Natural pedestrian crossings would occur at a location with limited sight distance.
- There are documented collisions or close calls involving pedestrians and vehicles.
- Ferry operations result in moderate-to-high pedestrian demand to cross a major roadway, vehicle access road, or exit lanes with high volumes and/or high speed traffic.
- There is a major physical barrier such as a water body, gulley, etc. which significantly restricts or prohibits an at-grade crossing.



Pedestrian Bridge at Seattle Ferry Terminal
Exhibit 500-4

(3) Signage and Wayfinding

Incorporate wayfinding elements into pedestrian access design per guidelines in Chapter 570. Provide wayfinding to ticketing, loading area, transit, concessions, nearby services, and attractions.

500.08 Bicycle Access and Exits

Provide bicycle access and exit lanes at all new terminals and consider at existing terminals to allow bicycles to access the holding area. Provide, at a minimum, 4-foot wide bike access and exit lanes that are physically separated from motorized traffic including motorcycles. With curb, guardrail or barrier, the minimum bike lane width is 5 feet. Design bicycle access to minimize the conflicts between bicyclists and motorists. Consider bicycle access routes along highways/roadways that lead to the terminal.

500.09 Perimeter Fences and Gates

(1) Security Fencing

Fencing is not required for security purposes at WSF terminals. During MARSEC Level 3 events, terminal agents are required to secure the facilities per USCG requirements. For international terminals (Anacortes and Sidney) contact the local USCBP office to determine project specific requirements for fencing. Design guidelines are contained in *Ferry Terminal Design Standards for Passenger Processing Facilities*, United States Customs and Border Protection.

Fencing, when provided, can assist terminal personnel in meeting this requirement. In general, fencing provides a greater level of security, aids in emergency management and can provide a means for revenue control. Consider providing fencing at terminals where these factors are of concern. Design fencing, at a minimum, per the WSDOT *Design Manual* Chapter 560 for Type 3 fencing. Fencing may be required to be of custom type depending on intended function.

(2) Revenue Control Fencing

Where feasible, provide fencing for revenue control at terminals collecting tolls for walk-on passengers. Design fencing for revenue control purposes to prevent non-ticketed customers from entering secure areas without passing through a designated access point. Fences shall be plastic coated.

(3) Vehicle Gates

Design vehicle gates to not impede emergency vehicle access to the site. Design gates in accordance with local emergency service requirements and standards of the local agency. Consider accessibility requirements of service vehicles such as garbage and maintenance trucks.

(a) Bail-Out Gates

Consider providing gates at the bail-out lanes as described in Chapter 510. The gates provide a means to prevent vehicles from entering the facility at a location other than the toll plaza.

(b) Exit Lane Gates

Consider providing gates at the end of the exit lanes. The gates can serve to prevent vehicles from entering the holding area without passing through the toll plaza and also for security purposes as noted in the above section. Exhibit 500-5 shows the exit gates at the Seattle Ferry Terminal.



Exit Gates at Seattle Ferry Terminal
Exhibit 500-5

(4) Pedestrian Gates

When fencing is provided around the terminal for revenue control, consider providing pedestrian access gates as shown in Exhibit 500-6. The access gates allow ticketed passengers to enter the terminal area without passing through the terminal building or the toll booths. Provide EFS kiosks at the entrance to the gates to allow passengers to purchase tickets. Refer to Chapter 300 (Accessibility) and Chapter 400 (Passenger Buildings) for additional considerations.



Pedestrian Gates at Seattle Ferry Terminal
Exhibit 500-6

Chapter 510 Toll Plaza

510.01 General
510.02 References
510.03 Design Considerations
510.04 Toll Plaza Elements
510.05 Determining Number of Toll Booths
510.06 Operational Strategies
510.07 Toll Plaza Signage

510.01 General

Toll plazas are utilized at many WSF terminals to collect fares for vehicles and their passengers before entering the vehicle holding area. Toll plazas need also to accommodate foot passenger ticket sales at terminals where there is not an operating ticket sales counter within the terminal building year-round. There currently are no toll booths at Friday Harbor, Lopez, Shaw, Tahlequah and Vashon Ferry Terminals, therefore guidance for toll plazas does not apply to these terminals.

The toll plaza consists of an approach zone, queue area, toll lanes, the toll island, a departure zone, a bail-out lane and, in some cases, a terminal supervisor office (see Chapter 500 for requirements). The toll plaza accommodates pre-ticketing space and required turning movements for vehicles to access the toll booths. Exhibit 510-1 shows the toll plaza for the Seattle Ferry Terminal.

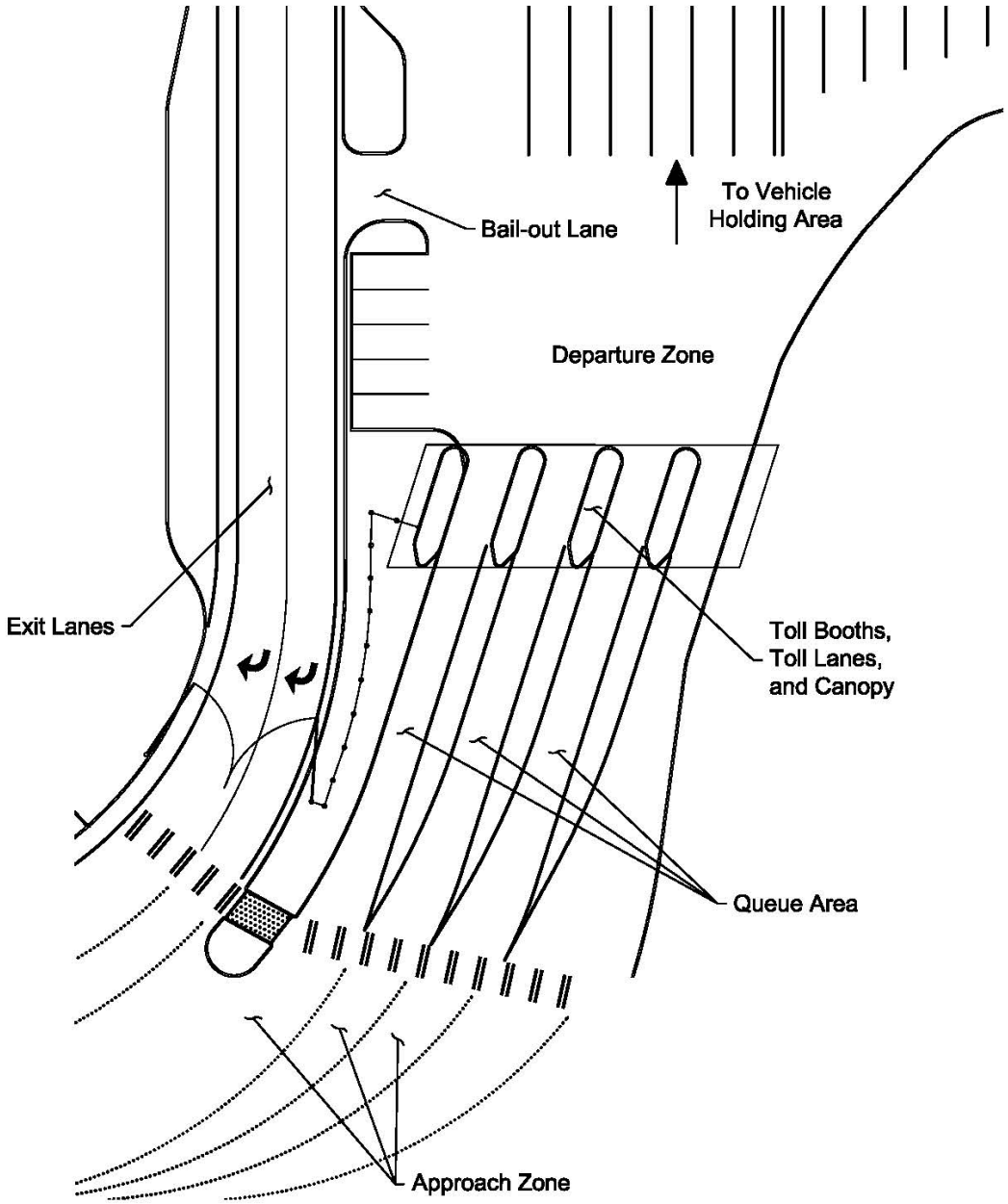
WSF provides priority access for certain vehicles that qualify for preferential loading. Refer to Chapter 520 (Vehicle Holding and Support Areas) for discussion of priority vehicles.



Seattle Ferry Terminal Toll Plaza
Exhibit 510-1

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
340	Civil
350	Buildings
360	Electrical
430	Terminal Supervisor Buildings
520	Vehicle Holding and Support Areas
570	Signage and Wayfinding



Example Toll Plaza Layout
Exhibit 510-2

510.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

ADA (28 CFR Part 35), Department of Justice

RCW 47.60.550 *Parking or holding area for ferry patrons in conjunction with municipal off-street parking facilities*

RCW 90.58 *Shoreline Management Act of 1971*

WAC 468-300-700 *Preferential Loading*

WAC 468-300-100 *Leases of Facilities and Facility Space*

(2) Design Guidance

Standard Plans for Road, Bridge, and Municipal Construction M 21-01

Traffic Manual M 51-02

Design Manual M 22-01

Reference Drawings, WSF

(3) Supporting Information

State of the Practice and Recommendations of Traffic Control Strategies at Toll Plazas, FHWA 2006.

WSDOT *Ferries Division Final Long-Range Plan* (*Long Range Plan*), WSDOT, 2009.

WSF *Traffic Statistics*, WSDOT.

510.03 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible. Design pedestrian facilities in the toll plaza to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessels security requirements, and additional information pertaining to terminal design. Below are links to relevant sections by topic.

Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for TWIC and SSI.

- MARSEC Levels: 310.04
- Signage: 310.13

(3) Environmental

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

(4) Civil

Refer to Chapter 340 for general civil design criteria pertaining to toll plazas. Below are links to relevant sections by topic.

- Channelization: 340.07(1)
- Design Vehicle: 340.07(6)
- AutoTURN Analyses: 340.07(7)
- Paving: 340.08
- Traffic Control: 340.09

(5) Operations and Maintenance

Consult with WSF Operations and Terminal Engineering Maintenance throughout the design process and provide opportunities for their review of the project drawings and specifications. Consider the following operations and maintenance issues when designing the toll plaza:

- Minimize repair and maintenance required during the design life.
- Standardize toll booth design between terminals to the extent feasible (refer to current toll booth WSF reference design drawings).

(6) Toll Booth Ergonomics

There are numerous toll booth design considerations related to ergonomics issues and reducing the potential for related workers' compensation claims. These include, but are not limited to, counter heights, height of seller's window relative to traffic lane, and distance of seller from driver's window. Refer to WSF reference design drawings (see the Terminal Engineering CAD Supervisor) for current WSF toll booth design drawings which address known ergonomic issues associated with toll booths.

(7) Worker Safety

Consider the safety of toll booth attendants in the toll booth design and layout. Proper design of impact attenuators, toll booth approach zones, posted and design speeds, lane widths, toll booth ergonomics, toll booth access by employees, and visibility of oncoming traffic are all important to worker safety. These items are discussed throughout this chapter and incorporated in the toll booth layouts located on the WSF reference design drawings.

(8) Fare Collection Auditing

Consider the capability for fare collection auditing in the toll booth design including visibility of cash sales. WSF currently utilizes fare auditing cameras above each seller to monitor ticket sales. The cameras are activated by traffic loops as discussed in Section 510.04(2).

510.04 Toll Plaza Elements

(1) Approach Zone and Queue Area

For WSF purposes, the toll plaza is divided into distinct zones/areas. The first zone, the approach zone, typically begins where the vehicle access road divides into one-directional flow. The queue area is located after the approach zone and separates vehicles into separate selling lanes. The approach zone and the queue area are both located in advance of the third area, the toll booths.

The fourth zone is the departure zone downstream of the toll booths.

Provide a minimum approach zone lane width of 11 ft with a preferred width of 12 ft. For approach zone lanes located on a curve, as shown in Exhibit 510-2, refer to the *Design Manual* Section 1240.04 of for turning roadways widths.

Base the queue zone length on the estimated peak hour queue for the design year traffic volume. Where feasible, provide 80 feet of straight roadway in the queue area. Consider providing an additional 2 feet of roadway width between lanes in the queue area for future implementation of automated vehicle measuring systems. Most ferry operators using automated technology are placing detection and cameras between the toll lanes rather than overhead. See Section 510.06(1) for additional information.

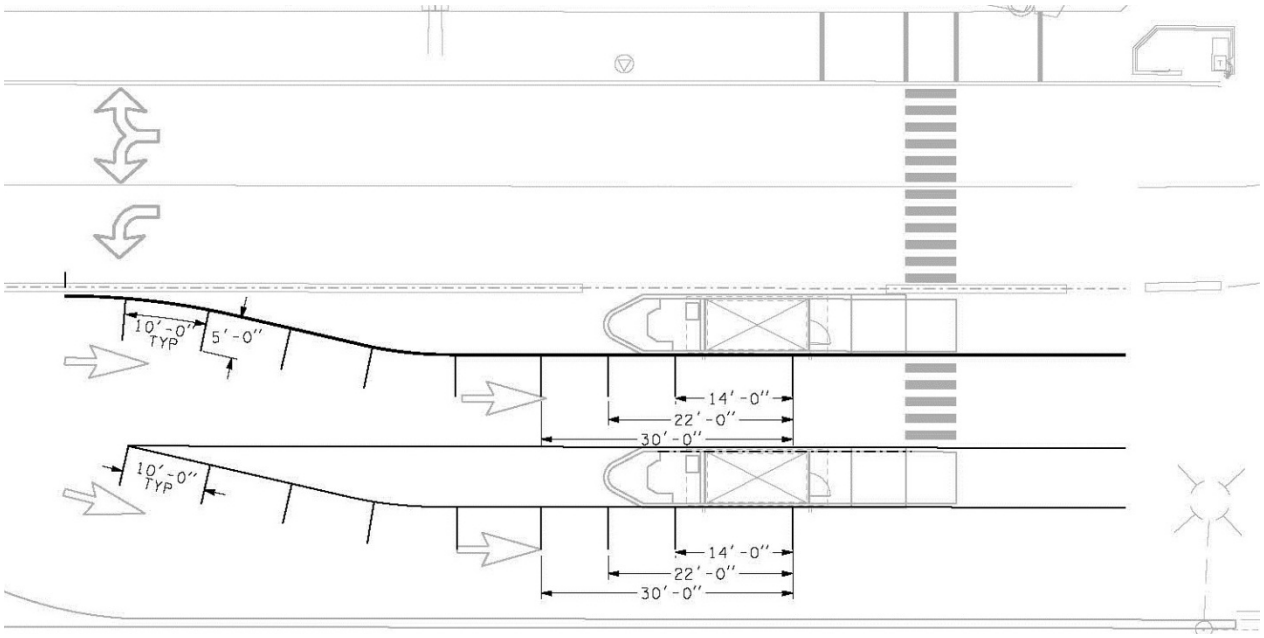
Provide a transition area between the queue area and the toll booths where the roadway tapers to the width of the toll lanes at a calculated taper rate. Base the taper rate on an approach design speed of 20 mph and the available right-of-way. The FHWA recommends a minimum taper of 10:1 for speeds less than 30 mph in *State of the Practice and Recommendations of Traffic Control Strategies at Toll Plazas*. This taper rate is typically applied to highway or expressway toll plazas and may be increased for WSF applications in order to encourage drivers to drive at lower speeds when approaching the toll booths. Refer to Chapter 340 for roadway design and channelization, paving, and traffic control requirements.

(2) Toll Lanes

Design the lanes between the toll booths, the toll lanes, to a minimum width of 11 feet with a preferred width of 12 feet. Where toll lanes exceed 11 feet in width, provide raised pavement markers on both sides in order to emulate 11-feet lane widths. The markers are to discourage drivers from stopping their vehicles too far from the toll window while still allowing larger vehicles to use the lane. Toll lane widths of less than 11 feet will require a design deviation.

Vehicle measurements, including vehicle length and height, are collected at the toll booths to determine fares and vehicle placement in the holding lanes and on the vessel. Provide plastic tariff markers, *Standard Specifications* Section 9-34.3(1) extending back from the sellers window to measure vehicle length. Plastic markers are preferred over paint because they require less maintenance. The markers are also to be placed on the pavement during construction of the toll lanes. Provide markers to determine vehicle lengths within the following ranges (see Exhibit 510-3):

- 0 to under 14 feet
- 14 to under 22 feet
- 22 to under 30 feet
- From 30 feet to 80 feet (provide markers at 10 foot intervals)



WSF Toll Booth Tariff Line Striping
Exhibit 510-3

Locate a flexible flag in each toll lane to measure oversized vehicles. Mount the flag at a height of 7 feet 6 inches. Do not provide truck scales in the toll lanes. Actual vehicle weight is not measured. The stenciled weight on the truck is checked to determine whether the truck requires an overweight permit. Permits are required for all trucks weighing more than 80,000 pounds.

Provide a 31.5-foot long concrete vehicle pad for the toll lanes. Concrete provides a solid foundation for the toll booths and toll booth equipment. Concrete pavement resists rutting. Design the toll booth foundation to be above the concrete roadway surface to divert drainage away from the toll booths. Consider raising the grade to address toll taker ergonomic issues with respect to the toll window height requirements.

Provide fare auditing cameras above each seller and place two loop detectors per toll booth. The first loop detector turns on the camera and the second loop detector turns off the camera. Refer to Exhibit 510-4 for loop detector locations within the concrete vehicle pad area.

(3) Design/Posted Speed

Use a design speed of 20 mph for the toll plaza. The posted speed is to be less than or equal to the design speed.

(4) Clear Zone/Shy Distance

The clear zone is the area between the edge of the traveled way and any obstruction. Design the clear zone in the toll plaza area to be a minimum of 2 feet shy distance. This distance can be reduced to a 1-foot minimum where warranted by site constraints. Document any site constraints that limit the clear zone distance in the clear zone inventory.

(5) Toll Booths

Arrange the toll booths in line with the lanes of the queue area in the approach zone. Locate toll booths such that motorists are able to see the booths, while driving at posted speed limits with adequate stopping sight distance before the queue zone.

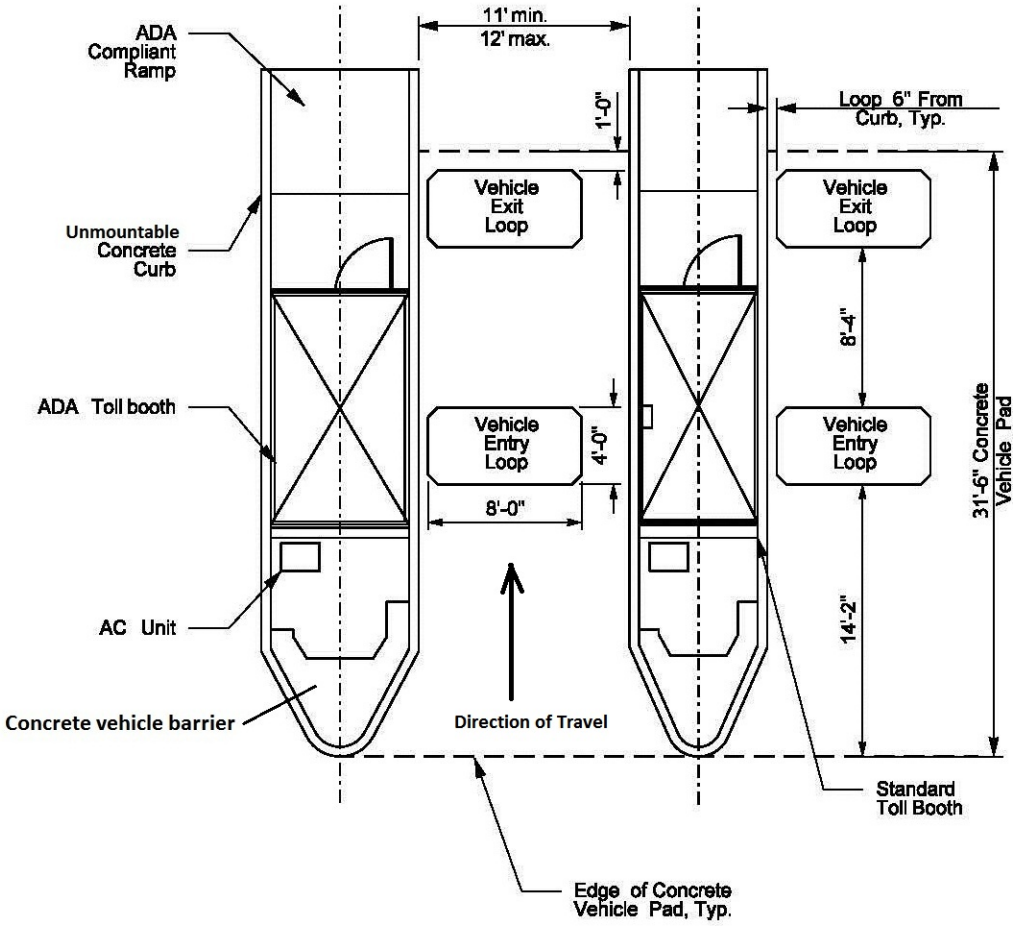
(a) Employee Work Space

Toll booths are employee work spaces. If toll booths are 200 feet or more from the terminal building, consider providing an employee restroom and restroom cleaning supply storage area.

(b) Standard and ADA Toll Booth Design

To the extent feasible, base all new toll booth design on WSF's current toll booth design, available on the WSF *Reference Drawings*. Exhibit 510-4 gives a schematic representation of the preferred layout for both standard and ADA toll booths. Minor toll booth design modifications may be required from project to project. For toll booth structural, mechanical and electrical requirements, refer to Chapters 350 and 360.

Unlike *Standard Plans* M 21-01, the drawings provided on the WSF *Reference Drawings* are intended for reference only and are not pre-approved, stamped engineering drawings. The final toll booth design drawings must be stamped by licensed engineers/architects, as required by state law.



WSF Toll Booth Layout
Exhibit 510-4

(c) Toll Booth Equipment

Outfit each toll booth with the following equipment:

- Electronic fare system and point of sale device
- Seller drop safe
- Phone/intercom /PA system
- Emergency and terminal radio communications
- Lane/sign control panel
- Electrical access panel
- Heat pump AC unit

(d) Toll Booth Layout

Layout each toll booth to allow for the following:

- Equipment counter and cabinetry
- Triple slider sellers window and window blinds
- Non-mountable vertical concrete curb encompassing the exterior traffic sides of the toll booth
- Concrete vehicle barrier located at front of toll booth structure

(6) Canopy



Seattle Ferry Terminal Concrete Barrier
Exhibit 510-5

Provide a canopy over the toll booths. Canopies shield patrons and toll attendants from the elements, serve as a mounting frame for signs, lighting, and lane signals, define the location of the toll lane for motorists and provide a chase for toll lane computer, communications, and power cables. Comply with minimum vertical clearance requirements under the signage of 16 feet with a preferred clearance of 16.5 feet.

When designing the size and shape of the canopy consider the angle of wind-driven precipitation, the sun's path, general aesthetics, and the terminal architectural requirements. The canopy also may be sloped following the cross slope of the toll plaza for aesthetic reasons and to facilitate drainage.

In lieu of a canopy, consider placing terminal supervisor's office over the tollbooths.

(7) Departure Zone

Provide an area between the toll booth and the vehicle holding area known as the departure zone. Note that it is common for a terminal to provide a greater number of vehicle holding lanes than toll booths. Therefore, unlike in highways where the departure zone allows traffic to merge back into the highway lanes, the ferries departure zone allows traffic to diverge into the vehicle holding lanes. Similar to the approach zone, calculate a taper for the departure zone per Section 510.04(1) for a design speed of 20 mph and the available right-of-way.

(8) Bail-out Lane

Provide a vehicle bail-out lane after the toll booths and prior to the vehicle holding area for customers who choose to exit the terminal without boarding a ferry.

Consider providing a bail-out gate for revenue control and/or to prevent unauthorized access into the ferry terminal. If the gate is to be operable by the toll booth operator, it must be located in a position visible to the operator, or other provisions made.



Seattle Ferry Terminal Toll Booths, Canopy, and Departure Zone
Exhibit 510-6

510.05 Determining Number of Toll Booths

As previously noted not all terminals have toll booths. Refer to Appendix P for the number of toll booths at existing terminals.

Where vehicle tolls are collected, calculate the minimum number of toll booths required based on both the rate at which vehicles are processed through the toll booth and the rate at which they must load onto a vessel to maintain the ferry schedule.

(1) Toll Booth Processing Rates

Historically, WSF has used an average vehicle processing rate of 2.5 vehicles per minute per toll booth. This calculates to a rate of 150 vehicles per hour per toll booth (vphpt). This rate was based on WSF operational experience, the accepted payment methods at the time, and required fare determination activities (counting passengers, determining age of passengers, measuring vehicle length and height of large vehicles, checking HOV passes).

Current toll booth processing data indicates that it is possible to process up to 180 vphpt; however, actual rates vary between terminals and throughout the day. The actual processing rate is dependent on a number of variables which include: rate for processing through the reservation system (both the existing manual check-in system and a future upgraded check-in system); use of credit cards and Smart Cards; down time between shifts; and holding lane capacity.

(2) Planning Level Toll Booth Calculation

Use the following calculation as a general planning level tool for calculating the number of toll booths required at a given terminal to meet the peak service schedule anticipated for the design year. Make adjustments to the calculated value based on the terminal-specific considerations discussed in Section 510.05(3) below and input from WSF Operations staff.

1. Rate of vehicle transaction (R)

$$R = 150 \frac{\left(\frac{vehicles}{hour}\right)}{tollboth}$$

2. Determine the published ferry capacity, vehicles per full ferry (V)[1].

$$V = \frac{vehicles}{ferry}$$

Note: If there is more than one vessel scheduled to moor at the slip, use the largest vehicle capacity as V.

3. Determine the boat service schedule at the terminal (B).

$$B = \frac{ferries}{hour}$$

Note: This value should be based on the peak service schedule anticipated for the design year and should be consistent with the *Long Range Plan*.

4. Calculate the number of vehicles per hour leaving the holding area (N).

$$\left(V \frac{vehicles}{ferry}\right) \times \left(B \frac{ferries}{hour}\right) = \left(N \frac{vehicles}{hour}\right)$$

Note: For terminals serving multiple destinations, calculate a separate value of N for each slip, based on a common design hour, and add the N values together for use in Step 5. The design hour is the 60-minute consecutive period that has the greatest total vehicle capacity on all sailings scheduled to depart within that hour.

5. Calculate the number of toll booths (T).

$$\left(N \frac{vehicles}{hour}\right) \div \left(R \frac{\frac{vehicles}{hour}}{tollbooth}\right) = T\ tollbooths$$

Note: Round up the calculated number of toll booths to the nearest whole number to determine the required number of toll booths (e.g., a calculated number of toll booths equal to 2.4 would result in 3 toll booths required). It may be possible to round this number down based on the terminal- specific considerations/adjustments noted below.

[1] For terminals serving the San Juan Island (Anacortes, Lopez, Shaw, Orcas and Friday Harbor), where one vessel serves multiple destinations, each terminal has an allotment of vehicle spaces on the vessel. For such terminals, use a value for V equal to the maximum vehicle allotment rather than the full ferry capacity. The allotment of vehicles for these terminals can be obtained from the Service Manager in the WSF Planning Department.

(3) Terminal-Specific Toll Booth Calculation Adjustments

Adjust the number of toll booths calculated in Section 510.05(2) above, as required, based on the following considerations and any other applicable site-specific conditions.

- Modify the rate of vehicle transaction (R) based on the actual measured processing rate at the terminal, adjusted for anticipated payment methods, fare determination activities, and existing technology in the design year.
- Consider the arrival rate of customers. The calculation above assumes relatively steady processing of the vehicles over the design hour. At terminals with a high percentage of commuters, there is a tendency for the majority of the customers to arrive about 10 minutes prior to sailing, resulting in the need for a higher processing rate in the last 10 minutes (assuming the ferry is to sail full). Adjust the value of (R) to reflect the average processing rate over the entire design hour. Consider performing a Business Case Analysis to determine the cost benefit of employing additional toll booth staff to process customers unwilling to arrive sufficiently early versus allowing the ferry to sail without being completely full when there are customers waiting in line.
- Adjust the published vehicle ferry capacity (V) based on a current vehicle count study. Published vehicle capacity data for the vessels may vary from actual numbers depending on the vehicle distribution (e.g. number of cars versus trucks, average lengths of cars, etc.).

510.06 Operational Strategies

This section describes operating strategies that WSF is currently researching to improve toll plaza efficiency. Coordinate with the WSF Operations Liaison to determine whether or not these strategies will be implemented at a terminal.

(1) Vehicle Metric Scanning

The installation of Vehicle Metric Scanning equipment at the approaches to the vehicle toll booths is being studied as a future fare collection technology. Vehicle Metric Scanning equipment will measure the height, width and length of each vehicle. This information will be used to classify the vehicle within a category for fare determination and will be used as input to the Load Management System.

(2) Load Management System

One of the reasons for a Load Management System is to determine what space is available for a specific sailing at the time the vehicle fare is collected. With a vision for fully automated self- service capability, this information will be needed in order to inform the customer/driver which lane to stage in once they leave the toll booth. In a fully automated system, the system will communicate this information on an interactive screen as well as printing the sailing and staging lane number on the sale receipt.

(3) Good to Go Transponders

WSF is looking into the use of license plate recognition cameras and software at the toll booths. This approach is similar to the WSDOT approach to tolling on SR 520.

(4) High-occupancy Toll (HOT) Lanes

HOT lanes are a hybrid system that combines voluntary congestion pricing and reservations. This strategy would require a creation of high-occupancy vehicle (HOV) lanes—such as those on freeways—at ferry terminals that would give priority to vehicles willing to pay a toll for assured passage on the next ferry. The lanes could also give priority to high-occupancy vehicles, such as their freeway counterparts do, or other sub-groups of vehicles deemed appropriate.

(5) Electronic Fare Collection (EFS)

Operational strategies pertaining to ticketing, such as eTicketing and fare structure simplification, are designed to reduce customer processing time and improve efficiencies at the terminal docks prior to departure. WSF has recently completed the roll out of a new electronic fare collection system (EFS), which would allow passengers to purchase future tickets, but not specific trips, online and via kiosks and some toll booths.

(6) Vehicle Reservation System

As described in the *Long Range Plan*, WSF is planning the implementation of a vehicle reservation system, which would allow customers to reserve space on a specific vessel sailing in advance. The customers would reserve a travel slot at the time of their choice through an Internet- hosted computer system, over the phone, or at walk-up kiosks. As stated in the *Long Range Plan*, "A well-designed reservation system would allow WSF to operate with the smallest possible terminal facilities while maintaining a high level of service."

A predesign study summarizing the potential results of the vehicle reservation system has been completed by WSF. This study is available for download from the WSF website *Final Vehicle Reservation System Predesign Study*.

510.07 Toll Plaza Signage

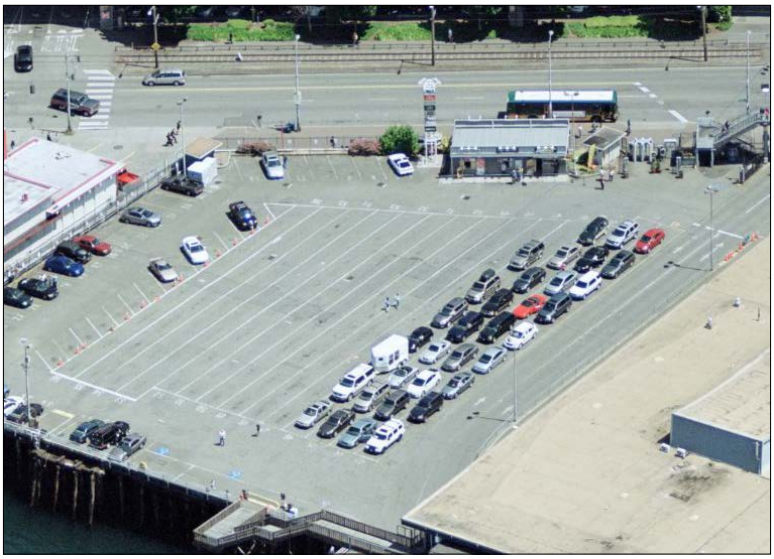
Provide electronic reader boards on the front of the toll booths with variable message indicating toll booth status. Toll booths may be identified as open, closed or for priority vehicle use only. Provide sign bridges/variable message signs with public information, lane assignments and sailing status information prior to the toll booths and/or within the holding area as needed. Refer to Chapter 770 for additional signage requirements.

Chapter 520 Vehicle Holding and Support Areas

520.01 General
520.02 References
520.03 Design Considerations
520.04 Vehicle Holding
520.05 Motorcycle/Bicycle Access and Holding
520.06 Outdoor Passenger Waiting
520.07 Passenger Amenities
520.08 Landscaping

520.01 General

This chapter provides design guidelines for the vehicle holding area, motorcycle and bicycle access lanes/holding, outdoor passenger waiting, and pet/service animal area. Additional guidance can be found in the *Design Manual* M 22-01 and *Standard Plans* M 21-01. Refer to Exhibit 600-2 for a sample layout of a vehicle holding area.



Seattle Ferry Terminal Vehicle Holding Area
Exhibit 520-1

The vehicle holding area, as defined for this manual, includes vehicle holding that is located on property owned by WSF and shown on the Sundry Site Plan. Two other potential conditions exist: (1) holding lanes are located on WSDOT right of way; or (2) holding lanes are located on property owned by another agency.

WSDOT has decision authority on state right of way in unincorporated areas and within cities below a specified population as set forth in the *Design Manual* M 22-01. WSDOT also maintains decision authority in limited access areas. Obtain approval through the local WSDOT district/region for modifications to state right of way in unincorporated areas. Shoulder holding lanes (or queuing lanes) on WSDOT right of way are addressed in the *Design Manual* M 22-01. Coordinate with both WSDOT and the local jurisdiction for improvements and any associated permit requirements within incorporated areas. If holding lanes are located on or over state-owned aquatic lands, a DNR authorization to use state-owned aquatic lands is required.

WSF/WSDOT is responsible for contacting the DNR early in the design process to determine any requirements for attaining or altering existing leases. Coordinate with the WSDOT Right of Way Branch on issues regarding DNR leased property.

Several topics pertaining to vehicle holding areas are addressed in other chapters of this *Terminal Design Manual*. These include, but are not limited to: pavement (see Chapter 340), park and ride lots (see Chapter 530), emergency and service vehicle access (see Chapter 550), and stormwater treatment for holding area runoff (see Chapter 560).

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
340	Civil
400	Passenger Building
410	Passenger Waiting Area Sizing
460	Landscape Architecture
500	Access, Approaches, and Exits
510	Toll Plaza
550	Site Circulation
560	Site Utilities
570	Signage and Wayfinding
600	Trestle

520.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

RCW 46.61.165 *High occupancy vehicle lanes*

RCW 47.60.550 *Parking or holding area for ferry patrons in conjunction with municipal off-street parking facilities*

WAC 468-300-700 *Preferential Loading*

WAC 468-300-100 *Leases of Facilities and Facility Space*

(2) Design Guidance

Design Manual M 22-01

Standard Plans M 21-01

Standard Specifications M 41-10

Traffic Manual M 51-02

WSF *Terminal Design Standards, Specifications, and Procedures - Electrical Engineering (Electrical Engineering Manual)*, WSF

(3) Supporting Information

WSDOT *Ferries Division Final Long-Range Plan* (Long Range Plan), WSDOT, 2009.

WSF *Traffic Statistics*, WSDOT.

520.03 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible.

Additionally, 49 CFR Part 39 prohibits owners and operators of passenger vessels from discriminating against passengers on the basis of disability, requires vessels and related facilities to be accessible, and requires owners and operators of vessels to take steps to accommodate passengers with disabilities.

Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessel security requirements, and additional information pertaining to terminal design. Below are links to relevant sections by topic.

Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for TWIC and SSI.

- MARSEC Levels: 310.04
- Vessel Security: 310.05
- Trestle Security Requirements: 330.09(1)
- Signage: 310.13

(3) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

(4) Civil

Refer to Chapter 340 for general civil design criteria pertaining to the vehicle holding area. Below are links to relevant sections by topic.

- Channelization: 340.07(1)
- Design Vehicle: 340.07(5)
- AutoTURN Analyses: 340.07(6)
- Paving: 340.08

(5) Illumination

Refer to Section 560.10 and the WSF *Electrical Engineering Manual* for information on site illumination.

(6) Operations and Maintenance

Consult with WSF Operations and Terminal Engineering Maintenance throughout the design process and provide opportunities for their review of the project drawings and specifications.

Consider the following operations and maintenance issues when designing the vehicle holding area:

- Minimize repair and maintenance required during the design life.
- Provide corrosion protection of steel piles as required to achieve the design life specified in the Life Cycle Cost Model.

(7) Emergency and Service Vehicle Access

Refer to Chapter 550 for requirements.

(8) Signage and Wayfinding

Provide sign bridges/variable message signs with public information, lane assignments and sailing status information prior to the toll booths and/or within the holding area as needed. Refer to Chapter 570 for signage requirements.

520.04 Vehicle Holding

The requirements for vehicle holding vary by terminal. The optimum size and configuration of vehicle holding areas are impacted by numerous factors including ridership, vessel capacity, vessel headway, and site and environmental constraints. Vehicle holding areas can be located either upland, over water, or a combination of the two.

(1) Vehicle Holding at Existing Terminals

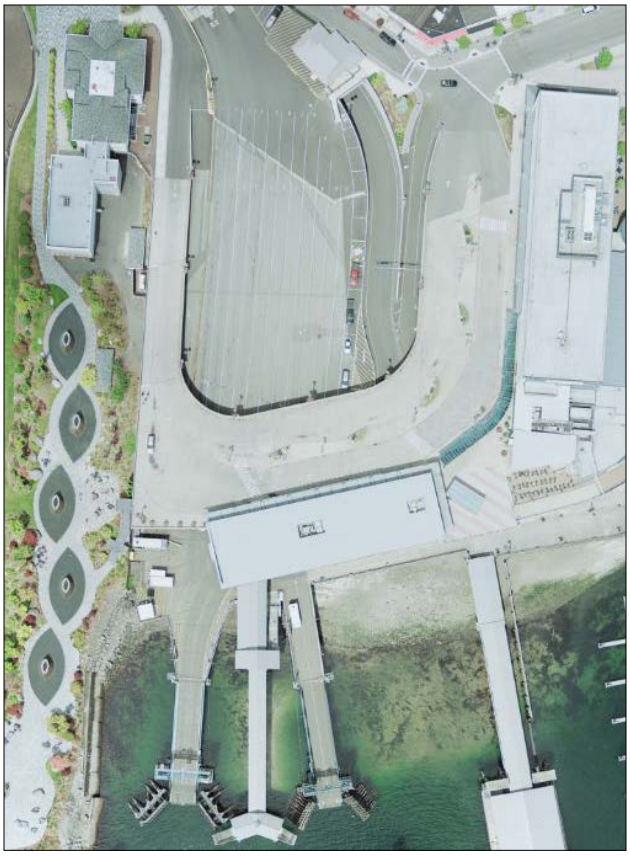
A summary of existing vehicle holding area data, by terminal, for WSF facilities is contained in Exhibit 520-2. This vehicle holding area data is based on WSF's 2006 *Route Reference Book*. Post-2006 terminal modifications are not reflected in this data. The identified holding lane capacity is based on the holding lane areas depicted in the site layout drawings included in Appendix R and assumes an average vehicle length of 20 feet. Note that some terminals have additional holding capacity in off-site lots and queuing lanes upstream of the toll plaza area, which are not included in these totals.

Off-site vehicle holding, in the form of a remote parking lot or a designated ferry holding lane along the shoulder of the access route, may be necessary at some terminals to reduce vehicle backup outside the terminal limits. The design of off-site vehicle holding lanes on state routes is not addressed in this manual. Ferry queuing lanes fall under WSDOT Highway Division's responsibility, and is therefore outside WSF's jurisdiction. WSF is currently in the process of implementing a vehicle reservation system and other operational strategies designed to significantly reduce vehicle backups outside their holding areas.

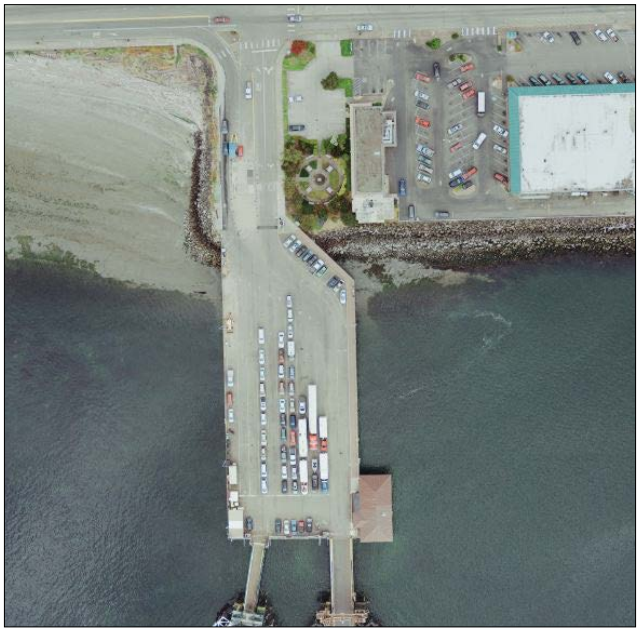
Aerial photos of an upland holding facility and an over-water holding facility are included as Exhibits 520-3 and 520-4.

Terminal	Holding Lane Width	Number of Holding Lanes	Holding Lane Capacity (vehicles)	Upland Holding	Over-water Holding
Anacortes	10'	15	450	Yes	No
Bainbridge Island	10'	14	212	Yes	Yes
Bremerton	10.5'	13	230	Yes	No
Clinton	9'	10	190	Yes	Yes
Coupeville	10'	10	120	Yes	No
Edmonds	10'	8	174	Yes	Yes
Fauntleroy	9'	4	84	Yes	Yes
Friday Harbor	9'	12*	136	Yes	No
Kingston	10'	24	288	Yes	No
Lopez	10'	4	88	Yes	No
Mukilteo	9'	12	103	Yes	No
Orcas	9'	8	175	Yes	No
Point Defiance	10'	2	50	Yes	No
Port Townsend	11'	10	100	No	Yes
Seattle	10'	40	650	Yes	Yes
Shaw	12'	2	22	Yes	No
Southworth	10'	9	160	Yes	Yes
Tahlequah	10'	1	4	Yes	Yes
Vashon	8'-11'	4	80	Yes	Yes

Existing Vehicle Holding Area Data by Terminal
Exhibit 520-2



Upland Vehicle Holding at Bremerton Ferry Terminal
Exhibit 520-3



Over-water Vehicle Holding at Port Townsend Ferry Terminal
Exhibit 520-4

(2) Location of Vehicle Holding Area

Locate the vehicle holding area as close as possible to the vessels. Site constraints, the cost of upland holding verses over-water holding, and associated environmental impacts may affect where the holding area can feasibly be located. Consider impacts to adjacent businesses and driveways when locating and designing holding areas and queuing lanes. Provide measures to maintain access to businesses and driveways during queuing.

Over-water holding is constructed on a trestle resulting in a higher construction cost and more environmental constraints. Refer to Chapter 600 for additional requirements associated with trestle construction.

(3) Sizing of Vehicle Holding Area

(a) Total Number of Vehicles

Design the vehicle holding area with a capacity of one and one-half full boat loads[1] (per destination). The area associated with the "extra" one-half boat load allows for vehicle staging necessary to sort priority vehicles (as defined below) and maintain vessel headways. This rule of thumb for sizing the vehicle holding area does not address vehicle backups that may occur upstream of the holding area, if more than one boat load of vehicles is present for a given sailing. Currently, some terminals accommodate vehicle holding area overflow with a designated ferry holding lane along the shoulder of the terminal vehicle access road (referred to as a queuing lane), see Exhibit 520-5. Some terminals also have off-site vehicle holding lots.



Mukilteo Ferry Terminal Vehicle Holding Lane on Shoulder
Exhibit 520-5

[1] This holding area sizing criteria does not apply to the Shaw Terminal. The Shaw terminal is served by intra-island vessels which make stops at multiple islands. Vessels departing from Shaw only have a small allotment of vehicle spaces on the vessel since the majority of the spaces are reserved for cars originating from other terminals. Consult with WSF Operations for vehicle holding area sizing at the Shaw Terminal.

The design of new vehicle overflow holding areas (queuing lanes and off-site lots) is not addressed in this manual as these areas are built outside WSF terminal boundaries. WSF is currently in the process of implementing a vehicle reservation system and other operational strategies designed to significantly reduce vehicle backups upstream of the toll plaza. Depending on the timing and effectiveness of implementing a vehicle reservation system at each of the terminals, off-site queuing lanes and holding lots may still be necessary. Refer to the *Roadside Manual* Chapter 630 for the design of off-site vehicle holding lots (parking lots).

(b) Number and Length of Holding Lanes

The dimensions of the holding area are based on operational criteria for the optimal number and length of individual lanes. Each ferry load requires staging vehicles in a first-come, first- served order and the capability to separate priority vehicles for preferential loading. The ideal number of lanes accommodates load management and sorting of a wide range of vehicle types while maintaining a per lane vehicle count between 10 and 20 vehicles. (Assume an average length of 20 feet per vehicle, which accounts for oversized vehicles and the space between vehicles.) Lanes shorter than 10 vehicles reduce loading efficiency due to the delay associated with starting a new lane in motion. Lanes longer than 20 vehicles impact the ability to sort vehicles. In addition, the breakdown of a vehicle in a holding lane can impede the loading of the entire lane, making longer lanes undesirable.

1. Priority Vehicles for Preferential Loading

WAC 468-300-700 *Preferential Loading* gives preferential loading privileges to certain exempt vehicles "in order to protect public health, safety and commerce; to encourage more efficient use of the ferry system; and to reduce dependency on single occupant private automobiles." Vehicles falling under the categories described in the preferential loading WAC are deemed "priority" vehicles. Exempt vehicle types that are granted preferential loading privileges on all WSF routes include the following (refer to WAC for route-specific "priority" vehicles):

1. Emergency medical vehicles
2. Emergency police or fire vehicles
3. Public utility vehicles
4. Private vehicles carrying persons with medical conditions of such a nature that waiting for passage is detrimental to such conditions, or vehicles of family members who need passage under dire medical emergencies.
5. School vehicles
6. Publicly or privately owned public transportation vehicles
7. Ride-sharing vehicles
8. Mail delivery vehicles
9. Oversized or overweight vehicles requiring transport at special times
10. Scheduled bicycle groups or events

2. **Preferential Lane for Registered Carpools and Vanpools**

   A designated preferential lane for registered carpools and vanpools is commonly provided at WSF terminals. Current WSF practice is to load registered carpools and vanpools prior to the general traffic. The WAC guarantees these priority vehicles a spot on the first vessel sailing after their arrival, but it does not specify that they are to be loaded prior to the general traffic. Note that buses are staged in the Tall Holding lanes.

3. **Tall Holding**

   Tall vehicles (vehicles over 7.5 feet) require placement in designated areas of a ferry vessel with greater overhead clearance. For this reason, tall vehicles are often separated in the holding area prior to loading.

4. **Preferential Lane for Emergency Vehicles and Accessibility Holding**

   It is WSF policy to provide accommodations for drive-on passengers with disabilities which are compatible with their needs to access elevators, restrooms and other passenger amenities both while waiting for the ferry and on the ferry. Where feasible, operations preference is to provide accessible parking stalls on the trestle, near the vehicle transfer span and convenient to restrooms and other passenger amenities. Where this is not feasible, provide a 12-foot wide preferential lane for accessibility holding. This preferential lane may be used jointly to accommodate emergency vehicles, although emergency vehicles only require a 10-foot wide holding lane.

   A pedestrian accessible route is required from accessible parking stalls or an accessible holding lane to passenger amenities within the holding area or passenger building, as applicable.

5. **Utility Lanes**

   Utility lanes are lanes designated for holding area operations requiring a greater amount of maneuvering room such as the turning and staging of trucks required to back onto the ferry and emergency access for fire trucks and oversized service vehicles. Trucks are required to back onto the ferry at the Vashon (to Southworth Ferry Terminal) and the San Juan Island Terminals. Exhibit 520-6 shows a truck preparing to back on to the ferry in route to Southworth at the Vashon Island Ferry Terminal.

The WAC does not specify a certain number of required holding lanes for priority vehicles. Provide designated preferential lanes and special use lanes such as tall holding and utility lanes as identified in the terminal program and as recommended by WSF Operations Design/Construction Manager.



Vashon Island Ferry Terminal Holding Lanes
Exhibit 520-6

(c) Vehicle Holding Lane Width

The standard vehicle holding minimum lane width for WSF facilities is as follows:

- General traffic lanes: 9 feet
- Tall holding lanes: 10 feet
- Carpool/vanpool lanes: 10 feet
- Shoulder holding lanes: 10 feet
- Utility lanes: 11 feet
- Accessibility holding lanes: 12 feet

Consider 10-foot holding lane widths for general traffic at ferry terminals that are categorized as recreational routes. Recreational routes tend to have drive-on passengers arrive well ahead of the scheduled sailing time. This behavior results in the passengers exiting their vehicles more frequently than passengers on commuter routes. Providing wider holding lanes at recreational routes allows passengers to exit and enter their vehicles more safely and lower the incident rate of vehicle doors damaging adjacent vehicles. Refer to Chapter 410 for additional information on recreational routes.

If existing lanes (see Exhibit 520-2) are below the minimum lane widths identified above, and it is beyond the scope of the project to widen the lanes, document the deficiency in the Design Documentation Package (See Chapter 220). Concurrence is to be obtained by the Assistant State Design Engineer assigned to WSF. No further action is required.

520.05 Motorcycle/Bicycle Access and Holding

Evaluate demand for motorcycle and bicycle facilities on a route by route basis. Access lanes are intended to provide both motorcycles and bicycles access for priority loading and unloading.

Locate motorcycle/bicycle holding area at the dock end of the vehicle holding area. This allows for priority loading of motorcycles and bicycles prior to vehicles. The motorcycle/bicycle holding area is typically incorporated into the buffer located at the end of the trestle. Consider incorporating the motorcycle/bicycle holding area and access lanes in areas already covered such as under an upper level of the terminal building or overhead loading structure. Do not provide cover exclusively for cyclist benefit.

Motorcycle access lanes are not to be combined with bicycle access lanes. For new terminal facilities, a 4-foot wide bicycle lane is required for both the vehicle holding and exit lanes. Motorcycle access is generally provided via unused vehicle holding lanes.



Bainbridge Island Ferry Terminal Motorcycle and Bicycle Holding Area
Exhibit 520-7



Seattle Ferry Terminal Motorcycle Access Lane
Exhibit 520-8

520.06 Outdoor Passenger Waiting Area

At new terminals, provide outdoor waiting space for passengers in the holding area who choose to leave their vehicles without going to the terminal building. Refer to Chapter 410 for requirements.

520.07 Passenger Amenities

Passenger amenities may be located within the terminal building, within the holding area, or a combination of the two. Amenities contained within the secure holding area are available to drive-on passengers only. The presence of select amenities within the holding area, such as restrooms and vending, could lessen the need for drive-on passengers to use the terminal building, reducing the required passenger waiting area within the terminal building. Evaluate the type of passenger amenities to be included within the holding area on a terminal by terminal basis based on ridership, dwell times and the amount of use anticipated throughout the day (coordinate with WSF retail/ concessions expert in determining appropriate passenger amenities). At terminals that provide passenger amenities, provide a pedestrian accessible route to the amenities. Refer to Chapter 400 for additional information.




Seattle Ferry Terminal Passenger Amenities in Holding Area
Exhibit 520-9

(1) Restrooms

Refer to Chapter 400 for restroom requirements both inside the terminal building and in the vehicle holding area.

(2) Passenger Conveniences

Refer to Chapter 400 for information on passenger conveniences both inside the terminal building and in the vehicle holding area.

(3) Retail and Concessions

Per WAC 468-300-100, "It is hereby declared to be the policy of the department to lease toll and ferry facilities and toll and ferry facility space in excess of current needs where feasible and where such lease will not interfere with the normal functioning or the primary operation of the toll or ferry facility. Such leasing should promote maximum use of the toll or ferry facility and constitute a benefit to the taxpayers of the state."

Inclusion of retail/concessions in the vehicle holding area will be made on a case by case basis to be justified in the predesign study (see Chapter 210). Factors influencing whether retail/concessions are incorporated in the holding area include available budget, return on investment, and the source of capital funding. Refer to Chapter 410 (Circulation and Passenger Waiting) and Chapter 420 (Passenger Amenities, Business Case) for additional information.

(4) Pet /Service Animal Relief Areas

Consider providing an outdoor pet/service animal relief area in the holding area. This feature is more commonly provided for terminals serving recreational routes which experience longer wait times and carry a larger number of animals.

Design a low maintenance area (approximately 100 square feet), which may consist of sand, natural or artificial turf, and other low maintenance vegetation. Avoid the use of long grass in the pet/service animal area which may hide pet waste and hinder waste removal. Equip pet/service animal area with a potable water source (a hose bib for cleaning and drinking water), bag dispensers, pet waste receptacles, and appropriate drainage. Design pet/service animal relief area to either biologically treat animal waste or drain runoff to a treated stormwater outlet.



Pet Area at Seattle Ferry Terminal
Exhibit 520-10

520.08 Landscaping

Landscaping may be required within the vehicle holding area for a variety of reasons including local code requirements and/or mitigation for environmental impacts. Landscaping within or between the vehicle holding lanes is undesirable due to its impact on the efficiency of WS's sorting and loading operations. Refer to Chapter 460 for general landscaping requirements.

Chapter 530 Parking

530.01 General
530.02 References
530.03 Design Considerations
530.04 Parking Program Elements
530.05 Parking Area Design
530.06 Employee Parking
530.07 Passenger Parking
530.08 Miscellaneous Parking

530.01 General

This chapter describes the parking elements associated with WSF facilities and provides parking guidelines for WSF applications. Refer to the *Roadside Manual* Chapter 630 for details on parking design. Design parking facilities to conform to local (city or county) regulations and zoning codes, all applicable ADA standards, and the guidelines outlined in this chapter.

Base parking requirements on a project-specific parking demand study. This study may be conducted prior to design or as part of the design effort.

The optimum design for a parking area is one that provides adequate parking, safe pedestrian and vehicular circulation, appropriate stall and aisle widths, adequate turning radii, reasonable gradients, a pleasing appearance, visual access for law enforcement surveillance, provisions for handling and treating stormwater runoff, fits the site, is easy to maintain, and is in close proximity to the facility it serves. Examples of existing WSF parking facilities are shown in Exhibits 530-1 and 530-2.



Anacortes Ferry Terminal Parking Facilities
Exhibit 530-1



Seattle Ferry Terminal Parking Facilities
Exhibit 530-2

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
520	Vehicle Holding and Support Areas

530.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

28 CFR Part 36 *Nondiscrimination on the basis of disability by public accommodations and in commercial facilities*

28 CFR Part 36 Appendix A, Standards for Accessible Design

(2) Design Guidance

Design Manual M 22-01

Roadside Manual M 25-30

Standard Plans M 21-01

WSF Terminal Design Standards, Specifications, and Procedures - Electrical Engineering (*Electrical Engineering Manual*), WSF

530.03 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible. Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements. Note that ADA requirements for parking may vary by parking use (employee/vendor verses public).

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessel security requirements, and additional information pertaining to terminal design. Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for TWIC and SSI.

(3) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

(4) Civil

Refer to Chapter 340 for general civil design criteria pertaining to parking. Below are links to relevant sections by topic.

- Grading and Erosion Control: 340.06
- Paving: 340.08

(5) Operations and Maintenance

Consult with WSF Operations and Terminal Engineering Maintenance throughout the design process and provide opportunities for their review of the project drawings and specifications. Consider the following during the design of parking areas:

- Minimize repair and maintenance required during the design life
- Provide for continuous flow of traffic through parking areas
- Allow for safe movement of pedestrians
- Provide adequate lighting for safety and security
- Provide appropriate landscaping without conflicting with visibility or site lighting
- Consider using plastic traffic markings

(6) Signage and Wayfinding

Signage and wayfinding is an important component of parking area design. Refer to Chapter 570 for details on signage and wayfinding design.

530.04 Parking Program Elements

Consider the following types of parking in conjunction with WSF ferry terminals. Note that not all types of parking listed in Exhibit 530-3 are required at every terminal.

Parking Type
Employee Parking
Curbside Drop-off • Passenger Drop-off • Van Pool • Paratransit • Taxi Stands
Short Term Parking • Passenger Loading • ADA Loading
Long Term Parking • Commuter Parking
Miscellaneous Parking • ADA • Vendor Parking • Washington State Patrol • Bicycle Storage • Holding Lanes • Off-site Holding

Parking Program Elements
Exhibit 530-3

530.05 Parking Area Design

Refer to the *Roadside Manual* Chapter 630 for details on parking area layout, stormwater treatment, lighting, pedestrian safety, vehicle and pedestrian circulation, transit movement and planting area design. Also refer to the *Standard Plans* M 21-01.

Additional information on illumination is provided in Section 560.10 and the WSF *Electrical Engineering Manual*. WSF illumination guidelines take precedence over illumination guidelines in the *Roadside Manual* M 25-30.

530.06 Employee Parking

The number of employee parking spaces provided is a negotiated union contract item. The minimum number of stalls which must be accessible is addressed in Chapter 300. Coordinate with the WSF Operations Liaison at the time of design to determine the number of employee parking spaces to be used in design. Exhibit 530-4 gives an estimate of employee parking space requirements for the existing terminals per input from WSF Operations. Additional parking may be provided for visiting agents as required.

To the extent feasible, locate employee parking in close proximity to the associated work areas. Locate employee parking such that it does not interfere with terminal operations.

If employee parking is provided within the paid holding area, consider providing a separate access point for employee that includes an automated gate and card reader.

Terminal	Employee Parking Spaces
Anacortes	107
Bainbridge Island	49
Bremerton	37
Clinton	2
Edmonds	13
Fauntleroy	1
Friday Harbor	10
Coupeville	8
Kingston	38
Lopez	4
Mukilteo	40
Orcas	5
Point Defiance	6
Port Townsend	16
Seattle	102
Shaw	0
Southworth	22
Tahlequah	3
Vashon	0

Systemwide Employee Parking by Terminal
Exhibit 530-4

530.07 Passenger Parking

(1) Curbside Drop-off

Provide curbside drop-off area near the entrance to the passenger terminal building. Provide accommodations for general passenger drop-off, van pools, individuals with disabilities, taxi stands and paratransit riders as identified in the terminal program. Coordinate with local agencies regarding street side parking as it may fall under the jurisdiction of the local agency.





Edmonds Ferry Terminal Accessible Drop-off Area
Exhibit 530-5

(2) Short Term Parking

Provide short term parking, as required by the terminal program, for people picking up passengers and visiting the terminal facilities. Short term parking is not intended for use by commuters.

Locate short term parking in close proximity to the terminal building, where terminal facilities are accessible without entering the vehicle holding areas or from the local access streets.

Additionally, design short-term parking for easy entrance and exiting to accommodate frequent vehicle turnover. Coordinate with local agencies regarding street side parking as it may fall under the jurisdiction of the local agency.

(3) Long Term (Commuter Parking)

WSF typically does not provide long term parking at their facilities unless it is a requirement of the local jurisdiction. Long term parking needs are generally accommodated by local park and ride lots which are designed and funded by others. Where additional commuter parking is required, coordinate with the local transit authority as the need for a park and ride lot and its location may already have been determined in the development of its comprehensive transit plan. When a memorandum of understanding (MOU) or other formal agreements exists that outlines the design, funding, maintenance and operation of park and ride lots, it must be reviewed for requirements pertaining to new lots.

Long term commuter parking is currently provided by WSF at the Tahlequah, Southworth, Bainbridge Island, Edmonds, Clinton, Anacortes, Orcas Island, and Lopez Island terminals.

530.08 Miscellaneous Parking

(1) ADA Accessible Parking

Refer to Chapter 300 for requirements.

(2) Vendor Parking

Provide parking for vendor staff per lease agreement or as otherwise negotiated with the vendor. Locate vendor parking as conveniently as feasible to the vendor's operation. Accommodate service vehicles for vendor delivery and supply. This area may be jointly used by service vehicles for other WSF operations.

(3) Washington State Patrol Parking

Parking spaces for Washington State Patrol (WSP) personnel are related to the number of work stations provided in the VATS room. Provide between two and four parking spaces based on terminal VATS requirements. Refer to Chapter 310 for additional information regarding VATS requirements.

(4) Covered Secure Bicycle Storage

For projects with a bicycle design element identified in the design matrices (see Chapter 210 for more information), provide a covered, secure bike storage area (typically bicycle storage racks) near the passenger terminal building. Size the bicycle storage area based on bicycle ridership projections identified in the project-specific parking demand study. Note that WSF does not provide bicycle storage lockers at their terminal facilities. Bicycle storage lockers are considered a security concern since they provide a concealed storage location available to the general public in close proximity to a transportation facility.

(5) Holding Lanes

Refer to Chapter 520 for design of holding lanes.

540.01 General
540.02 References
540.03 Design Considerations
540.04 Transit Facilities
540.05 Commuter Rail
540.06 HOVs and Taxis

540.01 General

This chapter provides guidance and information for designing high-occupancy vehicle (HOV) and transit facilities. HOV and transit facilities include transit centers, bus stops and pullouts, turnarounds, park and ride lots, HOV lanes, and commuter rail facilities. The objectives for the HOV and transit facilities are:

- Improve the capability of the terminal to move more people by increasing the number of people per vehicle.
- Provide travel time savings and a more reliable trip time to HOV lane users.
- Provide travel options for HOVs and individuals without adversely affecting the general- purpose lanes.
- Provide integrated connections for riders between the WSF terminal and adjacent transit facilities.



Bus Pull Out – Near Mukilteo Ferry Terminal
Exhibit 540-1

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
340	Civil
520	Vehicle Holding and Support Areas
530	Parking
550	Site Circulation

540.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

28 CFR Part 35 *Nondiscrimination on the Basis of Disability in State and Local Government Services*

RCW 46.61.165 *High-occupancy vehicle lanes*

RCW 47.52.025 *Additional powers – Controlling use of limited access facilities –High occupancy vehicle lanes*

WAC 468-300-700 *Preferential Loading*

WAC 468-510-010 *High occupancy vehicles (HOVs)*

(2) Design Guidance

Design Manual M 22-01

Standard Plans for Road, Bridge, and Municipal Construction M 21-01

Traffic Manual M 51-02

Local transit agency standards and guidelines

(3) Supporting Information

Guide for the Design of High-Occupancy Vehicle Facilities, AASHTO.

HOV Systems Manual, NCHRP Report 414, 1998.

Manual on Uniform Traffic Control Devices (MUTCD), FHWA

540.03 Design Considerations

Plan, design, and construct HOV facilities that provide intermodal linkages wherever feasible. Give consideration to future terminal capacity needs and planned transit facility related improvements. Design the terminal to accommodate local transit agency standards. Whenever possible, design HOV lanes so that the level of service for the general-purpose lanes is not degraded. Coordinate with the WSF Operations Liaison to determine if the terminal is included in WSF's vanpool priority loading program, as this differs from WSDOT's HOV program.

The ferry terminal will be the hub of access and activity. Users will be coming to the terminal from transit and vehicle drop-off areas and the adjacent waterfront areas. Users of the terminal should have a clear sense of arrival and comfort. Clearly mark areas designated as pedestrian safe zones using paving, bollards, fencing, striping and signing.

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible. Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessel security requirements, and additional information pertaining to security in HOV and transit design. Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for TWIC and SSI.

(3) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

(4) Civil

Refer to Chapter 340 for general civil design criteria pertaining to HOV and Transit design. Below are links to relevant sections by topic.

- Channelization: 340.07(1)
- Paving: 340.08

540.04 Transit Facilities

Transit facilities are commonly incorporated into the design of a multimodal ferry terminal facility. Early and continual coordination with the local transit authority and local government agencies is critical in the design of such facilities. Consider each of the following before developing plans for transit facilities:

- Multimodal strategies in the comprehensive plans of applicable local jurisdictions.
- Multimodal strategies in the regional plans of applicable Regional Transportation Planning Organizations (RTPOs).

- Strategies and plans of the applicable transit providers for the site under development.
- Design elements or constraints based on partnership agreements and funding requirements.

Following is some general information on the design of transit facilities. Detailed design guidance for transit facilities is provided in the WSDOT *Design Manual* Chapter 1430.

(1) Transit Centers

Transit centers are effectively large multimodal bus stops where buses on a number of routes converge to allow riders the opportunity to change buses or transfer to other modes of transportation. When designing a transit center, consider such features as passenger volume; number of buses on the site at one time; rail schedules; local auto and pedestrian traffic levels; and universal access.

Where several transit routes converge and where buses congregate, multiple bus berths or spaces are sometimes needed. Parallel and shallow saw tooth designs are the options available when considering multiple berths: however, sawtooth designs are often discouraged by many transit providers due to safety concerns.

(2) Bus Stops and Pullouts

The bus stop is the point of contact between the passenger and the transit services. The simplest bus stop is a location by the side of the road. The highest-quality bus stop is an area that provides passenger amenities and protection from the weather. Bus stops must meet accessibility requirements. Refer to Chapter 300 for additional design guidelines.

Bus pullouts allow the transit vehicle to pick up and discharge passengers in an area outside the traveled way. The interference between buses and other traffic can be reduced by providing bus pullouts.



Bus Stop – Near Edmonds Ferry Terminal
Exhibit 540-2

Specific bus stop locations are influenced not only by convenience to patrons, but also by the design characteristics and operational considerations of the roadway. Bus stops are usually located in the immediate vicinity of intersections. Where blocks are exceptionally long or where bus patrons are concentrated well away from intersections, midblock bus stops and midblock crosswalks may be used. Consider pedestrian refuge islands at midblock crosswalks on multilane roadways.

Transit stops located at terminals provide transfer points between the ferry system and the local transit system, and provide convenient passenger access to the terminal.

Where appropriate, provide space for expected bus usage based on existing route information and expected future growth rates. Allow space for coaches with independent arrival and departure.

Locate any paratransit vehicle stops close to the terminal for convenient access. Include parking space for school buses at terminals where applicable.

(3) Bus Stop Amenities

Provide bus passengers a comfortable place to wait for the bus. Providing an attractive, pleasant setting for the passenger waiting area is an important factor in attracting bus users. Important elements of a bus stop include:

- Universal access
- Protection from passing traffic
- Lighting
- Security
- Paved surface
- Protection from the environment
- Seating (if the wait may be long)
- Information about routes serving the stop

Locate stops where there is enough space for passengers to wait away from the edge of the traveled roadway. Providing a buffer between the roadway and the bus stop protects pedestrians from passing traffic. The buffering distance from the roadway increases with traffic speed and traffic volume. Where vehicle speeds are 30 mph or below, 5 feet is a satisfactory distance. In a heavy-volume arterial with speeds up to 45 mph, a distance of 10 feet provides passenger comfort.

Passengers arriving at bus stops, especially infrequent riders, want information and reassurance. Provide information that includes the numbers or names of routes serving the stop. Other important information may include a system route map, the hours and days of service, schedules, and a phone number for information. The information provided and format used is the responsibility of the local transit system.

Where shelters are not provided, a bus stop sign and passenger bench are desirable, depending on weather conditions. The sign indicates to passengers where to wait and can provide some basic route information.

(4) Bus Turnarounds

WSF does not mandate placing a bus turnaround on the trestle. However, a bus turnaround is a significant convenience to passengers, particularly for those with physical disabilities. Where applicable, consider the cost benefit associated with installing a bus turnaround on the trestle.

Where bus turnarounds are provided, provide a separate access point to allow buses to bypass the toll plaza and/or toll plaza queue backup.

Several existing terminals provide for bus access by local transit agencies to areas near the vessel interface via the trestle/vehicle holding area. These terminals include:

- Southworth
- Fauntleroy
- Vashon
- Kingston
- Clinton

Consider providing transit access to the end of the trestles where feasible. When access is provided, design the terminal to accommodate transit agency standards.



Bus Turnaround at Vashon Terminal
Exhibit 540-3

(5) Park and Ride Lots

Park and ride lots provide parking for people who wish to transfer from private vehicles to public transit or carpools/vanpools. Typically, WSF relies on existing commuter parking facilities and/or parking facilities provided by others. Where additional commuter parking is required, coordinate with the local transit authority for input as the need for a park and ride lot and its location may already have been determined in the development of its comprehensive transit plan. When a

memorandum of understanding (MOU) or other formal agreement exists that outlines the design, funding, maintenance and operation of park and ride lots, it must be reviewed for requirements pertaining to new lots.

540.05 Commuter Rail

Sound Transit is currently in the process of expanding their commuter rail service between Everett and Seattle. Commuter rail stations are typically located within the Burlington Northern right of way. Consider, where applicable, connecting the terminal to commuter rail stations by a publicly accessible overhead walkway. Design the walkway to provide a safe route of travel from ferry to train, free of potential pedestrian/vehicle conflicts. Coordinate location, connection and alignment with Sound Transit.



Commuter Train at Edmonds Terminal
Exhibit 540-4

540.06 HOVs and Taxis

(1) High Occupancy Vehicle (HOV) Lanes

High Occupancy Vehicle (HOV) lanes are exclusive traffic lanes limited to carrying public transportation vehicles, private motor vehicles with the number of occupants specified on posted signs, motorcycles, and emergency vehicles (WAC 468-510-010). HOV lanes are typically a characteristic of urban freeways, but may also be designated on urban arterials, highways serving major transportation hubs such as ferry terminals, and within ferry terminal holding areas. The HOV lane objectives are:

- Increase the people-carrying capacity of terminals.
- Reduce total travel time.
- Improve the efficiency and economy of public transit operations.
- Reduce fuel consumption.
- Improve air quality.

Where feasible and if ridership warrants, provide a separate queue bypass lane on the access road to the toll plaza for HOV/priority vehicle access. Note that a distinction exists between HOVs and priority vehicles in that HOVs are not subject to preferential loading as described in WAC 468-300-700. This lane may also provide future use to reservation holders to bypass standby vehicles. Refer to Chapter 520 for additional guidelines on HOV lanes in the holding areas.

(2) Taxi Waiting Areas

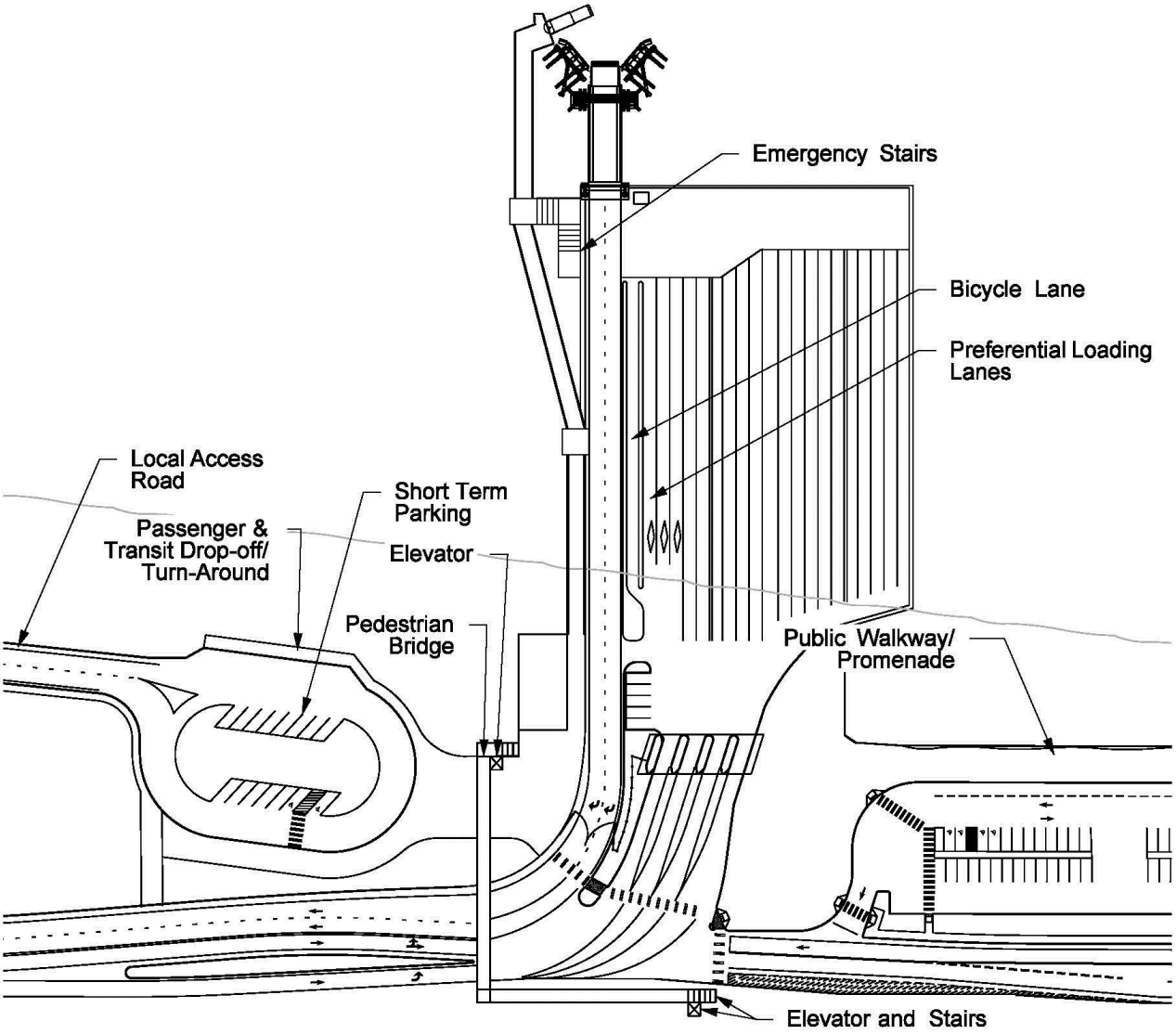
Consider the need for a taxi waiting area (taxi stand) near the terminal facility. This could be incorporated into the short term parking area. Provide additional parking stalls to accommodate taxi waiting where applicable. Accommodate taxi pick-up/drop-off, where applicable, in the sizing of curbside drop-off parking. Curbside drop-off parking may also be used for general passenger loading/unloading, vanpools, and paratransit. See Chapters 530 and 550 for additional information regarding these areas.

Chapter 550 Site Circulation

550.01 General
550.02 References
550.03 Design Considerations
550.04 Public Access
550.05 Vertical Circulation
550.06 Vehicle Circulation
550.07 Building Circulation

550.01 General

This chapter provides general design guidelines for site circulation. Design circulation patterns to be as simple and obvious as possible and to avoid conflicts between vehicular, bicycle and pedestrian traffic. Provide signage, signalization and traffic markings as necessary to facilitate circulation and improve public safety and awareness.



Site Circulation Features
Exhibit 550-1

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
340	Civil
410	Circulation and Passenger Waiting
440	Maintenance Buildings, Enclosures, and Support Areas
500	Access, Approaches, and Exits
520	Vehicle Holding and Support Areas
540	HOV and Transit
570	Signage and Wayfinding

550.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

28 CFR Part 35 *Nondiscrimination on the Basis of Disability in State and Local Government Services*

(2) Design Guidance

Bridge Design Manual LRFD M 23-50

Design Manual M 22-01

Roadside Manual M 25-30

Standard Plans for Road, Bridge, and Municipal Construction M 21-01

Traffic Manual M 51-02

(3) Supporting Information

Manual on Uniform Traffic Control Devices (MUTCD), FHWA

A Policy on Geometric Design of Highways and Streets (*Green Book*), AASHTO

550.03 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible. Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessel security requirements, and additional information pertaining to terminal design. Below are links to relevant sections by topic.

Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for TWIC and SSI.

- MARSEC Levels: 310.04
- Vessel Security: 310.05
- Access Control/ Restricted Areas/ TWIC 310.10
- Signage: 310.13

(3) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

(4) Civil

Refer to Chapter 340 for general civil design criteria pertaining to circulation. Below are links to relevant sections by topic.

- Channelization: 340.07(1)
- Paving: 340.08

(5) Operations and Maintenance

Consider the following operations and maintenance issues in the design of site circulation.

- Design vehicle and pedestrian circulation for a harsh marine environment including potential for heavy wind, rain, snow, and corrosion.
- Provide slip and weather resistant surfaces.
- Consider likely pedestrian short cuts which could create a safety hazard or damage landscaped areas and design to eliminate the short cut or minimize the potential impact.
- Consider the use of Low Impact Development (LID) features in the design of public access features such as pervious pavement in hardscaped areas.

(6) Signage and Wayfinding

Incorporate wayfinding elements into circulation design per guidelines in Chapter 570. Provide wayfinding to terminal building, ticketing, loading area, transit, concessions, nearby services, and attractions.

550.04 Public Access

Pedestrian travel is a vital transportation mode. It is used at some point by nearly all citizens and is the main link to everyday life for many. Be aware of the various physical needs and abilities of pedestrians. Accommodate this variation in design to allow universal access. The Americans with Disabilities Act of 1990 (ADA) requires that pedestrian facilities be designed and constructed such that they are readily accessible and usable by individuals with disabilities. Provide sidewalks, promenades, plazas and other pedestrian access routes in accordance with the accessibility requirements in Chapter 300. In addition to the ADA requirements, design pedestrian facilities using guidance in the *Roadside Manual* M 25-30, the *Bridge Design Manual LRFD* M 23-50, the *Design Manual* M 22-01 and the *Standard Plans* M 21-01.

Encourage cooperation and joint use between public agencies and private landowners to increase and diversify recreation opportunities at the shoreline. This may include but is not limited to walking, biking, boating, fishing, and diving. Design public access areas so they do not compromise revenue control features or interfere with vehicle operations at the terminals. For additional information regarding access, not contained in the following sections, see Chapter 500.

(1) Walkways and Promenades

Design pedestrian ways and promenades to provide for maximum pedestrian accessibility along the waterfront. Where possible, maintain or increase visual access to views of the water where topography or private ownership prevents direct access. Provide multiple access routes to increase use and safety.



Example of Waterfront Promenade
Exhibit 550-2

(2) Pedestrian Bridges

Provide pedestrian bridges as necessary to increase safety and efficiency of terminal operations through the separation of pedestrians and vehicles. Example uses for pedestrian bridges include connecting the passenger building to the pedestrian overhead loading transfer span; connecting different modes of transportation such as commuter rail and ferry; and crossing over busy access roads and holding lanes. Design pedestrian bridges in accordance with the *Bridge Design Manual LRFD* M 23-50. Determine if the bridge will be used solely for pedestrians or if it will accommodate bicycles as well. This consideration may affect bridge widths and rail heights.

Consult local jurisdiction for any specific requirements which may include but are not limited to bridge aesthetics. Note that it is WSF policy not to provide cover on pedestrian bridges unless it is a requirement of the local authority. Design bridges for appropriate stormwater drainage and snow and ice removal. Provide materials that are resistive to de-icing compounds.

In locations where pedestrian bridges cross over roadways, consider providing screening along the length of the bridge to discourage objects from being thrown off the bridge. Refer to the *Design Manual* Chapter 720 for guidance.

Pedestrian bridges are beneficial where at grade crossings would: interfere with ferry operations; provide significant concern for pedestrian safety; or would provide a direct route over a major physical barrier. Consider grade-separated crossings where:

- Natural pedestrian crossings would occur at a location with limited site distance.
- There are documented collisions or close calls involving pedestrians and vehicles.
- Ferry operation results in moderate-to-high pedestrian demand to cross a major roadway, vehicle access road, or exit lanes with high volumes and/or high speed traffic.
- There is a major physical barrier such as a water body, gulley, etc. which significantly restricts or prohibits an at-grade crossing.



Pedestrian Bridge at Seattle Ferry Terminal
Exhibit 550-3

550.05 Vertical Circulation

Provide vertical circulation features as required in the form of stairs, ramps, escalators, and elevators. Accessible vertical circulation must be in the same area as stairs and escalators, not isolated in the back of the facility.

(1) Vertical Clearance Requirements

When crossing the vehicle holding and exit lanes, the minimum clearance under the OHL system is 16.0 feet with 16.5 feet being desirable. All ferry vessels serving WSF terminals have a tunnel height of 16 feet or less. If any OHL structure is proposed to cross a state route, the minimum clearance must meet highway standards (WSDOT and AASHTO). Refer to the *Design Manual* M 22-01 for vertical clearance requirements for bridges.

(2) Stairs and Ramps

Refer to local building codes and Chapter 300 for the design and placement of ramps and stairs. Where uncovered stairs and ramps are provided, design the elements for appropriate stormwater drainage and snow and ice containment or removal. Specify materials that are resistive to de-icing compounds.



Accessible OHL Ramp at Bainbridge Ferry Terminal
Exhibit 550-4

(3) Escalators and Moving Walkways

Escalators and moving walkways typically have not been employed at WSF terminals due to cost and operations and maintenance issues associated with the marine environment. However, where ridership demand at a terminal requires access to a second level, consider the use of escalators for vertical circulation.

(4) Elevators

Design elevators and their components in accordance with ASME A17.1. Design elevators for a harsh waterfront environment. Specify elevators that are ADA accessible and have the ability to accept a gurney. Provide stainless steel finishes in public areas. Dual elevators are strongly advised in high traffic areas. Consider access by maintenance personnel and equipment when determining the placement of elevators. Provide a space to house hydraulic, mechanical, and electrical components for operation of the elevator system. Utilize concrete construction designed for containment.

550.06 Vehicle Circulation

(1) Design Vehicle

Design terminal facilities to accommodate a WB-67 tractor trailer accessing the general holding areas. Refer to Section 340.07 for addition details on critical operational maneuvers to be analyzed using turn simulation software (such as AutoTURN®) to verify the design. Areas intended for use by specific vehicles only, such as a dock bull, may be designed for those vehicles specifically. Consult with WSF Operations for locations where this is allowable.

(2) Transit Circulation

Link public transportation systems to the waterfront, recreation uses and transit stops/centers in a manner that is compatible with shoreline management goals and policies and results in the least disruption to the shoreline. Design site circulation to accommodate the design vehicle noted in Chapter 340. Provide priority access for buses to ensure arrival and departure with minimum delay. Consider providing transit access to the end of the trestles where feasible. When access is provided, design the terminal to accommodate transit agency standards.

Provide separate bus loading and unloading areas from auto and pedestrian travel ways. Provide covered, enclosed areas for pedestrians to wait for buses. At transit stops truncated domes are required at loading areas. Additional information on the design of transit circulation is contained in the *Design Manual* Chapters 1430 and 1510 provides additional guidance on pedestrian facilities.

(3) Emergency/Fire Access

Provide access for emergency vehicles including fire and medical aid to the terminal facilities and for preferential loading to the vessel. Coordinate with the local Fire Chief for emergency access requirements. Accommodate fire truck turning requirements in design of terminal roadways.

(4) HOV, Motorcycle, and Bicycle Circulation

Provide dedicated site circulation features including HOV lanes, motorcycle lanes, and bicycle lanes as identified in the project terminal program. See Chapter 520 for information regarding motorcycle and bicycle lanes and Chapter 540 for additional information regarding HOV considerations.

(5) Commercial Materials Delivery

Provide for circulation and loading/unloading of commercial delivery vehicles. Locate loading and unloading zones as close as feasible to the locations requiring delivery. Consider providing separate access for commercial delivery vehicles so they do not have to wait in toll line queues.



Bainbridge Island Ferry Terminal Motorcycle and Bicycle Holding Area
Exhibit 550-5

(6) Garbage and Recycling

Include a space to support the storage and transfer of vessel and terminal garbage and recycling. For projects with a fencing element in the applicable design matrices project type (see Chapter 210), unless WSF operations or the local jurisdiction objects (such as part of a shoreline or building permit process), provide a fence around the garbage and recycling to secure the area.

Document operations or local jurisdictional objections to fencing requirements in the Design Documentation Package (See Chapter 220). Allow for drive though access by locating lockable gates at either end of the area. Provide space for garbage dumpsters, recycle dumpsters, and a large trash compactor where applicable. Refer to Section 510.06(10) for additional garbage and recycling area criteria.



Seattle Ferry Terminal Garbage and Recycling Area
Exhibit 550-6

550.07 Building Circulation

Refer to Chapter 410 for building circulation requirements.

Chapter 560 Site Utilities

560.01 General
560.02 References
560.03 Design Considerations
560.04 Potable Water
560.05 Fire Protection
560.06 Sanitary Sewer
560.07 Stormwater
560.08 Natural Gas
560.09 Site Power
560.10 Site Lighting
560.11 Communications

560.01 General

This chapter provides guidelines for the types of utilities to be provided at the terminals. For vessel utility requirements, refer to Chapter 330. This chapter does not address utility routing across specific terminal elements. For information on utility routing, refer to Chapters 600, 610, and 620.

For additional information related to site utilities refer to the following chapters:

Chapter	Subject
200	Capital Project Scoping
210	Design Matrix Procedures
310	Security
320	Environmental Considerations
330	Marine
340	Civil
350	Buildings
360	Electrical
570	Signage and Wayfinding
580	Sustainability/Low Impact Development
600	Trestle
610	Vehicle Transfer Span
620	Passenger Overhead Loading

560.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

28 CFR Part 35 *Nondiscrimination on the Basis of Disability in State and Local Government Services*

International Building Code (IBC), International Code Council

RCW 47.24.020 *Jurisdiction, Control*

RCW 19.122 *Underground Utilities*

WAC Title 51 *General Administration, department of (building code council)*

(2) Design Guidance

Design Manual M 22-01

Highway Runoff Manual M 31-16

Hydraulics Manual M 23-03

Standard Plans M 21-01

Standard Specifications M 41-10

Stormwater Management Manual for Western Washington (SWMMWW), Washington State Department of Ecology

Utilities Manual M 22-87

Cross Connection Control Manual Accepted Procedure and Practice, Pacific Northwest Section of the American Water Works Association (AWWA)

NFPA 13 Standard for the Installation of Sprinkler Systems, National Fire Protection Association, Inc. (NFPA)

NFPA 15 Standard for Water Spray Fixed Systems, National Fire Protection Association, Inc. (NFPA)

NFPA 24 Standard for the Installation of Private Fire Service Mains and Their Appurtenances, National Fire Protection Association, Inc. (NFPA)

Uniform Plumbing Code, International Association of Plumbing and Mechanical Officials

International Fire Code, International Code Council

International Fuel Gas Code, International Code Council

560.03 Design Considerations

It is WSF policy to accommodate utilities within the adjacent highway right of way when such use is consistent with the provisions of federal, state, or local laws and regulations. Guidelines, provided in the *Utilities Accommodation Policy* M 22-86, have been developed to direct designers on when and how utilities may use state right of way, and where they may be placed.

Design utilities to provide minimum cover depths as defined in the *Utilities Manual* M 22-87 and the *Utilities Accommodation Policy* M 22-86. Consider future projects to determine whether the typical coverage depth is sufficient.

See Chapter 210 for utility requirements for specific project types.

See Chapter 220 for proprietary item use and Buy America/Buy American considerations.

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible. Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Locate utilities so that their placement does not result in excessive pavement cross slopes or uneven surfaces that do not satisfy ADA requirements for accessible paths. Refer to Chapter 300 for accessibility requirements.

(2) Security

Chapter 310 includes a general discussion of security requirements and additional information pertaining to utility design. Below are links to relevant sections by topic. Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the United States Coast Guard (USCG) and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for TWIC and SSI.

- IT Equipment Network Room Section 310.07(4)
- Access Control/Restricted Areas/TWIC Section 310.10
- Closed Circuit Television: Section 310.11
- Panic Buttons: Section 310.12

(3) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation. Note that site utilities such as stormwater, lighting, and sanitary sewer are often subject to environmental regulations that vary for each terminal.

(4) Marine

Refer to Chapter 330 for general marine design criteria pertaining to the site utilities. Below are links to relevant sections by topic.

- Vessel Utilities: Section 330.05(3)

(5) Civil

Refer to Chapter 340 for general civil design criteria pertaining to site utilities. Below are links to relevant sections by topic.

- Project Datum: Section 340.04
- Site Preparation: Section 340.05

(6) Buildings

Refer to Chapter 350 for general building design criteria pertaining to site utilities. Below are links to relevant sections by topic.

- Building Structures: Section 350.04
- Building Foundations: Section 350.05
- Building Utilities: Section 350.06

(7) Electrical

Refer to Chapter 360 for general electrical design criteria pertaining to site utilities. Below are links to relevant sections by topic.

- Wiring and Protection: Section 360.04
- Wiring Methods and Materials: Section 360.05

(8) Utility Coordination Meetings

Hold utility coordination meetings with local utility companies and utility districts early in the design process and throughout design. Coordination meetings serve to identify the applicable utility requirements and standards for areas outside WSDOT jurisdiction. These meetings also serve to identify the availability of existing utilities for connection purposes, identify potential utility conflicts, and help mitigate the risk involved during construction. Coordinate placement of utilities in the State Highway right of way with local agencies when within city limits. The local agency is ultimately responsible for granting utility franchises per RCW 47.24.020.

(9) Existing Utilities

Obtain as-built utility drawings from local utility providers and from WSF record drawings. WSF record drawings are available through the WSF librarian. Note the datum for all information obtained from as-built drawings. Convert all reference data to the Project Datum prior to use.

Refer to Chapter 200 for a list of major underwater utilities in the vicinity of existing WSF terminals of which the designer should take special note when designing terminal improvements and modifications in the area. This utility list is not all inclusive but is provided to make the designer aware of major underwater utilities which could impact design and construction and may otherwise go unnoticed.

Refer to the terminal base map for approximate locations of upland and trestle utilities. The terminal sundry site plan should be consulted for existing utility easements.

(10) Utility Restoration

Design road restoration resulting from utility work to WSDOT Standards or local jurisdiction standards, whichever is more stringent.

(11) Operations and Maintenance

Consult with WSF Operations and Terminal Engineering Maintenance throughout the design process and provide opportunities for their review of the project drawings and specifications. Consider minimizing repairs, operations, and maintenance required over the design life of utilities during the design. Consult Maintenance during design regarding access to system components.

(12) Seismic Design of Utilities and Utility Support Structures

The Operational Level Earthquake (OLE) is a seismic event that has a 50 percent probability of exceedance in 75 years (approximately100-year return period). All utilities shall remain fully operational following the OLE. The effects on a utility that crosses adjacent structures which move independently in a seismic event shall be considered. Utilities shall have flexible joints to accommodate the relative movement of the adjacent structures and/or the ground for the OLE. The project structural engineer shall provide the utility designer with the maximum relative displacement movement expected during the OLE between adjacent structures including earth- retained structures.

The Design Level Earthquake (DLE) is a seismic event that has a 7 percent probability of exceedance in 75 years (approximately 1000-year return period). All utilities and utility support structures shall not collapse but may require repairs to become operational following the DLE. The project structural engineer shall provide the utility designer with the DLE design loads which are based on the AASHTO LRFD *Bridge Design Specifications*.

OLE and DLE displacements and loads are based on the AASHTO LRFD *Bridge Design Specifications* and/or the AASHTO *Guide Specifications for LRFD Seismic Bridge Design*.

Utilities that are required to function for life safety purposes after a seismic event shall be designed in accordance with the IBC.

560.04 Potable Water

(1) General

Provide potable water service to the following ferry terminal destinations as required:

- Domestic water service to the passenger building
- Domestic water service to the terminal supervisor building
- Domestic water service to the WSF vessel slips
- Domestic water service to hose bibs on the trestle and across the site
- Irrigation water service to planting areas

The WSF Maintenance Department maintains a spreadsheet containing existing water line sizes for each terminal at the following locations: city meter, on dock, on transfer span, at vessel. See hyperlink below: G:\Term_Fac_Info\System_Wide\Terminal_Info

(2) Design Parameters

(a) Domestic Water System

Supply domestic water to buildings, vessels, and hose bibs. Provide a water service pipe running underneath or alongside the trestle. From the water service pipe, extend a branch line to each slip, each building and one or more to feed the hose bibs. Provide hose bibs on the trestle, typically along the trestle railing. Refer to Chapter 600 for utility routing on the trestle. Provide drain valves at the low points of the system. Provide remote valve operators for hard to reach valves so that valves can be operated from the trestle deck, transfer span, or other easily accessible location.

The domestic water service pipe will typically require a meter to be placed near the connection with the right of way. If the facility is to have several separately metered systems, as in the case of separately metered vendor spaces, the WSF meter shall be located downstream of the vendor branch line connection.

The domestic water distribution main will typically require a reduced pressure backflow prevention assembly (RPBP), housed in an insulated aluminum enclosure and located near the connection with the right of way. In addition to the reduced pressure device required for the domestic service, additional RPBP's or double check backflow prevention assemblies shall be provided to isolate service to each slip and building.

Some facilities do not have an RPBP on the main line. If this is the case, then RPBP's must be provided to isolate each slip and building. Consult the *AWWA Cross Connection Control Manual* for further design guidance.

The water service located under the trestle and on the transfer spans shall be protected from freezing by ambient temperature-sensing freeze prevention valves. The valves shall be located immediately adjacent to the water shut-off valve on the span and at the ends of each branch line under the trestle. Route the valve outlets away from walking and driving surfaces.

Water lines located under the trestle shall be mounted as close to the deck as possible to minimize potential damage from waves and floating debris. Pipes shall be clamped directly to rigid supports or hung from laterally and longitudinally braced trapeze-style supports.

Single rod-type pipe hangers shall not be used. Structural cage protection shall be provided if mounted below the pier cap.

Refer to the *Uniform Plumbing Code* for additional potable water system requirements.

(b) Local Water District

Water district standards apply to improvements outside the WSF property limits and govern the design of improvements within State and City right of way.

The local water district will require minimum depths of cover for buried water main facilities. Refer to the applicable water district standards for cover depths outside of the WSF right of way. For utility cover depths within the WSF right of way, refer to the *Utilities Manual* M 22-87 and the *Utilities Accommodation Policy* M 22-86.

(c) Thrust Blocking, Pipe Supports and Flexible Hose

Provide thrust blocking via pipe supports at all above-ground pipe bends. Install pipe supports to provide rigid support to piping both vertically and horizontally. Use flexible hose approved for potable water use where the force main transitions between the fixed pier and the movable transfer span.

(3) Material Selection

Design all materials to meet the requirements of the *Standard Specifications* M 41-10 and the local water district standards, or whichever is more stringent and more appropriate. Additional material considerations are as follows:

- Provide combination air and vacuum release assemblies per water district standards.
- Provide gate valves, blow-off assemblies, pressure-reducing valves, and other appurtenances per water district criteria.
- Provide seamless hot dip galvanized steel pipe for all above-ground water piping situated within the footprint of the trestle. Pipe sizes with nominal diameters 2 inches and below shall utilize threaded connections. Pipe sizes above 2-inch nominal diameter shall utilize mechanical couplings and grooved pipe.
- Buy America/Buy American considerations (see Chapter 220) and proprietary item use (see the *Plans Preparation Manual* Section 700.05(20) for more information

Refer to Chapter 610 for water line criteria at the vehicle transfer span.

(4) Permits and Approvals

The design of the water system must be approved by the local water district. Below is a list of permits and approvals which may be necessary for water system improvements.

- Building Permit, administered by local municipality
- Shoreline Development Permit, administered by local municipality
- Shoreline Exemptions

560.05 Fire Protection

(1) General

Provide fire water service to terminals for site and building fire protection facilities, including fire hydrants and building sprinkler systems. Per direction of the local fire marshal, the following fire water service for the terminal may be required:

- Fire water service to the passenger building sprinkler system
- Fire water service to the terminal supervisor building sprinkler system
- Fire water service to sprinkler system under passenger OHL
- Fire water service to upland fire hydrants
- Fire water service to sprinkler system under trestle

Refer to the NFPA publications for additional fire system requirements.

(2) Design Parameters

(a) Coordination with Fire Marshal and Water District

Schedule a coordination meeting between the local fire marshal, water district, WSF, and the design team to coordinate fire protection needs. The meeting will help to clarify fire flow requirements, hydrant locations and spacing, and fire access requirements.

Confirm the following:

- Fire flow requirements (gallons per minute)
- Fire flow provided by each hydrant
- Maximum distance between hydrants
- Hydrant setbacks
- Hydrant clear zones
- Hydrant requirements for trestle
- Fire lane access requirements
- Locations requiring medical aid access
- Locations requiring ladder truck access
- Lane width requirements for ladder truck
- Turning radii requirements for ladder truck
- Horizontal and vertical clearance requirements for ladder truck

(b) Fire Flow Calculations

Consult the local water district for available water pressure information and fire flow requirements. The gross square footage of structure to be used in the fire flow calculations includes any enclosed conditioned areas of the overhead walkway and/or the storage spaces under the walkway. Any portion of the overhead walkway and dock area that is not enclosed does not need to be included in the calculation.

(3) Material Selection

All materials will meet the requirements of the *Standard Specifications* M 41-10 and the local fire district standards.

Buy America/Buy American considerations (see Chapter 220) and proprietary item use policies (see the WSDOT *Plans Preparation Manual* Section 700.05(20) for more information) may apply.

(4) Permits and Approvals

Below is a list of permits and approvals which may be necessary for fire system improvements.

- Building Permit, administered by local municipality
- Shoreline Development Permit, administered by local municipality.
- Shoreline Exemptions

560.06 Sanitary Sewer

(1) General

Provide sanitary sewer service to terminals, including a force main for vessel pump-off from each slip at terminals where vessel pump-off is required. Exhibit 560-1 indicates which terminals accommodate vessel pump-off. Route the force main(s) to a gravity system.

Provide service lines from the passenger building and terminal supervisor building to the gravity system. At multi-slip terminals with common sewage lines, provide check valves in the force mains near the bridge seats to prevent sewage backflow. Structural cage protection shall be provided if mounted below the pier cap.

Terminal	Sewer Pump-out	Terminal	Sewer Pump-out
Anacortes	X	Mukilteo	X
Bainbridge Island		Orcas	
Bremerton		Point Defiance	X
Clinton		Port Townsend	X
Coupeville		Seattle	X
Edmonds	X	Shaw	
Fauntleroy	X	Southworth	
Friday Harbor	X	Sidney	
Kingston		Tahlequah	
Lopez		Vashon	

Sanitary Sewer Service at Existing Terminals
Exhibit 560-1

All sanitary sewer improvements outside WSF property boundaries will be owned and maintained by the local sewer district and will require design approval from that district. Use the local sewer district design standards for sanitary sewer facilities to be owned and maintained by the sewer district. Implement sewer district standards, wherever feasible, for sanitary sewer appurtenances that lie within the WSF property boundaries. Keep all existing live sewers (including septic tanks and drain fields) in service at all times.

Refer to Chapter 610 for sewer line criteria on the vehicle transfer span. Refer to the *Uniform Plumbing Code* for additional sewer line requirements.

(2) Design Parameters

Design sanitary sewer force mains to match the flow and pressure regime of existing and future WSF vessel pumps. Refer to Appendix O for the vessel sewage discharge rates. Simultaneous pump-off from multiple vessels is not a design requirement.

Design for use of a flexible hose and rotary joint in locations where the force main transitions between the trestle and the movable transfer span. Include a ball valve placed at the pump connection at the off-shore end of each vehicle transfer span.

Conduct a hydraulic analysis to validate the performance of the slip force mains. Base the design on maximum and minimum flow velocities of 8 fps and 2.5 fps, respectively. The minimum flow velocity has been set in order to avoid excessive increases in the hydrogen sulfide concentration within the force main. Provide cleanouts for flushing the force mains in locations where minimum flow velocities are not able to be maintained and where effluent from vessels may sit idle between vessel pumping. Use a 300-gpm vessel pump-off rate, assumed to occur during off- peak hours, for design.

Design gravity sanitary sewers to accommodate the 300-gpm vessel pump-off, combined with peak flows generated by the terminal supervisor and passenger buildings. Provide thrust blocking at all force main pipe bends by means of pipe supports and restrained joints. Install pipe supports to provide rigid support to piping both vertically and horizontally. Provide cleanout assemblies for access and cleaning. Analyze the potential for odor problems and address in the design.

Consult the local sewer district for additional development standards that apply to sanitary sewer improvements outside the WSF project site.

(3) Material Selection

All materials will meet the requirements of the *Standard Specifications* M 41-10 for sanitary sewers and the local sewer district requirements.

Buy America/Buy American considerations (see Chapter 220) and proprietary item use policies (see the *Plans Preparation Manual* Section 700.05(20) for more information) may apply.

Use schedule 80 PVC, steel, or ductile iron sanitary sewer pipe for all above-ground force main piping. Provide insulation and heat tracing.

(4) Permits and Approvals

Below is a list of permits and approvals which may be necessary for sanitary sewer system improvements.

- Building Permit, administered by local municipality
- Shoreline Development Permit, administered by local municipality
- Shoreline Exemptions, administered by local municipality or county

560.07 Stormwater

(1) General

Design storm drainage to collect, convey, treat, and discharge stormwater in accordance with WSDOT and DOE regulations. The stormwater system may consist of both natural and constructed facilities to provide for the conveyance and treatment of stormwater. Evaluate and select stormwater conveyance and treatment methods for each terminal individually based on site parameters. Refer to the *Highway Runoff Manual* Chapter 600 for additional stormwater design information. See Chapter 200 for stormwater retrofit scoping information.

(2) Design Parameters

(a) Conveyance

Design the conveyance system to the 25-year storm event and per guidelines contained in the HRM and the *Hydraulics Manual* M 23-03. Grade the site to prevent ponding of stormwater and to minimize the number of storm sewer structures (e.g. catch basins, manholes, piping). Design curbs and flow paths to direct runoff towards the drainage structures. Design the conveyance system to prevent stormwater from directly discharging into the Puget Sound.

Existing storm drainage at some terminals discharges stormwater directly to the Puget Sound; however, it is the intent of WSF that new terminals will provide treatment. Refer to Chapter 600 for a discussion of conveyance options on the trestle.

(b) Treatment

Provide stormwater treatment for the terminal. Evaluate stormwater treatment options for each terminal on an individual basis based on site parameters. Determine if the project site is considered a high use site per the definition provided in the HRM and provide associated treatment capabilities, as required. Oil control treatment for stormwater should be considered. Refer to Chapter 600 for stormwater treatment options.

(c) WSF Guidelines

Where feasible, incorporate the following guidelines into the stormwater design.

- Divide drainage into basins that are consistent with probable future maintenance responsibilities.
- Avoid tying WSF stormwater systems into local municipality systems
- Select treatment facilities capable of treating oil contaminants.
- Avoid wet vault as basic treatment
- Include low impact development techniques. Refer to Chapter 580.

(3) Stormwater Calculations

Exhibit 560-2 summarizes the main stormwater calculations required. Comply with the minimum requirements outlined in the HRM as they apply to the project. The minimum requirements are applied on a site-specific basis and may vary within the project limits depending on the drainage characteristics of the project. Design the terminal stormwater system to outfall into the Puget Sound. Stormwater systems that discharge to the Puget Sound are exempt from Minimum Requirement #6 (Flow Control) and therefore are not required to provide flow control.

Calculation Type	Calculation	Reference	Design Frequency	Standard
Conveyance	Inlet Spacing	Hydraulics Manual	10-year	Design Spread, Zd = Shoulder +2 ft (<45mph) Design Spread, Zd = Shoulder (>45mph)
	Sag	Hydraulics Manual	50-year	Design Spread, Zd = Shoulder +2 ft
	Conveyance	Hydraulics Manual	25-year	SBUH or Rational Method. Gravity Flow Required
	Ditch/Gutter Capacity	Hydraulics Manual	10-year	SBUH or Rational Method. 0.5 ft of freeboard required
Stability Calculations	Ditch Stability	*Highway Runoff Manual*	10-year	SBUH or Rational. Shear Stress to be less than allowable shear stress of ditch liner
	Outlet Protection	*Highway Runoff Manual*	25-year	SBUH or Rational Method. Flow velocity from Conveyance Calculations
Treatment	Treatment Sizing	*Highway Runoff Manual*	91st Percentile, 24-hour	MGS Flood Water Quality Volumes

Standards for Design Calculations
Exhibit 560-2

(4) Material Selection

Design conveyance structures per the *Standard Plans* M 21-01, the *Standard Specifications* M 41-10, and the WSDOT Hydraulics Manual.

(5) Permits and Approvals

Below is a list of permits and approvals that may be required for stormwater improvements.

- Hydraulic Project Approval, Washington State Department of Fish and Wildlife
- Section 10/404 Permit, U.S. Army Corps of Engineers
- Endangered Species Act Section 7 Consultation, NMFS and USFWS
- Stormwater Construction Permit, Washington State Department of Ecology
- Section 401 Water Quality Certification, Washington State Department of Ecology
- Coastal Zone Management Act Certification, Washington State Department of Ecology
- NPDES Municipal Stormwater Discharge Permit, local municipality
- Conditional Use Permit, local municipality
- Shoreline Substantial Development Permit, local municipality
- Building Permit, local municipality
- Shoreline Exemptions

560.08 Natural Gas

(1) General

Provide natural gas service based on the mechanical design. If required, provide gas service for building heat to the terminal supervisor and passenger buildings. Provide gas service stub out for future concessions, as necessary. Design the gas routing by the most economical path.

(2) Design Parameters

Design data and parameters relating to site natural gas distribution are set forth by the local gas company. The gas company will perform and/or review all engineering activities associated with the size and location of natural gas facilities serving the site. Coordinate with the gas company on design responsibilities. Reference the International Fuel Gas Code for design requirements.

Within WSF right of way limits, the gas company will be responsible for providing and installing all lateral (or main) piping and meters to the buildings. The selected construction contractor will be responsible for the accompanying trenching, earthwork, and surface restoration.

Locate gas utilities that will be within WSDOT right of way outside of the roadbed. Utilities located within the roadbed will require a design variance. Maintain WSDOT standard depths within WSDOT right of way.

(3) Material Selection

Design trenching, backfill, pipe installation, and surface restoration in conformance with local gas company, WSDOT, and local municipality standards.

Buy America/Buy American considerations (see Chapter 220) and proprietary item use policies (see the *Plans Preparation Manual* Section 700.05(20) for more information) may apply.

(4) Permits and Approvals

New gas mains will be reviewed and subject to the approval of the local gas company, WSDOT and the local municipality.

560.09 Site Power

Refer to Chapter 360 for electrical design criteria pertaining to site utilities. Below are links to relevant sections by topic.

- Design Considerations: Section 360.03

560.10 Site Lighting

Refer to Chapter 360 for lighting design criteria pertaining to site utilities. Below are links to relevant sections by topic.

- Lighting: Section 360.07

560.11 Communications

Refer to Chapter 360 for communications design criteria pertaining to site utilities.

Chapter 570 Signage and Wayfinding

570.01 General
570.02 References
570.03 Design Considerations
570.04 Signage and Wayfinding Types
570.05 Signage Functions
570.06 Signage Manuals
570.07 Signage By Location

570.01 General

This chapter contains information about signing and wayfinding at WSF terminal facilities. Wayfinding is the methodology of using sensory cues to guide people to their destinations. A successful wayfinding program is intuitive and self-navigable. Effective wayfinding is primarily achieved through the effective use of signage, informational displays and kiosks, building and site layout, and other architectural indicators such as light, color, and materials. Wayfinding also includes audible communication, tactile elements, and provisions for other persons with disabilities.

The logic of how buildings and terminal spaces are arranged affects the user's ability to understand and orient themselves within their environment. Visual dominance of entrances, clearly defined pathways, and definition of public spaces from private spaces (employee works spaces, restricted locations, etc), all play an important role in navigating the terminal.

Effective signing is the primary method to provide regulatory, warning, and guidance information to ferry system users. Signing that is clear, concise, and accurate supports safe, legal, and orderly use of WSF facilities. Sign use should be limited and conservative since signs can lose their effectiveness when used to excess.

Design signage elements to work with other terminal wayfinding elements by integrating the sign and graphic elements into the architectural and site design of each terminal as described in the following sections of this chapter. Designing and implementing an effective wayfinding system will help ensure that customers have a positive experience and do not rely on staff to direct them to their destinations.

Refer to the WSF Terminal Signage Standards Manual (available upon request) for information regarding standards signs and conventions.

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
400	Passenger Buildings
450	Architecture
460	Landscape Architecture

570.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

29 Code of Federal Regulations (CFR) Part 1917, Marine Terminals

29 CFR Part 1918, Safety and Health Regulations for Longshoring

Americans with Disabilities Act Accessibility Guidelines

International Building Code (IBC), International Code Council, Washington D.C.Electronic and Information Technology Accessibility Standards (Section 508)

RCW 46.61 *Rules of the Road.*

Senate Bill 6109

United States Coast Guard Specifications

Washington State Amendments to the Uniform Building Code for Barrier Free Facilities

WAC 468-95 *Manual on Uniform Traffic Control Devices for Streets and Highways*

(2) Design Guidance

Manual on Uniform Traffic Control Devices (MUTCD), FHWA

Sign Fabrication Manual M 55-05

Sign Standards for State Buildings and Grounds

Standard Plans

Traffic Manual M 51-02

Terminal Signage Standards Manual, WSF

WSDOT Reference Library, WSF

570.03 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible.

Additionally, 49 CFR Part 39 prohibits owners and operators of passenger vessels from discriminating against passengers on the basis of disability, requires vessels and related facilities to be accessible, and requires owners and operators of vessels to take steps to accommodate passengers with disabilities.

Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessel security requirements, and additional information pertaining to terminal design. Below are links to relevant sections by topic.

Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for TWIC and SSI.

- MARSEC Levels: 310.04
- Vessel Security: 310.05

570.04 Signage and Wayfinding Types

There are numerous types of signage and wayfinding techniques utilized at WSF terminals. These include: architecture and landscape architecture features, static signage, variable message signs, informational kiosks and displays, sign bridges, highway advisory radio, and the internet. Refer to Chapters 400, 450 and 460 for additional information on building and site layout and how to incorporate wayfinding techniques into their design.

(1) WSF Terminal Signage Types

WSF has identified 19 different signage types for use at WSF terminals. These signage types are described in the WSF Terminal Signage Standards Manual. Several examples of WSF signage types are given in Exhibit 570-1. Refer to Section 570.06 for more info on the WSF Terminal Signage Standards Manual.



Freestanding Sign



Portable Sign



Flag Mounted Sign



Information Display



Sign Bridge



Vehicle Fare Display



Exterior Sign Band



Tactile Room ID Sign



Interior Sign Band

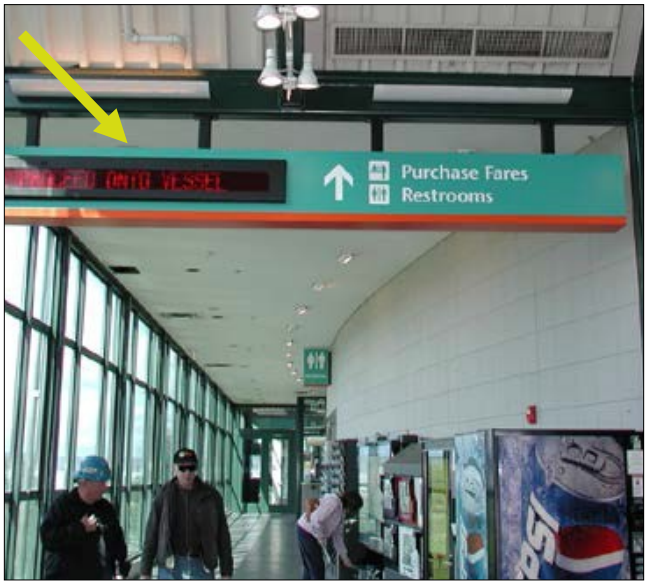
Sample WSF Signage Types
Exhibit 570-1

(2) Variable Message Signs

Consider exterior EMS at the terminal entrance, in advance of the terminal entrance, and in the holding lanes to advise customers of information such as sailing status, wait times, lane status, loading information, and general terminal announcements. The vehicle holding area is a good location to provide information while passengers wait and provides an opportunity for advertising revenue generation. In addition, install individual smaller signs at each toll booth to provide information on tolls and toll booth open/closed status.

Install interior EMS signs in the passenger building at the turnstile locations and at the information board. Utilize EMS signage at the control point prior to the movable span to inform customers of "Wait" verses "Now Loading" status. These signs are integrated into the door controls at the operator control station. In addition, install EMS along the overhead loading walkway and transfer span as appropriate.

The messages to be displayed on these EMS are programmable. The main components of an electronic message sign include the sign housing, a local sign controller and the operator interface that allows for monitor and control of the signs. Utilize Light Emitting Diode (LED) technology for the sign displays and locate the computerized controls for the EMS in the terminal supervisor office.



Interior Variable Message Sign



Exterior Variable Message Sign

Variable Message Signs
Exhibit 570-2

(3) Informational Kiosks and Display Cases

Use kiosks and display cases to provide information such as maps, ferry and transit schedules, brochures, and other information not easily conveyed using signage.

(4) Sign Bridges

Locate sign bridges above the road at terminals where there is appropriate physical space and a need to organize traffic. These may be located at the highway entrance to the terminal or inside the terminal such as in the holding lane area.

(5) Highway/ Ferry Advisory Radio (HAR/ FAR)

WSDOT has a designated radio frequency in which motorists can tune in to hear current information regarding ferry sailings including schedule delays, route detours, route closures, and emergency conditions. This provides motorists with an opportunity to modify their sailing plans based on breaking news and unforeseen and unusual circumstances. Locate highway advisory signs equipped with a flashing yellow beacon along the highway in advance of ferry terminals to advise motorists to tune in to the highway advisory radio. Consider temporary highway advisory radio signs when terminal projects will create traffic delays for long time periods. Locate ferry advisory signs at the terminal to provide similar information as that of the HAR, but with the addition of security information and regulatory information. The ferry advisory signs do not require flashing beacons.

(6) Internet

The internet is another source of wayfinding. Although not a terminal design element, the internet can be used in conjunction with terminal design to supplement terminal wayfinding systems.

WSDOT has a Washington State Ferries website which includes information such as terminal project web pages, ferry routes, sailing schedules, fares, reservations, and terminal directions. Where applicable, coordinate with WSDOT staff regarding website updates which can help achieve a project purpose.

570.05 Signage Functions

The function of WSF terminal signage is to direct, identify, inform, regulate or permit the travelling public at WSF terminals. In addition, sign codes, life safety issues and disabled access guidelines need to be addressed to meet national, state and local requirements.

A good sign system provides clear information where needed without overwhelming the user with too much information. Successfully designed signage helps visitors reach their destinations, makes information accessible, and provides an enhanced experience for the user.

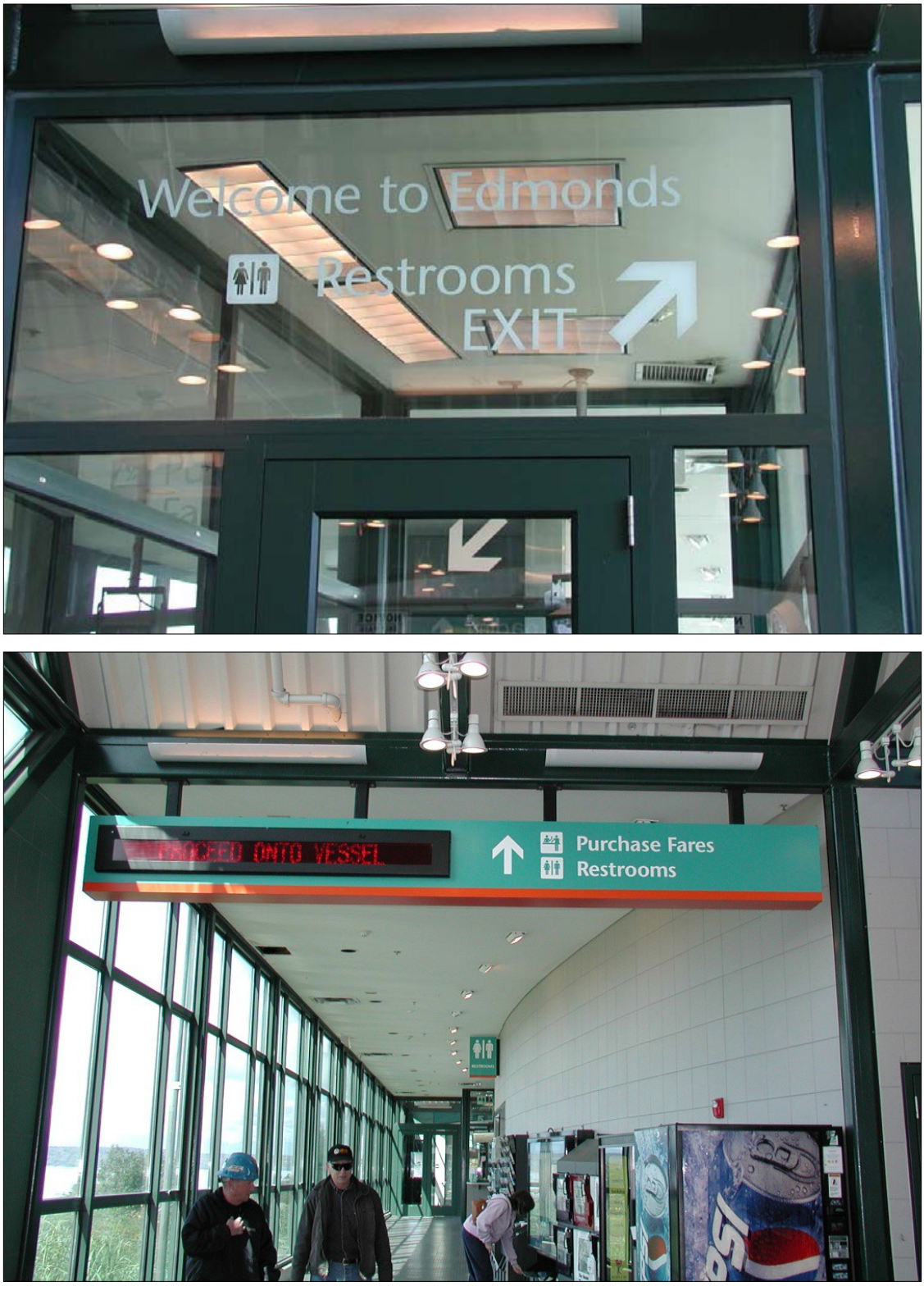
(1) Directional Signs

Directional signs guide users to the terminal, through the terminal site and buildings, and to their destinations within the terminal facilities. The main function of directional signs is to increase the flow of passengers through the system by helping customers reach their destinations efficiently.

Provide directional signage to guide users to the following locations:

- Terminal Entrance
- Pedestrian Access Routes
- Passenger Building Entrance
- Customer Service
- Passenger and Bicycle Waiting Areas
- Fare Purchase Locations
- Vessel Boarding
- Priority and Special Use Loading Lanes
- Restrooms
- Passenger Conveniences
- Parking and Drop-off Zones
- Pet Areas
- Exit Signs
- Transit Locations
- Commuter Rail Stations
- Public Destinations of Special Interest

Locate directional signs where they will be readily noticed by passengers (pedestrians, bicyclists, and motorists) as they approach the terminal, terminal buildings and along the main corridors and pathways of the terminal buildings and site. In addition to signage for WSF facilities, provide directional signage for nearby public destinations of special interest including waterfront promenades, scenic outlooks, fishing piers, and historic and cultural landmarks. Provide sufficient signage that is concise so that passengers can make informed decisions without having to stop and read the signs.



Interior Directional Signage
Exhibit 570-3













Exterior Directional Signage
Exhibit 570-4

(2) Identification Signs

Identification signs are used throughout the terminal buildings and terminal site to indicate the presence of a particular space, function, amenity, utility or piece of equipment. Some examples of identification signs are provided in Exhibit 570-5.



Restrooms



Bicycle Waiting Area



Equipment Signage



Equipment Signage



Phone



Fire Extinguisher

Identification Signs
Exhibit 570-5

(3) Informational Signs

Provide informational signage near the passenger building entrance, within the passenger waiting area, and throughout the terminal buildings and site. Information boards provide passengers with interactive information about WSF terminals and operations. Consider providing these signs as electronic messaging signs. EMS signs allow WSF operations staff to update relevant information when needed as well as convey multiple messages with a single sign.

Common informational signs include:

- Customer service schedule information
- Departure schedule/status
- General fare rates
- Concessions information
- Educational, cultural and historic information



WSF Informational Display



Transit Schedule Kiosk



Educational Signs



WSF Route Map and Schedule Display

Informational Signs, Displays, and Kiosks
Exhibit 570-6

Provide informational kiosks that display ferry, transit and community notices including directional signage that provides pedestrians with wayfinding systems to ferry passenger services.

Consider providing educational signage highlighting historical background, areas of public interest, marine ecology, and other relevant topics.

Also consider providing signs educating the public on WSF's commitment to the environment. Use interpretive signage to highlight special functions such as bioretention cells, rainwater reuse, and water quality issues in the Puget Sound.

(4) Regulatory Signs

Regulatory signs alert transportation system users to applicable laws or regulations, and provide information and instructions required for compliance. Regulatory signs, whose installation is required for enforcement of a law, are listed in Exhibit 570-7.

Some Rules of the Road (RCW 46.61) are not enforceable unless appropriate signs are posted. The following signs must be installed to enforce a regulation (RCW). Refer to WSDOT *Sign Fabrication Manual* for sign numbers. Place these signs at the point of regulation or where the prohibition begins and ends.

Sign Message	WSDOT Sign Number	RCW
Stop & Yield	R1-1 & R1-2	47.36.110
Speed Limit	R2-1	46.61.405
Parking Restrictions	R7 Series	46.61.575
Reserved Parking For Disabled Persons	R7-801	46.61.581
No Stopping Restrictions	R8 Series	46.61.570
Pedestrian Prohibition	R5 Series	WAC 468-58-030
Weight Restrictions, etc.	R12 Series	46.61.450

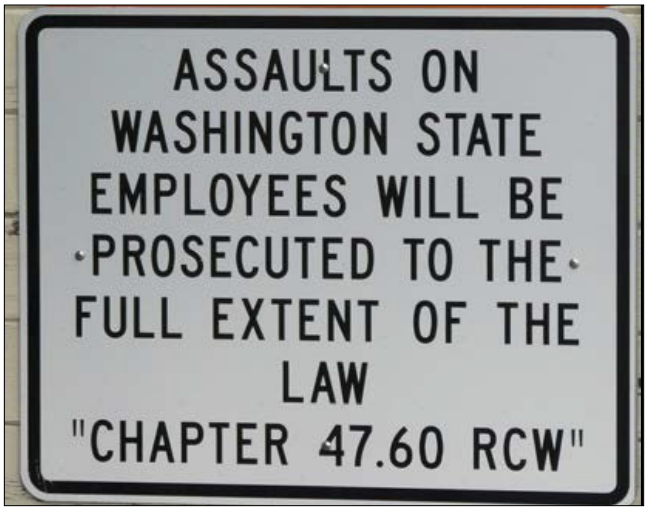
Signs Required for Law Enforcement
Exhibit 570-7

Second Substitute Senate Bill 6109 states that "Signage must be prominently displayed at each terminal and on each vessel that informs the public that assaults on Washington state employees will be prosecuted to the full extent or the law." Display this signage in high traffic areas and in highly visible locations such as at the terminal building entrance, at the front of the toll booths, and in the vehicle holding area.

Exhibit 570-8 gives some additional examples of regulatory signs that are commonly found at WSF terminals.



No Gas Cans Aboard Ferries



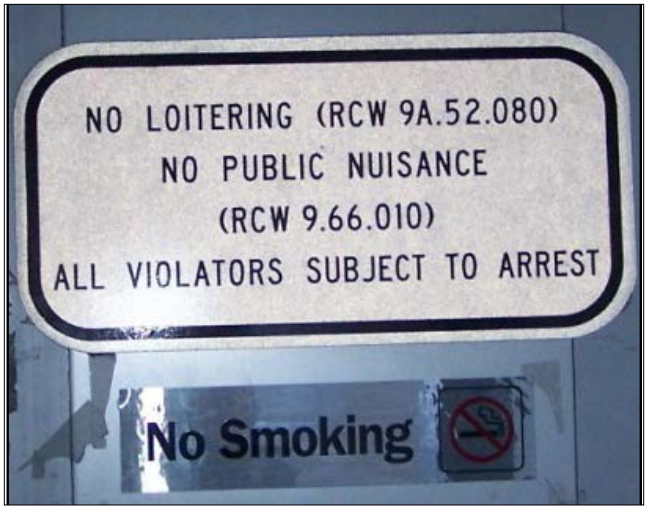
Assaults on State Employees



No Diving



Maximum Occupancy



No Loitering / No Smoking



No Solicitors

Regulatory Signs
Exhibit 570-8

(5) WSF Policy Signs

WSF Policy signs are signs that are intended to control activities at the terminal, but which are not strictly enforceable by law. Some examples of WSF policy signs are shown in Exhibit 570-9.



No Skating or Skateboarding



No Idling



Keep Pets on Leash



Do Not Feed Birds

WSF Policy Signs
Exhibit 570-9

(6) ADA and Universal Design Signage

The Americans with Disabilities Act consists of a series of national guidelines developed to help persons with disabilities achieve equal access to all public spaces in America. These guidelines require that most destinations in a public building which are identified with a sign have Braille and tactile identification information in order to provide orientation to the blind and visually impaired population. These guidelines also require signage and needs accommodations throughout public buildings and sites. Refer to Chapter 300 for additional information.

Provide ADA signage and tactile identification information as required by law. This includes but is not limited to signage for ADA permitted parking spaces and pick-up

drop off areas, tactile identification information at curb ramps and various additional locations, and signage displaying contact information for obtaining assistance for passengers with disabilities. In addition, provide signage indicating "Service Animals Welcome" near the terminal entrance. Service animal signs should be rectangular, blue, include Braille, and have the international symbol for accessibility. Refer to WSDOT signing guidelines for additional information on standard letter height, font, etc.

In addition to mandated requirements for disabled access, growing segments of the American population require other needs accommodations. Universal Design is a term applied to providing facilities and products that are inherently accessible to both people without disabilities and people with disabilities. Below are some examples of how signage and wayfinding is applied to ADA and Universal Design.

- Bright and appropriate lighting
- Clear lines of sight to reduce dependence on sound
- Use of meaningful icons with text labels
- Auditory output redundant with information on visual displays
- Visual output redundant with information in auditory output
- Contrast controls on visual output
- Volume controls on auditory output
- Choice of language on speech output
- Closed captioning on television networks
- Signs with light-on-dark visual contrast
- Instruction that presents material both orally and visually
- Large-print labels on equipment control buttons

WSF currently provides audible messaging at its terminals to accommodate the blind/low vision population and is working towards incorporating visual paging to accommodate the deaf/hard of hearing population. Provide visual paging information for all electronic sign systems in consultation with WSDOT's ADA Manager. See *Electronic and Information Technology Accessibility Standards (Section 508), Subpart B* for specific information on technology requirements. Refer to the *ADA Standards for Accessible Design* for the physical mounting of visual paging signs, colors of signs, and size of signs.



ADA Reserved Parking



ADA Assistance



ADA Load/Unload

ADA Signage
Exhibit 570-10

(7) Security Signage

The following security-related signage is incorporated at WSF terminals:

- MARSEC Level Signs are required at the entrance to the terminals in front of the toll booths.
- Signs indicating public areas are subject to video monitoring
- Signage at the OHL transfer span stating that once loading has begun, the captain's permission is required to disembark the vessel.
- No Loitering/ Public Nuisance signs. Violators are subject to arrest.
- Employee Access Only
- Restricted Area
- No Trespassing



No Trespassing



No Loitering / No Public Nuisance



OHL Transfer Span Security Signage

Security Signage
Exhibit 570-11



MARSEC Level



Items Prohibited on WSF Facilities



Restricted Area



Video Monitoring



Vehicle Screening and Inspection



Employee Access Only

Security Signage
Exhibit 570-11 (continued)

570.06 Signage Manuals

Signage manuals help promote the use of consistent signage making signing more effective. Consult the WSF Terminal Signage Standards Manual and the *Manual on Uniform Traffic Control Devices* in the design of signage systems at WSF facilities. An example WSF terminal signage plan is included in Appendix T. Refer also to the *Sign Fabrication Manual* and the *Standard Plans* M 21-01 for work zone traffic control signage.

(1) WSF Terminal Signage Standards Manual

The WSF Terminal Signage Standards Manual, available on the WSF Reference Library, provides guidelines for a uniform and consistent sign program throughout the Washington State Ferry System. The sign program utilizes international symbols and is compliant with the Americans with Disabilities Act to create a highly effective and easily understood information flow that can be quickly processed by all persons and keeps users moving efficiently to their destination.

The manual includes layouts (standard colors, text, and symbols), fabrication technique, materials, installation and mounting locations. Sign types are designed to accommodate the majority of information to be presented by the WSF System. Coast Guard required signs are also included to accommodate regulatory and emergency information as necessary.

(2) Manual on Uniform Traffic Control Devices (MUTCD)

Locate traffic control signs as necessary throughout the terminal. The *Standard Specifications* for MUTCD signs are determined by the USDOT and WSDOT and are not included in the WSF Terminal Signage Standards Manual.

MUTCD Location	Sign Type
Chapter 2B	Regulatory Signs, Barricades, and Gates
Chapter 2C	Warning Signs and Object Markers
Chapter 2D	Guide Signs – Conventional Roads
Chapter 2E	Guide Signs – Freeways and Expressways
Chapter 2F	Toll Road Signs
Chapter 2G	Preferential and Managed Lane Signs
Chapter 2H	General Information Signs
Chapter 2I	General Service Signs
Chapter 2J	Specific Service Signs
Chapter 2L	Changeable Message Signs
Chapter 2M	Recreational and Cultural Interest Signs
Chapter 2N	Emergency Management Signs
Part 6	Work Zone Signs
Part 7	School Area Signs
Part 8	Railroad and Light Rail Signs
Part 9	Bicycle Facility Signs

MUTCD Sign Type References
Exhibit 570-12

570.07 Signage by Location

(1) Building Signage

Building signage has both an interior and an exterior component. Exterior building signage is concentrated near the terminal entrance, much of it posted on the wall outside the building entrance. Interior building signage is located throughout the building, but is concentrated in high use areas such as passenger waiting and passenger loading areas. Design building signage to comply with the WSF Terminal Signage Standards Manual.

Provide signage for:

- Terminal building identification/entrance
- MARSEC level
- Items prohibited on WSF facilities
- Assaults on Washington State Employees will be prosecuted
- Fare purchase locations and fare rates
- Directions for walk-ons to terminal and overhead walkway
- Directions for bicycles to vehicle toll booths
- Unclaimed bicycle information
- Unclaimed baggage/package restrictions
- Telephones/vending areas
- Restrooms
- No smoking
- Customer service
- Schedule information
- Departure schedule/status
- Concessions and retail
- Maximum occupant load
- Fire extinguisher locations
- Exit locations
- Emergency evacuation/exit plan
- Transit /commuter rail information
- Shuttles/taxis
- Directions to pet area
- Accessibility information

Exhibits 570-13 and 570-14 give examples of interior and exterior building signage at WSF terminals. For additional building signage examples, refer to directional and informational signage examples shown in Exhibits 570-3 through 570-6.



Passenger Building Fare Collection



Passenger Ticket Booth Signage



Restroom ID Sign with Braille



No Smoking Sign



Phone Directional Sign



Fire Extinguisher Identification

Interior Building Signage
Exhibit 570-13



Anacortes Passenger Building



Pt. Defiance Passenger Building



Unclaimed Bicycles / Unattended Baggage



Vashon Passenger Building



Edmonds Passenger Building



Passenger Building Identification Sign

Exterior Building Signage
Exhibit 570-14

(2) Access, Approach and Exit Signage

Below are examples of signage used at the approach, entrance and exit to the terminals.



Directional Signage to Terminal



Waiting Area Warning Sign



Ferry Wait Time Signage



Directional Signage to Terminal



Ferry Holding Lane Signage



Ferry Holding Lane Signage

Terminal Approach Signage
Exhibit 570-15



Ferry Holding Lane Signage



Ferry Holding Lane Signage



No Right Turn into Ferry Holding Lane



Ferry Traffic Yield to Right Turns



Ferry Traffic Lane Signage



Sign Bridge for Ferry Signal

Terminal Approach Signage
Exhibit 570-15 (continued)



Exit Lane Signage



Posted Exit Speed Limit



Lights On?



Pedestrian Crossing



Vertical Clearance



Do Not Enter

Entrance and Exit Signage
Exhibit 570-16

(3) Toll Plaza Signage

The toll plaza is a very busy location for signage. There are numerous messages to convey to the terminal user, and the space can be quite congested. Use care in locating signage so that it can be easily seen, read and understood.

(a) Advance Signing

Advance signing is recommended especially where Electronic Fare Collection (EFC) and other mixed payment types are combined at toll plazas. The advance signs should warn of the Toll Plaza Ahead and, if appropriate, regulatory signs should identify which lanes to use for each payment type and any vehicle restrictions. Toll rate information should also be included on the advance signs or supplemental signs to give motorists notice of the required payment at the toll booths.

(b) Lane -use Signals

Lane-use signals are used at toll lanes to indicate an open or closed status. WSF is transitioning away from the use of the downward pointing green arrow to indicate a lane is open and a red X to indicate a lane is closed (see Exhibit 570-18) in favor of EMS signs at the toll booths which indicate "open" in green, "closed" in red or a particular function such as "pre-ticketed vehicles only" in green (see Exhibit 570-17).



Lane Closed Indicator Lane Open Indicator

Toll Booth Lane Status Indicators
Exhibit 570-17

(c) Toll Booth Signage

Toll booth signage includes:

- Fares, ticket sales and toll collection information
- Security information (vehicle inspection and MARSEC level)
- Hazardous and restricted materials regulations
- Tall vehicle (over 7' 6") marker and operational guidance signage
- ADA information



Toll Booth Signage
Exhibit 570-18



Tall Vehicles / No Gas Cans Aboard Ferries



Avoid Toll Booth When Turning



Signage Near Ticket Window



Signage Near Ticket Window



All Vehicles Must Stop at Toll Booth

Toll Booth Signage
Exhibit 570-18 (continued)

(4) Vehicle Holding Area Signage

Provide the following signage in or in advance of the vehicle holding area. Refer to Section 570.07(8) for additional signage pertaining to trestles.

- Directional signage to the terminal building
- Directional signage to outdoor restrooms, where applicable
- Operational signage for vehicle holding lanes
- Bicycle waiting area signage (see Exhibit 570-25)
- Motorcycle and carpool lane markings (see Exhibit 570-21)
- No idle zone signage (see Exhibit 570-23)
- Pet leash restrictions and clean up requirements (see Exhibit 570-23)



Vehicle Holding Lane Sign Bridge



Priority Loading Lane Designation



Lane Use Signage



Wide Vehicle Lane Use Signage

Vehicle Holding Lane Signage
Exhibit 570-19

(5) Parking Signage

Parking signage includes directional, identification, informational, and permit signage. This signage addresses such areas as loading/unloading zones, passenger parking, ADA parking, employee parking, and carpool parking. Some common signage examples are shown below.



Passenger Load Only



Employee Parking



Pick Up/Drop Restrictions



Pick Up and Drop Off Only



Carpool Permit Signage



Directional Signage to Parking

Parking Signage
Exhibit 570-20

(6) Multimodal Facilities Signage

Provide signage for multimodal facilities including but not limited to transit, commuter rail stations, car pool and vanpool accommodations, and motorcycle and HOV lane markings.



Commuter Rail Sign



Transit Sign



HOV Parking Space Markings



Motorcycle Lane Markings



Commuter Rail Sign



HOV Lane Signage

Multimodal Signs
Exhibit 570-21

(7) Site Utilities Signage

Mark site utilities both for identification purposes and for safety reasons. Utility signage includes but is not limited to the following:

- Fire hose and hydrant locations
- Water and sewer line information
- Buried natural gas lines
- Telephone
- Fiber optic
- Wireless network
- Power (include restricted access, danger and high voltage warning signs)



Fire Hose



Wireless Network



Telephone Service



Fire Hydrant Identification

Site Utility Signage
Exhibit 570-22

(8) Trestle Signage

Signage displaying the following messages, or similar, is commonly displayed on WSF trestles. See also 570.07(4) where holding lanes are located on the trestle.

- OSHA/WSHA signage, e.g. trestle load rating (29 CFR Part 1917.111b)
- Bicycle waiting area (see Exhibit 570-25)
- Motorcycle and carpool lane markings (see Exhibit 570-21)
- No idle zone signage
- Pet leash restrictions and clean up requirements
- Oil spill containment boom signage (see Exhibit 570-26)
- Parking information and restrictions
- Miscellaneous regulatory signage



No Fishing



No Skating or Skateboarding



No Diving



Keep Pets on Leash



No-Idle Zone



Do Not Feed Birds



Gas Can Storage



No Smoking within 50 Feet



Restricted Pick-up & Drop-off

Common Trestle Signage
Exhibit 570-23



Trestle Signage at Vashon Ferry Terminal
Exhibit 570-24



Trestle Signage at Edmonds Ferry Terminal
Exhibit 570-25



Trestle Signage at Edmonds Ferry Terminal
Exhibit 570-25 (continued)



Trestle Oil Spill Containment Boom Signage
Exhibit 570-26

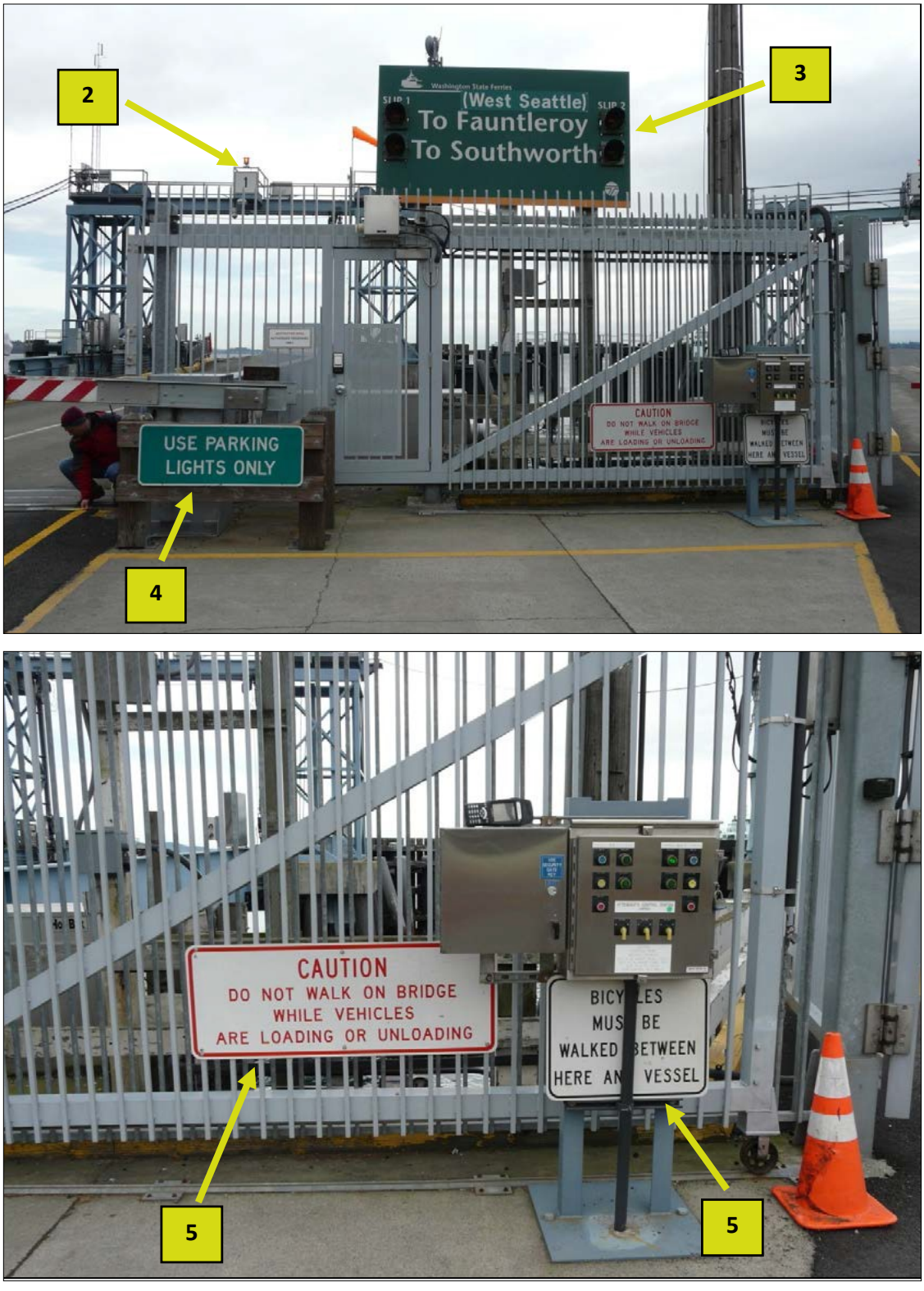
(9) Vehicle Transfer Span Signage

Signage conveying the following information, or similar, is commonly displayed at WSF vehicle transfer spans. Refer to Exhibits 570-27 and 570-28 for examples of vehicle transfer span signage at existing terminals.

1. Security restrictions, e.g.
   - Restricted Area, Authorized Personnel Only
   - Employee Access Area, Authorized Personnel Only
2. Slip Number
3. Ferry Destination
4. Parking Lights Only, e.g.
   - Use Parking Lights Only
   - Lights Out Please
5. Bicycle and Pedestrian Loading Procedures, e.g.
   - Caution, Do Not Walk on Bridge While Vehicles are Loading or Unloading
   - Bicycles Must Be Walked Between Here and Vessel
   - Bicycles will Load Only Before or After All Auto Traffic
   - Passengers and Bikes Please Wait Here for Attendant
   - Bicycles Wait Here for Attendant
6. Priority Vehicle Loading Information (locate in advance of the vehicle transfer span)
7. OSHA/WSHA signage, e.g. loading ramp load limit (29 CFR Part 1918.86b)



Security Signage on the Vehicle Transfer Span Gate Arm
Exhibit 570-27

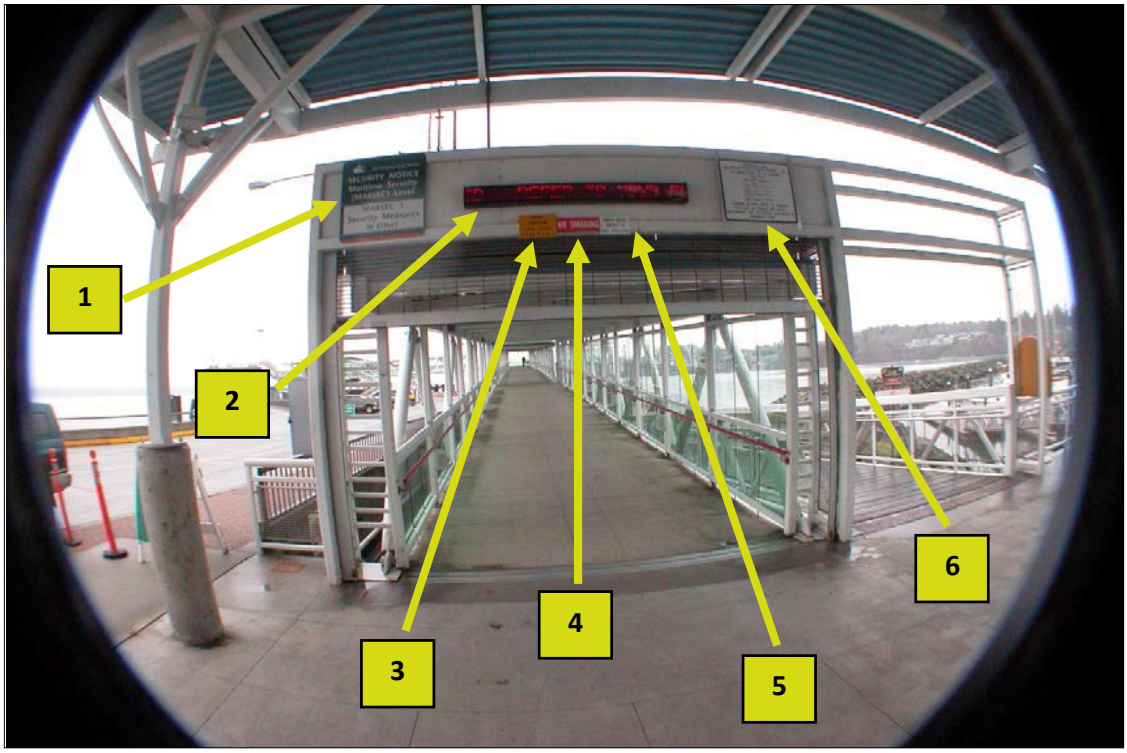


Vehicle Transfer Span Signage at Vashon Terminal
Exhibit 570-28

(10) Passenger Overhead Loading Signage

Signage displaying the following messages, or similar, is commonly displayed at WSF passenger overhead loading transfer spans (see Exhibits 570-29, 570-30 and 570-31).

1. MARSEC Level
2. Passenger Loading Information (variable message sign)
3. Maximum Uniform Live Load (see 29 CFR Part 1918.86b for OSHA/WISHA signage)
4. No Smoking
5. Public Areas Subject to Video Monitoring
6. Prohibited Items
7. Vertical Clearance Signage (16 FT 0 IN)
8. Passenger Loading Directional Signage
9. Notice – Only Paid Passengers Beyond this Point
10. Notice, - Once Loading Has Begun, the Captain's Permission is Required to Disembark, - Terminal and Vessel Public Areas Subject to Video Monitoring
11. No Skateboarding Allowed (not shown)
12. Do Not Make Adjustments While Passengers are On Transfer Span (not shown)



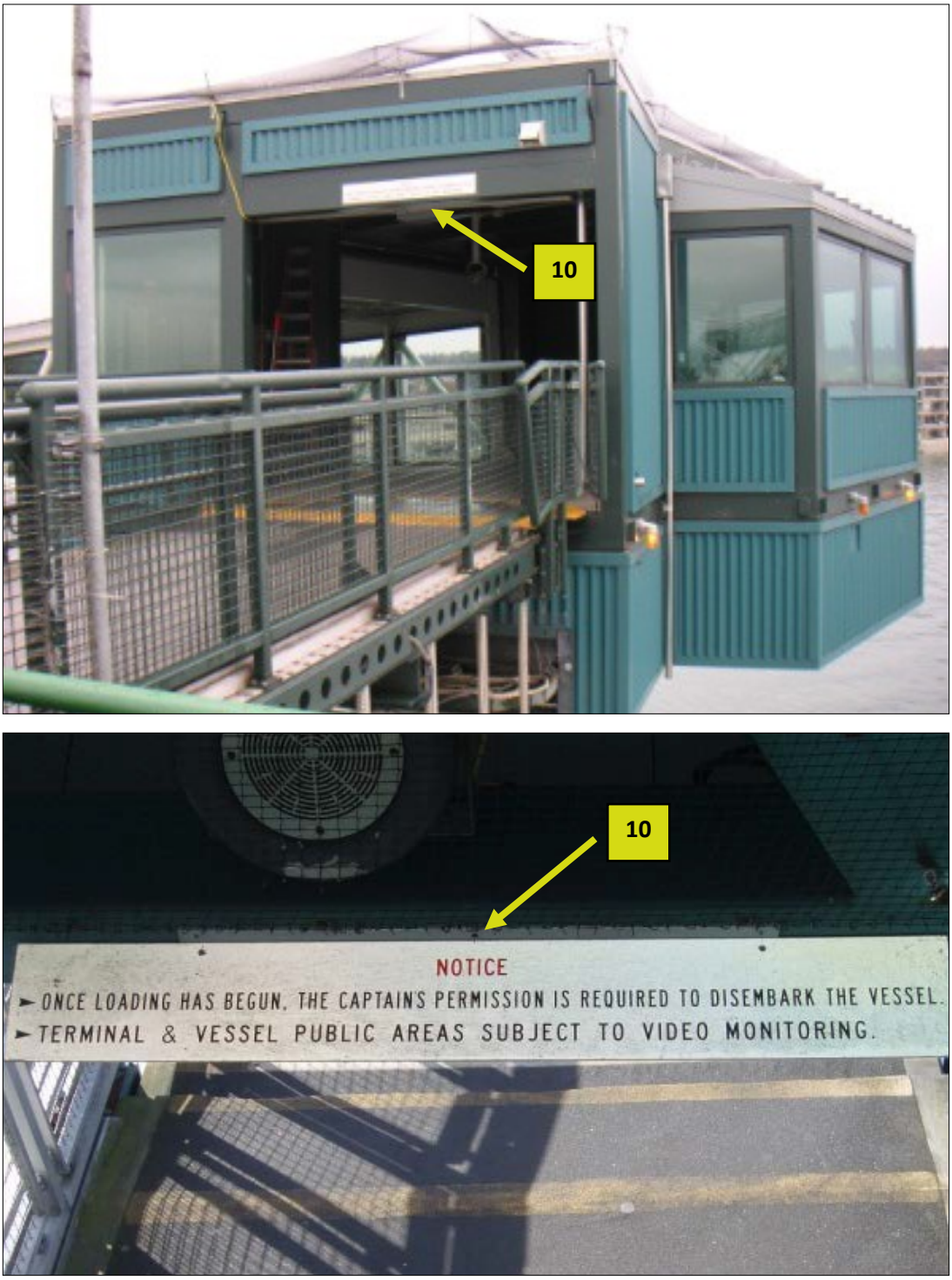
Passenger Overhead Loading Signage at Kingston Terminal
Exhibit 570-29



Passenger Overhead Loading Signage at Kingston Terminal
Exhibit 570-29 (continued)



Passenger Overhead Loading Signage at Edmonds Terminal
Exhibit 570-30



Passenger Overhead Loading Security Signage
Exhibit 570-31

(11) Slip and Wingwall Signage

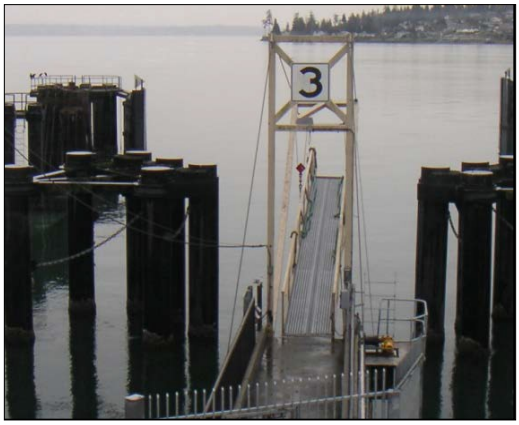
Signage identifying the slip number is provided at each slip. In addition, signs displaying the message "For Safety Do Not Start Motor Until Directed By Crew" are mounted on the top of both the right and left wingway of each slip. These are intended to instruct motorists onboard the vessels. See Exhibit 570-32.



Slip Identification Sign



Slip Identification Sign



Slip Identification Sign



Slip Identification Sign



Wingwall Signage Locations



Wingwall Signage Detail

Slip and Wingwall Signage
Exhibit 570-32

(12) Fixed and Floating Dolphin Signage

Navigational arrows, which point to the slip entrance, are typically mounted on the fixed and floating dolphins. No trespassing signage is also commonly located on the dolphins.



Fixed Dolphin Navigational Arrows



Sign Detail



Sign Detail



Floating Dolphin Navigational Arrows



No Trespassing Sign Location



Sign Detail

Fixed and Floating Dolphin Signage
Exhibit 570-33

Chapter 580 Sustainability/Low Impact Development

Future chapter

Division 6 Waterside Development

Chapter 600 Trestle 600-1
600.01 General 600-1
600.02 References 600-4
600.03 Design Considerations 600-5
600.04 Trestle Components 600-8
600.05 Trestle Civil Design 600-11
600.06 Trestle Structural Design 600-11
600.07 Bulkhead Structural Design 600-14
600.08 VTS Bridge Seat Structural Design 600-15
600.09 Trestle Utilities 600-16
Chapter 610 Vehicle Transfer Span 610-1
610.01 General 610-1
610.02 References 610-3
610.03 Design Considerations 610-4
610.04 VTS Components (H-Span) 610-8
610.05 VTS Gradients 610-11
610.06 Structural Design Criteria 610-13
610.07 VTS Piped Utilities 610-23
610.08 Mechanical Design Criteria 610-25
610.09 Electrical Design Criteria 610-36
Chapter 620 Passenger Overhead Loading 620-1
620.01 General 620-1
620.02 References 620-4
620.03 Design Considerations 620-6
620.04 OHL Components 620-10
620.05 Structural Design Criteria 620-14
620.06 OHL Utilities 620-16
620.07 Mechanical Design Criteria 620-18
620.08 Electrical Design Criteria 620-31
620.09 Architectural Design Criteria 620-36

Chapter 630 Wingwalls 630-1
630.01 General 630-1
630.02 References 630-3
630.03 Design Considerations 630-4
630.04 Design Criteria 630-5
630.05 Wingwall Alternatives 630-8
630.06 Miscellaneous Design 630-9
Chapter 640 Fixed Dolphins 640-1
640.01 General 640-1
640.02 References 640-2
640.03 Design Considerations 640-3
640.04 Design Criteria 640-4
640.05 Fixed Dolphin Alternatives 640-6
640.06 Miscellaneous Design 640-7
Chapter 650 Floating Dolphins 650-1
650.01 General 650-1
650.02 References 650-2
650.03 Design Considerations 650-3
650.04 Design Criteria 650-4
650.05 Stability 650-9
650.06 Anchor System 650-10
650.07 Fender System 650-10
650.08 Towing System 650-10
650.09 Miscellaneous Design 650-10

Chapter 600 Trestle

600.01 General
600.02 References
600.03 Design Considerations
600.04 Trestle Components
600.05 Trestle Civil Design
600.06 Trestle Structural Design
600.07 Bulkhead Structural Design
600.08 VTS Bridge Seat Structural Design
600.09 Trestle Utilities

600.01 General

This chapter provides guidance on the design of trestles, bridge seats, and bulkheads. The trestle is a pile-supported structure, as shown in Exhibit 600-1, which serves as a roadway connection from the bulkhead to the vehicle transfer span (VTS). For some terminals, the vehicle holding area is fully or partially located on the trestle. Various terminal outbuildings, enclosures and support areas may also be located on the trestle. Exhibit 600-2 and Exhibit 600-3 show an example layout of a trestle in plan and cross section, respectively. In this example, the vehicle holding area is exclusively located on the trestle.

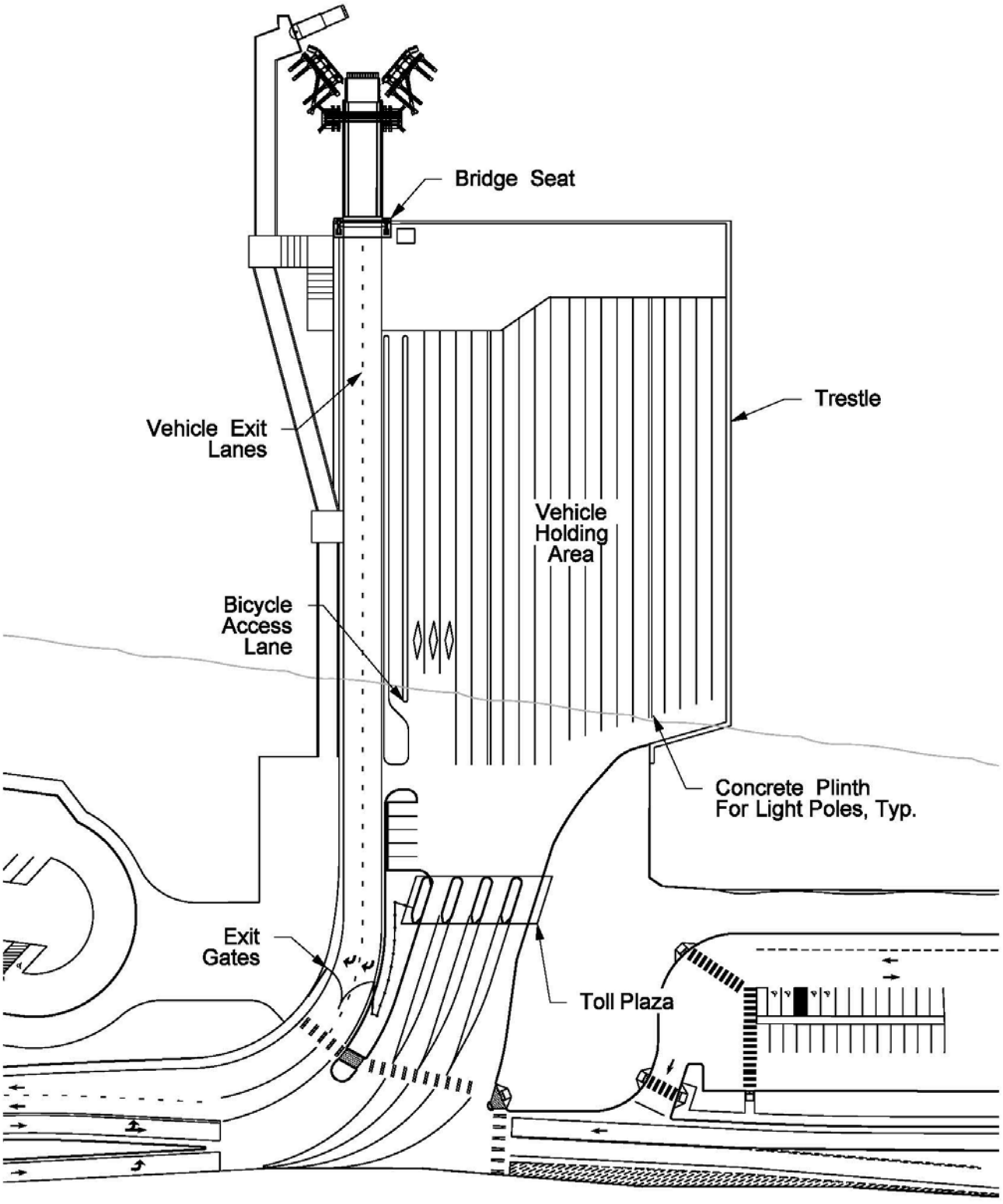
The trestle may also provide a pedestrian access path from the bulkhead to the terminal building. Further, the trestle may serve as the support structure for the overhead loading (OHL), VTS, terminal buildings, and various utilities, related equipment and structures. Use the trestle to run utilities from the land to the vehicle transfer spans. For recommendations on routing utilities, locating light posts and trench drains, refer to Section 600.09.



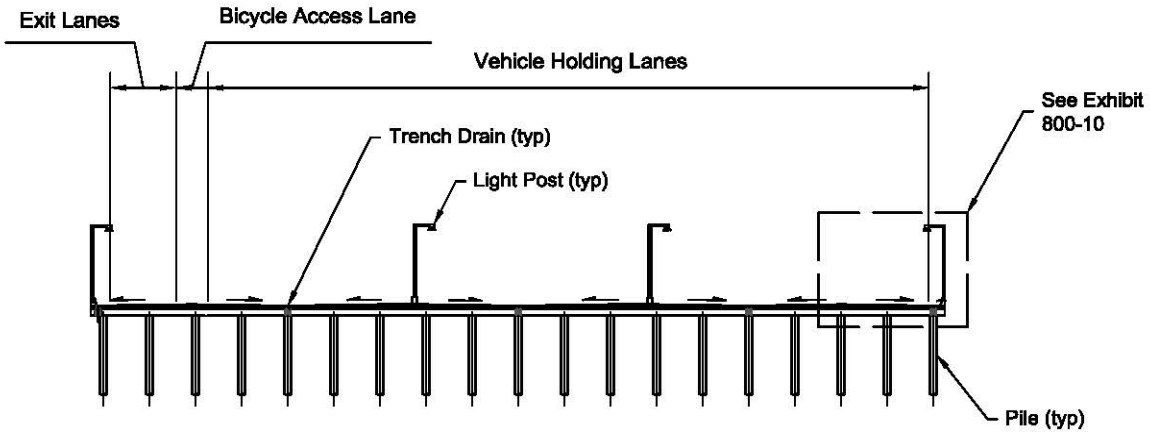
Clinton Trestle Substructure
Exhibit 600-1

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
330	Marine
340	Civil
360	Electrical
440	Maintenance Buildings, Enclosures and Support Areas
500	Access, Approaches, and Exits
510	Toll Plaza
520	Vehicle Holding and Support Areas
560	Site Utilities
570	Signage and Wayfinding
610	Vehicle Transfer Span
620	Passenger Overhead Loading



Example Trestle Plan
Exhibit 600-2



Example Trestle Cross Section
Exhibit 600-3

600.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

28 CFR Part 35 *Nondiscrimination on the Basis of Disability in State and Local Government Services*

49 CFR Part 39 *Transportation for Individuals with Disabilities – Passenger Vessels*

WAC 296-24 *General safety and health standards*

WAC 296-56 *Safety Standards - Longshore, stevedore and waterfront related operations*

WAC 296-876 *Ladders, portable and fixed*

(2) Design Codes and Specifications

AASHTO *LRFD Bridge Design Specifications* (AASHTO *LRFD Specification*), American Association of State Highway and Transportation Officials, Washington DC

AASHTO *Guide Specifications for LRFD Seismic Bridge Design* (AASHTO *Guide Specification*), American Association of State Highway and Transportation Officials, Washington DC

Bridge Design Manual LRFD, M 23-50

ASCE Seismic Design of Piers and Wharves, ASCE/COPRI 61-14, 2014, American Society of Civil Engineers, Reston, VA.

General Special Provisions

Highway Runoff Manual M 31-16

Reference Drawings, WSF

Regional General Special Provisions, WSF

Standard Specifications for Road, Bridge, and Municipal Construction M 41-10

(3) Supporting Information

Life Cycle Cost Model (LCCM), WSF

600.03 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible.

Additionally, 49 CFR Part 39 prohibits owners and operators of passenger vessels from discriminating against passengers on the basis of disability, requires vessels and related facilities to be accessible, and requires owners and operators of vessels to take steps to accommodate passengers with disabilities.

Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessel security requirements, and additional information pertaining to terminal design. Below are links to relevant sections by topic. Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for Transportation Worker Identification Certification (TWIC) and Sensitive Security Information (SSI).

- MARSEC Levels: 310.04
- Vessel Security: 310.05
- Waterside Structures: 310.09
- Access Control/Restricted Areas/TWIC: 310.10

(3) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

(4) Civil

Refer to Chapter 340 for general civil design criteria pertaining to the trestle. Below are links to relevant sections by topic.

- Design Vehicles: 340.07(6)
- Vehicle Turning Analyses: 340.07(7)

(5) Marine

Refer to Chapter 330 for marine criteria pertaining to the trestle. Below are links to relevant sections by topic.

- Operations and Maintenance: 330.04(4)
- Proprietary Items: 330.04(6)
- Long Lead Time Items: 330.04(7)
- Corrosion Mitigation: 330.04(9)
- Scour and Mudline Elevations: 330.04(10)
- Geotechnical Requirements: 330.04(11)
- Materials Specification: 330.04(12)
- Miscellaneous Considerations: 330.04(13)
- Tidal Information: 330.06
- Wave, Flood, and Coastal Storm Loading: 330.09(1)
- Paving: 340.08

(6) Electrical

Refer to Chapter 360 for general electrical design criteria pertaining to trestles. Below are links to relevant sections by topic.

- Wiring and Protection: 360.04
- Wiring Methods and Materials: 360.05
- Equipment: 360.06

(7) Design Life

Design life is based on the current *Life Cycle Cost Model* (LCCM) as required by the Washington State Office of Financial Management (OFM). Refer to Table 1 for the design life of new structures (as of 2007) and Table 2 for design life of structures prior to 2007, in the 2010 *Life Cycle Cost Model* Update (2010 LCCM) for information on when existing marine structures and their systems are due for replacement. Confirm design lives given below are consistent with the current LCCM. Replacement life may be reduced due to functional obsolescence.

- Trestle Substructure: 75 years
- Trestle Superstructure: 75 years
- Bulkhead: 75 years

(8) Elevation

The trestle elevations are controlled by the bulkhead elevation at the onshore end of the trestle, the bridge seat elevation at the offshore end of the trestle and any slope required for stormwater conveyance/treatment. Consider the following when selecting the bridge seat elevation: (1) resulting vehicle transfer span slopes; (2) trestle constructability; (3) trestle inspection needs; (4) anticipated sea level rise; (5) existing road profile/grade at shoreline/bulkhead; (6) storm surge/wave exposure.

Provide an elevation which is a compromise between keeping the trestle sufficiently high out of the seawater to keep it constructible (to avoid floating pile cap forms at high tide) and to minimize the potential for damage to the trestle/trestle utilities (from waves, sea level rise, storm surge and floating debris), and keeping it low enough to minimize the steepness of the vehicle transfer span at extreme low tides. It is advisable to provide adequate room beneath the trestle for post-seismic event inspections. Refer to Section 330.06(3) for information on anticipated sea level rise.

(9) Operational Classification

WSF trestles are operationally classified per the AASHTO LRFD *Specification* Section 1.3.5 as typical, not critical or essential, unless noted otherwise. The performance objective for "typical" bridges is life safety. See Section 600.06(1)(c) Limit States for use of this classification.

(10) Seismic Design

Perform seismic design of the trestle using a displacement-based design method in accordance with the AASHTO *Guide Specification* and supplemented as described herein. Design trestle for a design level earthquake (DLE) corresponding to a 7-percent probability of exceedance in 75 years (approximately a1000-year return period) with a life safety protection/collapse prevention performance objective. It is expected that the trestle will continue to support gravity loads after the DLE but may suffer significant damage and that significant disruption to service is possible.

Structures shall also be checked for an operational level earthquake event (OLE). This is an event in which no damage or only minor structural damage will occur, but a temporary interruption in service may occur.

This event corresponds to a 50-percent probability of exceedance in 75 years (approximately a 100-year return event). Expansion joint design and locations where the relative displacement of different structures could cause damage shall be checked for this level earthquake event. Soil parameters for developing seismic response spectra will be provided by the WSDOT Geotechnical Branch.

The designer shall identify in the general structural notes of the contract drawings the anticipated structural failure mode and locations for both the OLE and the DLE.

For seismic design of pile foundations, plastic hinging is limited to above ground and near-ground locations. In-ground plastic hinging is not permitted.

For geotechnical requirements, refer to Chapter 330.

(11) Accelerated Bridge Construction

Accelerated bridge construction methods such as precast concrete or steel bridge seat and trestle pile caps in the design are options where the duration of slip closures must be kept to a minimum. Use of these methods minimizes interruptions during construction and can be cost effective at terminals with high traffic volume.

(12) Expected Material Properties

Assess member capacities for earthquake loads using expected material properties in accordance with the AASHTO *Guide Specification*. Supplement expected material properties only where necessary by ASCE/COPRI 61-14.

(13) Signage and Wayfinding

Refer to Chapter 570 for requirements.

600.04 Trestle Components

(1) Superstructure

(a) Concrete Deck

Design the trestle deck to consist of precast prestressed concrete deck panels. A variety of deck panel types have been used successfully at WSF terminals. Design deck panel end connections for moment continuity over the pile caps to resist seismic forces and negative moments from super-imposed dead and live loads. Design the deck as a capacity-protected element, such that no inelastic deformations will occur. Yielding of the pile-to-cap connection is allowed.

Adjacent deck panels should be locked together by means of shear keys to allow for load sharing.

The depth of concrete deck members may be limited to prevent damage from floating logs and other debris at high tide.

(b) Pile Caps

The majority of trestle pile caps constructed at WSF terminals have been cast-in-place concrete. Precast concrete pile caps may be a feasible option for reducing environmental impacts associated with placing cast-in-place concrete over seawater and for accelerating the construction schedule. Two-stage pile caps consisting of precast base sections with cast-in-place connection pours may also be considered. Design pile caps as capacity-protected elements such that no inelastic deformations will occur.

Pile cap widths should be sufficient to allow for seated connection of deck panel ends above and for a concrete closure pour.

(2) Substructure

(a) Piling

Steel pipe piling and solid precast prestressed concrete piling have been used successfully at WSF.

Solid precast prestressed concrete piles are preferred due to their lower initial cost, resistance to corrosion, lower long term maintenance costs, and fewer requirements related to noise attenuation during impact driving. Permitting restrictions may prohibit pre-boring or jetting of pilot holes during the installation of solid precast concrete piles. However the difficulty in driving this type of pile into glacial till prevents them from being specified for most WSF projects.

Hollow precast prestressed concrete piles are not permitted due to concerns with their performance during an earthquake and the inability to inspect the interior of the piling afterwards.

Impact driving of steel piling will require the use of bubble curtains or other noise attenuation methods to reduce the impacts of pile driving on marine life. Steel and concrete pile capacities are to be verified (proofed) by driving at least the final portion of the pile with an impact hammer.

The optimal pile and bent spacing is based on providing the most efficient structural system with an emphasis on seismic performance and minimizing the number of piles required.

Documentation is required to demonstrate that the selected piling will achieve the design life specified in the LCCM.

(b) Plumb Piles

A ductile plumb pile system is the preferred foundation type.

(c) Batter Piles

Batter piles have performed poorly in past earthquakes. However, the use of batter piles is permitted provided the structure satisfies all force, displacement, and compatibility requirements due to seismic loading. In addition, the following restrictions apply:

1. Yielding of the tension batter pile at the cap connection is permitted in the DLE provided the hysteretic performance of the connection is considered. If sleeved dowels are used as a fusing mechanism for either solid concrete piles or pipe piles with a plug connection, calculate the permitted elongation in the dowels by multiplying the sleeve length by 50 percent of the strain limits in Exhibit 600-4.
2. Deck and pile caps are to be capacity-protected. Design deck and pile caps to resist 1.3 times the displacements associated with the lower bound geotechnical capacity of the piles and 1.3 times the forces associated with the upper bound geotechnical capacity of the piles.
3. It is prohibited to use pile buckling as a method of fusing the compression pile.

(3) Pile-to-Cap Connections

Pile-to-cap connections may be designed as full or partial moment connections provided they satisfy all displacement limits, ductility limits, strength, and lateral stability requirements.

During preliminary design, include consideration of a concrete plug connection created by extending dowels (reinforcing bars) into the cap from the pile. For steel pipe piles, anchor the dowels into a concrete plug cast into the pile. For prestressed concrete piles, grout the dowels into corrugated metal sleeves cast into the pile. The top of the pile may be isolated from the cap by placing a compressible material on the top and edges of the pile and a portion of the dowel lengths may be sleeved to debond them.

Connections created by extending prestressing tendons into the cap are not permitted.

Connections created by welding reinforcing bars to the steel pile are not permitted due to concerns about brittle fracture of the dowel.

Connections created by welding the top of a pipe pile to a steel plate embedded in a pile cap are not permitted.

Other connection types not discussed in this document will be permitted provided that the performance of the connection has been verified by testing, research, or analysis.

(4) Curbs, Barriers, and Railings

Trestle curbs, barriers, and railings are discussed in Section 600.06(1).

(5) Bulkhead

The bulkhead retains the soil at the landside end of the trestle and provides support for the first row of trestle deck panels. The bulkhead is discussed in Section 600.07.

(6) Bridge Seat

The bridge seat supports the vehicle transfer span at the trestle. Bridge seats are discussed in Section 600.08.

(7) Life Ladders and Life Rings

Locate life ladders and life rings in accordance with WAC 296-56-60115. Design life ladders to meet the requirements of WAC 296-56-60209 and WAC 296-876. WAC 296-56 has precedence over WAC 296-876.

(8) Vehicle Holding Area and Toll Plaza

Refer to Chapter 510 (Toll Plaza) and Chapter 520 (Vehicle Holding and Support Areas) for requirements.

(9) Bicycle Access Lanes

Refer to Chapter 510 for requirements.

(10) Pedestrian Access

Refer to Chapter 500 for requirements.

(11) Exit Lanes and Exit Gates

Refer to Chapter 500 for requirements.

(12) Terminal Outbuildings, Enclosures and Support Areas

Refer to Chapter 440 for requirements.

600.05 Trestle Civil Design

This section addresses civil design elements that are specific to the trestle, including the trestle design speed, posted speed, and grading. Refer to Chapter 340 for additional civil requirements including site preparation, grading and erosion control, design vehicles, roadway design and channelization, paving, and traffic control.

(1) Design Speed and Posted Speed

Determine trestle design speed and posted speed on a terminal-by-terminal basis. Note that the trestle barrier to be used for new and replaced trestles is independent of the design speed (refer to Section 600.06).

(2) Grading

The trestle surface should be graded to provide proper conveyance of stormwater per WSDOT *Highway Runoff Manual* requirements. Additional guidelines specific to the design of ferry terminal drainage is contained in Section 600.09 and Chapter 560.

600.06 Trestle Structural Design

(1) New Structures

(a) Design Codes

Design trestle in accordance with the following:

1. Design for all loads, except seismic, is governed by the AASHTO *LRFD Specifications*.
2. Seismic design is governed by the AASHTO *Guide Specifications* and supplemented as described in these criteria.
3. The AASHTO *Guide Specifications* is the controlling specification for seismic design and takes precedence over other criteria; however, where the AASHTO *Guide* does not provide specific displacement-based design specifications, *ASCE Seismic Design of Piers and Wharves* (ASCE/COPRI 61-14) may be used to supplement the AASHTO *Guide Specifications*.
4. Supplement design with WSDOT *Bridge Design Manual LRFD* (BDM).

Design curb, barrier and railing in accordance with the AASHTO *LRFD Specifications*. Provide TL-4 barrier for new trestle design regardless of trestle design speed.

Design ladders in accordance with WAC 296-56, WAC 296-876 and ANSI/AISC 360. WAC 296-56 has precedence over WAC 296-876.

WSF must approve any deviation from these design codes not specified below. Include a signed deviation in the Project File (PF)/Design Documentation Package (DDP). Refer to Section 220.05 for details on the PF/DDM.

(b) Design Life

Design life of the trestle is based on deterioration from corrosion and/or fatigue in accordance with Section 600.03(7). The design life of all structural elements, including steel piling, must be documented by analysis, testing, and/or research to demonstrate how the trestle design life identified in the LCCM will be met.

(c) Limit States

Utilize Limit States as specified in the AASHTO *LRFD Specifications*, Section 1.3.

Factor Relating to Ductility:	$\eta_D = 1.0$	For Conventional Designs and Details Complying with the AASHTO *LRFD Specifications*. Notify WSF if the value of η_D is not 1.0.
Factor Relating to Redundancy:	η_R	Determine During Design
Factor Relating to Operational Importance:	$\eta_I = 1.0$	For Typical Bridges

(d) Design Loads

The permanent and transient loads listed below apply.

1. **Permanent Loads**

DC **Dead Load of Structural Components and Nonstructural Attachments**

DW **Dead Load of Wearing Surfaces and Utilities**

CR **Force Effects Due to Creep**

DD **Downdrag Force**

EH **Horizontal Earth Pressure Load**

SH **Force Effects Due to Shrinkage**

2. **Transient Loads**

BR **Vehicular Braking Force**

Place braking force in all design lanes but do not combine with seismic loading.

CV **Vessel Collision**

Collision between a vessel and trestle need not be considered.

EQ **Earthquake Load**

Refer to Seismic Design in Section 600.03.

FL **Fatigue Load**

Design fatigue load in accordance with the AASHTO *LRFD Specifications*. WSF will provide site-specific $ADTT_{SL}$ and ADO.

LL **Vehicular Live Load**

Design trestle for HL-93 loading. The number of design lanes is equal to the number of traffic lanes. Design loading may be oriented in more than one direction on the trestle. Consider the orientation causing the maximum forces on the structural members for design.

For the DLE, use a vehicular live load of 640 pounds per feet (distributed over 10-foot lanes) and a vehicular live load factor γ_{EQ} of 0.5. The associated mass of live load need not be included in the dynamic analysis. (***Note:*** Truck Lane Loading with HL-93 trucks need not be considered for DLE load combinations.)

TG **Force Effect Due to Temperature Gradient**

TU **Force Effect Due to Uniform Temperature**

ULL **Uniform Live Load**

WSF project specific trestle structural design criteria will specify what areas, if any, of the trestle are to be designed for a uniform live load of 250 psf.

Distribute loading to produce maximum forces. Compare the design for ULL with the design for LL; the loading causing the maximum forces on the structural members will control. Do not apply dynamic load allowance to ULL or to HL-93 design lane load. ULL is to accommodate future construction on the trestle such as buildings.

WA **Wave, Flood, and Coastal Storm Loading**

Refer to Section 330.09(1) for wave, flood, and coastal storm loading criteria.

WL **Wind on Live Load**

WS **Wind Load on Structure**

Design wind load on structure in accordance with the WSDOT *Bridge Design Manual LRFD* and the AASHTO LRFD Specification. The design water level elevation is 0.00 feet corresponding to Mean Lower Low Water (MLLW).

(e) Load Combinations

Apply load combinations and load factors in accordance with AASHTO LRFD *Specification*. WSF does not require evaluation of an owner specified design vehicle.

(2) Retrofitted Structures

< Section pending completion>

600.07 Bulkhead Structural Design

The bulkhead provides the transition between the upland and the trestle. It retains the upland soils and supports the shoreward-most precast concrete trestle deck panels.

(1) Bulkhead Alternatives

(a) Steel Sheet Pile Wall System

The most common type of bulkhead used in past trestle construction consists of steel pipe piles and steel sheet piles connected at their tops by a cast-in-place concrete cap. The pipe piles provide the principal vertical support for dead and live loads. The sheet piles retain the soil and resist the lateral loads resulting from traffic and seismic ground motions. Include measures to mitigate corrosion in the design of the sheet pile bulkhead through the use of coating and cladding materials.

(b) Soldier Pile Wall System

Where especially high lateral forces (e.g. liquefaction and lateral spreading) are a factor in the design of the wall, a soldier pile wall may be considered to provide greater resistance to the anticipated lateral forces.

(2) Design Criteria and Loads

Design the bulkhead in accordance with the same dead load and live load provisions as used for the trestle. Lateral earth pressures and surcharge loads will be provided by the WSDOT Geotechnical Branch.

600.08 VTS Bridge Seat Structural Design

The bridge seat supports the shoreward end of the vehicle transfer span and controls the elevation of the offshore end of the trestle (see Section 6000.03(7)). Bridge seat data for existing WSF terminals are provided in Exhibit 600-6. Surveyed bridge seat elevations are provided in Exhibit 340-3.

Bridge Seat Data			
Terminal and Slip	**Date Built**	**Pile Type**	**Bridge Seat Type**
Anacortes - Slip 1	1994	Steel	Concrete
Anacortes - Slip 2	2002	Steel	Concrete
Bainbridge - Slip 1	1995	Concrete	Concrete
Bainbridge - Slip 2	2006	Steel	Concrete
Bremerton - Slip 1	1990	Concrete	Concrete
Bremerton - Slip 2	1990	Concrete	Concrete
Clinton - Slip 1	2000	Steel	Concrete
Clinton - Slip 2	2003	Steel	Concrete
Coupeville	1979	Timber/Underground	Concrete
Eagle Harbor - Slip B	2006	Steel	Concrete
Eagle Harbor - Slip E	1981	Concrete	Concrete
Edmonds	1995	Steel	Concrete
Fauntleroy	1984	Timber w/ 2 30” Steel	Timber
Friday Harbor	2005	Steel	Concrete
Kingston - Slip 1	1986/2001	Concrete/Steel	Concrete
Kingston - Slip 2	1990	Concrete	Concrete
Lopez	1998	Steel	Steel
Mukilteo	1999	Steel	Steel/Timber
Orcas	1987	Steel	Concrete
Point Defiance	1994	Steel	Concrete
Port Townsend - Slip 1	2013	Steel	Concrete
Port Townsend - Slip 2	1982	Concrete	Concrete
Seattle - Slip 1[1]	1993	Concrete	Concrete
Seattle - Slip 2	1964	Timber	Timber
Seattle - Slip 3	1989	Steel	Concrete
Shaw	2004	30” Pipe w/ Anchors	Steel
Southworth	2002	Steel	Concrete
Tahlequah	1994	Steel	Concrete
Vashon - Slip 1	1997	Steel	Concrete
Vashon - Slip 2	1993	Steel	Concrete

[1] New slip location after 1993

Bridge Seat Data for WSF Terminals
Exhibit 600-6

During preliminary design of a new trestle, consider the bridge seat to be either integral with or isolated from the trestle. Select the configuration which is most cost effective. When a new bridge seat will be adjacent to an existing timber or concrete trestle, design the bridge seat to act independently of the trestle, where possible. Provide adequate distance between the two structures to ensure no or minimal damage results during the design seismic event. Use a concrete cap supported on piles for the design of the bridge seat. Where anchored pipe piles are required (e.g., where bedrock is at or near the mudline), a steel bridge seat may be more feasible for installation of the rock anchors.

The transfer of loads from the transfer span to the bridge seat occurs via two bearings at the bridge seat. An example is the hydraulic transfer span bearing shown in Exhibit 600-7. As a primary element of a movable bridge system, design of the bearing requires the participation of a mechanical engineer to ensure the pins and related parts are sized and specified for the anticipated loads.



Bainbridge Island Terminal H-Span Bridge Seat
Exhibit 600-7

600.09 Trestle Utilities

The trestle is used to convey several utilities which may include storm drainage facilities, sanitary sewer, domestic and fire water, gas, mechanical, electrical (power and lighting), and communications. These utilities support the ferry vessels in the slips and various other functions on the trestle. This section provides design guidance for trestle storm drainage conveyance and treatment, trestle lighting locations, and methods for routing utilities along the trestle. For guidelines on the type and size of trestle utilities, refer to Chapter 340 and Chapter 560.

(1) Stormwater Conveyance

Provide for conveyance of stormwater on the trestle. Stormwater conveyance systems consist of constructed facilities that provide for the flow of stormwater. Stormwater conveyance methods should be evaluated for each terminal individually and selected based on site parameters. Design conveyance systems following guidelines in the WSDOT *Highway Runoff Manual* (HRM) and the WSDOT *Hydraulic Manual*. The following conveyance options should be considered; however, more options do exist.

(a) Trench Drains

Trench drains collect surface runoff along linear areas and convey the runoff just below the deck elevation to its intended destination (refer to Exhibit 600-8). This approach alleviates grading constraints associated with draining large areas for a modest tradeoff in available treatment head. Grade pavement towards trench drains at a minimum of 1.5 percent slope as shown in Exhibit 600-9. The length of a given trench drain run is likely to be limited by the trestle structure due to the structure's flatness. This requires that drains must include their own slope and get progressively deeper. Wider non-sloped drains may be considered, but tend to introduce additional maintenance burdens due to sediment and debris accumulation. This approach is ideal for use with a consolidated treatment strategy that maintains a manageable trench drain length to convey runoff to each facility.

Design grates for trench drains and inlets for drains to accommodate bicycles and anticipated foot traffic (e.g. high heels).

(b) Channelization

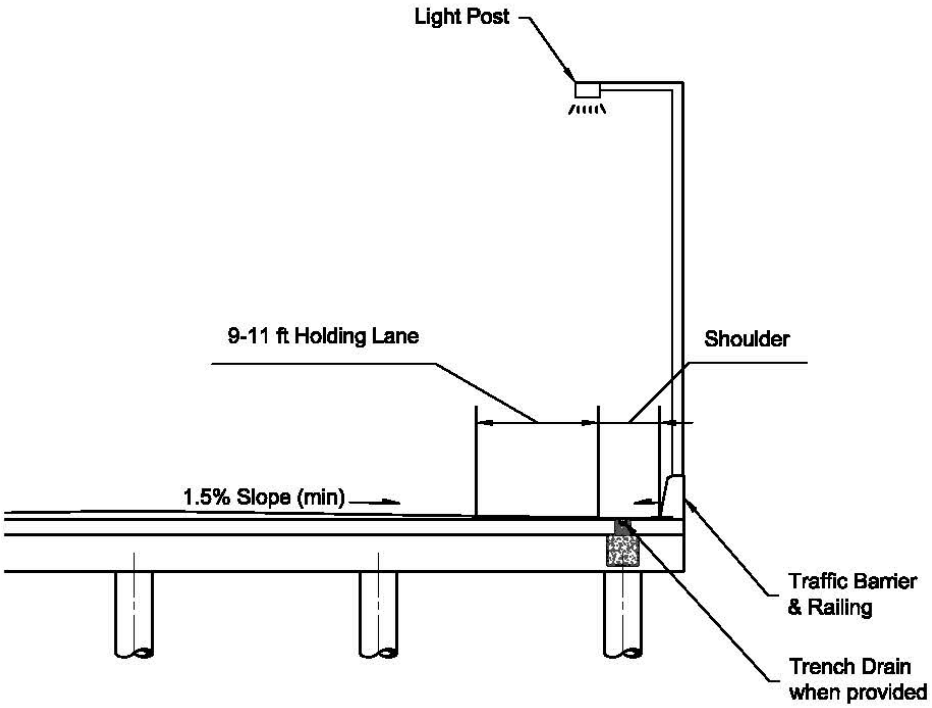
This approach relies on runoff being conveyed to treatment structures via sheet flow or shallow channelized flow. Its applicability is generally limited by deck grading constraints and concerns regarding flow depth. Limiting conveyance to surface runoff is advantageous for avoiding structural interference and maximizing the head available for passing the runoff through a treatment facility. (In other words, treatment facilities often have a minimum vertical flow distance measured from the inlet elevation of the structure to its outlet. Confining runoff to the surface maintains the outlet elevation of the treatment structure at its highest/shallowest potential). Drainage basins are generally limited in size, however, due to the grading and flow depth concerns. This approach is ideal for use with a localized treatment strategy.

(c) Underdeck Drain Piping

Underdeck drain piping alternatives suspend or otherwise incorporate drain piping under the deck to convey runoff to the intended destination. This approach provides slightly more flexibility with regard to trestle structure design, but requires additional inlet structures to capture the runoff. Underdeck piping is at risk of increased corrosion and damage from floating debris. It also provides the least available treatment head compared to the surface and trench drain conveyance alternatives. Under a flat trestle concept the challenge of providing adequate slope remains. This approach might be considered for conveying runoff from the trestle to an upland site, but is not otherwise a preferred approach for an overwater structure.



Clinton Trestle Stormwater Trench Drain
Exhibit 600-8



Trestle Cross Section - Trench Drain
Exhibit 600-9

(2) *Stormwater Treatment*

Provide for treatment of trestle stormwater. Stormwater may be treated either on or off the trestle. Evaluate stormwater treatment options for each terminal on an individual basis based on site parameters. Consider oil control treatment for stormwater at ferry terminals. The following subsections contain stormwater treatment options that have been found practical for ferry terminal trestle applications.

(a) Sand Filter

Sand filters consist of a vault structure with a bed of sand that acts as a filter. Runoff is directed over the sand bed where it infiltrates through to a collection pipe below the bed. The primary design constraint is based on providing sufficient bed area such that the facility can be adapted to a variety of site geometries and constraints. Stormwater runoff is collected and conveyed to a sand filter using trench drains and/or underdeck piping to an upland location with a flowsplitter and underground sand filter vault. Treated stormwater is discharged via an outfall.

An upland sand filter vault would likely require extensive excavation due to its inherent size and location at the downstream end of the trestle drainage system. The discharge of the vault is typically located under the filter bed, which introduces additional challenges for design of the outfall structure. Sand filter vaults also require ventilation grates, which are not desirable within traffic areas (both in terms of wear on the grates and maintenance access to the structure).

An alternative to locating a vault upland of the trestle is to place a linear sand filter along the centerline of the trestle and grade the trestle to drain to the filter. Treated runoff is discharged via drain holes in the filter structure.

A linear sand filter located on the trestle provides a more feasible approach. This configuration is shallower and performs as both conveyance and treatment. This facility may require regular maintenance on the sand bed to perform properly, however, and extended access to the structure may disrupt traffic.

(b) Wet Vaults

Wet vaults are underground storage structures designed to detain runoff and lower runoff velocity to permit suspended solids to settle out. Such facilities require infrequent removal of sediment and are not prone to clogging or other malfunction.

Runoff can be collected and conveyed to a wet vault using trench drains and/or underdeck drain pipe. Wet vaults may either be a concrete vault or a modular pipe-based system. Size the vault to retain the appropriate treatment volume per the WSDOT HRM. Treated stormwater is discharged via an outfall.

Construction costs are fairly high with wet vaults. In addition, due to the size of the structures, wet vaults would need to be located upland, introducing similar challenges as sand filter vaults. There is, however, greater flexibility with regard to the outlet location. Ecology and various permitting agencies generally regard their performance as limited and highly discourage their use unless no other option can be feasibly provided.

(c) Media Cartridge Filter

Ecology has approved a variety of media cartridge-based filters for Basic Treatment. The filters typically consist of a catch basin or vault with one or more cylindrical cartridges filled with granular filter material (zeolite and perlite are most common). Runoff passes through the cartridges for treatment. Maintenance consists of replacing the cartridges and occasionally removing accumulated sediment from the structure. Frequency of cartridge replacement is dependent on site sediment levels and number of cartridges, but is generally no more infrequent than annually. Annual service agreements are commonly available from suppliers to replace the cartridges and maintain the structures.

Catch basins containing cartridges can be placed throughout the deck to collect and treat localized drainage basins. Treated runoff is discharged directly to the water below. Determine the number of cartridges per catch basin based on the drainage basin size and the associated online treatment flowrate.

Alternatively, runoff can be collected from the trestle and routed through a flowsplitter and a single upland vault containing the appropriate number of cartridges to treat the site. As an offline and consolidated facility, the total number of cartridges will be less than placing cartridges in individual catch basins.

Media cartridge filters provide considerable design flexibility due to their compact and modular nature. Maintenance, though fairly simple, is a concern from the standpoint that each cartridge system is proprietary and long term availability of compatible cartridges cannot be guaranteed.

(d) Bioretention Structures

Bioretention areas (aka rain gardens) are designed to treat runoff via infiltration and biological uptake using water-tolerant plants in landscaped settings. A bioretention structure provides the same function by housing such landscape within planter structures outfitted with additional drainage components for collection of runoff and connection to storm drain systems. Such structures can be custom designed based on the criteria for a bioretention area. Maintenance consists of basic landscaping efforts and mulch replacement approximately once or twice a year.

Structures can be placed along the pedestrian area to collect and treat runoff. Depending on grading limitations, lateral trench drains or underdeck piping may be used to convey runoff from the opposite side of the trestle to the unit for treatment as well. Treated stormwater is discharged directly from the structure.

Use of bioretention structures can provide an aesthetically pleasing solution for stormwater treatment. The primary challenge of this concept is avoiding undue interference with pedestrian movement along the terminal. Structure depth and plant selection may also factor in to the final feasibility.

(e) Filter Strips/ Ecology Embankments/ Pervious Pavement

These treatment options consist of narrow permeable areas (either vegetated or covered with pervious pavement) that act as media filters for runoff conveyed via sheet flow. Incorporation of this type of treatment facility on an overwater structure is unconventional but technically feasible.

A pedestrian walkway could be constructed with pervious pavement over a sand treatment layer with the trestle graded to direct sheet flow over the pavement. Runoff would infiltrate through the pavement and treatment bed to a drainage layer for collection and discharge through soffit drains spaced periodically along the walkway.

It is anticipated that construction costs associated with this concept would be higher than other treatment alternatives due to a more complex deck structure or expanded footprint.

(f) Stormwater Oil Control

Treatment is focused on removing petroleum hydrocarbons. Applicability of this treatment target is based on the type of project as follows:

- Intersections where either >15,000 vehicles (ADT) must stop to cross a roadway with >25,000 vehicles (ADT) or vice versa
- Rest Areas with an expected trip end count greater than or equal to 300 vehicles per day
- Maintenance facilities that park, store, or maintain 25 or more vehicles (trucks or heavy equipment) that exceed 10 ton gross weight each

Specific elements of a ferry terminal are classified by the HRM as Rest Area or Bridge components. Such classification does not clearly align with the stated Oil Control treatment criteria (e.g. how trip counts are applied to a ferry terminal building or whether the trestle might be considered an intersection as well). Consult with the WSDOT Regional Headquarters for further design guidance.

(3) Trestle Lighting

Trestle lighting is typically installed along the trestle barriers and between holding lanes. (refer to Exhibit 600-9 and Exhibit 600-10). Install lighting within vehicle holding area such that it does not impede traffic from moving between lanes. Avoid the use of trestle luminaire poles with slip or break away bases since the trestle is a pedestrian area. Refer to Chapter 360 for additional lighting criteria.



Clinton Trestle Utility Corridor and Light Poles
Exhibit 600-10

(4) Sanitary Sewer

Refer to Chapter 560 for requirements.

(5) Potable Water

Refer to Chapter 560 for requirements.

(6) Fire Protection

Coordinate with fire marshal and local authorities to determine any requirements for fire lines, sprinklers and hydrants. Refer to Chapter 560 for additional information.

(7) Natural Gas

Refer to Chapter 560 for requirements.

(8) Routing Methods

The following are some potential methods for routing utilities along the trestle.

(a) Inside of Trestle Railing/Barrier

Provided accessibility requirements are not compromised, consider attaching utilities to the inside of the trestle railing/traffic barrier with an enclosure such as a sheet metal shrouding to provide protection and aesthetic improvement (see Exhibit 600-11). Mounting utilities on the inside of the trestle railing along the pedestrian walkway allows for easy access without impacting the vehicle holding lanes or exit lanes. Where practical, this is generally the preferred method for routing utilities along the trestle.





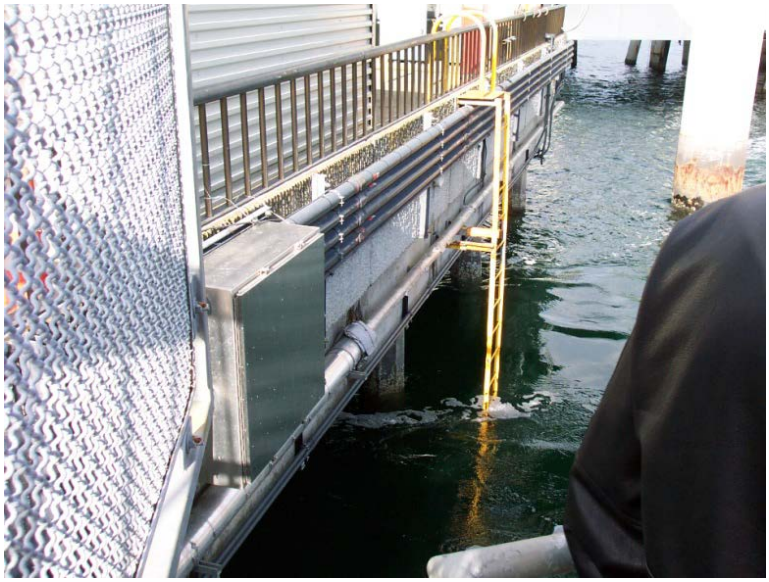
Vashon Island Utility Enclosure
Exhibit 600-11

(b) Outside of the Trestle Railing/Barrier

Consider mounting utilities along the outside of the trestle railing/traffic barrier as shown in Exhibit 600-12. Provide a means to support a temporary work platform for accessing utilities.

(c) Utility Catwalk

Consider providing a utility catwalk along the trestle. Locate an approved traffic barrier between the utility catwalk and the trestle interior. Ensure the corridor is wide enough to carry all utilities and leave the utilities uncovered. Consider providing grating as the floor of the corridor to reduce the increase in over water coverage.



Bainbridge Island Utilities Mounted on the Outside of Trestle
Exhibit 600-12

(d) Underside of Trestle

Consider hanging the utilities by installing trapeze type hanger assemblies on the underside of the trestle. Install the utilities between pile caps such that the utilities do not exist below the elevation of the bottom of the pile caps. Cast sleeves into the pile caps where necessary to convey a utility through one or more of the caps. Note that sleeves for larger utilities may not be feasible. Exhibit 600-13 shows a fire line hung under the trestle using a trapeze type hanger assembly. Note that the fire line is hung below the bottom of the pile caps, which is not recommended.



Vashon Island Utilities Suspended Under the Trestle
Exhibit 600-13

(e) Underside of Overhead Loading Structure

Where overhead loading structures are present over the trestle, subject to height restrictions, certain utilities may be attached to the underside of the overhead loading structure to minimize the space requirements to convey utilities on the trestle.

(f) Utility Corridor

WSF no longer favors the use of utility corridors in the trestle deck such as illustrated in Exhibit 600-10. These utility corridors tend to be difficult to access and are a maintenance issue due to the high volume of traffic driving over them.

Chapter 610 Vehicle Transfer Span

610.01 General
610.02 References
610.03 Design Considerations
610.04 VTS Components (H-Span)
610.05 VTS Gradients
610.06 Structural Design Criteria
610.07 VTS Piped Utilities
610.08 Mechanical Design Criteria
610.09 Electrical Design Criteria

610.01 General

This chapter provides guidance on the design of new and retrofitted vehicle transfer spans (VTS), aprons and drilled shaft foundations for bridge lift hydraulic cylinders. The vehicle transfer span and apron provide a means for vehicles and pedestrians to load and unload from the fixed trestle to the vehicle deck of the ferry vessel.

Design the transfer span and apron for the operational and extreme range of motion based on the design tidal range and design vessels identified for a given location. See Chapter 330 for tidal range, design vessels, freeboards, and other related information.

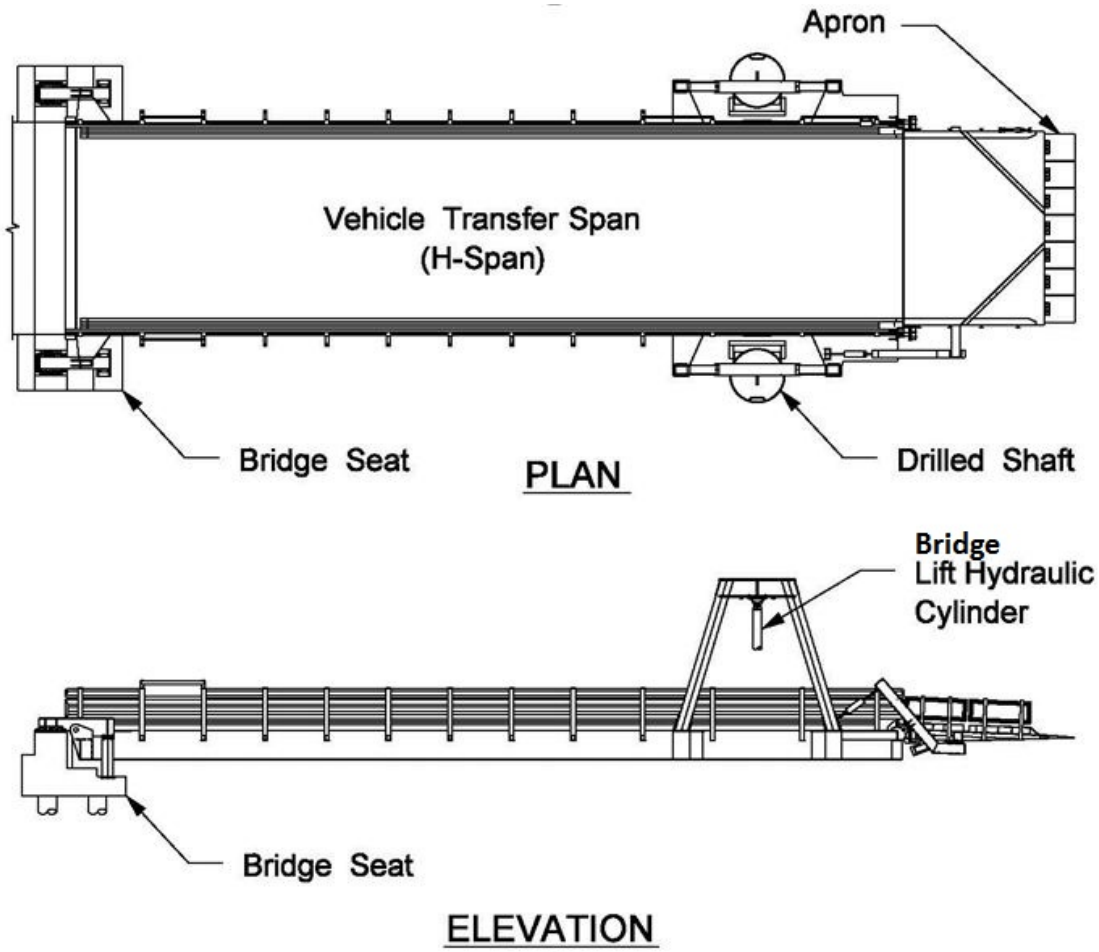


Bainbridge Island Hydraulic Transfer Span (H-Span)
Exhibit 610-1

WSF currently utilizes three distinct VTS system designs − the hydraulically actuated transfer span (H-Span), double cable-operated transfer span (M-Span), and single cable-operated transfer span. Exhibits 610-1 and 610-2 illustrate the H-Span, WSF's preferred design concept for the vehicle transfer span. This concept is discussed in more detail in Section 610.04. The double cable-operated transfer span is no longer being built by WSF due to the high cost of construction and maintenance. The single cable-operated transfer spans are retrofitted when steel structures have projected extended life, but the electrical and mechanical systems are at the end of their life based on the *Life Cycle Cost Model* (LCCM).

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
330	Marine
340	Civil
570	Signage and Wayfinding
600	Trestle
620	Passenger Overhead Loading



Hydraulic Transfer Span (H-Span)
Exhibit 610-2

610.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

WAC 296-24 *General Safety and Health Standards*

WAC 296-56 *Safety Standards – Longshore, Stevedore and Waterfront Related Operations*

WAC 296-876 *Ladders, Portable and Fixed*

(2) Design Codes and Specifications

AASHTO *LRFD Bridge Design Specifications* (AASHTO LRFD *Specifications*), American Association of State Highway and Transportation Officials, Washington, DC

AASHTO Guide *Specifications for LRFD Seismic Bridge Design* (AASHTO LRFD *Guide Specifications*), American Association of State Highway and Transportation Officials, Washington, DC

AASHTO LRFD *Movable Highway Bridge Design Specifications* (AASHTO LRFD *Movable Specifications*), American Association of State Highway and Transportation Officials, Washington, DC

Bridge Design Manual LRFD M 23-50, WSDOT

Proposed Passenger Vessels Accessibility Guidelines. United States Access Board. Published in the Federal Register on June 25, 2013. This document contains scoping and technical requirements for accessibility to passenger vessels by individuals with disabilities. The requirements are to be applied during the design, construction, additions to, and alteration of facilities and elements on passenger vessels to the extent required by Federal agencies under the Americans with Disabilities Act of 1990 (ADA).

International Building Code (IBC), International Code Council, Inc.

Uniform Plumbing Code (UPC), International Association of Plumbing and Mechanical Officials

Unified Facilities Criteria, "Design: Piers and Wharves", (UFC 4-152-01), Department of Defense, Washington, DC

Specification for Structural Steel Buildings, ANSI/AISC 360 (ANSI/AISC 360), American Institute of Steel Construction, Chicago, IL

General Special Provisions, WSDOT

Reference Drawings, WSF

Regional General Special Provisions, WSF

Standard Specifications for Road, Bridge, and Municipal Construction (*Standard Specifications*) M 41-10, WSDOT

(3) Supporting Information

2010 Port Townsend Ferry Dock Spot Speed Study, WSF

Life Cycle Cost Model (LCCM), WSF

610.03 Design Considerations

(1) Accessibility

Per Section V410 of the *Proposed Passenger Vessels Accessibility Guidelines*, the VTS shall meet all passenger accessibility requirements with the exception of Section V410.2 Slope which states that "Gangway runs shall have a running slope not steeper than 1:12". Because the VTS may serve both vehicles and pedestrians its slope may exceed 1:12. See Chapter 300 for general accessibility information and Section 300.09 for specific information related to passenger loading.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessel security requirements, and additional information pertaining to terminal design. Below are links to relevant sections by topic. Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for Transportation Worker Identification Certification (TWIC) and Sensitive Security Information (SSI).

- MARSEC Levels: 310.04
- Vessel Security: 310.05
- Waterside Structures: 310.09
- Access Control/Restricted Areas/TWIC: 310.10

(3) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation. The design should minimize the risk of hydraulic fluid spills and leaks.

(4) Civil

Refer to Chapter 340 for general civil design criteria pertaining to the VTS. Below are links to relevant sections by topic.

- Design Vehicles: Section 340.07(6)
- Vehicle Turning Analyses: Section 340.07(7)

(5) Marine

Refer to Chapter 330 for marine criteria pertaining to the VTS. Below are links to relevant sections by topic.

- Operations and Maintenance: Section 330.04(4)
- Proprietary Items: Section 330.04(6)
- Long Lead Time Items: Section 330.04(7)
- Corrosion Mitigation: Section 330.04(9)
- Scour and Mudline Elevations: Section 330.04(10)
- Geotechnical Requirements: Section 330.04(11)
- Materials Specification: Section 330.04(12)
- Miscellaneous Considerations: Section 330.04(13)
- Tidal Information: Section 330.06
- Wave, Flood, and Coastal Storm Loading: Section 330.09(1)

(6) Electrical

Refer to Chapter 360 for general electrical design criteria pertaining to vehicle transfer spans. Below are links to relevant sections by topic.

- Wiring and Protection: 360.04
- Wiring Methods and Materials: 360.05
- Equipment: 360.06

(7) Design Life

Design life is based on the current *Life Cycle Cost Model* (LCCM) as required by the Washington State Office of Financial Management (OFM). Refer to Table 1 for the design life of new structures (as of 2007) and Table 2 for design life of structures prior to 2007, in the 2010 *Life Cycle Cost Model* Update (2010 LCCM) for information on when existing marine structures and their systems are due for replacement. Confirm design lives given below are consistent with the current LCCM. Replacement life may be reduced due to functional obsolescence.

- VTS and Apron: 75 years
- VTS Substructure: 75 years

(8) Operational Classification

WSF vehicle transfer spans are operationally classified per AASHTO LRFD *Specifications* Section 1.3.5 as typical, not critical or essential, unless noted otherwise. The performance objective for "typical" bridges is life safety. See Section 610.06(1)(c) Limit States for use of this classification.

(9) Design Drawing Information

Drawing format and software used shall follow the WSF Terminal Engineering (TE) CADD Standards. See Division 8 – CADD Standards and Procedures

Include or reference the following information on design drawings:

- Principal loads used in design and number of load cycles anticipated over the life of the structure
- Statement of conformity to *Terminal Design Manual* and any other applicable guidelines
- Provide the operational and extreme range of motion (highest and lowest elevations); maximum and minimum slopes of the transfer span and any other specific operating limitations
- Tide or sea level variation considered for design
- Materials specified for structure elements and load-bearing components
- Features of vessels used in design (displacement, freeboard, geometry of gate openings, etc.)
- Design life expectancy
- Description of the sequence of operations as well as any operating limitations
- Weight of major components and structural sections

(10) Proprietary Items

WSF uses competitively acquired products to fulfill the requirements of a contract wherever feasible to help achieve the lowest price, the best quality, and the most efficient use of resources. There are instances in which competitive bidding may not or cannot be provided and a specific proprietary product is allowed. Refer to Section 220.07(2) for limitations on the use of proprietary items.

(11) Signage and Wayfinding

Refer to Chapter 570 for information regarding signage requirements on the vehicle transfer span.

(12) Seismic Design

Perform seismic design of VTS structures in accordance with the AASHTO LRFD *Specifications* and supplemented by the AASHTO LRFD *Guide Specifications* where appropriate. Design VTS structures for a design level earthquake (DLE) corresponding to a 7 percent probability of exceedance in 75 years (~1000 year return period) with a life safety protection/collapse prevention performance objective. VTS structures are expected to support gravity loads after the DLE but may suffer significant damage that may disrupt service.

VTS Structures shall also be checked for an operational level earthquake event (OLE). This is an event in which no damage or only minor structural damage will occur, but a temporary interruption in service may occur.

For the fixed portions of the VTS system, e.g., the bridge seat, the OLE is similar to a 50 percent exceedance in 75 years (~100 year return event). Expansion joint design and locations where the relative displacement of different structures could cause damage shall be checked for this level earthquake event.

For the movable portions of the VTS system, the OLE is based on the AASHTO LRFD *Movable Specifications*. The OLE for movable bridges is defined as half of the demand values associated with the DLE. For the OLE, design and detailing are intended to allow the transfer span and apron to remain operational, i.e., movable.

Minor damage to the movable span is acceptable during the OLE event provided that it is designed to occur at a predetermined location and can be easily identified and quickly repaired.

The designer shall identify in the general structural notes of the contract drawings the anticipated structural failure locations for both the OLE and the DLE.

For seismic design of drilled shaft foundations, plastic hinging is limited to aboveground and near-ground locations. In-ground plastic hinging is not permitted.

For geotechnical requirements, refer to Chapter 330.

(13) Accelerated Bridge Construction

Accelerated bridge construction methods such as precast concrete bridge seat caps in the design are options where the duration of slip closures must be kept to a minimum. Use of these methods minimizes interruptions during construction and can be cost effective at busy terminals.

610.04 VTS Components (H-Span)

Design new VTS systems using an H-Span concept similar to the existing hydraulic vehicle transfer spans installed at Bainbridge Island Ferry Terminal, Eagle Harbor Maintenance Facility, and most recently Port Townsend Ferry Terminal. The H-Span system consists of a vehicle transfer span, bridge seat, apron, and two bridge lift hydraulic cylinders and foundations. WSF uses the most recent project drawings as the basis for design of new H-Spans. Review and incorporate into the design all issues and lessons learned from past projects. In particular, fabrication issues from past projects have included welds and bolted connections, control of distortion due to welding, and steel coating.

(1) Vehicle Transfer Span and Bridge Seat

The vehicle transfer span with apron is a movable bridge which connects the fixed trestle to the vessel. The offshore end is adjusted vertically to account for the tides. The VTS is vertically supported on hydraulic cylinders via an A-Frame on the offshore end and by a bridge seat on the shoreward end. Refer to Chapter 600 for bridge seat requirements. The transfer span is torsionally stiff allowing the bridge and WSF design live load to be safely supported on one cylinder should one of the two lift cylinders on either side fail.

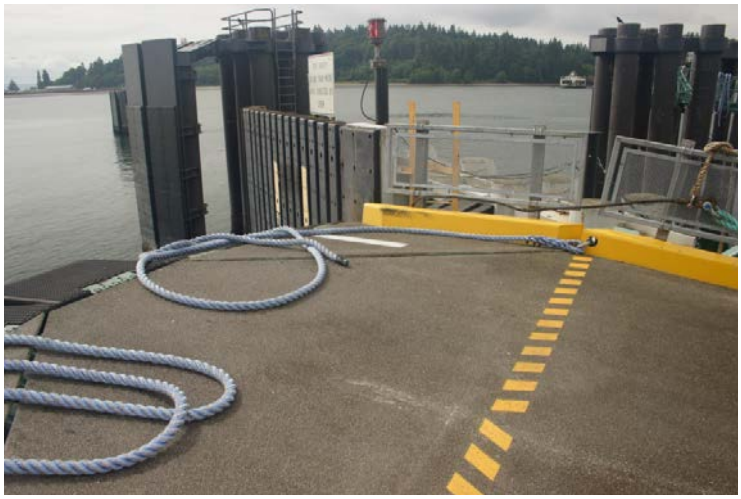


Bainbridge Island Vehicle Transfer Span (H-Span)
Exhibit 610-3

(2) Hydraulic Apron

The hydraulic apron provides a connection between the hydraulic transfer span and the vehicle deck of the ferry vessel for loading and unloading. The hydraulic apron is lowered onto the vessel after the vessel is positioned in the operating slip using a single hydraulic cylinder and lever arm. Exhibit 610-4 shows the hydraulic apron on the Bainbridge Island Ferry Terminal vehicle transfer span. Design the contact plates on the apron underside with rounded edges to minimize damage and excessive wear to the vessel deck.

Provide apron lips to transition between the hydraulic apron and the vessel. Apron lips along the offshore edge of the apron are separated by a 1-inch gap. This gap allows for the lips to move independently of each other and creates a smooth transition for vehicles during loading and unloading. The gaps can pose a potential hazard for bicycles. Mark these gaps with high-visibility paint so that they are noticeable to bicyclists while loading and unloading the vessel. Additionally, consider providing signage in areas such as the bicycle holding area notifying bicyclists of the gaps and the potential hazard. For additional signage information, see Chapter 570.



Bainbridge Island Hydraulic Apron
Exhibit 610-4

(3) Bridge Lift Hydraulic Cylinders and Foundations

The bridge lift hydraulic cylinder foundations provide support and hazardous spill containment for the hydraulic cylinders that raise and lower the vehicle transfer span. The cylinders are housed in a steel casing filled with concrete to the base of the cylinders. The piston ends of the compression cylinders are mounted in cup-shaped bearings to accommodate the operating and seismic motions of the cylinders. The rod ends are connected to the A-Frames using spherical bearings. Because the cylinders are pinned end members, no lateral loads are taken by them. All seismic loads are resisted by the bridge seat assuming no contact between the VTS and seismic bumpers attached to the steel casings. For H-Span design, it is preferred the VTS does not contact the shaft seismic bumpers. The design includes a gap between the VTS and the seismic bumpers to accommodate VTS seismic motions during the design earthquake. However, the design should be bracketed between the entire seismic load being resisted at the bridge seat and the seismic bumpers engaging and lateral load being resisted by the drilled shaft foundations. Exhibit 610-5 shows a bridge lift hydraulic cylinder and maintenance ladder within the lift hydraulic cylinder foundation casing.



Bainbridge Island Bridge Lift Hydraulic Cylinder and Foundation
Exhibit 610-5

(4) Security

(a) Gates

Design security gates at new vehicle transfer spans where vessels tie up overnight to prevent unauthorized personnel from gaining access to the vessel. Security gates consist of either sliding gates or swing gates across the two vehicle lanes fitted with a person-sized, self-closing, and pass-through door with electronic locks. Locate gates in the bridge seat area such that when open they do not impede traffic.

Design gates with an overall gate height of 9 feet above the pavement and a maximum clearance of 6 inches from the bottom of gate to the lowest deck elevation when the gate is closed. Gates are to be non-climbable with a spacing that shall not allow the passage of a 4 inch sphere, measured at any point between the vertical bars.

Provide gates which are lockable in the closed position, utilizing a latch and padlock system.

Fit swing gates across the traveled lanes with drop bolts to prohibit the gates from swinging in the offshore direction beyond the plane in which they will be locked.

Provide gates with a means whereby the gate will remain in the open position during normal operations of the ferry terminal.



Bainbridge Island VTS Security Gates
Exhibit 610-6

(b) Camera and Intrusion Detection

Equip all gates and doors with intrusion detection to detect gate openings.

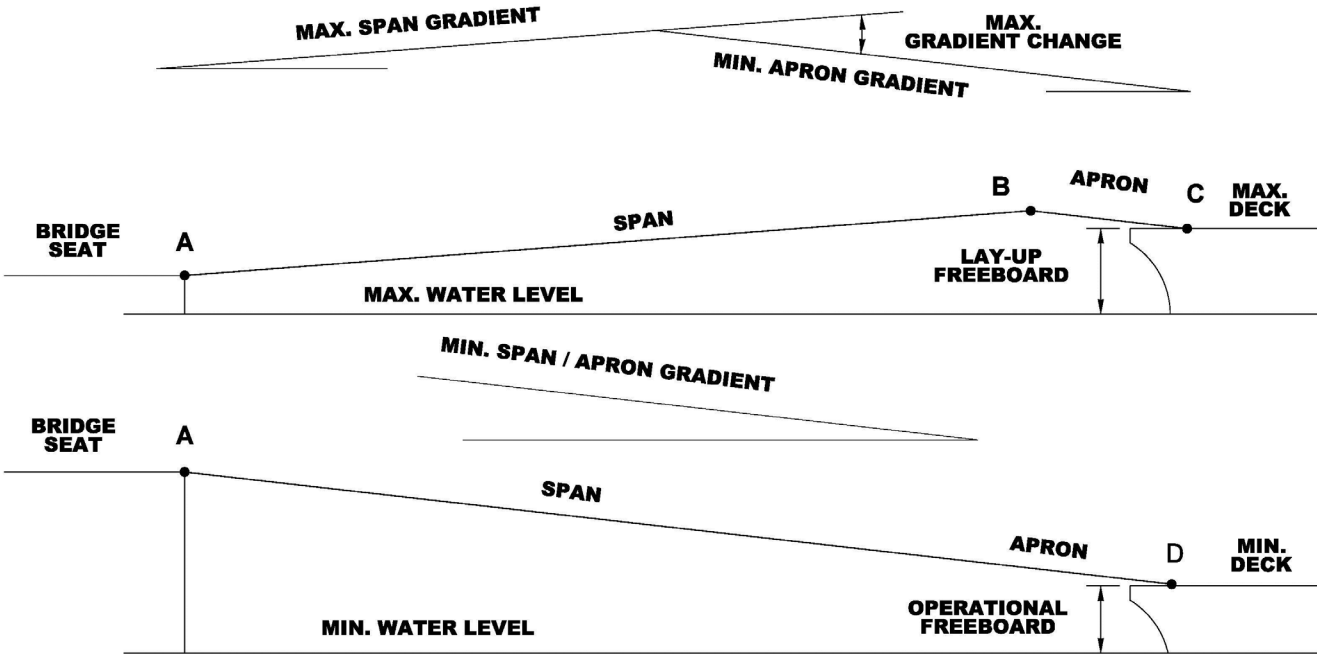
Install cameras that can monitor the pass through doors and the overall operation on the transfer span. Where field of view allows, use pan tilt zoom (PTZ) camera on the structures to monitor gate security. Refer to Chapter 310 for additional information.

610.05 VTS Gradients

Maximum and minimum gradients for the vehicle transfers spans at each terminal have been tabulated in Exhibit 610-7. Normal operation gradients are intended to be used to check existing transfer spans for operational issues and are based on Mean Higher High and Mean Lower Low Water levels and the controlling freeboard of both the Category I and Category II vessels assigned to each route. Design gradients are intended to be used for design of new transfer spans and are based on Minimum and Maximum Design Tidal Ranges and the controlling freeboard of only the Category I vessels assigned to each route.

See Terminal Tidal Datums (Exhibit 330-10), Design Vessels (Exhibit 330-4) and Appendix O: Vessel Data for Terminal Engineer for data used in the calculations of the gradients. For additional data, assumptions and intermediate values used in calculating the gradients see Appendix AA.

Terminal	Slip	Normal Operation Gradient (%)				Design Gradient (%)			
		Max Span Gradient	Max Apron Gradient	Max Gradient Change	Min Span/ Apron Gradient	Max Span Gradient	Max Apron Gradient	Max Gradient Change	Min Span/ Apron Gradient
Anacortes	1	1	-4	5	-10	5	-4	8	-14
Anacortes	2	2	-4	5	-9	5	-4	8	-13
Bainbridge Island	1	3	-5	8	-10	7	-5	11	-14
Bainbridge Island	2	3	-6	9	-10	7	-6	13	-14
Bremerton	1	5	-4	8	-9	9	-4	12	-14
Bremerton	2	6	-4	9	-8	9	-4	13	-13
Clinton	1	4	-2	6	-10	7	-2	10	-14
Clinton	2	4	-4	7	-10	7	-4	11	-14
Coupeville	1	4	-3	7	-7	7	-3	10	-11
Edmonds	1	5	-4	8	-9	8	-4	11	-13
Fauntleroy	1	6	-4	10	-8	10	-4	13	-12
Friday Harbor	1	1	-4	4	-10	4	-4	8	-14
Kingston	1	3	-5	8	-10	7	-5	11	-14
Kingston	2	4	-4	8	-9	7	-4	11	-13
Lopez	1	-1	-4	3	-11	2	-4	6	-15
Mukilteo	1	4	-2	6	-9	7	-2	9	-13
Orcas	1	-1	-3	2	-12	2	-3	5	-15
Point Defiance	1	3	-4	7	-11	6	-4	10	-16
Port Townsend	1	1	-3	5	-9	5	-3	8	-13
Port Townsend	2	2	-7	9	-11	6	-7	13	-16
Seattle	1	3	-5	8	-11	7	-5	11	-15
Seattle	2	3	-4	7	-10	7	-4	10	-15
Seattle	3	3	-4	7	-10	7	-4	10	-15
Shaw	1	6	-4	10	-6	10	-4	13	-11
Southworth	1	2	-4	6	-11	6	-4	10	-15
Tahlequah	1	4	-4	8	-10	8	-4	11	-15
Vashon	1	2	-4	6	-11	6	-4	10	-16
Vashon	2	3	-4	6	-11	6	-4	10	-15



Maximum and Minimum VTS Gradients

Exhibit 610-7

610.06 Structural Design Criteria

(1) New Structures

(a) Design Codes

Design the bridge seat foundation, transfer span, apron, and bridge lift hydraulic cylinder shafts in accordance with the AASHTO LRFD *Movable Specifications* and the AASHTO LRFD *Guide Specifications*. Additional owner-specified loads are defined by WSF. Supplement design using the WSDOT *Bridge Design Manual* LRFD.

Design curb and bridge railing in accordance with the AASHTO LRFD *Specifications* and the given design speeds provided in (1)(d)2.

Design hydraulic cylinder shaft access platform and ladder in accordance with WAC 296-24, WAC 296-56, WAC 296-876 and ANSI/AISC 360. WAC 296-56 takes precedence over WAC 296-876.

WSF is to approve any deviation from these design codes not specified below. Include a signed deviation in the Project File (PF)/Design Documentation Package (DDP). Refer to Section 220.05 for details on the PF/DDM.

(b) Design Life

The design life of new vehicle transfer span structures, including the transfer span, apron, and foundations, is based on deterioration from corrosion due to exposure and/or fatigue in accordance with Section 610.03(7).

(c) Limit States

Utilize Limit States as specified in the AASHTO LRFD *Specifications*, Section 1.3.

Factor Relating to Ductility:	$\eta_D = 1.0$	For Conventional Designs and Details Complying with the AASHTO LRFD *Specifications*. Notify WSF if the value of η_D is not 1.0.
Factor Relating to Redundancy:	η_R	Determine During Design
Factor Relating to Operational Importance:	$\eta_I = 1.0$	For Typical Bridges

(d) Design Loads

The permanent and transient loads listed below apply.

1. **Permanent Loads**

   DC Dead Load of Structural Components and Nonstructural Attachments

   DW Dead Load of Wearing Surfaces and Utilities

2. **Transient Loads**

BR **Vehicular Braking Force**

For all AASHTO-specified load combinations, design the transfer span and apron for both one and two lanes of HL-93 load headed in the same direction during loading and unloading of the vessel.

For the Design Level Earthquake (DLE), use a vehicular braking force factor γ_{EQ} of 0.

For the Operational Level Earthquake (OLE), use a vehicular braking force factor γ_{EQ} of 0.5.

CT **Vehicular Collision Force**

Design transfer span railing as equivalent in strength and geometry to bridge railing that has been successfully crash tested to Test Level One (TL-1) or greater in accordance with AASHTO LRFD Specifications. The design speed for the transfer span and curb is 15 mph as established by WSF in the *2010 Port Townsend Ferry Dock Spot Speed Study*. The lowest speed listed in AASHTO LRFD *Specifications* for design and testing of bridge railing is 30 mph, associated with the TL-1 test selection criteria. TL-1 is for work zones with low posted speeds and very low volume, and low speed local streets.

Design speed for the apron is 10 mph. Therefore, it is assumed vehicle wheels will not ride up and over the apron curb. Design apron curb for a lateral load of 500 plf. Design apron railing for pedestrian and bicycle loads in accordance with the AASHTO LRFD *Specifications*.

DAD **Dead Load Dynamic Load Allowance**

As specified in the AASHTO LRFD *Movable Specifications*, Section 2.4.1.2.2, "Structural parts in which the force effect varies with the movement of the span, or in parts which move or support moving parts shall be designed for a load taken as 20 percent of the total dead load to allow for dynamic load allowance or vibratory effect."

For load combinations involving moving of the transfer span and/or apron with stationary live load, the DAD factor applies to dead load and stationary live load.

DAM **Force Effects Due to Operation of Machinery**

As specified in the AASHTO LRFD *Movable Specifications*, Section 2.4.1.2.3, "Structural components supporting forces caused by machinery during operation of the span shall be designed for the calculated machinery forces, increased 100 percent as a dynamic load allowance."

For the transfer span, the DAM factor applies at the following structural components:

- A-Frame
- A-Frame connection to the transfer span
- Apron lever arm
- Apron lever arm connection to the transfer span
- Apron lift hydraulic cylinder shoreward support post
- Apron lift hydraulic cylinder shoreward support post connection to transfer span

The DAM factor does not apply to design of the apron or the transverse lift beam.

Force effects on structural connections to hydraulic cylinders are as specified in the AASHTO LRFD *Movable Specifications*, Section 2.4.1.8, "Hydraulic Cylinder Structural Connections".

EQ **Earthquake Load**

Seismic design is based on a two-level approach considering a Design Level Earthquake (DLE) and an Operational Level Earthquake (OLE).

The DLE is the 1000-year event specified in the AASHTO LRFD *Specifications*. For the DLE, design and detailing are intended to prevent collapse of all or part of the transfer span. Transfer span and apron can be in any position.

The OLE as specified in the AASHTO LRFD *Movable Specifications* is defined as having half of the demand values associated with the DLE. For the OLE, design and detailing are intended to allow the transfer span and apron to remain operational, i.e., movable. Minor damage to the H-Span is acceptable during the OLE event provided that it is designed to occur at a predetermined location and can be easily identified and quickly repaired.

The designer shall identify on the contract drawings anticipated structural failure locations for both the OLE and the DLE.

Soil parameters for developing seismic response spectra will be provided by the WSDOT Geotechnical Branch.

FL **Fatigue Load**

Evaluate the fatigue limit state in accordance with the AASHTO LRFD *Specifications*, the AASHTO LRFD *Movable Specifications*, and the WSDOT BDM for 75 year design life. The fatigue load shall be as specified in AASHTO LRFD *Specifications* Section 3.6.1.4.1.

In addition to vehicular traffic, include the number of times the transfer span and apron are raised and lowered (ADO), in the fatigue calculations.

ADT (*average daily traffic*):	20,000
ADTTSL (*average daily truck traffic*):	270
ADO (*average daily openings*):	40

Note: These numbers are based on 2012 traffic data from the Edmonds and Mukilteo Ferry Terminals and include an applied 1.4 future traffic factor. The Edmonds and Mukilteo Ferry Terminals are the busiest single-slip terminals in the system.

FR **Friction Load**

As the vessel deck supports the apron during loading and unloading operations, friction forces occur between the bottom of the apron and the vessel deck as wind, wave, current, and braking forces cause the vessel to move. The friction load is equal to a friction coefficient multiplied by the maximum normal reaction of the apron bearing on the vessel deck. In practice, the vessel is typically held motionless against a dolphin resulting in little or no movement during loading and unloading operations.

For both the DLE and OLE, the friction force between the bottom of the apron and the vessel deck is not considered because of the low probability of the simultaneous occurrence of the friction force and the earthquake.

Use the following friction coefficients specified in UFC 4-152-01 to calculate friction forces:

Steel to steel:	0.25
Steel to rubber:	0.65

IM **Vehicular Dynamic Load Allowance**

LL **Vehicular Live Load**

For AASHTO-specified load combinations, design the H-Span for both one and two lanes of HL-93 load headed in the same direction during loading and unloading of the vessel.

For the DLE, use a vehicular live load factor γ_{EQ} of 0.

For the OLE, use a vehicular live load factor γ_{EQ} of 0.5. The associated mass of live load need not be included in the dynamic analysis.

MLL1 Apron Maintenance Live Load

WSF personnel occasionally use the H-Span to launch a small boat. A single-axle boat trailer approximately 16 feet long is backed onto the apron and then the transfer span is lowered to the level of the seawater. With boat included, the service level load at each of the two trailer wheels spaced 6 feet apart is 2000 pounds. In addition, consider two personnel having a service level load of 300 pounds each to be on the apron. Consider both the trailer wheels and personnel to be located anywhere on the apron. Neglect wheel loads for the tow vehicle because the distance from the trailer axle to the vehicle hitch is approximately 15 feet, placing the vehicle rear axle wheel loads very close to the apron hinges.

The apron maintenance live load is supported by the apron lifting arm (apron lever arm) and apron hinges. During loading and unloading the vessel, the apron lever arm does not support any load.

Design the apron lever arm to support the apron's dead load and maintenance live load. The strength load factor applied to service level dead load and maintenance live load shall be 1.25.

MLL2 Bridge Lift Hydraulic Cylinder Shaft Access Platform Maintenance Live Load

Design the bridge lift hydraulic cylinder access platform for a uniform live load of 100 psf.

Do not apply the dynamic load allowance (IM) to the access platform live load.

OLL Operational Vehicular Live Load

OLL consists of a single lane of HL-93 load with WSF-defined load factors that are used only with specific WSF-defined load cases.

Geometry constraints, including turning requirements and lane widths, make it impractical to load two large trucks side by side on the H-Span. WSF's normal loading and unloading practice is to send large trucks and RVs single file across the H-Span. Smaller trucks, weighing up to 36 kips, may be loaded side by side. A single lane of OLL with WSF-defined load factors is approximately equivalent to the maximum expected loading on the transfer span for WSF-defined load cases.

Design the H-Span for the additional WSF-defined loads described below.

1. One Transfer Span Lift Hydraulic Cylinder Failure: WSF-defined load to ensure that the H-Span can support one lane of HL-93 load located anywhere on the H-Span in the event one lift hydraulic cylinder fails. The AASHTO LRFD *Specifications* multiple presence factor (m) and vehicular dynamic load allowance factor (IM) apply. The AASHTO LRFD *Movable Specifications* dynamic load allowance factors (DAD) and (DAM) do not apply.

2. Moving Transfer Span with Stationary Vehicular Live Load: WSF-defined load to ensure that the transfer span can be moved with one lane of stationary HL-93 load located anywhere on the transfer span. Consider vehicular live load on the apron only when the apron is supported by the vessel deck. The AASHTO LRFD *Specifications* multiple presence factor (m) applies and the vehicular dynamic load allowance factor (IM) does not apply. The AASHTO LRFD *Movable Specifications* dynamic load allowance factors (DAD) and (DAM) apply to dead load and stationary live load.

PL **Pedestrian Live Load**

Design the H-Span for a uniform pedestrian live load of 100 psf.

TL **Tie-up Line Force**

Two tie-up lines between the vessel and apron are used as a backup to vessel propulsion to maintain the vessel position during loading and unloading operations. Each line is a 1.75-inch diameter 3-strand blue steel poly rope with a minimum breaking force of approximately 68 kips. Install a fuse mechanism in the line to limit the service level force (TL) transferred to the apron to 68 kips per line. Design all of the components in the line using a strength limit state load factor of 1.25 to ensure that the fuse mechanism fails before other components in the line.

WA **Water Loads – Wave, Flood, and Coastal Storm Loading**

Refer to Section 330.09(1) for wave, flood, and coastal storm loading criteria.

WL **Wind on Live Load**

WS **Wind Load on Structure**

Design wind load on structure in accordance with the WSDOT *Bridge Design Manual* LRFD and the AASHTO LRFD *Specifications*.

The design water level elevation is 0.00 feet corresponding to Mean Lower Low Water (MLLW).

(e) Unfactored Load Combinations

Provide WSF-defined unfactored load combinations seen at the hinge points and cylinder connections to the mechanical designer for use in designing the mechanical system. Reference Section 610.08 for mechanical load combinations.

Limit State	Description
Strength IA:	Normal vehicular use of the bridge without wind.
Strength IB:	Pedestrian use of the bridge without wind.
Strength II:	Does not apply. Owner-specified special design vehicles are not considered.
Strength III:	Bridge exposed to wind velocity exceeding 55 mph.
Strength IV:	Does not apply. DL to LL ratio effect is not considered.
Strength VA:	Normal vehicular use of the bridge with a 55 mph wind velocity.
Strength VB:	Pedestrian use of the bridge with a 55 mph wind velocity.
Extreme IA:	OLE with vehicular live load.
Extreme IB:	OLE without live load.
Extreme IC:	DLE without live load.
Extreme II:	Collision by vehicles.
Service IA:	Normal operational use of bridge with a 55 mph wind velocity.
Service IB:	One transfer span lift hydraulic cylinder failure with one lane HL-93 load.
Service IC:	Pedestrian use of bridge with a 55 mph wind velocity.
Service IIA:	Control yielding of steel structures due to vehicular live load.
Service IIB:	Control yielding of steel structures due to vehicular live load for one transfer span lift hydraulic cylinder failure with one lane HL-93 load.
Service IIC	Control yielding of steel structures due to pedestrian live load.
Service III:	Does not apply. For longitudinal analysis relating to tension in prestressed concrete superstructures.
Service IV:	For tension in prestressed concrete columns only with the objective of crack control.
Fatigue I:	Does not apply. Infinite load-induced fatigue life is not considered.
Fatigue II:	Finite load-induced fatigue life.
WSF-STR-1:	Vessel tie-up line force on apron.
WSF-STR-2:	One transfer span lift hydraulic cylinder failure with one lane HL-93 load.

Note: Refer to AASHTO Guide Specification for Bridges Vulnerable to Storms for additional load combinations.

Fixed (Non-Moving) Bridge Design Limit States
Exhibit 610-8

Limit State	Description
WSF-STR-3:	Moving bridge with no live load, both cylinders operational. Structural components where the dynamic load allowance factor DAD applies. Bridge not exposed to wind.
WSF-STR-4:	Moving bridge with no live load, both cylinders operational. Structural components where the dynamic load allowance factor DAM applies. Bridge not exposed to wind.
WSF-STR-5:	Moving bridge with no live load, both cylinders operational. Structural components where the dynamic load allowance factor DAD applies. Bridge exposed to wind velocity exceeding 55 mph.
WSF-STR-6:	Moving bridge with no live load, both cylinders operational. Structural components where the dynamic load allowance factor DAM applies. Bridge exposed to wind velocity exceeding 55 mph.
WSF-STR-7:	Moving bridge with one lane of stationary HL-93 load, both cylinders operational. Structural components where the dynamic load allowance factor DAD applies. Bridge not exposed to wind.
WSF-STR-8:	Moving bridge with one lane of stationary HL-93 load, both cylinders operational. Structural components where the dynamic load allowance factor DAM applies. Bridge not exposed to wind.
WSF-STR-9:	Moving bridge with one lane of stationary HL-93 load, both cylinders operational. Structural components where the dynamic load allowance factor DAD applies. Bridge exposed to a 55 mph wind velocity.
WSF-STR-10:	Moving bridge with one lane of stationary HL-93 load, both cylinders operational. Structural components where the dynamic load allowance factor DAM applies. Bridge exposed to a 55 mph wind velocity.

Movable Bridge Design Limit States
Exhibit 610-9

Design Load	Description
Strength IA:	η_i [$\gamma_{p,DC}$ DC + $\gamma_{p,DW}$ DW + 1.75 (LL + IM) + 1.75 BR + (FR + IM)]
Strength IB:	η_i [$\gamma_{p,DC}$ DC + $\gamma_{p,DW}$ DW + 1.75 PL + FR]
Strength III:	η_i [$\gamma_{p,DC}$ DC + $\gamma_{p,DW}$ DW + 1.4 WS + FR]
Strength VA:	η_i [$\gamma_{p,DC}$ DC + $\gamma_{p,DW}$ DW + 1.35 (LL + IM) + 1.35 BR + 0.4 WS + WL + (FR + IM)]
Strength VB:	η_i [$\gamma_{p,DC}$ DC + $\gamma_{p,DW}$ DW + 1.35 PL + 0.4 WS + WL + FR]
Extreme Event IA:	η_i [$\gamma_{p,DC}$ DC + $\gamma_{p,DW}$ DW + □EQ (LL + IM) + □EQ BR + 0.5 EQ]
Extreme Event IB:	η_i [$\gamma_{p,DC}$ DC + $\gamma_{p,DW}$ DW + 0.5 EQ]
Extreme Event IC:	η_i [$\gamma_{p,DC}$ DC + $\gamma_{p,DW}$ DW + EQ]
Extreme Event II:	η_i [$\gamma_{p,DC}$ DC + $\gamma_{p,DW}$ DW + 0.5 (LL + IM) + 0.5 BR + (FR + IM) + CT]
Service IA:	η_i [DC + DW + (LL + IM) + BR + 0.3 WS + WL + (FR + IM)]
Service IB:	η_i [DC + DW + 1.25 (OLL + IM) + 1.25 BR + 1.25 (FR + IM)]
Service IC:	η_i [DC + DW + PL + 0.3 WS + WL + FR]
Service IIA:	η_i [DC + DW + 1.3 (LL + IM) + 1.3 BR + 1.3 (FR + IM)]
Service IIB:	η_i [DC + DW + 1.65 (OLL + IM) + 1.65 BR + 1.65 (FR + IM)]
Service IIC:	η_i [DC + DW + 1.3 PL + FR]
Service IV:	η_i [DC + DW + 0.7 WS + FR]
Fatigue II:	η_i [0.75 (FL + IM) + 0.75 BR]
WSF-STR-1:	η_i [$\gamma_{p,DC}$ DC + $\gamma_{p,DW}$ DW + 1.25 TL]
WSF-STR-2:	η_i [$\gamma_{p,DC}$ DC + $\gamma_{p,DW}$ DW + 1.60 (OLL + IM) + 1.60 BR + 1.25 (FR + IM)]

Load combinations pertaining to the design of the lift hydraulic cylinder shaft access platform are not included.

Fixed (Non-Moving) Bridge Design Load Combinations
Exhibit 610-10

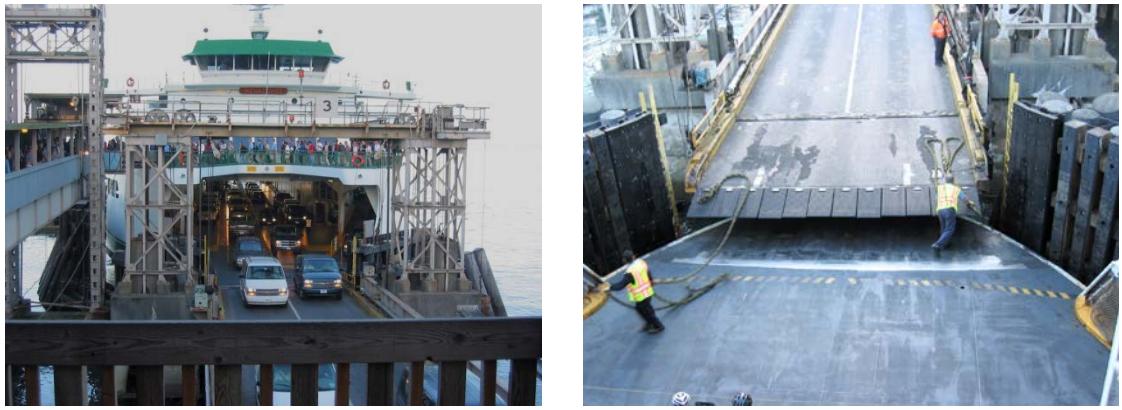
Design Load	Description
WSF-STR-3:	η_i [1.55 (DC + DW + DAD) + (FR + DAD)]
WSF-STR-4:	η_i [1.55 (DC + DW + DAM) + (FR + DAD)]
WSF-STR-5:	η_i [1.25 { (DC + DW + DAD) + WS } + (FR + DAD)]
WSF-STR-6:	η_i [1.25 { (DC + DW + DAM) + WS } + (FR + DAD)]
WSF-STR-7:	η_i [1.55 (DC + DW + DAD) + 1.3 (OLL + DAD) + (FR + DAD)]
WSF-STR-8:	η_i [1.55 (DC + DW + DAM) + 1.3 (OLL + DAM) + (FR + DAD)]
WSF-STR-9:	η_i [1.25 { (DC + DW + DAD) + 0.3 WS + WL } + 1.3 (OLL + DAD) + (FR + DAD)]
WSF-STR-10:	η_i [1.25 { (DC + DW + DAM) + 0.3 WS + WL } + 1.3(OLL + DAM) + (FR + DAD)]

Load combinations pertaining to the design of the apron lever arm are not included.

Movable Bridge Design Load Combinations
Exhibit 610-11

(2) Retrofitted Single Cable-Operated Transfer Span System

Base retrofitting of existing VTS systems on the particular type of structure to be upgraded. The majority of existing single cable-operated transfer spans consist of pile-supported concrete foundations, a steel frame superstructure (headframe and towers), and a cable and counterweight (CW) mechanical system. The WSF inventory also includes a small number of timber pile-supported steel headframes and timber bridge seats. The majority of existing transfer spans consists of a pair of longitudinal plate girders, transverse floor beams, longitudinal stringers and a steel grid deck, which is either unfilled or filled with concrete. The apron is typically operated with hydraulic cylinders or, in some older VTS systems, a hoist cable and counterweight system. The WSF inventory also includes a small number of pre-1964 truss transfer spans which are equipped with hoist cable and counterweight-operated aprons. Several variations of the span cable and counterweight system are utilized at WSF facilities. Exhibit 610-12 shows the Seattle Ferry Terminal single cable-operated vehicle transfer span and apron.



Seattle Single Cable-Operated Transfer Span
Exhibit 610-12

WSF has existing VTS systems that have remaining life in the foundations, bridge seats, towers, vehicle transfer spans, etc., while the electrical and mechanical machinery have reached the end of their service life. Some of these existing VTS systems were retrofitted with an updated electrical and mechanical single wire rope hoist system. Completely new VTS systems were also constructed with this same single wire rope hoist system as recently as 2003.

The main features of these new and retrofitted single wire rope systems are as follows:

- Single wire rope hoist system
- Multi-layering non grooved wire rope drum
- Hoist machinery mounted on girder of bridge
- Hoist motor mounted single brake
- Approximately 30,000 lbs unbalanced, span heavy load on hoist system
- 50” diameter CW sheaves for 1.5” diameter wire rope
- Hydraulic apron, operated by two hydraulic cylinders
- Hydraulic live load pins

- Hydraulic power unit with full fluid containment
- Slotted hanger bars for supporting live load
- Wire rope tension control
- PLC control system

These main features represent the ideal solution; however, vessel slips are evaluated for full or partial retrofits depending on usage, age, impending future projects and available budget.

610.07 VTS Piped Utilities

(1) Water Line Criteria

(a) Design Codes

See Section 610.02(2).



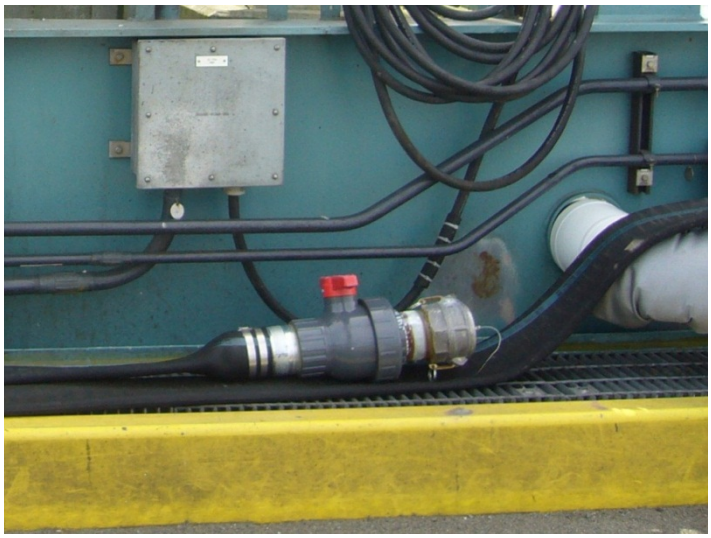
Water Line on VTS
Exhibit 610-13

(b) Water Lines

- Incorporate freeze protection valves in transfer span lines located as close to the vessel connection shutoff valve as possible. Route valve discharge off the span.
- Incorporate a swivel joint and a potable water rated flexible hose in the water line flexible connection from the trestle to the bridge.
- Incorporate a backflow preventer in each transfer span water line. For 4” lines, locate the backflow preventer in a heated enclosure or room on the trestle near the transfer span hinge line. For smaller lines, locate the backflow preventer towards the offshore end of the transfer span and cover with an insulated blanket.
- Design transfer span piping and water line to vessel connections to match the water line size under the trestle.
- Provide an aluminum cam and groove type A adapter with dust cap at the off shore end of the water line.

- Propose the following parts as sole-source components to increase the reliability of the system and to facilitate maintenance:
  - Backflow preventer: Febco Model 860 reduced pressure type
  - Backflow preventer enclosure: Hot Box (for 4" valves)
  - Swivel joint: OPW Model #3930, 3730, 3940 or 3740, as appropriate.
  - Hose: Gates Food and Beverage Master #3132-XXXX.

(2) Sewer Line Criteria



Sewer Line Connection
Exhibit 610-14

(a) Design Codes

See Section 610.02(2).

(b) Sewer Lines

- Design exposed hard sewer lines with heat tape, insulation, and jacketing.
- Design sewer hose connection between the trestle and transfer span with heat tape and insulation.
- Design sewer line to vessel connections to be 4 inches.
- Incorporate a swivel joint and a flexible hose in sewer line connection from the trestle to the bridge.
- Provide an aluminum cam and groove type B coupler with dust plug at the off shore end of the sewer line.
- Propose the following parts as sole-source components to increase the reliability of the system and to facilitate maintenance:
  - Swivel joint: OPW Model #3930-0401.
  - Ball valve:
    - Single entry: Spears # 2431-0409
    - Double entry: Spears # 2321-0400

610.08 Mechanical Design Criteria

(1) Tidal Range of Motion

Design the VTS for a tidal range in accordance with Section 330.06.

(2) Vessel Fit Requirements

Check each installation for fit up for each appropriate vessel class under the following conditions.

- Each appropriate vessel class in light (lay-up) and full (operational) load conditions
- At low tide
- At high tide
- At 0 degree span slope

(3) Maintenance

The mechanical system shall be designed with ease of maintenance in mind. There shall be sufficient access to remove and replace all components without having to remove or disassemble adjacent components.

Safe access to all mechanical system components shall be provided.

There shall be sufficient clearance on all fittings and fasteners that they can be tightened or loosened without requiring the use of special tools. All spot faces and countersinks shall be sized to allow for the use of standard tooling in the removal of the associated components.

Provisions shall be made to support the apron structure while replacing the apron lift system.

(4) New Dual Wire Rope Hoist Operated VTS Structures

The design criteria for this new design/construction can be found in the following reports, criteria documents and project drawings/calculations available in the WSF library.

- Final Design Report for Vehicle Transfer Spans (M-Span), Volume 1 and 2
- Conceptual Design Report - Hydraulically Actuated Transfer Span Systems
- Millennium Vehicle Span - Hoist Machinery Calculations
- Port Townsend Ferry Terminal Standard Transfer Span - Contract #6519 (installed at Friday Harbor under Contract #6737)
- Friday Harbor Ferry Terminal Preservation Project - Contract #6737 (full size span)
- Shaw Island Ferry Terminal Slip Reconstruction - Contract #6576 (reduced size span)

(5) New and Retrofitted Single Wire Rope Hoist Operated VTS Structures

In the late 1990's WSF established design criteria for the mechanical components of a single wire rope hoist system based on available ASME, CFR's, L & I rules, WAC's, and ANSI rules and codes. This was required because no single code or set of rules exactly fit or defined WSF's actual installations or method of operation. WSF's moveable bridge system was not defined by any rules or codes, including AASHTO.

WSF put together a book called *Safety Rules and Regulations*. This document includes 17 codes/rules on which WSF based the single hoist wire rope design/retrofit criteria. At this time none of the designs or existing installations followed any AASHTO design criteria nor did the existing AASHTO criteria seem reasonable for WSF's design or method of operation. The other codes in the safety book also did not entirely address WSF's particular needs. So WSF Engineering took available parts of the listed codes which seemed reasonable and, studying existing designs, using engineering logic, common sense and past experiences, came up with the following design criteria for single wire rope hoist operated vehicle transfer spans.

Single wire rope hoist system design criteria summary:

- 0.75" diameter hoist wire rope
- Multiple layered non-grooved wire rope drum, 12.75" diameter drum barrel
- 14" diameter hoist wire rope sheaves
- 15 ton single blocks, 4 to 1 minimum safety factor
- 20 ton double blocks, 4 to 1 minimum safety factor
- Minimum factor of safety of 4 for all connection parts and hardware
- 2500 to 2800 lbs dead end wire rope tension
- Up limit travel limit switch
- Hoist wire rope tension control, high, low and low-low tensions settings
- Bridge mounted hoist, with single motor mounted spring applied, electrically released motor brake
- 50" diameter CW weight sheaves
- 1½" diameter CW wire rope, factor of safety of 6 minimum
- CW equalizers attached to counterweights
- Hydraulic apron, with two standard apron cylinders
- Hydraulic live load pins
- Fully contained 30 gallon standard hydraulic power unit as detailed on the Standard Drawings
- PLC control system
- View screen on operators control panel for operational and alarm indicators
- Manual push button for apron control on end of apron
- Remote control capabilities for span and apron
- Email connection to Terminal Engineering of select equipment faults/alarms

(6) Hydraulic Transfer Span (H-Span)

(a) System Description

The hydraulic system operates two hydraulic circuits. A pair of hydraulic cylinders raise and lower the transfer span, and a single cylinder raises and lowers the apron. There is one hydraulic system power unit to serve both span and apron functions. The power unit components such as motors, pumps, tank, filters and valves are located in a dedicated hydraulic power unit (HPU) enclosure incorporating an environmental spill pan. The enclosure also houses electrical power and control cabinets.

The span is powered in the raise direction. Span raise speed is limited by the flow rate of the pumps. The span is lowered by gravity (although a pump must be running to provide pilot pressure to load holding valves). Flow control valves mounted on the lift cylinders control the lowering speed. If, at any time, the operator releases the span pushbutton, span motion will cease.

The apron is powered in both the raise and lower directions. Flow control valves located in the HPU manifold control the apron raise and lower speeds.

For vehicle loading and unloading the apron is lowered onto the vessel deck and the apron cylinder continues to extend until the cylinder has reached full stroke. A pressure transducer connected to the rod end of the cylinder will cause the float light to illuminate indicating to the operator that it is safe to begin loading or off-loading vehicles. When in the float mode, the apron is free to move with the movement of the vessel deck. When raising the apron, the float light is extinguished when the raise apron command is given. If the operator releases the apron pushbutton before the apron weight is supported by the lever arm, the apron cylinder will return to its fully extended position. If the operator releases the apron pushbutton after the apron weight is supported by the lever arm, apron motion will cease.

(b) Emergency Operating Description

In case of electric power loss the transfer span hydraulic system can be operated in a vessel back feed mode. The smaller pump (20 HP) is used in this situation. The span raise operation will be significantly slower and all other operations will occur at normal speeds.

(c) Operating Conditions

1. **Normal Operation**
   - Lifting/lowering bridge + operator + snow load + wind load
   - Span speed minimum 5.75 ft/min at the A-frame (bridge cylinder extend speed)
2. **Live Load Operation**
   - Lifting/lowering bridge + live load as defined in WSF load combinations.
   - HL-93 vehicle is anywhere on the span
   - Reduced span speed is acceptable
   - Full two lane live load

(d) Failure Conditions

1. **Loss of any one component or credible cascade tree**
   - Must not result in harm to persons, vehicles, or structure if the following occur while performing the above operations.
   - Holds design load.
2. **Loss of power**
   - Requires operation on vessel backfeed, limited to 30 amps
   - Lifting/lowering bridge + operator
   - Reduced speed acceptable
   - Ability to provide live load operation at reduced speed a nice to have, but is not required

3. **Jammed Transfer Span**
   - Possible failure scenarios that could result in a jammed span will be investigated and addressed (such as foreign objects inserted into pinch points).
4. **Tie-up**
   - Vessel tied up in slip with incoming tide
   - Systems must allow movement of bridge
   - If an action is required to protect bridge system, an alarm shall signal or some secondary operation will occur automatically
   - Components shall resist tie-up forces as defined in WSF load combinations.

(e) Load Combinations

The mechanical system, including hydraulic cylinders, clevises, cylinder connection pins, and hinge pins, shall be designed per the appropriate sections of the AASHTO LRFD *Movable Specifications* to the maximum extent practical and for the following WSF defined non-factored load combinations. See Exhibits 610-15 and 610-16. Reference Section 610.06 for load combination descriptions. Notify the WSF Mechanical Engineer of instances where deviations to the AASHTO LRFD *Movable Specifications* are recommended.

Limit State	Description
WSF-SER-1:	Control yielding due to vehicular live load.
WSF-SER-2:	Bridge exposed to wind velocity exceeding 55 mph.
WSF-SER-3:	Pedestrian use of bridge with a 55 mph wind velocity.
WSF-SER-4	Control yielding due to pedestrian live load.
WSF-EXT-1:	Design Level Earthquake (DLE) without live load.
WSF-EXT-2:	Operational Level Earthquake (OLE) with vehicular live load.
WSF-EXT-3:	Operational Level Earthquake (OLE) without live load.
WSF-FAT-1	Infinite load induced fatigue live
WSF-FAT-2:	Finite load-induced fatigue life.
WSF-OVL-1:	Collision by vehicles.
WSF-OVL-2:	Vessel tie-up line force on apron.
WSF-OVL-4:	Normal operational use of bridge with a 55 mph wind velocity.
WSF-OVL-6:	One transfer span lift hydraulic cylinder failure with one lane HL-93 load.

Mechanical Load Combination Descriptions
Exhibit 610-15

Design Load	Description
WSF-SER-1:	η_i [DC + DW + (LL + IM) + BR + (FR + IM)]
WSF-SER-2:	η_i [DC + DW + WS + FR]
WSF-SER-3:	η_i [DC + DW + PL + 0.3 WS + FR]
WSF-SER-4:	η_i [DC + DW + PL + FR]
WSF-EXT-1:	η_i [DC + DW + EQ]
WSF-EXT-2:	η_i [DC + DW + γ_{EQ} (LL + IM) + γ_{EQ} BR + 0.5 EQ]
WSF-EXT-3:	η_i [DC + DW + 0.5 EQ]
WSF-FAT-I	$\frac{\sigma'_a}{\sigma_e} + \frac{\sigma'_m}{\sigma_{yt}} \leq 0.80$
WSF-FAT-2:	η_i [(FL + IM) + BR]
WSF-OVL-1:	η_i [DC + DW + 0.5 (LL + IM) + 0.5 BR + (FR + IM) + CT]
WSF-OVL-2:	η_i [DC + DW + TL]
WSF-OVL-4:	η_i [DC + DW + (LL + IM) + BR + 0.3 WS + WL + (FR + IM)]
WSF-OVL-6:	η_i [DC + DW + 1.25 (OLL + IM) + 1.25 BR + 1.25 (FR + IM)]

Mechanical Load Combinations
Exhibit 610-16

For load combinations WSF-EXT-1 and WSF-OVL-6, the pressure in the bridge lift cylinders is allowed to increase to 4500 psi. The safety factors for the cylinder connections and hinge pins is allowed to be as low as 1.7 based on the yield strength of the material. For all other load combinations the hydraulic pressures shall be 3,000 psi or below and the safety factors will be a minimum of 3 or 4 as specified in section 6.6.1 of the AASHTO LRFD *Movable Specifications*.

For the WSF-FAT-1 load combination, the minimum and maximum stresses used in the equation shall be as follows:

- For the bridge lift cylinders, pins and clevises; the bridge hinge pins and clevises; and the apron hinge pins and clevises; use the stress occurring with dead load only for the minimum and the stress occurring from the WSF-SER-1 combination as the maximum.
- For the apron lift cylinder pins and clevises and the apron lever arm pins and clevises, use the stress occurring from the apron lever arm only for the minimum and the stress occurring from the lever arm and apron as the maximum.

(f) Design Criteria

1. **Hydraulic Fluid**

   Hydraulic fluid shall be Mobil DTE 10 Excel 15. The design of span lift/apron hydraulic machinery will utilize all possible means to prevent and contain leaks of hydraulic fluid to the environment.

2. **Component Connections**

   Clevis pins, bearings, clevises, trunnions, and other machinery for support of hydraulic cylinders shall be designed in accordance with the Mechanical and Hydraulic section of the AASHTO LRFD *Movable Specifications* to the maximum extent practical.

3. **Operating Pressure**

   All hydraulic components shall be rated for 3,000 psi minimum working pressure. The hydraulic system shall be designed to operate with pressures ranging from 800-3,000 psi. The maximum working pressure in the system or circuit shall be controlled physically through use of pressure control valves.

   Hydraulic span cylinders shall be sized to achieve pressures below 3,000 psi for all the mechanical load combinations with the exception of : WSF-EXT-1 and WSF-OVL-6. The pressures resulting from these load conditions shall remain below 4,500 psi.

4. **Hydraulic Cylinder Design, General**

   Effort shall be made to utilize hydraulic cylinders of the same dimensions and pressure ratings as those currently in WSF inventory.

   The designer shall specify cylinder bore diameter, rod diameter, stroke, retracted length, mounting pin diameter and manifold mounting configuration.

   All cylinders shall be of welded construction, no tie rod cylinders.

   Provide spacers to prevent cylinders from twisting excessively in the clevis brackets.

   Bearings shall be sized using the bearing manufacturer's published dynamic ratings.

   Pin dimensions and hardness shall be per the bearing manufacturer's recommendation

   Critical dimensions of cylinders shall be identical to those of existing H-Span cylinders. Cylinders shall be interchangeable with existing H-Span cylinders.

   All cylinders shall include a valve manifold mounted directly to the cylinder. Manifolds shall contain a load holding valve to hold fluid in the cylinder and thereby support the load when the cylinder is not in motion.

5. **Seals**

   Specify seals that are compatible with the hydraulic oil specified and which have proven prior usage with the hydraulic oil in similar applications.

6. **Bridge Lift Cylinders**

   Factor of safety for all parts – 5:1 based on material ultimate strength and 4:1 based on material yield strength with 3000 psi pressure

   Buckling safety factor – 3:1 based on 3000 psi

   Buckling calculations based on the AASHTO LRFD *Movable Specifications*, NFPA (Fluid) T3.6.37 or other method approved by the WSF Mechanical Engineer.

   Manifold Ports – to accommodate SAE code 61 4-bolt flange fittings, 1" for the blind side port and ¾" for the rod side port.

   Rod material – rod end stainless steel, rod chrome plated stainless steel

Stop tubes or other design features shall be incorporated to ensure sufficient separation between the piston bearing and rod bearing at full cylinder stroke

Bleed and gage ports shall be provided

The design shall allow for the cylinder to be thoroughly bled in the vertical position

The manifold shall be mounted on the cylinder rod end.

7. **Apron Cylinder**

   The apron cylinder shall have a factor of safety of 3:1 based on material yield strength and 3000 psi working pressure.

   Manifold Ports – to accommodate ¾" SAE code 61 4-bolt flange fittings

   Rod material – chrome plated stainless steel

   Air bleed and gage ports shall be provided on both ends of the cylinders. The bleed ports shall be oriented such that air can be completely bled with the cylinder in the installed position.

8. **Cylinder Testing**

   Each cylinder shall be shop tested with the specified hydraulic fluid and witnessed by a WSF Mechanical Engineer. Hydraulic pressure shall be recorded for no load extension and retraction. Cylinders shall demonstrate the ability to hold pressure on both sides of the piston seal. Tests shall demonstrate that no leakage occurs across piston seal, from either side and that no leakage occurs from the rod seal.

   Cylinders shall be stroke tested to demonstrate that no vibration occurs during operation. Large cylinders shall be tested in the vertical position.

   If manifolds are supplied with the cylinder, the manifold shall be tested for leaks, for pressure holding and valve function independent of the cylinder. The manifold shall also be attached to the cylinder and pressure tested to verify no leakage at the manifold to cylinder connection.

9. **Apron Operational Requirements**

   The apron hinge design will include locating the apron bearing centerlines at the deck level to improve accessibility for maintenance. An apron stop shall be incorporated to facilitate changing the apron cylinder.

10. **Hydraulic Pumps**

    Hydraulic pumps intended for fluid power generation are to be selected based upon maximum flow and pressure. Span operation will be accomplished utilizing a minimum of two pumps selected such that in the event one pump fails the remaining pump can operate the span at a reduced speed. Span operation using vessel power will use one pump and a reduced span speed. Pump power is to be selected to produce a span lift speed of 5.75 ft/min. as measured at the lift cylinders. Span will be gravity lowered, but under the control of pilot operated check valves so that in the event of a fault in the hydraulic system or a power failure, the cylinders will lock.

    Pumps and control valves shall be selected so that electric motors are not started under load.

11. **Control Valves**

    Control operating movement of hydraulic lifting systems electronically through solenoid-activated valves or valve stacks. Specify valves that are marine service rated if exposed to weather. Large cylinders shall be controlled through proportional directional control valves to control speed and acceleration/deceleration. The speed and acceleration/deceleration control ranges of the control units shall be sufficient to alter or limit the effects of operating vibrations and frequencies detrimental to component operation.

    Include holding valves at all cylinder ports pressurized by carried loads. Provide valves which allow fluid release only for the following conditions:

    a. Overpressure from impact or thermal pressure rise

    b. Pilot signal descend command

    Pilot signal ratios are to be such that the valves do not open at excessive rates and do not require excessive pilot pressure.

    Require holding valves that allow free flow in reverse direction.

    Solenoid valves protected from the weather shall have lighted plugs. Solenoid valves exposed to the weather shall have conduit connections. Plug connections shall not be allowed.

    Cartridge valves shall be made of stainless steel.

12. **Pump Motors**

    All motors shall comply to NEMA dimensional standards. Motors to be three phase, squirrel cage induction type. Pump motor power is to be determined by the design.

13. **Hydraulic Fluid Reservoir**

    Design fluid reservoirs in compliance with ISO 4413:2010, Hydraulic fluid power – General rules and safety requirements for systems and their components and the following additional requirements:

    - **Baffle** – Baffle the reservoir between the suction and return lines.
    - **Cleanout access** – Reservoir is to have a cleanout access opening for cleaning and inspection purposes that allows access to both sides of the baffle(s). Locate a drain at the lowest point on the reservoir sloping bottom. Equip drain with a ball valve that is plugged.
    - **Material** – Specify reservoirs be fabricated from 316/316L stainless steel and welded with corresponding materials. Covers are to be fabricated with not less than 3/8 inch thickness.
    - **Capacities** – Unless heat loss calculations dictate otherwise, size reservoirs to hold the equivalent of 2 minutes of maximum combined pump capacity in addition to the combined swept volumes of all cylinders rods plus 10 percent and, if applicable, to include provisions for any local conditions such as installation at a non-horizontal angle or installation on a moving ramp that results in a fluctuating angle.

- **Intake lines** – Design intake lines for the minimum velocity possible, less than 4 feet per minute (FPM). Ensure the intake line opening is submerged 1.75 to 2 times the intake line inside diameter. Use bell mouth openings on suction pipes to reduce intake velocity, ensure that the intake pipe is 5 to 6 times the pipe ID away from the nearest wall on at least one side and ensure that the intake pipe is no closer to the reservoir bottom than the pipe ID/2.
- **Calculations** – Heat loss calculations are to be supplied with the calculation package.
- The hydraulic fluid reservoir shall be a heavy duty design and constructed of stainless steel conforming to ASTM A276, Type 316L. Volumetric capacity of the reservoir will be determined by the design. The reservoir shall feature a desiccant type breather system to prevent water contamination due to the ingress of moist air.
- The hydraulic reservoir tank shall be fitted with a 10 micron return line filter placed in a location allowing ready access for replacement. Filters shall be fixed for a 5 psi pressure drop at 70 degrees F and shall be fitted with visual element condition indicators.
- Provision of a small continuously running filter circulation pump is desirable.

14. **HPU Enclosure**

    The HPU enclosure will be constructed with an oil sump capable of containing oil spillage up to the volume of the hydraulic tank. The enclosure will be mounted on the trestle, preferably on the right hand side of the transfer span adjacent to the bridge seat.

    The hydraulic power unit will be located as appropriate for the site but in each case to minimize environmental risks to the cabinet and piping.

15. **Tubing, Pipe, and Fittings**

    Hydraulic tube inside the HPU shall be seamless, annealed, 316L SST tube per ASTM A269. Sizes shall be (OD x min. wall): 1 x .109, 1.25 x .120, 1.5 x .156, 2 x .188.

    Hydraulic pipe shall be 316L SST SCH 80 pipe per ASTM A312 passivated per Alaskan Copper and Brass “Procedure for Passivation” No. N706. After passivation, the pipe shall be protected from contact with carbon steel at all times. This includes contact with airborne particles produced by machining and blasting operations, carbon steel tools, and other tools, rags, grinding wheels, abrasives, etc. that may have been contaminated with carbon steel particles.

    After passivation, the stainless steel pipe that is to run transversely under the transfer span shall be solvent cleaned, blast cleaned and painted with a marine grade protective coating. For the purposes of this requirement, references to pipe include the end flanges. The mating surfaces of the end flanges shall not be coated.

    - Follow the surface preparation and product application procedures recommended by the paint manufacturer for stainless steel.
    - The pipe shall be solvent cleaned per SSPC-SP 1 using a non-chlorine and non-salts containing solvent. The solvent used shall be compatible with the coating and approved by the coating manufacturer.

- The pipe shall be brush-off blast cleaned per SSPC-SP 16 using virgin garnet abrasive to obtain the surface profile recommended by the coating manufacturer.
- Apply protective coating as soon as possible after blasting.
- The pipe shall be coated with a minimum of two coats high build, high solids, marine grade, epoxy coating acceptable for immersion use in salt water. Final dry film thickness (dft) shall be as listed below.
- Acceptable coatings include: Macropoxy 646 Fast Cure Epoxy manufactured by Sherwin Williams, final dft 8-12 mils; Interzone 954 Epoxy manufactured by International, final dft 20-24 mils; Amerlock 2 Epoxy manufactured by PPG, final dft 8-12 mils; and other coatings as approved by the Engineer.
- Any damage incurred by the coating during the course of the project shall be repaired immediately.

Pipe and tube fittings shall be stainless steel. Fittings up to and including 3/4 inch in diameter shall be Parker Ferulok three piece bite type fittings or SAE Code 61 four bolt flange fittings welded directly to tube/pipe ends. Fittings 1 inch in diameter or greater shall be of the 4 bolt flange type (code 61). Welding of fittings to pipe or tube ends shall be per ASME B31.3 Chapter IX, High Pressure Piping.

Hose fittings shall be of the o-ring face seal type or SAE Code 61 four bolt flange fittings constructed of carbon steel.

16. **Hydraulic Hose and Fittings**

All hydraulic hose except for suction hoses shall be rated for a minimum of 3,000 psi working pressure. All hoses are to be the no skive type.

Except for the ¾" hose connected to the apron lift cylinder, all high pressure hose shall be Parker 782TC. The ¾" hoses connected to the apron cylinder shall be Parker 451TC.

All hose assemblies (hose with attached end fittings) shall be pressure tested to 1.5 times their rated working pressure before installation into the system.

Hose fittings shall have the same pressure rating as that of the hose used, as a minimum. Hose fittings shall be the o-ring face seal type or SAE Code 61 four bolt flange fittings. All hose fittings shall be plated carbon steel and crimped onto the hose.

All hose fitting or attachment bolts are to be tightened to the manufactured specified torque for the particular size and style of fitting used.

All hydraulic hose and hose fittings used in an installation are to be the same model number when possible.

Require all hydraulic hose assemblies to have metal tags attached defining pressure rating, length and installation date.

All hydraulic hose will be replaced five years after the date of installation unless inspections determine that replacement of the hose is required earlier.

Provide Partek abrasion sleeves on all hoses connected to moving components.

All hose fittings shall be wrapped with petrolatum impregnated tape after final inspection.

(g) Hydraulic Maintenance Requirements

The incorporation of the standard design features will allow the existing maintenance procedures and schedules to be used on the new installation.

Isolation valves shall be incorporated into the design to allow removal of major components without draining excessive amounts of hydraulic fluid. Lifting lugs shall be provided on the structure above all components weighing over 75 lbs.

The following parts are proposed as sole-source components.

- Tube fittings: Parker Ferulok type up to and including 3/4 inch in diameter.
- Hose fittings: Parker Seal-Lok o-ring face seal type
- Hydraulic components: as shown on the plans.
- High pressure hoses: Parker 782TC and Parker 451TC.

(h) Hydraulic Testing

1. **General**

   All components and sub-assemblies shall be tested by the contractor and inspected by WSF Terminal Engineering before being installed in the field.

2. **Component Testing**

   Key critical components or long lead items that are not easily replaced or substituted shall be tested by the manufacturer and inspected by WSF Terminal Engineering before the component is shipped to WSF or a WSF Contractor.

3. **Shop Testing**

   All Contractor manufactured hydraulic components shall be shop tested. Sub-assemblies, tanks, manifolds and valves shall be tested before final assembly in the HPU or in the OHL structure. Valve settings and flow controls shall be tested and set in the shop prior to installing in the HPU or in the OHL structure. In addition, the completed HPU shall be shop tested before being installed or sent to the terminal site.

5. **Yard Testing**

   The system shall be tested to the maximum extent possible in the Contractor's yard before being moved on site.

6. **Field Testing**

   Once the structure is installed at the terminal site, and the HPU field connections are completed, the hydraulic system shall be tested again following the requirements in the contract specifications.

(i) Alarms and Monitoring

The mechanical designer shall work with the electrical designer in identifying required controls and indication and providing necessary hardware to achieve them.

Alarm Conditions shall be displayed on the message screen on the HPU Operator Control Station and illuminate the alarm light on the span control panel.

Shutdown Conditions shall stop all movement by de-energizing all equipment and valves. Shutdown Conditions shall be displayed in the message screens on the Operator Control Stations and illuminate the shutdown light on the span control panel.

In addition to displaying Alarm and Shutdown messages, the message screens will also display System Status messages.

610.09 Electrical Design Criteria

(1) General

This section provides a description of the electrical systems used in connection with vehicle hydraulic transfer span (H-Span) design. The H-Span electrical design will be provided by WSF Terminal Engineering. Refer to Chapter 360 for additional information including VTS lighting requirements.

Refer to Chapter 360 for non-H-Span transfer span electrical criteria.

(2) Power System Overview

The key components of the transfer span power system are listed and described below.

(a) Junction Box JB-T1 (For Electrical Service from Left Side)

The on-shore electrical service power feed comes onto the transfer span at junction box JB-T1. The power feed is 480V, 3-phase. JB-T1 is located on the outside of the left guardrail near the bridge seat.

(b) Junction Box JB-T2 (For Electrical Service from Right Side)

For electrical service coming from the right side, the power feed comes onto the transfer span at junction box JB-T2. JB-T2 is located on the outside of the right guardrail near the bridge seat.

(c) Vessel Backfeed Cord and Plug

A 480V, 3-phase plug on the end of a 100 foot cord is located on a rack on the left guardrail near the apron. The plug connects to a receptacle on the car deck of ferries and is used to connect vessel power to the transfer span power system.

(d) Manual Transfer Switch (MTS-1)

The onshore electrical service power feed and the vessel backfeed are each routed to a manual transfer switch, MTS-1, located on the inside of the left guardrail. MTS-1 is used to transfer from the onshore service power to vessel power if the onshore service is not available. MTS-1 will normally be connected to the onshore electrical service feed. Moving the handle on MTS-1 to the center position disconnects the transfer span power system from both services.

(e) Motor Control Panel (MCP)

The power feed is 480V, 3-phase from MTS-1. The panel contains the breakers and controls for the HPU motor starters (M1), (M2) and (M3), as well as the breaker for transformer 41T-HPU which serves panelboard 1P-HPU.

The MCP panel is located in the HPU enclosure. See below for a description of the HPU enclosure.

1. **HPU Motor Starter (M1) Section**

   HPU Motor Starter (M1) is an IEC type motor starter rated 480V, 3-phase. It is fed from MTS-1 through the MCP main breaker. M1 is connected to a 30 HP HPU pump motor in the HPU enclosure. The control contact that operates the contactor comes from the PLC cabinet. Control power for the contactor also comes thru the PLC cabinet from panelboard 1P-HPU.

2. **HPU Motor Starter (M2) Section**

   HPU Motor Starter (M2) is an IEC type motor starter rated 480V, 3-phase. It is fed from MTS-1 through the MCP main breaker. M2 is connected to a 30 HP HPU pump motor in the HPU enclosure. The control contact that operates the contactor comes from the PLC cabinet. Control power for the contactor also comes thru the PLC cabinet from panelboard 1P-HPU.

3. **HPU Motor Starter (M2) Section**

   HPU Motor Starter (M3) is an IEC type motor starter rated 480V, 3-phase. It is fed from MTS-1 through the MCP main breaker. M3 is connected to the 20 HP HPU pump motor in the HPU enclosure. The control contact that operates the contactor comes from the PLC cabinet. Control power for the contactor also comes thru the PLC cabinet from panelboard 1P-HPU.

(f) Panel 1P-HPU

Panel 1P-HPU is a 120/240V panelboard fed from an adjacent 10 kVA single phase transformer. The transformer is fed from the motor control panel (MCP). Branch circuits from the panelboard provide 120V power for the PLC cabinet, range lights, cargo lights and control station light, fog light, gate motor, foghorn, duplex receptacles, and HPU enclosure lighting and duplex receptacles. Panel 1P-HPU and the transformer are located in the HPU enclosure.

(3) Vehicle Transfer Span Control System

The transfer span is normally operated from the bridge control station (1PBS) located on the left side of the bridge. There are individual pushbuttons on the front of 1PBS for BRIDGE UP, BRIDGE DOWN, APRON UP, and APRON DOWN. The pushbuttons connect as inputs to the PLC. The PLC is programmed to start the HPU pump(s) and open and close valves in the hydraulic system as required to move the bridge and apron. Exhibit 610-17 summarizes the control system.

Control System Component	Notes
Programmable Logic Controller (PLC)	Allen Bradley CompactLogix Control System
Panel View	On Bridge Control Station 4PBS Allen Bradley PanelView Plus 6 600
Bridge Control Station (1PBS and 4PBS) (Continued Below)	There are two bridge controls stations, 1PBS on the transfer span and 4PBS in the HPU Enclosure. On Bridge Control Station 1PBS, there are pushbuttons for: • BRIDGE UP • BRIDGE DOWN • APRON UP • APRON DOWN • ALARM SILENCE/RESET • GATE UP • GATE DOWN • GATE STOP There is a lighted pushbutton for: • EMERGENCY STOP There are indicating lights for: • MAINTENANCE REQUIRED • SHUTDOWN • APRON FLOAT On Bridge Control Station 4PBS, there are pushbuttons for: • BRIDGE UP • BRIDGE DOWN • APRON UP • APRON DOWN • ALARM SILENCE/RESET There is a lighted pushbutton for: • EMERGENCY STOP There is a selector switch for: • CONTROL POWER 1PBS ON – 4PBS ON
Attendant's Control Station (2PBS and 3PBS)	There are two attendant's controls stations, 2PBS on the transfer span and 3PBS by the traffic gate. On Attendant's Control Station 2PBS there are lighted pushbuttons for: • TRAFFIC STOP • TRAFFIC GO There is a selector switch for: • FOG LIGHT ON - OFF On Attendant's Control Station 3PBS, there are pushbuttons for: • GATE UP • GATE DOWN • GATE STOP There are lighted pushbuttons for: • TRAFFIC STOP • TRAFFIC GO There is a selector switch for: • FOG LIGHT ON - OFF

Summary of Transfer Span Control System
Exhibit 610-17

(a) PLC Cabinet

The PLC Cabinet contains the PLC, remote radio receiver, terminal boards, and counters required to control the bridge and apron.

(b) Bridge Control Station (1PBS)

The bridge control station contains the required pushbuttons and indicating lights for the control of the bridge, apron, traffic gate and trouble indicating light and audible devices associated with the transfer span. Refer to Exhibit 610-18.

(c) Attendant Control Station (2PBS)

The attendant control station contains the required pushbuttons and indicating lights for control of the transfer span miscellaneous systems (traffic signals, foghorn, and fog light). Refer to Exhibit 610-18.



Bridge Control Station and Attendant Control Station
Exhibit 610-18

(d) Attendant Control Station (3PBS)

The attendant control station contains the required pushbuttons and indicating lights for control of the transfer span miscellaneous systems (traffic signals, foghorn, and fog light).

(e) Bridge Control Station (4PBS)

The bridge control station contains the required pushbuttons and indicating lights for control of the bridge, apron, HPU and trouble indicating light and audible devices associated with the transfer span. Control station 4PBS is located in the HPU enclosure.

(f) Motor Control Panel (MCP)

The motor control panel contains the contractors, motor starters and terminal boards required for the operation of the motors associated with the operation of the transfer span.

(4) HPU Enclosure

The HPU enclosure is a freestanding self-contained enclosure containing the hydraulic manifold, valves, tank, filters, pumps, motors, tubing and hoses and the electrical panelboard, transformer, MCP cabinet, PLC cabinet, control station 4PBS and all associated junction boxes, devices, conduit, and wire. Mount the HPU enclosure on the trestle, preferably on the right hand side of the transfer span adjacent to the bridge seat.

(5) Remote Control

The H-Span is designed to allow the personnel on the ferry to adjust the transfer span via wireless radio remote control.

Chapter 620 Passenger Overhead Loading

620.01 General
620.02 References
620.03 Design Considerations
620.04 OHL Components
620.05 Structural Design Criteria
620.06 OHL Utilities
620.07 Mechanical Design Criteria
620.08 Electrical Design Criteria
620.09 Architectural Design Criteria

620.01 General

This chapter provides guidance for the design of new and retrofitted passenger overhead loading (OHL) structures. These structures provide an elevated walkway for passenger access between the terminal building and the passenger deck of the ferry vessels. OHL increases the operational efficiency of the terminal by allowing vehicle and pedestrian loading and unloading operations to occur simultaneously. It can also create a safe grade-separated ADA accessible travel path for pedestrian riders from the boat to other modes of transportation.



Edmonds OHL Structures
Exhibit 620-1

Exhibit 620-2 indicates which WSF facilities currently have OHL systems. Where OHL facilities are provided, accommodate the possibility of vehicle transfer span (VTS) pedestrian loading in the event that the OHL system is out of service.

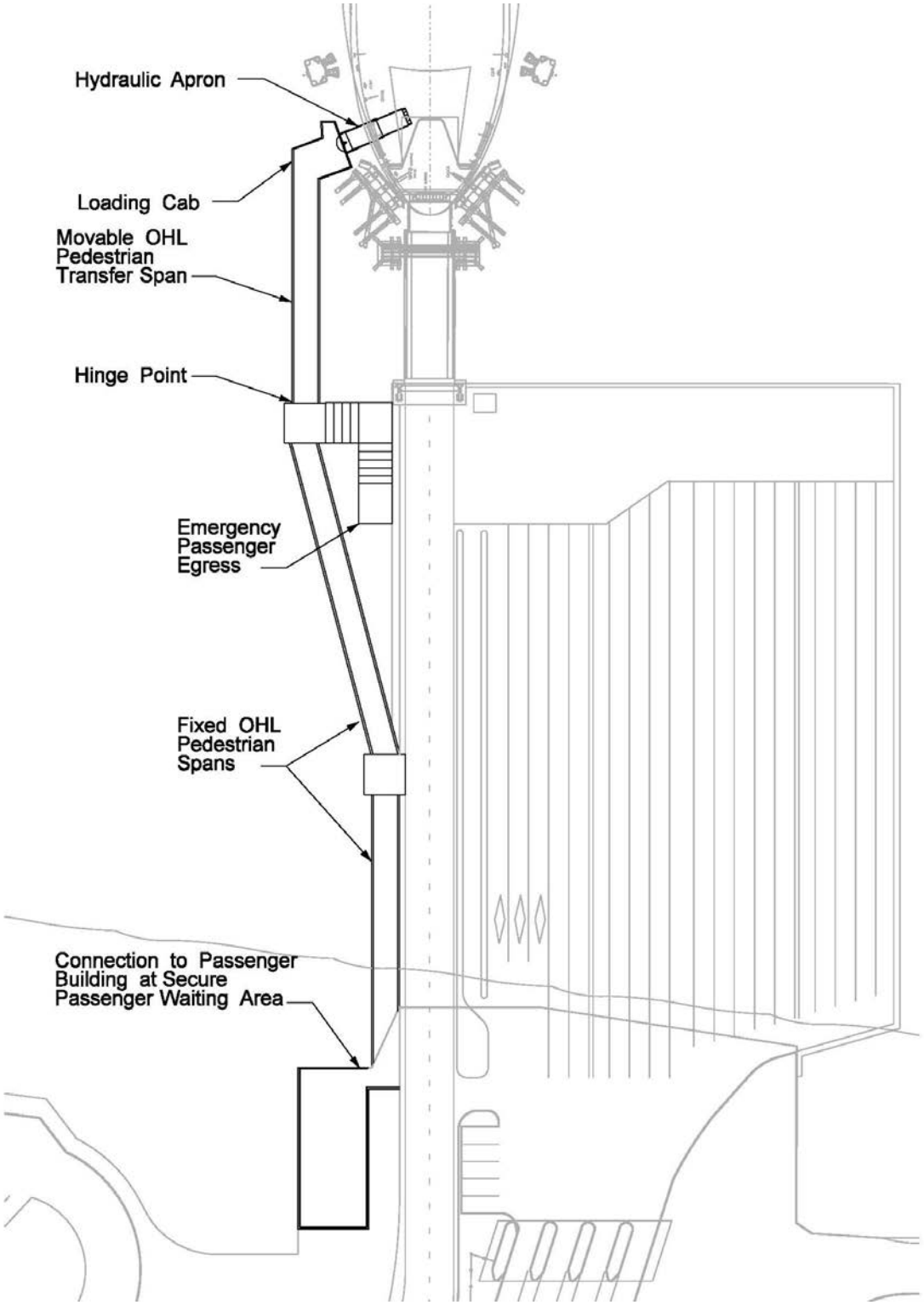
Terminal	Existing Overhead Loading Design
Anacortes	Cable Hoist
Bainbridge Island	Cable Hoist
Bremerton	Supercolumn
Edmonds	Supercolumn
Kingston	Supercolumn
Seattle Slip 1	Tension Cylinder
Seattle Slip 2	Cable Hoist
Seattle Slip 3	Cable Hoist

Overhead Loading at Existing Terminals
Exhibit 620-2

WSF currently utilizes three distinct OHL system designs – the supercolumn design, the cable hoist design, and the tension cylinder design – as shown in Exhibit 620-2. These concepts are discussed in Section 620.04. Exhibit 620-3 shows an example layout utilizing the WSF-preferred supercolumn design.

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
330	Marine
360	Electrical
600	Trestle
610	Vehicle Transfer Span



Example OHL Structures Plan
Exhibit 620-3

620.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

29 Code of Federal Regulation (CFR) Part 1918, Safety and Health Regulations for Longshoring

(2) Design Codes and Specifications

AASHTO *LRFD Bridge Design Specifications* (AASHTO *LRFD Specifications*), American Association of State Highway and Transportation Officials, Washington, DC

AASHTO *Guide Specifications for LRFD Seismic Bridge Design* (AASHTO *LRFD Guide Specifications*), American Association of State Highway and Transportation Officials, Washington, DC

AASHTO *LRFD Guide Specifications for the Design of Pedestrian Bridges* (AASHTO *LRFD Pedestrian Specifications*), American Association of State Highway and Transportation Officials, Washington, DC

AASHTO *LRFD Movable Highway Bridge Design Specifications* (AASHTO *LRFD Movable Specifications*) American Association of State Highway and Transportation Officials, Washington, DC

AASHTO S*tandard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*, American Association of State Highway and Transportation Officials, Washington, DC

ASCE *Minimum Design Loads for Buildings and Other Structures, ASCE/SEI 7-10*, 2010, American Society of Civil Engineers, Reston, VA.

International Building Code, International Code Council, Inc.

Bridge Design Manual LRFD (BDM) M 23-50

Proposed Passenger Vessels Accessibility Guidelines. Published in the Federal Register on June 25, 2013. This document contains scoping and technical requirements for accessibility to passenger vessels by individuals with disabilities. The requirements are to be applied during the design, construction, additions to, and alteration of facilities and elements on passenger vessels to the extent required by Federal agencies under the Americans with Disabilities Act of 1990 (ADA).

2010 ADA Standards for Accessible Design, United States Department of Justice

Structural Welding Code – Steel (AWS D1.1), American Welding Society, Miami, FL

Bridge Welding Code (AASHTO/AWS D1.5M/D1.5), American Association of State and Highway Transportation Officials, Washington, DC and American Welding Society, Miami, FL

Specification for Structural Steel Buildings (ANSI/AISC 360), American Institute of Steel Construction, Chicago, IL

Design Manual M 22-01

Ferry Boarding Facilities, CAN/CSA-S826 Series-01

General Special Provisions, WSDOT

Hydraulic fluid power – General Rules and Safety Requirements for Systems and Their Components, ISO 4413, International Organization for Standardization, Geneva, Switzerland

Application guidelines for selected fluid power components – Accumulators Cylinders Hydraulic valves Pneumatic filters, regulators and lubricators Selection of position transducers, National Fluid Power Association, Milwaukee, WI

Hydraulic fluid power - Filters – Multi-pass method for evaluating filtration performance of a filter element, ISO 16889, International Organization for Standardization, Geneva, Switzerland

AASHTO *Standard Specifications for Movable Highway Bridges*, 5th Edition with 1992, 1993 and 1995 Interims, American Association of State Highway and Transportation Officials, Washington, DC

Hydraulic fluid power - Cylinders - Method for determining the buckling load, (NFPA T3.6.37) National Fluid Power Association, Milwaukee, WI

Hydraulic Flanged Tube, Pipe, and Hose Connections, 4-Screw Flange Connection Part 1: 3.5 MPa to 35 MPa (Code 61), SAE J518, SAE International, Warrendale, PA

Reference Drawings, WSF

Regional General Special Provisions, WSF

Standard Specifications for Road, Bridge, and Municipal Construction M 41-10

(3) Supporting Information

1999 Colman Dock Seattle Ferry Terminal Design Memorandum for Existing Terminal Building Design Evaluation, WSF

2006 Mukilteo Multimodal Ferry Terminal Overhead Loading Configuration/ Pedestrian Bridge Alternatives Technical Memorandum, WSF

2006 Mukilteo Multimodal Ferry Terminal Overhead Loading Mechanical Design Criteria Technical Memorandum, WSF

Life Cycle Cost Model (LCCM), WSF

620.03 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible.

Additionally, 49 CFR Part 39 prohibits owners and operators of passenger vessels from discriminating against passengers on the basis of disability, requires vessels and related facilities to be accessible, and requires owners and operators of vessels to take steps to accommodate passengers with disabilities. Incorporate features into the OHL facilities to allow access by persons with reduced mobility per the applicable requirements. In the absence of such features, WSF is responsible for the assisted transfer of persons with reduced mobility.

Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessel security requirements, and additional information pertaining to passenger OHL design. Below are links to relevant sections by topic. Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for Transportation Worker Identification Certification (TWIC) and Sensitive Security Information (SSI).

- MARSEC Levels: 310.04
- Vessel Security: 310.05
- Waterside Structures: 310.09
- Access Control/Restricted Area/TWIC: 310.10

(3) Environmental Considerations

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation. The design should minimize the risk of hydraulic fluid spills and leaks.

(4) Marine

Refer to Chapter 330 for marine criteria pertaining to passenger overhead loading. Below are links to relevant sections by topic.

- Operations and Maintenance: 330.04(4)
- Proprietary Items: 330.04(6)
- Long Lead Time Items: 330.04(7)
- Corrosion Mitigation: 330.04(9)
- Scour and Mudline Elevations: 330.04(10)
- Geotechnical Requirements: 330.04(11)
- Materials Specification: 330.04(12)
- Miscellaneous Considerations: 330.04(13)
- Tidal Information: 330.06
- Wave, Flood, and Coastal Storm Loading: 330.09(1)

(5) Electrical

Refer to Chapter 360 for general electrical design criteria pertaining to overhead loading. Below are links to relevant sections by topic.

- Wiring and Protection: 360.04
- Wiring Methods and Materials: 360.05
- Equipment: 360.06

(6) Operations and Maintenance

- Minimize repair and maintenance required during the design life.
- Minimize potential for hydraulic fluid spills and leaks.
- Incorporate nonskid coatings appropriate to the weather exposure on surfaces intended for use by pedestrians.
- Provide on the outside of the OHL structures a means to support fall protection systems for performing periodic maintenance, cleaning, and repair of the elevated portions of the OHL structures including all mechanical and electrical components.
- Provide bird deterrent wire at all OHL structures. Provide mesh screening to prevent birds from entering the supercolumn area and the machinery compartments located under the cab floor.
- Provide unobstructed view of the holding lanes by operations personnel, where feasible.
- Provide unobstructed view of pedestrian access way from operator's cab. Locate operator control station such that there is good visibility for setting the plank on the vessel deck.
- A security gate is required before the loading cab to restrict access prior to vessel departure and until after the next arrival.
- Reader board signs, gate/door controls, and intercom/PA controls are required at the shoreward hinge point of the movable transfer span.
- Where necessary, provide an employee access door back into the terminal building adjacent to the entry into the OHL system.

(7) Design Life

Design life is based on the current *Life Cycle Cost Model* (LCCM) as required by the Washington State Office of Financial Management (OFM). Refer to Table 1 for the design life of new structures (as of 2007) and Table 2 for design life of structures prior to 2007, in the 2010 *Life Cycle Cost Model* Update (2010 LCCM) for information on when existing marine structures and their systems are due for replacement. Confirm design lives given below are consistent with the current LCCM. Replacement life may be reduced due to functional obsolescence.

- Overhead Loading Drilled Shafts: 75 years
- Overhead Loading Walkways, Transfer Span, Loading Cab and Aprons: 75 years
- Mechanical System Type 6 - Cable hoist, cable cab, manual apron and pins, counter weight: 30 years
- Mechanical System Type 7 - Cable hoist, hydraulic apron, hydraulic pins, counter weight: 30 years
- Mechanical System Type 8 - Hydraulic hoist, hydraulic apron: 40 years

(8) Vertical Clearance Requirements

When the OHL system crosses the vehicle holding and/or exit lanes, the minimum clearance under the OHL system is 16.0 feet with 16.5 feet preferred. All ferry vessels serving WSF terminals have a tunnel height of 16 feet or less. If any OHL structure is proposed to cross a state or local route, the minimum clearance must meet highway standards (WSDOT). Refer to the *Design Manual* M 22-01 for vertical clearance requirements for bridges. Contact individual railway companies for their overcrossing design standards.

(9) Operational Classification

WSF OHL systems are operationally classified per the AASHTO LRFD Specification Section 1.3.5 as typical, not critical or essential, unless noted otherwise. The performance objective for "typical" bridges is life safety. See Section 620.05(1)(c) Limit States for use of this classification.

(10) Seismic Design

Perform seismic design of OHL structures in accordance with the AASHTO *LRFD Specifications* and supplemented by the AASHTO *LRFD Guide Specifications* where appropriate. Design OHL structures for a design level earthquake (DLE) corresponding to a 7 percent probability of exceedance in 75 years (~1000 year return period) with a life safety protection/ collapse prevention performance objective. OHL structures are expected to support gravity loads after the DLE but may suffer significant damage that may disrupt service.

OHL Structures shall also be checked for an operational level earthquake event (OLE). This is an event in which no damage or only minor structural damage will occur, but a temporary interruption in service may occur.

For the fixed portions of the OHL system, the OLE event is similar to a 50 percent exceedance in 75 years (~100 year return event). Expansion joint design and locations where the relative displacement of different structures could cause damage shall be checked for this level earthquake event.

For the movable portions of the OHL system, the OLE is based on the AASHTO *LRFD Movable Specifications*. The OLE for movable bridges is defined as half of the demand values associated with the DLE. For the OLE, design and detailing are intended to allow the transfer span and apron to remain operational, i.e., movable.

Minor damage to the movable span is acceptable during the OLE event provided that it is designed to occur at a predetermined location and can be easily identified and quickly repaired.

The designer shall identify in the general structural notes of the contract drawings the anticipated structural failure locations for both the OLE and the DLE.

For seismic design of single drilled shaft foundations, plastic hinging is limited to aboveground and near-ground locations. In-ground plastic hinging is not permitted.

For geotechnical requirements, refer to Chapter 330.

(11) Accelerated Bridge Construction

Accelerated bridge construction methods such as precast concrete bridge seat caps in the design are options where the duration of slip closures must be kept to a minimum. Use of these methods minimizes interruptions during construction and can be cost effective at busy terminals.

(12) Vibration

Evaluate the vibration of OHL structures in accordance with the AASHTO *LRFD Pedestrian Specifications*. Ensure that vibration of the structures does not cause discomfort or concern to users.

(13) Fire Protection

Design provisions to safeguard the overhead loading against fire in conformance with the National Fire Protection Association as well as State and local ordinances.

Consider the following in conjunction with WSF's emergency procedures:

- The safe and efficient evacuation of passengers transiting and personnel working between shore and vessel.
- The requirements for emergency response to any fire occurring on shore, vessel, and OHL passenger spans.

(14) Signage and Wayfinding

Refer to Chapter 570 for signage requirements.

(15) Design Drawing Information

Drawing format and software used shall follow Division 8.

Include or reference the following information on design drawings:

- Principle loads used in design and number of load cycles anticipated over the life of the structure
- Statement of conformity to WSF *Terminal Design Manual* and any other applicable guidelines

- Provide the operational and extreme range of motion (highest and lowest elevations); maximum and minimum slopes of the transfer span and any other specific operating limitations
- Tide or sea level variation considered for design
- Materials specified for structure elements and load-bearing components
- Features of vessels used in design (displacement, freeboard, geometry of gate openings, etc.)
- Design life expectancy
- Description of the sequence of operations as well as any operating limitations
- Weight of major components and structural sections

(16) Proprietary Items

WSF uses competitively acquired products to fulfill the requirements of a contract wherever feasible to help achieve the lowest price, the best quality, and the most efficient use of resources. There are instances in which competitive bidding may not or cannot be provided and a specific proprietary product is allowed. Refer to Section 220.07(2) for limitations on the use of proprietary items.

620.04 OHL Components

(1) New Structures – Supercolumn Design

Design new OHL systems similar to the existing systems located at the Edmonds and Bremerton Ferry Terminals. These systems include fixed spans, pedestrian transfer span (movable bridge), loading cab, hydraulic apron, hydraulic lift cylinder, and drilled shaft foundations. Provide a supercolumn design consisting of a drilled shaft foundation that supports the loading cab at the offshore end of the pedestrian transfer span and houses a single hydraulic cylinder used to raise and lower the transfer span and loading cab. Design the OHL system with the ability to serve two vessels, one on each side of the transfer span and loading cab, where applicable. For existing OHL system drawings, refer to the WSF *Reference Drawings* or contact the WSF CADD Manager.

(a) Fixed Spans

The OHL fixed spans are fixed pedestrian bridges that provide access from the terminal building to the pedestrian transfer span for walk-on passengers. Based on ridership, design the OHL fixed spans with a 12- to 16-foot clear width between handrails. New OHL structures may require a study to determine the ideal width of the fixed and movable span. Provide a secure partial height, such as a railing, or full height division between the loading and unloading pedestrian walkways to maintain fare control, where applicable. Maintain the minimum clear width of the walkway between any doorways located along the OHL system.

In order to maintain expeditious loading, it is desirable to have a significant number of passengers as close to the vessel as possible. Therefore, passengers waiting to load queue along the fixed spans up to the pedestrian transfer span's shoreward hinge point prior to vessel arrival. Provide automatic doors at the end of the fixed span and provide a gate or door at the hinge point as well for passenger control. Provide level landings

or platforms near areas used for staging to provide a level resting place for passengers with limited mobility or in wheel chairs. Passengers are not allowed past the hinge point onto the pedestrian transfer span due to building code egress requirements prohibiting "dead-end" situations.

Consider the use of fixed spans to provide passenger access to other modes of transportation in the terminal vicinity.

(b) Pedestrian Transfer Span and Hinge Point Elevation

The pedestrian transfer span is a movable bridge which connects the fixed spans to the loading cab and apron and is adjusted vertically to account for the tides. The critical elevation of the pedestrian transfer span is located at the shoreward hinge point. Locate the hinge point at the elevation which provides no more than a 1:12 slope along the pedestrian transfer span from the hinge point to the loading cab for the greatest percentage of the time.

Exhibit 620-4 lists the standard dimensions for the pedestrian transfer span. Design the pedestrian transfer span for a minimum specified, or a 12-foot clear width between handrails. Design the span to be 120 feet in length. At this length, the pedestrian transfer span (gangway) is no longer required to meet the 1:12 maximum slope at all tides. Design the pedestrian transfer span for an 8.5-foot minimum clear height. The clear height is measured from the top of walking surface to the bottom of any sign or other obstacle. Hanging or protruding objects within the walkway may present obstacles for pedestrians with visual disabilities.

Element	Measurement
Clear Width	12 feet – 16 feet
Length	120 feet
Clear Height	8.5 feet

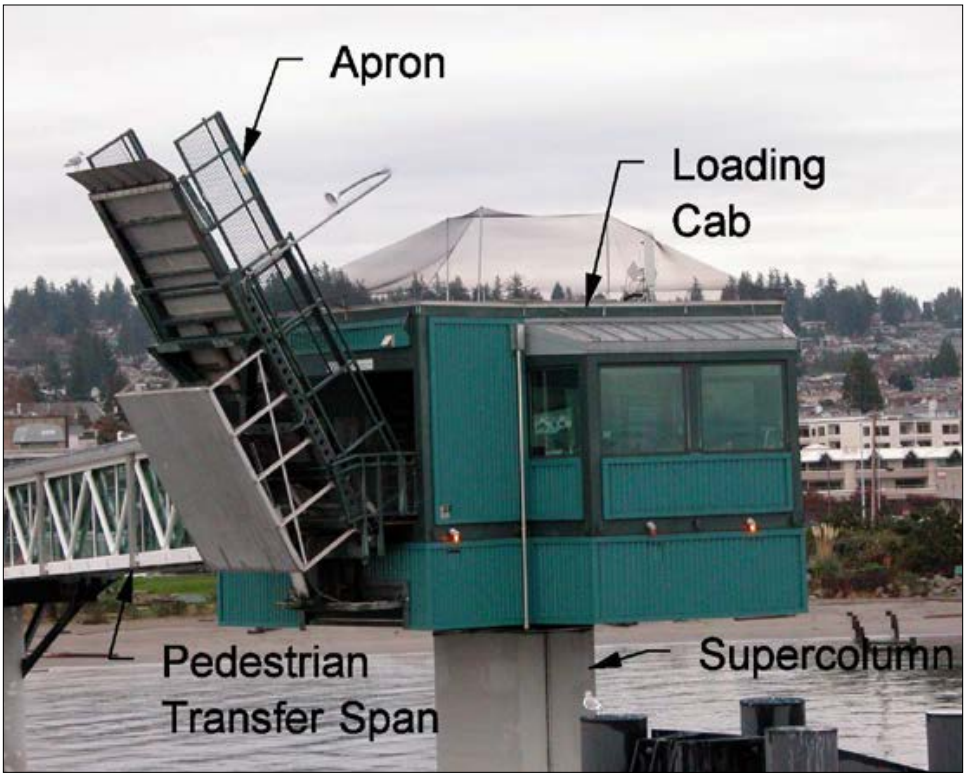
Pedestrian Transfer Span Dimensions
Exhibit 620-4

(c) Loading Cab

The loading cab system is a movable structure that serves as the last node on the passenger walkway connecting the terminal building to the ferry vessel. Exhibit 620-5 below shows the loading cab at the Edmonds Ferry Terminal. The loading cab has a movable apron which provides a ramp from the cab to the passenger deck of the ferry. The loading cab and apron are used to adjust the passenger walkway to accommodate changes in tide elevation as well as differences in ferry boat designs.

For tidal range, design vessels, and freeboards, refer to Chapter 330.

For terminals with two operating slips, consider providing a single loading cab with two hydraulically actuated aprons.



Edmonds Loading Cab and Hydraulic Apron
Exhibit 620-5

(d) Operator Station

The operator station is for the WSF attendant who operates the loading cab and hydraulic apron. Locate the operator station on the offshore side of the loading cab. Locate the controls for the loading cab, hydraulic apron, gate controls, sign controls, intercom, and PA system at the operator station. Provide the operator station with a wall heater for winter and the ability to open a couple windows for circulation during the summer. Design the operator station to be ADA accessible.

(e) Hydraulic Apron

The hydraulic apron provides a walkway for passengers traveling from the loading cab to the vessel. The hydraulic apron is lowered onto the passenger deck of the ferry vessel after the vessel is moored in the operating slip. Exhibit 620-5 shows the hydraulic apron in the raised position at the Edmonds Ferry Terminal. Include provisions to allow the apron to "float" following the movement of the vessel due to changing freeboards while loading/unloading and vessel movement due to wave action.

Element	Measurement
Apron Clear Width	9 feet – 12 feet
Length (retracted)	23 feet
Length (extended)	33 feet
Clear Height	8.5 feet

OHL Apron Dimensions
Exhibit 620-6

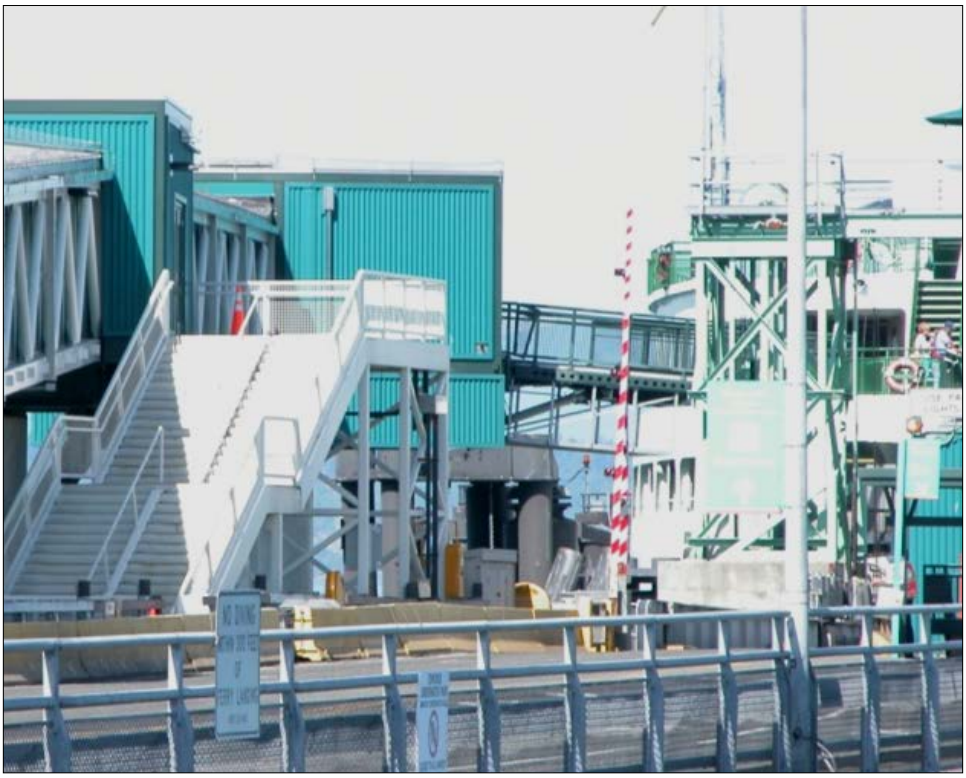
Exhibit 620-6 lists guidelines which allow for the use of standard sized apron cylinders. Verify these dimensions for each design vessel which moors at the slip and the tidal range for the terminal.

(f) Supercolumn

The supercolumn consists of a drilled shaft foundation which houses the hydraulic lift cylinder used to raise and lower the loading cab. The exact position of the supercolumn is dependent on a number of variables including the location of the trestle, vehicle transfer span system and wingwalls. The elevation of the top of the drilled shaft casing shall be a minimum of 1 foot above the maximum design tide elevation. Provide a protective dolphin for the supercolumn drilled shaft.

(g) Emergency Egress Stairs

Provide emergency egress stairs for the fixed OHL walkway in the vicinity of the shoreward end of the pedestrian transfer span. Consult with the local fire marshal for locating and sizing the stairs. Ensure that an adequate place of refuge or egress exists at the bottom of the stairs.



Edmonds OHL Emergency Egress Stairs
Exhibit 620-7

(2) Retrofitted Structures – Cable Hoist Design

<Section pending completion>

(3) Retrofitted Structures – Tension Cylinder Design

<Section pending completion>

620.05 Structural Design Criteria

(1) New Structures – Supercolumn Design

(a) Structural Design Specifications

Design OHL structures in accordance with the AASHTO *LRFD Pedestrian Specifications* and associated reference documents.

- **Steel Superstructures –** Design steel superstructures in accordance with the AASHTO *LRFD Pedestrian Specifications*. Overhead loading structures at WSF typically consist of tube steel member trusses enclosed with walls and a roof. Use prequalified welded joints to fabricate the trusses where practical. Include wind and snow loads appropriate for an enclosed structure. Design components and cladding in accordance with ASCE 7.
- **Drilled Shaft Foundations –** Design drilled shafts in accordance with the AASHTO *LRFD Specifications*, and supplemented by the AASHTO LRFD Seismic Specifications and the WSDOT BDM where appropriate. Plastic hinging in shafts or columns is limited to above-ground and near-ground locations. In-ground plastic hinging is not permitted.
- **Railings/Handrails –** Design railings and handrails in accordance with the *International Building Code*.
- **Movable Bridge/Operating Machinery –** See Mechanical Design Criteria in Section 620.07.
- **Design Deviations –** WSF is responsible for approving any deviation from these design codes not specified. Include a signed deviation in the Project File (PF)/ Design Documentation Package (DDP). Refer to Section 220.05 for details on the PF/DDM.

(b) Design Life

The design life of all structural elements, including permanent steel casing, must be documented by analysis, testing, and/or research to demonstrate how the OHL structures design life identified in the LCCM will be met.

The design life for the OHL structures is based on deterioration from corrosion and/or fatigue in accordance with Section 620.03(7).

(c) Limit States

Utilize Limit States as specified in the AASHTO *LRFD Specifications*, Section 1.3, and the AASHTO *LRFD Movable Specifications*, Section 1.3.

Factor Relating to Ductility:	$\eta_D = 1.0$	For Conventional Designs and Details Complying with the AASHTO *LRFD Specifications*. Notify WSF if the Value of η_D is not 1.0.
Factor Relating to Redundancy:	η_R	Determine During Design
Factor Relating to Operational Importance:	$\eta_I = 1.0$	For Typical Bridges

(d) Design Loads

The permanent and transient loads listed below apply. Protect OHL columns from vehicle impact or include vehicle impact as a load condition.

1. Permanent Loads

DC **Dead Load of Structural Components and Nonstructural Attachments**

DW **Dead Load of Wearing Surfaces and Utilities**

2. Transient Loads

DAD **Dead Load Dynamic Load Allowance**
Include the dead load dynamic load allowance in accordance with the AASHTO *LRFD Movable Specifications*. Section 2.4.1.2.2 of the AASHTO *LRFD Movable Specifications* states, "Structural parts in which the force effect varies with the movement of the span, or in parts which move or support moving parts shall be designed for a load taken as 20 percent of the total dead load to allow for dynamic load allowance or vibratory effect."

DAM **Force Effects Due to Operation of Machinery**
Include the force effects due to operation of machinery in accordance with AASHTO *LRFD Movable Specifications*. Section 2.4.1.2.3 of the AASHTO *LRFD Movable Specifications* states, "Structural components supporting forces caused by machinery during operation of the span shall be designed for the calculated machinery forces, increased 100 percent as a dynamic load allowance."

Force effects on structural connections to hydraulic cylinders are specified in the AASHTO *LRFD Movable Specifications*, Section 2.4.1.8 "Hydraulic Cylinder Structural Connections."

EQ **Earthquake Load**
Refer to Seismic Design in Section 620.03.

LL **Vehicular Live Load**
Design OHL structures for a maintenance vehicle load in accordance with the AASHTO *LRFD Pedestrian Specifications* where vehicular access is not prevented by permanent physical methods. Locate design vehicle to produce the maximum load effects. The vehicular live load (LL) and pedestrian live load (PL) need not be considered to act simultaneously. The dynamic load allowance need not be considered for this load.

The earthquake load (EQ) and vehicular live load (LL) need not be considered to act simultaneously.

FL **Fatigue Load**
Design fatigue load in accordance with the AASHTO *LRFD Pedestrian Specifications* and the AASHTO *LRFD Movable Specifications*. The maintenance vehicle need not be considered as a fatigue design load due to infrequent loading.

PL **Pedestrian Live Load**

Design OHL structures for a pedestrian live load of 90 psf in accordance with AASHTO *LRFD Pedestrian Specifications*. Pattern the loading to produce the maximum load effects. The dynamic load allowance does not apply.

For the design level earthquake (DLE), use a pedestrian live load factor of γ_{EQ} of 0.5. The associated mass of pedestrian live load need not be included in the dynamic analysis.

S **Snow Load**

Design for snow load, S, in accordance with the appropriate local building code. Include the following load combinations for design of the superstructure:

1.25D + 1.75L + 0.5S

1.25D + 1.6S Consider snow drifting as appropriate.

WS **Wind Load on Structures**

Design the main wind force-resisting structure in accordance with the AASHTO *LRFD Pedestrian Specifications*. Structure height is measured from elevation = 0.0 feet MLLW. Design components and cladding in accordance with ASCE/SEI 7-10 Unfactored Loads.

(e) Unfactored Loads

Provide WSF-defined unfactored load combinations seen at the hinge points and cylinder connections to the mechanical designer for use in designing the mechanical system.

(2) Retrofitted Structures – Cable Hoist Design

<Section pending completion>

(3) Retrofitted Structures – Tension Cylinder Design

<Section pending completion>

620.06 OHL Utilities

(1) Locations of Utilities

(a) Under the walkway structure

Consider locating the utilities on the underside of the OHL fixed spans and transfer span. This can be achieved by hanging the utilities below the bottom chord of the support beams. Note that locating the utilities here will impact the available vertical clearance under the walkway.

(b) Above the walkway structure

Consider locating the utilities above the clear height envelope within the OHL fixed spans and transfer span.



Above the Walkway Structure - Edmonds Ferry Terminal



Below the Walkway Structure - Seattle Ferry Terminal

OHL Utility Mounts
Exhibit 620-8

(2) Types of Utilities

(a) Electrical and Communication

Refer to Section 620.08.

(b) Mechanical

Refer to Section 620.07.

(c) Drainage

Accomplish drainage of the fixed portion of the OHL walkway by means of a roof drainage collection system and floor sloped drains located at particular intervals in the walkway slab. Collect OHL drainage system into either a trestle trench drain system or the landside storm drainage system.

(d) HVAC

Consider providing radiant panel heaters. Do not provide HVAC systems for the passenger OHL.

(e) Fire Protection

Provide fire protection along the OHL system if the vehicle holding area is located underneath the spans. If the OHL system is not located over the vehicle holding area, consult with the local fire marshal to determine the fire protection requirements.

620.07 Mechanical Design Criteria

(1) Tidal Range of Motion

Design the overhead loading for a tidal range in accordance with Section 330.06.

(2) Vessel Fit Requirements

Check each installation for apron fit up for each appropriate vessel class under the following conditions using the existing vessel gate opening.

- Each appropriate vessel class in light and full load conditions
- At low tide
- At high tide
- At 0 degree span slope
- Against either side dolphin or floater as well as an alternate floater position if applicable. The alternate floater position represents floater movement due to vessel forces, wind, current, etc. and is 5 feet outboard of the nominal design position measured perpendicular to the slip centerline.
- Allow apron positioning as soon as vessel has landed and apron lines secured with no delay due to vessel maneuvering after landing lines are secured.

(3) Cab and Apron Range of Motion

The following range of motion should generally serve each terminal location, but range of motion requirements need to be checked for each installation. The correct height of the lift cylinder base is dependent on the length of the transfer span, transfer span pivot point elevation, and cylinder configuration required to accommodate the tidal range, all of which could be different at each location. Consider wave or storm surge and vessel pitch and roll in addition to tide, in setting the range of motion for the apron.

Component Movement	Range of Motion
Cab Vertical Movement	25 feet
Apron Swing	18 degrees off shore, 18 degrees in shore
Apron Raise and Lower (angle from horizontal)	65 degrees up, 14 degrees down
Apron Extend	110 inches (adjust based on slip location)

Cab and Apron Range of Motion
Exhibit 620-9

Check apron movement for interference with all surrounding structure(s). When the apron can contact any structure or object, use limit switches or position sensors to prevent all impacts. Minimize or eliminate this type of limited movement control, if possible. Design, control or limit the motion of the cab or apron so neither structure comes closer than 12 inches to any other terminal or offshore structure other than the vessel.

Design the fixed portion of the apron such that it is not capable of contacting any part of a vessel under all vessel load and tidal conditions.

(4) Apron Dimensions

The apron width shall be as specified by the Operations group, usually ten (10) to twelve (12) feet clear. The apron length shall be determined during the range of motion study to be performed at the beginning of the project by the structural/mechanical engineering team. The design shall allow for the apron to always slope down to the vessel deck. In no instance shall the apron be allowed to bear against the edge of the vessel at an upward angle to meet the design tide and freeboard conditions.

The apron length and adjustments shall be such that the apron can be positioned to rest on the deck of the vessel within the existing gate openings, has a minimum overlap with the vessel deck of two feet and a minimum clear distance between the apron edge and far pickle fork fencing of 10-12 feet with the vessel positioned at any angle within the slip.

(5) Maintenance

The mechanical system shall be designed with ease of maintenance in mind. There shall be sufficient access to remove and replace all components without having to remove or disassemble adjacent components.

Safe access to all mechanical system components shall be provided.

There shall be sufficient clearance on all fittings and fasteners that they can be tightened or loosened without requiring the use of special tools. All spot faces and countersinks shall be sized to allow for the use of standard tooling in the removal of the associated components.

Isolation valves shall be incorporated into the design to allow removal of major components without draining excessive amounts of hydraulic fluid. Lifting lugs shall be provided on the structure above all components weighing over 75 lbs.

Pad eyes shall be provided on the cab to support and raise the apron structure from the cab while replacing the apron lift cylinder or to raise the apron in emergency situations using come-alongs or similar devices.

Provisions shall be made to support the cab super column structure while replacing the cab lift cylinder. There shall be three possible support positions, low cab, mid cab and high cab heights.

(6) Factor of Safety

Design clevis pins, bearings, trunnions, clevises, and other machinery for support of hydraulic cylinders in accordance with the *Mechanical* and *Hydraulic* sections of the AASHTO *LRFD Movable Specifications* to the maximum extent practical. Design structural connections for cylinder support, including clevis brackets, weldments and high strength bolts as structural elements.

(7) Calculations

Submit calculations, including weight estimates, with each drawing submittal for the PS&E package. Provide calculations at the same or higher level of completion as the drawing submittal except at the 90 percent submittal; provide calculations ready for checking and in final form.

(8) Transfer Span to Cab Connection

The preferred method is to guide the transfer span on the cab using appropriately sized captured rollers with fixed stops and to provide the transfer span with pivot hinge pins at the bridge seat. Based on seismic analysis, the Engineer of record, with concurrence from WSF, may design the span supports at cab and bridge seat differently to suit the expected seismic movements.

(9) Speed of Operation

Component Action	Speed of Operation
Cab Raise	5 to 7 feet/minute
Apron Extend	23-23 feet/minute
Apron Lift (cylinder rod velocity)	7.5-12 feet/minute
Apron Swing (cylinder rod velocity)	3.7-5 feet/minute

Cab and Apron Speed of Operation
Exhibit 620-10

(10) Cylinder Safety

WSF requires safe and dependable operating systems, under all conditions. Terminal Engineering and Operations has decided to use a cylinder based safety design approach to ensure lift cylinder safety and reliability. Elimination of the use of the locking pins during normal operations at every cab stop is the preferred design, relying on the lift cylinder design for cab safety. Super column locks or blocks shall be provided for maintenance and inspection purposes. These locks/blocks may be manually activated and be designed to lock the cab in three general cab positions, high, medium, and low.

The designer of record, in agreement with WSF, shall have the ability to use performance-based design criteria per ASCE 7-10 Minimum Design Loads for Building and Other Structures, to demonstrate that the cab lift cylinder has an equivalent level of safety as structures designed to the code.

Cylinders shall be designed to the appropriate sections of the following prescriptive design codes:

- AASHTO Bridge Code (Structure Elements)
- ASME Boiler & Pressure Vessel Code (Fluid Retaining Elements)
- ASME A17 Elevator and Escalator Code – No cab safeties required on direct acting hydraulic elevators

By using code accepted procedures to demonstrate equivalent levels of safety to structures designed using ASCE 7-10, by documenting the procedure and by having the procedure peer reviewed, incorporation of a locking pin or similar column locking device is not mandated for the super column lift system's daily operation.

(11) Hydraulic Cylinder Design

Effort shall be made to utilize hydraulic cylinders of the same dimensions and pressure ratings as those currently in WSF inventory.

The designer shall specify cylinder bore diameter, rod diameter, stroke, retracted length, mounting pin diameter and manifold mounting configuration, including manifold orientation with respect to piston side mounting ear.

The following parameters represent cylinder sizes desired for a "supercolumn" style OHL system. If another system is chosen that uses hydraulic cylinders, the same general design principles, rod and barrel pin bearing type, pressure rating, factor of safety, design life, material, etc. apply. Adjust the size to suit the design.

(a) Seals

Specify seals that are compatible with the hydraulic oil specified and which have proven prior usage with the hydraulic oil in similar applications. Specify standard size seals with gland size compatible with at least two separate manufacturers. Custom made seals or sole source seals are undesirable.

(b) Main Lift Cylinder

- Welded construction, no tie rod cylinders
- 3000 psi working pressure
- 5000 psi non-shock design pressure
- Factor of safety for all parts – 5:1 based on material ultimate strength with 3000 psi pressure
- Buckling safety factor – 3:1 based on 3000 psi
- Buckling calculations shall be based on the AASHTO *LRFD Movable Specifications*, *NFPA (Fluid) T3.6.37*, or other method approved by the WSF Mechanical Engineer.
- Manifold Ports – to accommodate SAE code 61 4-bolt flange fittings
- Rod material – rod end stainless steel, rod chrome plated stainless steel
- Stop tubes or other design features shall be incorporated to ensure sufficient separation between the piston bearing and rod bearing at full cylinder stroke
- Bleed and gage ports shall be provided
- The design shall allow for the cylinder to be thoroughly bled in the vertical position

(c) Apron Cylinders General

- Welded construction, no tie rod cylinders
- 3000 psi working pressure
- Factor of safety for all parts – 5:1 based on material ultimate strength with 3000 psi pressure
- Buckling safety factor – 3:1 based on 3000 psi
- Buckling calculations based on the AASHTO *LRFD Movable Specifications*, *NFPA (Fluid) T3.6.37*, or other method approved by the WSF Mechanical Engineer.
- Manifold Ports - to accommodate SAE code 61 4-bolt flange fittings or SAE straight thread O-ring boss fittings.

- Rod material – chrome plated stainless steel
- Barrel end of cylinder equipped with plain bronze or Orkot sleeve bearing, grooved for grease or, if spherical bearings are used, provide spacers to prevent cylinder from twisting excessively in the clevis bracket. Spherical bearings may be made of self-lubricating material.
- Rod end of cylinder equipped with spherical self-aligning bearing, grooved for grease or constructed from self-lubricating materials.
- Spacers shall be provided to prevent the cylinder from cocking in the clevis brackets
- Air bleed and gage ports shall be provided on both ends of the cylinders. The bleed ports shall be oriented such that air can be completely bled with the cylinder in the installed position.
- Bearings shall be sized using the bearing manufacturer's published dynamic ratings.
- Pin dimensions and hardness shall be per the bearing manufacturer's recommendation

The dimensions listed may be adjusted if necessary to achieve the safe operational requirements of a specific terminal and slip configuration. Notify the WSF Mechanical Engineer prior to the 30 percent submittal if any such adjustments are necessary.

(d) Apron Extend Cylinder

- Rod end of the cylinder barrel supported or constrained against buckling
- Bore – 4 inches
- Stroke – 111 inches
- Rod diameter – 2.5 inches
- Pin diameter – 1.375 inches
- Pin retainers redundant and failure proof
- Stop tube

(e) Apron Swing Cylinder

- Bore – 5 inches
- Stroke – 32 inches
- Rod diameter – 3.5 inches
- Pin diameter – 1.75 inches

(f) Apron Lift Cylinder

- Bore – 7 inches
- Stroke – 52 inches
- Rod diameter – 4 inches
- Pin diameter – 2.5 inches

(12) Cylinder Testing

Each cylinder shall be shop tested with the specified hydraulic fluid and witnessed by a WSF Mechanical Engineer. Hydraulic pressure shall be recorded for no load extension and retraction. Cylinders shall demonstrate the ability to hold pressure on both sides of the piston seal. Tests shall demonstrate that no leakage occurs across piston seal, from either side and that no leakage occurs from the rod seal.

Cylinders shall be stroke tested to demonstrate that no vibration occurs during operation. Large cylinders shall be tested in the vertical position.

If manifolds are supplied with the cylinder, the manifold shall be tested for leaks, for pressure holding and valve function independent of the cylinder. The manifold shall also be attached to the cylinder and pressure tested to verify no leakage at the manifold to cylinder connection.

(13) Hydraulic System

(a) General

The following sections deal with the special consideration related to hydraulic lifting, locking and holding systems for ferry OHL facilities. In the design of hydraulic systems, consider the marine environment in which these systems must operate, as well as climatic conditions, operating temperature range and functional requirements.

Design all systems in conformance with the applicable NFPA, ANSI, SAE, and ISO Standards, and the requirements specified below.

(b) Safety

Design the mechanical and control systems to be fail safe. Perform a failure mode analysis on the design prior to the 90 percent review

to ensure that the failure of any component or subcomponent in the system will not result in harm to personnel, the travelling public, or the structure.

1. **Safety of Users –** At all times the design of the OHL facilities shall provide for the continual safety of users transiting through such facilities. The system shall be designed to allow the cab height to be safely adjusted with live load on the cab and/or transfer span
2. **Safety of Workers –** The design of the OHL shall provide for the continual safety of the operation, inspection, and maintenance personnel in the performance of their duties.

(c) Pressure

- Maximum encountered system pressure 3000 psi
- Maximum operating pressure 2500 psi
- Pumps and valves rated pressure 3000-4500 psi
- Other component pressure ratings are listed in other areas of this criteria

(d) Controls

Control operating movement of hydraulic lifting systems electronically through solenoid-activated valves or valve stacks. Specify valves that are marine service rated if exposed to weather. Large cylinders shall be controlled through proportional directional control valves to control speed and acceleration /deceleration. The speed and acceleration/deceleration control ranges of the control units shall be sufficient to alter or limit the effects of operating vibrations and frequencies detrimental to component operation.

Include holding valves at all cylinder ports pressurized by carried loads. Provide valves which allow fluid release only for the following conditions:

1. Overpressure from impact or thermal pressure rise
2. Pilot signal descend command

   Pilot signal ratios are to be such that the valves do not open at excessive rates and do not require excessive pilot pressure.

   Require holding valves that allow free flow in reverse direction.

   Solenoid valves protected from the weather shall have lighted plugs. Solenoid valves exposed to the weather shall have conduit connections and be water proof marine grade. Plug connections shall not be allowed.

   Power supply to individual solenoid valves in each apron shall have separate circuit protection.

(e) Apron Float

Apron float is activated when a pressure switch senses a pressure drop on/in the apron lift cylinder due to the apron coming to rest on the vessel. This signal then opens several valves that allow the apron lift, swing and extend cylinders to move freely (float) with the vessel movement. This keeps the apron in contact with the vessel deck at all times. Pushing the apron lift operator closes all float valves and ports fluid to the blind end of the cylinder. Once the cylinder pressure is raised above the pressure switch set point, the apron moves only when and how commanded by the operator. Provide automatic and manual off/on controls for the float function. Prevent the apron from going into float if the apron is 7 degrees or more above horizontal.

(f) Hydraulic Fluid

Specify Mobil DTE 10 Excel 15 hydraulic fluid.

Design the span lift/apron hydraulic machinery to utilize all possible means to prevent and contain leaks of hydraulic fluid to the environment. Full containment of the fluid is mandatory where possible.

(g) Hydraulic System Schematic

Use the symbols of ANSI/Y32.10 in the schematic to indicate component and circuit functions.

Use complete symbols, not a simplified form, in the schematic diagrams for multiple flow path control valves.

Convey information on the arrangement of the schematic(s) in accordance with ISO1219 and include the following:

- Identification of all hydraulic equipment by name, catalog number, series or design number and the manufacturer's name
- Size of fluid conduits and connectors (outside diameter and wall thickness of tubing, size and schedule of pipe, inside diameter and maximum operating pressure for hose assemblies)
- Bore, rod diameter, and length of stroke of each cylinder
- The displacement per revolution and/or flow rate and output torque rating for each hydraulic motor
- The displacement per revolution and/or delivery flow rate at drive speed for each hydraulic pump
- The power rating, speed, and direction of rotation of each hydraulic pump prime mover
- Pressure and flow setting for all pressure and flow regulation devices and maximum rated operating pressure
- Design flow rate, filtration rating (acceptable minimum B_x min) and or time weighted average value of filtration ratio ($B_{x\ twa}$), for each filter
- Usable reservoir capacity and total system fluid volume
- Data, text or both depicting the operational performance including the function(s) of the related electrical and mechanical controls and actuating equipment

(h) Layout of Fluid Conduits and Connectors

Submit drawings detailing all fluid conduit and connectors. Clearly show the conduit routing, size, fittings, and supports. Drawings are to be revised to reflect "as built" conditions.

Design tubing supports following the guidelines listed below.

Tube OD	A	B	C
1/4" to 3/8"	2"	3'	4"
7/16" to 1"	4"	5'	8"
1¼" to 2"	6"	7'	12"

Dimension "A" is distance from fitting to support

Dimension "B" is distance between supports

Dimension "C" is distance from change of direction to first support

Hydraulic Tubing Support Guidelines
Exhibit 620-11

Submit pressure drop calculations using the actual routing, tubing and hose size, fittings and including all change of directions with the calculations package.

(14) Hydraulic Power Unit (HPU)

(a) General

Design and size hydraulic power unit(s) to a standard that allows safe, efficient, and reliable system performance.

(b) Redundancy

Provide an auxiliary HPU consisting of a small pump/valve unit for lifting the apron off the vessel under all failure scenarios, including but not limited to main HPU failure, electrical power failure to slip and to terminal.

The Auxiliary Pump motor starter shall be hardwired with pushbuttons to control the motor. Valves shall be manually operated. There shall be no connections in this system from the PLC.

(c) Ergonomics

Locate valves and components requiring service where accessible for adjustment, inspection, replacement, or repair. Component placement shall take into account accessibility to lifting equipment, as specified by applicable labor codes and regulations.

Arrange valve manifolds and bulkhead fittings so that all fittings (tube and hose) can be removed or tightened without removing or disturbing the fitting alongside the one being worked on. Locate all fittings, tube and hose ends such that they are clearly visible and accessible for inspection and repair.

Cartridge valves and fittings should not be countersunk into the manifold. If countersinking is required, a spotface of sufficient depth and diameter to accommodate standard tool sizes shall be provided.

(d) Hydraulic Fluid Reservoirs

Design fluid reservoirs in compliance with *ISO 4413:2010, Hydraulic fluid power – General rules and safety requirements for systems and their components* and the following additional requirements:

1. **Baffle** – Baffle the reservoir between the suction and return lines.
2. **Cleanout Access** – Reservoir is to have a cleanout access opening for cleaning and inspection purposes that allows access to both sides of the baffle(s). Locate a drain at the lowest point on the reservoir sloping bottom. Equip drain with a ball valve that is plugged. A valved port with cap shall also be provided to facilitate oil sampling for oil quality testing purposes.
3. **Material** – Specify reservoirs be fabricated from 316/316L stainless steel and welded with corresponding materials. Covers are to be fabricated with not less than 3/8 inch thickness.
4. **Capacities** – Unless heat loss calculations dictate otherwise, size reservoirs to hold the equivalent of 2 minutes of maximum combined pump capacity in addition to the combined swept volumes of all cylinders rods plus 10 percent and, if applicable, to include provisions for any local conditions such as installation at a non-horizontal angle or installation on a moving ramp that results in a fluctuating angle.

5. **Intake lines** – Design intake lines for the minimum velocity possible, less than 4 feet per minute (FPM). Ensure the intake line opening is submerged 1.75 to 2 times the intake line inside diameter. Use bell mouth openings on suction pipes to reduce intake velocity, ensure that the intake pipe is 5 to 6 times the pipe ID away from the nearest wall on at least one side and ensure that the intake pipe is no closer to the reservoir bottom than the pipe ID/2.
6. **Calculations** – Heat loss calculations are to be supplied with the calculation package.

(e) Containment

The HPU shall be built to contain all hydraulic spills whether they are from gravity drips or high pressure spray. Design net retention volume of the containment to be a minimum of 115 percent of the fluid tank's content, including allowances for containment trays subject to inclinations from horizontal. Design to ensure that no hydraulic oil from inside the HPU enters any waterway, spill on dock, transfer span or vehicle holding area. The containment is to have a plugged valve drain that allows the fluid held by the containment to be evacuated easily.

(f) Sound Level

Ensure the noise developed by the power unit during continuous operation does not exceed the sound levels that would be acceptable in a work place under applicable local or federal regulations.

When possible enclose the HPU in sound insulation to achieve the following ratings: A Sound Transmission Class (STC) rating of 50 (Field Tested) minimum is required and a STC rating of 60 shall be the target. The rating shall be achieved by an architecturally proven and calculable method.

As a minimum, apply sound damping material (Dexdamp 432) to the inside surfaces of the enclosure covering at least 80 percent of the inside area, not including vent areas and areas with brackets or components mounted to them. Apply a second sound barrier (¾ inch thick Barrier 104) on top of the Dexdamp 432 with its Mylar face exposed to the interior of the enclosure.

(g) Hydraulic Pumps

Specify axial piston type hydraulic pumps with a variable displacement configuration to accommodate various flow rate requirements of cylinders without excessive relief valve operation. Pumps are to be equipped with horsepower-limiting systems to allow pump and electric motor sizing to match normal demands and to ensure overloads are prevented at the motors during maximum operating conditions or intermittent extreme operating conditions. Gear pumps are allowed for emergency apron lift systems.

Accomplish hydraulic operation utilizing two pumps selected such that in the event that one pump fails the remaining pump can operate the span at half speed.

The pumps are to be direct coupled and supported by the electric motor. Design electric motor feet to rest on vibration absorbing mounts to reduce transmitted noise. Use flexible hose and electrical conduit to connect the pump/motor electrical and hydraulic systems.

(h) Filtration

Locate a pressure line filter directly downstream from each pump.

A properly sized return line filter is to be installed in the main system return line.

(15) Hydraulic Tubing and Fittings

Tubing shall be AL6XN per ASTM B 676.

Tube fittings for .75 inch OD and smaller tubing shall be:

For tube to tube connections - three piece bite type flareless tube fittings per SAE J514; stainless body, nuts and ferrules; minimum operating pressure rating of 3,000 psi.

- PARKER FERULOCK
- Body – ASTM A479 type 316 stainless steel
- Tube Nuts – ASTM A479 type 316 or 316L stainless steel
- Ferrule – ASTM A564 Type 630 stainless
- Ensure nut is pre-lubricated with a bonded dry film lubricant.

For tube to hose connections -three piece O-ring face seal type tube fittings per SAE J1453; stainless steel body, nuts and ferrules; minimum operating pressure rating of 3,000 psi; no flanged tubing or tubing with sleeves brazed on.

- PARKER SEAL –LOK
- Body – ASTM A479 type 316 stainless steel
- Tube Nuts – ASTM A479 type 316 or 316L stainless steel
- Flange Sleeves – ASTM A479 Type 316 stainless steel

All tube fittings are to be tightened to the manufacturer's recommended torque for the size and style of fitting used.

For 1 inch OD and larger tubing, fittings shall be SAE code 61 four bolt flange fittings welded directly to the tube ends. Body, bolts and nuts shall be 316 stainless steel. The minimum operating pressure shall be 3,000 psi.

If pipe is used, specify seamless 316 or 316L conforming to ASTM A312/A 312M with a pipe weight class of schedule 80. Pipe fittings shall be socket weld or SAE code 61 four bolt flange fittings welded directly to the tube ends. Body, bolts and nuts shall be stainless steel. Pipe assemblies shall be passivated after fabrication and welding by a WSF approved process. The minimum operating pressure shall be 3,000 psi.

No pipe threads (NPT or NPFT) are to be used on any component of the hydraulic system.

(a) Tube and Pipe Clamps

Provide heavy duty clamps to ensure that no contact occurs with structure, components, other tubes and hoses and no vibration shakes the tubing. Guide for tubing support spacing is given earlier in the criteria. Clamps are to have polypropylene clamp bodies for vibration and noise dampening of the hydraulic lines and to prevent galvanic corrosion. Do not allow pipes or tubing to come in contact with ferrous material. The clamp bodies are to have a smooth bore in contact with the hydraulic line. Specify stainless steel mounting hardware.

(16) Hydraulic Hose and Fittings

All hydraulic hose except for suction hoses shall be rated for a minimum of 3000 psi working pressure. All hoses are to be the no skive type.

All hose assemblies (hose with attached end fittings) shall be pressure tested to 1.5 times their rated working pressure before installation into the system.

Hose fittings shall have the same pressure rating as that of the hose used, as a minimum. Hose fittings shall be the o-ring face seal type or SAE Code 61 four bolt flange fittings. All hose fittings shall be plated carbon steel and crimped onto the hose.

All hose fitting or attachment bolts are to be tightened to the manufactured specified torque for the particular size and style of fitting used.

All hydraulic hose and hose fittings used in an installation are to be the same model number when possible.

Require all hydraulic hose assemblies to have metal tags attached defining pressure rating, length and installation date.

All hydraulic hose will be replaced five years after the date of installation unless inspections determine that replacement of the hose is required earlier.

Provide abrasion sleeves on all hoses connected to moving components.

All hose fittings shall be wrapped with petrolatum impregnated tape after final inspection.

(17) Hydraulic Testing

(a) General

All components and sub-assemblies shall be tested and inspected by WSF Terminal Engineering before being installed in the field. Take these testing requirements into consideration during design and include in the contract specifications.

(b) Component Testing

Key critical components or long lead items that are not easily replaced or substituted shall be tested and inspected by WSF Terminal Engineering before the component is shipped to WSF or a WSF Contractor.

(c) Shop Testing

All Contractor-manufactured hydraulic components shall be shop tested. Sub-assemblies, tanks, manifolds and valves shall be tested before final assembly in the HPU or in the OHL structure. Valve settings and flow controls shall be tested and set in the shop prior to installing in the HPU or in the OHL structure. In addition, the completed HPU shall be shop tested before being installed or sent to the terminal site.

(d) Yard Testing

The system shall be tested to the maximum extent possible in the Contractor's yard before being moved on site.

(e) Field Testing

Once the structure is installed at the terminal site, and the HPU field connections are completed, the hydraulic system shall be tested again following the requirements in the contract specifications.

(18) Alarms and Monitoring

The mechanical designer shall work with the electrical designer in identifying required indication and providing necessary hardware to achieve the required indications. Alarm Conditions shall be displayed on the message screen on the Operator Control Station. The following is a preliminary list of Alarm Conditions:

- Pressure Filter Clogged
- Return Filter Clogged
- HPU Pump Disconnect Open
- HPU Pump Overload
- HPU Pump Not In AUTO
- HPU Pump Suction Valve Closed
- Low Oil Level Warning
- Low Oil Pressure
- Cab High Limit
- Cab Low Limit

Shutdown Conditions shall stop all movement by de-energizing all equipment and valves. Shutdown Conditions shall be displayed in the message screens on the Operator Control Stations. The following is a preliminary list of Shutdown Conditions:

- High Oil Temp
- Low Oil Level
- Emergency Stop Pushbutton Pressed

In addition to displaying Alarm and Shutdown messages, the message screens will also display System Status messages. The following is a preliminary list of System Status messages:

- Apron in Float
- HPU Pump Running
- Loading Cab RAISE/LOWER Functions Disabled

620.08 Electrical Design Criteria

(1) OHL System – Super Column

(a) Power Distribution

Refer to Chapter 360 for general electrical design criteria pertaining to OHL System.

(b) Control System

Provide a Control System to control operation of the following OHL system components.

- Hydraulic power supply
- Loading cab lift cylinder and two locking pin cylinders
- Three apron control cylinders (raise, extend and swing)
- Emergency hydraulic power unit

The entire hydraulic system is controlled through an operator's console located in the loading cab. The control system uses a programmable logic controller (PLC), which is a computer, to operate all the hydraulic equipment and illuminate lights on the operator console signifying status of components and warnings of possible failure conditions. The following components are detailed:

1. **Loading Apron** – The loading apron is a ramp which extends from the loading cab to the passenger deck of the ferry. It is composed of two segments which pivot left and right and up and down from the loading cab by the action of two hydraulic cylinders. The outer of the two segments can be extended and retracted from the inner apron segment by the action of a third hydraulic cylinder.
2. **Cab Lift** – The loading cab sits on top of a square column that moves up and down with the cab. A single hydraulic cylinder is mounted under the loading cab to raise and lower the cab.
3. **Hydraulic Power Unit** – The HPU is composed of two hydraulic pumps with 30 horse power motors running from 480V, 60 Hz, 3-phase power.
4. **Emergency HPU** – The emergency HPU is mounted under the floor of the loading cab. It is to be used to raise the apron off the deck of the ferry if the main hydraulic system fails. The emergency HPU is operated from a separate control box mounted near the operators control station.
5. **Hydraulic Tank** – The hydraulic tank is used to hold hydraulic oil needed to operate all of the hydraulic systems. It is located under the floor of the loading cab. Included in the hydraulic tank is a return filter, level switches, fill port and sight level. The hydraulic tank also has breather bags connected to provide clean and dry air to the tank when oil is used to operate the system.

The primary components in the OHL control system are the programmable logic controller (PLC) cabinet and panel view screen, operator control station (one for each apron), and the auxiliary hydraulic pump system.

Control System Component	Notes
Programmable Logic Controller (PLC)	Allen Bradley Compact Logix Control System
Panel View	Allen Bradley PanelView Plus 6 1000
Operator Control Stations	There is one main control station for each apron. On each main control station there are lighted pushbuttons for: • Emergency Stop There are individual pushbuttons for: • Loading Cab Raise • Loading Cab Lower • Loading Apron Raise • Loading Apron Lower • Loading Apron Swing Left • Loading Apron Swing Right • Loading Apron Extend • Loading Apron Retract • Test Pilot Lights/Reset Alarms There are individual indicating lights for: • Maintenance Required • Shutdown Alarm There is a lighted selector switch for: • Apron Float Off-On -Auto There is a keyed selector switch for: • Control Power Off-On There are individual pushbuttons for: • Stop Auxiliary Power Unit • Start Auxiliary Power Unit • Apron Raise

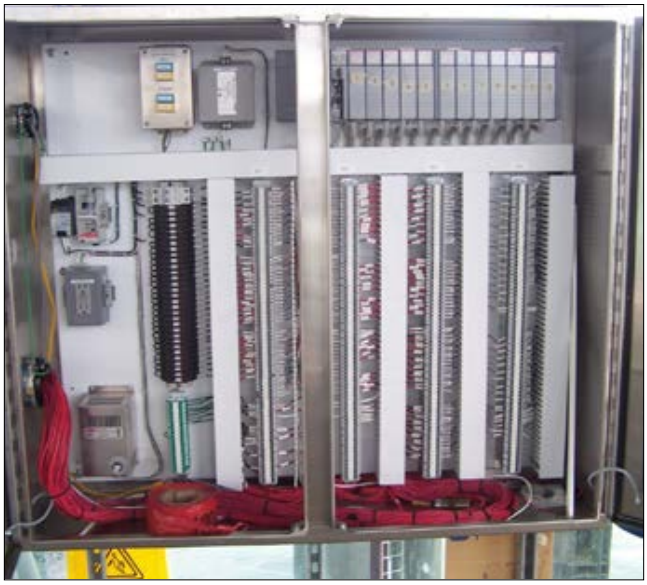
Typical OHL Control System
Exhibit 620-12

The PLC cabinet, shown in Exhibit 620-13, contains the PLC and terminals required to control the bridge and apron. The PLC also sends messages to the panel view screen, Exhibit 620-14 that are displayed in various colors for troubleshooting and to indicate the status of the OHL system. The PLC and PanelView shall communicate on the WSF Network. Provide and Ethernet Switch or Fiber Ethernet Switch in the PLC Cabinet as required to connect the Control System to the WSF Network.

The operator control station contains the required pushbuttons and indicating lights for the control of the OHL, as shown in Exhibit 620-15.

The auxiliary hydraulic pump system, shown in Exhibit 620-16, is designed to lift the apron off the boat if there is a PLC or other type failure that would prevent the main HPU from lifting the apron. The auxiliary hydraulic pump system is hardwired with pushbuttons to control the motor and valves. There are no connections in this system from the PLC.

All other push buttons on the control stations, except emergency stop, are connected as inputs to the PLC. The main hydraulic power unit motor starter contactors and hydraulic system valves are controlled by outputs from the PLC. All interlocks and shutdowns, except the emergency stop pushbuttons, are programmed in the PLC's ladder logic software. The emergency stop pushbuttons are hardwired to immediately stop all motion and equipment.



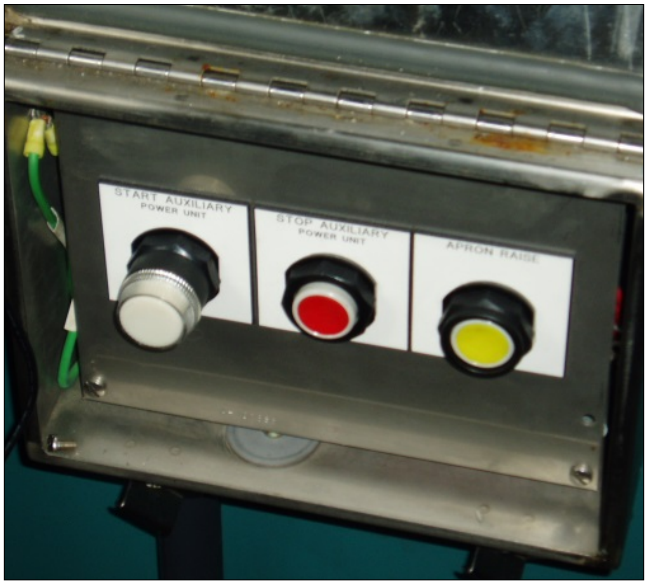
PLC Cabinet
Exhibit 620-13



PLC Panel View Screen
Exhibit 620-14



Operator Control Station
Exhibit 620-15



Auxiliary Hydraulic Pump
Exhibit 620-16

A description of the control panel follows.

1. Control Power Off/On Switch
   - Keyed selector switch
   - Has two positions - OFF / ON
   - When turned "ON" connects power to the operator control station and activates the pushbuttons and selector switches on the control station to control the cab and apron.
   - When turned "OFF" disconnects power to the operator control station and deactivates the pushbuttons and selector switches. One exception is the EMERGENCY STOP pushbutton. The EMERGENCY STOP pushbutton is always active regardless of the position of the ON/OFF KEY SWITCH.
   - Remains in the "ON" position during OHL Operation.
2. Loading Cab – Raise/Lower Pushbutton
   - Square yellow pushbutton with right and left segments.
   - The right segment is for Loading Cab Raise. The left segment is for Loading Cab Lower.
   - When either segment is pressed, the Control System automatically starts the HPU pump motors. It will take approximately 6 seconds for both motors to come up to speed.
   - When either segment is pressed, the Control System will automatically raise the cab until the locking pins are centered with the pin holes and retract the pins. The cab will then move in the direction corresponding to the segment being pressed (right segment for Raise and left segment for Lower).
   - Hold the Raise or Lower pushbutton down until the cab is at the approximate desired height.
   - When released, the Control System will automatically continue moving the cab in the same direction until the pins are centered with the next pin hole. Then the Control System will stop the cab, insert the pins, and lower the cab slightly.
   - When raising or lowering the Loading Cab, it takes approximately 10 to 12 seconds between pin holes
3. Test Pilot Lights or Reset Alarms Buttons
   - Blue push button
   - Has two primary functions
     - Pressed when there are no active alarms, tests indicating light bulbs on control panel
     - Pressed when there is an alarm, if the alarm condition is no longer present, resets alarm.
     - There are no audible alarms.
     - Flashing lights are the alarms.
   - Push at the beginning of each shift to test the indicating light bulbs. If any of the lights do not turn ON, note the light and notify the Agent so that she/he can arrange to have Terminal Maintenance replace the bulb.

4. Loading Apron – Raise/Lower Pushbutton
   - Square blue pushbutton with right and left segments.
   - The right segment is for Loading Apron Raise. The left segment is for Loading Apron Lower.
   - When pressed, automatically starts one HPU pump motor
   - When pushed either to raise or lower and held, raises or lowers the apron
   - Stops when released

5. Loading Apron Swing – Left/Right Pushbutton
   - Square blue pushbutton with right and left segments.
   - The right segment is for Loading Apron Swing Right. The left segment is for Loading Apron Swing Left.
   - When pressed, automatically starts one HPU pump motor
   - Stops when released

6. The Loading Apron – Extend/Retract Pushbutton
   - Square blue pushbutton with right and left segments.
   - The right segment is for Loading Apron Retract. The left segment is for Loading Apron Extend.
   - When pressed, automatically starts one HPU pump motor
   - Stops when released

7. Loading Apron Float – Lighted Auto/Off/On Apron Float Switch
   - A three position switch: AUTO is the standard operating position
   - Green light in handle will illuminate when float is ON allowing the apron to float (ride) up and down with vessel

8. Emergency Stop Pushbutton
   - Mushroom head pushbutton, push to stop and pull to reset.
   - Hardwired to stop all cab and apron motion.

9. Panel View – Displays system status and alarms

(c) Lighting System

Illumination shall be provided in accordance with Exhibit 620-17.

Light Level Chart			
Area Description	**Minimum Average Horizontal Illuminance (Footcandles)**	**Minimum Maintained Illuminance (Footcandles)**	**Distance Above Finished Floor (Inches)**
Passenger Overhead Loading Access Ramps	5	1	0
Passenger Overhead Loading Apron	15		0
Passenger Overhead Loading Cab	15	5	0
Passenger Overhead Loading Transfer Span	7	3	0

OHL Illumination Requirements
Exhibit 620-17

Refer to Section 360.07 for general lighting design criteria pertaining to OHL Systems.

620.09 Architectural Design Criteria



Kingston Weather Screened OHL
Exhibit 620-18

The following architectural design criteria apply to OHL structures.

- The pedestrian transfer span and fixed bridges are weather-shielded structures providing protection from wind and rain (shown in Exhibit 620-18). Provide a glass wind screen wall system for OHL structures.
- Consider feasibility of providing weather protected holding and loading lane for bicycles and motorcycles under the OHL structure on the trestle.
- Provide emergency egress stairs for the fixed overhead walkway in the vicinity of the shore side end of the pedestrian transfer span.
- Design security gates into the passenger OHL transfer spans.
- Provide a concrete floor with a light broom finish and standing seam metal roofing.
- Provide lighting capable of maintaining current lighting code lumen level requirements. Shield to provide down lighting only.

Chapter 630 Wingwalls

630.01 General
630.02 References
630.03 Design Considerations
630.04 Design Criteria
630.05 Wingwall Alternatives
630.06 Miscellaneous Design

630.01 General

This chapter provides guidance on the design of wingwalls. Wingwalls serve as the primary structure used to stop and hold the vessel in place for loading, unloading and overnight tie-up. Wingwalls serve both operating slips and tie-up slips.

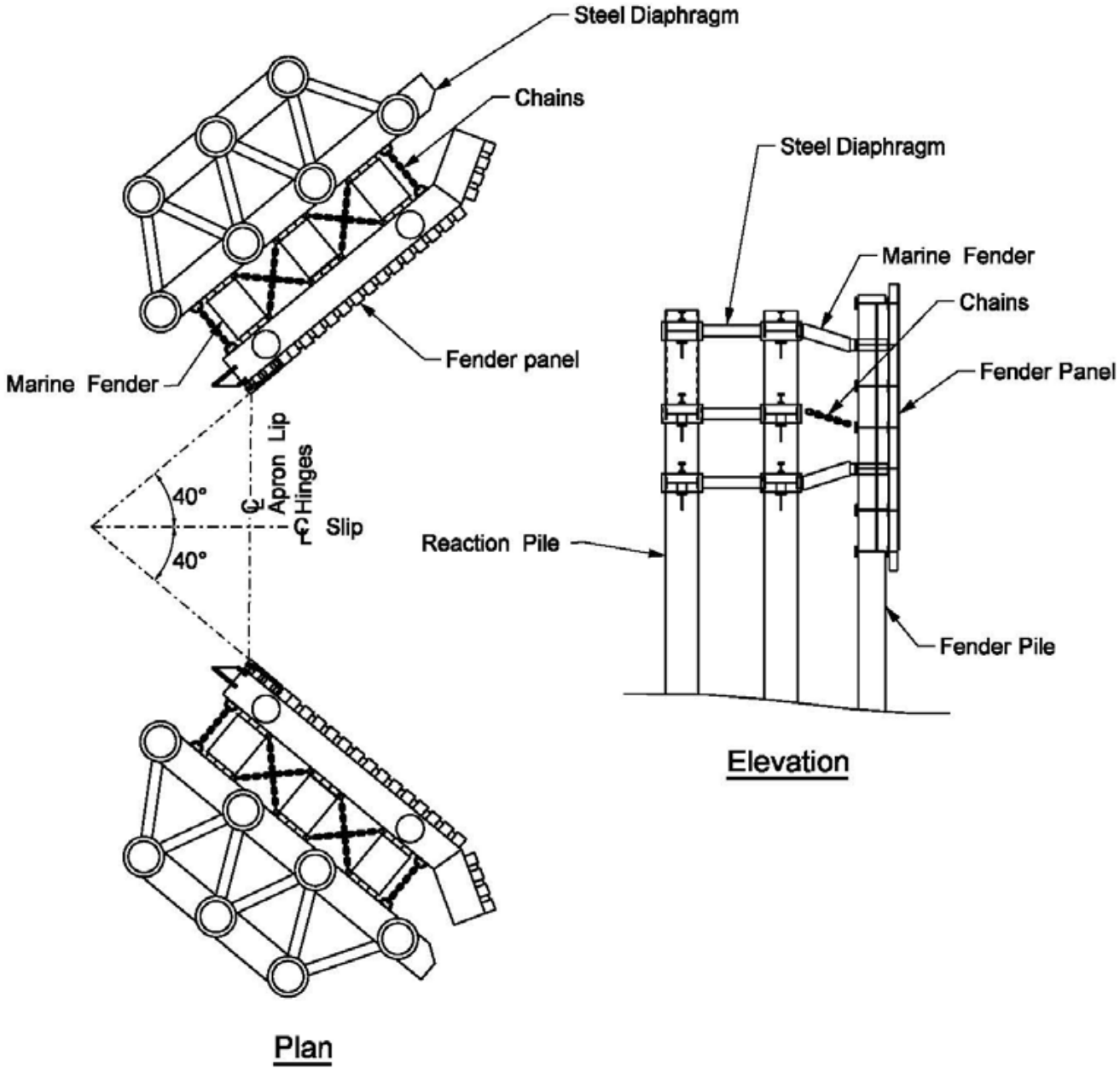
Typical wingwalls are illustrated in Exhibit 630-1. The principal components of wingwalls are illustrated in Exhibit 630-2.



Typical Wingwalls
Exhibit 630-1

For additional information, see the following chapters:

Chapter	Subject
320	Environmental Considerations
330	Marine



Typical Wingwall Layout and Components
Exhibit 630-2

630.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

Structural Welding Code – Steel (AWS D1.1: 2010)

WAC 296-24 *General safety and health standards*

WAC 296-56 *Safety standards – longshore, stevedore and waterfront related operations*

WAC 296-876 *Ladders, portable and fixed*

(2) Design Guidance

ASD/LRFD Manual for Engineered Wood Construction (ANSI/AF&PA NDS-2005), American Forest and Paper Association

Bridge Design Manual LRFD M 23-50

Design: Moorings, Unified Facilities Criteria (UFC) 4-159-03, Department of Defense, 2005

Design: Piers and Wharves, UFC 4-152-01, Department of Defense, 2005

General Special Provisions

Geotechnical Design Manual M 46-03

Guidelines for the Design of Fender Systems: 2002, The World Association for Waterborne Transport Infrastructure (PIANC), 2002

Minimum Design Loads for Buildings and Other Structures (ASCE/SEI 7-10), American Society of Civil Engineers

Region General Special Provisions, WSF

SSPC Painting Manual – Volume 2 Systems and Specifications (2011 Edition)

Specification for Structural Steel Buildings (ANSI/AISC 360-05), American Institute of Steel Construction

Standard Specifications for Road, Bridge, and Municipal Construction M 41-10

630.03 Design Considerations

(1) Location

To ensure proper fit by all of the vessels in the fleet, locate the wingwalls at a standard position in relation to the apron lip hinge centerline, at a standard distance from the slip centerline, and at a standard angle (40 degrees) from the slip centerline, unless noted otherwise in the project calculations. Align the throat of each wingwall with the hinge line of the apron lips (roughly the point of contact between the steel apron and the vessel deck) and locate it 12 feet from the slip centerline. The throat is defined as the point formed by the intersection of the face of the UHMW polyethylene rubbing surface and the shoreward end of the steel fender panel wale.

Locate wingwalls for tie-up slips to accommodate placement of the gangplank on the vessel car deck.

(2) Environmental

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

(3) Marine

Refer to Chapter 330 for general marine design criteria pertaining to wingwalls. Below are links to relevant sections by topic.

- Operations and Maintenance: 330.04(4)
- Proprietary Items: 330.04(6)
- Long Lead Time Items: 330.04(7)
- Design Life: 330.04(8)
- Corrosion Mitigation: 330.04(9)
- Scour and Mudline Elevations: 330.04(10)
- Material Specifications: 330.04(12)
- Tidal Information: 330.06
- Slips: 330.07
- Berthing and Mooring Criteria: 330.08

(4) Geotechnical Requirements

Design piles in accordance with the Geotechnical Recommendations provided by the WSDOT Geotechnical Branch. Do not include seismic effects including liquefaction in the design. The Geotechnical Recommendations will typically include:

- Axial capacity of piles
- Input data for L-Pile lateral analysis
- Group reduction factors due to pile spacing
- Constructability recommendations including type and capacity of pile driving equipment and use of cutting shoes.

630.04 Design Criteria

(1) General

Wingwalls are flexible pile-supported structures designed to absorb a vessel's kinetic energy through rotation and bending of the fender and reaction piles, compression of the marine fenders, and movement of the piles through the soil. Size wingwalls in accordance with the design energy which is a function of the design vessel's mass and velocity, and other variables and constants.

(2) Design Vessel

Refer to Chapter 330 for design vessel information and Appendix O for vessel particulars. Consider WSF's future plans for vessel assignment to the subject terminal and slip. The design vessel is determined in consultation with WSF Operations staff.

(3) Design Life

Design lives for the following components of the wingwalls are based on deterioration due to corrosion and/or fatigue in accordance with the LCCM.

- Piles, fender frames, and reaction frames: 50 years
- Marine fenders: 30 years
- Timber rubfaces: 20 years
- UHMW polyethylene rub panels: 20 years
- Chain and hardware: 20 years

(4) Design Loads

Design wingwalls for dead loads, live loads, berthing forces, and overnight mooring conditions. Wind, wave, current, and tide effects are considered insignificant and are not included in the analysis. Seismic forces also are not included in the analysis.

Design the wingwalls with load definitions, factors, and combinations in accordance with the provisions of Section 2.4 of *Minimum Design Loads for Buildings and Other Structures (ASCE/SEI 7-10)*, except as modified below.

(a) Load Definitions

D = dead load of structural components and nonstructural attachments

L = live loads

CV = vessel collision force

(b) Dead Loads, D

Dead loads associated with the structure are permanent loads that do not change during the service life of the wingwalls. Dead loads include:

- Weight of the steel piling and structural steel
- Weight of the rub timbers
- Weight of the fender system

Use the following material unit weights for calculation of loads:

Material	Unit weight (lb/ft3)
Steel (all types)	490
ACZA-treated Timber	45
Rubber	80
UHMW	60

Material Unit Weights (in air) for Structural Loading
Exhibit 630-3

(c) Live Load, L

Live loads associated with the normal operation of the wingwalls are loads that could change during the mode of operation considered and are controllable through operating procedures. Live loads consist of the Type I berthing event and maintenance crew loading of ladders and platforms. Personnel are never on the wingwalls during berthing events.

(d) Vessel Collision Load, CV

Vessel collision load consists of the Type III berthing event.

Design Load	Combination
Type I Impact (Piling and all other Steel, Foundations, Deflection Analysis)	S = D + L
Type III Impact (Pushover Analysis)	S = D + CV

Load Combinations
Exhibit 630-4

(5) Design Velocities and Energies

The design energy for wingwalls is calculated using a standard Type I Impact berthing velocity (see Exhibit 630-5). The design velocity has been adopted based on experience from previous WSF wingwall projects. The vessel impact velocity for the tie-up slip is typically two-thirds of the velocity of the operating slip due to the fact that a vessel uses the tie-up slip only at the end of the day when it is not maintaining a service schedule. At certain terminals unusual conditions may require a reduced approach velocity. For example, at Friday Harbor, the presence of marinas adjacent to the slip dictates an approach velocity of 1.0 knot for both the operating slip and the tie-up slip.

Type III berthing velocity is used as the extreme event load case for operating slip wingwalls and assumes a loss of propulsion or other atypical berthing event. The Type III velocity is based on the typical approach velocity as measured at the outer dolphin from global positioning data furnished by WSF Operations staff. Data are in the form of approach velocity-versus-distance from the apron. Drag acts to reduce the impact velocity during any coasting that occurs after loss of propulsion. Use Type III velocity data provided by WSF Operations staff to complete the table shown in Exhibit 630-6.

Calculate design berthing energies in accordance with the provisions of Section 5-2 of the *UFC: Design: Piers and Wharves (UFC 4-152-01)*, unless noted otherwise in the project criteria.

Complete the tables shown in Exhibit 630-5 and Exhibit 630-6.

Wingwall	Vessel Impact Velocity (knots)	Vessel Impact Velocity (feet per second)	Design Energy (kip-feet)
Operating Slip	1.5	2.53	calculated
Tie-up Slip	1.0	1.69	calculated

Type I Impact Berthing Velocities and Energies
Exhibit 630-5

Wingwall	Vessel Impact Velocity (knots)	Vessel Impact Velocity (feet per second)	Design Energy (kip-feet)
Operating Slip	calculated	calculated	calculated

Type III Impact Berthing Velocity and Energy
Exhibit 630-6

It is WSF practice to use 50 percent of the total design berthing energy for the design of an individual wingwall. The vessel is assumed either to contact both wingwalls simultaneously or to contact a single wingwall while continuing to slide or rotate as forward movement continues. The initial impact on one wall will eventually load both walls relatively equally as the vessel slides along the wall toward the centerline of the slip.

(6) Pile Allowable Stress

Design steel piles for an allowable stress in flexure of 0.90 times the yield stress under normal operating conditions (Type I Impact).

630.05 Wingwall Alternatives

The standard wingwall design utilizes pile fixity in the soil and one or more non-rigid diaphragms at the top of the reaction piles to achieve the required structural stability and flexibility (see Exhibit 630-2). At the majority of terminals there exists adequate soil depth to allow piles to be driven, either by vibratory or impact methods, to the embedment required for fixity. The loose connection between the steel diaphragms and the pile tops allows the piles to act as cantilevers, thereby contributing to the energy absorption capacity of the wingwall as a whole.

At those terminals where inadequate soil or especially hard soil exists (for example at Shaw and Orcas), alternative designs have been developed in which fixity is achieved at the pile top through a rigid connection to the frame and an unfixed (or pinned) condition is achieved at the pile tip- bedrock interface. Tensioned and non-tensioned ground anchors typically are used to ensure adequate uplift and shear capacity at this interface (see Exhibit 630-7).

In both cases, energy absorption is achieved through a combination of pile bending, reaction frame displacement and rotation, and marine fender compression.



Wingwall Ground Anchors
Exhibit 630-7

630.06 Miscellaneous Design

(1) Vessel Tie-up and Navigational Aids

Consult with WSF Operations staff to determine the location of tie-up mooring lines. The right wingwall is typically outfitted with a fog light that provides an aid to navigation at night (see Exhibit 630-8).



Wingwall Fog Light
Exhibit 630-8

(2) Ladders

Furnish each operating slip wingwall with a rescue ladder sized to meet all applicable WAC and OSHA requirements and locate adjacent to the vehicle transfer span apron (see Exhibit 630-1). Furnish each tie-up slip wingwall with a rescue ladder sized to meet all applicable WAC and OSHA requirements and located adjacent to the gangplank. In addition, each wingwall that is outfitted with night tie-up lines requires a ladder to access the top mooring line bracket.

Chapter 640 Fixed Dolphins

640.01 General
640.02 References
640.03 Design Considerations
640.04 Design Criteria
640.05 Fixed Dolphin Alternatives
640.06 Miscellaneous Design

640.01 General

This chapter provides guidance on the design of fixed dolphins. Fixed dolphins serve a number of functions: as protection of adjacent properties (e.g., marinas and breakwaters) or other WSF structures (e.g., wingwalls and overhead loading facilities), as approach and berthing aids, as means to remain stationary during loading and unloading operations, and as mooring points for overnight tie-up. Fixed dolphins serve both operating slips and tie-up slips.

The maximum depth of water for which fixed dolphins can be designed and constructed is approximately 45 ft. In water deeper than 45 ft, floating dolphins become a more feasible and economical alternative. Refer to Chapter 650 for more information.

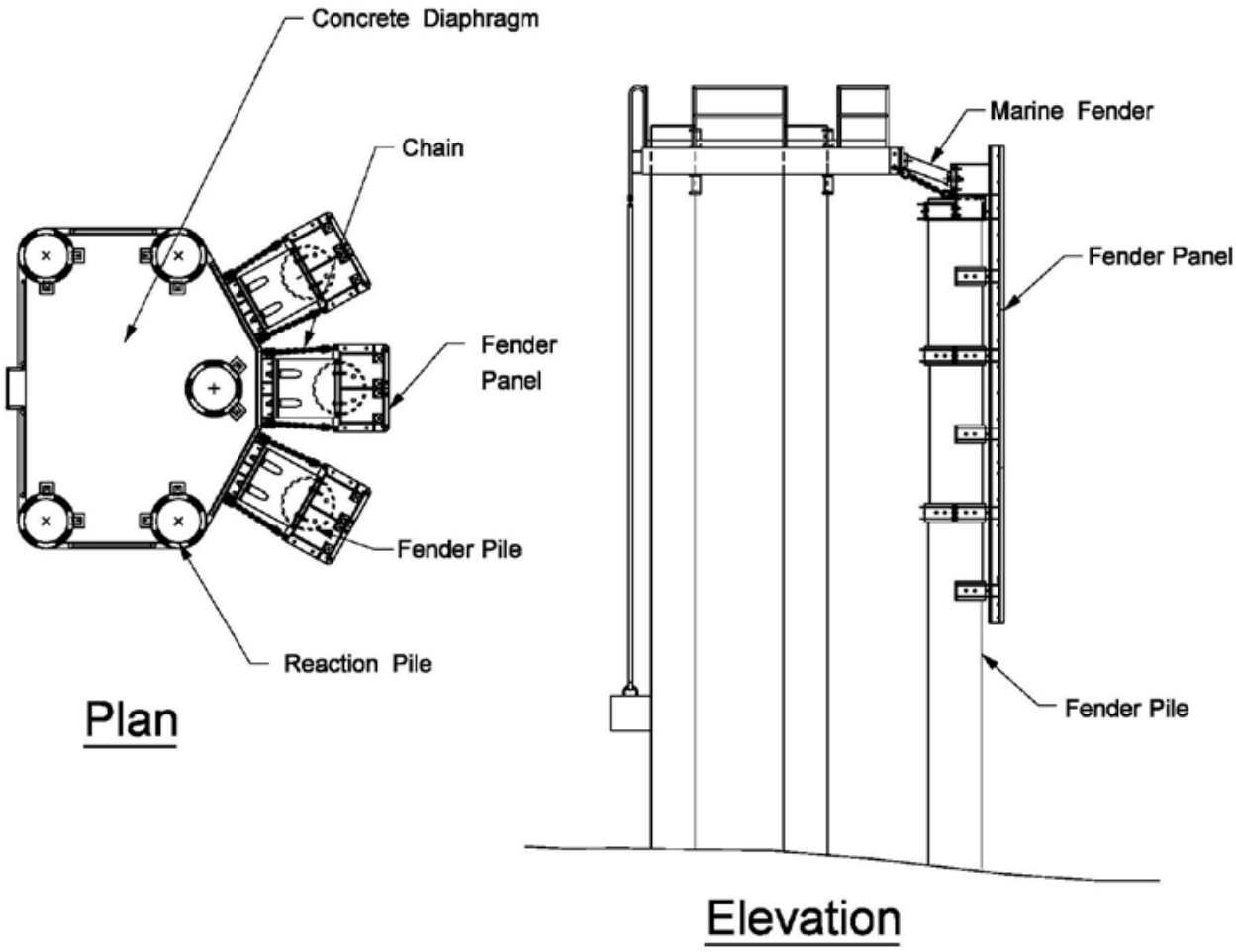
Typical fixed dolphins are illustrated in Exhibit 640-1. The principal components of fixed dolphins are illustrated in Exhibit 640-2.

For additional information, see the following chapters:



Typical Fixed Dolphins
Exhibit 640-1

Chapter	Subject
320	Environmental Considerations
330	Marine
650	Floating Dolphins



Typical Fixed Dolphin Components
Exhibit 640-2

640.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

Structural Welding Code – Steel (AWS D1.1: 2010)

Structural Welding Code – Reinforcing Steel (AWS D1.4:2005)

WAC 296-24 *General Safety and Health Standards*

WAC 296-56 *Safety standards – longshore, stevedore and waterfront related operations*

WAC 296-876 *Ladders, portable and fixed*

(2) Design Guidance

Bridge Design Manual LRFD M 23-50

Building Code Requirements for Structural Concrete (ACI 318-08), American Concrete Institute

Design: Moorings, UFC 4-159-03, Department of Defense, Washington, DC 2005

Design: Piers and Wharves, UFC 4-152-01, Department of Defense, Washington, DC 2005

General Special Provisions

Geotechnical Design Manual M 46-03

Guidelines for the Design of Fender Systems: 2002, The World Association for Waterborne Transport Infrastructure (PIANC), 2002

Minimum Design Loads for Buildings and Other Structures (ASCE/SEI 7-10), American Society of Civil Engineers

Region General Special Provisions, WSF

Specification for Structural Steel Buildings (ANSI/AISC 360-05), American Institute of Steel Construction

SSPC Painting Manual – Volume 2 Systems and Specifications (2011 Edition)

Standard Specifications for Road, Bridge, and Municipal Construction M 41-10

640.03 Design Considerations

(1) Location

Consult with WSF Operations staff to determine the location of fixed dolphins. Chapter 330 provides design guidelines on WSF dolphin configurations.

(2) Environmental

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

(3) Marine

Refer to Chapter 330 for general marine design criteria pertaining to fixed dolphins. Below are links to relevant sections by topic.

- Operations and Maintenance: 330.04(4)
- Proprietary Items: 330.04(6)
- Long Lead Time Items: 330.04(7)
- Design Life: 330.04(8)
- Corrosion Mitigation: 330.04(9)
- Scour and Mudline Elevations: 330.04(10)
- Material Specifications: 330.04(12)
- Tidal Information: 330.06
- Slips: 330.07
- Berthing and Mooring Criteria: 330.08

(4) Geotechnical Requirements

Design piles in accordance with the Geotechnical Recommendations provided by the WSDOT Geotechnical Branch. Do not include seismic effects including liquefaction in the design. The Geotechnical Recommendations will typically include:

- Axial capacity of piles
- Input data for L-Pile lateral analysis
- Group reduction factors due to pile spacing
- Constructability recommendations including type and capacity of pile driving equipment and use of cutting shoes.

640.04 Design Criteria

(1) General

Fixed dolphins are flexible pile-supported structures designed to absorb a vessel's kinetic energy through rotation and bending of the fender and reaction piles, compression of the marine fenders, and movement of the piles through the soil. The dolphin is sized in accordance with the design energy which is a function of the design vessel's mass, velocity, and approach angle, and other variables and constants. The dolphin may be single-sided or double-sided depending on the slip layout.

(2) Design Vessel

Refer to Chapter 330 for design vessel information and Appendix O for vessel particulars. Consider WSF's future plans for vessel assignment to the subject terminal and slip. The design vessel is determined in consultation with WSF Operations staff.

(3) Design Life

Design lives for the following components of the fixed dolphins are based on deterioration due to corrosion and/or fatigue in accordance with the LCCM.

- Piles, fender panels, and diaphragms: 50 years
- Marine fenders: 30 years
- UHMW polyethylene rub panels: 20 years
- Chain and hardware: 20 years

(4) Design Loads

Design fixed dolphins for dead loads, live loads, berthing forces, and overnight mooring conditions. Wind, wave, current, and tide effects are considered insignificant and are not included in the analysis. Seismic forces also are not included in the analysis.

Design fixed dolphins with load definitions, factors, and combinations in accordance with the provisions of Section 2.4 of *Minimum Design Loads for Buildings and Other Structures* (ASCE/SEI 7-10), except as modified below. Design fixed dolphin reinforced concrete in accordance with the provisions of Section 2.3 of ASCE/SEI 7-10.

(a) Load Definitions

D = dead load of structural components and nonstructural attachments

L = live loads

CV = vessel collision force

(b) Dead Loads, D

Dead loads associated with the structure are permanent loads that do not change during the service life of the wingwalls. Dead loads include:

- Weight of the steel piling and structural steel
- Weight of the reinforced concrete diaphragm
- Weight of the fender system

Use the following material unit weights for calculation of loads:

Material	Unit weight (lb/ft3)
Steel (all types)	490
Reinforced Concrete	155
Rubber	80
UHMW	60

Material Unit Weights (in air) for Structural Loading
Exhibit 640-3

(c) Live Load, L

Live loads associated with the normal operation of the fixed dolphins are loads that could change during the mode of operation considered and are controllable through operating procedures. Live loads consist of the Type I berthing events and maintenance crew loading of ladders and platforms. Personnel are never on the dolphins during berthing events.

(d) Vessel Collision Load, CV

Vessel collision load consists of the Type III berthing event.

Design Load	Combination
Type I Impact (Piling and all other Steel, Foundations, Deflection Analysis)	S = D + L
Type I Impact (Reinforced Concrete)	U = 1.2 D + 1.6 L U = 0.9 D + 1.6 L
Type III Impact (Pushover Analysis)	S = D + CV

Load Combinations and Load Factors
Exhibit 640-4

(5) Design Velocities and Energies

Determine berthing velocities for bow impacts to dolphins from global positioning data furnished by WSF Operations staff in the form of approach velocity-versus-distance from apron data. Base drift impact velocities on past experience with this type of approach. Drift impact velocities typically apply only to outer and intermediate dolphins. Calculate berthing energies in accordance with the provisions of Section 5-2 of the *UFC: Design: Piers and Wharves* (UFC 4-152-01), unless noted otherwise in the project-specific criteria. Complete the table as shown in Exhibit 640-5 for the dolphin(s) to be designed.

Dolphin	Impact	Angle (degrees)	Vessel Impact Velocity (knots)	Vessel Impact Velocity (feet per second)	Design Energy (kip-feet)
Outer	Bow	measured	calculated	calculated	calculated
	Drift	90	1.0	1.69	calculated
Intermediate	Bow	measured	calculated	calculated	calculated
	Drift	90	1.0	1.69	calculated
Inner	Bow	measured	calculated	calculated	calculated

Note: Bow impact angle is defined as the angle between the vessel centerline and the berthing velocity component normal to the dolphin fender panel face.

Type I Impact Berthing Velocities and Energies
Exhibit 640-5

(6) Pile Allowable Stress

Design steel piles for an allowable stress in flexure of 0.90 times the yield stress under normal operating conditions (Type I Impact) steel piles.

640.05 Fixed Dolphin Alternatives

The standard fixed dolphin design utilizes pile fixity in the soil and a non-rigid diaphragm at the top of the reaction piles to achieve the required structural stability and flexibility (see Exhibit 640-2). At the majority of terminals there exists adequate soil depth to allow piles to be driven, either by vibratory or impact methods, to the embedment required for fixity. The loose connection between the concrete diaphragm and the pile tops allows the piles to act as cantilevers, thereby contributing to the energy absorption capacity of the dolphin as a whole.

At those terminals where inadequate soil exists (for example at Lopez Island), alternative designs have been developed in which fixity is achieved at the pile top through a rigid connection to the diaphragm and an unfixed (or pinned) condition is achieved at the pile tip-bedrock interface (see Exhibit 640-6). Flexibility is maintained and stability is achieved by anchoring the piles into the bedrock using permanent rock anchors.

In both cases, energy absorption is achieved through a combination of pile bending, diaphragm displacement and rotation, and marine fender compression.

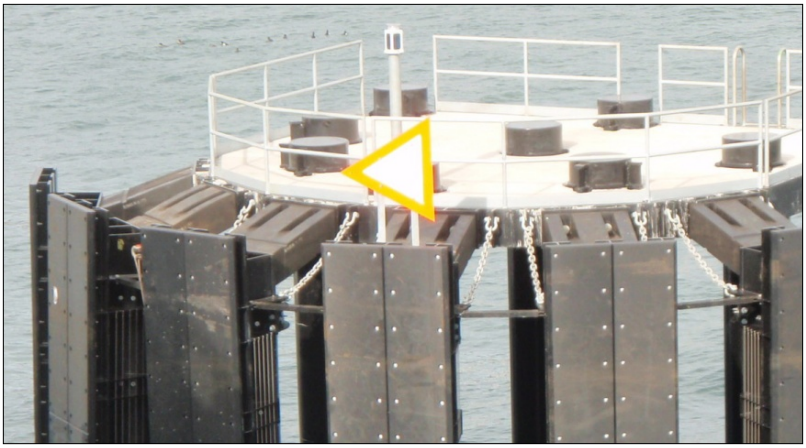


Lopez Fixed Dolphin
Exhibit 640-6

640.06 Miscellaneous Design

(1) Vessel Tie-up and Navigational Aids

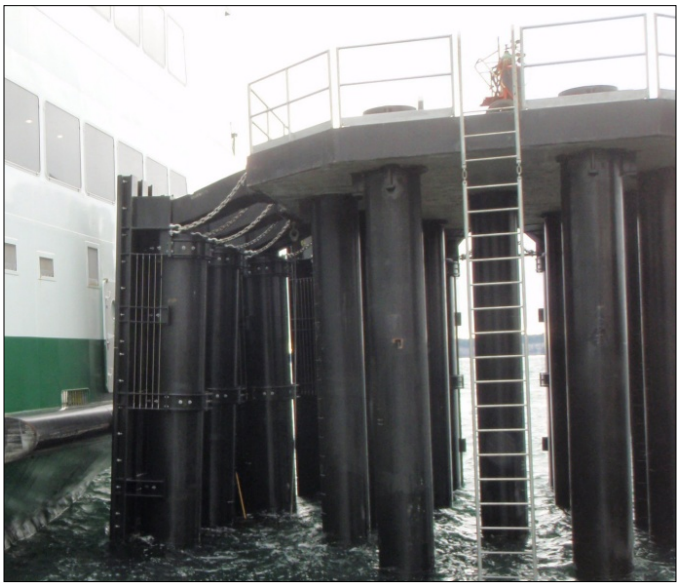
Consult with WSF Operations staff to determine the location of tie-up mooring lines. The outermost dolphin on each side of the slip is typically outfitted with a directional triangle that points toward the center of the slip and with a marine lantern that provides an aid to navigation at night (see Exhibit 640-7).



Fixed Dolphin Navigational Aids
Exhibit 640-7

(2) Ladders

Furnish each dolphin with a maintenance ladder sized to meet all applicable WAC and OSHA requirements and located away from the slip centerline (see Exhibit 640-8).



Fixed Dolphin Maintenance Ladder
Exhibit 640-8

(3) Bird Deterrence

At certain terminals nesting birds can create a maintenance nuisance resulting in health risks and environmental permitting issues. When directed by the Maintenance staff, include bird deterrent measures (bird wire and bird spikes) on the fender panels (see Exhibit 640-8).

Chapter 650 Floating Dolphins

650.01 General
650.02 References
650.03 Design Considerations
650.04 Design Criteria
650.05 Stability
650.06 Anchor System
650.07 Fender System
650.08 Towing System
650.09 Miscellaneous Design

650.01 General

This chapter provides guidance on the design of floating dolphins. Floating dolphins serve a number of functions: as protection of adjacent properties (e.g., marinas and breakwaters), as approach and berthing aids, as a means to remain stationary during loading and unloading operations, and as mooring points for overnight tie-up.

Floating dolphins are used primarily at terminals with deep water (typically deeper than 45 feet) or where the presence of bedrock makes pile-supported fixed dolphins impractical. At such locations, the construction of fixed pile-supported structures will be much more expensive and difficult. Also, many vessel captains prefer floating dolphins over fixed dolphins since they are typically a much softer berthing element.

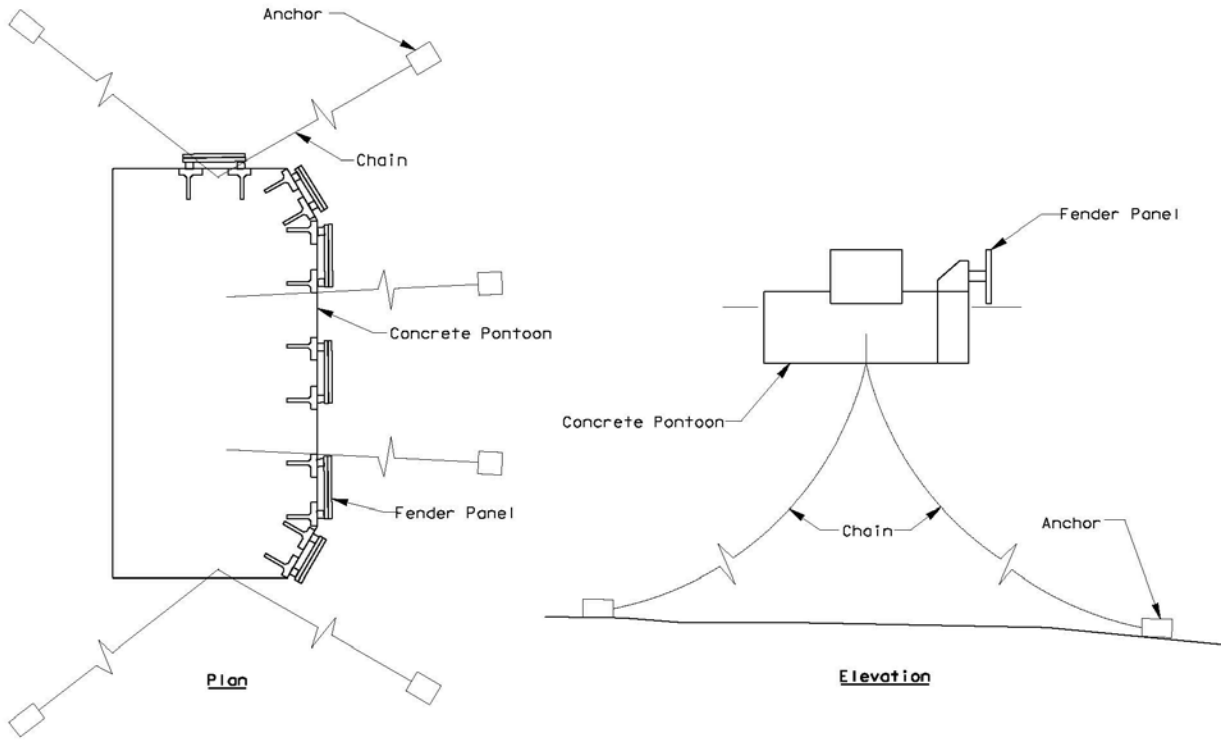
A typical floating dolphin is illustrated in Exhibit 650-1. The principal components of floating dolphins are illustrated in Exhibit 650-2.



Typical Floating Dolphin
Exhibit 650-1

For additional information, see the following chapters:

Chapter	Subject
320	Environmental Considerations
330	Marine
640	Fixed Dolphins



Typical Floating Dolphin Components
Exhibit 650-2

650.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

46 Code of Federal Regulations (CFR) Part 170 Subpart E, Weather Criteria

46 CFR Part 174 Subpart C, Special Rules Pertaining to Mobile Offshore Drilling Units

WAC 296-24 *General safety and health standards*

WAC 296-56 *Safety standards – longshore, stevedore and waterfront related operations*

WAC 296-876 *Ladders, portable and fixed*

(2) Design Guidance

Bridge Design Manual LRFD M 23-50

Design: Piers and Wharves, Unified Facilities Criteria (UFC) 4-152-01, Department of Defense, Washington, DC 2005

Design: Moorings, UFC 4-159-03, Department of Defense, Washington, DC 2005

General Special Provisions

Geotechnical Design Manual M 46-03

Guidelines for the Design of Fender Systems: 2002, The World Association for Waterborne Transport Infrastructure (PIANC), 2002

AASHTO *LRFD Bridge Design Specifications*, American Association of State Highway and Transportation Officials, Washington DC

Region General Special Provisions, WSF

Specification for Aluminum Structure, Aluminum Association

Specification for Structural Steel Buildings (ANSI/AISC 360), American Institute of Steel Construction

Structural Welding Code – Steel (AWS D1.1), American Welding Society

Structural Welding Code – Reinforcing Steel (AWS D1.4), American Welding Society

Structural Welding Code – Aluminum (AWS D1.2), American Welding Society

Control of Cracking in Structural Concrete, ACI 224R, American Concrete Institute

Standard Plans for Road, Bridge, and Municipal Construction M 21-01

Standard Specifications for Road, Bridge, and Municipal Construction M 41-10

Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 5th ed. with Interim Revision, AASHTO, Washington, DC 2009

Velocity Pattern Generated by Propulsion of Four Ferries, Pacific International Engineering Draft Technical Memorandum, 2001

650.03 Design Considerations

(1) Location

Consult with WSF Operations staff to determine the location of floating dolphins. Chapter 330 provides design guidelines on WSF dolphin configurations.

Tune the translational response of the dolphin as much as practical to the current operational norm of 5 to 10 feet in the typical berthing contact. Accomplish this by adjusting the catenary shape of the anchor lines. Within limits, adjustment to the plan locations of the dolphins can be made if the vessel captains request a location adjustment at the time of installation, or after installation. The position of the dolphin can be adjusted by plus or minus 10 feet by changing the length of the anchor chains.

(2) Environmental

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

(3) Marine

Refer to Chapter 330 for general marine design criteria pertaining to floating dolphins. Below are links to relevant sections by topic.

- Operations and Maintenance: 330.04(4)
- Proprietary Items: 330.04(6)
- Long Lead Time Items: 330.04(7)
- Design Life: 330.04(8)
- Corrosion Mitigation: 330.04(9)
- Scour and Mudline Elevations: 330.04(10)
- Material Specifications: 330.04(12)
- Tidal Information: 330.06
- Slips: 330.07
- Berthing and Mooring Criteria: 330.08

(4) Geotechnical Requirements

Design anchors in accordance with the Geotechnical Recommendations provided by the WSDOT Geotechnical Branch. Do not include seismic effects including liquefaction in the design. The Geotechnical Recommendations will typically include:

- Type of anchors to be used
- Resistance and safety factors to be used for the given anchors
- Capacity charts or values for the given anchors

650.04 Design Criteria

(1) General

Floating dolphins are moored concrete pontoons with standard dimensions as shown in Exhibit 650-3 below. Two standard sizes are used depending on whether the dolphin is single-sided or double-sided. Design the float to consist of the number of individual cells tabulated below, each capable of being independently ballasted to attain level trim. Moor each dolphin with the number of chain mooring lines tabulated below and secure the chains to the sea bed with anchors. Locate one or more sinkers along the length of each mooring line as required to control the mooring line response and help meet energy design levels. Sinkers can also provide more vertical clearance between the vessel and the mooring lines. Typically for single-sided dolphins sinkers are provided only on the slip-side mooring lines.

Characteristic	Single-sided	Double-sided
Pontoon Length	80 feet	80 feet
Pontoon Width	40 feet	48 feet
Pontoon Depth	14 feet	14 feet
Number of Cells	21	24
Number of Mooring Lines	6	8

Standard Floating Dolphin Characteristics
Exhibit 650-3

(2) Design Vessel

Refer to Chapter 330 for design vessel information and Appendix O for vessel particulars. Consider WSF's future plans for vessel assignment to the subject terminal and slip. The design vessel is determined in consultation with WSF Operations staff.

(3) Design Life

Design lives for the following components of the floating dolphins are based on deterioration due to corrosion and/or fatigue in accordance with the LCCM.

- Pontoon: 50 years
- Mooring chain and anchors: 25 years
- Marine fenders: 30 years
- UHMW polyethylene rub panels: 20 years
- Fender chain and hardware: 20 years

(4) Design Loads

Design floating dolphins for dead loads, live loads, berthing, overnight mooring, wind, wave, current, and tidal conditions. Berthing loads are due to the ferries laying into the dolphins as they enter the slip. Wind, wave, current, and tide are important in designing the mooring lines for the berthing loads as well as float motions. Float motions, resulting from wind, wave and current environmental loads, are important to berthing vessels because excessive movement may result in the dolphin impacting nearby structures, damage to the ferries, or overload of the mooring system.

(a) Load Designations

DC = dead load of structural components and nonstructural attachments

DW = dead load of wearing surfaces and utilities

LL = live load

EQ = seismic force

WA = static water loads and current pressure

BY = buoyant force

WS = wind force on structure

WV = wave force on structure

CV = vessel collision force

TU = uniform temperature

SH = shrinkage

EL = locked-in force effects

(b) Permanent (Dead) Loads, DC and DW

Dead loads associated with the structure are loads that do not change during the service life of the dolphin. Dead loads include:

- Weight of the concrete pontoon
- Weight of permanent ballast
- Weight of the fender system
- External hydrostatic pressure and buoyancy in calm sea conditions assuming dolphin is submerged to the design waterline. Hydrostatic pressures shall be based on a water level 1 foot higher than the design waterline.
- Anchor chain force in calm sea conditions

Use the following material unit weights for calculation of loads:

Material	Unit weight (lb/ft3)
Reinforced Concrete	160
Steel (all types)	490
Aluminum	165
Rubber	80
UHMW	60
Ballast	120

Material Unit Weights (in air) for Structural Loading
Exhibit 650-4

The unit weight of seawater is 64 pounds per cubic foot. Calculate the buoyant weight of other materials at their unit weight minus the unit weight of seawater.

Include marine growth as 5 pounds per square foot (submerged weight) uniformly distributed over submerged concrete faces.

(c) Live Loads, LL

Live loads associated with the normal operation of the dolphin are loads that could change during the mode of operation considered and are controllable through operating procedures. Live loads include:

- Type I berthing events from WSF ferry vessels
- A concentrated load of 2000 pounds acting anywhere on the top or keel slabs
- A uniform distributed live load of 40 pounds per square foot at any location or locations on the top or keel slabs
- Forces exerted on the dolphin from towing. Specify the maximum towing load (obtained by limiting tow cable load) and used for this load.

(d) Seismic, EQ

The floating dolphin is not designed for any seismic loads.

(e) Water Load, WA and BY

Water loads include the buoyant uplift force as well as horizontal fluid pressure. This includes the current generated by a maximum propeller wash velocity of 19 feet per second. This does not include loads due to waves.

When determining hydrostatic pressures, assume a water level 1.0 foot above design freeboard.

(f) Wind and Wave Loads, WS and WV

Includes both wind and wave loads on the structure. Design wind speed is site-specific.

(g) Vessel Collision Load, CV

Consider vessel collisions beyond the Type I berthing event.

(h) Temperature and Shrinkage, TU and SH

Use a load factor of 1.20 for temperature and shrinkage when deformations are being calculated. For all other effects use the load factor from Exhibit 650-5.

(i) Locked-in Force Effects, EL

Accumulated locked-in force effects resulting from construction process, including the secondary forces from post-tensioning.

(j) Load Factors and Combinations

Load factors and combinations are based on Table 3.4.1-1 of AASHTO *LRFD Bridge Design Specifications.*

1. **Strength I**

   Basic load combination for normal use of facility without wind or wave when typical live load is considered.

2. **Strength III**

   Load combination relating to facility exposed to a “design” storm.

3. **Strength V**

   Load combination relating facility exposed to an “operational” storm.

4. **Extreme Event II**

   Load combination relating to vessel collision forces beyond the Type I berthing event.

5. Service I

Load combination relating to the normal operational use of the facility.

Load Combination Limit State	DC DW EL	LL	WA BY	WS WV	TU SH	CV
Strength I	γp	1.75	1.00	—	0.50	—
Strength III	γp	—	1.00	1.40	0.50	—
Strength V	γp	1.35	1.00	0.40	0.50	—
Extreme Event II	γp	0.50	1.00	—	—	1.00
Service I	1.00	1.00	1.00	0.30	1.00	—

Load Combinations and Load Factors
Exhibit 650-5

Type of Load	Load Factor, Yp	
	Maximum	Minimum
DC: Components and Attachments	1.25	0.90
DW: Wearing surface and Utilities	1.50	0.65
EL: Locked-in Force Effects	1.00	1.00

Load Factors for Permanent Loads, Yp
Exhibit 650-6

(k) Damage States

Evaluate the dolphin and moorage system to prevent failure due to damage loads. Damage loads include evaluation of the following:

- Type III berthing event. Design the dolphin and moorage system to provide continuous energy dissipation response to ferry berthing events with energy level in excess of the quantified Type I berthing event. Accomplish this by providing a mechanism for sliding anchorage. There is no quantified design energy level for a Type III berthing event.
- Flooding damage. Design the concrete pontoon to remain afloat (and stable as defined by Section 650.05) with complete flooding of one cell (full height), such as may occur in the event of a hull breach.

(5) Design Velocities and Energies

Determine berthing velocities for bow impacts to dolphins from global positioning data furnished by WSF Operations staff in the form of approach velocity-versus-distance from apron data. Base drift impact velocities on past experience with this type of approach. Calculate berthing energies in accordance with the provisions of Section 5-2 of the *UFC: Design: Piers and Wharves (UFC 4-152-01)*, unless noted otherwise in the project-specific criteria. Complete the table shown in Exhibit 650-7.

Dolphin	Impact	Angle (degrees)	Vessel Impact Velocity (knots)	Vessel Impact Velocity (feet per second)	Energy (kip-feet)
Floating	Bow	measured	calculated	calculated	calculated
	Drift	90	1.0	1.69	calculated

Note: Bow impact angle is defined as the angle between the vessel centerline and the berthing velocity component normal to the dolphin fender panel face.

Type I Impact Berthing Velocities and Energies
Exhibit 650-7

650.05 Stability

Check the following four conditions for dolphin stability: stability of the dolphin anchored in its final location (anchored stability) and stability of a free-floating dolphin before being anchored (free-floating stability) with intact and damaged cases for both.

(1) Anchored Stability

- An anchored intact dolphin is considered stable if the metacentric height (GM) is greater than 2.0 and the deck does not go awash during a Type I berthing event.
- An anchored damaged dolphin is considered stable if the metacentric height (GM) is greater than 1.0 and the deck does not go awash with one cell flooded.

(2) Free-floating Stability

- A free-floating intact dolphin (during launching or towing) is considered stable if the area under the righting arm curve up to the downflooding angle is greater than or equal to 10.0 foot-degrees as per *46 CFR 174.015*. The downflooding angle is defined as when the deck goes awash.
- A free-floating damaged dolphin (during launching or towing), is considered stable if the metacentric height is greater than 1.0 and the deck does not go awash with one cell flooded.

650.06 Anchor System

Analyze and design the anchor system using the OPTIMOOR computer program or other suitable mooring software at multiple tide levels using the controlling design vessel parameters and the design impact energy parameters. Use the following criteria to determine the capacity of the anchor system:

- The anchors have a factor of safety of 1.5. The applied anchor force (horizontal and uplift) is less than the ultimate resistance provided by the Geotechnical Recommendations.
- The tension in the mooring chain reaches 40 percent of its breaking capacity (this correlates to a factor of safety of 2.5 and is typical of the industry).

650.07 Fender System

Design the fender system to meet the following performance requirements (per fender panel):

- Energy Absorbed, minimum = 150 kip-feet
- Reaction at Rated Energy = 150 kips (± 10 percent)
- Deflection at Rated Energy = 50 percent (± 10 percent)

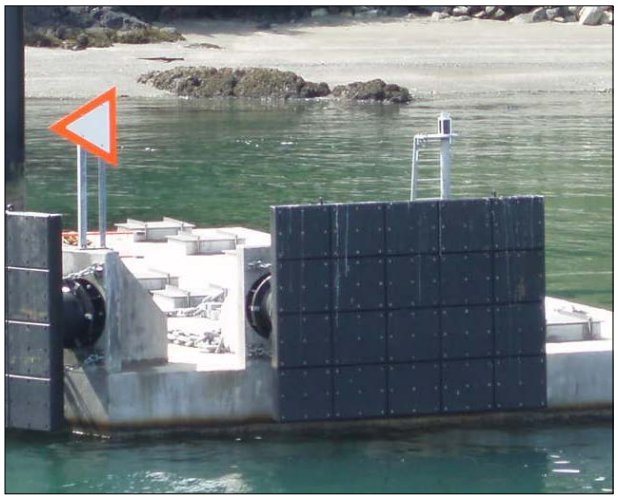
650.08 Towing System

Maximum towing load is the minimum of manufacturer's stated cleat capacity or the capacity of the cleat connection to the floating dolphin.

650.09 Miscellaneous Design

(1) Vessel Tie-up and Navigational Aids

Consult with WSF Operations staff to determine the location of tie-up mooring lines. The outermost dolphin on each side of the slip is typically outfitted with a directional triangle that points toward the center of the slip and with a marine lantern that provides an aid to navigation at night (see Exhibit 650-8).



Floating Dolphin Navigational Aids
Exhibit 650-8

(2) Hatches

Size the pontoon cell hatches to meet all applicable WAC and OSHA requirements as well as to have a diagonal dimension of at least 4.5 feet for the removal of formwork and other equipment from the cells (see Exhibit 650-9).



Floating Dolphin Cell Hatch
Exhibit 650-9

(3) Ladders

Furnish each floating dolphin with a fixed ladder to provide access to the marine lantern and a portable maintenance ladder located on the pontoon deck to provide access to the cells, both sized to meet all applicable WAC and OSHA requirements (see Exhibit 650-10).



Floating Dolphin Portable Ladder
Exhibit 650-10

(4) Freeboard

Design the dolphins for a freeboard of 3.0 feet. The freeboard is measured from the top of the top slab at the edge of the pontoon to the normal water level. The normal water level is to be marked on each side of the pontoon. Calculate the freeboard and draft based on the following criteria:

- Include structure dead load as defined in the Section 650.04.
- Do not include live load.
- Include vertical component of the anchor chain forces.
- Include weight of attachments such as hatches and other hardware.
- The unit weight of seawater as given in Section 650.04.
- Include the weight of reserve ballast equivalent to 3 inches of freeboard to account for construction tolerances and to compensate for potential increases in pontoon draft (loss of freeboard) due to unforeseen weight being added to the dolphin. The final ballast location and amounts are determined by the contractor's naval architect and some adjustments are made in the final placement in the field.
- Include the weight of ballast required to level out (both list and trim) the dolphin.

Division 7 Miscellaneous

Chapter 700 Maintenance 700-1
Chapter 710 Overweight Vehicle Check 710-1
Chapter 720 Scour 720-1
Chapter 730 Bridge Rating 730-1

Chapter 700 Maintenance

Future chapter

Chapter 710 Overweight Vehicle Check

Future chapter

Chapter 720 Scour

Future chapter

Chapter 730 Bridge Rating

Future chapter

Division 8 CADD Standards and Procedures

Division 8 CADD Standards and Procedures 800-1

801 Introduction 800-2
801.01 Purpose and Scope 800-2
801.02 Procedure for Revisions and Updates 800-2

802 WSF CADD Software 800-3
802.01 General 800-3
802.02 File Sharing/Delivery 800-3

803 MicroStation Resource and Support Files 800-4
803.01 Fonts 800-4
803.02 Line Styles 800-5
803.03 Pen Table 800-6
803.04 Color Table 800-8
803.05 Seed Files 800-9

804 Project Naming 800-18
804.01 Project Naming Convention 800-18

805 Directory Structure 800-19
805.01 Project Directory 800-19

806 File Names 800-20
806.01 File Extensions 800-20
806.02 File Naming 800-22

807 Plan Sequence 800-27
807.01 Plan Sequence List 800-27

808 Drawing List 800-28
808.01 Drawing List Example 800-28

809 Drafting Standards 800-29
809.01 Plan Sheet Size 800-29
809.02 Permit and Repair Letter Sheet Layout 800-33
809.03 WSF Borders 800-33
809.04 WSF Monuments 800-37
809.05 Referencing Note 800-40
809.06 Sheet Numbering 800-41
809.07 Text 800-42

809.08 Recommended Scales 800-43
809.09 Addendums, Revisions and Change Orders. 800-44
809.10 Preliminary Stamps 800-44
809.11 Element Symbology. 800-44
809.12 Civil and Right-of-Way Level Symbology 800-44
809.13 Existing Architectural Level Symbology. 800-45
809.14 Architectural Demolition Symbology 800-46
809.15 Proposed Architectural Symbology 800-48
809.16 Existing Electrical Symbology 800-50
809.17 Electrical Demolition Symbology 800-51
809.18 Proposed Electrical Symbology. 800-52
809.19 General Sheet Symbology 800-53
809.20 Existing Landscape Symbology. 800-54
809.21 Landscape Demolition Symbology 800-56
809.22 Proposed Landscape Symbology 800-58
809.23 Existing Mechanical Symbology 800-60
809.24 Mechanical Demolition Symbology 800-61
809.25 Existing Security Symbology 800-63
809.26 Security Demolition Symbology 800-63
809.27 Proposed Security Symbology. 800-64
809.28 Existing Structural Symbology 800-64
809.29 Structural Demolition Symbology 800-66
809.30 Proposed Structural Symbology 800-68
809.31 Abbreviations. 800-69
809.32 Standard Drawings. 800-88
809.33 Updating Project Basemaps 800-89

810 Plan Submittals. 800-90

810.01 Submittals Scheduling 800-90
810.02 Submittal Border Example. 800-90
810.03 Review Submittals 800-91
810.04 Final Submittals 800-91
810.05 Design File Archiving 800-91
810.06 As-Built Drawings 800-92

811 Environmental Permit Standards 800-93

811.01 Permit Drawing Checklist 800-93
811.02 Format of Drawings 800-94

812 General Plan Sheets 800-97
813 Civil Plan Sheet Series 800-98
814 Structural Plan Sheet Series 800-99
815 Fluid Power Hydraulic Plan Sheet Series 800-100
816 Electrical Design Drawing Series 800-101
817 Mechanical Design Drawing Series 800-104

Division 8 CADD Standards and Procedures

801 Introduction
802 WSF CADD Software
803 MicroStation Resource and Support Files
804 Project Naming
805 Directory Structure
806 File Names
807 Plan Sequence
808 Drawing List
809 Drafting Standards
810 Plan Submittals
811 Environmental Permit Standards
812 General Plan Sheets
813 Civil Plan Sheet Series
814 Structural Plan Sheet Series
815 Fluid Power Hydraulic Plan Sheet Series
816 Electrical Design Drawing Series
817 Mechanical Design Drawing Series

801 Introduction

801.01 Purpose and Scope

Division 800 provides instruction and guidance for the preparation of contract drawings using Bentley's MicroStation© Computer-Aided Design and Drafting (CADD or CAD) software on all Washington State Ferries (WSF) projects. WSF is a division of the Washington State Department of Transportation (WSDOT), which uses the *Plans Preparation Manual* M 22-31 as a guideline for preparing PS&E documents. However, the *Plans Preparation Manual* applies primarily to roadway-type projects and does not adequately address the specific needs and variety of projects performed by WSF. The purpose of Division 800 is to supplement the WSDOT *Plans Preparation Manual* to meet WSF CADD requirements. The WSF CADD Standards and Procedures specified in Division 800 shall supplement those in the WSDOT *Plans Preparation Manual*.

Special exceptions to the use of MicroStation are those projects that include within their scope the construction of shore side buildings. Washington State Ferries depends on the WSDOT Facilities Branch or Consultants to provide the building design services necessary to complete that portion of the contract. In projects that incorporate items of work other than architecture there will be a "design limit" of 5 feet beyond the perimeter of the architectural work that will mark the boundary where the architectural and other discipline work will coincide.

801.02 Procedure for Revisions and Updates

(a) Project Specific CADD Standards

As with everything there are exceptions to the rules. The format for the PS&E CADD documents may be changed slightly by the Project Manager for WSF. In order to accommodate changes, the proposed variations to the CADD Manual shall be forwarded to the WSF CADD Coordinator for review and approval.

Changes can be made to text properties, line styles, level symbology and element attributes. There will, however, be no changes allowed in the layout of the WSF sheet borders.

802 WSF CADD Software

802.01 General

WSF only supports MicroStation© (Bentley Systems, Inc.) electronic CADD files. The importance of organization and consistency cannot be overemphasized as the electronic files prepared by consultants are frequently used as a basis for continued work or modifications. Electronic organization quality is equally important as the plotted deliverables.

All work submittals and deliverables must be created and developed in MicroStation© format and conform to Division 800, the Washington State Department of Transportation (WSDOT) *Plans Preparation Manual* (PPM), and the WSDOT *Bridge Design Manual* LRFD (BDM) (for Structures related issues). Structural work will be completed in accordance with Chapter 11 of the BDM as it pertains to detailing.

Any inconsistencies—electronic, aesthetic, or otherwise—with the previously noted manuals are the sole responsibility of the originators of the drawings to correct.

On any WSF project done by a consultant team, the prime consultant is responsible for insuring the CADD files are submitted in a "usable" MicroStation format.

All Computer-Aided Engineering (CAE) by the Washington State Ferries and its consultants must conform to the WSF CSPM, the WSDOT PPM, and in part, the WSDOT BDM. Any inconsistencies—electronic, aesthetic, or otherwise—with the WSF CSPM, WSDOT PPM, or the WSDOT BDM are the sole responsibility of the originators of the drawings to resolve. InRoads© is the standard CAE package and AutoTurn© is the standard turn radius analyzing software of WSDOT and WSF.

For all "in house" work the MicroStation© files will be accessed through the use of the desktop icon for MicroStation©. All work will be done in the Expanded Levels environment.

802.02 File Sharing/Delivery

WSF will accept files transported to it in the following formats:

- CD or DVD.
- Posting to the Consultant's ftp site and made available to WSF for downloading.
- Uploading to the WSDOT ftp site at ftp://ftp.wsdot.wa.gov/ and placed in a location made accessible for public or Consultant use.
- Uploading to the WSDOT secured ftp site. This requires the use of software that will accommodate the input of information that is required for access to these types of sites. The program recommended by WSDOT is FileZilla©. Access information can be obtained from the Project Manager.

All files must be in a format specified in this CADD Manual and be useable by MicroStation© **without** conversion.

803 MicroStation Resource and Support Files

803.01 Fonts

MicroStation© font resource files are binary files created from font cells, true type and postscript shape fonts. MicroStation© has the ability to read multiple font resource files according to the paths set by the MS_SYMBRSC configuration variable in the selected workspace. WSF uses three font resource files (font.rsc, ntfont.rsc and wsf_font.rsc) all located in: C:\CAE_rsc\MS_63Level

WSF uses fonts 2, 42, and 50 in preparing PS&E plan sheets. All others are non-standard. It may be necessary to use non-standard fonts to maintain the formatting of information imported from other applications. For example an imported Excel spreadsheet may require certain True Type fonts in order to appear correctly.

Font 50 – (PSE_STD) is to be used for most information. **Font 2 – (STD)** is to be used only in places where font 50 cannot fit (e.g., dimensioning the width of roadway).

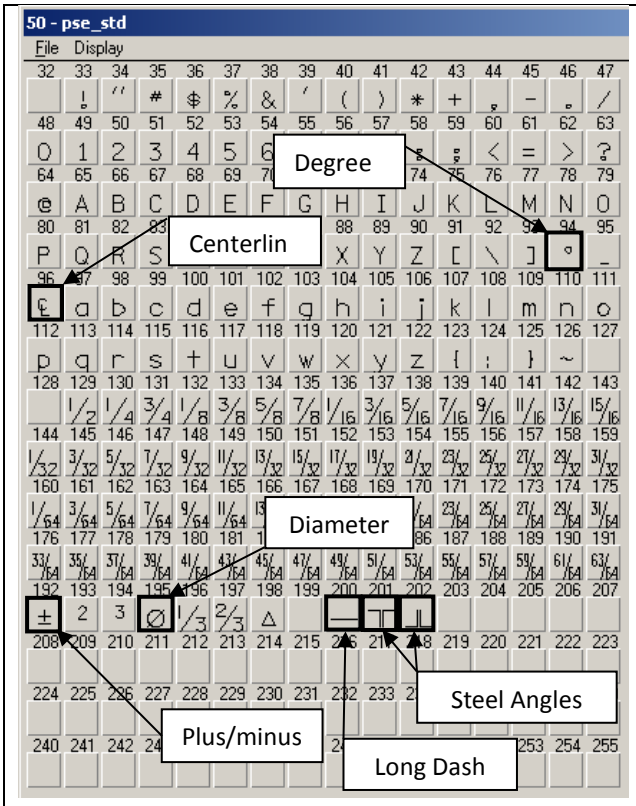
Font 42 – (FONT042) is used for names of cities, towns, interchanges, subdivisions, waterways, etc. Sometimes, other fonts come into the design file from foreign sources. Cartography uses special fonts when preparing Quad Maps. When Quad Maps are utilized in preparing details it is not necessary to change the fonts as long as the appearance is acceptable.

(a) Font 50/Special Characters

To access special text symbols in MicroStation©, while placing text hold down ALT key and type decimal equivalent number.

At the left is the Font Table for the WSDOT/WSF font 50. All of the characters from 33 to 126 are available on the keyboard without doing anything special. Characters with numbers (located above the character) greater than 126 can be placed by holding down the ALT key and typing the number corresponding to the character. For example, to place the diameter symbol you would hold down the ALT key and typing 0195 (ALT+0195).

The special characters framed can be placed with the following:



At the left is the **Font Table** for the WSDOT/WSF font 50. All of the characters from 33 to 126 are available on the keyboard without doing anything special. Characters with numbers (located above the character) greater than 126 can be placed by holding down the ALT key and typing the number corresponding to the character. For example, to place the diameter symbol you would hold down the ALT key and typing 0195 (ALT+0195).

The special characters framed can be placed with the following:

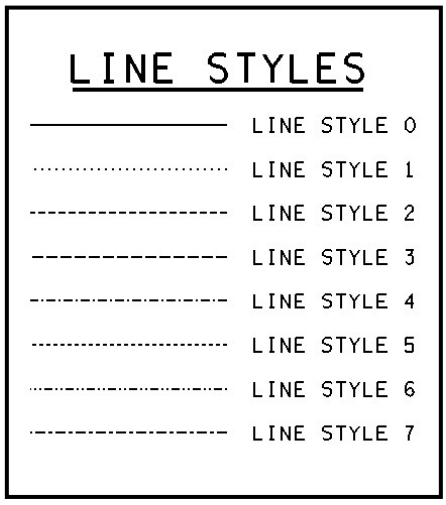
- ° => **Shift + 6 or ALT + 0094**
- ℄ => **(Accent) or ALT + 0096**
- ± => **ALT+0192**
- Ø => **ALT+0195**
- — => **ALT+0200**
- ╥ => **ALT+0201**
- ╨ => **ALT+0202**

Font Table for Font 50
Exhibit 800-1

803.02 Line Styles

The line styles developed for the WSDOT/WSF CADD system conforms to that specified in the *Plans Preparation Manual* and to what is currently in general use by the WSDOT.

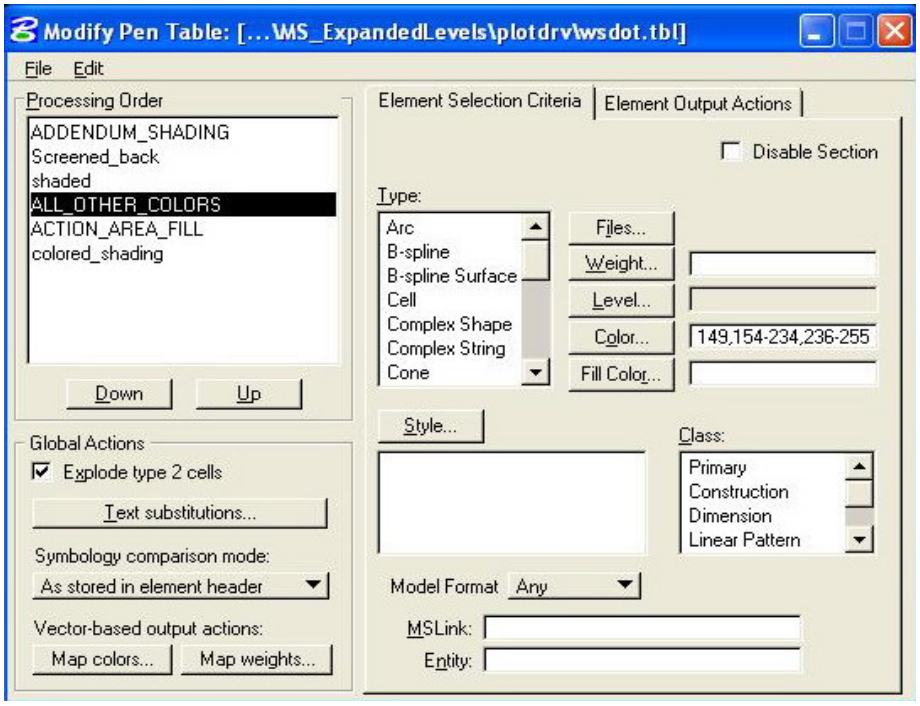
The 8 standard line styles as delivered with MicroStation© are shown. These line styles shall be used to prepare WSF design plans. See the *Plans Preparation Manual* for examples of all civil custom line styles available in the resource file (estylew.rsc).



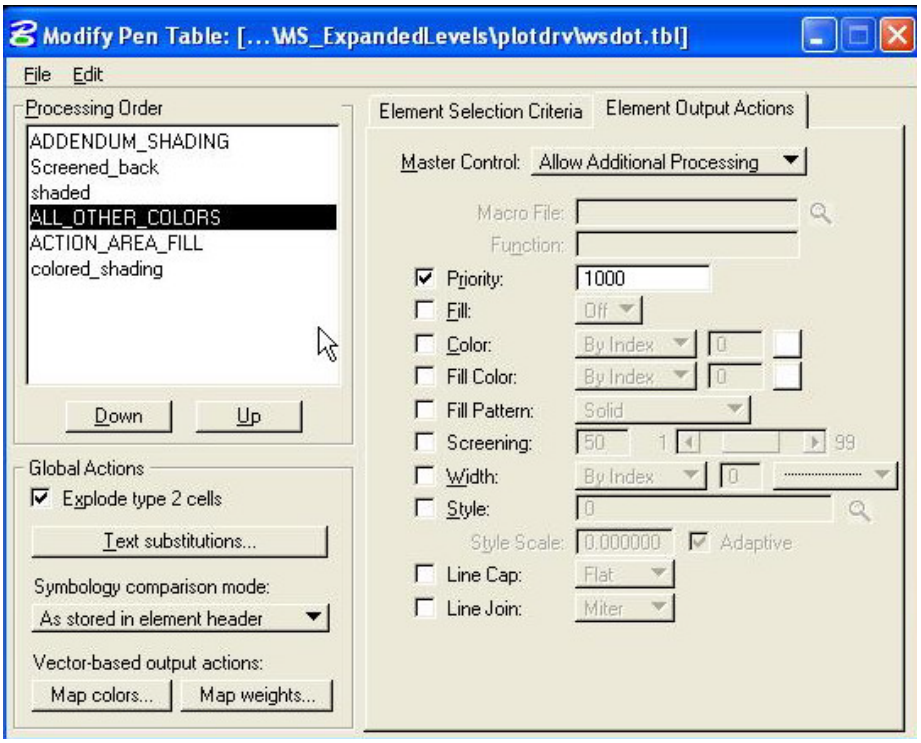
Line Styles
Exhibit 800-2

803.03 Pen Table

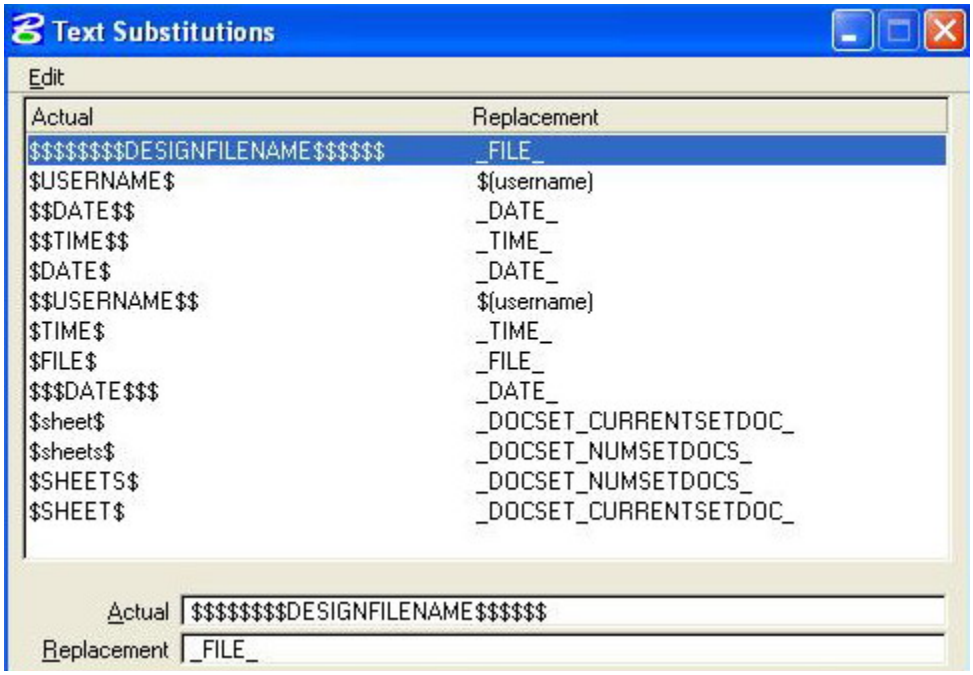
WSF uses the same pen table as is currently in use by WSDOT. The title of the pen table is wsdot.tbl. This file is also located in G:\cae_rsc\MS_ExpandedLevels\plotdrv\.



First section of pen table – Element Criteria
Exhibit 800-3



First section of pen table – Output Actions
Exhibit 800-4

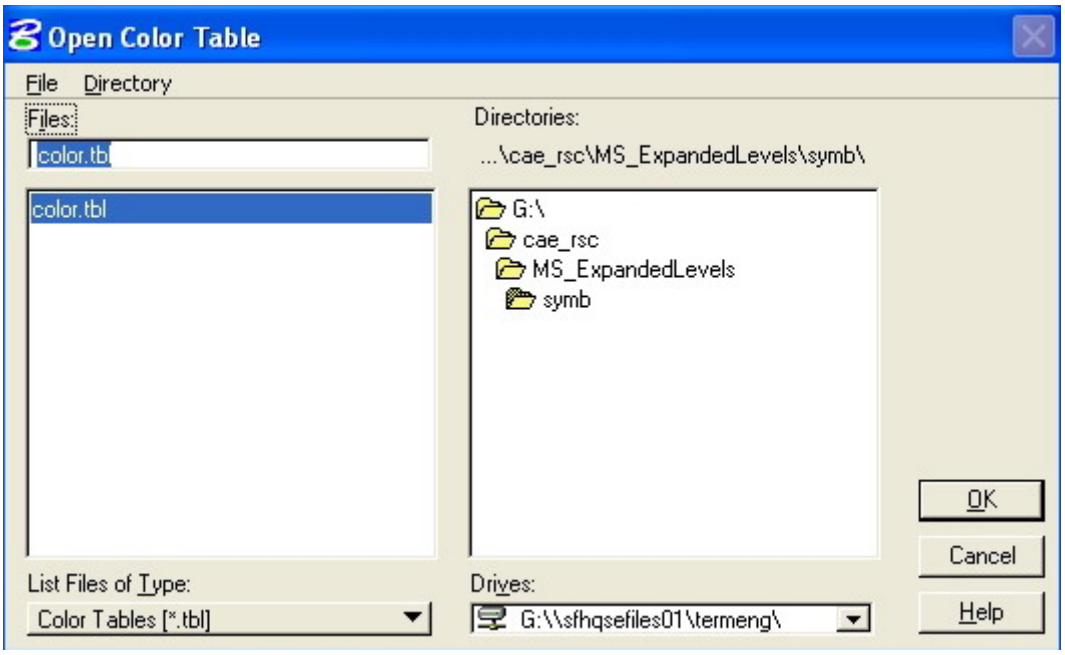


Text Substitutions for WSDOT.tbl
Exhibit 800-5

By placing the exact variable listed under **Actual**, MicroStation© will replace it with the value listed under **Replacement**. These values are taken from information on the computer or listed in the MicroStation© variable list. Note that by using the "$sheet$/$sheets$" text substitution the operator is able to utilize the BATCHPLOT capability within MicroStation© and to have the sheet number and total number of sheets in the set being printed automatically applied at the time of printing.

803.04 Color Table

WSF uses a specific Color Table for the production of its CADD files. All CADD files must use this color table. The color table (**COLOR.tbl**) can be found on the shared drive at G:\cae_rsc\MS_ExpandedLevels\symb\COLOR.tbl. It can also be obtained from the WSF Design Team or the WSF CADD Coordinator.



Color Table
Exhibit 800-6

Note that colors 150-153 are used for half-toning or screening back printing. The amount of screening for each color will be as follows:

Color (by number)	R, G, B Value‡	Percent "Screen back"	Approx. Color
150	100, 100, 100	40%	Dark Grey
151	130, 130, 130	50%	Grey
152	205, 205, 205	80%	Light Gray
153	230, 230, 230	90%	Lightest Grey
Color 160*	255, 255, 255	Wipe Out	White

RED, GREEN, BLUE values: RGB value = (255,255,255) is equal to WHITE and RGB = 0,0,0 is Black.

*Color 160 is used to block out anything underneath to keep clarity of drawing.

803.05 Seed Files

(a) General

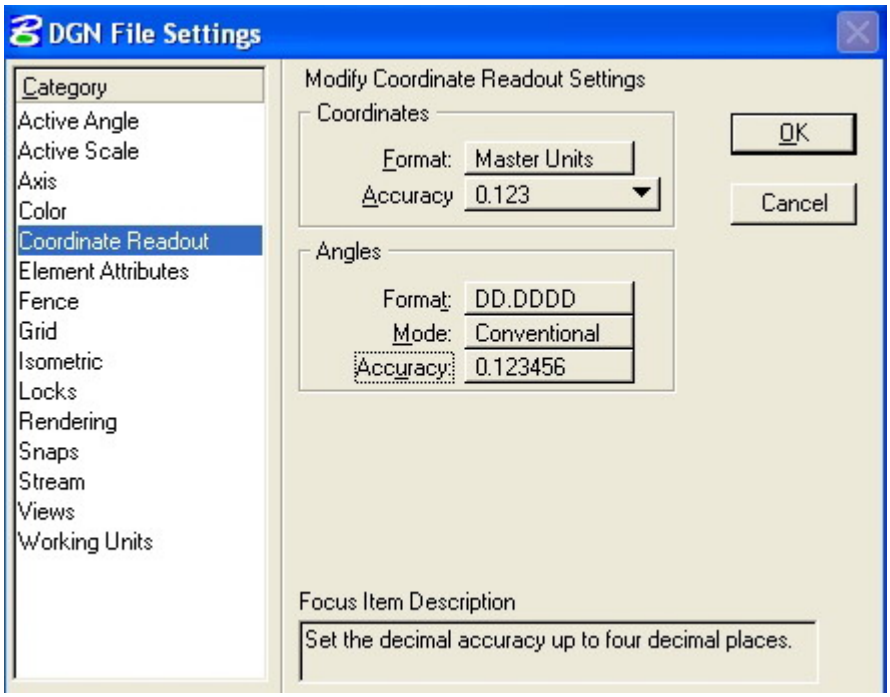
Washington State Ferries (WSF) uses a seed file for CADD files that are produced for PS&E sets. It is **WSF_seed.dgn** and it can be found in the shared drive directory C:\Users\Public\CAE\Standards\WSDOT\seed

The seed file is used mainly for the creation of plan sheets. It is also used for the preparation of Permit Drawings. Once a new file is created, the user should reference the project border which already has the **WSF_STD_CACHE.mst** file attached. These reference files can be moved, rotated and scaled, as needed for use with the civil site basemaps and civil master files. The seed file **WSF_seed.dgn** is also used for the creation of Architectural, Electrical, Structural, Mechanical, and WSF Standard Drawing plans.

(b) General & Civil Drawings: Working Units

The MicroStation© Working Units used for the Seed File for all CADD drawings prepared for PS&E plans are to include the following working unit parameters:

1. **Coordinate Readout**

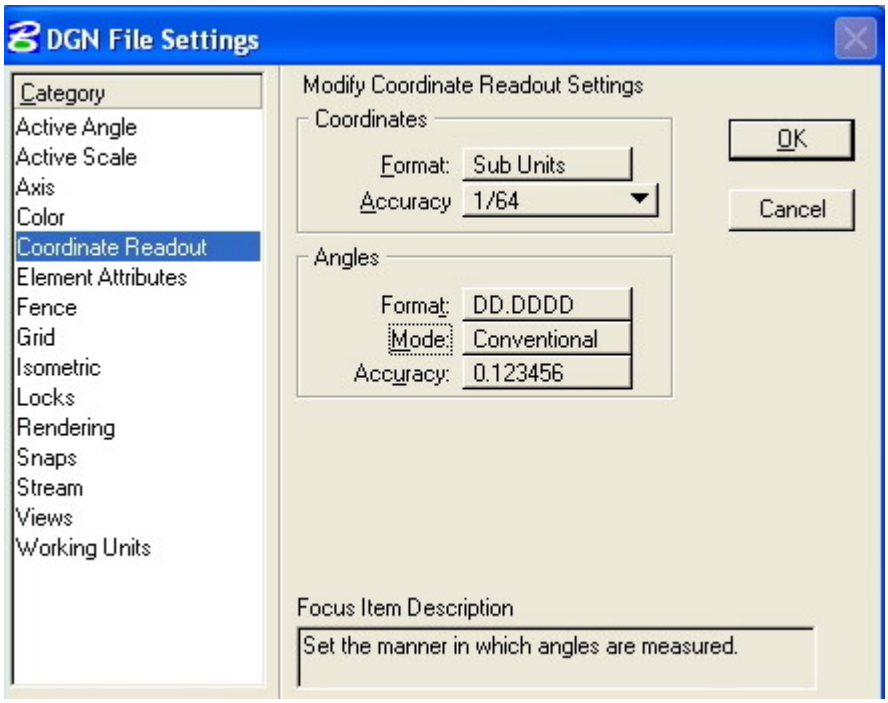


Coordinate readout for Civil & General Plans
Exhibit 800-7

(c) Structural, Electrical, Mechanical, & Architectural: Working Units

The MicroStation© Working Units used for the Seed File for all CADD drawings prepared for PS&E plans are to include the following working unit parameters:

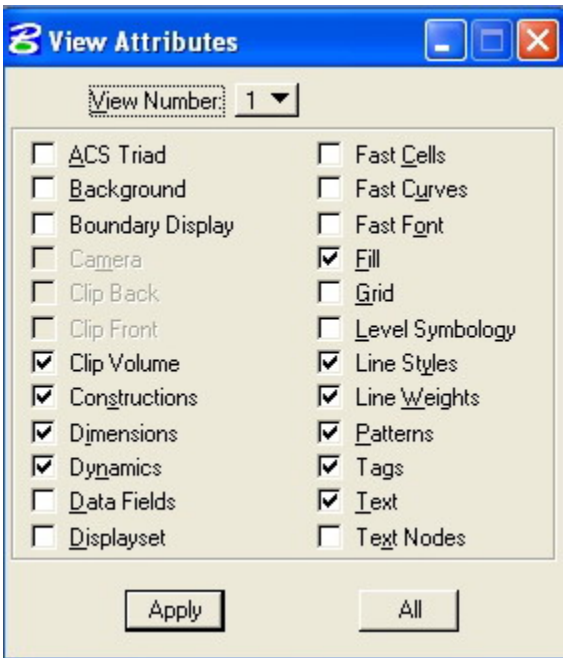
1. **Coordinate Readout**



Coordinate Readout For Structural, Electrical, Mechanical, & Architectural Plans
Exhibit 800-8

(d) View Attributes

The View Attributes for all WSF CADD files shall be set as follows:

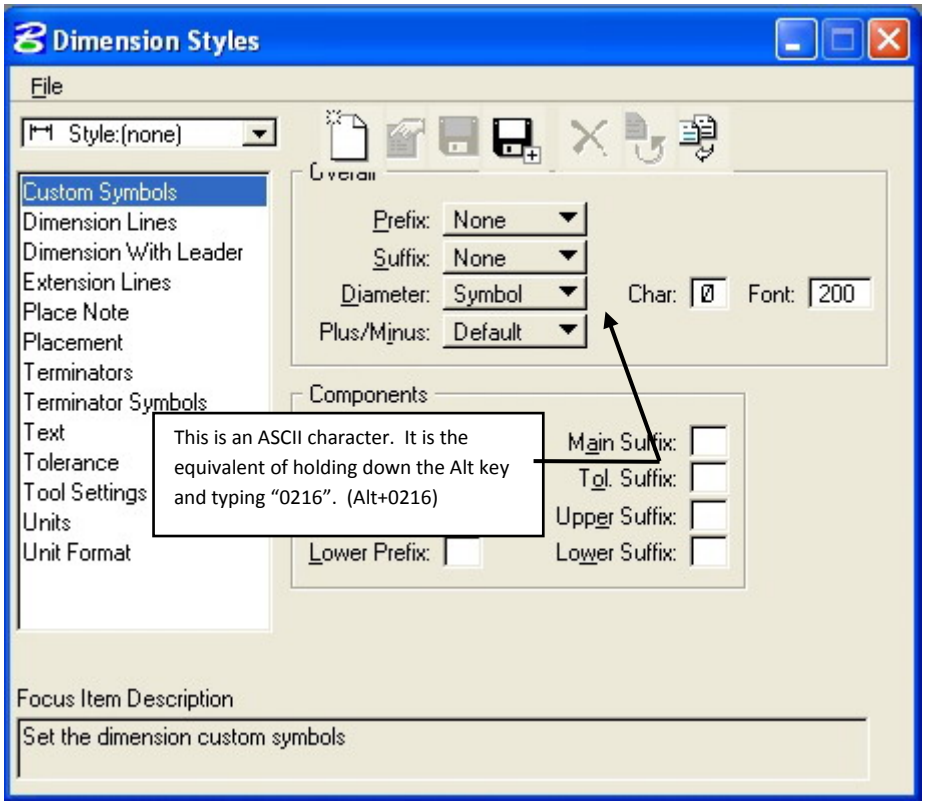


Initial View Attributes Settings
Exhibit 800-9

(e) Dimension Settings

Options for the Dimension Settings shall be as follows in Exhibits 800-10 through 800-20:

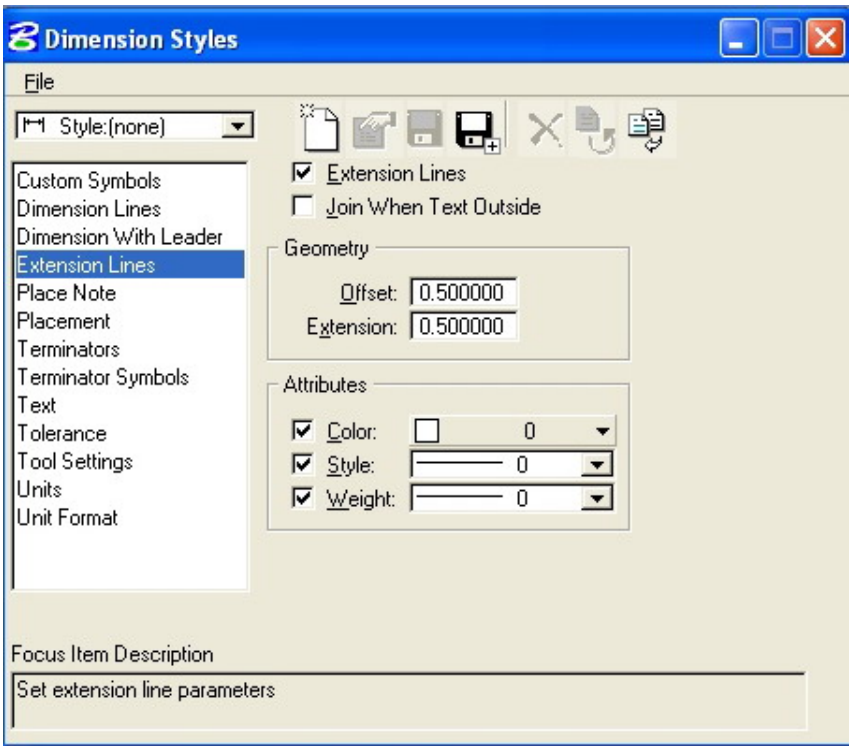
1. **Custom Symbols**



Dimension Custom Symbol
Exhibit 800-10

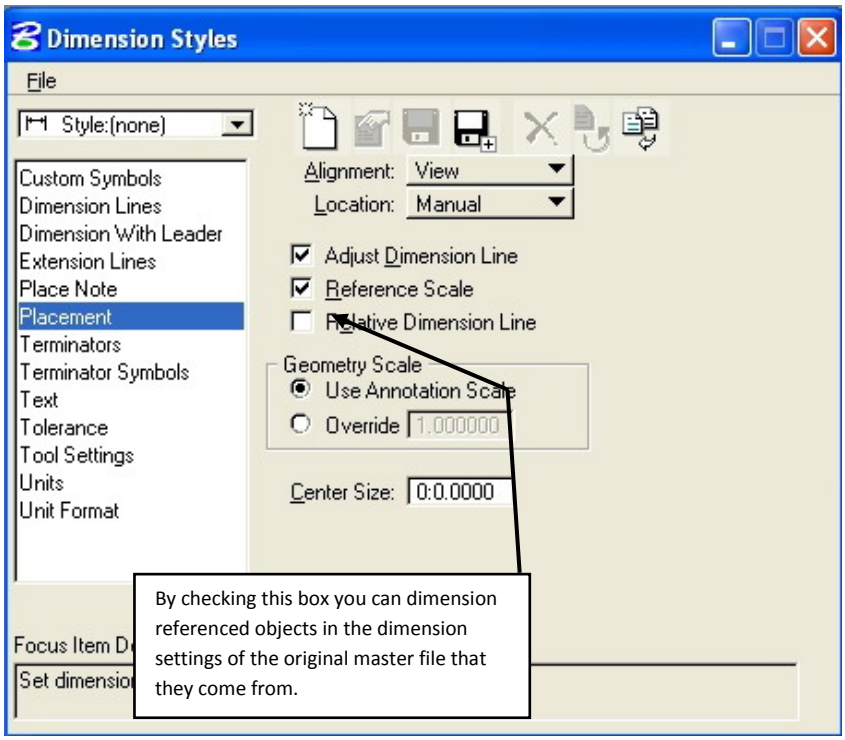
The diameter symbol "ø" in the font resource file for font 200.

2. **Extension Lines**



Dimension Extension Line
Exhibit 800-11

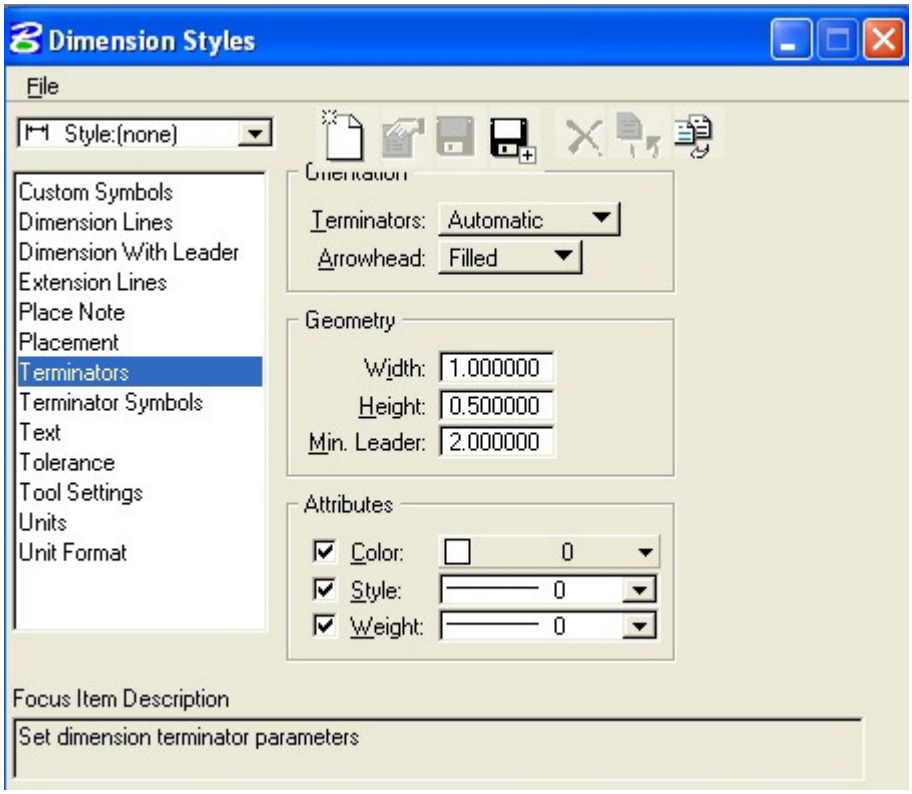
3. **Placement**



Dimension Placement
Exhibit 800-12

4. **Terminators**

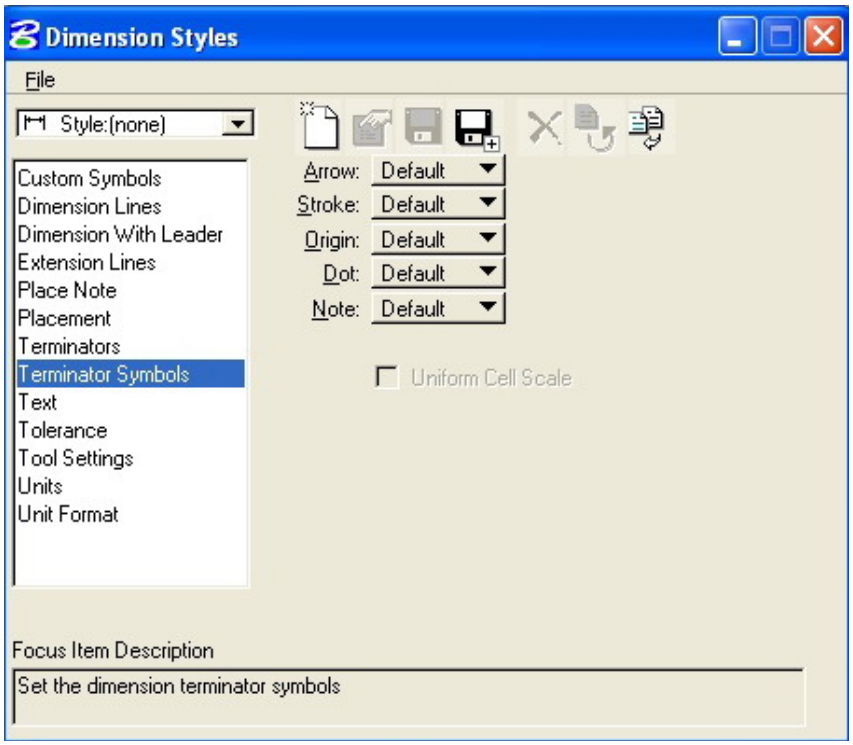
The **Default** terminator shall be used for all CADD applications. This includes but is not limited to dimensioning, text notes, and leaders.



Dimension Terminator
Exhibit 800-13

5. **Terminator Symbols**

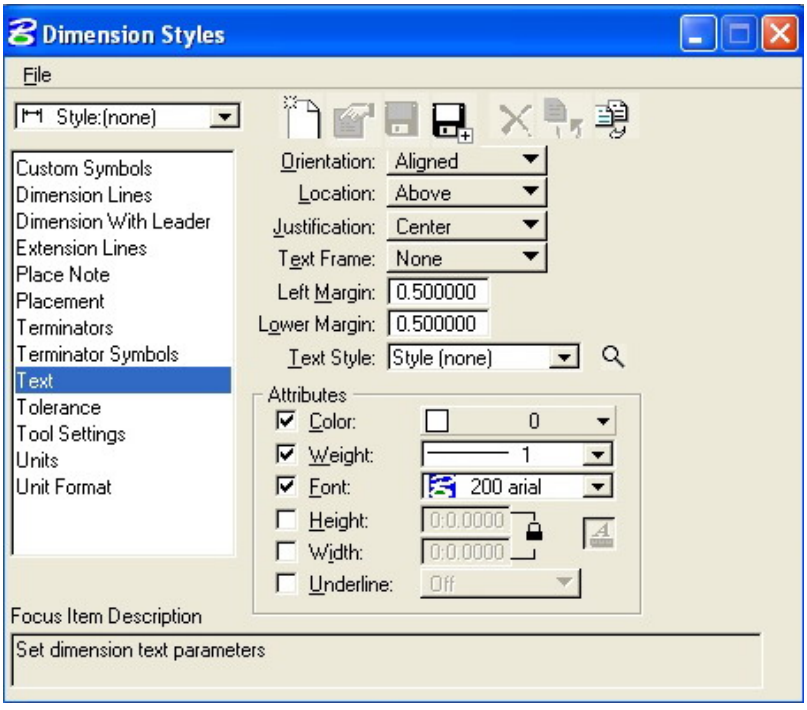
All terminator symbols shall use the MicroStation default settings as follows:



Dimension Terminator Symbols
Exhibit 800-14

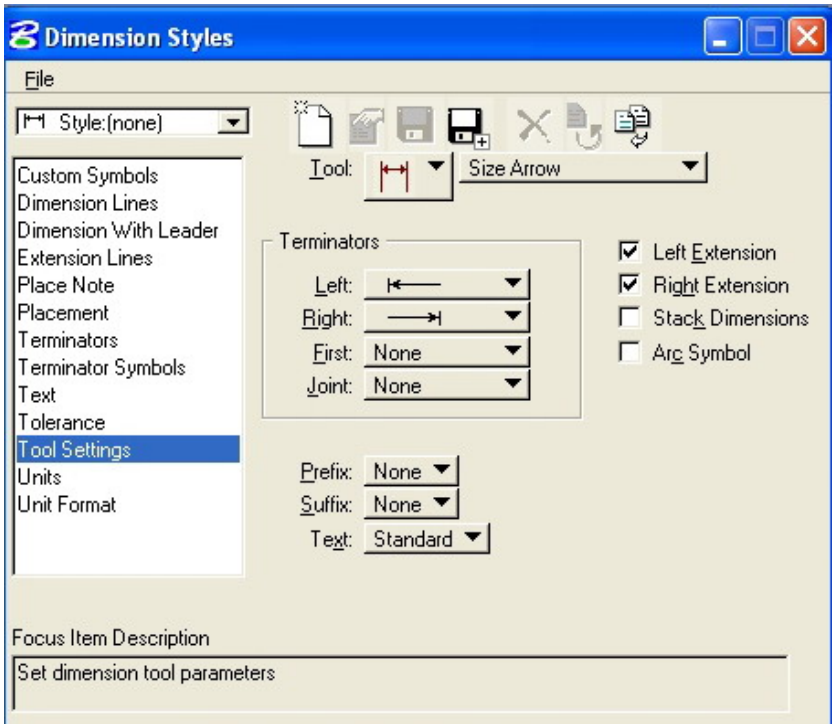
6. **Text**

Placement of dimension text will use the following settings:



Dimension Text
Exhibit 800-15

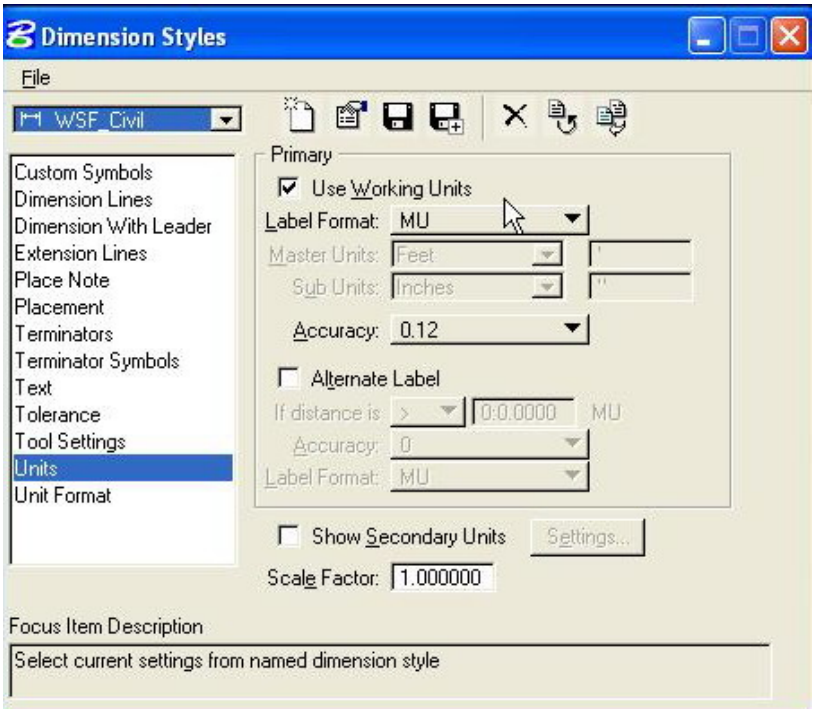
7. **Tool Settings**



Dimension Tool Settings
Exhibit 800-16

8. **Civil Units**

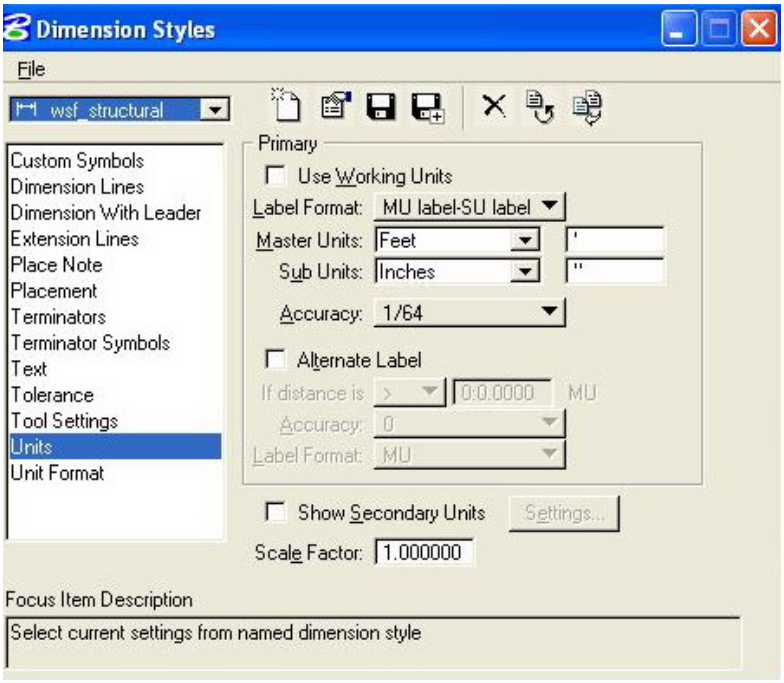
The unit format for Civil drafting will be set as follows:



Dimensions Units
Exhibit 800-17

9. **Structural, Mechanical, Electrical, and Architectural Units**

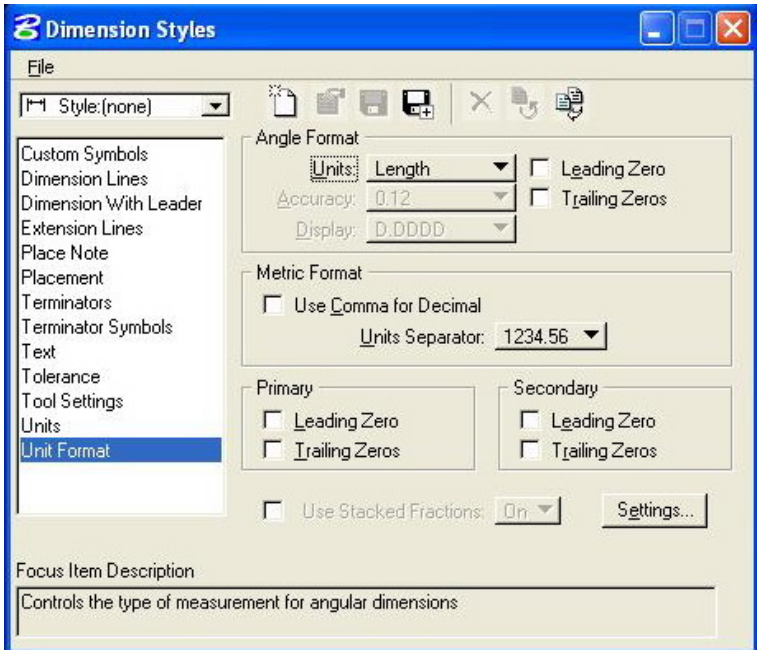
The unit format for Structural, Mechanical, Electrical, and Architectural drafting will be set as follows:



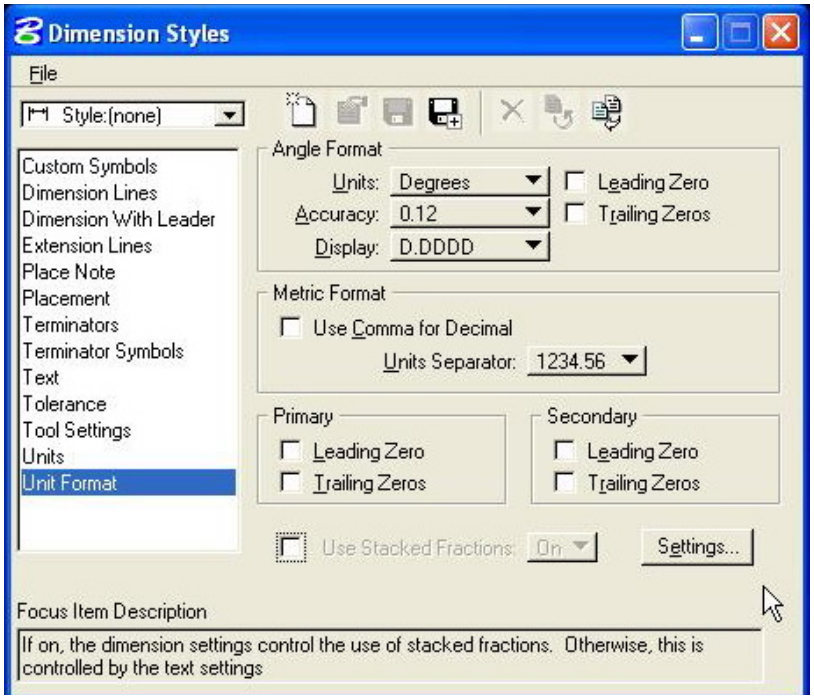
Dimension Units
Exhibit 800-18

10. **Unit Format**

The unit format for the seed file shall be set as follows for angular measurement and length measurement:



Dimension Unit Format
Exhibit 800-19

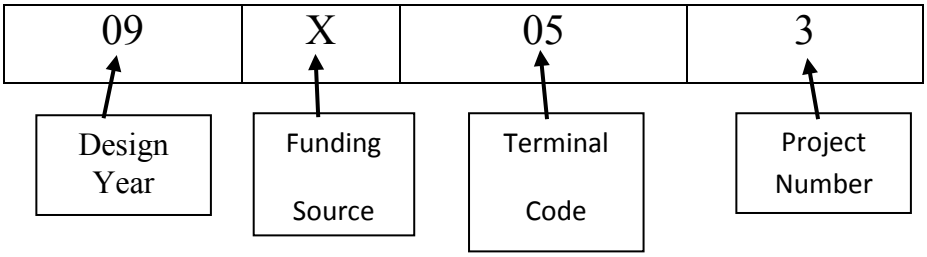


Unit Format for Angular Dimensions
Exhibit 800-20

Note that neither the leading zeros nor the following zeros are shown. This is consistent for all WSF CADD files except for Mechanical files. Mechanical files shall include following zeros as determined by the engineer.

804 Project Naming

804.01 Project Naming Convention



Where,

09 = the year that the project design was begun
X = Maintenance or W = Capital Funding
05 = Terminal Code (Edmonds Ferry Terminal is shown)
3 = Third design project begun for the Edmonds terminal in design year

Terminal Codes			
Anacortes	= 01	Mukilteo	= 12
Bainbridge	= 02	Orcas	= 13
Bremerton	= 03	Point Defiance	= 14
Clinton	= 04	Port Townsend	= 15
Edmonds	= 05	Seattle	= 16
Eagle Harbor	= 06	Shaw	= 17
Fauntleroy	= 07	Sidney	= 18
Friday Harbor	= 08	Southworth	= 19
Coupeville*	= 09	System Wide	= 20
Kingston	= 10	Tahlequah	= 21
Lopez	= 11	Vashon	= 22

* Formerly Keystone

1. The project "name" or "number is generated by the Project Manager when they fill out the information in the "Cradle to Grave project number" file. The file can be found at: G:\Admin\C2G_Proj_Numbers\Project_Numbers.xls. The number will appear in the Terminal directory on the "G" drive with either the Work Order number or the contract number following it. The number accompanying the project number will indicate what phase of work the project is in, design or construction. (This will also be the number that employees charge to when they work on the project.)

   Example: a design phase designation of - **09X053_XL4430**

   Or,

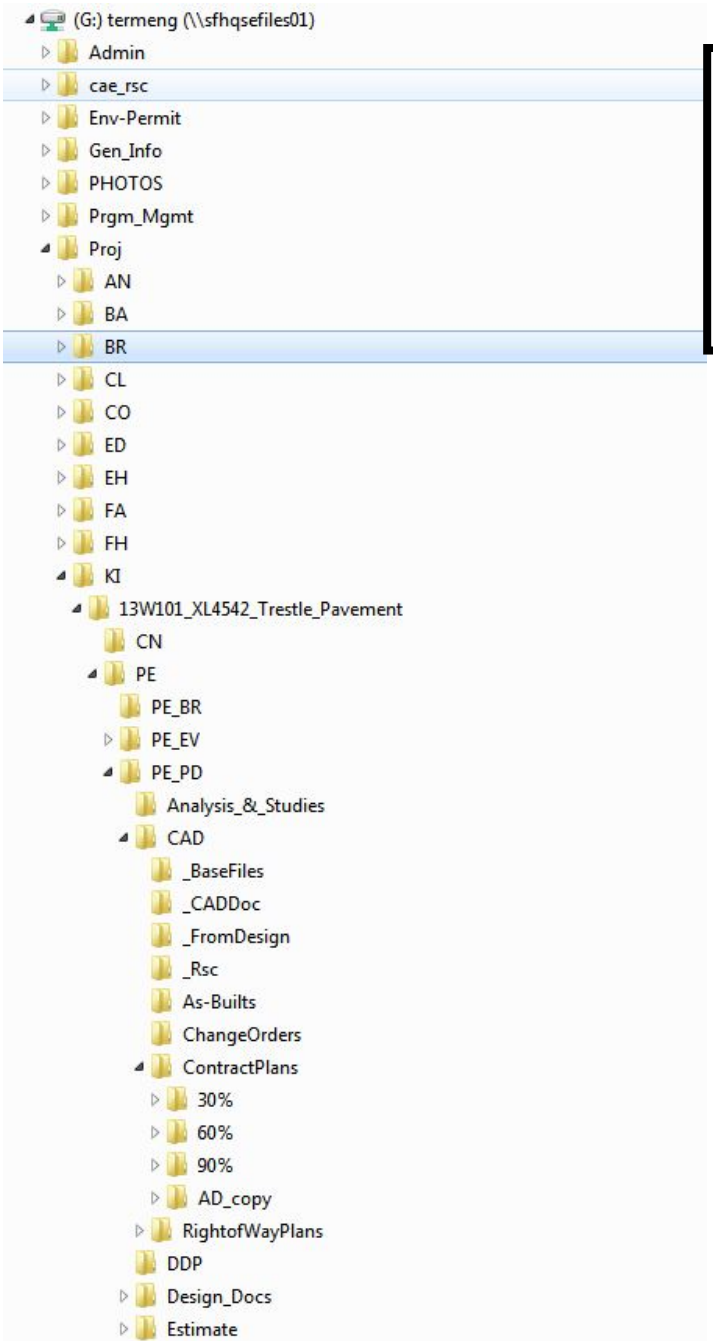
   a construction phase designation of - **09X053_8893**

2. Upon completion of the design phase the CAD files for the project will be archived to the "U" drive using the assigned construction contract number with the project number appended to it.

805 Directory Structure

805.01 Project Directory

The following is a partial outline of the WSF file structure. Only directories that may be necessary to CADD production are shown. (Not all directories pertain specifically to CADD files).



Directories found under the "Proj_No" are the same for all projects. The Template for the directory structure can be found under:

G:\Proj\Z-PM_Standards\Standards-Project_Management\Filing_system\August_2009_File_Structure_Template

Typical Project File Directory
Exhibit 800-21

806 File Names

806.01 File Extensions

(a) Master Files and Basemaps (.mst)

Master files are files that contain information that is used by multiple drawings and/or by multiple disciplines. The information in the master file is drawn at 1:1 scale and in its true State Plane coordinate position when applicable. Proposed Master Files can be broken up by phase to add ease and controllability to plan development. The information is mostly line work with generally no text or dimensions. Additional master (mst) files can be added as needed to facilitate plan production. Master files are referenced to Deliverable files (.dlv) and make up the contents of the drawing.

Basemap, in this case, is a term to describe files that include existing background information to be used for the entire project. For Civil work it could mean the site plan with all surveyable surface features including topography. For Structural work it could mean a plan showing the location of all site structures, piles, caps, stringers, barriers, and etc. It could also be a detailed drawing of a transfer span that is used as a base from which to compile new plan sheets.

Typical master files/basemaps might include the following:

Filename	Logical name	Description
eαα##βχc_basemap.mst	ec_basemap	Existing Civil Basemap
eαα##βχc_bathy.mst	ec_bathy	Existing Bathymetry
eαα##βχs_framing.mst	es_framing	Existing Structural Framing
pαα##βχc_basemap.mst	pc_basemap	Proposed Civil Basemap
pαα##βχc_alignment.mst	pc_alignment	Proposed Alignment/Work Line
pαα##βχs_basemap.mst	ps_basemap	Proposed Structural Basemap
pαα##βχs_framing.mst	ps_framing	Proposed Structural Framing
pαα##βχe_basemap.mst	pe_basemap	Proposed Electrical Basemap
pαα##βχm_basemap.mst	pm_basemap	Proposed Mechanical Basemap
pαα##βχc_outline.mst	pc_outline	Outlines of Phase 1 Construction
pαα##βχc_outline.mst	pc_outline	Outlines of Phase 2 Construction
PSE_border.mst	border	Project Border

(b) Deliverable Files (.dlv)

Deliverable files are files that represent the sheets that make up the set of drawings submitted on a project. Deliverable files reference the title and border, sheets limits if needed, and existing and proposed information or details. The deliverable files contain the text and dimensions for the drawing. Do not reference deliverable files. Do not self-reference files. Work files may be temporarily referenced, but all unnecessary reference attachments shall be detached before project completion.

(c) Working Files (.dgn)

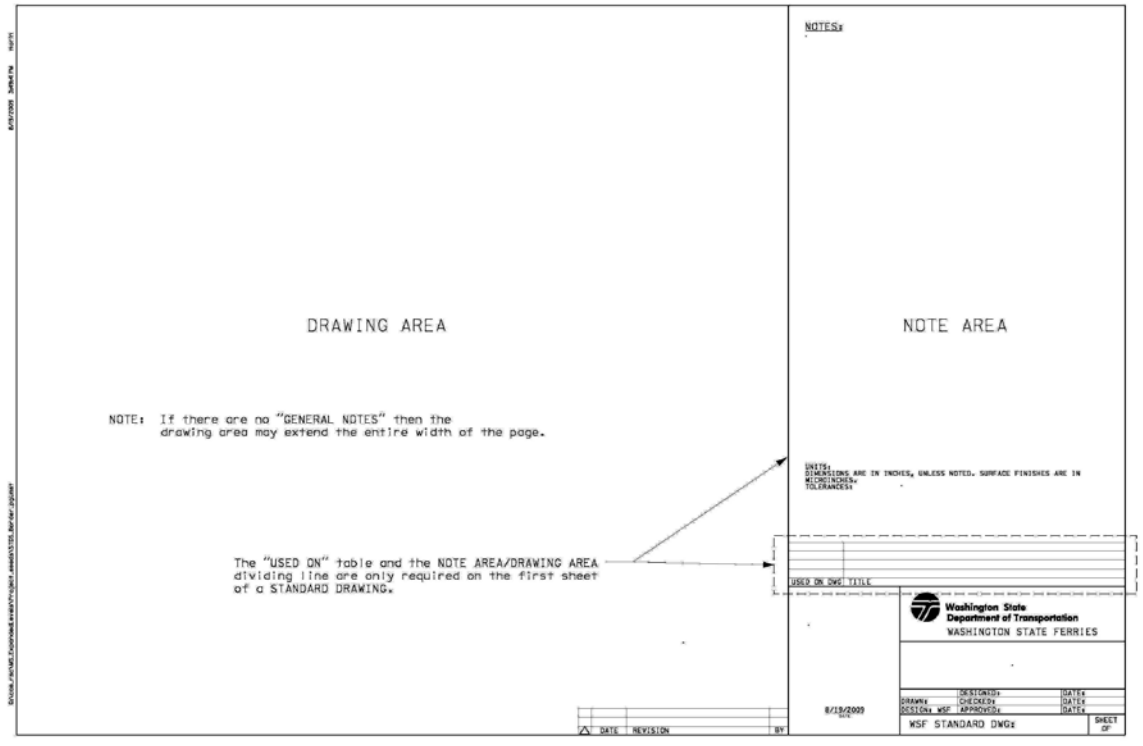
Files in the project directories that are not Deliverables or Master files, but include project information used by the engineers or technicians to test concepts, layouts, ideas, etc.

(d) Survey Basemaps

Survey Basemaps are to be considered as project master files. All Basemaps produced for WSF will be referenced to the Washington State North Zone US Survey Feet. They shall be correctly located and oriented in a file using the units designated for Civil CADD files. Coordinates will be directly readable from the CADD file.

(e) WSF Standard Drawings and Details

Washington State Ferries has standard drawings and details for a variety of parts and assemblies that it uses at all of the State's Ferry Terminals.



Plan sheet layout for WSF Standard Drawings
Exhibit 800-22

(f) Backup Files

Backup files for project design shall only be created when a major revision to a Deliverable file is made. The backup is made so that if the revision is found to be in error a copy of the file, as it existed immediately prior to the change, will still exist.

The naming of a Backup file shall be the same as for a Deliverable file (see pg. 24 – **Deliverable Files**) except that the file extension will be ". bak" instead of ".dlv".

Backup files are **not** to be created for the sole purpose of retaining a copy of the plan set at review points. If the Project Manager decides that a copy of the plans at review point is necessary a CD will be created to store the required contents of the project directory.

At project completion all backup files will be removed from the directory prior to archiving.

WSF keeps weekly backups of its main servers off-site at a secure storage facility. A request to restore the desired file shall be forwarded to the **WSF IT Help Desk** and will include:

- The last known "good" date of the file
- The Server that the file was housed on
- The name and directory path that the file can be found in

The Help desk can be contacted by email at WSFHelpDesk@wsdot.wa.gov or at 206-515-3800. In house CADD users can contact the Help desk by dialing "3800" on their phone.

Allow 2 to 3 working days for retrieval of the file.

Please note: The weekly tapes are archived for a term of one (1) year only. If you need to retrieve a file older than that you will either find it in the U drive archives (for in-house personnel) or you won't find it.

806.02 File Naming

The "File Name" is the unique identification for each drawing. It is from a minimum of 12 to a maximum of 24 characters in length and is alpha/numeric in character. There will be no spaces in the file name. If a space is necessary then either the underscore symbol ("_") or the hyphen ("-") shall be used. Each design drawing shall be assigned a drawing number. The drawing numbering is defined by the discipline and plan number within that discipline.

(a) Discipline Designators

Exhibit 800-23 shows discipline designators for typical disciplines used by both master files and deliverables. These numbers will be listed on the project drawing list.

Designator	Discipline
a	**A**rchitectural
c	**Ci**vil
d	**D**esign Report
e	**E**lectrical
f	**F**ire Protection
g	**G**eneral
h	**H**ydraulic Power Systems
i	**I**nstrumentation and Control Systems
k	Cathodic Protection
l	**L**ighting
ls	**L**andscape(& Irrigation)
m	**M**echanical
p	**P**ermitting
s	**S**tructural
sc	**Sec**urity
t	**T**elecommunications
u	Site **U**tilities

Discipline Designators
Exhibit 800-23

(b) Master Files

Those files created for the project that become the project Master files shall be named using the following criteria:

Where, **xαα##βχd_#……...# .mst**

x	=	**e** => if the file contains existing information **p** = > if the file contains proposed information **d** = > if the file contains demolition information
αα##βχ	=	The project identification number (See Project Naming).
d	=	Discipline Designator. See Table 1 – 6.02.01
#…….#	=	Short description of work location – Maximum of 13 characters.
.mst	=	Suffix denoting a **Master File**.

Example: The original basemap depicting **existing** conditions used for the civil drawings for project number **09X053** would be named:

e09X053c_basemap.mst

(c) Deliverable Files

Those files created for projects that are to be delivered for review or final submittal shall be named using the following criteria:

Where, **αα##βχdxx_xx_#……...# .dlv**

αα##βχ	=	The project identification number (supplied by the WSF Project Manager).
d	=	Discipline Designation. See Table 1 – 6.02.01
xx_xx	=	Plan sheet number within the list of disciplinary drawings. (Fourth sheet of series 10 = 10_04)
#…….#	=	Short description of work location – Maximum of 13 characters. *
.dlv	=	Suffix denoting a **Deliverable File**.

Example: The fourth sheet in a series beginning with sheet 10.01 of the electrical drawings for project number **09X053** showing the transfer span electrical work would be named:

09X053e10_04_t-span.dlv

****Note***: The description portion of the filename is optional and shall be removed from ***deliverables*** prior to the 90 percent review submittal or when the sheet numbering is complete, whichever occurs first. Deliverable files being archived shall retain only the ***Project ID***, ***discipline***, and the ***plan sheet number***.

(d) Working Files

Those files that will not contain a title or border and are for purposes other than addition to the deliverable plan set or creation of a Master file shall be named using the following criteria:

Where, **OINwαα##βχd_#……...# .dgn**

OIN	=	Originator's initials
w	=	Denotes a working drawing
αα##βχ	=	The numerals of the project identification number (supplied by the WSF Project Manager).
d	=	Discipline Designation. See Table 1 – 6.02.01
#…….#	=	Description of work – Maximum of 13 characters.
.dgn	=	Suffix denoting a standard MicroStation design file.

Example: A file created by the engineer Jeff Jefferson to make a sketch of a possible layout for onshore drainage work for the project SW02AX would be named:

JJw09X053c_onshore_drain.dgn

(e) Permitting Files

The permit drawings created for all WSF projects shall be considered to be Deliverable files. They will adhere to the following naming convention:

Where, **αα##βχPd_x_y_#……...# .dlv**

αα##βχ	=	The numerals of the project identification number (supplied by the WSF Project Manager).
P	=	Permitting Code. See Table 1 – 6.02.01 for Discipline Designations. This character is upper case.
d	=	Discipline Code. See Table 1 – 6.02.01 for Discipline Designations. This character is upper case.
x,y	=	**x** = Number of the permit plan w/in the set of permit drawings. **y** = Number of the drawings in the set of permit drawings.
#…….#	=	Short description of the type of permit (i.e., JARPA, Shoreline, Corps, etc.)
.dlv	=	Suffix denoting a **Deliverable File**.

Example: A Civil drawing that is the fourth sheet in the JARPA permit submittal consisting of 7 plans for Project **09X053** would be named:

09X053Pc_4_7_JARPA.dlv

(f) Standard Drawings

The WSF Standard Drawings are to be named using the following convention:

1. Upland	Assemblies: 1-A-XXX-#-@† Parts: 1-P-XXX-#-@
2. Trestle	Assemblies: 2-A-XXX-#-@ Parts: 2-P-XXX-#-@
3. Transfer Span & Apron	Assemblies: 3-A-XXX-#-@ Parts: 3-P-XXX-#@
4. Towers & Headframes	Assemblies: 4-A-XXX-#-@ Parts: 4-P-XXX-#-@
5. Overhead Loading	Assemblies: 5-A-XXX-#-@ Parts: 5-P-XXX-#-@
6. Wingwalls & Dolphins	Assemblies: 6-A-XXX-#-@ Parts: 6-P-XXX-#-@
7. Hydraulics	Assemblies: 7-A-XXX-#-@ Parts: 7-P-XXX-#-@
8. Electrical	Assemblies: 8-A-XXX-#-@ Parts: 8-P-XXX-#-@
9. Miscellaneous	Assemblies: 9-A-XXX-#-@ Parts: 9-P-XXX-#-@

File Naming for WSF Standard Drawings
Exhibit 800-24

†Where XXX is the drawing number assigned by the designer, "#" is the sheet number (1,2,3, etc.) and "@" is the revision (A= rev. A, B= rev. B, etc.)

Prior to naming the file, the designation must be obtained from the WSF employee responsible for the care and maintenance of the Standard Drawings.

Revisions of a Standard Drawing will be indicated by renaming the file. A letter will be added to the end of the name that corresponds to the revision number.

Example: The third revision of 3-A-051-2 would be

3-A-051-2-C.dlv

Completed Standard Drawings will be archived to the **U:\Standard Drawings\CADD** directory for local use.

807 Plan Sequence

807.01 Plan Sequence List

The following is the general sequence for the required sheets that shall be used in assembling the plans for a WSF construction project:

I. General Sheets (See 800-12)

G01.00 - Project Index, Project Location and Vicinity Map
(Combined for smaller projects)

G01.00 - Project Location and Vicinity Map
(Separated for larger projects)

G01.01 - Project Index
(Separated for larger projects)

G02.00 - Sundry Site Plan

SQ1 - Summary of Quantities Sheet (if more than one SQ2, SQ3, etc.)
(These sheets are produced by a separate application called EBASE and are added to the plan set as hard copy)

II. Civil Plan Sheet Series (See 800-13)

III. Architectural Plan Sheet Series (per Architect submittal)

IV. Structural Plan Sheet Series (See 800-14)

V. Fluid Power Hydraulic Plan Sheet Series (See 800-15)

VI. Electrical Design Drawing Series (See 800-16)

VII. Mechanical Design Drawing Series (See 800-17)

Plan Sequence List

The preceding is a list of possible plan sheets, and is not intended to represent a project. The designer is to determine the actual plan sheets required to best depict the project. Even with logical combinations of plan sheet series, the following basic order of sheets shall be maintained:

1. Item Information (Quantity Tabulation/Structure Notes/Sign Specifications)
2. Plan Series (Site and Location specific drawings of the required work)
3. Details (Dimension and Material specific drawings of work noted in Plan Series)

808 Drawing List

808.01 Drawing List Example

It is the responsibility of the user creating a new file to make sure that the entry gets made to the Drawing List. Furthermore, it is the responsibility of each CADD user who modifies the file, in any way, to update the contents of the Project Drawing List.

The template for the Drawing List can be found in the Shared Drive directory for those project personnel working on site at Washington State Ferries.

Drawing List and File Attachment (EXAMPLE)

Project Name:

All files reside in

Sheet No.	File Name	Title *Contents*	Owner	Attached Reference Files					Notes:
				File Name	Description	Originator	Scale	% Comp	
					GENERAL ARRANGEMENT				
C10.01	09X053c10_01.dlv	Site Plan	BB	eSW02AXc_basemap.mst	Basemap	DR	1:500		
				eSW02AXc_contour.mst	Contour map	SS	1:500		
				PSE_border.mst	Proj. Plan sht. Border	RG	1:100		
S09.01	09X053Xs09_01.dlv	Transfer Span Details	TB	PSE_border.mst	Proj. Plan sht. Border	RG	1:100		
H01.01	09X053h01_01.dlv	Hydraulic Controls	AM	PSE_border.mst	Proj. Plan sht. Border	RG	1:200		
M04.13	09X053m04_13.dlv	Transfer Span Cable System	JS	eSW02AXs_TS detail.mst	Structural Transfer Span Details	HC	1/8"=1'		
				PSE_border.mst	Proj. Plan sht. Border	RG	1:8		
E01.05	09X053e01_05.dlv	Illumination Site Plan		eSW02AXc_basemap.mst	Basemap	DR	1:100		
				PSE_border.mst	Proj. Plan sht. Border	RG	1:200		

"% Comp" – defines the degree of completion for each sheet.

Example Drawing List (From Excel Template)
Exhibit 800-25

809 Drafting Standards

809.01 Plan Sheet Size

The review and the advertisement plan sets shall require plan sheets to be 11-inch by 17-inch paper sheets. All symbols, text, and weights are to be sized to plot to the correct scale on 11×17 sheets.

If the contract plans have more than 225 sheets or contract provisions have more than 225 pages, they will have to be separated into volumes, with no volume having more than 225 sheets or pages. The break for volumes is to be made at a logical point in the package, which may not be at 225 sheets or pages. If a project has 275 plan sheets, and the last 80 are bridge sheets, the logical break would be between the civil sheets and the bridge sheets. If multiple volumes are required for the contract provisions, the logical break would be at the end of a main section. For example, break between ASPHALT CONCRETE PAVEMENT, and the following main section, CULVERTS. Do not place the break in the middle of a section. A complete drawing list will begin each volume of the plans.

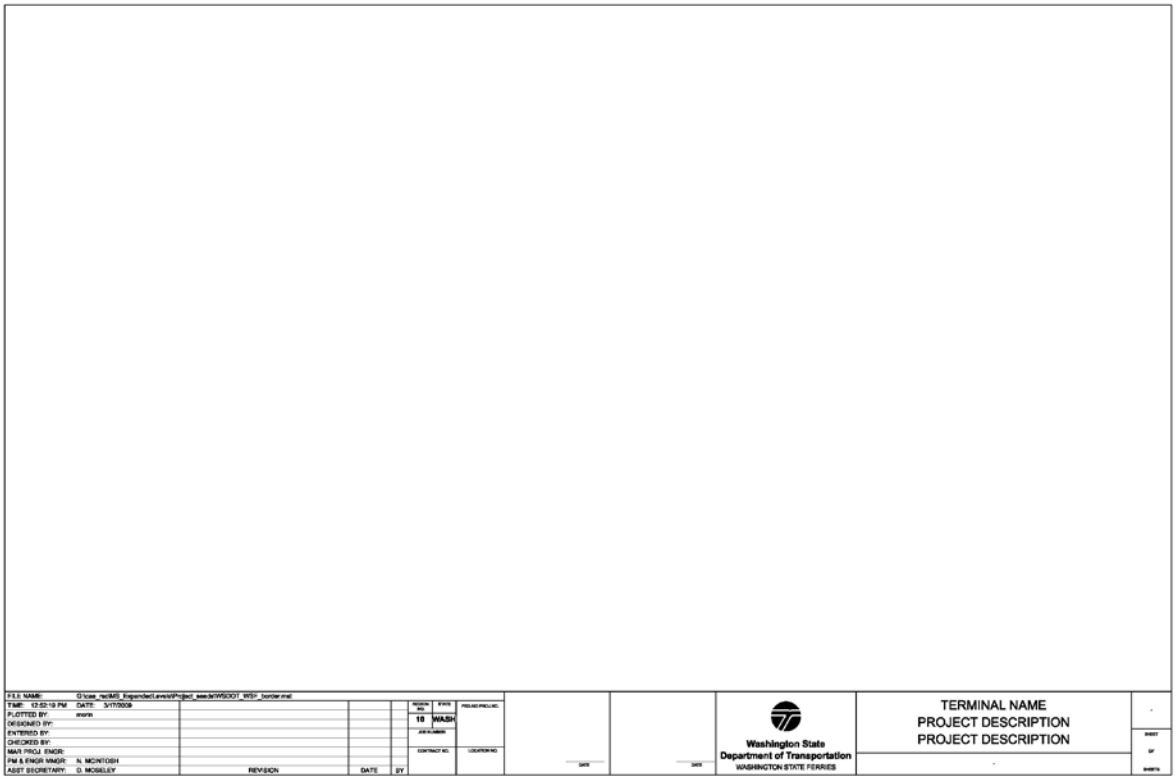


Exhibit 800-26: Sheet layout for WSF Design Plan drawings

Sheet layout for WSF Design Plan drawings
Exhibit 800-26

(a) Plan Sheet Grid System

All PS&E contract drawings will use a grid system. The grid system will be used on all applicable sheets to help locate placement of various sheets. (See Exhibit 800-27). The following is an explanation of how the grid system is placed.

Trestle, Tie-Up Slip, and Passenger Only Walkways:

- Main rows of piles roughly aligned with the centerline of the trestle or the transfer span will be designated by a letter. The designation will ascend from the row furthest left of the centerline (looking offshore) to the row furthest to the right of centerline.
- Pile bents oriented transversely to the trestle or transfer span centerline will be designated by a number. The designation will ascend from the bulkhead to the last bent of trestle piles furthest offshore.
- Piles found between the main rows and bents will be given either a “letter.#” designation or a “#.#” designation depending on whether it is more convenient to identify the piles as a bent or a row. (Example: a pile midway between bent 11 and 12 and midway between rows D and E could be designated as bent 11.5 or as row D.5)

Wingwalls:

- Rows of piles that are parallel to the wingwall rub face will be designated by a number. The numbers will ascend going from front to back of the wingwalls.
- Rows of piles that are perpendicular to the wingwall rub face will be designated by a letter. The letters will ascend progressing from closest onshore to furthest offshore.
- Any pile that doesn’t align with another pile will be given its own letter and number designations. Decimal designations will not be used for wingwalls.

Towers:

- Rows of piles that are parallel to the transfer span centerline will be designated with a letter. The letters will ascend progressing from the farthest from the transfer span centerline to the closest to the centerline.
- Rows of piles that are perpendicular to the transfer span centerline will be designated by a number. The numbers will ascend progressing from closest onshore to furthest offshore.
- Any pile that doesn’t align with another pile will be given its own letter and number designations. Decimal designations will not be used for towers.

Fixed Dolphins:

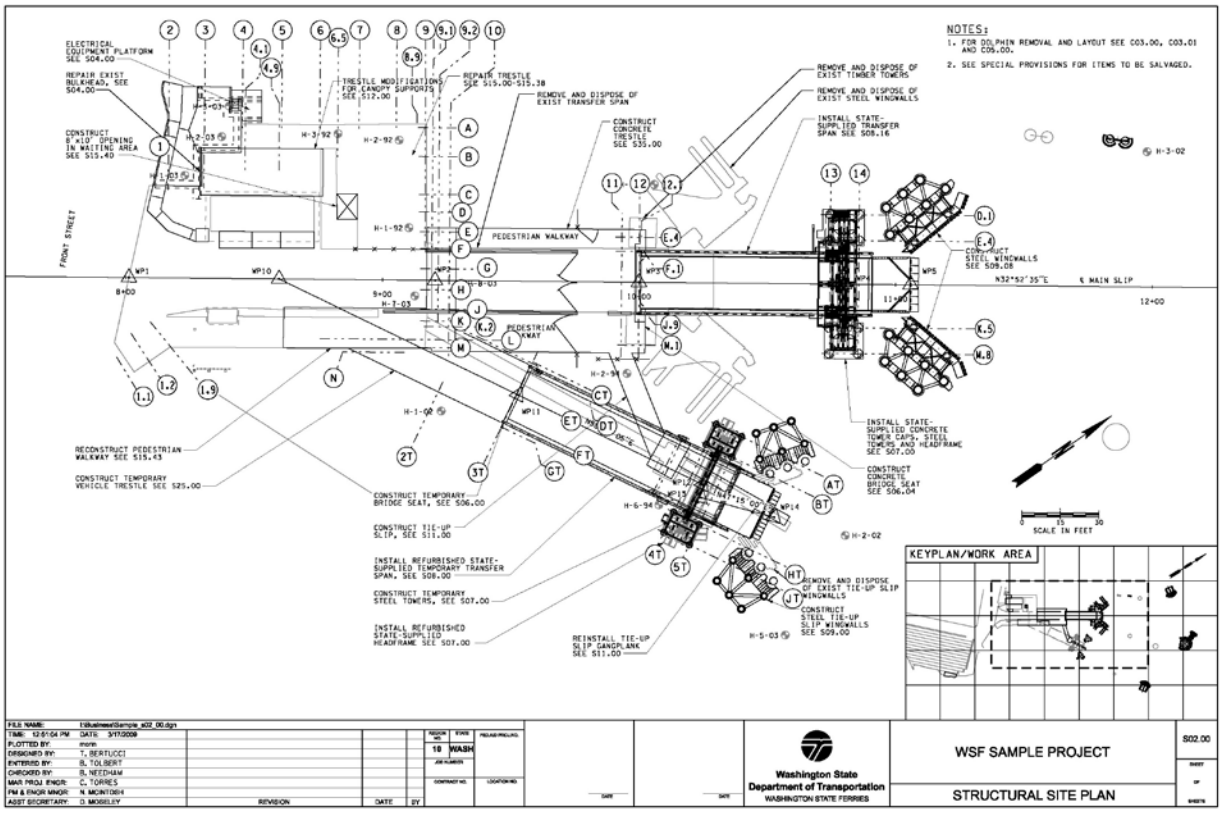
Fixed dolphins come in two different varieties, single sided and multisided. In the single sided type the face opposite the fenders is considered to be the back face. In the multisided type the side without fenders or the side closest onshore is considered to be the back side. In both varieties any piles that only support the fenders will be numbered in a clockwise direction, starting on the left. The numbering will continue from the last number used for pile designation within the diaphragm. The centerline of a dolphin will be that line that connects the center of the back face of the dolphin to the center of the opposite face.

- Rows of piles that are parallel to the dolphin centerline will be designated with a letter. The letters will ascend progressing from the furthest left of the centerline to the furthest right of the centerline.
- Rows of piles that are perpendicular to the dolphin centerline will be designated by a number. The numbers will ascend progressing from back of the dolphin to the front of the dolphin.

Floating Dolphins:

Floating dolphins are broken down into two parts, the floating dolphin itself, and the anchor system that holds the "floater" in place. The floater is made up of cast-in-place concrete placed in a cell structure. It is usually put in position with its long axis at a small angle from parallel to the slip centerline. The anchors are placed in relation to the floater and are either "in front" or "behind" it, with the front being closer to the centerline of the slip.

- The "Floater" – the floater's grid system utilizes all of the cast-in-place cell walls to designate the grid lines. The walls that run parallel to the long axis of the floater are on lettered grid lines that ascend from the "back" to the "front" of the floater. The walls that run perpendicular to the long axis are labeled with a number and ascend from right to left when the floater is viewed from behind and looking toward centerline of the slip. The cells of the floater are designated by a number/letter pair that is taken from the lowest numbered and lettered grid lines that border them. An example would be: the cell that lays between grid lines C & D and 4&5 would be labeled cell 4C.
- The anchors are designated by a letter/number pair. The letter being either "B" or "F" depending on whether the anchor is in front of the floater or behind it. The number designation ascends from closest onshore to furthest offshore. Typical designations would be B1, B2… F1, F2, etc.



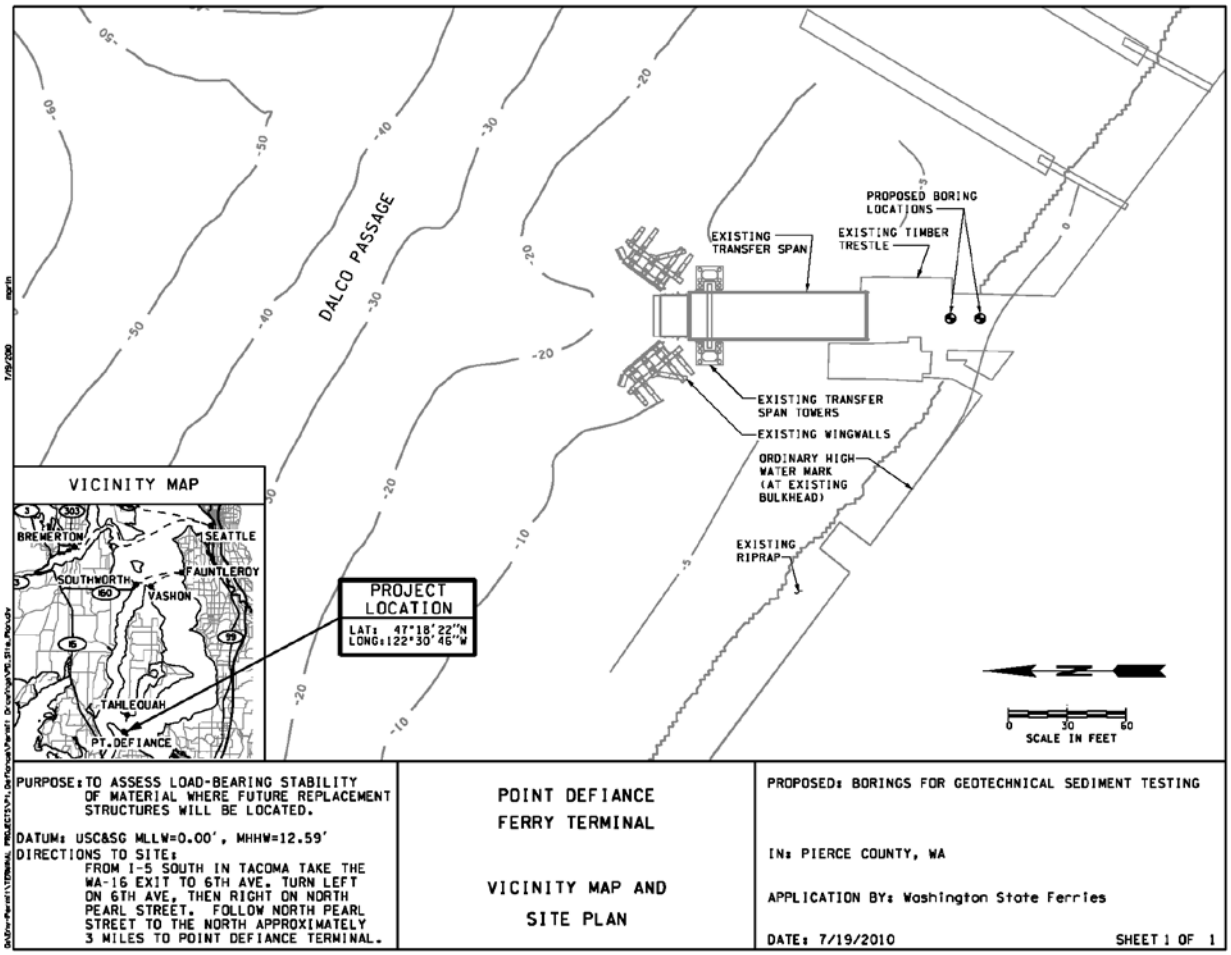
Sheet layout for WSF grid system
Exhibit 800-27

Guidelines:

1. Use at bents and main structure lines
2. Number at top, ascending left to right
3. Letters at right, ascending alphabetically top to bottom.
4. Wing walls and dolphins use separate grid system.

809.02 Permit and Repair Letter Sheet Layout

Permit drawings are required to include but not limited to: Vicinity Map, Existing Conditions, Proposed Conditions, and details as required. This information can be divided into as many sheets as may be necessary by the complexity of the work.



Plan sheet layout for WSF Perm and Repair Letter Drawings
Exhibit 800-28

809.03 WSF Borders

Both the Standard Drawing border and the Project design border are formatted to print on 11x17 paper. The Permit border is formatted for printing on an 8½x11 sheet.

All of the borders are to be placed using the following method:

1. Place a copy of the required border files listed below in the CADD directory of the WSF project.
2. The border .mst file shall be referenced into the deliverable .dlv files for the project.
   - For site plans that have topographical type reference files, the border shall be scaled up or down and the base files shall remain true scale.
   - For detail sheets the border shall remain true scale while the master file containing the details will be scaled as required.

Text that is individual to each sheet shall be placed following the placement of the Title Block. This text will be part of the deliverable file but not part of the referenced files.

The following sheets are the templates of the WSF Permit border, the Plan Sheet border, and the Standard Drawing border. These files can be copied from the Shared Drive directory (G:\) at \cae_rsc\MS_ExpandedLevels\Project_seeds\.

Reference Name	Use
PERMIT_Border_8X11_L.mst	Landscape 8½x11 sheet border for environment permitting.
PERMIT_Border_8X11_P.mst	Portrait 8½x11 sheet border for environment permitting.
PERMIT_Border_11X17.mst	Standard 11x17 sheet border for environment permitting.
DESIGN_REPORT_8X11.mst	Standard 8½x11 sheet border for Design Report Figures.
DESIGN_REPORT_11X17.mst	Standard 11x17 sheet border for Design Report Figures.
PSE_Border.mst	Standard sheet border for PS&E plan sheets.
PROFILE_Border.mst	Standard sheet border for PS&E plan sheets when Plan and Profile are required (Civil working units).
PlanProfileSht_Border.mst	Same as Profile border except plan and profile appear on the same sheet.
Presentation_BORDER_8X11.mst	For use in public displays, meetings and agency presentations.
WSF_STD_CACHE.mst	Cache File for PS&E plans.
STDS_Border_pg1.mst (sht. 1) STDS_Border_additional_shts.mst (sht. 2)	Standard sheet borders for WSF Standard Drawings.

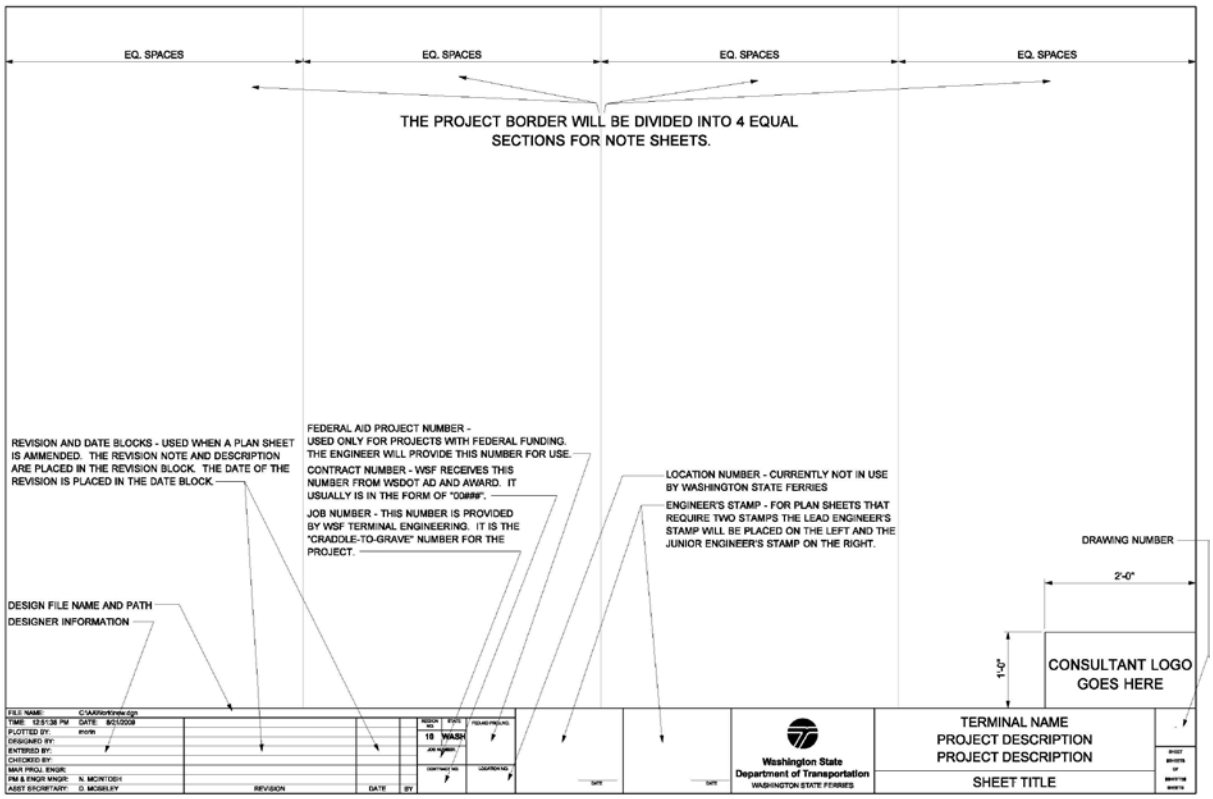
Standard Title Block and Borders
Exhibit 800-29

WSF utilizes three (3) distinct borders for the plan sheets that are produced for its projects. The borders are broken down as follows: design drawings, permit drawings and WSF standard drawings.

(a) Project Border Layout

Exhibit 800-30 shows how the Standard Project Border can be used under various circumstances. Depicted are the format additions to the Standard Project Border so that it can be used with a Consultant logo or divided up for use as a Standard Note Sheet. For Consultant prepared plans, the Consultant's seal, signature, and date signed shall be placed at half size on the plan sheet. The Consultant's logo shall be placed on every plan sheet prepared by the consultant (per the *Plans Preparation Manual* Section 400.05.C) in the lower right corner of the body of the sheet unless the plan sheet contains a Key Plan. In this case the Consultant's logo shall be placed immediately to the left of the Key Plan.

WSF requires that note sheets be arranged into 4 equal columns. All sections of notes are required to have headings pertaining to the notes.



Consultant Logo Title Block
Exhibit 800-30

(b) Standard Detail Sheet Layout

WSF requires that all details drafted to be placed on a separate detail sheet and placed at the end of each element criteria. Sections that are taken from a detail will still be considered SECTION VIEW's and will be labeled as such when placed on a sheet. The title SECTION VIEW will normally be placed between the DETAIL call out and the drawing.

Detail Guidelines:

1. Do not cross leader lines with each other or other symbology.
2. Make effort to align text callouts when space allows for it.
3. Convention for placing Leaders on all details will be upper left or lower right.
4. Line types and weights will be as per the original source drawing. Proposed features should be bold (wt. 2 to 4) and stand out. Existing features will use color 151 which appears as a screen back in a readable and reproducible weight (see Section 3.04 for RGB value of color 151)
5. Place text in clear areas on the sheet.
6. Show gridlines where they occur in detail.
7. Indicate direction of view.

(c) Standard Section Sheet Layout

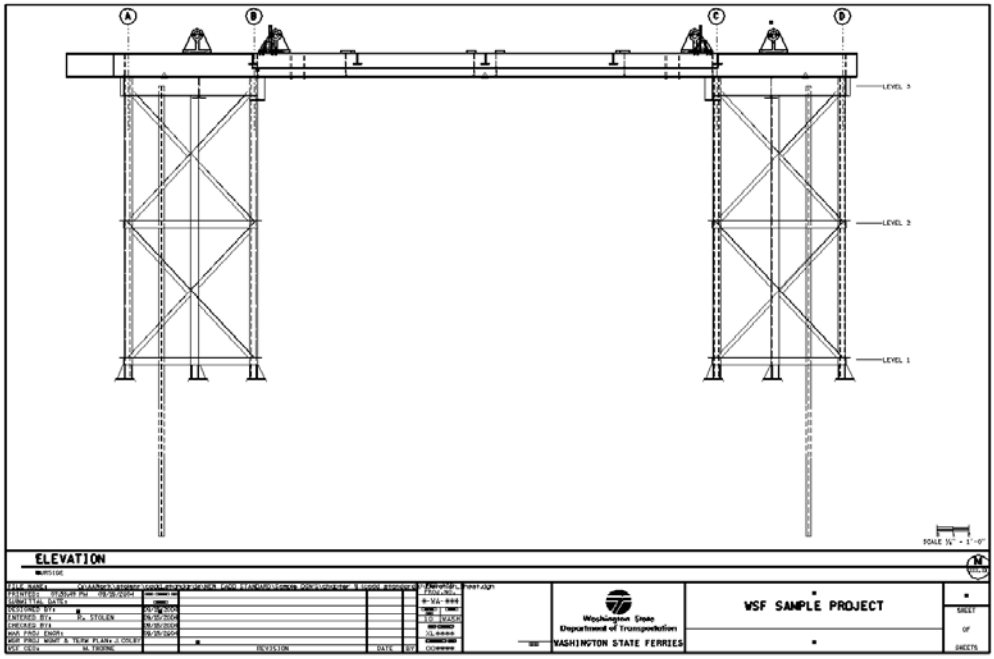
Sections are used to create a view perpendicular to the original source drawing. They are used to create a larger view of an area in the same orientation as the original. Sections are intended to provide detailed information at a larger horizontal or vertical distance than detail. When applicable, show gridline information in the section, thus giving a reference to where the information is relative to other sheet files. When putting sections together the information that is being cut should be dark and prominent where as all other information is considered beyond and grayed back, but readable and reproducible.

Section Guidelines:

1. Do not cross leader lines with each other or other symbology.
2. Make effort to align text callouts when space allows for it.
3. Convention for placing Leaders on all sections will be upper left or lower right.
4. Line types and weights will be as per the original source drawing.
5. Proposed features should be bold (wt. 2 to 4) and stand out.
6. Existing features will use color 151 which appears as a screen back in a readable and reproducible weight.
7. Place text in clear areas on the sheet.
8. Show gridlines where they occur in section.
9. Indicate direction of view.

(d) Standard Elevation Sheet Layout

Elevations are intended to show entire layout constructed of bent or gridline location. Where practical, elevations are normally shown as looking offshore, but certain elevations such as Bridge Seat or Tower elevations may require different orientation and will be labeled with the direction the plan reader is looking to see the view. (See figure 5).



Standard Elevation Sheet Layout
Exhibit 800-31

Elevation Guidelines:

1. Show gridlines in elevation where they occur.
2. Show information that is most pertinent in elevation.

809.04 WSF Monuments

(a) General

All reference files containing plan/site layouts will be drawn in Civil working units. All plan/site layouts will be on State plane coordinates. This will allow cross-referencing between all engineering disciplines. While this is beneficial for the purposes of cross-discipline referencing/checks it is a hindrance for using the layouts in detail plans using the structural working units. Therefore, it is required that all site plans and basemaps shall include the USGS monuments for the project site. These points will be used as reference points for scaling and rotating basemaps in Deliverable (.DLV) files. The points will be displayed as Cross-Discipline Reference Monuments. An example of the monument is shown on the Cache file.

(b) Monuments

The following figure lists the monument points and the associated coordinates for each:

Site Monuments			
Terminal	**Mon. Names**	**Northing**	**Easting**
Anacortes	IS2908	553,499.653	1,192,843.649
	TRACIE	554,588.385	1,193,234.439
	GP29020-15A	554,797.801	1,193,154.090
Bainbridge/Eagle	IS1824	230,965.043	1,225,969.095
Harbor	IS1825	231,634.274	1,226,907.853
	EAGLE	231,680.872	1,226,468.133
	TRAIL	231,898.876	1,225,971.523
Bremerton	GP18304-20	210,601.819	1,198,399.934
	GP18304-21	211,030.677	1,198,615.462
Clinton	GP15525-21	359,286.988	1,268,232.190
	GP15525-22	359,946.852	1,268,062.557
	CLINTON	359,374.685	1,268,203.261
Edmonds	EDMONDS	300,582.135	1,260,232.474
	JEFF RESET	300,331.033	1,259,750.353
	EDM-01	300,819.372	1,259,800.618
Fauntleroy	FAUNTLEROY	194,806.379	1,254,939.334
	FAUNTLEROY AZ	194,645.424	1,255,133.484
Friday Harbor	CANNERY	567,393.829	1,112,025.197
	CANDLE	571,500.356	1,113,788.829
	FRI-01	567,623.294	1,111,793.282
Coupeville	KEYSTONE	427,092.371	1,191,263.546
	KEYSTONE AZI	427,959.229	1,191,938.919
	ADMIRALTY WEST BASE	428,547.397	1,192,436.939
Kingston	KINGSTON	295,076.142	1,231,971.798
	KINGSTON AZI	296,016.931	1,232,527.430
	ROB	294,798.055	1,231,829.531
Lopez	GP28-4	573,061.469	1,146,215.477
	LPZ-01	579,153.337	1,144,013.732
	LPZ-02	579,521.013	1,144,004.808
Mukilteo	GP31525-132	349,234.803	1,279,967.811
	GP31525-133	349,415.000	1,279,510.869
	NEW MUK	348,759.798	1,279,488.468
Orcas	UW QUAKE	589,885.651	1,129,443.617
	UW QUAKE AZ	589,996.553	1,130,359.947

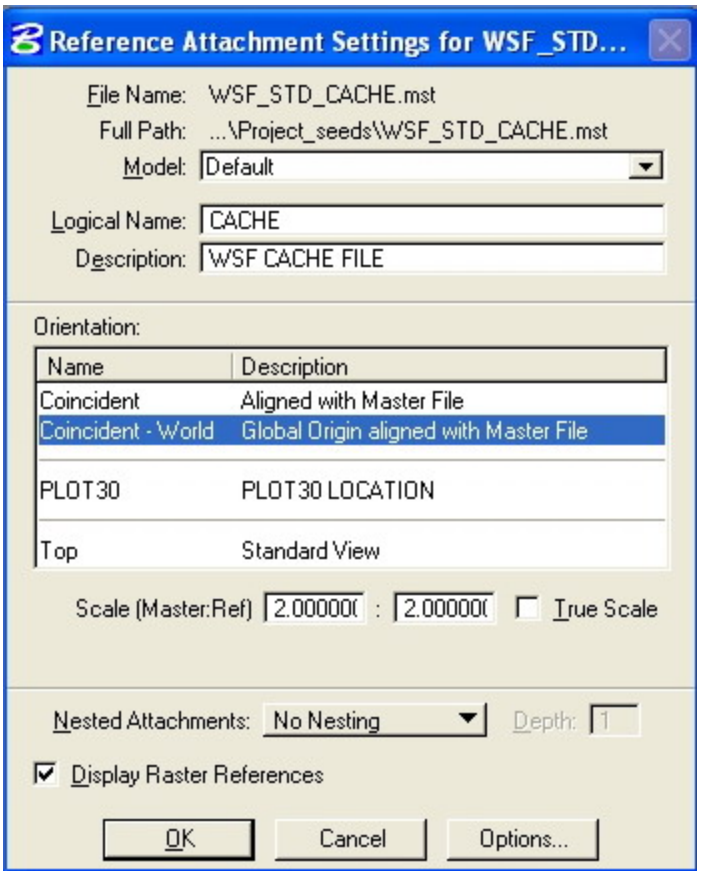
Site Monuments
Exhibit 800-32

Site Monuments			
Terminal	**Mon. Names**	**Northing**	**Easting**
Point Defiance	POINT DEFIANCE	726,004.578	1,140,318.710
	PT DEFIANCE AZ	725,578.106	1,140,910.730
	PDF	725,116.837	1,140,646.095
Port Townsend	PORT TOWNSEND AZ	411,607.290	1,169,716.832
	S 257 RESET 1983	411,410.407	1,169,117.383
Seattle	DAVE	223,142.323	1,268,962.393
	GP17005-51	223,148.425	1,268,928.191
	IS17200	223,137.946	1,269,514.672
Shaw	SH-01	584,672.108	1,132,943.275
	SH-02	585,118.469	1,133,383.819
	SH-03	584,674.211	1,133,145.122
Southworth	GP18160-13	191,168.643	1,228,351.516
	SOUTHWORTH	191,094.070	1,228,987.270
Tahlequah	TLQ-01	725,818.745	1,142,582.718
	TAHLEQUAH2	735,625.970	1,142,780.516
	IPT	748,333.897	1,146,957.007
Vashon	VASHON	189,828.429	1,237,430.191
	VASHON AZI	190,625.058	1,237,287.565
	944 6025 F	189,857.150	1,237,246.910

Site Monuments
Exhibit 800-32

809.05 Referencing Note

All reference files shall be given a Logical Name and a Description when they are attached.



Reference File Attachment
Exhibit 800-33

809.06 Sheet Numbering

The Drawing Number shall be placed in the upper right-hand corner of the Title Block. The font shall be font 200 and will be scaled to 1.33 times the standard text size as it appears on the standard plan sheet border.

The Index Numbers shall be placed in the lower right-hand corner of the Title Block. The font shall be font 200 and will be scaled to the standard text size as it appears on the standard plan sheet border. It will have a line spacing of 2.5.

The format for sheet numbering shall be:

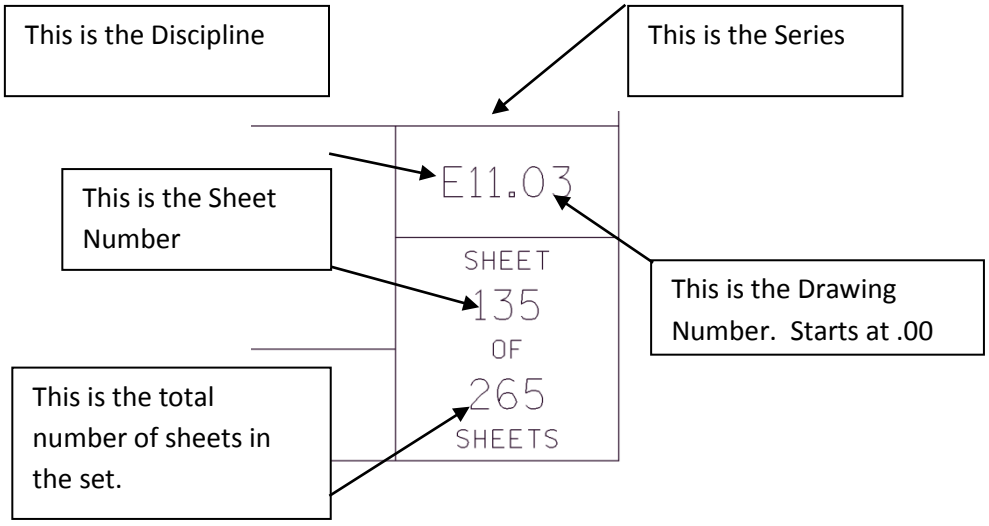
Dxx.xx

Where,

D	Discipline designation (from Table 1 – 6.02.01)
xx.xx	Four character sheet number

Following are examples on how to utilize the sheet numbering requirements.

Example: The electrical one-line diagrams are being placed on the series 11 sheets of the electrical plans. This sheet is the 135th sheet in a 265-sheet set. The third one-line diagram would have the sheet number:



809.07 Text

(a) General

WSF has added examples of the correct standard text size to the cache file.

The table below shows the relationship between the plotted size of the text and the size of the text when measured in MicroStation at the sheet location when the sheet border is placed at the scale shown.

When You Reference the Border at this Scale:	And You Place Text in the CADD file at this Size :	The Text will be this Size on an 11x17 Sheet:
1”=500’	31.25	1/16”
1”=200’	12.50	1/16”
1”=100’	6.25	1/16”
1”=60’	3.75	1/16”
1”=50’	3.15	1/16”
1”=40’	2.5	1/16”
1”=30’	1.875	1/16”
1”=20’	1.26	1/16”
1”=10’	.625	1/16”
¾”=1’ (same as 1”=16’)	1.00	1/16”
½”=1’ (same as 1”=24’)	1.5	1/16”
⅜”=1’ (same as 1”=32’)	2.00	1/16”
¼”=1’ (same as 1”=48’)	3.00	1/16”
⅛”=1’ (same as 1”=96’)	6.00	1/16”

Placement of text (Derived using formula shown in the section on “Text Size”)
Exhibit 800-34

For legibility, text and titles shall be all caps for the 11” × 17” contract plans.

(b) Text Size

The drawings are scaled at the time of plotting. It is important to place text at an appropriate CADD height within the drawing based on the intended scale of the plotted drawing.

Since WSF adheres to a minimum text size for its plan sheets, the following equation can be used to determine the text size to be placed on any scale plan sheet:

$$T_s = T_p \times S_s$$

Where,

T_p = text size on the paper (11x17)(inches)
T_s = text size in the "CACHE" file (feet)
S_s = sheet border scale (feet/inches)

Example: You want to place text onto a 1"=50' scale sheet so that it measures 1/16 " (.0625")

So,

$$T_s = T_p \times S_s$$

Becomes,

$$T_s = (.0625")x\ 50$$

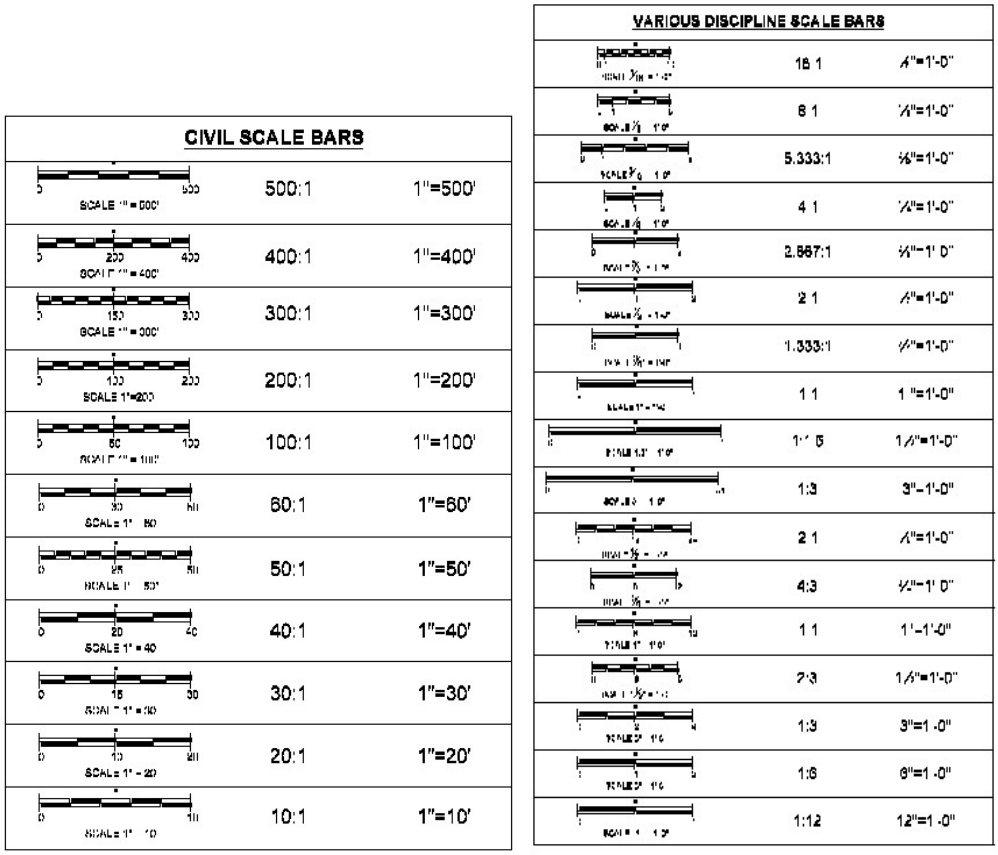
Thus,

$$T_s = 3.125$$

809.08 Recommended Scales

Recommended drawing scales are indicated in Figure 8. The Scale Bars are accessible from the cache file.

Note: While Structural drawings will be drawn to scale there will be no scale bars placed on the Structural plan sheets (per the WSDOT BDM).



Drawing Scales
Exhibit 800-35

809.09 Addendums, Revisions and Change Orders

WSF uses the same method for identifying changes to drawings during the addendum and change order processes as WSDOT. Examples of Addenda, Revisions, and Change Order Documents can be found in the *Plans Preparation Manual* Appendix 5 "Addendum Preparation". Additionally WSF uses "clouding" and revision triangles to indicate changes to the WSF Standard drawings. Specific changes to these drawings are clouded and appended with a revision triangle. Upon a new revision to the drawing the clouding from the previous revision is removed but the revision triangle remains as a note that the drawing has been previously revised.

809.10 Preliminary Stamps

All plan sheets are required to have a "Preliminary" or "Submittal" Stamp in the lower left corner until the final printing before sending to Olympia. This text is located in the WSF_STD_CACHE.mst file and should be placed in the project's PSE_Border.mst file, not in the deliverable file.

809.11 Element Symbology

The use and application of the element attributes defined in this section shall be uniformly observed for the following reasons:

1. **Work Transfer –** To efficiently transfer work between functional units, CADD drawings must conform to a uniform data base arrangement - levels, etc. If all units do not use the same system, considerable time can be lost in learning a new system when work is transferred.
2. **Multi-Operators –** It is not uncommon for more than one person to work on the same drawing. For the level attributes to be meaningful, each operator must conform to a common level definition.
3. **Drawing Life –** At WSF, drawings are active for several years. How the data is entered today (i.e., what levels are used for what kinds of data) must be readily apparent for a long period. This problem is minimized with a uniform definition and use of the various levels.

809.12 Civil and Right-of-Way Level Symbology

WSF uses the WSDOT Level and Symbology (line color, style, and weight) schemes as found in the *Plans Preparation Manual* Division 3 and Division 5 for "onshore" work. All "offshore" work will utilize the WSF leveling schemes. Elements of work that bridge the gap between "onshore" and "offshore", an overhead loading system for example, will utilize WSF symbology until the point that they become an integral part of the "onshore" structure. The determination of this "point" will be made by the State.

809.13 Existing Architectural Level Symbology

WSF uses the following existing architectural symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_A_area	Area (Existing)	151	0	1
SF_A_area_iden	Area Identification (Existing)	151	0	1
SF_A_backgrnd	Background (Existing)	151	0	1
SF_A_cling	Cling (Existing)	151	0	1
SF_A_cling_patt	Cling Pattern (Existing)	151	0	1
SF_A_col	Column (Existing)	151	0	1
SF_A_detl	Architectural Detail (Existing)	151	0	1
SF_A_detl_iden	Detail Identification (Existing)	151	0	1
SF_A_detl_mcut	Architectural Cut Section (Existing)	151	0	1
SF_A_detl_patt	Detail Pattern (Existing)	151	0	1
SF_A_door	Door (Existing)	151	0	1
SF_A_door_iden	Door Identification (Existing)	151	0	1
SF_A_fence	Fence (Existing)	151	0	1
SF_A_flor	Floor Plan (Existing)	151	0	1
SF_A_flor_fixt	Flooring Fixtures (Existing)	151	0	1
SF_A_flor_iden	Flooring Identification (Existing)	151	0	1
SF_A_flor_ovhd	Flooring Overhead (Existing)	151	0	1
SF_A_flor_patt	Flooring Pattern (Existing)	151	0	1
SF_A_furn	Furnishing (Existing)	151	0	1
SF_A_furn_case	Furnishing Casement (Existing)	151	0	1
SF_A_furn_iden	Furnishing Identification (Existing)	151	0	1
SF_A_glaz	Glazing (Existing)	151	0	1
SF_A_glaz_iden	Glazing Identification (Existing)	151	0	1
SF_A_glaz_sill	Glazing Sill (Existing)	151	0	1
SF_A_graphic_fine	Graphics – Fine (Existing)	151	0	1
SF_A_grid	Grid Lines (Existing)	151	0	1
SF_A_grnd	Ground Line (Contour) (Existing)	151	0	1
SF_A_lev	Elevator (Existing)	151	0	1
SF_A_lev_iden	Elevator Identification (Existing)	151	0	1
SF_A_lev_otln	Elevator Outline (Existing)	151	0	1
SF_A_levator	Elevator (Existing)	151	0	1
SF_A_patt	Pattern (Existing)	151	0	1
SF_A_pedwalkway	Pedestrian Walkway (Existing)	151	0	1
SF_A_roof	Roof (Existing)	151	0	1
SF_A_roof_otln	Roof Outline (Existing)	151	0	1
SF_A_roof_patt	Roof Pattern (Existing)	151	0	1

Existing Architectural Symbology
Exhibit 800-36

Level Name	Description	Element Color	Line Style	Line Weight
SF_A_sect	Section (Existing)	151	0	1
SF_A_sect_iden	Section Identification (Existing)	151	0	1
SF_A_sect_patt	Section Pattern (Existing)	151	0	1
SF_A_site	Site (Existing)	151	0	1
SF_A_site_lite	Sight Lighting (Existing)	151	0	1
SF_A_site_ovhd	Site Overhead (Existing)	151	0	1
SF_A_site_pole	Site Pole (Existing)	151	0	1
SF_A_site_undr	Site (Existing)	151	0	1
SF_A_soun	Sound Equipment (Existing)	151	0	1
SF_A_stair	Architectural Stairs (Existing)	151	0	1
SF_A_wall_fire	Fire Wall (Existing)	151	0	1
SF_A_wall_full	Full Wall (Existing)	151	0	1
SF_A_wall_patt	Wall Pattern (Existing)	151	0	1
SF_A_wall_prht	Partial Height Wall (Existing)	151	0	1

Existing Architectural Symbology
Exhibit 800-36

809.14 Architectural Demolition Symbology

WSF uses the following architectural demolition symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_AD_area	Area (Demolition)	151	0	1
SF_AD_area_iden	Area Identification (Demolition)	151	0	1
SF_AD_backgrnd	Background (Demolition)	151	0	1
SF_AD_cling	Cling (Demolition)	151	0	1
SF_AD_cling_patt	Cling Pattern (Demolition)	151	0	1
SF_AD_col	Architectural Column (Demolition)	151	0	1
SF_AD_detl	Detail (Demolition)	151	0	1
SF_AD_detl_iden	Detail Identification (Demolition)	151	0	1
SF_AD_detl_mcut	Architectural Cut Section Detail (Demolition)	151	0	1
SF_AD_detl_patt	Detail Pattern (Demolition)	151	0	1
SF_AD_door	Door (Demolition)	151	0	1
SF_AD_door_iden	Door Identification (Demolition)	151	0	1
SF_AD_fence	Fence (Demolition)	151	0	1
SF_AD_flor	Floor Plan (Demolition)	151	0	1
SF_AD_flor_fixt	Flooring Fixtures (Demolition)	151	0	1
SF_AD_flor_iden	Flooring Identification (Demolition)	151	0	1
SF_AD_flor_ovhd	Flooring Overhead (Demolition)	151	0	1

Architectural Demolition Symbology
Exhibit 800-37

Level Name	Description	Element Color	Line Style	Line Weight
SF_AD_flor_patt	Flooring Pattern (Demolition)	151	0	1
SF_AD_furn	Furnishing (Demolition)	151	0	1
SF_AD_furn_case	Furnishing Casement (Demolition)	151	0	1
SF_AD_furn_iden	Furnishing Identification (Demolition)	151	0	1
SF_AD_glaz	Glazing (Demolition)	151	0	1
SF_AD_glaz_iden	Glazing Identification (Demolition)	151	0	1
SF_AD_glaz_sill	Glazing Sill (Demolition)	151	0	1
SF_AD_graphic_fine	Graphics – Fine (Demolition)	151	0	1
SF_AD_grid	Grid Lines (Demolition)	151	0	1
SF_AD_grnd	Ground Line (Contour) (Demolition)	151	0	1
SF_AD_lev	Elevator (Demolition)	151	0	1
SF_AD_lev_iden	Elevator Identification (Demolition)	151	0	1
SF_AD_lev_otln	Elevator Outline (Demolition)	151	0	1
SF_AD_levator	Elevator (Demolition)	151	0	1
SF_AD_patt	Pattern (Demolition)	151	0	1
SF_AD_pedwalkway	Pedestrian Walkway (Demolition)	151	0	1
SF_AD_roof	Roof (Demolition)	151	0	1
SF_AD_roof_otln	Roof Outline (Demolition)	151	0	1
SF_AD_roof_patt	Roof Pattern (Demolition)	151	0	1
SF_AD_sect	Section (Demolition)	151	0	1
SF_AD_sect_iden	Section (Demolition)	151	0	1
SF_AD_sect_patt	Section Pattern (Demolition)	151	0	1
SF_AD_wall_fire	Fire Wall (Demolition)	151	0	1
SF_AD_wall_full	Full Wall (Demolition)	151	0	1
SF_AD_wall_patt	Wall Pattern (Demolition)	151	0	1
SF_AD_wall_prht	Partial Height Wall (Demolition)	151	0	1

Architectural Demolition Symbology
Exhibit 800-37

809.15 Proposed Architectural Symbology

WSF uses the following architectural proposed symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
sf_AP_area_iden	Area Identification (Proposed)	0	0	2
sf_AP_area	Area (Proposed)	1	0	2
sf_AP_backgrnd	Background (Proposed)	8	0	2
sf_AP_cling	Cling (Proposed)	0	0	2
sf_AP_cling_patt	Cling Pattern (Proposed)	0	0	2
sf_AP_col	Architectural Column (Proposed)	4	0	2
sf_AP_detl_iden	Detail Identification (Proposed)	0	0	2
sf_AP_detl_mcut	Cut Section Detail (Proposed)	1	0	4
sf_AP_detl	Detail (Proposed)	1	0	3
sf_AP_detl_patt	Detail Pattern (Proposed)	3	0	3
sf_AP_door	Door (Proposed)	3	0	2
sf_AP_door_iden	Door Identification (Proposed)	0	0	2
sf_AP_door	Door (Proposed)	2	0	2
sf_AP_elev_iden	Elevator Identification (Proposed)	0	0	2
sf_AP_elev_otln	Elevator Outline (Proposed)	1	0	3
sf_AP_elevator	Elevator (Proposed)	2	0	2
sf_AP_fence	Fence (Proposed)	3	0	2
sf_AP_flor_fixt	Flooring Fixtures (Proposed)	0	0	2
sf_AP_flor_iden	Flooring Identification (Proposed)	0	0	2
sf_AP_flor_ovhd	Flooring Overhead (Proposed)	4	0	2
sf_AP_flor	Flooring (Proposed)	0	0	2
sf_AP_flor_patt	Flooring Pattern (Proposed)	5	0	2
sf_AP_furn_case	Furnishing Casement (Proposed)	0	0	2
sf_AP_furn_iden	Furnishing Identification (Proposed)	0	0	2
sf_AP_furn	Furnishing (Proposed)	3	0	2
sf_AP_glaz_elev	Glazing Elevation (Proposed)	4	0	2
sf_AP_glaz_iden	Glazing Identification (Proposed)	0	0	2
sf_AP_glaz	Glazing (Proposed)	4	0	1
sf_AP_glaz_sill	Glazing Sill (Proposed)	3	0	2
sf_AP_GRAPHIC_FINE	Architectural: Graphic - Fine (Proposed)	163	0	1
sf_AP_GRAPHIC_ HIDDEN	Architectural: Graphic - Hidden (Proposed)	1	3	1
sf_AP_GRAPHIC_LITE	Architectural: Graphic - Lite (Proposed)	1	0	1
sf_AP_GRAPHIC_ SCREEN	Architectural: Graphic - Screen (Proposed)	152	0	1
sf_AP_grid	Grid (Proposed)	0	0	2
sf_AP_grnd	Ground Line (Contour) (Proposed)	2	0	2

Proposed Architectural Symbology
Exhibit 800-38

Level Name	Description	Element Color	Line Style	Line Weight
sf_AP_patt	Pattern (Proposed)	3	0	2
sf_AP_pedwalkway	Pedestrian Walkway (Proposed)	5	0	2
sf_AP_roof_otln	Roofing Outline (Proposed)	1	0	2
sf_AP_roof	Roofing (Proposed)	3	0	2
sf_AP_roof_patt	Roofing Pattern (Proposed)	0	0	2
sf_AP_sect_iden	Section Identification (Proposed)	3	0	2
sf_AP_sect_mcut	Architectural Cut Section (Proposed)	1	0	3
sf_AP_sect	Section (Proposed)	3	0	2
sf_AP_sect_patt	Section Pattern (Proposed)	3	0	2
sf_AP_stair	Stairs (Proposed)	0	0	2
sf_AP_site_pole	Site - Pole (Proposed)	0	0	2
sf_AP_wall_fire	Wall - Fire (Proposed)	2	0	2
sf_AP_wall_full	Wall – Full (Proposed)	2	0	2
sf_AP_wall_patt	Wall - Pattern (Proposed)	3	0	2
sf_AP_WALL_PRHT	Architectural: Walls - Partial Height	2	0	2

Proposed Architectural Symbology
Exhibit 800-38

809.16 Existing Electrical Symbology

WSF uses the following existing electrical symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_E_Buried_com	Buried Communication Line (Existing)	151	exbc	1
SF_E_Buried_Power	Buried Power (Existing)	151	UT_PW_UndGndPowerLine	1
SF_E_Buried_Tele	Buried Telephone Line (Existing)	151	UT_CM_ UndGndTelephoneCable	1
SF_E_Buried_Fiber	Buried Fiber Optic (Existing)	151	UT_CM_UndGndFiberOptic	1
SF_E_Circuits	Circuits (Existing)	151	0	1
SF_E_Comm	Communication (Existing)	151	0	1
SF_E_Control	Control (Existing)	151	0	1
SF_E_Devices	Devices (Existing)	151	0	1
SF_E_Disconnect	Disconnect (Existing)	151	0	1
SF_E_Emerg_Light	Emergency Lighting (Existing)	151	0	1
SF_E_Emerg_Raceway	Emergency Raceway (Existing)	151	0	1
SF_E_Fire_Alarm	Fire Alarm (Existing)	151	0	1
SF_E_Fire_Alarm_ Raceway	Fire Alarm Raceway (Existing)	151	0	1
SF_E_Generator	Generator (Existing)	151	0	1
SF_E_Grounding	Grounding (Existing)	151	0	1
SF_E_Junction_Box	Junction Box (Existing)	151	0	1
SF_E_Lighting	Lighting (Existing)	151	0	1
SF_E_Panelboard	Panelboard (Existing)	151	0	1
SF_E_Raceway	Raceway (Existing)	151	0	1
SF_E_Receptacle	Receptacle (Existing)	151	0	1
SF_E_Supports	Supports (Existing)	151	0	1
SF_E_Switchboard	Switchboard (Existing)	151	0	1
SF_E_Transformer	Transformer (Existing)	151	0	1
SF_E_Ovrhead_power	Overhead Power (Existing)	151	UT_PW_AbvGndPowerLine	1
SF_E_Ovrhead_Tele	Overhead Telephone Line (Existing)	151	UT_CM_ AbvGndTelephoneCable	1
SF_E_Ovrhead_Fiber	Overhead Fiber Optic (Existing)	151	UT_CM_ AbvGndOpticFiberCable	1
SF_E_Riser_Diagram	Riser Diagram (Existing)	151	0	1
SF_E_Schematic_ Diagram	Schematic Diagram (Existing)	151	0	1
SF_E_Schematic_Fld_ Wiring	Schematic Field Wiring (Existing)	151	2	1
SF_E_Text	Text (Existing)	151	0	1

Existing Electrical Symbology
Exhibit 800-39

809.17 Electrical Demolition Symbology

WSF uses the following demolition electrical symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_ED_Buried_com	Buried Communication Line (Demolition)	4	exbc	2
SF_ED_Buried_Power	Buried Power (Demolition)	4	UT_PW_UndGndPowerLine	2
SF_ED_Buried_Tele	Buried Telephone Line (Demolition)	4	UT_CM_ UndGndTelephoneCable	2
SF_ED_Buried_Fiber	Buried Fiber Optic (Demolition)	4	UT_CM_UndGndFiberOptic	2
SF_ED_Circuits	Circuits (Demolition)	4	0	2
SF_ED_Comm	Communication (Demolition)	4	0	2
SF_ED_Control	Control (Demolition)	4	0	2
SF_ED_Devices	Devices (Demolition)	4	0	2
SF_ED_Disconnect	Disconnect (Demolition)	4	0	2
SF_ED_Emerg_Light	Emergency Lighting (Demolition)	4	0	2
SF_ED_Emerg_Raceway	Emergency Raceway (Demolition)	4	0	2
SF_ED_Fire_Alarm	Fire Alarm (Demolition)	4	0	2
SF_ED_Fire_Alarm_ Raceway	Fire Alarm Raceway (Demolition)	4	0	2
SF_ED_Generator	Generator (Demolition)	4	0	2
SF_ED_Grounding	Grounding (Demolition)	4	0	2
SF_ED_Junction_Box	Junction Box (Demolition)	4	0	2
SF_ED_Lighting	Lighting (Demolition)	4	0	2
SF_ED_Panelboard	Panelboard (Demolition)	4	0	2
SF_ED_Raceway	Raceway (Demolition)	4	0	2
SF_ED_Receptacle	Receptacle (Demolition)	4	0	2
SF_ED_Supports	Supports (Demolition)	4	0	2
SF_ED_Switchboard	Switchboard (Demolition)	4	0	2
SF_ED_Transformer	Transformer (Demolition)	4	0	2
SF_ED_Ovrhead_power	Overhead Power (Demolition)	4	UT_PW_AbvGndPowerLine	2
SF_ED_Ovrhead_Tele	Overhead Telephone Line (Demolition)	4	UT_CM_ AbvGndTelephoneCable	2
SF_ED_Ovrhead_Fiber	Overhead Fiber Optic (Demolition)	4	UT_CM_ AbvGndOpticFiberCable	2
SF_ED_Riser_Diagram	Riser Diagram (Demolition)	4	0	2
SF_ED_Schematic_ Diagram	Schematic Diagram (Demolition)	4	0	2
SF_ED_Schematic_Fld_ Wiring	Schematic Field Wiring (Demolition)	4	2	2
SF_ED_Text	Text (Demolition)	0	0	2

Electrical Demolition Symbology
Exhibit 800-40

809.18 Proposed Electrical Symbology

WSF uses the following proposed electrical symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_EP_Buried_com	Buried Communication Line (Proposed)	5	exbc	2
SF_EP_Buried_Power	Buried Power (Proposed)	5	UT_PW_UndGndPowerLine	2
SF_EP_Buried_Tele	Buried Telephone Line (Proposed)	5	UT_CM_ UndGndTelephoneCable	2
SF_EP_Buried_Fiber	Buried Fiber Optic (Proposed)	5	UT_CM_UndGndFiberOptic	2
SF_EP_Circuits	Circuits (Proposed)	5	0	2
SF_EP_Comm	Communication (Proposed)	5	0	2
SF_EP_Control	Control (Proposed)	5	0	2
SF_EP_Devices	Devices (Proposed)	5	0	2
SF_EP_Disconnect	Disconnect (Proposed)	5	0	2
SF_EP_Emerg_Light	Emergency Lighting (Proposed)	5	0	2
SF_EP_Emerg_Raceway	Emergency Raceway (Proposed)	5	0	2
SF_EP_Fire_Alarm	Fire Alarm (Proposed)	5	0	2
SF_EP_Fire_Alarm_ Raceway	Fire Alarm Raceway (Proposed)	5	0	2
SF_EP_Generator	Generator (Proposed)	5	0	2
SF_EP_Grounding	Grounding (Proposed)	5	0	2
SF_EP_Junction_Box	Junction Box (Proposed)	5	0	2
SF_EP_Lighting	Lighting (Proposed)	5	0	2
SF_EP_Panelboard	Panelboard (Proposed)	5	0	2
SF_EP_Raceway	Raceway (Proposed)	5	0	2
SF_EP_Receptacle	Receptacle (Proposed)	5	0	2
SF_EP_Supports	Supports (Proposed)	5	0	2
SF_EP_Switchboard	Switchboard (Proposed)	5	0	2
SF_EP_Transformer	Transformer (Proposed)	5	0	2
SF_EP_Ovrhead_power	Overhead Power (Proposed)	5	UT_PW_AbvGndPowerLine	2
SF_EP_Ovrhead_Tele	Overhead Telephone Line (Proposed)	5	UT_CM_ AbvGndTelephoneCable	2
SF_EP_Ovrhead_Fiber	Overhead Fiber Optic (Proposed)	5	UT_CM_ AbvGndOpticFiberCable	2
SF_EP_Riser_Diagram	Riser Diagram (Proposed)	5	0	2
SF_EP_Schematic_ Diagram	Schematic Diagram (Proposed)	5	0	2
SF_EP_Schematic_Fld_ Wiring	Schematic Field Wiring (Proposed)	5	2	2
SF_EP_Text	Text (Proposed)	0	0	2

Proposed Electrical Symbology
Exhibit 800-41

809.19 General Sheet Symbology

WSF uses the following general sheet symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_GN_border	Sheet Border	0	0	3
SF_GN_border_text	Sheet Border Text	0	0	1
SF_GN_coordinate_text	Coordinate Text	0	0	0
SF_GN_demo_hatch	Demolition Hatching	3	0	2
SF_GN_grid_bubble	Gid Bubble	0	0	1
SF_GN_grid_dim	Architectural: Dimensions - Demolition	2	0	1
SF_GN_grid_line	Grid Line	0	0	1
SF_GN_logo	Logo	2	0	4
SF_GN_matchline	Matchline	0	0	5
SF_GN_n_Arow	General: Arrow	1	0	1
SF_GN_NPLT		140	0	0
SF_GN_pe_seal	PE Stamp	0	0	2
SF_GN_plot_border	Plot Border	175	6	1
SF_GN_rev_cloud	Revision Cloud	3	0	3
SF_GN_rev_sym	Revision Symbology	3	0	3
SF_GN_rev_text	Revision Text	3	0	3
SF_GN_scale_bar	Scale Bar	0	0	2
SF_GN_section_cut	Section Cut	0	0	2
SF_GN_submittal_text	Submittal Text	151	0	0
SF_GN_symbol	Symbology	2	0	4
SF_GN_text	Text	0	0	2
SF_GN_titles	Titles	0	0	3
SF_GN_VPORT	General: Viewport	9	0	1
SF_GN_XREF	General: Insertion Layer for External References	7	0	0

General Sheet Symbology
Exhibit 800-42

809.20 Existing Landscape Symbology

WSF uses the following existing landscape sheet symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_L_plnt_biocell_htch	biocell htch (Existing)	151	0	1
SF_L_plnt_legend_box	legend box (Existing)	151	0	1
SF_L_plnt_legend_htch	legend htch (Existing)	151	0	1
SF_L_plnt_low_plnt_htch	low plnt htch (Existing)	151	0	1
SF_L_plnt_nat_frst_htch	native forest htch (Existing)	151	0	1
SF_L_plnt_nat_grnd_cvr_htch	native ground cover htch (Existing)	151	0	1
SF_L_plnt_plnt_lines	plant lines (Existing)	151	0	1
SF_L_tr_grt	trench grate (Existing)	151	0	1
SF_L_trash can	trash can (Existing)	151	0	1
SF_L_area	area (Existing)	151	0	1
SF_L_area_t_o	area takeoffs (Existing)	151	0	1
SF_L_conc_htch	concrete htch (Existing)	151	0	1
SF_L_plnt_tree	columnar tree (Existing)	151	0	1
SF_L_plnt_dim text	dim text (Existing)	151	0	1
SF_L_bench	bench (Existing)	151	0	1
SF_L_plnt_turf	lawn (Existing)	151	0	1
SF_L_plnt_crush rock	crush rock (Existing)	151	0	1
SF_L_site_curb face	curb face (Existing)	151	0	1
SF_L_site_crushed rock htch	crushed rock htch (Existing)	151	0	1
SF_L_site_edges	edges (Existing)	151	0	1
SF_L_site_flag	flag (Existing)	151	0	1
SF_L_site_gc	gc (Existing)	151	0	1
SF_L_site_guide lines	guide lines (Existing)	151	0	1
SF_L_site_no plot	no plot (Existing)	151	0	1
SF_L_site_trash can	trash can (Existing)	151	0	1
SF_L_site_Aea line	area line (Existing)	151	0	1
SF_L_site_biocell	biocell (Existing)	151	0	1
SF_L_site_concrete	concrete (Existing)	151	0	1
SF_L_site_concrete htch	concrete htch (Existing)	151	0	1
SF_L_site_take offs	take offs (Existing)	151	0	1
SF_L_site_tr grate	truck grate (Existing)	151	0	1
SF_L_site_light rock	light rock (Existing)	151	0	2
SF_L_site_phone	phone (Existing)	151	0	2
SF_L_site_rock dark	rock dark (Existing)	151	0	2
SF_L_site_sign	sign (Existing)	151	0	2

Existing Landscape Symbology
Exhibit 800-43

Level Name	Description	Element Color	Line Style	Line Weight
SF_L_site_bench	bench (Existing)	151	0	2
SF_L_site_heavy	heavy (Existing)	151	0	4
SF_L_site_leaning rail	leaning rail (Existing)	151	0	4
SF_L_site_rail	rail (Existing)	151	0	4
SF_L_site_wall	wall (Existing)	151	0	4
SF_L_site_fence	fence (Existing)	151	0	4
SF_L_site_gate	gate (Existing)	151	0	2
SF_L_site_ref	ref (Existing)	151	0	1
SF_L_site_flag htch	flag htch (Existing)	151	0	1
SF_L_site_crush rock	crush rock (Existing)	151	0	1
SF_L_site_nopt	nopt (Existing)	151	0	1
SF_L_site_zport	zport (Existing)	151	0	1
SF_L_site_zone	zone (Existing)	151	0	1
SF_L_site_guide lines	guide lines (Existing)	151	0	1
SF_L_site_no plot	no plot (Existing)	151	0	1
SF_L_site_line of work	line of work (Existing)	151	3	1
SF_L_site_concrete htch	concrete htch (Existing)	151	0	1
SF_L_site_sign htch	sign htch (Existing)	151	0	1
SF_L_psht_flag pole	flag pole (Existing)	151	0	1
SF_L_psht_htch	htch (Existing)	151	0	1
SF_L_psht_line	line (Existing)	151	0	1
SF_L_psht_phone	phone (Existing)	151	0	1
SF_L_psht_symb dark	symb dark (Existing)	151	0	1
SF_L_psht_bench	bench (Existing)	151	0	1
SF_L_psht_concrete	concrete (Existing)	151	0	1
SF_L_psht_legend box	legend box (Existing)	151	0	1
SF_L_psht_notes	notes (Existing)	151	0	1
SF_L_psht_symb	SF_L_psht_symb (Existing)	151	0	1
SF_L_psht_bus	bus (Existing)	151	0	1
SF_L_psht_machline	machline (Existing)	151	5	1
SF_L_psht_text	text (Existing)	151	0	1

Existing Landscape Symbology
Exhibit 800-43

809.21 Landscape Demolition Symbology

WSF uses the following landscape demolition sheet symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_LD_area	rock dark (Demolition)	2	0	1
SF_LD_area_t_o	Sign (Demolition)	2	0	1
SF_LD_bench	Bench	5	0	1
SF_LD_conc_htch	Heavy (Demolition)	2	0	1
SF_LD_plnt_biocell_htch	leaning rail (Demolition)	2	0	1
SF_LD_plnt_crush rock	Rail (Demolition)	151	0	1
SF_LD_plnt_dim text	Wall (Demolition)	2	0	1
SF_LD_plnt_legend_box	Fence (Demolition)	1	0	1
SF_LD_plnt_legend_htch	Gate (Demolition)	1	0	1
SF_LD_plnt_low_plnt_ htch	Ref (Demolition)	2	0	1
SF_LD_plnt_nat_frst_htch	flag htch (Demolition)	2	0	1
SF_LD_plnt_nat_grnd_ cvr_htch	crush rock (Demolition)	2	0	1
SF_LD_plnt_plnt_lines	Nopt (Demolition)	1	0	1
SF_LD_plnt_tree	Zport (Demolition)	4	0	1
SF_LD_plnt_turf	Zone (Demolition)	151	0	1
SF_LD_psht_bench	guide lines (Demolition)	2	0	1
SF_LD_psht_bus	no plot (Demolition)	3	0	1
SF_LD_psht_concrete	line of work (Demolition)	2	0	1
SF_LD_psht_concrete htch	concrete htch (Demolition)	151	0	1
SF_LD_psht_dark rock	sign htch (Demolition)	4	0	1
SF_LD_psht_flag htch	flag pole (Demolition)	151	0	1
SF_LD_psht_flag pole	Htch (Demolition)	1	0	1
SF_LD_psht_htch	Line (Demolition)	1	0	1
SF_LD_psht_legend box	Phone (Demolition)	2	0	1
SF_LD_psht_line	symb dark (Demolition)	1	0	0
SF_LD_psht_machline	Bench (Demolition)	3	5	1
SF_LD_psht_nopl	Concrete (Demolition)	151	0	1
SF_LD_psht_notes	legend box (Demolition)	2	0	1
SF_LD_psht_phone	Notes (Demolition)	1	0	1
SF_LD_psht_symb	SF_L_psht_symb (Demolition)	2	0	1
SF_LD_psht_symb dark	symb dark (Demolition)	1	0	0
SF_LD_psht_text	Text (Demolition)	3	0	1
SF_LD_psht_zport lines	zport lines (Demolition)	3	0	1
SF_LD_site_line of work	line of work (Demolition)	151	3	1

Landscape Demolition Symbology
Exhibit 800-44

Level Name	Description	Element Color	Line Style	Line Weight
SF_LD_site_Aea line	area line (Demolition)	2	0	1
SF_LD_site_bench	Bench (Demolition)	3	0	1
SF_LD_site_biocell	Biocell (Demolition)	2	0	1
SF_LD_site_concrete	Concrete (Demolition)	2	0	1
SF_LD_site_concrete htch	concrete htch (Demolition)	2	0	1
SF_LD_site_concrete htch	concrete htch (Demolition)	151	0	1
SF_LD_site_crush rock	crush rock (Demolition)	151	0	1
SF_LD_site_crushed rock htch	crushed rock htch (Demolition)	1	0	1
SF_LD_site_curb face	curb face (Demolition)	1	0	1
SF_LD_site_edges	Edges (Demolition)	1	0	1
SF_LD_site_fence	Fence (Demolition)	5	0	1
SF_LD_site_flag	Flag (Demolition)	1	0	0
SF_LD_site_flag htch	flag htch (Demolition)	151	0	1
SF_LD_site_gate	Gate (Demolition)	3	0	1
SF_LD_site_gc	Gc (Demolition)	1	0	1
SF_LD_site_guide lines	guide lines (Demolition)	1	0	1
SF_LD_site_guide lines	guide lines (Demolition)	152	0	1
SF_LD_site_heavy	Heavy (Demolition)	5	0	1
SF_LD_site_leaning rail	leaning rail (Demolition)	5	0	1
SF_LD_site_light rock	light rock (Demolition)	3	0	1
SF_LD_site_no plot	no plot (Demolition)	1	0	1
SF_LD_site_no plot	no plot (Demolition)	151	0	1
SF_LD_site_nopt	Nopt (Demolition)	151	0	1
SF_LD_site_phone	Phone (Demolition)	3	0	1
SF_LD_site_rail	Rail (Demolition)	5	0	1
SF_LD_site_ref	Ref (Demolition)	5	0	1
SF_LD_site_rock dark	rock dark (Demolition)	3	0	1
SF_LD_site_sign	Sign (Demolition)	3	0	1
SF_LD_site_sign htch	sign htch (Demolition)	151	0	1
SF_LD_site_take offs	take offs (Demolition)	2	0	1
SF_LD_site_tr grate	tr grate (Demolition)	2	0	1
SF_LD_site_trash can	trash can (Demolition)	1	0	1
SF_LD_site_wall	Wall (Demolition)	5	0	1
SF_LD_site_zone	Zone (Demolition)	151	0	1
SF_LD_site_zport	Zport (Demolition)	151	0	1
SF_LD_tr_grt	trench grate (Demolition)	1	0	1
SF_LD_trash can	trash can (Demolition)	1	0	1

Landscape Demolition Symbology
Exhibit 800-44

809.22 Proposed Landscape Symbology

WSF uses the following proposed landscape sheet symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_LP_area	area	2	0	2
SF_LP_area_t_o	area takeoffs	2	0	1
SF_LP_bench	bench	5	0	2
SF_LP_conc_htch	concrete htch	2	0	2
SF_LP_plnt_biocell_htch	biocell htch	2	0	1
SF_LP_plnt_crush rock	crush rock	151	0	1
SF_LP_plnt_dim text	dim text	2	0	1
SF_LP_plnt_legend_box	legend box	1	0	2
SF_LP_plnt_legend_htch	legend htch	1	0	2
SF_LP_plnt_low_plnt_ htch	low plnt htch	2	0	1
SF_LP_plnt_nat_frst_htch	native forest htch	2	0	1
SF_LP_plnt_nat_grnd_ cvr_htch	native ground cover htch	2	0	1
SF_LP_plnt_plnt_lines	plant lines	1	0	1
SF_LP_plnt_tree	columnar tree	4	0	2
SF_LP_plnt_turf	lawn	151	0	1
SF_LP_psht_bench	bench	2	0	1
SF_LP_psht_bus	bus	3	0	2
SF_LP_psht_concrete	concrete	2	0	1
SF_LP_psht_concrete htch	concrete htch	151	0	1
SF_LP_psht_dark rock	dark rock	4	0	3
SF_LP_psht_flag htch	flag htch	151	0	1
SF_LP_psht_flag pole	flag pole	1	0	1
SF_LP_psht_htch	htch	1	0	1
SF_LP_psht_legend box	legend box	2	0	2
SF_LP_psht_line	line	1	0	1
SF_LP_psht_machline	machline	3	5	2
SF_LP_psht_nopl	nopl	151	0	1
SF_LP_psht_notes	notes	2	0	1
SF_LP_psht_phone	phone	1	0	1
SF_LP_psht_symb	SF_LP_psht_symb	2	0	1
SF_LP_psht_symb dark	symb dark	1	0	2
SF_LP_psht_text	text	3	0	2
SF_LP_psht_zport lines	zport lines	3	0	2
SF_LP_site_line of work	line of work	151	3	1

Proposed Landscape Symbology
Exhibit 800-45

Level Name	Description	Element Color	Line Style	Line Weight
SF_LP_site_Aea line	area line	2	0	1
SF_LP_site_bench	bench	3	0	2
SF_LP_site_biocell	biocell	2	0	1
SF_LP_site_concrete	concrete	2	0	1
SF_LP_site_concrete htch	concrete htch	2	0	1
SF_LP_site_crush rock	crush rock	151	0	1
SF_LP_site_crushed rock htch	crushed rock htch	1	0	1
SF_LP_site_curb face	curb face	1	0	1
SF_LP_site_edges	edges	1	0	1
SF_LP_site_fence	fence	5	0	2
SF_LP_site_flag	flag	1	0	1
SF_LP_site_flag htch	flag htch	151	0	1
SF_LP_site_gate	gate	3	0	1
SF_LP_site_gc	gc	1	0	1
SF_LP_site_guide lines	guide lines	1	0	1
SF_LP_site_heavy	heavy	5	0	3
SF_LP_site_leaning rail	leaning rail	5	0	2
SF_LP_site_light rock	light rock	3	0	2
SF_LP_site_no plot	no plot	151	0	1
SF_LP_site_phone	phone	3	0	2
SF_LP_site_rail	rail	5	0	2
SF_LP_site_ref	ref	151	0	2
SF_LP_site_rock dark	rock dark	3	0	2
SF_LP_site_sign	sign	3	0	2
SF_LP_site_sign htch	sign htch	151	0	2
SF_LP_site_take offs	take offs	2	0	1
SF_LP_site_tr grate	tr grate	2	0	1
SF_LP_site_trash can	trash can	1	0	1
SF_LP_site_wall	wall	5	0	2
SF_LP_site_zone	zone	151	0	1
SF_LP_site_zport	zport	151	0	1
SF_LP_tr_grt	trench grate	1	0	2
SF_LP_trash can	trash can	1	0	2

Proposed Landscape Symbology
Exhibit 800-45

809.23 Existing Mechanical Symbology

WSF uses the following existing mechanical sheet symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_M_base_plate	Base Plate (Proposed)	151	0	1
SF_M_bldg_HVAC	Building HVAC (Proposed)	151	0	1
SF_M_bldg_plumb_ fixtures	Building Plumbing Fixtures (Proposed)	151	0	1
SF_M_bldg_plumb_piping	Building Plumbing Piping (Proposed)	151	3	1
SF_M_blocks	Blocks (Proposed)	151	0	1
SF_M_bracket	Brackets (Proposed)	151	0	1
SF_M_brakes	Brakes (Proposed)	151	0	1
SF_M_cw_cable	Counter Weight Cable (Proposed)	151	0	1
SF_M_cw_sheaves	Counter Weight Sheaves (Proposed)	151	0	1
SF_M_couplings	Couplings (Proposed)	151	0	1
SF_M_cylinders	Cylinders (Proposed)	151	0	1
SF_M_fasteners	Fasteners (Proposed)	151	0	1
SF_M_fire_line	Fire Lines (Proposed)	151	0	1
SF_M_ts_hoist	Hoist Gears (Proposed)	151	0	1
SF_M_ts_hoist_cables	Hoist Cable (Proposed)	151	0	1
SF_M_ts_hoist_sheaves	Hoist Sheaves (Proposed)	151	0	1
SF_M_HPU	HPU (Proposed)	151	0	1
SF_M_mounting_structure	Mounting Structure (Proposed)	151	0	1
SF_M_pins	Pins (Proposed)	151	0	1
SF_M_pumps	Pumps (includes pumps and pump motors) (Proposed)	151	0	1
SF_M_sanitary_sewer	Sanitary Sewer (Proposed)	151	0	1
SF_M_shafts	Shafts (Proposed)	151	0	1
SF_M_steel_hatch	pattern	151	0	1
SF_M_hyd_tube_&_hoses	Hydraulic Tubing and Hoses (Proposed)	151	0	1
SF_M_waterline	Waterline (Proposed)	151	0	1

Existing Mechanical Symbology
Exhibit 800-46

809.24 Mechanical Demolition Symbology

WSF uses the following mechanical demolition sheet symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_MD_base_plate	Base Plate (Demolition)	3	0	2
SF_MD_bldg_HVAC	Building HVAC (Demolition)	3	0	2
SF_MD_bldg_plumb_ fixtures	Building Plumbing Fixtures (Demolition)	3	0	2
SF_MD_bldg_plumb_ piping	Building Plumbing Piping (Demolition)	3	3	2
SF_MD_blocks	Blocks (Demolition)	3	0	2
SF_MD_bracket	Brackets (Demolition)	3	0	2
SF_MD_brakes	Brakes (Demolition)	3	0	2
SF_MD_cw_cable	Counter Weight Cable (Demolition)	3	0	2
SF_MD_cw_sheaves	Counter Weight Sheaves (Demolition)	3	0	2
SF_MD_couplings	Couplings (Demolition)	3	0	2
SF_MD_cylinders	Cylinders (Demolition)	3	0	2
SF_MD_fasteners	Fasteners (Demolition)	3	0	2
SF_MD_fire_line	Fire Lines (Demolition)	3	0	2
SF_MD_ts_hoist	Hoist System (includes motor, gearbox, & drums) (Demolition)	3	0	2
SF_MD_ts_hoist_cables	Hoist Cable (Demolition)	3	0	2
SF_MD_ts_hoist_ sheaves	Hoist Sheaves (Demolition)	3	0	2
SF_MD_HPU	HPU (Demolition)	3	0	2
SF_MD_mounting_ structure	Mounting Structure (Demolition)	3	0	2
SF_MD_pins	Pins (Demolition)	3	0	2
SF_MD_pumps	Pumps (includes pumps and pump motors) (Demolition)	3	0	2
SF_MD_sanitary_sewer	Sanitary Sewer (Demolition)	3	0	2
SF_MD_shafts	Shafts (Demolition)	3	0	2
SF_MD_steel_hatch	Steel Hatch Pattern (Demolition)	3	0	2
SF_MD_hyd_tube_&_ hoses	Hydraulic Tubing and Hoses (Demolition)	3	0	2
SF_MD_waterline	Waterline (Demolition)	3	0	2

Mechanical Demolition Symbology
Exhibit 800-47

WSF uses the following proposed mechanical sheet symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_MP_base_plate	Base Plate (Proposed)	3	0	2
SF_MP_bldg_HVAC	Building HVAC (Proposed)	3	0	2
SF_MP_bldg_plumb_ fixtures	Building Plumbing Fixtures (Proposed)	3	0	2
SF_MP_bldg_plumb_ piping	Building Plumbing Piping (Proposed)	3	3	2
SF_MP_blocks	Blocks (Proposed)	3	0	2
SF_MP_bracket	Brackets (Proposed)	3	0	2
SF_MP_brakes	Brakes (Proposed)	3	0	2
SF_MP_cntr_wt_cable	Counter Weight Cable (Proposed)	3	0	2
SF_MP_cntr_wt_sheaves	Counter Weight Sheaves (Proposed)	3	0	2
SF_MP_couplings	Couplings (Proposed)	3	0	2
SF_MP_cylinders	Cylinders (Proposed)	3	0	2
SF_MP_fasteners	Fasteners (Proposed)	3	0	2
SF_MP_fire_line	Fire Lines (Proposed)	3	0	2
SF_MP_gears	Gears (Proposed)	3	0	2
SF_MP_ts_hoist	Hoist System (includes motor, gearbox, & drums) (Proposed)	3	0	2
SF_MP_ts_hoist_cables	Hoist Cables (Proposed)	3	0	2
SF_MP_ts_hoist_ sheaves	Hoist Sheaves (Proposed)	3	0	2
SF_MP_hydraulics	Hydraulics (Proposed)	3	0	2
SF_MP_motors	Motors (Proposed)	3	0	2
SF_MP_mounting_ structure	Mounting Structure (Proposed)	3	0	2
SF_MP_pins	Pins (Proposed)	3	0	2
SF_MP_pumps	Includes pumps and pump motors (Proposed)	3	0	2
SF_MP_sanitary_sewer	Sanitary Sewer (Proposed)	3	0	2
SF_MP_shafts	Shafts (Proposed)	3	0	2
SF_MP_steel_hatch	Hatch Pattern (Proposed)	3	0	2
SF_MP_tubing_hoses	Tubing and Hoses (Proposed)	3	0	2
SF_MP_waterline	Waterlines (Proposed)	3	0	2

Proposed Mechanical Symbology
Exhibit 800-48

809.25 Existing Security Symbology

WSF uses the following existing security sheet symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_SC_Cameras	All Cameras (Existing)	151	0	1
SF_SC_Entry_sys	Door locks, card reader, Request for exit, Key, key pad, A/V signals (Existing)	151	0	1
SF_SC_Motion_det	Motion detectors (Existing)	151	0	1
SF_SC_Alarms	Alarms (Existing)	151	0	1
SF_SC_Conduits	Conduits (Existing)	151	0	1
SF_SC_Racks	Security equipment racks (Existing)	151	0	1
SF_SC_Cabinets	Misc. security cabinets (Existing)	151	0	1
SF_SC_ACP	Access Control Panel (Existing)	151	0	1
SF_SC_PDC	Power Distribution Cabinet (Existing)	151	0	1
SF_SC_UPS	Uninterruptable Power Supply (Existing)	151	0	1

Existing Security Symbology
Exhibit 800-49

809.26 Security Demolition Symbology

WSF uses the following security demolition sheet symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_SCD_Cameras	All Cameras (Demolition)	5	0	2
SF_SCD_Entry_sys	Door locks, card reader, Request for exit, Key, key pad, A/V signals (Demolition)	5	0	2
SF_SCD_Motion_det	Motion detectors (Demolition)	5	0	2
SF_SCD_Alarms	Alarms (Demolition)	5	0	2
SF_SCD_Conduits	Conduits (Demolition)	5	0	2
SF_SCD_Racks	Security equipment racks (Demolition)	5	0	2
SF_SCD_Cabinets	Misc. security cabinets (Demolition)	5	0	2
SF_SCD_ACP	Access Control Panel (Demolition)	5	0	2
SF_SCD_PDC	Power Distribution Cabinet (Demolition)	5	0	2
SF_SCD_UPS	Uninterruptable Power Supply (Demolition)	5	0	2

Security Demolition Symbology
Exhibit 800-50

809.27 Proposed Security Symbology

WSF uses the following proposed security sheet symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_SCP_Cameras	All Cameras (Proposed)	6	0	2
SF_SCP_Entry_sys	Door locks, card reader, Request for exit, Key, key pad, A/V signals (Proposed)	6	0	2
SF_SCP_Motion_det	Motion detectors (Proposed)	6	0	2
SF_SCP_Alarms	Alarms (Proposed)	6	0	2
SF_SCP_Conduits	Conduits (Proposed)	6	0	2
SF_SCP_Racks	Security equipment racks (Proposed)	6	0	2
SF_SCP_Cabinets	Misc. security cabinets (Proposed)	6	0	2
SF_SCP_ACP	Access Control Panel (Proposed)	6	0	2
SF_SCP_PDC	Power Distribution Cabinet (Proposed)	6	0	2
SF_SCP_UPS	Uninterruptable Power Supply (Proposed)	6	0	2

Proposed Security Symbology
Exhibit 800-51

809.28 Existing Structural Symbology

WSF uses the following proposed security sheet symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_S_Breakline	Breakline (Existing)	151	0	1
SF_S_Cable	Cables (Existing)	151	0	1
SF_S_Centerline	Centerline (Existing)	151	0	1
SF_S_Chain	Chain (Existing)	151	0	1
SF_S_Conc_Curb	Concrete Curb (Existing)	151	0	1
SF_S_Conc_Foundation	Concrete Foundation (Existing)	151	0	1
SF_S_Conc_Hatch	Concrete Hatch (Existing)	151	0	1
SF_S_Conc_Member	Concrete Member (Existing)	151	0	1
SF_S_Conc_Pile	Concrete (Existing)	151	0	1
SF_S_Conc_Pile_Cap	Concrete Pile Cap (Existing)	151	0	1
SF_S_Conc_Sidewalk	Concrete Sidewalk (Existing)	151	0	1
SF_S_Conc_Slab	Concrete Slab (Existing)	151	0	1
SF_S_Dimension	Dimension (Existing)	151	0	1
SF_S_dol_anch_chain_lt	Floating Dolphin Anchor Chain (Left looking Offshore) (Existing)	151	0	1
SF_S_dol_anch_chain_rt	Floating Dolphin Anchor Chain (Right looking Offshore) (Existing)	151	0	1
SF_S_dol_anchor_lt	Floating Dolphin Anchor (Left looking Offshore) (Existing)	151	0	1

Existing Structural Symbology
Exhibit 800-52

Level Name	Description	Element Color	Line Style	Line Weight
SF_S_dol_anchor_rt	Floating Dolphin Anchor (Right looking Offshore) (Existing)	151	0	1
SF_S_dol_float_lt	Floating Dolphin (Left looking Offshore) (Existing)	151	0	1
SF_S_dol_float_rt	Floating Dolphin (Right looking Offshore) (Existing)	151	0	1
SF_S_Fastener	Fastener (Existing)	151	0	1
SF_S_Groundline	Groundline (Existing)	151	0	1
SF_S_Ladder	Ladder (Existing)	151	0	1
SF_S_Life_Ring	Life Ring (Existing)	151	0	1
SF_S_Metal_Bracing	Metal Bracing (Existing)	151	0	1
SF_S_Mooring_Line	Mooring Line (Existing)	151	0	1
SF_S_Notes	Notes (Existing)	151	0	1
SF_S_Rebar	Rebar (Existing)	151	0	1
SF_S_Rub_Pad	Rub Pads (Existing)	151	0	1
SF_S_Rub_Rail	Rub Rail (Existing)	151	0	1
SF_S_Sign	Signing (Existing)	151	0	1
SF_S_Steel	Steel (Existing)	151	0	1
SF_S_Steel_Bracing	Steel Bracing (Existing)	151	0	1
SF_S_Steel_Decking	Steel Decking (Existing)	151	0	1
SF_S_Steel_Fender	Steel Fender (Existing)	151	0	1
SF_S_Steel_Girder	Steel Girder (Existing)	151	0	1
SF_S_Steel_Grating	Steel Grating (Existing)	151	0	1
SF_S_Steel_Hatch	Steel Hatch Pattern (Existing)	151	0	1
SF_S_Steel_Liftbeam	Steel Lift Beam (Existing)	151	0	1
SF_S_Steel_Mics	Steel Miscellaneous (Existing)	151	0	1
SF_S_Steel_Pile	Steel Pile (Existing)	151	0	1
SF_S_Steel_Pile_Cap	Steel Pile Cap (Existing)	151	0	1
SF_S_Steel_Post	Steel Post (Existing)	151	0	1
SF_S_Steel_Railing	Steel Railing (Existing)	151	0	1
SF_S_Stirrup	Stirrup (Existing)	151	0	1
SF_S_Support	Support (Existing)	151	0	1
SF_S_Text	Text (Existing)	151	0	1
SF_S_Timber	Timber (Existing)	151	0	1
SF_S_Timber_Curb	Timber Curb (Existing)	151	0	1
SF_S_Timber_Hatch	Timber Hatch (Existing)	151	0	1
SF_S_Timber_Pile	Timber Pile (Existing)	151	0	1
SF_S_Timber_Pile_Cap	Timber Pile Cap (Existing)	151	0	1
SF_S_Timber_Post	Timber Post (Existing)	151	0	1
SF_S_Timber_Railing	Timber Railing (Existing)	151	0	1
SF_S_Weld_Symbol	Timber Symbol (Existing)	151	0	1

Existing Structural Symbology
Exhibit 800-52

809.29 Structural Demolition Symbology

WSF uses the following proposed security sheet symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_SD_Breakline	Breakline (Demolition)	3	0	1
SF_SD_Cable	Cables (Demolition)	3	0	2
SF_SD_Chain	Chain (Demolition)	3	0	2
SF_SD_Conc_Curb	Concrete Curb (Demolition)	3	0	2
SF_SD_Conc_Foundation	Concrete Foundation (Demolition)	3	0	2
SF_SD_Conc_Hatch	Concrete Hatch (Demolition)	3	0	2
SF_SD_Conc_Member	Concrete Member (Demolition)	3	0	2
SF_SD_Conc_Pile_Cap	Concrete (Demolition)	3	0	2
SF_SD_Conc_Pile	Concrete Pile Cap (Demolition)	3	0	2
SF_SD_Conc_Sidewalk	Concrete Sidewalk (Demolition)	3	0	2
SF_SD_Conc_Slab	Concrete Slab (Demolition)	3	0	2
SF_SD_demo_Hatch	Hatch Pattern (Demolition)	3	0	2
SF_SD_demo_Text	Demolition Text	3	0	2
SF_SD_dimension	Demolition Dimension	3	0	2
SF_SD_dol_anch_chain_lt	Floating Dolphin Anchor Chain (Left looking Offshore) (Demolition)	3	0	2
SF_SD_dol_anch_chain_rt	Floating Dolphin Anchor Chain (Right looking Offshore) (Demolition)	3	0	2
SF_SD_dol_anchor_lt	Floating Dolphin Anchor (Left looking Offshore) (Demolition)	3	0	2
SF_SD_dol_anchor_rt	Floating Dolphin Anchor (Right looking Offshore) (Demolition)	3	0	2
SF_SD_dol_float_lt	Floating Dolphin (Left looking Offshore) (Demolition)	3	0	2
SF_SD_dol_float_rt	Floating Dolphin (Right looking Offshore) (Demolition)	3	0	2
SF_SD_Fastener	Fastener (Demolition)	3	0	2
SF_SD_Ladder	Ladder (Demolition)	3	0	2
SF_SD_Life_Ring	Life Ring (Demolition)	3	0	2
SF_SD_Metal_Bracing	Metal Bracing (Demolition)	3	0	2
SF_SD_Mooring_Line	Mooring Line (Demolition)	3	0	2
SF_SD_Notes	Notes (Demolition)	3	0	2
SF_SD_Rebar	Rebar (Demolition)	3	0	2
SF_SD_Rub_Pad	Rub Pads (Demolition)	3	0	2
SF_SD_Rub_Rail	Rub Rail (Demolition)	3	0	2
SF_SD_Sign	Signing (Demolition)	3	0	2
SF_SD_Steel_Bracing	Steel Bracing (Demolition)	3	0	2
SF_SD_Steel	Steel (Demolition)	3	0	2
SF_SD_Steel_Decking	Steel Decking (Demolition)	3	0	2

Structural Demolition Symbology
Exhibit 800-53

Level Name	Description	Element Color	Line Style	Line Weight
SF_SD_Steel_Fender	Steel Fender (Demolition)	3	0	2
SF_SD_Steel_Girder	Steel Girder (Demolition)	3	0	2
SF_SD_Steel_Grating	Steel Grating (Demolition)	3	0	2
SF_SD_Steel_Hatch	Steel Hatch Pattern (Demolition)	3	0	2
SF_SD_Steel_Liftbeam	Steel Lift Beam (Demolition)	3	0	2
SF_SD_Steel_Mics	Steel Miscellaneous (Demolition)	3	0	2
SF_SD_Steel_Pile_Cap	Steel Pile Cap (Demolition)	3	0	2
SF_SD_Steel_Pile	Steel Pile (Demolition)	3	0	2
SF_SD_Steel_Post	Steel post (Demolition)	3	0	2
SF_SD_Steel_Railing	Steel Railing (Demolition)	3	0	2
SF_SD_Stirrup	Stirrup (Demolition)	3	0	2
SF_SD_Support	Support (Demolition)	3	0	2
SF_SD_Text	Text (Demolition)	3	0	1
SF_SD_Timber_Curb	Timber Curb (Demolition)	3	0	2
SF_SD_Timber	Timber (Demolition)	3	0	2
SF_SD_Timber_Hatch	Timber Hatch (Demolition)	3	0	2
SF_SD_Timber_Pile_Cap	Timber Pile (Demolition)	3	0	2
SF_SD_Timber_Pile	Timber Pile Cap (Demolition)	3	0	2
SF_SD_Timber_Post	Timber Post (Demolition)	3	0	2
SF_SD_Timber_Railing	Timber Railing (Demolition)	3	0	2
SF_SD_Weld_Symbol	Timber Symbol (Demolition)	3	0	2

Structural Demolition Symbology
Exhibit 800-53

809.30 Proposed Structural Symbology

WSF uses the following proposed security sheet symbology (line color, style, and weight) schemes as follows:

Level Name	Description	Element Color	Line Style	Line Weight
SF_SP_Breakline	Breakline (Proposed)	0	0	2
SF_SP_Cable	Cables (Proposed)	2	0	2
SF_SP_Centerline	Chain (Proposed)	0	0	2
SF_SP_Chain	Concrete Curb (Proposed)	0	0	2
SF_SP_Conc_Curb	Concrete Foundation (Proposed)	6	0	2
SF_SP_Conc_Foundation	Concrete Hatch (Proposed)	6	0	2
SF_SP_Conc_Hatch	Concrete Member (Proposed)	6	0	2
SF_SP_Conc_Member	Concrete (Proposed)	6	0	2
SF_SP_Conc_pile	Concrete Pile Cap (Proposed)	3	0	3
SF_SP_Conc_Sidewalk	Concrete Sidewalk (Proposed)	6	0	2
SF_SP_Conc_Slab	Concrete Slab (Proposed)	6	0	2
SF_SP_Dimension	Hatch Pattern (Proposed)	0	0	2
SF_SP_dol_anch_chain_lt	Floating Dolphin Anchor Chain (Left looking Offshore) (Proposed)	0	0	2
SF_SP_dol_anch_chain_rt	Floating Dolphin Anchor Chain (Right looking Offshore) (Proposed)	0	0	2
SF_SP_dol_anchor_lt	Floating Dolphin Anchor (Left looking Offshore) (Proposed)	0	0	2
SF_SP_dol_anchor_rt	Floating Dolphin Anchor (Right looking Offshore) (Proposed)	0	0	2
SF_SP_dol_float_lt	Floating Dolphin (Left looking Offshore) (Proposed)	0	0	2
SF_SP_dol_float_rt	Floating Dolphin (Right looking Offshore) (Proposed)	0	0	2
SF_SP_Fastener	Fastener (Proposed)	5	0	2
SF_SP_Groundline	Groundline (Proposed)	0	0	2
SF_SP_Ladder	Ladder (Proposed)	2	0	2
SF_SP_Life_Ring	Life Ring (Proposed)	2	0	2
SF_SP_Metal_Bracing	Metal Bracing (Proposed)	3	0	2
SF_SP_Mooring_Line	Mooring Line (Proposed)	0	0	2
SF_SP_Notes	Notes (Proposed)	0	0	2
SF_SP_Rebar	Rebar (Proposed)	4	0	2
SF_SP_Rub_Pad	Rub Pads (Proposed)	0	0	2
SF_SP_Rub_Rail	Rub Rail (Proposed)	0	0	2
SF_SP_Sign	Signing (Proposed)	0	0	2
SF_SP_Steel	Steel (Proposed)	3	0	2
SF_SP_Steel_pile	Steel Pile (Proposed)	3	0	2
SF_SP_Steel_pile_Cap	Steel Pile Cap (Proposed)	3	0	2
SF_SP_Steel_Bracing	Steel Bracing (Proposed)	3	0	2
SF_SP_Steel_Decking	Steel Decking (Proposed)	3	0	2

Proposed Structural Symbology
Exhibit 800-54

Level Name	Description	Element Color	Line Style	Line Weight
SF_SP_Steel_Fender	Steel Fender (Proposed)	3	0	2
SF_SP_Steel_Grating	Steel Grating (Proposed)	3	0	2
SF_SP_Steel_Hatch	Steel Hatch Pattern (Proposed)	3	0	2
SF_SP_Steel_Liftbeam	Steel Lift Beam (Proposed)	3	0	2
SF_SP_Steel_Mics	Steel Miscellaneous (Proposed)	3	0	2
SF_SP_Steel_Railing	Steel Railing (Proposed)	3	0	2
SF_SP_Stirrup	Stirrup (Proposed)	4	0	2
SF_SP_Support	Support (Proposed)	5	0	2
SF_SP_Text	Text (Proposed)	0	0	2
SF_SP_Timber	Timber (Proposed)	1	0	2
SF_SP_Timber_Curb	Timber Hatch (Proposed)	1	0	2
SF_SP_Timber_Hatch	Timber Pile (Proposed)	1	0	2
SF_SP_Timber_pile	Timber Pile Cap (Proposed)	1	0	2
SF_SP_Timber_pile_Cap	Timber Post (Proposed)	1	0	2
SF_SP_Timber_post	Timber Railing (Proposed)	1	0	2
SF_SP_Timber_Railing	Timber Symbol (Proposed)	1	0	2
SF_SP_Weld_Symbol	Weld Symbol (Proposed)	4	0	2

Proposed Structural Symbology
Exhibit 800-54

809.31 Abbreviations

Contract drawings may convey information by letter symbols and abbreviations. A letter symbol is a letter or group of letters contained within a line or symbol shape. All letter symbols shall be shown in a legend with the line work, and not in a list of abbreviations.

The use of abbreviations on contract drawings is not encouraged. Abbreviations should be used only where their meaning is unquestionably clear. When in doubt, spell it out.

Because this is a combined list for all engineering disciplines, and there are so many structures represented in a set of contract documents, many abbreviations listed have more than one meaning. Again, abbreviations should be used only where their meaning is unquestionably clear.

- Consistency is essential in using abbreviations. If an abbreviation is used on one part of the drawing, the same abbreviation shall be used whenever that structure is drawn. Do not abbreviate the word in one call-out and spell the word out in the next call-out.
- Do not use abbreviations in General Notes.
- Do not abbreviate words of five letters or fewer, except in schedules. A schedule column heading may need an abbreviation to reduce the size of the column and the overall size of the schedule.
- At times, the plural form is required on drawings. The following are examples of plurals in abbreviations:

DWG	SH	NO.
DWGs	SHs	NO.s

Abbreviation List

Term	Abbreviation
Abandon	ABDN
Abbreviation	ABBR; ABBREV
Above Counter	AC
Above Finished Floor	AFF
Above Suspended Ceiling	ASC
Above Water Level	AWL
Abrasive	ABRSV
Absolute	ABS
Abutment	ABUT
Accelerate	ACCEL
Access Floor	ACFL
Accommodate	ACCOM
Accordance With	A/W
Account	ACCT
Accumulate	ACCUM
Acetylene	ACET
Acoustic	ACST
Acre Feet	ACRE-FT
Acrylic Plastic	ACR
Acrylonitrile Butadiene Styrene	ABS
Adapter	AD
Addendum	ADD
Addition	ADDN
Adhere	ADH
Adjacent	ADJ
Adjust	ADJ
Adjustable	ADJ
Adjustable Speed	ADJ SP
Advanced Waste Treatment	AWT
Aggregate	AGG
Air Blast Circuit Breaker	ABCB
Air Blast Transformer	ABT
Air-Break Switch	AB SW
Air Circuit Breaker	ACB
Air Circulating	ACIRC
Air Compressor	AC
Air-Condition	AIR COND
Air Cooled	ACLD
Air Cooled Condensing Unit	ACU
Air Release Valve	ARV
Air Shutoff	ASHOF

Term	Abbreviation
Air Supply Unit	ASU
Airtight	AT
Air Turbine Motor	ATM
Alarm Check Valve	ACV
Alcohol	ALC
Alignment	ALIGN
Alkalinity	ALKY
Alloy Steel	ALY STL
Alloy-Steel Protective Plating	ASPP
Alternate	ALT
Alternating Current	AC
Alternating Current Synchronous	ACS
Alternator	ALTNTR
Altimeter	ALTM
Altitude Valve	ALTV
Aluminum	AL
Aluminum Conductor Steel-Reinforced	ACSR
American Association of State Highway and Transportation Officials	AASHTO
American Bureau of Shipping	ABS
American Concrete Institute	ACI
American Gage Design Standard	AGDS
American Institute of Steel Construction	AISC
American Institute of Timber Construction	AITC
American National Standard	AMER NATL STD
American National Standards Institute	ANSI
American Petroleum Institute	API
American Society for Testing and Materials	ASTM
American Steel Wire Gage	ASWG
American Welding Society	AWS
American Wire Gage	AWG
Ammeter	AMM
Ammeter Switch	AS
Ammonia Removal and Recovery Process	ARRP
Ammonium Nitrate	AM NIT
Ammonium Sulfate	(NH4)2SO4

Term	Abbreviation
Amount	AMT
Ampere	AMP
Ampere-hour	AMP HR
Ampere-hour Meter	AHM
Amplifier	AMPL
Anchor	AHR
Anchor Bolt	AB
And So Forth	ETC
Angle	L
Angle Point	AP
Angle Stop Valve	ASV
Annunciator	ANN
Anodize	ANDZ
Analog	A
Antenna	ANT
Aperture	APERT
Apparatus	APP
Appendix	APPX
Application	APPL
Approach	APRCH
Approval	APPVL
Approve	APPV
Approved	APPRD
Approximate	APPROX
Architecture	ARCH
Arcing	ARNG
Arc Weld	ARCW
Area Drain	AD
Armature	ARM
Armature Accelerator	AA
Armature Shunt	ARMSHT
Armored	ARMD
Armored Cable	ARM CA
Arrange	ARR
Arrester	ARSR
Asbestos	ASB
Asbestos Cement	AC
Asbestos Cement Pipe	ASB CP
Asphalt	ASPH
Asphalt Concrete	AC
Asphaltic Concrete Pavement	ACP
Asphalt Tile	AT

Term	Abbreviation
Asphalt Treated Base	ATB
Assemble	ASSEM
Assembly	ASM
Associate	ASSOC
Association	ASSN
As Soon As Possible	ASAP
Audio Frequency	AF
August	AUG
Authorize	AUTH
Auto-Manual	AM
Automatic	AUTO
Automatic Transfer Switch	ATS
Automatic Overload	AUTO OVLD
Automatic Reclosing	AUTO RECL
Automatic Starter	AUTOSTRT
Automatic Starting	AUTOSTRTG
Automatic Stop and Check Valve	AUTO S&CV
Automatic Transformer	AXFMR
Autotransformer	AUTO XMFR
Auto-Transformer Temperature Switch	TS
Auxiliary	AUX
Auxiliary Power Unit	APU
Auxiliary Register	AUXR
Auxiliary Switch (breaker) Normally Closed	ASC
Auxiliary Switch (breaker) Normally Open	ASO
Available	AVAIL
Avenue	AVE
Average	AVG
Average Diameter	AVG DIA
Azimuth	AZ
Background	BKGD
Back of Pavement Seat	BPS
Back to Back	B to B
Backwash Supply Water	BWS
Backwash Wastewater	BWW
Ballast	BLST
Ball Valve	BV
Barrier	BARR
Base Line	BL
Basement	BSMT

Term	Abbreviation
Base Plate	BP
Batten	BATT
Batter	BAT
Battery (electrical)	BAT
Bearing	BRG
Bedding	BDNG
Begin Horizontal Curve (Point of Curvature)	PC
Begin Vertical Curve	BVC
Bell and Flange	B&F
Bell and Spigot	B&S
Bell End	BE
Bench Mark	BM
Bend Line	BL
Bend Radius	BR
Between	BET
Bituminous	BITUM
Bituminous Surface Treatment	BST
Black Iron	BI
Black Steel Pipe, Schedule 40	BSP-80
Black Steel Pipe, Schedule 80	BSP-40
Blanket	BLKT
Blind Flange	BF
Blocking	BLKG
Blower	BLO
Blowoff	BO
Board	BD
Board Foot	FBM
Boiler	BLR
Bolt Center	BLT CTR
Bolt Circle	BC
Booster	BSTR
Booster Coil	BC
Both Faces	BF
Both Sides	BS
Both Ways	BW
Bottom	BOT
Bottom Chord	BC
Bottom Face	BF
Bottom Layer	BL
Boulevard	BLVD
Boundary	BDY
Bracket	BRKT

Term	Abbreviation
Break	BRK
Breaker	BRKR
Bridge	BR
Bridge Drain	BR DR
British Thermal Unit	BTU
Bronze	BRZ
Brown	BRN
Building	BLDG
Building Line	BL
Bulkhead	BHD
Buried Cable	BC
Bushing	BSHG
Butterfly	BTFL
Butterfly Valve	BV
Cabinet	CAB
Cabinet Unit Heater	CUH
Camber	CAM
Cantilever	CANTIL
Capacitor	CAP
Capacity	CAP
Cap Screw	CS
Carbon Column	CC
Carbon Dioxide	CO2
Case Harden	CH
Casement	CSMT
Casing	CSG
Casting	CSTG
Cast-In-Place Concrete	CIPC
Cast Iron	CI
Cast Iron Pipe	CIP
Cast Iron Soil Pipe	CISP
Castle Nut	CAS NUT
Cast Stone	CST
Catalog	CAT
Catch Basin	CB
Cathode	CATH
Cathode-ray Tube	CRT
Caulking	CLKG
Ceiling	CLG
Ceiling Height	CHT
Celsius (formerly Centigrade)	C
Cement	CEM

Term	Abbreviation
Cement Asbestos	CEM ASB
Cement Concrete Pavement	CCP
Cement Treated Base	CTB
Center	CTR
Center Line	CL
Center of Gravity	CG
Center to Center	CTR to CTR; C/C
Centimeter	CM
Central	CEN; CENT
Central Control System	CCS
Central Processing Unit	CPU
Centrifugal	CNTFGL
Ceramic	CER
Ceramic Tile	CT
Chalkboard	CHBD
Chamfer	CHAM
Change Order	CO
Channel	CHAN
Charge	CHG
Charger	CHGR
Chemical	CHEM
Chemical Oxygen Demand	COD
Chemical Sludge	CMS
Chlorinated PVC - Schedule 80	CPVC SCH80
Chlorine	CL2
Chlorine Gas	CG
Chlorine Vacuum	CGV
Circle	CIR
Circuit	CKT
Circuit Breaker	CB
Circuit Closing	CKT CL
Circuit Opening	CKT OP
Circular	CIRC
Circumference	CIRC; CIRCUM
Classification	CLASS
Clay Pipe	CP
Cleanout	CO
Clearance	CLR
Clino Bed	CLB
Closet	CLO
Coefficient	COEF
Cold Water	CW

Term	Abbreviation
Column	COL
Combination	COMB
Combination Air Release Valve	CARV
Communication	COMM
Company	CO
Complete Penetration	CP
Compound	COMPD
Compressed-Air Circuit Breaker	CACB
Compression, Compressive	COMP
Compressor	CPRSR
Computer-Auto-Manual	CAM
Computer-Manual	CM
Concrete	CONC
Concrete Cylinder	CC
Concrete Cylinder Pipe	CCP
Conc. Masonry Units	CMU
Conc. Reinforcing Steel Institute	CRSI
Condensate Return	CR
Conductivity	COND
Conductor	COND
Conductor Multiple (number indicated)	3/C
Conduit	CND; COND
Connect	CON
Connection	CON
Connection Diagram	CON DIAG
Connector	CON
Console	CSL
Constant Speed	CS
Construction	CONSTR
Construction Joint	CJ
Continue	CONT
Continued	CONT
Continuous	CONT
Contract	CONTR
Contract Limit Line	CLL
Contractor	CONTR
Control	CONT
Control Cable	CC
Control Panel	CP
Control Circuit	CONT CKT
Control Power Transformer	CPT
Control Relay	CR

Term	Abbreviation
Control Room	CR
Conventional	CONV
Conventional & Chemical Treatment	C&CT
Converter	CONV
Coordinate	COORD
Copper	COP
Corkboard	CKBD
Corner	COR
Corner Guard	CG
Corporation	CORP
Corrosion	CRSN
Corrugate	CORR
Corrugated Metal	CM
Corrugated Metal Pipe	CMP
Corrugated Steel Pipe	CSP
Cosecant	CSC
Cosine	COS
Cotangent	COT
Counterclockwise	CCKW
Countersink	CSK
Counterweight	CTWT
County	CO
Coupling	CPLG
Covered Walkway	CW
Cross Arm	X-ARM
Cross Beam	X-BM
Crossing	XING
Cross Section	X-SECT
Crushed Surfacing Base Course	CSBC
Crushed Surfacing Top Course	CSTC
Cubic Centimeter	CC; CM^3
Cubic Foot	CU FT; FT^3 ; CF
Cubic Foot Per Second	CFS; FT^3/S
Cubic Inch	CU IN; IN^3
Cubic Meters Per Second	CU M/S
Cubic Yard	CU YD; YD^3; CY
Cubic Foot Per Minute	FT^3/MIN
Cubic Meter	CM; M^3
Culvert	CULV
Current	CUR
Current Relay	CR
Current Transformer	CT

Term	Abbreviation
Cutoff	CO
Cutoff Valve	COV
Cutout	CO
Cutout Valve	COV
Cylinder	CYL
Dead Load	DL
December	DEC
Decrease	DEC; DECR
Deflect	DEFL
Deformed Bar Anchor	DBA
Degree	DEG
Department	DEPT
Design	DSGN
Designation	DES
Detail	DET
Develop	DVL
Development	DEV
Diagonal	DIAG
Diagram	DIAG
Diameter	DIAM
Diaphragm	DIAPH
Difference	DIFF
Differential	DIFF
Differential Pressure	DP
Digested Sludge	D/S
Digital	DGTL
Dimension	DIM
Direct	DIR
Direct-Connect	DIR CON
Direct Current	DC
Direct Digital Control	DDC
Direct Drive	DDR
Direct Tension Indicators	DTI
Direction	DIR
Directional	DIR
Disassemble	DISASM
Discharge	DISCH
Disconnect	DISC
Disconnect Switch	DS
Dissolved Oxygen	DO
Distance	DIST
Distribution Box	DB

Term	Abbreviation
Distribution Panel	DPNL
Distributor	DISTR
Door Closer	DCL
Door Stop	DST
Double	DBL
Double-Acting Door	DAD
Double-Acting Steam	DASTM
Double-Hung Windows	DHW
Double-Pole Double-Throw	DPDT
Double-Pole Double-Throw Switch	DPDT SW
Double-Pole Single-Throw	DPST
Double-Pole Single-Throw Switch	DPST SW
Double-Pole Switch	DP SW
Douglas Fir	DF
Dowel	DWL
Downspout	DS
Drain Board	DRB
Drain Tile	DT
Drawer	DWR
Drawing	DWG
Drinking Fountain	DF
Drop Inlet	DI
Drop Manhole	DMH
Ductile Iron	DI
Ductile Iron Mechanical Joint	DIMJ
Ductile Iron Pipe	DIP
Dye Penetrant Testing	DT
Each Face	EF
Each Layer	EL
Each Way	EW
Easement	EASE; ESMT
Eccentric	ECC
Edge of Pavement	EP
Edge of Shoulder	ES
Edge Thickness	ET
Effluent	EFL
Elapsed Time Meter	ETM
Electric	ELEC
Electrical	ELEC
Electrical Load Center	ELC
Electrically Operated Valve	ELV
Electric-Motor Driven	EMD

Term	Abbreviation
Electric Power Distribution	EPD
Electric Water Cooler	EWC
Electrode	ELCTD
Elementary	ELEM
Elevate	ELEV
Elevation	EL; ELEV
Elevator	ELEV
Emergency	EMER
Emergency Overflow	EO
Enamel	ENAM
Encased	ENCSD
Enclose	ENCL
Enclosure	ENCL
End Vertical Curve	EVC
End to End	E to E
Endwall	EW
Energize	ENRGZ
Energize Closed	EC
Energize Open	EO
Energy	ENGY
Engine	ENG
Engineer	ENGR
Engineering	ENGRG
Engrave	ENGRV
Enlarge, Enlarged	ENL
Entrance	ENTR
Environment	ENVIR
Environmental	ENVIR
Equally	EQL
Equally Spaced	EQL SP
Equation	EQ
Equipment	EQUIP
Equivalent	EQUIV
Erection	ERECT
Escalator	ESC
Estimate	EST
Excavate	EX
Excavation	EXC
Except	EXC
Excluding	EXCL
Exhaust	EXH
Exhaust Fan	EF

Term	Abbreviation
Existing	EXIST
Expand	EXP
Expansion	EXP; EXPAN
Expansion Anchor	EXP AHR
Expansion Joint	EXP JT
Explosion-Proof	EP
Exposed	EXP
Extension	EXT
Exterior	EXT
External	EXT
External Pipe Thread	EPT
Extra Fine (threads)	E F
Extra Strong	XSTR
Extreme High Water	EHW
Extreme Low Water	ELW
Fabricate	FAB
Face Brick	FB
Face of Concrete	FOC
Face of Finish	FOF
Face of Masonry	FOM
Face of Studs	FOS
Face to Face	F to F
Facility	FACIL
Factory	FCTY
Factory Finish	FF
Fahrenheit	F
Figure, Figures	FIG; FIGS
Finish	FIN
Fire Alarm	FA
Federal Specification	FS
Feeder	FDR
Flat Head	FH
Flexible	FLEX
Footing	FTG
Forward	FWD
Forward Reverse	FR
Foundation	FDN
Foundry	FDRY
Four-Conductor	4/C
Four-Pole	4P
Four-Pole Double-Throw Switch	4PDT SW
Four-Pole Single-Throw Switch	4PST SW

Term	Abbreviation
Four-Pole Switch	4P SW
Four-Way	4WAY
Four-Wire	4W
Freeway	FWY
Frequency	FREQ
Fresh Air	FRA
Fresh Water	FW
Fresh Water Pump	FWP
Fuel Oil Return	FOR
Fuel Oil Supply	FOS
Full Voltage Non-Reversing	FVNR
Full Voltage Reversing	FVR
Furnished By Others	FBO
Furred	FUR
Furring	FUR
Gage Board	GABD
Gallon	GAL
Gallons Per Day	GPD
Gallons Per Hour	GPH
Gallons Per Minute	GPM
Gallons Per Second	GPS
Galvanized (Hot Dip)	GALV
Galvanized Iron	GALVI
Galvanized Steel	GALVS
Galvanized Steel Pipe	GSP
Gas Fired Make Up Heater	GFMUH
Gasket	GSKT
Gasoline	GAS
Gate Valve	GTV
General	GENL
General Special Provisions	GSP
Generator	GEN
Girder	GIR
Glass Block	GLB
Glass Lined Cast Iron Pipe - Flanged Joint	GLCI
Glass Lined Cast Iron Pipe - Mechanical Joint	GLCIMJ
Glazed Concrete Masonry Unit	GCMU
Globe Valve	GLV
Government	GOVT
Grab Bar	GB
Grating	GRTG

Term	Abbreviation
Gravel	GVL
Grooved Coupling	GC
Grooved Coupling Fitting	GCF
Ground	GR
Ground Face	GF
Ground Fault Relay	GFR
Ground Fault Interrupter	GFI
Guage	GA
Gypsum	GYP
Gypsum Dry Wall	GPDW
Gypsum Lath	GPL
Gypsum Tile	GPT
Gypsum Wallboard	GWB
Hand-Hole	HH
Hand-Off-Auto	HOA
Hand-Off-Remote	HOR
Hanger	HGR
Hardboard	HBD
Hard-Drawn	HD DRN
Hardness	HDNS
Handrail	HR
Hardware	HDWE
Hardwood	HDWD
Headed Anchor Stud	HAS
Header	HDR
Head Joint	HJT
Heater	HTR
Heating	HTG
Heating Ventilating and Air Conditioning	HVAC
Heavy-Duty	HD
Height	HGT
Hexagonal	HEX
High Early-Strength Cement	HES
High Intensity Discharge	HID
High Pressure Sodium	HPS
High Strength	HS
High Strength Bolt	HSB
High Voltage	HV
High Voltage Regulator	HVR
High Water	HW
High Water Line	HWL
High Water Mark	HWM

Term	Abbreviation
Highway	HWY
Hollow Core	HC
Hollow Metal	HM
Hollow Structural Section	HSS
Hollow Tile	HT
Horizontal	HORIZ
Horsepower	HP
Hose Bib	HB
Hose Rack	HR
Hot Mix Asphalt	HMA
Hot Water	HW
Hot Water Heater	HWH
Hot Water Return	HWR
Hot Water Supply	HWS
Housing	HSG
Howler	HW
Hub Drain	HD
Hub Joint	HJ
Hundred	HUND
Hydraulic	HYDR
Hydrogen-Ion Concentration	PH
Hydrogen Peroxide	H2O2
Identify	IDENT
Ignition	IGN
Illuminate	ILLUM
Incandescent	INCAND
Inch per Second	IPS
Inch-Pound	IN LB
Incinerator	INCIN
Include	INCL
Increase	INCR
Increment	INCR
Independent Wire Rope Core	IWRC
Indicate	IND
Industry	IND
Influent	INFL
Information	INF; INFO
Inlet and Outlet	I&O
Inorganic	INORG
Inside Diameter	ID
Inside Face	IF
Inside Radius	IR

Term	Abbreviation
Install	INS
Installation	INS
Instrument	INST
Insulate	INSUL
Intake	INTK
Interconnection	INTCON
Interior	INT
Interlock	INTLK
Intermediate	INTERM
Internal	INTL
Internal Combustion	IC
Internal Pipe Thread	IPT
International Building Code	IBC
International Pipe Standard	IPS
Interrupting Capacity	IC
Intersect	INTSCT
Interstate	I
Invert	INV
Iron Pipe	IP
Iron Pipe Size	IPS
Iron Pipe Thread	IPT
Irregular	IRREG
Island	IS
Janitor	JAN
January	JAN
Job Order	JO
Junction	JCT
Junction Box	JB
Keene's Cement Plaster	KCP
Keeping	KPG
Key Interlock	K
Keyway	KWY
Kilonewton	KN
Kilowatt	KW
Kilovolt Ampere	KVA
Kilometer	KM
Kilopunds	KIPS; K
Kitchen	KIT
Knock Down	KD
Laboratory	LAB
Lag Bolt	LB
Laminate	LAM

Term	Abbreviation
Landing	LDG
Latching Relay	LR
Lateral	LATL
Latitude	LAT
Lavatory	LAV
Layout	LO
Leakage	LKG
Left Bank	LBK
Left Hand	LH
Left Regular Lay	LRL
Length	LG
Length of Curve	LC
Letter	LTR
Light Control	LC
Lighting	LTG
Lighting Contractor	LC
Lightning Arrester	LA
Lightproof	LP
Light Switch	LTSW
Lightweight	LW
Limit Switch	LS
Linear Feet	LF
Linear, Lineal	LIN
Lintel	LNTL
Liquid	LIQ
Liquefied Petroleum Gas	LPG
Live Load	LL
Loading	LDG
Loading Relay	LDR
Local Panel	LP
Local Remote	LR
Locate	LCT
Locked	LKD
Locknut	LKNT
Lockout Stop Push Button	LOS
Lock Washer	LK WASH
Longitudinal	LONG
Long Radius	LR
Louver	LVR
Louvered Door	LVD
Lower Explosive Limit	LEL
Low Point	LPT

Term	Abbreviation
Low-Water Line	LWL
Lumber	LBR
Machine	MACH
Machine Bolt	MB
Magnetic Control Coil	MCC
Maintenance	MAINT
Male Pipe Thread	MPT
Malleable	MALL
Malleable Iron	MI
Manhole	MH
Manhole Cover	MC
Manual Auto	MA
Manufacture	MFR
Manufactured	MFD
Manufacturer	MFR
Manufacturing	MFG
Masonry	MSNRY
Masonry Opening	MO
Master Switch	MSW
Material	MATL
Material List	ML
Maximum	MAX
Maximum Capacity	MAX CAP
Maximum Water Surface	MWS
Mean High Water	MHW
Mean Higher High Water	MHHW
Mean Low Water	MLW
Mean Lower Low Water	MLLW
Mean Sea Level	MSL
Measure	MEAS
Mechanical	MECH
Mechanical Mounting Panel	MMP
Mechanical Joint	MJ
Mechanism	MECH
Mercury Vapor	MERC
Median	MDN
Medium	MED
Membrane	MEMB
Membrane Waterproofing	MWP
Meridian	MER
Metal Casement Window	MCW
Metal Door	METD

Term	Abbreviation
Metal Floor Decking	MFD
Metal Furring	MTFR
Metallic	MTLC
Metallurgical	MET
Metal Roof Decking	MRD
Metal Threshold	MTHR
Meter (instrument)	MTR
Meters	M
Metering	MTR
Methylene Blue Active Substances	MBAS
Metal Halide	MHD
Middle	MID
Miles Per Hour	MPH
Millimeter	MM
Million Gallons per Day	MGD
Mill Type Steel Pipe	MTS
Millwork	MWK
Minimum	MIN
Minute	MIN
Miscellaneous	MISC
Mixed Liquor	ML
Modify	MOD
Modular	MOD
Modulate-Close	MC
Modulate/Demodulate	MODEM
Moisture	MSTRE
Molding	MLDG
Monument	MON
Motor Control Center	MCC
Motor Starter	MS
Motor Starter Panel	MSP
Mounted	MTD
Mounting	MTG
Mullion	MULL
Multiplexer	MUX
Nailable	NL
Nameplate	NPL
National	NATL
National Coarse (thread)	NC
National Electrical Code	NEC
National Electrical Code Standards	NECS
National Extra Fine (thread)	NEF

Term	Abbreviation
National Fine (thread)	NF
National Geodetic Vertical Datum 1929	NGVD 29
National Pipe Thread	NPT
National Wire Gauge	NWG
Natural	NAT
Near Face	NF
Near Side	NS
Necessary	NEC
Neutral	NEUT
Night Light	NL
Nipple	NIP
No. 1 Water, Potable	1-W
No. 2 Water, Chlorinated Effluent	2-W
Noise Reduction	NR
Noise Reduction Coefficient	NRC
Non-Automatic	NA
Non Destructive Testing	NDT
Nonreinforced-Concrete Pipe	NRCP
Normal	NORM
Normally Closed	NC
Normally Open	NO
North American Vertical Datum 1988	NAVD 88
Northbound	NB
Not Applicable	NA
Not in Contract	NIC
Not to Scale	NTS
November	NOV
Number	NO
October	OCT
Ohmmeter	OHM
Oil Circuit Breaker	OCB
Oil Circuit Re-closer	OCR
Oil Mat	OM
On Center	OC
On-Off-Auto	OOA
One-Pole	SP
Open-Close (D)	OC
Open-Close-Auto	OCA
Open-Close-Open	OCO
Opening	OPNG
Open Site Drain	OSD

Term	Abbreviation
Open-Stop-Close	OSC
Operate	OPR
Operation	OPN
Opposite	OPP
Opposite Hand	OPH
Opposite Surface	OPS
Optional	OPTL
Original	ORIG
Outlet	OUT
Output	OUT
Outside Circumference	OC
Outside Diameter	OD
Outside Face	OF
Outside Radius	OR
Out to Out	O to O
Oval Head Machine Screw	OHMS
Oval Head Wood Screw	OHWS
Overcrossing	O-XING
Overcurrent	OC
Overcurrent Relay	OCR
Overflow	OVFL
Overhead	OH
Overhead Loading	OHL
Overload	OVLD
Overload Relay	ORLY
Oxygen	OXY
Package	PKG
Painted	PTD
Paper Towel Dispenser	PTD
Paper Towel Receptor	PTR
Parallel	PRL
Parking	PK
Partial	PART
Particle Board	PBD
Partition	PTN
Pascal	PA
Paving	PV
Pavement	PVMT
Pedestal	PED
Pedestrian	PED
Pedestrian Overhead Walkway	OHL
Penetrate	PEN

Term	Abbreviation
Penetration	PEN
Penny Nail (size)	D
Percent	PCT
Perforate	PERF
Performance Evaluation and Review Technique	PERT
Perimeter	PERI
Permanent	PERM
Perpendicular	PERP
Photocell	PC
Pig Catch Point	PCP
Pilaster	P
Piling	PLG
Pillar	PLR
Pipe Hanger	PH
Pipeline	PPLN
Pipe Sleeve	PSL
Pipe Tap	PT
Piping	PP
Pivot Point	PP
Plain End	PE
Plan View	PV
Plans, Specifications and Estimates	PS&E
Plant Waste	PW
Plaster	PLAS
Plastic	PLSTC
Plastic Laminate	PLAM
Plate Steel	PL
Platform	PLATF
Plug Mold	PM
Plug Valve	PV
Plumbing	PLMB
Plunger	PLGR
Plywood	PLYWD
Pneumatic	PNEU
Point	PT
Point of Compound Curve	PCC
Point of Curvature	PC
Point of Intersection	PI
Point of Reverse Curve	PRC
Point of Tangency	PT
Point on Horizontal Curve	POC
Point on Tangent	POT
Point on Vertical Curve	PVC
Polypropylene Lined	PPL
Polyvinyl Chloride	PVC
Porcelain Enamel	PE
Portable	PORT
Portland Cement Concrete	PCC
Position	POSN
Post-Tensioned Concrete	PSC
Potable Water	POTW
Potential	POT
Potential Switch	PSW
Potential Transformer	PT
Pound	LB
Pound Per Cubic Foot	LB/FT^3; PCF
Pound Per Horsepower	LB/HP; PHP
Pounds Per Square Foot	PSF; LBS/FT^2
Pounds Per Square Inch	PSI; LBS/IN^2
Pounds Per Square Inch (Gauge)	PSIG
Power Amplifier	PA
Power and Lighting	P&L
Power and Lighting Distribution	P&L DISTR
Power Circuit Breaker	PCB
Power Factor	PF
Powerhouse	PWRH
Power Pole	PP
Power Takeoff	PTO
Precast	PC
Prefabricated	PREFAB
Preferred	PFD
Prefinished	PFN
Preliminary	PRELIM
Premolded Joint Filler	P J F
Preparation	PREP
Prepare	PREP
Pressure	PRES
Pressure Gauge	PG
Pressure-Reducing Valve	PRV
Pressure Relief Valve	PRFV
Pressure Switch	PS
Prestressed	PS
Prestressed Concrete	PSC

Term	Abbreviation
Prestressed Concrete Pipe	PCP
Primary	PRIM
Primary Sludge	P/S
Priority	PRI
Problem	PROB
Procedure	PROC
Process and Instrumentation Diagram	P&ID
Product	PROD
Profile	PF
Project	PROJ
Projection	PJTN
Property	PROP
Property Line	PL
Public Address	PA
Puget Sound Power and Light	PSP&L
Pull Box	PB
Pulse Duration	PD
Pulse Frequency	PF
Pump Discharge	PDISCH
Pump Station	PS
Pump Suction	PMPSCT
Push Button	PB
Push-Button Station	PB STA
Push Button Switch	PB
Push-on-Joint	PO
Quadrant	QUAD
Quality	QUAL
Quantity	QTY
Radial	RDL
Radius	R; RAD
Radiographic Testing	RT
Railroad	RR
Railway	RY
Rain Leader	RL
Rapid Access Device	RAD
Rating	RTG
Receiver	RCVR
Receptacle	RCPT
Recess	REC
Recirculate	RECIRC
Recommend	RECM
Recorder	RCDR

Term	Abbreviation
Rectangle	RECT
Rectangular	RECT
Rectifier	RECT
Reduced Voltage Non-Reversing	RVNR
Reduced Voltage Reversing	RVR
Reducer	RDCR
Redwood	RDW
Reference	REF
Reference Line	REFL
Refrigerator	REFR
Regenerate Solution	RGS
Regenerate Carbon	RGC
Regulator	REG
Reinforce	REINF
Reinforced Concrete	RC
Reinforced Concrete Box	RCB
Reinforced Concrete Culvert Pipe	RCCP
Reinforced Concrete Pipe	RCP
Reinforcing Steel	RST
Relocated	RELOC
Remote	RMT
Remote Control	RC
Remote Panel	RP
Remote Multiplexing Module	RM
Remote Multiplexer	RM
Removable Cover	REM COV
Remove	RMV
Remove and Replace	R&R
Replace	REPL
Reproduce	REPRO
Required	REQD
Reservoir	RSVR
Resilient	RESIL
Resistor	RES
Retaining	RTNG
Retaining Wall	RET WALL
Return	RTN
Return Activated Sludge	RAS
Return Air	RA
Reverse	REV
Revise	REV
Revision	REV

Term	Abbreviation
Revolutions per Minute	RPM
Right Angle	RTANG
Right Bank	RBK
Right Hand	RH
Right-Hand Drive	RH DR
Right-of-Way	R/W
Right Regular Lay	RRL
Rigid Steel	RS
Rigid Galvanized Steel	RGS
Rigid Galvanized Steel PVC Coated	RGSP
Roadway	RDWY
Rod Hole	RH
Roller Bearing	RLR BRG
Roof Drain	RD
Roof Hatch	RFH
Roofing	RFG
Roof Vent	RV
Root Mean Square	RMS
Rotate	ROT
Rough	RGH
Rough Opening	RO
Round	RND
Round Head	RDH
Rubber	RBR
Rubber Base	RB
Rubber Lined Steel	RLS
Saddle	SDL
Safety Glass	SFGL
Sanitary	SAN
Sanitary Sewer	SS
Schedule	SCHED
Schematic	SCHEM
Screen	SCRN
Screwed Joint	SCR
Sea Level Rise	SLR
Sealant	SNT
Sealed	SLD
Seamless	SMLS
Seating	STG
Seconds	SEC
Secondary	SEC
Secondary Digested Sludge	SD/S

Term	Abbreviation
Section	SECT
Select	SEL
Selector	SEL
Self-Tapping	SLFTPG
Sensor	SNSR
Separate	SEP
September	SEPT
Serial	SER
Settling	SETLG
Seven Conductor	7/C
Sewage	SEW
Sewage Gas	SG
Sheathing	SHTHG
Sheet Glass	SG
Shelving	SH
Shield	SHLD
Shored	SHO
Shoring	SHO
Short Circuit Rating	SCR
Shoulder	SH; SHLD
Sidewalk	SD; SDWK
Siding	SDG
Similar	SIM
Single	SGL
Single Conductor	1/C
Single-Phase	1 PH
Single-Pole	SP
Single-Pole Double-Throw	SPDT
Single-Pole Double-Throw Switch	SPDT SW
Single-Pole Single-Throw	SPST
Single-Pole Single-Throw Switch	SPST SW
Single-Pole Switch	SP SW
Sleeve	SLV
Slower-Faster	SF
Socket Head Cap Screw	SHCS
Soil Pipe	SP
Solder	SLDR
Solenoid	SOL
Solenoid Valve	SOLV
Solid Core	SC
Solids Handling System	SHS
Solvent Weld Steel	SOL

Term	Abbreviation
Soundproof	SNDPRF
Southbound	SB
Space Heater	SPH
Spacing	SPG
Speaker	SPKR
Special	SPCL
Special Provisions	SPEC PROV
Specification	SPEC
Specific Gravity	SP GR
Speed Control Unit	SCU
Spent Carbon	SPC
Spent Regenerate	SP REG
Spot-Weld	SW
Square	SQ
Square Centimeter	CM^2; SQ CM
Square Foot	FT^2; SQ FT
Square Head	SQH
Square Inch	IN^2; SQ IN
Square Root	SQRT
Square Yard	SQ YD; YD^2
Stabilize	STAB
Stabilizer	STAB
Stainless	STNLS
Stainless Steel	SST
Stairway	STWY
Standard	STD
Standard Cubic Feet per Minute	SCFM
Standby	STBY
Standoff	STDF
Standpipe	SP
Start and Stop	ST & SP
Starter	START
Starting	STG
State Route	SR
Station	STA
Stiffener	STIFF
Stirrup	STIR
Storage	STOR
Storeroom	STRM
Storm Drain	SD
Straight	STR
Strainer	STR

Term	Abbreviation
Street	ST
Strength	STR
Structural	STRL
Structure	STRUCT
Submerged	SUBMG
Substation	SUBSTA
Substitute	SUBST
Suction	SUCT
Sump Tank	SMTK
Supply	SUP
Support	SPRT
Surface	SUR
Surface Wash	SW
Survey	SURV
Suspend	SUSP
Suspension	SPNSN
Switch	SW
Switchboard	SWBD
Switchgear	SWGR
Symbol	SYM
Symmetrical	SYM
Symmetrical About	SYM ABT
Synchronize	SYNC
System	SYS
Tackboard	TKBD
Tackstrip	TKS
Tangent	T; TAN
Taper Pipe Thread	NPT
Taxiway	TWY
T-Bar (structural shape)	T
Technical	TECH
Telemetry	TLMY
Telephone	TEL
Television	TV
Temperature	TEMP
Temperature Detector Relay	TD
Temperature Switch	TSW
Tempered Glass	TG
Template	TEMPL
Temporary	TEMP
Temporary Bench Mark	TBM
Tentative	TENT

Term	Abbreviation
Terminal	TERM
Terminal Board	TB
Terminal Junction Box	TJB
Termination	TERMN
Tertiary	TER
Test Hole	TH
Test-Off-Auto	TOA
Test Switch	TSW
Thermometer	THERM
Thermostat	THERMO
Thickness	TH
Thousand	M
Thousand (feet) Board Measure	MBM
Thousand Pounds	KIP
Thread	THD
Thread Both Ends	TBE
Thread One End	TOE
Three-Conductor	3/C
Three-Phase	3PH
Three-Pole	3P
Three-Pole Double-Throw	3PDT
Three-Pole Single-Throw	3PST
Three-Way	3WAY
Three-Wire	3W
Threshold	THR
Through	THRU
Thrust Block	TB
Thrust Tie	TT
Timber	TMBR
Time Clock	TC
Time Delay	TD
Time-Delay Closing	TDC
Time-Delay Opening	TDO
Time Delay Relay	TDR
Timer Relay	TM
Time-Repeat Cycle	TR
Toggle	TGL
Toilet	T
Toilet Partition	TPTN
Tongue and Groove	T&G
Top and Bottom	T&B
Top Face	TF

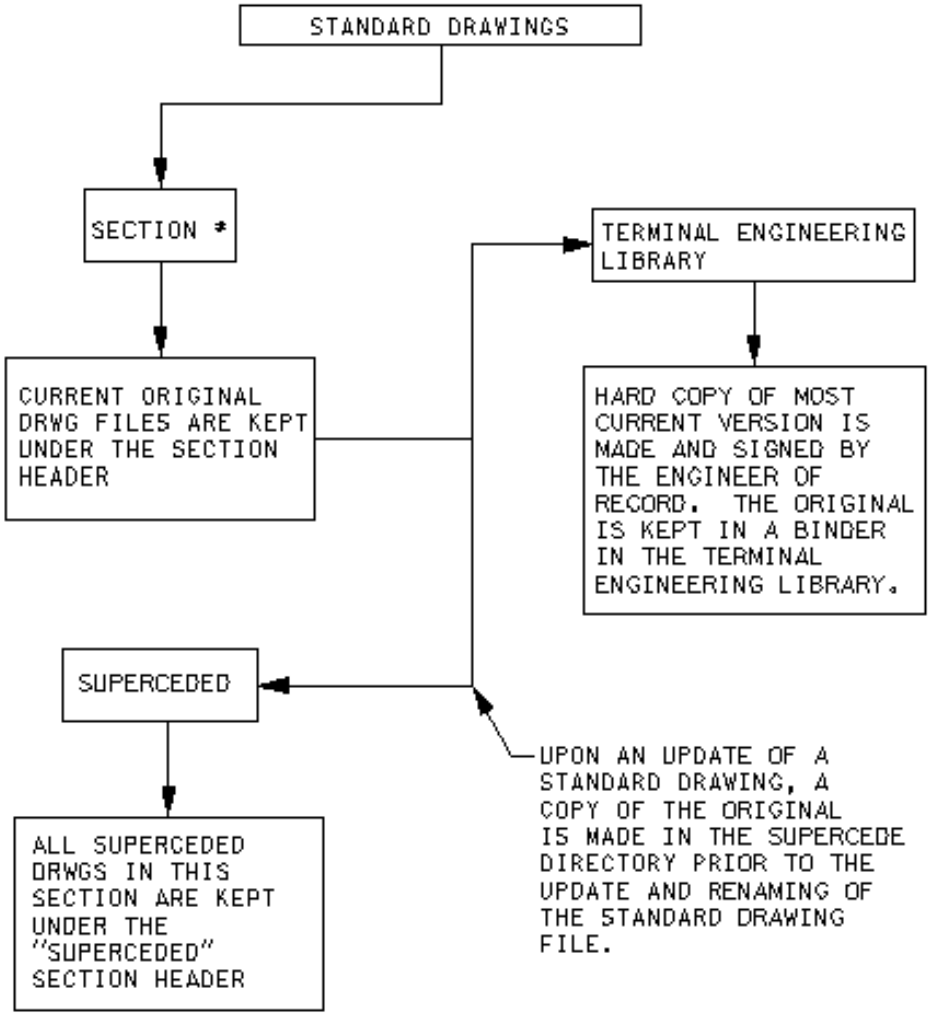
Term	Abbreviation
Top of Concrete	TOC
Top of Curb	TOC
Top of Slab	TOS
Top of Steel	TOS
Top of Wall	TOW
Topping	TOPG
Total Chlorine Residual	TCL2
Total Load	TLLD
Total Organic Carbon	TOC
Total Oxygen Demand	TOD
Towel Bar	TB
Township	T
Traffic	TRFC
Transducer	XDCR
Transformer	XFMR
Transition	TRANS
Transition Coupling	TC
Transmitter	XMTR
Transportation	TRANSP
Transverse	TRANS
Treated	TRTD
Treatment	TR
Tributary	TRIB
Trigonometry	TRIG
Triple-Pole	3P
Triple-Pole Double-Throw	3PDT
Triple-Pole Double-Throw Switch	3PDT SW
Triple-Pole Single-Throw	3PST
Triple-Pole Single-Throw Switch	3PST SW
Triple-Pole Switch	3P SW
Triple-Throw	3T
Tubing	TBG
Turbidity	TURB
Turning Point	TP
Twisted Shield Pair	TSP
Two-Conductor	2/C
Two-Phase	2PH
Two-Pole	DPDT
Two-Pole Double-Throw	DPDT
Two-Pole Single-Throw	DPST
Two-Way	2WAY
Typical	TYP

Term	Abbreviation
Tyton Joint	TJ
Ultimate	ULT
Ultrahigh Frequency	UHF
Ultrahigh Density Polyethylene	UHDP
Ultrahigh Molecular Weight Polyethylene	UHMW - PE
Ultrasonic Frequency	UF
Ultrasonic Testing	UT
Undercrossing	U-XING
Undercut	UC
Underground	UGND
Underside	US
Unfinished	UNFIN
Under Voltage Relay	UVR
Uniform	UNIF
Uniform Building Code	UBC
Unit Heater	UH
United Facilities Criteria	UFC
Universal	UNIV
Unless Otherwise Noted	UON
Vacuum	VAC
Valve Box	VB
Valve Stem	VSTEM
Vapor Barrier	VB
Vapor Proof	VAP PRF
Variable	VAR
Variable Speed	VS
Var-Hour Meter	VARHM
Velocity	VEL
Veneer	VNR
Ventilator	VENT
Vent Pipe	VP
Vent Through Roof	VTR
Vermiculite	VRM
Vertical	VERT
Vertical Curve	VC
Vertical Grain	VG
Very High Frequency	VHF
Very Low Frequency	VLF
Vibrate	VIB
Vibration	VIB
Vinyl Asbestos Tile	VAT
Vinyl Base	VB
Vinyl Fabric	VF
Vinyl Tile	VT
Vitrified Clay	V
Vitrified Clay Pipe	VCP
Vitrified Clay Tile	VCT
V-Jointed	VJ
V-Joint	VJ
Volatile Hydrocarbons	VHC
Voltage	V
Voltage Regulator	VR
Voltage Relay	VRLY
Voltmeter	VM
Volume	V; VOL
Wainscot	WAS
Wallboard	WLB
Wall Hung	WH
Wall to Wall	W/W
Wall Vent	WV
Warehouse	WHSE
Washer	WSHR
Waste Activated Sludge	WAS
Water Closet	WC
Water Heater	WH
Water Line	WL
Water Meter	WM
Waterproof	WTRPRF
Water Pump	WP
Water Repellent	WR
Water Seal Booster	WSB
Waterstop	WS
Water Surface	WS
Watertight	WTRTT
Watt-hour	WH
Watt-hour Meter	WHM
Watt-hour Demand Meter	WHDM
Wattmeter	WM
Weathering Sheet Steel	W
Weatherproof (insul.)	WP
Weight	WT
Welded Steel	WS
Welded Wire Fabric	WWF
Welded Wire Rope	WWR

Term	Abbreviation
Wheel Bumper	WHB
Wide Flange (beam)	W
Winding	WDG
Wingwall	WW
Wire Gauge	WG
Wire Mesh	WM
Wire Mold	WM
Wireway	WW
Wiring	WRG
Without	W/O
Wood Stave	WOOD
Working Point	WP
Wrought Iron	WI
Wrought Steel	WS
Yellow	YEL

809.32 Standard Drawings

The only Standard Drawings to be included in a contract are copies of the signed originals kept in the Terminal Engineering Library. These are the only drawings that hold the Engineer of Record's signature. Hard copies of the current Standard Drawings are made directly from the Library record set and included in the final printed version of the contract plans. To ensure that WSF maintains a history of changes to all the standard drawings the following diagram is used.

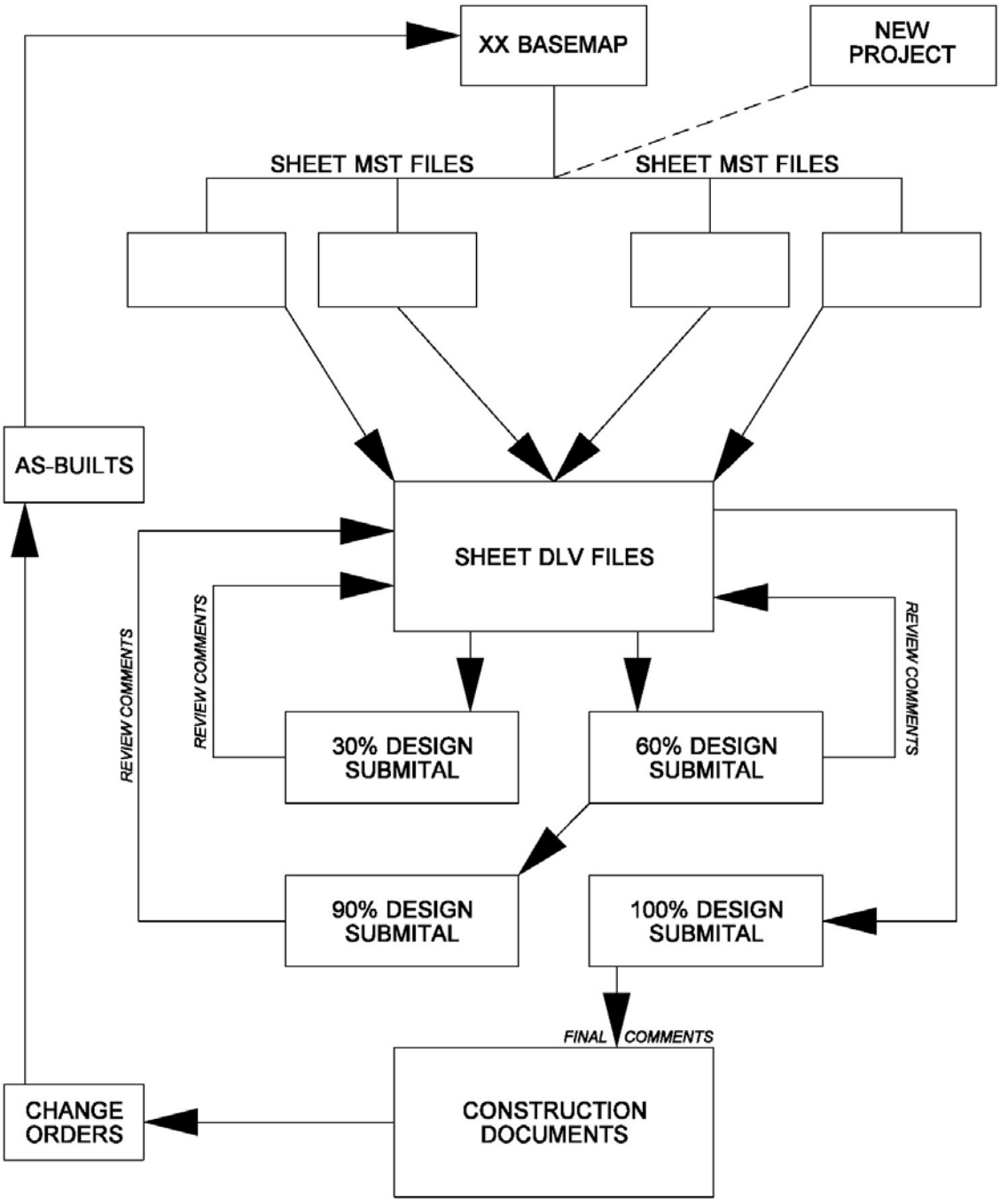


Standard Drawing Diagram
Exhibit 800-55

Under each section of standard drawings there will be found the current electronic version of the Standard Drawings within that section. Before revisions are made to the current file a copy of the deliverable (.dlv) and the master file (.mst) for the drawing is made in the "Superseded" sub-directory of the section. The new version of the Standard drawing's deliverable and master files will then be saved with a new version letter in the file name. This is done to ensure that there is a record of the existing drawing before it is overwritten with a new version. Standard Drawing Files should never be used or found in any other than the Standard Drawings directory on the WSF's Termlib server.

809.33 Updating Project Basemaps

To keep all project basemaps current, the following flow chart is used to help with the process in maintaining the basemap files. Updating project basemaps is important to reflect the current existing conditions for all new projects that will be started. As a project goes through the construction process and is completed, the CADD Lead for the project will then incorporate the changes into the project basemap. Once the project basemap is updated with the as-built information, it will then be copied to and stored as the updated basemap in the basemap directory found in the "Terminal Facilities Information" (Term_fac_Info) directory.



Project Plan Development & Updating Basemaps Flow Chart
Exhibit 800-56

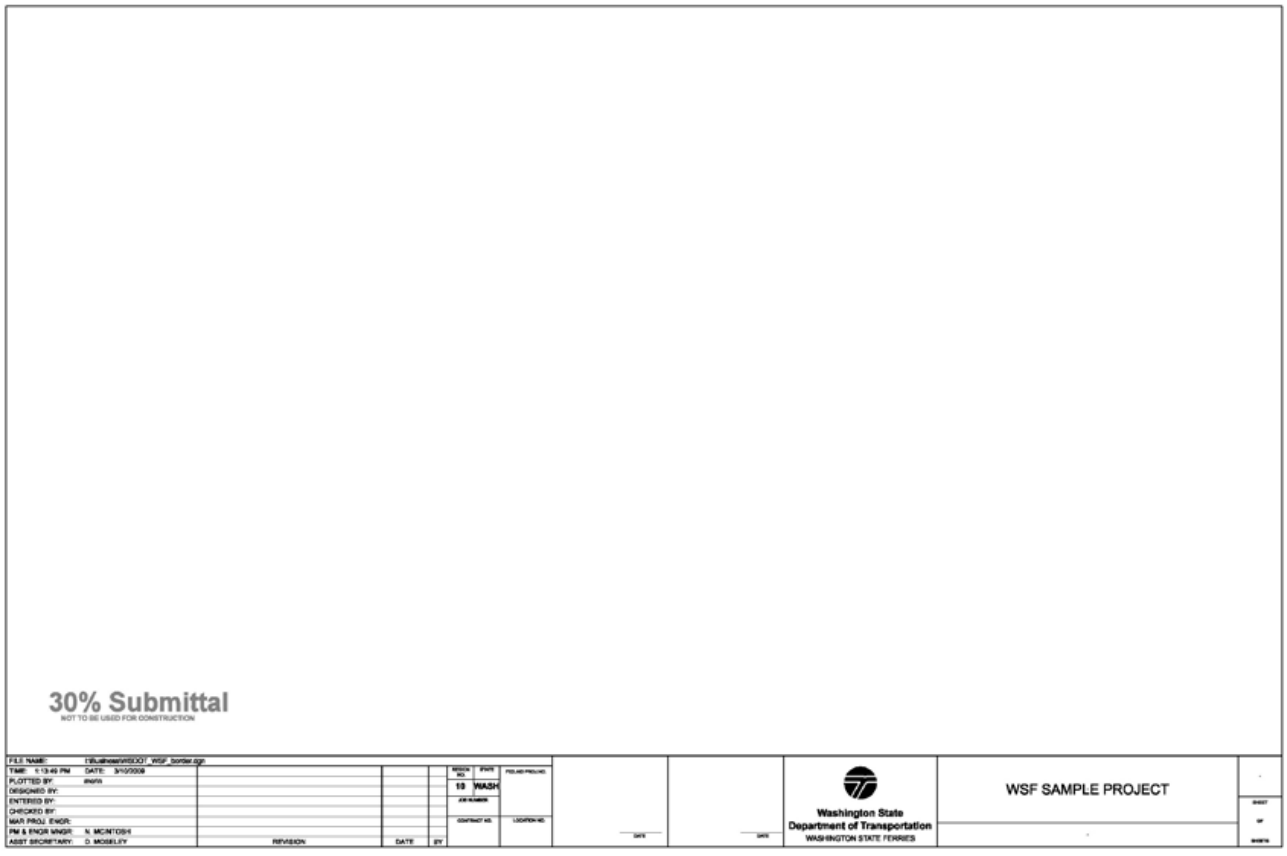
810 Plan Submittals

810.01 Submittals Scheduling

In order to effectively complete scheduled reviews, typically 30 percent, 60 percent, 90 percent and Ad Copy submittals, in a productive and cost effective manner, WSF requires that a schedule of submittal dates be submitted to the WSF CADD Manager for staff scheduling purposes. It is understood that submittals are estimated dates for completion of work, but to effectively schedule appropriate work force to complete the scheduled tasks this information is required.

There will also be included in the schedule for review and final submittals, a markup cut- off date. This date to be established by the Project Manager and CAD Manager will be the last date any work can be brought to the WSF CADD Manager. This cut-off date will allow appropriate time for work to be completed and returned to engineering staff for review and any comments that need to be addressed before submitting review or final submittals.

810.02 Submittal Border Example



Submittal Border Example
Exhibit 800-57

810.03 Review Submittals

Once the plan set has been prepared for submittal an experienced CADD operator must perform a drafting plan review. Once the plan set has been amended to incorporate changes from this review the plan set will be ready for distribution for review by WSF staff and other associated parties.

Once the plot files have successfully plotted, they are ready for PS&E archive submittal. The plan files will be copied to the folder titled with the next submittal stage. The files left in the just completed submittal folder will be compressed and left as a record to previous project submittals.

810.04 Final Submittals

Submittal of the final plan set will follow the same process as that for review submittals with the exception that; once the plans have been sealed and approved for transmittal to Olympia for Advertisement, the CADD Manager will archive the entirety of the project CADD directory to the Terminal Design archive on the U: drive.

Upon completion of the design portion of the project the design team leader shall generate a memorandum to the WSF CADD Manager. The memo shall request that a CD be created containing the contents of the project directory. A copy of this memo shall be given to the WSF Marine Project Engineer and a copy shall be placed in the project files.

The CD shall contain the entire final PS&E submittal. A copy of this CD will be archived with the Project archives kept at the home offices of Washington State Ferries Terminal Engineering.

810.05 Design File Archiving

Once the final submittal is completed and has been signed by all pertinent engineers, the files will be transferred to the U:\ drive (archive drive). After the files have been transferred it is considered a completed project and write access is restricted. A CD of the project along with any Standard drawings will be compiled and stored as a backup copy to that on the server.

810.06 As-Built Drawings

It is standard business practice for WSDOT to obtain As-built drawings at the close of the construction project. These drawings are to be continuously updated with the changes, substitutions, and as-built information that occur during the course of the project. Some As-built information will require changes be made to the WSF basemap.

CADD copies of the As-built drawings will be kept with the archived project CADD files in a folder labeled “AS-BUILTS”

G:\Term_Fac_Info\”Terminal”\Facility_Plans\”Terminal”_basemap.mst

Examples of work that require changes to the basemap are:

- Placement of new utility lines
- Construction of new on site structures
- Replacement of existing structures with more current technology
- Relocation of existing elements

(See Section 809.33 for information on updating the project basemap.)

811 Environmental Permit Standards

811.01 Permit Drawing Checklist

There are two different types of drawings required for permit applications: Joint Aquatic Resource Permits Application (JARPA) drawings and Substantial Shoreline Development drawings. JARPA drawings are submitted to the U.S. Army Corps of Engineers (Corps), the Washington Department of Fish and Wildlife (WDFW), the Washington Department of Ecology (Ecology), National Marine Fisheries Service (NMFS), and the U.S. Fish and Wildlife Service (USFWS). These agencies have different areas of jurisdiction and different regulatory mandates. Since the JARPA is the same for these agencies, each of their specific areas of jurisdiction must be shown on the drawings.

The Shoreline drawings are sent to local jurisdictions. Many local jurisdictions have their own requirements in addition to those required for the JARPA application. Differences include: scale, drawing size, and location of neighboring properties. The JARPA drawing works for some local jurisdictions, and can provide the basis for Shoreline drawings. An Environmental Permitting staff person will supply any additional information required by the City or County you are working in.

In addition to the Guidance for Completion of Drawings found in this section, the following information will assist in the preparation of permit drawings:

- Permit drawings, dimensions, scale bars, and contour lines will be in English measurement notation.
- Show the distance from MHHW to the point of Construction closest to shore and furthest from shore. If the area is too large to show sufficient detail in the plan view show the area or distance from MHHW to the work area on one sheet. Then include an additional sheet with a closer detail of the work.
- Show the depths of the work (i.e., for a dolphin, indicate the approximate depth of that dolphin) in contour intervals of 2 feet.
- Include Datum indicators.
- Include the Section, Township, and Range numbers for the terminal location.
- A vicinity map shall be placed in an upper corner of the plan view.
- All information shall be presented in a standard border.
- All drawings shall be to scale.

811.02 Format of Drawings

The following is a list of requirements for permit drawings.

(a) Guidance for Completion of Drawings

Required Drawings
Three types of illustrations are needed to properly depict the proposed activity: Vicinity Map, Plan View, and Cross-Sectional View. Coast Guard Bridge Permit drawings must also include clearance and elevation views. Drawings to scale should be prepared using clear printing, black ink, and the fewest number of sheets possible. Include the scale. The importance of clear accurate drawings cannot be overstated. At a minimum, drawings must contain the following information; other information may be required depending on project type. If you have questions regarding completing the drawings, call the appropriate agency.

1. **Vicinity Map**

   A copy of a county or city road map, or a U.S. Geological Survey topographic map may be used. Include:

   a. North arrow.

   b. Name of water body (and river mile if appropriate).

   c. Location of the proposed activity (indicate with a circle, arrow, X, or similar symbol).

   d. Provide latitude and longitude of the site to the nearest second.

   e. Provide directions to the site – this is usually done using roads.

2. **Plan View**

   This drawing illustrates the proposed project area as if you were looking down at the site from overhead.

   a. North arrow.

   b. Name of water body and direction of water flow.

   c. Location of existing shoreline. For Shoreline permits, show 200’ landward and waterward of the shoreline. For tidal and non-tidal waters show the following:

      i. **Tidal Waters**: Show the Mean Higher High and Mean Lower Low Water Marks, and/or wetland boundaries. Indicate elevation above datum.

      ii. **Non-tidal waters**: Show the Ordinary High Water Mark or Line, Meander Line, and/or wetland boundary.

   d. Dimensions of the activity or structure and impervious surfaces, distance from property lines, and the distance it extends into the water body beyond the Mean Higher High, and Mean Low Water Mark or Line, and/or wetland boundaries, as appropriate.

e. For Corps permits, indicate the distance to Federal projects and/or navigation channels (if applicable). To ascertain, call the Corps Regulatory Branch Office at (206) 764-3495.

f. Show existing structures on subject and adjoining properties.

g. Indicate adjoining property ownership.

h. If fill material is to be placed, identify the type of material, amount of material (cubic yards), and area to be filled (acres).

i. If project involves dredging, identify the type of material, amount of material (cubic yards), area to be dredged, method of dredging, and location of disposal site. Dredging in areas shallower than -10 feet needs to be clearly identified on drawings.

j. Identify any part of the activity that has been completed.

k. Indicate types and location of aquatic, wetland, riparian and upland vegetation.

l. **The Following are not applicable on most projects—consult with the permitting department:**

   i. Erosion control measures, stabilization of disturbed areas, etc.

   ii. Utilities, including water, sanitary sewer, power and stormwater conveyance systems (e.g., bioswales).

   iii. Indicate stormwater discharge points.

   iv. Proposed landscaping where applicable (for complex landscape plans, please attach a separate drawing).

   v. Where applicable, plans for development of areas on or off site as mitigation for impacts associated with the proposal.

   vi. On all variance applications the plans shall clearly indicate where development could occur without approval of a variance, the physical features and circumstances on the property that provide a basis for the request, and the location of adjacent structures and uses.

3. **Cross-Sectional View**

   This drawing illustrates the proposed activity as if it were cut from the side and/or front. Include:

   a. Location of water lines.

   b. Tidal Waters: Show the Mean Higher High and Mean Lower Low Water Marks or Lines, and/or wetland boundary.

   c. Non-tidal waters: Show the Ordinary High Water Mark or Line, and/or wetland boundary.

   d. Water depth or tidal elevation at waterward face of project.

e. Dimensions of the activity or structure, and the distance it extends into the waterbody beyond the Mean Higher High and Mean Lower Low Water Mark or Line, and/or wetland boundaries.

f. Indicate dredge and/or fill grades as appropriate.

g. Indicate existing and proposed contours and elevations.

h. Indicate types and location of aquatic, wetland, and riparian vegetation present on site.

i. Indicate type and location of material used in construction and method of construction.

j. Indicate height of structure.

4. **Clearance and Elevation Views (Applies to Coast Guard Bridge Permits only)**

a. Vertical clearance measured from Mean Higher (tidal waters) or Ordinary High (non-tidal water).

b. Horizontal clearance between piers or pilings.

c. Bottom elevation of the waterway at the bridge.

812 General Plan Sheets

The following is a list and order of General Plan Sheets. Also included are starting numbering designations for the applicable plan sheet series.

G01.00 **PROJECT INDEX, PROJECT LOCATION AND VICINITY MAP**
(COMBINED FOR SMALL PROJECTS)

G01.00 **PROJECT LOCATION AND VICINITY MAP**
(SEPARATE FOR LARGE PROJECTS)

G01.01 **PROJECT INDEX**
(FOR PROJECTS WITH GREATER THAN 80 SHEETS THE INDEX WILL BE DONE SEPARATELY)

G02.00 **SUNDRY SITE PLANS**
Sundry Site Plans are available for use at the following terminal locations:

- Anacortes
- Bainbridge Island
- Bremerton
- Clinton
- Eagle Harbor
- Edmonds
- Fauntleroy
- Friday Harbor
- Coupeville
- Kingston
- Lopez Island
- Mukilteo
- Orcas Island
- Point Defiance
- Port Townsend
- Seattle
- Shaw Island
- Southworth
- Tahlequah
- Vashon

SQ1 **Summary of Quantities**
These sheets are generated by EBASE.

813 Civil Plan Sheet Series

The following is a list and order of General Plan Sheets. Also included are starting numbering designations for the applicable plan sheet series.

C00.00 **CIVIL INDEX SHEET**

C01.00 **CIVIL GENERAL PLAN SHEETS**
BORROW, PIT, QUARRY, STOCKPILE, WASTE SITES & RECLAMATION PLANS

C02.00 **STAGE CONSTRUCTION PLAN**

C03.00 **QUANTITY TABULATION SHEETS**

C04.00 **ALIGNMENT/RIGHT – OF – WAY/PAVING & GRADING PLAN SHEETS**
INCLUDES THE FOLLOWING SHEETS AND GENERAL ORDER:

C04.00	**MONUMENTATION**
C04.10	**ALIGNMENT**
C04.20	**SITE PREPARATION**
C04.30	**ROADWAY PROFILES**
C04.40	**GRADING PLANS**
X04.50	**ROADWAY SECTIONS**

C05.00 **SITE PREPARATION PLANS (IF ADDITIONAL NEEDED)**
EXISTING TOPOGRAPHY, AND REMOVAL AND DEMOLITION WORK CAN BE SHOWN ON THE ALIGNMENT PLANS, BUT EXCESS DETAILS SHOULD BE SHOWN IN THIS SECTION.

C06.00 **EXISTING UTILITIES**

C07.00 **DRAINAGE PLANS/TESC PLANS**
INCLUDES THE FOLLOWING SHEETS AND GENERAL ORDER:
a. **DRAINAGE STRUCTURE NOTES**
b. **DRAINAGE DETAILS**

C08.00 **UTILITY DETAILS**
(ONLY IF THE CONTRACTOR WILL DO WORK ON EXISTING UTILITIES)

C09.00 **IRRIGATION & LANDSCAPE**
a. **IRRIGATION STRUCTURE NOTES**
b. **IRRIGATION PLANS**
c. **IRRIGATION DETAILS**
d. **LANDSCAPE & WETLANDS**

C10.00 **PAVING PLANS & PAVING DETAILS**

C11.00 **PAVEMENT MARKING PLANS & PAVEMENT MARKING DETAILS**

C12.00 **SIGNING PLANS**

C13.00 **TEMPORARY EROSION & SEDIMENT CONTROL (TESC) PLANS**

C14.00 **TRAFFIC CONTROL**

814 Structural Plan Sheet Series

S00.00	**STRUCTURAL INDEX**
S01.00-S01.10	**GENERAL**
S02.00	**SITE PLANS / DEMOLITION PLANS / DEMOLITION DETAILS**
S03.00	**PILES / PILING / SHAFT**
S04.00	**BULKHEAD / UPLAND**
S05.00	**TRESTLE**
S06.00	**BRIDGE SEAT**
S07.00	**TOWER/LIFT CYLINDER SHAFT**
S08.00	**HEADFRAME**
S09.00	**TRANSFER SPAN**
S10.00	**APRON**
S11.00	**WIGNWALL**
S12.00	**DOLPHIN**
S13.00	**TIE-UP SLIP**
S14.00	**TERMINAL BUILDING**
S15.00	**OVERHEAD LOADING**
S16.00	**RAILING**
S17.00	**UNASSIGNED**
S18.00	**UNASSIGNED**

815 Fluid Power Hydraulic Plan Sheet Series

H00.00	**TRANSFER SPAN HYDRAULIC SYSTEM INDEX**
H00.1X	**HYDRAULLIC SITE PLAN**
H01.00	**TRANSFER SPAN HYDRAULIC SYSTEM NOTES**
H02.00	**TRANSFER SPAN HYDRAULIC SYSTEM SITE PLAN**
H03.00	**TRANSFER SPAN HYDRAULIC SYSTEM DEMOLITION**
H04.00	**TRANSFER SPAN HYDRAULIC SYSTEM INSTALLATION**
H05.00	**TRANSFER SPAN HYDRAULIC SYSTEM DETAILS**
H06.00	**OVERHEAD LOADING HYDRAULIC SYSTEM NOTES**
H07.00	**OVERHEAD LOADING HYDRAULIC SYSTEM SITE PLAN**
H08.00	**OVERHEAD LOADING HYDRAULIC SYSTEM DEMOLITION**
H09.00	**OVERHEAD LOADING HYDRAULIC SYSTEM INSTALLATION**
H10.XX	**OVERHEAD LOADING HYDRAULIC SYSTEM DETAILS**

816 Electrical Design Drawing Series

E00.00	**ELECTRICAL SHEET INDEX**
E01.00	**ELECTRICAL SYMBOLS**
E01.01	**ELECTRICAL ABBREVIATIONS AND NOTES**
EA02.00	**ELECTRICAL SITE PLAN – DEMOLITION**
EA03.00	**ELECTRICAL SITE PLAN**
EA04.00	**ELECTRICAL SITE POWER DISTRIBUTION ONELINE – DEMOLITION**
EA05.00	**ELECTRICAL SITE POWER DISTRIBUTION ONELINE**
EA10.00	**ELECTRICAL SITE TIE-UP SLIP– DEMOLITION**
EA11.00	**ELECTRICAL SITE TIE-UP SLIP**
EA14.00	**ELECTRICAL SITE ELECTRICAL DETAILS**
EA15.00	**ELECTRICAL PANEL SCHEDULES**
EA16.00	**ELECTRICAL SITE LIGHTING FIXTURE SCHEDULE**
EA16.01	**ELECTRICAL SITE LIGHTING PLAN**
EA17.00	**ELECTRICAL SITE SCHEMATICS**
EA18.00	**ELECTRICAL SITE CONDUIT AND WIRE SCHEDULE**
EA19.00	**ELECTRICAL SITE UNASSIGNED**
EA20.00	**ELECTRICAL SITE UNASSIGNED**
EA40.00	**ELECTRICAL SITE COMMUNICATION PLANS – DEMOLITION**
EA41.00	**ELECTRICAL SITE COMMUNICATION PLANS**
EA42.00	**ELECTRICAL SITE COMMUNICATION SITE BLOCK DIAGRAM – DEMOLITION**
	ELECTRICAL SITE COMMUNICATION ONELINE - DEMOLITION
EA43.00	**ELECTRICAL SITE COMMUNICATION SITE BLOCK DIAGRAM**
	ELECTRICAL SITE COMMUNICATION ONELINE
EB08.00	**BUILDING ELECTRICAL PLAN – DEMOLITION**
EB09.00	**BUILDING ELECTRICAL PLAN**
EB14.00	**BUILDING ELECTRICAL DETAILS**
EB15.00	**BUILDING PANEL SCHEDULES**
EB16.00	**BUILDING LIGHTING FIXTURE SCHEDULE**

EB16.01	**BUILDING LIGHTING PLAN**
EB17.00	**BUILDING SCHEMATICS**
EB18.00	**BUILDING CONDUIT AND CABLE SCHEDULE**
EB19.00	**BUILDING UNASSIGNED**
EB20.00	**BUILDING UNASSIGNED**
EB40.00	**BUILDING COMMUNICATION PLANS – DEMOLITION**
EB41.00	**BUILDING COMMUNICATION PLANS**
EB42.00	**BUILDING COMMUNICATION SITE BLOCK DIAGRAM – DEMOLITION**
	BUILDING COMMUNICATION ONELINE - DEMOLITION
EB43.00	**BUILDING COMMUNICATION SITE BLOCK DIAGRAM**
	BUILDING COMMUNICATION ONELINE
EB44.00	**BUILDING UNASSIGNED**
EB45.00	**BUILDING FIRE SYSTEM ONELINE**
EB46.00	**BUILDING FIRE SYSTEM PLANS**
EC04.00	**VEHICLE TRANSFER SPAN POWER DISTRIBUTION ONELINE – DEMOLITION**
EC05.00	**VEHICLE TRANSFER SPAN POWER DISTRIBUTION ONELINE**
EC06.00	**VEHICLE TRANSFER SPAN ELECTRICAL PLAN – DEMOLITION**
EC07.00	**VEHICLE TRANSFER SPAN ELECTRICAL PLAN**
EC14.00	**VEHICLE TRANSFER SPAN ELECTRICAL DETAILS**
EC15.00	**VEHICLE TRANSFER SPAN PANEL SCHEDULES**
EC16.00	**VEHICLE TRANSFER SPAN LIGHTING FIXTURE SCHEDULE**
EC16.01	**VEHICLE TRANSFER SPAN LIGHTING PLAN**
EC17.00	**VEHICLE TRANSFER SPAN SCHEMATICS**
EC18.00	**VEHICLE TRANSFER SPAN CONDUIT AND WIRE SCHEDULE**
EC19.00	**VEHICLE TRANSFER SPAN UNASSIGNED**
EC20.00	**VEHICLE TRANSFER SPAN UNASSIGNED**
EC21.00	**VEHICLE TRANSFER SPAN BLOCK DIAGRAM**
EC22.00	**VEHICLE TRANSFER SPAN PLC CABINET**
EC23.00	**VEHICLE TRANSFER SPAN BRIDGE CONTROL STATION (1PBS)**

EC24.00	**VEHICLE TRANSFER SPAN BRIDGE CONTROL STATION (2PBS)**
EC25.00	**VEHICLE TRANSFER SPAN ATTENDANT'S CONTROL STATION (3PBS)**
EC26.00	**VEHICLE TRANSFER SPAN LINE CONTROL CABINET**
EC27.00	**VEHICLE TRANSFER SPAN RELAY CONTROL CABINET**
EC28.00	**VEHICLE TRANSFER SPAN HYDRAULIC POWER UNIT (HPU) ELECTRICAL**
EC29.00	**VEHICLE TRANSFER SPAN MOTOR CONTROL PANEL**
EC30.00	**VEHICLE TRANSFER SPAN UNASSIGNED**
ED12.00	**OVERHEAD LOADING ELECTRICAL PLAN – DEMOLITION**
ED13.00	**OVERHEAD LOADING ELECTRICAL PLAN**
ED14.00	**OVERHEAD LOADING ELECTRICAL DETAILS**
ED15.00	**OVERHEAD LOADING PANEL SCHEDULES**
ED16.00	**OVERHEAD LOADING LIGHTING FIXTURE SCHEDULE**
ED16.01	**OVERHEAD LOADING LIGHTING PLAN**
ED17.00	**OVERHEAD LOADING SCHEMATICS**
ED18.00	**OVERHEAD LOADING CONDUIT AND WIRE SCHEDULE**
ED19.00	**OVERHEAD LOADING UNASSIGNED**
ED20.00	**OVERHEAD LOADING UNASSIGNED**
ED31.00	**OVERHEAD LOADING BLOCK DIAGRAM**
ED32.00	**OVERHEAD LOADING PLC CABINET**
ED33.00	**OVERHEAD LOADING OPERATOR'S CONTROL STATION**
ED34.00	**OVERHEAD LOADING UNASSIGNED**
ED35.00	**OVERHEAD LOADING UNASSIGNED**
ED36.00	**OVERHEAD LOADING LINE CONTROL CABINET**
ED37.00	**OVERHEAD LOADING RELAY CONTROL CABINET**
ED38.00	**OVERHEAD LOADING HYDRAULIC POWER UNIT (HPU) ELECTRICAL**
ED39.00	**OVERHEAD LOADING MOTOR CONTROL**

817 Mechanical Design Drawing Series

M00.00	**MECHANICAL INDEX**
M00.1X	**MECHANICAL NOTES**
M02.00	**MECHANICAL SITE PLAN**
M03.00	**CABLE HOIST & COUNTERWEIGHT SYSTEM STANDARD DRAWING LIST**
M03.XX	**CABLE HOIST & COUNTERWEIGHT SYSTEM ASSEMBLY AND DETAILS**
M04.00	**TIE-UP SLIP – GANGWAY HOIST SYSTEM ASSEMBLY AND DETAILS**
M05.00	**OVERHEAD PASSENGER LOADING ASSEMBLY AND DETAILS**
M06.00	**WATER / SEWER LINE SITE PLAN**
M06.01	**WATER / SEWER LINE DEMO**
M07.00	**MAIN SLIP – WATER / SEWER LINE**
M08.00	**AUX. SLIP – WATER / SEWER LINE**
M09.00	**TIE-UP SLIP – WATER / SEWER LINE**

Appendices

Appendix A	Acronyms and Abbreviations	A-1
Appendix B	Definitions	B-1
Appendix C	Comment Review Form	C-1
Appendix D	Quality Audit Sign-Off Sheet	D-1
Appendix E	Quality Control Color Code	E-1
Appendix F	Project Management Plan	F-1
Appendix G	Checking Process Flow Chart	G-1
Appendix H	DQC Sign-Off Sheet	H-1
Appendix I	Deliverables Expectation Matrices	I-1
Appendix J	Project Status Report	J-1
Appendix K	PS&E Turn-In QA/QC Process	K-1
Appendix L	Review Checklist Templates	L-1
Appendix M	Step-by-Step Instructions on Submitting Plans for Advertisement	M-1
Appendix N	Environmental Compliance Plan	N-1
Appendix O	Vessel Data for Terminal Design	O-1
Appendix P	Route Information	P-1
Appendix Q	Terminal Reference Data	Q-1
Appendix R	Terminal Site Plans	R-1
Appendix S	Terminal Building Programs	S-1
Appendix T	Terminal Signage Plan	T-1
Appendix U	Design/Project Development Approval Templates	U-1
Appendix V	Memorandum of Understanding Arts in Public Places Washington Arts Commission and Washington State Department of Transportation	V-1
Appendix W	Trestle Pavement Depths	W-1
Appendix X	Terminal Tidal Information	X-1
Appendix Y	Vacant	Y-1
Appendix Z	Terminal Vertical Datums	Z-1
Appendix AA	Vehicle Transfer Span Gradients	AA-1

Appendix A Acronyms and Abbreviations

AASHTO	American Association Of State Highway And Transportation Officials
ACI	American Concrete Institute
ACP	Asphaltic Concrete Pavement
ACZA	Ammoniacal Copper Zinc Arsenate
ADA	Americans With Disabilities Act
ADO	Average Daily Openings
ADT	Average Daily Traffic
ADTT	Average Daily Truck Traffic
AHJ	Authorities Having Jurisdiction
AIPP	Art in Public Places
ANSI	American National Standards Institute
APS	Accessible Pedestrian Signal
ASCE	American Society of Civil Engineers
ASDE	Assistant State Design Engineer
ASME	American Society of Mechanical Engineers
ASTM	American Society For Testing And Materials
ATM	Automated Teller Machine
AWS	American Welding Society
B/C	Benefit Cost
BDM	Bridge Design Manual
BF	Ballast Factor
BMP	Best Management Practice
CBP	Customs Border Patrol
CCTV	Closed Circuit Television
CDF	Control Density Fill
CE	Categorical Exclusion
CEVP	Cost Estimate Validation Process
CFM	Cubic Feet Per Minute

CFR	Code of Federal Regulations
CLSM	Controlled Low-Strength Material
CR1	Commuter Route Type 1
CR2	Commuter Route Type 2
CRF	Comment Review Form
CSO	Company Security Officer
CW	Counter Weight
DBE	Disadvantaged Business Enterprise
DC	Direct Current
DCE	Documented Categorical Exclusion
DDM	Design Decisions Memorandum
DDP	Design Documentation Package
DDS	Design Decision Summary
DE	Design Earthquake
DHS	Department of Homeland Security
DL	Dead Load
DIA	Diameter
DL	Dead Load
DLE	Design Level Earthquake
DM	Design Manual
DOS	Declaration of Security
DOT	Department of Transportation
DNR	Department of Natural Resources
DNS	Determination of Significance
DS	Determination of Non-significance
DQC	Document Quality Control
DVI	Design Variance Inventory
DVIS	Design Variance Inventory System
DWG	Drawing

EA	Each, Environmental Assessment
ECS	Environmental Classification Summary
EFC	Electronic Fare Collection
EFS	Electronic Fare System, Exterior Finish System
EIBC	Existing International Building Code
EIA	Electronic Industries Alliance
EIS	Environmental Impact Statement
EL	Elevation
EMS	Electronic Message Signs
EPA	Environmental Protection Agency
ERS	Environmental Review Summary
ESA	Endangered Species Act
ESHB	Engrossed State House Bill
ESM	Enterprise Security Management
EU	Evaluate Upgrade
EXIST	Existing
FAR	Ferry Advisory Radio
FHWA	Federal Highway Administration
FONSI	Finding of No Significant Impact
FPS	Feet per Second
FT	Foot
FTA	Federal Transit Administration
FTE	Full Time Equivalent
FWS	Fish and Wildlife Service
GA	General Administration
GAL	Gallons
GPM	Gallons per Minute

HAR	Highway Advisory Radio
HAZMAT	Hazardous Materials
HID	High-intensity Discharge
HMA	Hot Mix Asphalt
HORIZ	Horizontal
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
HPA	Hydraulic Project Approval
HPS	High Pressure Sodium
HPU	Hydraulic Power Unit
HRM	Highway Runoff Manual
HSAS	Homeland Security Advisory System
HQ	Headquarters
HVAC	Heating, Ventilation, and Air Conditioning
IBC	International Building Code
ID	Inside Diameter
IE	Invert Elevation
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IFC	International Fire Code
IT	Information Technology
IHA	Incidental Harassment Authorizations
IESNA	Illumination Engineering Society of North America
IMC	International Mechanical Code
ISO	International Organization for Standardization
ITS	Intelligent Transportation System
JB	Junction Box
KW	Kilowatt
KT	Knot (Nautical Mile per Hour)

LB	Pound
LCC	Line Control Cabinet
LCCM	Life Cycle Cost Model
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
LF	Linear Feet
LFD	Load Factor Design
LID	Low Impact Development
LL	Live Load
LLD	Lamp Lumen Depreciation
LRFD	Load And Resistance Factor Design
LRP	Long Range Plan
LOS	Level of Service
MAX	Maximum
MARSEC	Maritime Security
MBTA	Migratory Bird Treaty Act
MCP	Motor Control Panel
MEF	Maximum Extent Feasible
MH	Metal Halide
MHZ	Megahertz
MIL	Milimeters
MIN	Minimum, Minutes
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act
MOA	Memorandum of Agreement
MOTEMS	Marine Oil Terminal Engineering And Maintenance Standards
MOU	Memorandum of Understanding
MPH	Miles Per Hour
MTS	Manual Transfer Switch
MUTCD	Manual on Uniform Traffic Control Devices
MWBE	Minority/Women-Owned Business Enterprise

NAAQS	National Ambient Air Quality Standards
NAD	North American Vertical Datum
NAVD	North American Vertical Datum
NGVD	National Geodetic Vertical Datum
NEC	National Electric Code
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NGS	National Geodetic Survey
NHS	National Highway System
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOX	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NPT	National Pipe Thread
NPV	Net Present Value
NTDE	National Tidal Datum Epoch
NTS	Not To Scale
O&M	Operations and Maintenance
OD	Outside Diameter
OFM	Office of Financial Management
OHL	Overhead Loading
OLE	Operational Level Earthquake
OSHA	Occupational Safety and Health Administration
PA	Public Address
PAR	Pedestrian Access Route
PC	Personal Computer
PCB	Polychlorinated Biphenyl
PCCP	Portland Cement Concrete Pavement
PCF	Pounds Per Cubic Foot, Project Considerations Form
PCRF	Project Change Request Form
PD	Project Definition
PE	Polyethylene

PF	Project File
PFD	Personal Floatation Device
PIF	Project Impacts Form
PLC	Programmable Logic Controller
PO	Passenger Only
PPM	Plans Preparation Manual
PSCAA	Puget Sound Clean Air Agency
PSE	Puget Sound Energy
PSF	Pounds per Square Foot
PSI	Pounds per Square Inch
PTZ	Pan Tilt Zoom
PVC	Polyvinyl Chloride
PVDF	Polyvinylidene Fluoride
QA	Quality Assurance
QC	Quality Control
R/W	Right of Way
RCW	Revised Code of Washington
RDCR	Reducer
ROD	Record of Decision
ROI	Return on Investment
ROW	Right of Way
RTPO	Regional Transportation Planning Organization
SBC	Seattle Building Code
SEI	Structural Engineering Institute
SEPA	[Washington] State Environmental Policy Act
SIP	State Implementation Plan
SF	Square Foot , Square Feet
SLR	Sea Level Rise
SMP	Shoreline Master Program
SMS	Safety Management System
SOV	Single Occupancy Vehicle

SPCC	Spill Prevention, Control, and Countermeasures
SQ	Square
SQ FT	Square Foot, Square Feet
SR	State Route
SSI	Sensitive Security Information
SSPC	The Society for Protective Coatings
STD	Standard
STA	Station
SWPP	Stormwater Pollution Prevention
SWPPP	Stormwater Pollution Prevention Plan
TEMP	Temporary
TESC	Temporary Erosion and Sediment Control
TIA	Telecommunications Industry Association
TIP	Transportation Improvement Program
TMDL	Total Maximum Daily Load
TRB	Transportation Research Board
TSA	Transportation Security Administration
TS&L	Type Size and Location
TWIC	Transportation Worker Identification Credential
TYP	Typical
U&A	Usual and Accustomed
UBC	Uniform Building Code
UFC	Unified Facilities Criteria
UHMW	Ultra-High Molecular Weight
UL	Underwriters Laboratories
ULL	Uniform Live Load
UPC	Uniform Plumbing Code
USC	United States Code
USCBP	United States Customs and Border Protection
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USDOT	United States Department of Transportation

VATS	Vessel and Terminal Security
VCT	Vinyl Composite Tile
VE	Value Engineering
VERT	Vertical
VMS	Variable Message Sign
VOC	Volatile Organic Compound
VPHPT	Vehicles per Hour per Toll Booth
VTS	Vehicle Transfer Span
WAC	Washington Administrative Code
WB-50	Wheelbase 50
WDFW	Washington Department of Fish and Wildlife
WISHA	Washington Industrial Safety and Health Act
WSDOT	Washington State Department of Transportation
WSF	Washington State Ferries
WSP	Washington State Patrol
WZTCP	Work Zone Traffic Control Plan

Appendix B Definitions

A

A/E	Architect-Engineer Firm.
A/E/C	Architect, Engineer and Construction
accelerated bridge construction	A type of project delivery in which pre-fabricated structural elements are constructed offsite and delivered to the project site for installation. Offsite construction allows for greater productivity, efficiency, and quality control than infield construction, thereby reducing overall construction time and cost.
accessible	Usable by persons with disabilities (ADA compliant).
accessible pedestrian signal (APS)	A device that communicates information about the "WALK" phase in audible and vibrotactile (vibrating surface that communicates information through touch, located on the accessible pedestrian signal button) formats.
accessible route	See pedestrian access route.
ADA	An abbreviation for the Americans with Disabilities Act of 1990. The ADA is a civil rights law that identifies and prohibits discrimination based on disability. Title II of the ADA requires public entities to design new pedestrian facilities or alter existing pedestrian facilities to be accessible to and usable by people with disabilities.
adjustment (ramp)	The action of raising or lowering the unhinged end of an apron or ramp in accordance with water level and vessel freeboard variations.
alteration	A change to a facility in the public right of way that affects or could affect access, circulation, or use. Alterations include, but are not limited to, renovation; rehabilitation; reconstruction; historic restoration; resurfacing of circulation paths or vehicular ways; or changes or rearrangement of structural parts or elements of a facility. Alterations do not include: • Spot pavement repair • Liquid-asphalt sealing, chip seal (bituminous surface treatment), or crack sealing • Lane restriping that does not alter the usability of the shoulder
alternate pedestrian access route	A temporary accessible route to be used when the existing pedestrian access route is blocked by construction, alteration, maintenance, or other temporary condition(s).

application	Software designed to meet specific software needs and perform specific tasks, unlike system software, which runs other software.
approach zone	An area within the toll plaza area immediately upstream of the queue area. This area typically beings where the roadway divides into one-directional flow.
apron	The steel structure that provides an articulated transition from the end of the Transfer Span to the vessel deck. Aprons are classified by framing system (stiffener plate, tube steel) and by the mechanical system by which it is raised and lowered (cable hoist, hydraulic cylinder).
apron float	With the outboard end of the apron resting on the vessel, the apron cylinders are allowed to move freely. This allows the apron to "float" or stay in contact with the vessel deck while the vessel moves in the slip. Vessel movement is caused by waves and current and by the loading and unloading operation.
apron lips	Plate flaps that are hinged on the end of the apron to provide a let-down and smooth transition onto the vessel deck from the end structure edge of the apron. Apron lips are usually reinforced plate, 20 inches long, can be segmented but combined for full width coverage.
articulated bus	A two-section bus that is permanently connected at a joint.
attendant control station	Contains the required pushbuttons and indicating lights for control of the transfer span miscellaneous systems (traffic signals, foghorn, fog light).
attribute	Descriptive or characteristic information concerning a particular graphical object or entity.
AutoCad©	A CADD software program developed by Autodesk, Inc. Registered and trademarked by Autodesk, Inc.
AutoTURN©	Computer software used for analyzing vehicle turning movements.
average daily traffic (ADT)	The total volume of vehicles during a given time period (in whole days) greater than one day and less than one year, divided by the number of days.
average daily truck traffic (ADTT)	The total volume of trucks during a given time period (in whole days) greater than one day and less than one year, divided by the number of days.

B

bail-out lane	A path immediately downstream of the toll booths that provides a means of egress from the holding area for vehicles that are required to exit due to failure to pass security measures, payment of fares, or other reasons.
basemap	2D or 3D CADD file (at 1:1 scale) that depicts the existing conditions, structures, roadways, etc. correctly located on the state plane coordinate system.
batter pile	A pile that is driven at an inclination to the vertical to provide resistance to horizontal forces.
berthing	The act of navigating a vessel into a berth for housing a vessel at the ferry trestle.
best management practices (BMPs)	A term used to refer to a type of water pollution control. Stormwater BMPs are control measures taken to mitigate changes to both quality and quantity of stormwater runoff caused by changes to land use.
bicycle access lane	A dedicated lane for bicycle traffic to access the bicycle holding area of the terminal.
bitmap	Also raster image. A digital image made up of pixels (onscreen dots).
bituminous surface treatment (BST)	Also known as a seal coat or chip seal, a BST is a thin, protective wearing surface that is applied to the pavement.
boarding	Loading of passengers onto a mode of transportation.
breadth (or beam)	The width of a vessel at its widest point.
bridge control station	Contains the required pushbuttons and indicating lights for the control of the bridge, apron, live load pins and other systems associated with the transfer span.
bridge seat	The fixed pile-supported structure upon which the shoreward end of the transfer span is supported. Bridge seats are classified by material (timber pile and cap, concrete pile and cap, steel pile and concrete cap, steel pile and steel cap). The bridge seat is typically integral with the trestle.
buffer	A space measured from the back of the curb to the edge of the sidewalk that could be treated with planting or alternate pavement, or be used for needs such as drainage treatment or utility placement.
building envelope	The physical separator between the interior and exterior environments of a building.
bulkhead	The pile-supported earth-retaining structure that supports the shoreward end of the trestle. Bulkheads are classified by material (timber, concrete, steel).
bus pullout	A bus stop with parking area designed to allow transit vehicles to stop wholly off the roadway.
bus shelter	A facility that provides seating and protection from the weather for passengers waiting for a bus.

bus stop	A place designated for transit vehicles to stop and load or unload passengers.
busiest day	The individual day with the highest total passengers for all sailings.

C

cab	The transition structure that bridges the transfer span to the apron, usually contains the operators station(s) and is the preferred structure to move up or down to adjust for vessel freeboard and tidal fluctuations.
CADD	Computer-aided design and drafting.
CAE	Computer-aided engineering.
carpool/vanpool	A group of people who share the use and cost of a car or van for transportation on a regular basis.
CD-ROM	Compact disc, read-only memory. A form of data storage that uses laser optics rather than magnetic means for reading data.
cell	A permanent association of elements that can be stored and placed as a group and then manipulated as a group of individual elements.
cell Library	A collection of cells stored together in one file. These files have a (.cel) extension. circulation The movement of pedestrian and vehicular traffic through the terminal.
clam-shelling	A pile-removal technique involving a clam-shell type dredging bucket to remove timber piles. The clam-shell bucket is operated by a crane.
clear width	The unobstructed width of a pedestrian circulation path. The clear width within a pedestrian circulation path must meet the accessibility criteria for a pedestrian access route.
commuter route	WSF route type with a large percentage of commuter traffic relative to ridership. These routes demonstrate minimal increases in traffic flow during the summer months.
construction impact zone	The area in which an alteration to an existing facility takes place (also known as the project footprint). For a paving project, this zone encompasses the paving limits and all curb lines and associated curb ramps adjacent to the paving limits.
counter slope	The slope of the gutter or roadway at the foot of a curb ramp or landing where it connects to the roadway, measured along the axis of the running slope extended.
counterweight	A mass that is secured to the cab, transfer span or apron by wire ropes or structural arms in such a way that its mass partially or fully balances the dead load of a structure (usually transfer span, cab, or apron). Counterweights are used to limit the size and power requirements of lift systems for large structures or components that are actively adjusted.
cross-hatch	A specific configuration of hatch lines used to aid in delineating graphical features.

cross slope The slope measured perpendicular to the direction of travel.

crosswalk A marked or unmarked pedestrian crossing, typically at an intersection, that connects the pedestrian access routes on opposite sides of a roadway. A crosswalk must meet accessibility criteria.

A crosswalk is also defined as:

- "…the portion of the roadway between the intersection area and a prolongation or connection of the farthest sidewalk line or in the event there are no sidewalks then between the intersection area and a line ten feet therefrom, except as modified by a marked crosswalk" (RCW 46.04.160).
- "(a) That part of a roadway at an intersection included within the connections of the lateral lines of the sidewalks on opposite sides of the highway measured from the curbs or in the absence of curbs, from the edges of the traversable roadway, and in the absence of a sidewalk on one side of the roadway, the part of the roadway included within the extension of the lateral lines of the sidewalk at right angles to the center line; (b) any portion of a roadway at an intersection or elsewhere distinctly indicated as a pedestrian crossing by lines on the surface, which might be supplemented by contrasting pavement texture, style, or color" (MUTCD, 2003; Guide for the Planning, Design, and Operation of Pedestrian Facilities, AASHTO, 2004).

curb extension A curb and sidewalk bulge or extension out into the parking lane used to decrease the length of a pedestrian crossing and increase visibility for the pedestrian and driver.

curb ramp A combined ramp and landing to accomplish a change in level at a curb. This element provides street and sidewalk access to pedestrians with mobility impairments.

curb ramp (parallel) A curb ramp design where the sidewalk slopes down to a landing at road level at road level with the running slope is in line with the direction of sidewalk travel.

curb ramp (perpendicular) A curb ramp design where the ramp path is perpendicular to the curb and meets the gutter grade break at a right angle.

D

database A collection of information organized for easy retrieval. Databases are organized into a hierarchy of files having a predetermined structure and organization that can be communicated, interpreted, or processed by a specific program.

deck The running surface or walking surface of a vessel, transfer span, apron or elevated structure. The deck is the primary contact surface between live load and the structure. It is usually required to withstand high concentrated loads and to provide friction surface for traffic.

deficiency An identifiable and currently unwanted condition that is not consistent with the original intent of the design.

departure zone	The area immediately downstream of the toll booths that transitions from the toll lanes to the holding area. This area will typically taper from multiple lanes to a single lane depending on the terminal layout.
depth	Distance from the deck level to the lowest point of the vessel.
design life	The period of time during which a structure or system is expected by its designer to work within its specified parameters (its life expectancy). The period of time over which a structure or system is required to perform safely, with an acceptable probability that it will not require replacement of significant repair during that time. Routine maintenance is assumed to be performed as required.
design speed	The speed used to determine the various geometric design features of the roadway.
design vehicle	A vehicle used to establish intersection and lane geometry.
detectable warning surface	A tactile surface feature of truncated dome material built into or applied to the walking surface to alert persons with impairments of vehicular ways. Federal yellow is the color used on WSDOT projects to achieve visual contrast. Colors other than federal yellow that meet the light-on-dark/dark-on-light requirement may be used on projects where cities have jurisdiction. (Detectable warning surfaces are detailed in the *Standard Plans*.)
deterioration	A defect that has occurred over time.
directional signs	Signage used to guide users to the terminal area, through the terminal site and buildings, and to their destinations within the terminal facilities. The main function is to increase the flow of passengers through the system.
directory	A file that contains the names of other files.
displacement	A measure of the weight of a vessel which is the weight of the water it displaces.
dock bull	A multi-use tractor type vehicle used by WSF personnel for the transportation of carts and other equipment throughout the terminal area and on the vessels. The carts are often used to tow or push broken-down passenger vehicles.
dolphin	A structure that aids the vessel while berthing, protects critical structures such as overhead loading systems, and provides a stationary structure against which the vessel moors to prevent lateral motion. Dolphins are classified by location (inner, intermediate, outer, operating slip, tie-up slip), by structure type (fixed, floating), and by material (timber, steel, concrete).
draft	Distance from the water line to the lowest point of a vessel.

drive-on passenger	A customer that intend to board the ferry vessel with a motorized vehicle. These passengers are assumed to use passenger amenities within the terminal building at certain route types, but not all.
driveway	A vehicular access point that provides access to or from a public roadway.

E

electronic fare system (EFS)	An automated, standalone device that dispenses pre-paid tickets when payment is made by a credit or debit card. These devices are only for the sale of regular priced tickets.
element	An architectural or mechanical component or design feature of a space, site, or public right of way.

F

facility	All or any portion of buildings, structures, improvements, elements, and pedestrian or vehicular routes located in a public right of way.
feature	A component of a pedestrian access route, such as a curb ramp, driveway, crosswalk, or sidewalk.
file	A group of related information.
file format	A defined digital organization and arrangement that determines how a computer file will be written and displayed on screen or in print.
fixed dolphin	A type of dolphin consisting of a cluster of timber piles (numbering from 35 to 100) or steel piles (numbering from three to 20).
flangeway gap	The gap for the train wheel at a railroad crossing. The space between the outer edge of a rail and the crossing surface.
floating dolphin	A type of dolphin consisting of a floating concrete pontoon, a fendering system, and an anchorage system made up of chains and steel or concrete anchors. Floating dolphins are typically used at locations characterized by deep water or rocky substrate.
freeboard	The vertical distance between the waterline and a particular deck of a vessel or the deck surface of a ramp or apron.
fog light	A light that is used in foggy conditions to guide the vessel into the slip.
gangway (overhead trestle) T	he fixed portion of the pedestrian walkway between the terminal building and the vessel or bulkhead

G

grade break	The intersection of two adjacent surface planes of different grade.

H

hand rail	A narrow rail for support along walking surfaces, ramps, and stairs.
headway	The time interval between two vessels departing from the same terminal on the same route.
high-occupancy vehicle (HOV)	A vehicle that meets the occupancy requirements of the facility as authorized by WAC 468-510-010.
hinge	A joint assembly situated at one end of a transfer span or apron to allow rotation during adjustment of the ramp or apron.
hinge point	A joint assembly situated at one end of a transfer span or apron to allow rotation during adjustment of the ramp or apron.
holding area	An area composed of multiple parallel lanes inside the terminal property that is designated for the queuing of vehicles prior to boarding the vessel.
holding lane	A lane either inside or outside of the terminal property that is designated for queuing vehicles either prior to purchasing tickets or boarding the vessel.
HOV Facility	A priority treatment for HOVs.
hydraulic power unit (HPU)	Packaged equipment consisting of hydraulic pumps, PLC control panel, motor control panel (MCP), control station 4PBS, panel board 1P-HPU, transformer 41T- HPU, lighting fixtures, duplex receptacles, control valves, and a hydraulic reservoir that is designed to pressurize and control a hydraulic system.
hydraulic transfer span (H-Span)	A type of movable bridge (transfer span) designed to raise and lower with hydraulic cylinders to mate with the vehicle deck of the ferries as tides change.

I

identification signs	Signage used to indicate the presence of a particular space, function, amenity, utility, or piece of equipment.
information signs	Signage that provides passengers with interactive information about WSF terminals and operations, often provided as electronic messaging signs.
inspection	A survey or assessment of the boarding facility or part(s) of it, performed for the purpose of determining its condition and/or serviceability.
intelligent transportation systems (ITS)	An integrated system of advanced sensor, computer, electronics, and communication technologies and management strategies, used to increase the safety and efficiency of the surface transportation system.

J	
JARPA	Joint Aquatic Resource Permits Application
L	
landing	A level paved area, within or at the top and bottom of a stair or ramp, designed to provide turning and maneuvering space for wheelchair users and as a resting place for pedestrians.
life cycle cost model (LCCM)	A complete inventory database of terminal structures and systems, their age, their estimated remaining service life, and their replacement cost. The model calculates when structures and systems are due for replacement and projects the annual capital investment necessary to sustain all inventory items within their useful life.
lift cylinder	A hydraulic cylinder or cylinders that are used to raise and lower a transfer span or apron to adjust for tide and vessel freeboard variations.
line style	A specific line pattern that has vector properties and is used to delineate between different graphical entities, which are represented by lines or polygons.
links	An electronic relationship between similar attributes or fields in a database.
leadership in energy and environmental design (LEED)	An internationally recognized green building certification system, providing third-party verification that a building or facility was designed and built using strategies intended to improve environmental performance.
level of service (LOS)	A qualitative measure describing operational conditions within a vehicular or pedestrian traffic stream, based on service measures such as speed, travel time, freedom to maneuver, traffic interruptions, comfort, and convenience. There are six levels of service (A-F).
loading cab	The transition structure that bridges the transfer span to the apron, usually containing the operators station(s) and is the preferred structure to move up or down to adjust for vessel freeboard and tidal fluctuations.
locking pins	Retractable pins that are used to secure the transfer span or cab to a supporting element or hanger bar and to transfer the loads to that support element.
low impact development (LID)	A land planning and engineering design approach to managing stormwater runoff which emphasizes conservation and use of on-site natural features to protect water quality.

M

maintenance building	A terminal building with the primary function of providing space for maintenance supplies, equipment and/or activities.
MARSEC Level	A three-tiered security level system developed by the United States Coast Guard to communicate with the maritime industry regarding preplanned scalable responses for threats.
maximum extent feasible	From the U.S. Department of Justice, 28 CFR Part 36.402, Alterations. The phrase "to the maximum extent feasible" applies to "the occasional case where the nature of an existing facility makes it virtually impossible to comply fully with applicable accessibility standards through a planned alteration." This phrase also refers to a stand-alone piece of design documentation that WSF uses to record its reasons for not being able to achieve full ADA compliance in alteration projects (called a Maximum Extent Feasible document).
MicroStation©	CADD software program developed by Bentley Systems, Inc., registered and trademarked by Bentley Systems, Inc.
midblock pedestrian crossing	A marked pedestrian crossing located between intersections.
minimum passenger waiting area	The minimum determined area required for any passenger waiting area in order to maintain functionality and usability of the space.
model	Describes a subset of a structure's geometry and its physical components: piers, trestles, and other components. A model has no scale (1:1); it is drawn life-size. Most structures are described by a series of two-dimensional models plans, elevations, sections, and details although the organizational concept also supports three-dimensional models. Models can be constructed hierarchically; in other words, models can contain other models.
mooring	The act of securing a vessel in a particular location as by cables and anchors or by lines.
motor control panel	See Section 810.
MS-DOS©	Microsoft Disk Operating System, a registered trademark of the Microsoft Corporation. Software that allows application programs to interact with the computer's hardware and translates the user's commands.
mudline	General term used in marine engineering to designate the elevation of the seabed or riverbed.
multimodal	A facility which provides multiple transportation options such as ferry, transit, and commuter rail, among others.

N

net passenger waiting area	The area that comprises the majority of the gross passenger waiting area. This value accounts for the amount of area required to accommodate passengers to sit and stand but does not accommodate for necessary circulation within the waiting area or queuing at the turnstiles. The main corridor upstream of the turnstiles is accounted for in this area.
nonconformity	An identified condition that does not meet minimum requirements specified in applicable codes, regulations or this Criteria.
non-graphic	Data that provide information about a graphical entity or object, but are not required for displaying or plotting the graphical entity or object.

O

origin	In coordinate geometry, the point where the x-, y-, and z-axes intersect.
overhead loading (OHL)	The system which serves as the walkway from the passenger terminal building to the vessel passenger deck for walk-on passengers. OHL systems typically consist of fixed walkways, a movable transfer span, and a mechanically actuated loading cab with aprons which provide the final transition to the vessel passenger deck. OHL systems are classified by material (timber, pile-supported steel framing, drilled shaft-supported steel framing).
overhead loading trestle (gangway)	The pedestrian walkway between the bulkhead and the terminal building.
overwater coverage	The total area of a structure that is located directly above a body of water as measured from the shoreline seaward.

P

paddle turnstile	A type of access control device using a horizontally moving arm to prevent access without use of a pre-purchased ticket. These devices are nominally 4-ft wide and have an approximate processing rate of 9 transactions per minute. Additionally, paddle turnstiles meet ADA requirements and can accommodate passengers with large carry-on items.
Paint©	A software program using pixel program (raster) images to permit electronic painting and drawing.
paratransit	An alternative mode of transit that does not follow fixed routes or schedules and typically serves individuals with disabilities and the elderly.
passenger building	A terminal building which provides services and amenities for ferry passengers prior to boarding the vessel. This building also provides WSF employee spaces.
passenger circulation	Area that is allotted to various elements within the terminal building that allows passengers to move throughout the building and access the different building elements.

passenger control point	The location within the terminal building designated as the point at which passengers are not allowed to go beyond until loading operations have begun. This location is the turnstile area for fare-collecting routes and typically a location near the transfer span at non- fare-collecting routes.
passenger loading zone	An area provided for pedestrians to board/disembark a vehicle.
passenger waiting area	An area for ferry passengers to sit and stand, both inside and outside the terminal building, when they are not actively buying tickets or retail items, or walking through the terminal. This area includes secondary circulation corridors to allow passengers to move throughout the area during times of maximum occupancy and additional area immediately upstream and downstream of the turnstiles.
path	The route consisting of drive and directory address used by the operating system to find a program or file.
pattern	A specific configuration of lines, dots, or other graphical objects used to aid in delineating graphical features.
PC	Personal computer with an Intel, or Intel-compatible, CPU. Normally contains a Pentium CPU for CADD applications.
peak sailing	The vessel sailing with the single highest passenger volume.
peak walk-on passenger sailing	The vessel sailing with the single highest count of walk-on passengers. Used for the sizing of the passenger waiting area.
pedestrian	Any person afoot or using a wheelchair (manual or motorized) or means of conveyance (other than a bicycle) propelled by human power, such as skates or a skateboard.
pedestrian access route (PAR) (same as accessible route)	A continuous, unobstructed walkway within a pedestrian circulation path that provides accessibility. Pedestrian access routes shall consist of one or more of the following pedestrian facilities: walkways/sidewalks, curb ramps (excluding flares), landings, crosswalks, pedestrian overpasses/underpasses, access ramps, elevators, and platform lifts. ***Note:*** Not all transportation facilities need to accommodate pedestrians. However, those that do accommodate pedestrians need to have an accessible route.
pedestrian circulation path	A prepared exterior or interior way of passage provided for pedestrian travel. Includes independent walkways, shared-use paths, sidewalks, and other types of pedestrian facilities. All pedestrian circulation paths are required to contain a continuous pedestrian access route that connects to all adjacent pedestrian facilities, elements, and spaces that are required to be accessible.
pedestrian facilities	Walkways such as sidewalks, walking and hiking trails, shared-use paths, pedestrian grade separations, crosswalks, and other improvements provided for the benefit of pedestrian travel. Pedestrian facilities are intended to be accessible routes.

pedestrian overpass or underpass	A grade-separated pedestrian facility, typically a bridge or tunnel structure over or under a major highway or railroad that allows pedestrians to cross.
pedestrian refuge island	An island in the roadway that physically separates the directional flow of traffic, provides pedestrians with a place of refuge, and reduces the crossing distance. Note: Islands with cut-through paths are more accessible to persons with disabilities than are raised islands.
pedestrian transfer span	A movable bridge structure designed to raise and lower to mate with the passenger deck of the ferry vessel as tides change. This is often combined with the vehicle transfer span at terminal where overhead loading is not provided.
person with disability	An individual who has an impairment, including a mobility, sensory, or cognitive impairment, that results in a functional limitation in access to and use of a building or facility.
Pixel	Tiny dots grouped together to form the images displayed on the computer screen.
PKZIP	A shareware utility computer PKUNZIP software program that provides for compression and decompression of programs and files.
PLC	A small computer used in the control of multiple operations, usually electrical in nature. Stands for “programmable logic controller”.
plane	A spatial element in geometry that may or may not have a boundary, but is level, having no elevations or depressions, and is two-dimensional.
plinth	A block, slab, or footing on which a pedestal, column, or other vertical structure is placed. These typically serve as the base for light standards or footing of a building immediately above the ground level.
plumb pile	A structural element that is placed vertically into the ground through the use of various devices, typically a vibratory or impact hammer.
point of sale (POS) data	Data collected electronically at the ticket sales counter documenting the time and type of all ferry ticket transactions.
preferential loading	Allowing certain exempt vehicles the privilege to board the vessel prior to other non-exempt vehicles per WAC 468-300-700. Vehicle types include emergency vehicles, school vehicles, and mail delivery vehicles among others.
primary circulation corridor	The area inside the passenger waiting area that is upstream of the turnstiles. This area is the primary route between the terminal entrance and the turnstiles. This area is calculated as part of the net passenger waiting area.
propwash, propeller wash	The backwash from a propeller. Often used to refer to erosion resulting from ferry propeller backwash.
PS&E	Plans, Specifications and Estimates.
PTZ Camera	A video camera with pan, tilt, and zoom capabilities.

public art	Art in any media that has been planned and executed with the specific intention of being sited or staged in the physical public domain, usually outside and accessible to all. The term is also applied to any art which is exhibited in a public space including publicly accessible buildings.

Q

queuing lanes	Synonymous with holding lanes, a lane either inside or outside of the terminal property that is designated for holding vehicles either prior to purchasing tickets or boarding the vessel.

R

railroad track crossings	Locations where a pedestrian access route intersects and crosses a railroad track.
raised median	A raised island in the center of a road used to restrict vehicle left turns and side street access. Note: Islands with cut-through paths are more accessible to persons with disabilities than are raised islands.
ramp	A walking surface with a running slope steeper than 20H:1V (5 percent).
recreational route	WSF route type with a large percentage of recreational passengers relative to ridership. These routes demonstrate large increases in traffic flow during the summer months.
reference drawing	Drawings that are used by WSF to maintain standard layouts of project elements but are not stamped by a professional engineer.
regulatory signs	Signage which alerts terminal users of applicable laws and regulations and instructions required for compliance. These signs are often required for law enforcement purposes.
resolution	A means for defining the sharpness or clarity of a computer image made of pixels. The higher the resolution, the clearer the image.
roadway	See Design Manual Chapter 1140.
running slope	A slope measured in the direction of travel, normally expressed as a percent.

S

sailing	A singular scheduled vessel departure on a route.
scanner	An electronic device that converts an image from paper into a raster image stored in an electronic computer file.
scour	Erosion of the seabed or riverbed caused by wave or current action.
seed file	A previously created MicroStation© design file (.dgn) with the design settings already set. This file is used as the basis for all other design files whether they are master files, deliverable files, etc.
service life	The length of time between a system's construction or installation and its replacement or removal from service. The length of time during which a system can be operated or used economically or before breakdown.

sheet	Contains one scaled view of one or more models arranged within a border and title block. Basically, a sheet is a "ready-to-plot" CADD file.
sidewalk	A walkway along a highway, road, or street that is intended for use by pedestrians.
sidewalk ramp	See curb ramp.
site	A parcel of land bounded by a property line or a designated portion of a public right of way.
slip	The berthing area of a single vessel, including the associated mooring and berthing structures.
software	An electronic digital program that contains instructions used to perform certain tasks on a computer or to manage a computer's operation.
sounding	A measurement of depth from the water surface to the mudline.
special provisions	Supplemental specifications and modifications to the *Standard Specifications* and the amendments to the *Standard Specifications* that apply to an individual project.
splash zone	An area that is exposed to salt water spray, wash or heavy sea (salt) mist due to vessel landing, wave, wind or storm action.
standard turnstile	A type of access control device using rotating arms to prevent access without use of a pre-purchased ticket. These devices are nominally 3-feet wide and have an approximate processing rate of 17 transactions per minute. Standard turnstiles typically do not meet ADA requirements.
street furniture	Sidewalk equipment or furnishings, including garbage cans, benches, parking meters, and telephone booths.
supercolumn	Consists of a drilled shaft foundation which houses the hydraulic lift cylinder used to raise and lower the pedestrian transfer span.

T

terminal building	A building that houses any of the following functions: passenger waiting, WSF terminal supervisor offices, utility rooms, etc.
terminal program	A description of the terminal spaces/functions to be included at a given terminal which is used for scoping, design and budgeting purposes. Usually provided in a tabular form along with space/design requirements for each space/function.
terminal supervisor building	A building that houses the terminal supervisor office and various other employee spaces necessary for operating the terminal.
terrazzo	A composite material poured in place or precast, which is used for floor and wall treatments. It consists of stone chips sprinkled and poured with a binder that is cementitious, chemical, or a combination.
text font	A specific style and size of letters, characters, and numbers.

tie-up slip	The berthing area of a single vessel, including the associated mooring and berthing structures, which is used for the vessel to stay for period of times such as overnight when the vessel is not in use.
toll booth	A building that houses toll collection personnel and equipment.
toll lanes	The lanes between the individual toll booths within the toll plaza.
toll plaza	The area within the terminal property consisting of the toll booths, toll queuing lanes and approach lanes. The toll plaza acts as a control point for the terminal and regulates access in order to collect fares.
towers	The pair of structures that supports the mechanical system used for raising and lowering the transfer span or OHL cab. Most commonly a pile-supported structure that supports the hoist and counterweight cable systems, the towers are classified by material (timber pile and timber framing, steel pile with concrete cap and steel framing). Hydraulic cylinder lift systems are supported by reinforced concrete drilled shafts.
traffic calming	Design techniques that have been shown to reduce traffic speeds and unsafe maneuvers. These techniques can be stand-alone or used in combination, and they include lane narrowing, curb extensions, surface variations, and visual clues in the vertical plane.
transfer span	The movable steel bridge that provides the transition for vehicles and passengers from the fixed trestle and the moored vessel. Supported by a hinged bearing at the bridge seat it is raised and lowered to accommodate tidal fluctuations by mechanical means at the towers. Transfer spans are classified by structure type (the older-style truss, the most common plate girder, and the newest box girder) and by the mechanical system by which it is raised and lowered (hoist and counterweight cable, hydraulic cylinder).
transit facility	A capital facility that improves the efficiency of public transportation or encourages the use of public transportation.
transit stop	An area designed for boarding/disembarking a bus.
transitional segments	Segments of a pedestrian circulation path that blend between existing pedestrian facilities and newly constructed pedestrian facilities. Use of transitional segments may permit the work of the alteration to more nearly meet the new construction standards. At a later time, when other segments of the pedestrian circulation path are reconstructed, the noncomplying transitional segments can be removed and replaced with pedestrian facilities that meet the accessibility criteria.

traveled way A route provided for vehicular traffic. The portion of the roadway intended for the movement of vehicles, exclusive of shoulders and lanes for parking, turning, and storage for turning.

trestle The fixed pile-supported bridge structure that provides the transition from shore to the transfer span. The trestle typically accommodates several lanes of holding for vehicles waiting to board a ferry as well as two or more exit lanes. The trestle may also support other facilities including overhead loading structures, terminal and storage buildings, and utilities. Trestles are classified by material (timber pile and cap, concrete pile and cap, steel pile and concrete cap, timber or concrete deck).

truncated domes Small raised protrusions of a detectible warning surface that are readily detected and understood by a vision-impaired person who uses the sense of touch for guidance. The *Standard Plans* show the appropriate pattern and dimensions.

turnstile A post with arms pivoted on the top set in a passageway so that passengers can only pass through one at a time. For terminals with fare collection, turnstiles serve as the passenger control point.

U

universal access Access for all persons regardless of ability or stature.

V

vector A quantity possessing both magnitude and direction, generally represented by a line. Vectors can be manipulated geometrically and are represented as a coordinate triple (x, y, z).

vehicle exit lanes Lanes within the terminal area that provide a means of egress from the terminal property for vehicles unloading the vessel.

vehicle transfer span (VTS) The Vehicle Transfer Span consists of a movable bridge (transfer span) designed to raise and lower to mate with the vehicle (car) deck of the ferries as tides change. When the term "Transfer Span" is used, it is typically in reference to a "Vehicle Transfer Span" even though the overhead loading system also includes a transfer span. One end of the transfer span is hinged at the bridge seat and the other is moved up and down by the lift system.

vertical clearance The distance required below overhead structures to allow for the passing of vehicles of a standard height.

vertical circulation The movement of passengers between separate levels of a terminal building. This is typically accomplished with staircases, escalators, and elevators.

W

walk interval	That phase of a traffic signal cycle during which the pedestrian is to begin crossing, typically indicated by a WALK message or the walking person symbol and its audible equivalent.
walk-on passenger	Ferry system users that will load and unload the vessel on foot. This passenger type is assumed to contribute the most to passenger waiting area sizing.
walkway	The continuous portion of the pedestrian access route that is connected to street crossings by curb ramps.
wayfinding	The methodology of using sensory cues to guide people to their destination. Wayfinding is commonly achieved through the use of signage, information displays and kiosks, building and site layout, and other architectural indicators such as light, color and materials. Wayfinding also includes audible communication, tactile elements, and provisions for other persons with disabilities.
windage	The surface area of the vessel above the water line exposed to the wind.
Windows©	Windows operating system software, a registered trademark of the Microsoft Corporation. Software that provides a graphical interface, allowing application programs to interact with the computer hardware, and translates the user's commands. Windows, version 3.1 and below requires MS-DOS to operate.
Windows NT©	Windows New Technology operating system, a registered trademark of the Microsoft Corporation. Software that allows application programs to interact with the PC or workstation hardware, translates the user's com-mands, and does not require MS-DOS to operate.
wingwall	The pair of structures located at the offshore end of the transfer span that provides the vessel with a fixed structure to berth and moor against and which prevents longitudinal motion during loading and unloading of vehicles and passengers. Wingwalls are classified by location (operating slip, tie-up slip) and by material (timber, steel).
workstation	A terminal that contains an internal CPU and can operate in a stand-alone mode or as part of a network.
wythe	A continuous vertical section of masonry one unit in thickness. A wythe may be independent of, or interlocked with, the adjoining wythe(s).

Project Title: <Project Title>
Submittal: <REVIEW>

Project Number
<Cradle To Grave Number>

Reviewers:
<list of reviewers>

Designers:
<list of designers>

No.	Reviewer (Initials)	Discpline	Section	Page or Sheet	Line No. or Detail	Comments	Designer's Reply	Designer (Initials)	Status	Back-Check (X)
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										

Appendix D Quality Audit Sign-Off Sheet

DQC AUDIT SIGN-OFF SHEET

Project name: _____ WOA #: _____

Yes	No	**Design calculations have received a 100% Check and DQC Sign-Off Sheets and Checkprints are filed**
☐	☐	Civil
☐	☐	Structural
☐	☐	Mechanical
☐	☐	Electrical

Yes	No	**Construction Cost Estimates have received a 100% Check and DQC Sign-Off Sheets are filed**
☐	☐	Civil
☐	☐	Structural
☐	☐	Mechanical
☐	☐	Electrical

Yes	No	**PS&E Reviews have been performed and DQC Sign-Off Sheets are filed**
☐	☐	Design Report
☐	☐	30% Submittal
☐	☐	60% Submittal
☐	☐	90% Submittal

Yes	No	**PS&E Review comments have been back checked and incorporated**
☐	☐	Design Report
☐	☐	30% Submittal
☐	☐	60% Submittal
☐	☐	90% Submittal

Yes	No	**Constructability Reviews have been performed and DQC Sign-Off Sheets are filed**
☐	☐	60% Submittal
☐	☐	90% Submittal

Yes	No	**Constructability Review comments have been back checked and incorporated**
☐	☐	60% Submittal
☐	☐	90% Submittal

Project Manger: _____ Date _____

Washington State Department of Transportation

Washington State Ferries

DQC AUDIT SIGN-OFF SHEET

Project name: _____ WOA #: _____

Yes	No	
		Design calculations have received a 100% Check and DQC Sign-Off Sheets and Checkprints are filed
☐	☐	Civil
☐	☐	Structural
☐	☐	Mechanical
☐	☐	Electrical
Yes	No	**Construction Cost Estimates have received a 100% Check and DQC Sign-Off Sheets are filed**
☐	☐	Civil
☐	☐	Structural
☐	☐	Mechanical
☐	☐	Electrical
Yes	No	**PS&E Reviews have been performed and DQC Sign-Off Sheets are filed**
☐	☐	Design Report
☐	☐	30% Submittal
☐	☐	60% Submittal
☐	☐	90% Submittal
Yes	No	**PS&E Review comments have been back checked and incorporated**
☐	☐	Design Report
☐	☐	30% Submittal
☐	☐	60% Submittal
☐	☐	90% Submittal
Yes	No	**Constructability Reviews have been performed and DQC Sign-Off Sheets are filed**
☐	☐	60% Submittal
☐	☐	90% Submittal
Yes	No	**Constructability Review comments have been back checked and incorporated**
☐	☐	60% Submittal
☐	☐	90% Submittal

Project Manger: _____ Date _____

Appendix E Quality Control Color Code

The use of color is very important during the checking and "mark-up" process of the quality control program. The color code provides a visual, auditable document trail.

The colors used in document review and checking are as follows:

RED	Additions or Corrections to documents
GREEN	Deletions and items that are to be removed from the documents
YELLOW	Highlight for verification/concurrence of items or verification of updates and deletions from mark-ups
BLUE, PINK	Concurrence of drafted items or verification of updates and deletions from mark-ups

It is imperative that every item checked receives the appropriate color code – yellow highlight; red, green, blue or pink marks. This provides an auditable document, and assures the designer and PE signee that each item was checked in accordance with the QA/QC process. This may make sense on big projects but auditable trail is there if you have amarkedup set with initials.

The document color code procedure can be summarized as follows.

COLOR	PURPOSE	RESPONSIBLE PARTY
BLACK	Calculations, text or line work (checkprint documents)	Originator
RED	Additions/Corrections to checkprint document	Checker
GREEN	Deletions to checkprint document	Checker
YELLOW	Concurrence of checked items	Checker/Rechecker
BLUE/ PINK	Concurrence or Incorporation	Drafter, Updater
	Reviewer notes	Reviewer
	Responses to review comments	Updater

Quality Control Color Code Example

Originate Document/Checkprint: [Originator/Designer]	*Calculations, text or line work to be checked* (not red, green, yellow, blue or pink)
Check Document: [Checker]	*Yellow highlight for correct items*: Seattle Slip 1 Overhead Loading *Red for additions or corrections*: Seattle Slip 2 ~~OHL~~ Overhead Loading *Green for deletions*: Revise the Plans ~~and Special Provisions~~
Backcheck Document: [Designer]	*Blue or Pink check mark for concurrence*: Seattle Slip 2 ~~OHL~~ Overhead Loading Revise the Plans and ~~Special Provisions~~
Update Document: [Designer]	*Blue or Pink encirclement when updated*: Seattle Slip 2 ~~OHL~~ Overhead Loading Revise the Plans and ~~Special Provisions~~
Recheck Document: [Checker]	*Yellow over red and green to indicate incorporation of change*: Seattle Slip 2 OHL ~~Overhead Loading~~ Revise the Plans and ~~Special Provisions~~

Project Management Plan
SR 16 Burley Olalla Interchange

MP 19.47 to MP 20.52
3/18/2009

Project Description

The SR 16/Burley Olalla R. intersection has been identified as a high accident location (HAL). This I2 safety improvement project will replace the existing at-grade crossing with a new interchange in a effort to improve safety and provide for better traffic movements at this location. Nickel Funds were authorized in 2003 to construct the interchange.

Project Boundaries/Limits

Project limits:
South - SR16 MP 19.47
North - SR16 MP 20.52
East - Not beyond Olympic Drive
West - Not beyond Burley Creek

PE Phase Estimate

Group	Budget ($)
Design	$1,429,700
GeoTech	$66,000
Environmental	$75,000
Hydraulics	$20,000
Agreement Admin	$10,000
Public Involvement	$45,000
Traffic	$114,000
Materials	$15,000
Utilities	$20,000
Plans Review	$100,000
PC Total	**$1,894,700**

CN Phase Estimate

Group	Budget ($)
Preparation	$150,000
Grading	$200,000
Drainage	$125,000
Structure	$1,500,000
Surfacing	$50,000
Erosion Cntrl Rdside Rest.	$75,000
Traffic	$100,000
CN Total	**$2,200,000**

Sales Tax	$171,600
CN Engineering	$200,000
Contingencies	$94,900
Total Project Estimate	**$4,606,200.00**

Team Mission

Deliver a PS&E package and all supporting documents and approvals required to advertise the project. Criteria:
- Minimize impacts to the public and environment.
- Design that is responsive to traveling public needs and stakeholder requirements

- Minimize impacts to the public and environment.
- Design that is responsive to traveling public needs and stakeholder requirements.

Milestones

Activity ID	Activity Name	Date
MS0100	Project Definition Complete	7/17/2008
MS0110	Begin Preliminary Engineering	7/17/2008
MS0160	Environmental Documentation Complete	3/2/2009
MS0180	Right of Way Certification	9/22/2010
MS0190	Advertisement (Ad) Date	3/1/2012
MS0200	Award	3/26/2012
MS0240	Operationally Complete	9/30/2013

Measures of Success

- Complete the project under budget.
- Complete the project ahead of schedule
- No scope creep.

Operating Guidelines

Team decision making process:
-All team members support final team decisions
-Voice & respect each other's opinions
-No formal voting process
-Resolve conflicts
-Continues involvement of key players
Team meetings: attend team meetings as scheduled, team meetings may be held on an individual basis
Communication: Refer to the Communication Plan
Manage team change: communicate change in a timely manner
Report on Milestones monthly
Report on risks during Quarterly Project Reports

Project Team		PMP Endorsed?
Project Engineer	**Tom Jones**	Yes
- Project Oversight - Provide guidance and approval		
Assistant PE	**Dave Smith**	No

Assistant PE **Dave Smith** No

- Track and report on project delivery
- Review deviations and recommend approval

Utilities Engineer **Utilities** Don't know

- Determine impacts
- Prepare and process all agreements
- Provide timely communication status / issues

GeoTech Engineer **GeoTech** N/A

- Perform geotechnical explorations
- Conduct specialized testing as necessary
- Provide geotechnical/seismic recommendations for foundations, retaining walls, and embankments.

Bridge & Structures Engineer **Harry Abbott** Yes

- Provide bridge design
- Provide bridge PS&E
- Provide timely communication of status/issues

Team Identification

	Scope of Work Agreement?	SOW/PMP Endorsed?
Access	Yes	Yes
Bridge & Structures	No	No
Construction	No	Yes
Consultant Liaison	No	Don't know
Design & Plans Review	No	Yes
Environmental	No	N/A
Geotechnical Services	Yes	Yes
Local Agencies	No	Don't know
Materials	Yes	No
Real Estate Services	Yes	Yes
Utilities	Yes	Yes

Stakeholders

City of Burley Olalla	Angel Smith
City of Port Orchard	Raymond Jones
City of Gig Harbor	Nathaniel Green
Kitsap County	Emily Hart
Law Enforcement	Ava
Emergency Services	Breckenridge
	Aaron Gifford

GoTo Section

Budget/Aging Plan *g:\Project Management\XLxxxx\AgingPlan*

Change Management	*g:\Project Management\XLxxxx\ChgMgmtPlan*
Communication Plan	*g:\Project Management\XLxxxx\CommunicationPlan*
Project Schedule	*PMRS*
SOW Agreemnts	*g:\Project Management\XLxxxx\SOWAgreements*

SR 16 Burley Olalla Interchange

Project Description

The SR 16/Burley Olalla R. intersection has been identified as a high accident location (HAL). This I2 safety improvement project will replace the existing at-grade crossing with a new interchange in a effort to improve safety and provide for better traffic movements at this location. Nickel Funds were authorized in 2003 to construct the interchange.

Team Mission

Deliver a PS&E package and all supporting documents and approvals required to advertise the project. Criteria:

- Minimize impacts to the public and environment.
- Design that is responsive to traveling public needs and stakeholder requirements.

Measures of Success

- Complete the project under budget.
- Complete the project ahead of schedule
- No scope creep.

Project Boundaries/Limits

Project limits:
South - SR16 MP 19.47
North - SR16 MP 20.52
East - Not beyond Olympic Drive
West - Not beyond Burley Creek

Milestones

Activity ID	Activity Name	Date
MS0100	Project Definition Complete	7/17/2008
MS0110	Begin Preliminary Engineering	7/17/2008
MS0160	Environmental Documentation Complete	3/2/2009
MS0180	Right of Way Certification	9/22/2010
MS0190	Advertisement (Ad) Date	3/1/2012
MS0200	Award	3/26/2012
MS0240	Operationally Complete	9/30/2013

Project Team

	PMP Endorsed?
Project Engineer Tom Jones	Yes
Assistant PE Dave Smith	No
Utilities Engineer Utilities	Don't know
GeoTech Engineer GeoTech	N/A
Bridge & Structures Engineer Harry Abbott	Yes

Stakeholders

City of Burley Olalla Angel Smith
City of Port Orchard Raymond Jones
City of Gig Harbor Nathaniel Green
Kitsap County Emily Hart
Law Enforcement Ava Breckenridge
Emergency Services Aaron Gifford

PE Phase Estimate

Group	Budget ($)
Design	$1,429,700
GeoTech	$66,000
Environmental	$75,000
Hydraulics	$20,000
Agreement Admin	$10,000
Public Involvement	$45,000
Traffic	$114,000
Materials	$15,000
Utilities	$20,000
Plans Review	$100,000
PC Est Total	**$1,894,700**

CN Phase Estimate

Group	Budget ($)
Preparation	$150,000
Grading	$200,000
Drainage	$125,000
Structure	$1,500,000
Surfacing	$50,000
Erosion Cntrl Rdside Rest.	$75,000
Traffic	$100,000
CN Est. Total	$2,200,000

SalesTax	$171,600
CN Engineering	$200,000
Contingencies	$94,900
Total Project Estimate	**$4,606,200**

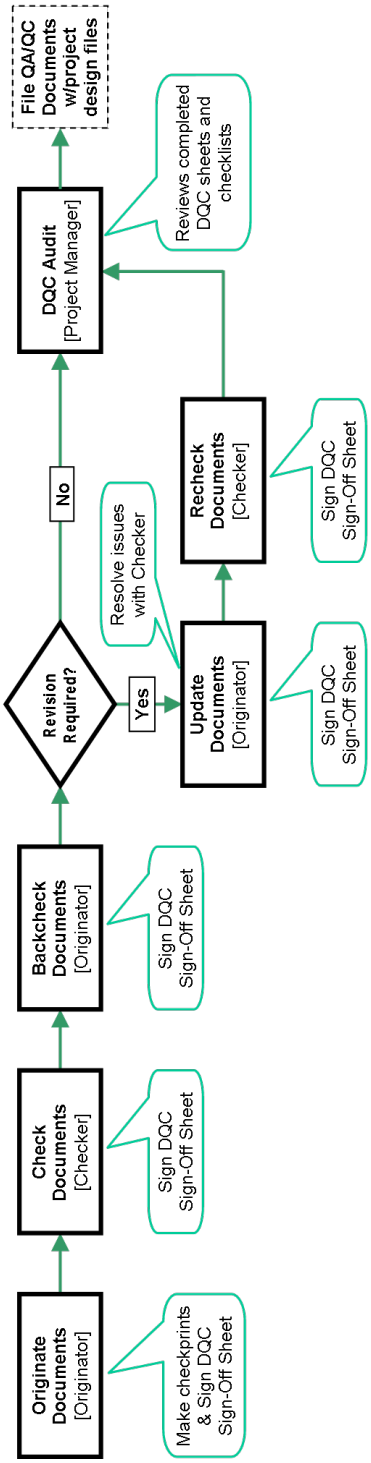
Team Identification	SOW Agreement?	PMP Endorsed?
Access	Yes	Yes
Bridge & Structures	No	No
Construction	No	Yes
Consultant Liaison	No	Don't know
Design & Plans Review	No	Yes
Environmental	No	N/A
Geotechnical Services	Yes	Yes
Local Agencies	No	Don't know
Materials	Yes	No
Real Estate Services	Yes	Yes

GoTo Section

Budget/Aging Plan: *g:\Project Management\XLxxxx\AgingPlan*
Change Management: *g:\Project Management\XLxxxx\ChgMgmtPlan*
Communication Plan: *g:\Project Management\XLxxxx\CommunicationPlan*

CHECKING PROCESS OVERVIEW

Peer review – A detailed document inspection for verification of engineering design correctness.



Appendix H *DQC Sign-Off Sheet*

QA/QC Signature Sheet

Project Name:	
Project Number:	
Design Lead:	
Date:	

Design Item	Designer	Checker	Job Complete	Calculations Bound
1 Drawings				
2 Calculations				
3 Quantities				
4 Estimate				
5 Specifications				

Note: Design Lead has option of adding additional design items

___ FERRY TERMINAL
_____ (Project Title)
_____ (Project Number)
STRUCTURAL CALCULATIONS - WINGWALLS
QA/QC CHECKLIST

Item	Designer	Date	Checker	Date
Design Criteria				
Design Energy				
Design Vessel Data				
Design Tide Data				
Design Bathymetry/Scour Reduction				
Design Impact Elevations				
Design Layout (as approved by Operations)				
Design Approach Data				
Design Vessel Energy				
Design Impact Energy				
Geotechnical				
Geotechnical Recommendations				
Borings				
Soil Parameters for Lpile Input				
Group Effect Modification Factors				
Axial Capacity Curves				
Cutting Shoes recommendation				
Hammer Capacity recommendation				
Special requirements (anchors, dowels)				
Structural				
Level I Analysis				
Soil Spring calculation				
Lpile runs (final)				
Load Cases (high and low tide, inside, outside)				
GTStrudl runs and Energy Spreadsheet (final)				
Stress Check				
Pile Embedments				
Level III Analysis				
Load Cases (high and low tide, inside)				
Moment-Rotation Spring Development for GTStrudl				
Lateral Load-Pile Head Deflection for GTStrudl				
GTStrudl runs and Energy Spreadsheet (final)				
Reaction Frame Displacement				
Pile Embedments				
Miscellaneous Calculations				
Ladders				
Chain and Hardware				

Appendix H DQC Sign-Off Sheet
WINGWALLS
6/18/2012

___ FERRY TERMINAL
_____ (Project Title)
_____ (Project Number)
STRUCTURAL CALCULATIONS - DOLPHINS
QA/QC CHECKLIST

Item	Designer	Date	Checker	Date
Design Criteria				
Design Energy				
Design Vessel Data				
Design Tide Data				
Design Bathymetry/Scour Reduction				
Design Impact Elevations				
Design Layout (as approved by Operations)				
Design Approach Data				
Design Vessel Energy				
Design Impact Energy				
Geotechnical				
Geotechnical Recommendations				
Borings				
Soil Parameters for Lpile Input				
Group Effect Modification Factors				
Axial Capacity Curves				
Cutting Shoes recommendation				
Hammer Capacity recommendation				
Special requirements (anchors, dowels)				
Structural				
Level I Analysis				
Lpile runs (final)				
Load Cases (high and low tide, one pile, two pile)				
Energy Spreadsheet (final)				
Stress Check				
Pile Embedments				
Miscellaneous Calculations				
Ladders				
Railings				
Chain and Hardware				

Appendix H DQC Sign-Off Sheet
DOLPHINS
6/18/2012

H Span Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	**Project Planning and Endorsement (PMP)** PE.PM.03.15	**Pre-Design Study (5%)** PE.PS.07	**Geometric Review (30%)** PE.PD.75.30 **Design Approval** PE.PD.42.10	**Environmental Review Documentation Complete** PE.EV.18	**General Plans Review (60%)** PE.PD.75.60	**Preliminary Contract Review (90%)** PE.PD.75.90	**Environmental Permits Received** PE.EV.29	**Project Development Approval (100%)** PE.PD.42.60	**Contract Ad and Award** PE.PD.90.35	**PE Phase End (Close Out and Archiving)** PE.PD.90.65
Milestone Purpose	Provides basis to charter project team and begin developing the PMP Review Scoping documents	PM validates the project scope, schedule, and budget Management endorses the project's work plan	Refine the scope, schedule, budget Evaluate Alternatives	Documents design criteria and major design decisions. Documents the project purpose, type, strategy, phase durations, budget, and recommended ad date. Type, Size and Location	Complete NEPA/SEPA environmental process Complete the permit applications for agency approvals	Design of major project elements completed, review for constructability, conformance with standards	100 % PS&E review. Items missing from design should be minor and should be documented to reviewers.	All permits necessary for the project are received.	Comments from 90% review are incorporated. No other major changes to 90% PS&E review documents. At the end of this review, Contract Plans are Ad Ready.	Submittal of all final deliverables to Olympia for ad and award	Archive project electronic and hard copy files Document project in Z-PM standards file historical data base. Close out project through Project Controls Group.
Decisions Frozen and Milestones Completed (Overview)	Legislative budget Legislative ad dates	PMP complete Milestone dates set Schedule baselined Environmental Process defined Assumptions defined Risks defined File system and Logs are set up	Preferred alternative identified Predesign Study document complete OFM endorsed Predesign Study	Design criteria completed Alternative Analysis completed Design concept fixed Design type, size and location fixed Approval to begin ROW acquisition process Design Approval Package stamped and signed Draft construction schedule and phasing complete	The environmental review documentation is considered complete on the date that all necessary NEPA/SEPA is complete Permits submitted to the agencies (excluding building and CZM permits)	All key project elements and features that drive the project outcome and costs are defined. Geometric Review comments resolved and documented. Design details to be completed identified	✓ The deliverables are substantially complete ✓ Review and acceptance of design detail of key elements and features ✓ Permits Obtained. All environmental permits are approved, verified, and accepted for inclusion into the plans ✓ General Plans Review comments resolved & documented.	Permits are included in the contract documents	PS&E deliverables are complete. All review comments adjudicated. Plans and specifications stamped and sealed at end. ROW Certification Final Project Approval	Owner accepts design Approval to advertise ROW is clear	Consultants/WSDOT staff forward all required project records and files to the Project Manager Project Manager sends design file to library / construction group Electronic design file archived
Preliminary Engineering											
Design/PS&E Elements											
Project Management	0106 Draft Project Mgmt Plan • Deliverable Expectation Matrix • Critical Path Schedule • Milestone Schedule • Budget Sheet 01A0 Scheduling and Reporting • Confidence Reports • Quarterly Performance 0169 Project Summary • Scope Validation • Estimate Validation • Verify Project Definition • Verify Environmental Review Summary • Verify Design Decisions Summary • Project Kick Off Meeting	0101 General Project Management • Electronic and hard copy file System Set Up • Bid Book and Change Management Book Set Up 0106 Endorsed PMP • Signed Team Agreements • Baseline schedule • Budget • Cash Flow Sheet • Risk assessment • Communication Plan • Change management plan • QA/QC plan 0121 Change Management • Project Change Log • Contingency Estimate 0166 Cost and Risk Estimating • Project Management Risks Identified • Risk Modeling Spreadsheet	0111 Communication Plan • Draft Public Involvement Plan 0123 Pre-Design Study • PDS Draft Narrative • Alternatives Analysis • Cost Benefit Analysis • PDS Revised per Mgmt Review • PDS Final Narrative • PDS Revised per Executive	0111 Communication Plan • Key Messages • Outreach Schedule • Project Desc. (Simple) • Impact to the Public • Draft Operations Plan • Draft Traffic Control Plan • Stakeholder List 0172 Design Documentation Package (DDP) Appr. Submittal Incl: • Stamped cover sheet • Project Description • Concept Drawings • Site Plans and Elevations • Cost Estimate • Risk Spreadsheet • Project Analysis • Design Criteria worksheets or equivalent: www.wsdot.wa.gov/design/projectdev • Des. Variances Inventory 0181 PS&E Review • QAQC Cover Sheets for the Project		0101 General Project Management • 60% Cover Sheet responses to 30% review comments 01A0 Scheduling and Reporting • Confidence Reports • Quarterly Performance • Monthly Statused Schedules and Project Control Spreadsheets 0111 Communication Summary • Record of Contact • Outreach Decisions • Outreach List • Public Meeting Minutes • Public Hearings Record	0101 General Project Management • Peer Reviews Complete and documented • 90% Coversheet responses to 60% review comments 01A0 Scheduling and Reporting • Confidence Reports • Quarterly Performance • Monthly Statused Schedules and Project Control Spreadsheet 0185 Pre-Ad Review and Preparation • Request WMBE & Training Goals		0101 General Project Management • 100% Coversheet responses to 90% review comments 01A0 Scheduling and Reporting • Confidence Reports • Quarterly Performance • Monthly Statused Schedules and Project Control Spreadsheet 0172 DDP Project Development Approval Submittal Project Development Submittal Includes: • Stamped Cover Sheet • Design Approval Submittal • Environmental Permits • Design Variance Inventory • Cost Estimate • Cost Estimate Summary (for Nicole, with Budget Comparison Worksheet) • Contract	01A0 Scheduling and Reporting • Confidence Reports • Quarterly Performance • Monthly Statused Schedules and Project Control Spreadsheet 0185 Pre-Ad Review and Preparation • Memo to OEO • Memo to Contract Ad & Award • Ad Package to HQ 0198 Construction Preparation • Construction Phase File Setup • Construction Funding • Design Record Close Out • Funding Adjust-to-Award 0199 Addenda Preparation • Contract Addendum • Respond to Bidder RFIs	0101 Project Management • Lessons Learned • Design Records to Library • Design E-Files Archived • Consultant Evaluations • Team Evaluations • Copy records to Z-PM standards historical data base • DDP finalized and in Design File • Scope description • Budget Workbook, schedule archieved on Z-PM Stds 0198 Construction Preparation • Design Record Close Out

H Span Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	Project Planning and Endorsement (PMP) PE.PM.03.15	Pre-Design Study (5%) PE.PS.07	Geometric Review (30%) PE.PD.75.30 Design Approval PE.PD.42.10	Environmental Review Documentation Complete PE.EV.18	General Plans Review (60%) PE.PD.75.60	Preliminary Contract Review (90%) PE.PD.75.90	Environmental Permits Received PE.EV.29	Project Development Approval (100%) PE.PD.42.60	Contract Ad and Award PE.PD.90.35	PE Phase End (Close Out and Archiving) PE.PD.90.65
Project Management	0166 Cost and Risk Estimating • Risk Analysis: Self Modeling Spreadsheet (also see "Project Management" above) • Project Kick Off Meeting	0166 Cost and Risk Estimating • Scoping Level Cost Validation • Determine if project needs Value Engineering or Cost Risk Assessment/Cost Estimating Validation Process • Basis of Estimate (see Cost Estimating Manual) • Bid Book with Initial Estimate		0166 Cost and Risk Estimating - 60% • Ebase Setup • Permit Cost Estimate • Risk Cost, 60% level • Cost Est, 60% level • Operations Cost Est. (CN) • Outreach Cost Est. (PE & CN) • Env. Monitoring Est. • Traffic Control Est. • Discipline Cost Estimates		0166 Cost and Risk Estimating 90% • Pay groups and pay items determined • Summary of Quantities Draft • Lump sum cost detail	0166 Cost and Risk Estimating Final • Cost Estimate Final • Cost estimate below the line items (building permit, operations cost, risk cost, environmental and archaeological monitoring) • Summary of Quantities Final		0166 Cost and Risk Estimating Final • Construction Estimate Final Revisions		
Environmental	0132 Endangered Species Act Compliance • Environmental Permit List • Project Kick Off Meeting 0138 Environmental Permits • Validate ERS (Environmental Review Summary) • Project Kick Off Meeting	0106 Project Management Plan • Team Agreement Validated • Environmental project schedule development • Environmental permit list • Estimate of design hours • Signed Env. Internal Agreement (scope, sched., budget) 0132 Endangered Species Act Compliance • ESA Risks Identified 0138 Environmental Permits • Environ. Permit Risks Identified • Soil Boring Notice of Intent	0123 Pre-Design Study • Environmental Section of Pre-Design Study 0138 Environmental Permits • Boring Permit	0138 Environmental Permits • Discipline studies, reports, and predecessor information completed • Noise Variance Application • JARPA Preparation • Eelgrass Survey	0132 Endangered Species Act Compliance • Biological Assessment or No Effect Letter • Drawings for Permits • Noise Test for Monitoring Zone • Permit Drawings for ESA (CAD) • SEPA Checklist and Determination	0138 Environmental Permits • Follow Up with Permit Agencies	0138 Environmental Permits • All environmental special provisions approved and included in the PS&E plan set • Environmental Commitment Meetings Set Up • Water Quality Certification		0138 Environmental Permits • Environmental Commitment File Entered	0138 Environmental Permits • Environmental Commitment Meetings	0138 Environmental Permits • Deliver Env. Files to PM for archiving
Tribal Outreach				0109 Tribal • Initial Letters to Tribes • Tribal Interim Notifications			0109 Tribal • Tribal MOUs			0138 Environmental Permits Environmental Commitment Meetings	
Geotechnical	0143 Geotechnical • Project Site Data to RME - Geotech Work • Onsite field investigation scheduled (schedule and initiate no sooner than 1 year prior to construction) • Topographic survey requested	0143 Geotechnical • Soil Boring Notice of Intent • Field and Core Investigation completed • Borings coordinated with aerial obstructions	0143 Geotechnical • Location of Borings	0143 Geotechnical • Soils and Geotechnical Report Received					0143 Geotechnical • Boring logs submitted	0143 Geotechnical • Geotechnical Report compiled for contractor review • Geotechnical Report & cross-sections posted on website	

H Span Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	Project Planning and Endorsement (PMP) PE.PM.03.15	Pre-Design Study (5%) PE.PS.07	Geometric Review (30%) PE.PD.75.30 Design Approval PE.PD.42.10	Environmental Review Documentation Complete PE.EV.18	General Plans Review (60%) PE.PD.75.60	Preliminary Contract Review (90%) PE.PD.75.90	Environmental Permits Received PE.EV.29	Project Development Approval (100%) PE.PD.42.60	Contract Ad and Award PE.PD.90.35	PE Phase End (Close Out and Archiving) PE.PD.90.65
Traffic and Operations	0117 Project Data • Project survey requirements finalized, including areas that may be Project Limits • Potential utility relocations identified • Utilities within the project limits notified • Washington Utilities Transportation Commission (WUTC) permit application for railroad crossings submitted	0117 Project Data • Aerial Photographs Background Data • Final Basemap • Established Geodetic Survey Control - Document in Design File • Utility As-Builts requested		0117 Project Data • Record of Survey completed and filed • Utility Plan with as-built information completed and transmitted to Utilities • Preliminary Utility conflicts identified • Project Overview Meeting held with Utility Owners 0150 Operations Plan • Operations Project Review - Document Decisions • Terminal Traffic Analysis Report		0117 Project Data • Field review of proposed features completed • Utility conflicts confirmed and relocation letters sent to utilities • Utility relocation meeting held 0150 Traffic Analysis • Assumptions and conclusions in Traffic Analysis Report verified for consistency with design • Traffic control plans showing Construction Sequence and staging • Traffic Control Final Estimate	0117 Project Data • DNR Permits to Destroy Monuments • Utility Relocation Plan information and specifications Incorporated in PS&E • Letters of Understanding issued to utilities requiring relocation • Construction Maintenance Agreement completed 0150 PS&E • Staging and Channelization Plans • Traffic Control Plans • Traffic Control Provisions				
Civil	0169 Project Summary • Review Project Summary Docs • Civil Design Criteria • Project Analysis • Project Kick Off Meeting	0106 Project Management Plan • Validate Civil Project Scope, Schedule, Budget • Incorporate Civil Scope, Schedule, Budget into MDEM • Plans list with estimate of design hours • Signed Civil Internal Agreement (scope, sched., budget) 0172 Civil Design • Civil Risks Identified • 5% Civil Plan, Elevation, Phasing Plan • Construction Water Quality Monitoring Plan submitted • Hydraulic and Water Quality issues identified • Stormwater Treatment Deficiencies Identified • Storm Water Management and Report Requirements and type documented • Stormwater Management	0123 Pre-Design Study • Civil Section of Pre-Design Study 0172 Civil Design • Civil Site Plans and Elevations • Preliminary Civil Item Estimate	0172 Design Approval • Civil Design Criteria • Civil Concept Drawings • Civil Site Plans and Elevations • DDP 01F1 Civil Design • Paving Plans • Stormwater Plans • TESC Plans & BMPs • Utilities Plans • Civil Plans 60% • Civil Specifications 30% • Civil Estimate 60% • Documented Minimum Requirements from Highway Runoff Manual Special Provisions • PSE Word Set Up • Initial Run List		01F1 Civil Design • Environmental Site Plans • Civil Plans 90% • Civil Details 60% • Civil Specifications 60% • Civil Estimate 90% • Civil Abbreviations & Symbols, General Notes 90% Special Provisions • Diver Provisions • Environmental Provisions Draft • GSPs • Penalties and Incentives Draft • Proprietary Item (Sole Source) Provisions • RGSPs Coordination with Disciplines • Staging Provisions Draft	01F1 Civil Design • Environmental Site Plans 100% • Civil Plans 100% • Civil Details 90% • Civil Specifications 90% • Civil Estimate 100% Special Provisions - 100% • Environmental Provisions Final • GSPs check for updates • Penalties and Incentives Final • Proprietary Item (Sole Source) Provisions updates • RGSPs Coordination with Disciplines • Staging Provisions Final • Summary of Geotechnical Conditions Appendix	01F1 Special Provisions - 100% • Environmental Appendix	01F1 Civil Design • Final Environmental Site Plans • Final Civil Plans • Final Civil Details • Final Civil Specifications • Final Civil Estimate Special Provisions • Last Changes to Provisions • Incorporating 90% Review Comments	01F1 Civil Design • Response to Bidder RFIs • Addendum Preparation	01F1 Civil Design • Deliver Design Calcs to PM for archiving • Complete QA/QC

H Span Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	Project Planning and Endorsement (PMP) PE.PM.03.15	Pre-Design Study (5%) PE.PS.07	Geometric Review (30%) PE.PD.75.30 Design Approval PE.PD.42.10	Environmental Review Documentation Complete PE.EV.18	General Plans Review (60%) PE.PD.75.60	Preliminary Contract Review (90%) PE.PD.75.90	Environmental Permits Received PE.EV.29	Project Development Approval (100%) PE.PD.42.60	Contract Ad and Award PE.PD.90.35	PE Phase End (Close Out and Archiving) PE.PD.90.65
Architectural	0169 Project Summary • Review Project Summary Docs • Project Kickoff Meeting	0106 Project Management Plan • Validate Arch. Project Scope, Schedule, Budget • Incorporate Arch. Scope, Schedule, Budget into MDEM • Plans list with estimate of design hours • Signed Architectural Internal Agreement (scope, sched., budget) 0172 Architectural Design • Architectural Risks Identified • 5% Architectural Plan, Elevation, Phasing Plan	0123 Pre-Design Study • Architectural Section of Pre-Design Study 0172 Architectural Design • Architectural Site Plans and Elevations • Preliminary Architectural Item Estimate	0172 Design Approval • Architectural Design Criteria: View Corridor & Bldg Height • Project Analysis • Architectural Concept Drawings 01F2 Architectural Design • Building Permit Pre-Submittal Meeting with Pt. Townsend • Utilities Plans • Architectural Specifications 30% • Architectural Estimate 30% • Architectural Plan, Elevation, Phasing Plan: 15% • Fire Marshall Approval	01F2 • Architectural Permit input	01F2 Architectural Design • Architectural Phasing Plan 60% • Architectural Building Plans 90% • Architectural Security Plans 90% • Architectural Sections 60% • Architectural Details 60% • Architectural Specifications 60% • Architectural Estimate 90% • Architectural Abbreviations & Symbols, General Notes 90% • Architectural Demolition Plans	01F2 Architectural Design • Building Permit Submittal • Architectural Phasing Plan 90% • Architectural Plans 100% • Architectural Sections 90% • Architectural Details 90% • Architectural Specifications 90% • Architectural Estimate 100%	01F2 Architectural Design • Building Permit Received	01F2 Architectural Design • All plans, specs, and estimate 100%	01F2 Architectural Design • Response to Bidder RFIs • Addendum Preparation	01F2 Architectural Design • Deliver Design Calcs to PM for archiving • Complete QA/QC
Structural	0169 Project Summary • Review Project Summary Docs • Scope for TS&L Determined • Structural Input on Environmental Documentation and Permits • Project Kick Off Meeting	0106 Project Management Plan • Validate Struct. Project Scope, Schedule, Budget • Incorporate Struct. Scope, Schedule, Budget into MDEM • Plans list with estimate of design hours • Signed Structural Internal Agreement (scope, sched., budget) 0172 Structural Design • Structural Risks Identified • 5% Structural Plan, Elevation, Phasing Plan	0123 Pre-Design Study • Structural Section of Pre-Design Study 0172 Structural Design • Structural Site Plans and Elevations • Preliminary Structural Item Estimate • Establish Structural Methodology • Reload and Familiarize Model • Determine Foundation Type • Determine Bridge Seat/Foundation Connection Type	0172 Design Approval • Structural Design Criteria • Structural TS&L • Project Analysis • Structural Concept Drawings 01F3 Structural Design • Building Permit Pre-Submittal Mtg with Port Townsend • Struct. Phasing Plan 30% • Structural Plans 90% • Structural Specs 60% • Structural Construction Est. 60% • Structural Type, Size & Location • 60% Construction Sequence & Schedule • Ferry Service Impact 60% • Determine Foundation Size 90% • Structural Permitting Submittal Review (includes constructability review for viable construction method, sequence, and schedule)		01F3 Structural Design • Struct. Phasing Plan 90% • Structural Plans 90% • Structural Sections 60% • Structural Details 60% • Structural Spec 90% • Structural Construction Est. 90% • 90% Construction Sequence & Schedule • Ferry Service Impact 90% • Determine Foundation Size 100% • Structural Abbreviations & Symbols, General Notes 90% • Structural Demolition Plans • Bridge Seat, Headframe, Railings and Ladders, Trestle, Transfer Span, Materials Schedules • Possible: Dolphins, Wingwalls • Final Analysis 90% • Final Design 90%	01F3 Structural Design • Building Permit Submittal • Struct. Phasing Plan 100% • Structural Plans 100% • Structural Sections 90% • Structural Details 90% • Structural Specs 100% • Structural Construction Est. 100% • 100% Construction Sequence & Schedule • Ferry Service Impact 100% • Bridge Seat, Headframe, Railings and Ladders, Trestle, Transfer Span, Materials Schedules • Wingwalls • Final Analysis 100% • Final Design 100%		01F3 Structural Design • All plans, specs, and estimate 100%	01F3 Structural Design • Response to Bidder RFIs • Addendum Preparation	01F3 Structural Design • Deliver Design Calcs to PM for archiving • Deliver Geotech report to Library • Complete QA/QC

H Span Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	**Project Planning and Endorsement (PMP)** PE.PM.03.15	**Pre-Design Study (5%)** PE.PS.07	**Geometric Review (30%)** PE.PD.75.30 **Design Approval** PE.PD.42.10	**Environmental Review Documentation Complete** PE.EV.18	**General Plans Review (60%)** PE.PD.75.60	**Preliminary Contract Review (90%)** PE.PD.75.90	**Environmental Permits Received** PE.EV.29	**Project Development Approval (100%)** PE.PD.42.60	**Contract Ad and Award** PE.PD.90.35	**PE Phase End (Close Out and Archiving)** PE.PD.90.65
Electrical	0169 Project Summary • Review Project Summary Docs • Project Kick Off Meeting	0106 Project Management Plan • Validate Elect. Project Scope, Schedule, Budget • Incorporate Elect. Scope, Schedule, Budget into MDEM • Plans list with estimate of design hours • Signed Electrical Internal Agreement (scope, sched., budget) 0172 Electrical Design • Electrical Risks Identified • 5% Electrical Plan, Elevation, Phasing Plan	0123 Pre-Design Study •Electrical Section of Pre-Design Study 0172 Electrical Design • Electrical Site Plans and Elevations • Preliminary Electrical Item Estimate	0172 Design Approval • Electrical Concept Dwgs • Electrical Site Plans & Elev • Prelim. Electrical Item Est. • Electrical Design Criteria • Project Analysis 01F5 Electrical Design • Electrical Plans 60% • Utilities Plans • Electrical Specs 30% • Electrical Estimate 60% • Lighting Plan 60% • One-Line & One-Line Demolition 60% • Temp Power Plan 60% • 30% Transfer Span PLC Cabinet Layout, HPU Input Electrical Plan, PLC Network Block Diagram, Motor Control Panel, PLC Schematic, Range Lights and Fog Lights, Attendant's Control Station & Bridge Control Station		01F5 Electrical Design • Electrical Plans 90% • Electrical Sections 60% • Electrical Details 60% • Electrical Specs 60% • Electrical Estimate 90% • Electrical Abbreviations & Symbols, General Notes 90% • Electrical Demolition Plans • Lighting Plan 90% • One-Line & One-Line Demolition 90% • Temporary Power Plan 90% • 90% Transfer Span Electrical Plan & Schedules, PLC Terminal Wiring, Electrical Details, Conduit Block Diagram	01F5 Electrical Design • Electrical Plans 100% • Electrical Sections 90% • Electrical Details 90% • Electrical Specs 90% • Electrical Estimate 100% • Lighting Plan 90% • One-Line & One-Line Demolition Final • Temp Power Plan Final • Final Transfer Span Electrical Plan & Schedules, PLC Terminal Wiring, Electrical Details, Conduit Block Diagram		01F5 Electrical Design All plans, specs, and estimate 100%	01F5 Electrical Design • Response to Bidder RFIs • Addendum Preparation	01F5 Electrical Design • Deliver Design Calcs to PM for archiving • Complete QA/QC
Reviewers (Mech, Electrical, Structural, Maintenance, Construction, etc.)				0180 Constructability Review • Participate in 30% Constructability Review Session • Provide 30% Constructability Comments • Review and Comment on Draft Construction Schedule 0181 PS&E Review • 30% Design Peer Review		0180 Constructability Review • 60% Constructability Review • 60% Constructability Comments • Draft Construction Schedule Review 0181 PS&E Review • 60% Design Peer Review	0180 Constructability Review • 90% Constructability Review • 90% Constructability Comments • Draft Construction Schedule Review 0181 PS&E Review • 90% PS&E Building Permit Application Package • 90% Design Peer Review • State Materials Justification and Approval by ASDE • Discipline QAQC Memos		0181 PS&E Review • File Review Comments and Designer Replies in Project File • Final PS&E Contract Packaged for Management Review • Contract Package QAQC Cover Sheet for Ad and Award		
Construction				01AC Construction Scheduling • Draft Construction Schedule		01AC Construction Scheduling • Draft Construction Schedule • Construction Phasing Alternatives	01AC Construction Scheduling • Final Construction Schedule				0199 Construction Admin • Construction Funding • Design Record Close Out • Funding Adjust-to-Award • Contract Addendum • Respond to Bidder RFIs

Dolphin Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	Project Planning and Endorsement (PMP) PE.PM.03.15	Pre-Design Study (5%) PE.PS.07	Geometric Review (30%) PE.PD.75.30 Design Approval PE.PD.42.10	Environmental Review Documentation Complete PE.EV.18	General Plans Review (60%) PE.PD.75.60	Preliminary Contract Review (90%) PE.PD.75.90	Environmental Permits Received PE.EV.29	Project Development Approval (100%) PE.PD.42.60	Contract Ad and Award PE.PD.90.35	PE Phase End (Close Out and Archiving) PE.PD.90.65
Milestone Purpose	Provides basis to charter project team and begin developing the PMP Review Scoping documents	PM validates the project scope, schedule, and budget Management endorses the project's work plan	Refine the scope, schedule, budget Evaluate Alternatives	Documents design criteria and major design decisions. Documents the project purpose, type, strategy, phase durations, budget, and recommended ad date.	Complete NEPA/SEPA environmental process Complete the permit applications for agency approvals	Design of major project elements completed, review for constructability, conformance with standards	100 % PS&E review. Items missing from design should be minor and should be documented to reviewers.	All permits necessary for the project are received.	Comments from 90% review are incorporated. No other major changes to 90% PS&E review documents. At the end of this review, Contract Plans are Ad Ready.	Submittal of all final deliverables to Olympia for ad and award	Archive project electronic and hard copy files Document project in Z-PM standards file historical data base. Close out project through Project Controls Group.
Decisions Frozen and Milestones Completed (Overview)	Legislative budget Legislative ad dates	PMP complete Milestone dates set Schedule baselined Environmental Process defined Assumptions defined Risks defined File system and Logs are set up	Preferred alternative identified Predesign Study document complete OFM endorsed Predesign Study	Design criteria completed Alternative Analysis completed Design concept fixed Design type, size and location fixed Approval to begin ROW acquisition process Design Approval Package stamped and signed Draft construction schedule and phasing complete	The environmental review documentation is considered complete on the date that all necessary NEPA/SEPA is complete Permits submitted to the agencies (excluding building and CZM permits)	All key project elements and features that drive the project outcome and costs are defined. Geometric Review comments resolved and documented. Design details to be completed identified	✓ The deliverables are substantially complete ✓ Review and acceptance of design detail of key elements and features ✓ Permits Obtained. All environmental permits are approved, verified, and accepted for inclusion into the plans ✓ General Plans Review comments resolved & documented.	Permits are included in the contract documents	PS&E deliverables are complete. All review comments adjudicated. Plans and specifications stamped and sealed at end. ROW Certification Final Project Approval	Owner accepts design Approval to advertise ROW is clear	Consultants/WSDOT staff forward all required project records and files to the Project Manager Project Manager sends design file to library / construction group Electronic design file archived
Preliminary Engineering											
Design/PS&E Elements											
Project Management	0106 Draft Project Mgmt Plan • Deliverable Expectation Matrix • Critical Path Schedule • Milestone Schedule • Budget Sheet 01A0 Scheduling and Reporting Confidence Reports Quarterly Performance 0169 Project Summary • Scope Validation • Estimate Validation • Verify Project Definition • Verify Environmental Review Summary • Verify Design Decisions Summary	0101 General Project Management • Electronic and hard copy file System Set Up • Bid Book and Change Management Book Set Up 0106 Endorsed PMP • Signed Team Agreements • Baseline schedule • Budget • Cash Flow Sheet • Risk assessment • Communication Plan • Change management plan • QA/QC plan 0121 Change Management • Project Change Log • Contingency Estimate 0166 Cost and Risk Estimating • Risk Modeling Spreadsheet	0123 Pre-Design Study • PDS Draft Narrative • Alternatives Analysis • Cost Benefit Analysis • PDS Revised per Mgmt Review • PDS Final Narrative • PDS Revised per Executive 0111 Communication Plan • Draft Public Involvement Plan 0172 Design Documentation Package (DDP) • Design Approval Submittal (Concept Drawings, Site Plans, Elevations, Project Analysis, Cost Estimate)	0111 Communication Plan • Key Messages • Outreach Schedule • Project Description (Simple) • Impact to the Public • Draft Operations Plan • Draft Traffic Control Plan • Stakeholder List 0181 PS&E Review • QAQC Cover Sheets for the Project		0111 Communication Summary • Record of Contact • Outreach Decisions • Outreach List • Public Meeting Minutes • Public Hearings Record 0172 Design Documentation Package (DDP) Design Approval Submittal **Design Approval Submittal Includes:** • Stamped cover sheet • Project Description • Concept Drawings • Site Plans and Elevations • Cost Estimate • Risk Cost & Confidence • Project Analysis • Design Criteria worksheets or equivalent: www.wsdot.wa.gov/design/projectdev • Design Variances Inventory	01A0 Scheduling and Reporting • Confidence Reports • Quarterly Performance • Monthly Statused Schedules and Project Control Spreadsheet		01A0 Scheduling and Reporting • Confidence Reports • Quarterly Performance • Monthly Statused Schedules and Project Control Spreadsheet 0172 DDP Project Development Approval Submittal **Project Development Submittal Includes:** • Stamped Cover Sheet • Design Approval Submittal • Environmental Permits • Design Variance Inventory • Cost Estimate • Cost Estimate Summary (for Nicole, with Budget Comparison Worksheet) • Contract	01A0 Scheduling and Reporting • Confidence Reports • Quarterly Performance • Monthly Statused Schedules and Project Control Spreadsheet	0101 Project Management • Lessons Learned • Design File Transferred to CN • Design Records to Library • Design Files Archived • Consultant Evaluations • Team Evaluations • Copy records to Z-PM standards historical data base • DDP finalized and in Design File

Dolphin Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	Project Planning and Endorsement (PMP) PE.PM.03.15	Pre-Design Study (5%) PE.PS.07	Geometric Review (30%) PE.PD.75.30 Design Approval PE.PD.42.10	Environmental Review Documentation Complete PE.EV.18	General Plans Review (60%) PE.PD.75.60	Preliminary Contract Review (90%) PE.PD.75.90	Environmental Permits Received PE.EV.29	Project Development Approval (100%) PE.PD.42.60	Contract Ad and Award PE.PD.90.35	PE Phase End (Close Out and Archiving) PE.PD.90.65
Environmental	0132 Endangered Species Act Compliance • Environmental Permit List 0138 Environmental Permits • Validate ERS (Environmental Review Summary) • Soil Boring Notice of Intent	0101 General Project Management • Team Agreement Validated	0138 Environmental Permits • Environmental Section of Pre-Design Study • Boring Permit	0138 Environmental Permits • Discipline studies, reports, and predecessor information completed • Noise Variance Application • JARPA Preparation • Eelgrass Survey	0132 Endangered Species Act Compliance • Biological Assessment or No Effect Letter • Drawings for Permits • Noise Test for Monitoring Zone • Permit Drawings for ESA (CAD) • SEPA Checklist and Determination		0138 Environmental Permits • All environmental special provisions approved and included in the PS&E plan set • Environmental Commitment Meetings Set Up • Water Quality Certification	0138 Environmental Permits • Validated ERS (NEPA CE) • HPA (Hydraulic Project Approval) • Section 402 NPDES Permit • Shoreline Permit • Section 106 Corps and Tribal Response • SEPA Response to Comments • Noise Variance • USFW Biological Opinion • Section 106 Agreement on Area of Potential Effect and • Action Area for ESA work • CZM Certification • NOAA Biological Opinion or • Concurrence Letter	0138 Environmental Permits • Environmental Commitment File Entered	0138 Environmental Permits • Environmental Commitment Meetings	
Tribal Outreach				0109 Tribal • Initial Letters to Tribes • Tribal Interim Notifications			0109 Tribal • Tribal MOUs			0138 Environmental Permits Environmental Commitment Meetings	
Geotechnical	0143 Geotechnical • Project Site Data to RME - Geotech Work • Onsite field investigation scheduled (schedule and initiate no sooner than 1 year prior to construction) • Topographic survey requested	0143 Geotechnical • Soil Boring Notice of Intent • Field and Core Investigation completed • Borings coordinated with aerial obstructions	0143 Geotechnical • Location of Borings	0143 Geotechnical • Soils and Geotechnical Report Received					0143 Geotechnical • Boring logs submitted	0143 Geotechnical • Geotechnical Report compiled for contractor review • Geotechnical Report & cross-sections posted on website	
Cost Estimate and Risk Management	0166 Cost and Risk Estimating • Risk Analysis: Self Modeling Spreadsheet (also see "Project Management" above)	0166 Cost and Risk Estimating • Scoping Level Cost Validation • Determine if project needs Value Engineering or Cost Risk Assessment/Cost Estimating Validation Process • Basis of Estimate (see Cost Estimating Manual) • Bid Book with Initial Estimate		0166 Cost and Risk Estimating - 60% • Ebase Setup • Permit Cost Estimate • Risk Cost, 60% level • Cost Est, 60% level • Operations Cost Est. (CN) • Outreach Cost Est. (PE & CN) • Env. Monitoring Est. • Traffic Control Est. • Discipline Cost Estimates		0166 Cost and Risk Estimating 90% • Pay groups and pay items determined • Summary of Quantities Draft • Lump sum cost detail	0166 Cost and Risk Estimating Final • Cost Estimate Final • Cost estimate below the line items (building permit, operations cost, risk cost, environmental and archaeological monitoring) • Summary of Quantities Final		0166 Cost and Risk Estimating Final • Construction Estimate Final Revisions		
Specifications				01F1 Special Provisions - 30% PSE Word Set Up Initial Run List		01F1 Special Provisions - 60% • Diver Provisions • Environmental Provisions Draft • GSPs • Penalties and Incentives Draft • Proprietary Item (Sole Source) Provisions • RGSPs Coordination with Disciplines • Staging Provisions Draft	01F1 Special Provisions - 90% • Environmental Provisions Final • GSPs check for updates • Penalties and Incentives Final • Proprietary Item (Sole Source) Provisions updates • RGSPs Coordination with Disciplines • Staging Provisions Final		01F1 Special Provisions - Final • Summary of Geotechnical Conditions Appendix • Environmental Appendix • Last Changes to Provisions		

Dolphin Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	Project Planning and Endorsement (PMP) PE.PM.03.15	Pre-Design Study (5%) PE.PS.07	Geometric Review (30%) PE.PD.75.30 Design Approval PE.PD.42.10	Environmental Review Documentation Complete PE.EV.18	General Plans Review (60%) PE.PD.75.60	Preliminary Contract Review (90%) PE.PD.75.90	Environmental Permits Received PE.EV.29	Project Development Approval (100%) PE.PD.42.60	Contract Ad and Award PE.PD.90.35	PE Phase End (Close Out and Archiving) PE.PD.90.65
Project Data, Survey and Basemap	0117 Project Data • Project survey requirements finalized, including areas that may be Project Limits • Potential utility relocations identified • Utilities within the project limits notified • Washington Utilities Transportation Commission (WUTC) permit application for railroad crossings submitted	0117 Project Data • Aerial Photographs Background Data • Final Basemap • Established Geodetic Survey Control - Document in Design File • Utility As-Builts requested		0117 Project Data • Record of Survey completed and filed • Utility Plan with as-built information completed and transmitted to Utilities • Preliminary Utility conflicts identified • Project Overview Meeting held with Utility Owners		0117 Project Data • Field review of proposed features completed • Utility conflicts confirmed and relocation letters sent to utilities • Utility relocation meeting held	0117 Project Data • DNR Permits to Destroy Monuments • Utility Relocation Plan information and specifications Incorporated in PS&E • Letters of Understanding issued to utilities requiring relocation • Construction Maintenance Agreement completed				
Traffic and Operations				0150 Operations Plan • Operations Project Review - Document Decisions • Terminal Traffic Analysis Report		0150 Traffic Analysis • Assumptions and conclusions in Traffic Analysis Report verified for consistency with design • Traffic control plans showing Construction Sequence and staging • Traffic Control Final Estimate	0150 PS&E • Staging and Channelization Plans • Traffic Control Plans • Traffic Control Provisions				
Design/PS&E Elements By Support Group											
01F1 Civil	0169 Project Summary • Civil Design Criteria • Project Analysis • Plans list with estimate of design hours	01F1 Civil Design • Construction Water Quality Monitoring Plan submitted • Civil Estimate 30% • Hydraulic and Water Quality issues identified • Stormwater Treatment Deficiencies Identified • Storm water Management and Report Requirements and type documented • Stormwater Management Strategy endorsed (HQ)		0172 Design Approval • Civil Design Criteria • Civil Concept Drawings • Civil Site Plans and Elevations • Preliminary Civil Item Estimate • DDP 01F1 Civil Design • Civil Plans 60% • Civil Specifications 30% • Civil Estimate 60%		01F1 Civil Design • Environmental Site Plans • Civil Plans 90% • Civil Details 60% • Civil Specifications 60% • Civil Estimate 90% • Civil Abbreviations & Symbols, General Notes 90% 0181 PS&E Review • Civil Design Peer Review	01F1 Civil Design • Environmental Site Plans 100% • Civil Plans 100% • Civil Details 90% • Civil Specifications 90% • Civil Estimate 100% 0181 PS&E Review • Civil QAQC		01F1 Civil Design • Final Environmental Site Plans • Final Civil Plans • Final Civil Details • Final Civil Specifications • Final Civil Estimate	01F1 Civil Design • Response to Bidder RFIs • Addendum Preparation	

Dolphin Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	Project Planning and Endorsement (PMP) PE.PM.03.15	Pre-Design Study (5%) PE.PS.07	Geometric Review (30%) PE.PD.75.30 Design Approval PE.PD.42.10	Environmental Review Documentation Complete PE.EV.18	General Plans Review (60%) PE.PD.75.60	Preliminary Contract Review (90%) PE.PD.75.90	Environmental Permits Received PE.EV.29	Project Development Approval (100%) PE.PD.42.60	Contract Ad and Award PE.PD.90.35	PE Phase End (Close Out and Archiving) PE.PD.90.65
01F3 Structural	0169 Project Summary • Plans list with estimate of design hours 01F3 Structural Design • Scope for TS&L Determined • Structural Input on Environmental Documentation and Permits	01F3 Structural Design • Structural Estimate 30% • 15% Structural Plan, Elevation, Phasing Plan	01F3 Structural Design • Structural Site Plans and Elevations • Preliminary Structural Item Estimate	0172 Design Approval • Structural Design Criteria • Structural TS&L • Project Analysis • Structural Concept Drawings 01F3 Structural Design • Structural Phasing Plan 30% • Structural Plans 60% • Structural Specifications 30% • Structural Estimate 60% • Structural Type, Size & Location • Structural Permitting Submittal Review (includes constructability review for viable construction method, sequence, and schedule)		01F3 Structural Design • Structural Phasing Plan 60% • Structural Plans 90% • Structural Sections 60% • Structural Details 60% • Structural Specifications 60% • Structural Estimate 90% • Structural Abbreviations & Symbols, General Notes 90% • Structural Demolition Plans • Bridge Seat, Headframe, Railings and Ladders, Trestle, Transfer Span, Materials Schedules • Possible: Dolphins, Wingwalls 0181 PS&E Review • Structural Design Peer Review	01F3 Structural Design • Structural Phasing Plan 90% • Structural Plans 100% • Structural Sections 90% • Structural Details 90% • Structural Specifications 90% • Structural Estimate 100% • Bridge Seat, Headframe, Railings and Ladders, Trestle, Transfer Span, Materials Schedules • Possible: Dolphins, Wingwalls 0181 PS&E Review • Structural QAQC		01F3 Structural Design • All plans, specs, and estimate 100%	01F3 Structural Design • Response to Bidder RFIs • Addendum Preparation	
01F5 Electrical PE.PD.30.05	0169 Project Summary • Plans list with estimate of design hours	01F5 Electrical Design • Electrical Plans 60% • Utilities Plans • Electrical Specifications 30% • Electrical Estimate 60% • 30% Hydraulic System	0172 Design Documentation Package • Electrical Concept Drawings • Electrical Site Plans and Elevations • Preliminary Electrical Item Estimate 01F5 Electrical Design • Electrical Site Plans and Elevations • Preliminary Electrical Item Estimate	0172 Design Approval • Electrical Concept Drawings • Electrical Site Plans and Elevations • Preliminary Electrical Item Estimate • Electrical Design Criteria • Project Analysis 01F5 Electrical Design • Electrical Plans 60% • Utilities Plans • Electrical Specifications 30% • Electrical Estimate 60% • Lighting Plan 60% • One-Line & One-Line Demolition 60% • Temporary Power Plan 60% • 30% Transfer Span PLC Cabinet Layout, HPU Input Electrical Plan, PLC Network Block Diagram, Motor Control Panel, PLC Schematic, Range Lights and Fog Lights		01F5 Electrical Design • Electrical Plans 90% • Electrical Sections 60% • Electrical Details 60% • Electrical Specifications 60% • Electrical Estimate 90% • Electrical Abbreviations & Symbols, General Notes 90% • Electrical Demolition Plans • Lighting Plan 90% • One-Line & One-Line Demolition 90% • Temporary Power Plan 90% • 90% Transfer Span Electrical Plan & Schedules, PLC Terminal Wiring, Electrical Details, Conduit Block Diagram 0181 PS&E Review • Electrical Design Peer Review	01F5 Electrical Design • Electrical Plans 100% • Electrical Sections 90% • Electrical Details 90% • Electrical Specifications 90% • Electrical Estimate 100% • Lighting Plan 90% • One-Line & One-Line Demolition Final • Temporary Power Plan Final • Final Transfer Span Electrical Plan & Schedules, PLC Terminal Wiring, Electrical Details, Conduit Block Diagram 0181 PS&E Review • Electrical QAQC		01F5 Electrical Design All plans, specs, and estimate 100%	01F5 Electrical Design • Response to Bidder RFIs • Addendum Preparation	

Dolphin Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	Project Planning and Endorsement (PMP) PE.PM.03.15	Pre-Design Study (5%) PE.PS.07	Geometric Review (30%) PE.PD.75.30 Design Approval PE.PD.42.10	Environmental Review Documentation Complete PE.EV.18	General Plans Review (60%) PE.PD.75.60	Preliminary Contract Review (90%) PE.PD.75.90	Environmental Permits Received PE.EV.29	Project Development Approval (100%) PE.PD.42.60	Contract Ad and Award PE.PD.90.35	PE Phase End (Close Out and Archiving) PE.PD.90.65
Reviews and QAQC				0181 PS&E Review • 30% Constructability Review • 30% Constructability Comments 0180 Constructability Review • 30% Constructability Review • 30% Constructability Comments • Draft Construction Schedule Review		0181 PS&E Review • 60% Constructability Review • 60% Constructability Comments • Discipline Peer Reviews 0180 Constructability Review • 60% Constructability Review • 60% Constructability Comments • Draft Construction Schedule Review	0181 PS&E Review • 90% PS&E Building Perm Application Package • State Materials Justification and Approval by ASDE • 90% Constructability Review • 90% Constructability Comments • Discipline QAQC Memos 0180 Constructability Review • 90% Constructability Review • 90% Constructability Comments • Draft Construction Schedule Review		0181 PS&E Review • File Review Comments and Designer Replies in Project File • Final PS&E Contract Packaged for Management Review • Contract Package QAQC Cover Sheet for Ad and Award		
PE Close Out											
Construction Preparation				01AC Construction Scheduling • Draft Construction Schedule		01AC Construction Scheduling • Draft Construction Schedule • Construction Phasing Alternatives	01AC Construction Scheduling • Final Construction Schedule			0189 Advertisement • Memo to OEO • Memo to Contract Ad & Award • Ad Package to HQ	0199 Construction Admin • Construction Funding Approval Work Order • Design Record Close Out • Funding Adjust-to-Award • Contract Addendum • Respond to Bidder RFIs 0101 Project Management • Lessons Learned • Design Records to Library

Wingwall Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	Project Planning and Endorsement (PMP) PE.PM.03.15	Pre-Design Study (5%) PE.PS.07	Geometric Review (30%) PE.PD.75.30 Design Approval PE.PD.42.10	Environmental Review Documentation Complete PE.EV.18	General Plans Review (60%) PE.PD.75.60	Preliminary Contract Review (90%) PE.PD.75.90	Environmental Permits Received PE.EV.29	Project Development Approval (100%) PE.PD.42.60	Contract Ad and Award PE.PD.90.35	PE Phase End (Close Out and Archiving) PE.PD.90.65
Milestone Purpose	Provides basis to charter project team and begin developing the PMP Review Scoping documents	PM validates the project scope, schedule, and budget Management endorses the project's work plan	Refine the scope, schedule, budget Evaluate Alternatives	Documents design criteria and major design decisions. Documents the project purpose, type, strategy, phase durations, budget, and recommended ad date.	Complete NEPA/SEPA environmental process Complete the permit applications for agency approvals	Design of major project elements completed, review for constructability, conformance with standards	100 % PS&E review. Items missing from design should be minor and should be documented to reviewers.	All permits necessary for the project are received.	Comments from 90% review are incorporated. No other major changes to 90% PS&E review documents. At the end of this review, Contract Plans are Ad Ready.	Submittal of all final deliverables to Olympia for ad and award	Archive project electronic and hard copy files Document project in Z-PM standards file historical data base. Close out project through Project Controls Group.
Decisions Frozen and Milestones Completed (Overview)	Legislative budget Legislative ad dates	PMP complete Milestone dates set Schedule baselined Environmental Process defined Assumptions defined Risks defined File system and Logs are set up	Preferred alternative identified Predesign Study document complete OFM endorsed Predesign Study	Design criteria completed Alternative Analysis completed Design concept fixed Design type, size and location fixed Approval to begin ROW acquisition process Design Approval Package stamped and signed Draft construction schedule and phasing complete	The environmental review documentation is considered complete on the date that all necessary NEPA/SEPA is complete Permits submitted to the agencies (excluding building and CZM permits)	All key project elements and features that drive the project outcome and costs are defined. Geometric Review comments resolved and documented. Design details to be completed identified	✓ The deliverables are substantially complete ✓ Review and acceptance of design detail of key elements and features ✓ Permits Obtained. All environmental permits are approved, verified, and accepted for inclusion into the plans ✓ General Plans Review comments resolved & documented.	Permits are included in the contract documents	PS&E deliverables are complete. All review comments adjudicated. Plans and specifications stamped and sealed at end. ROW Certification Final Project Approval	Owner accepts design Approval to advertise ROW is clear	Consultants/WSDOT staff forward all required project records and files to the Project Manager Project Manager sends design file to library / construction group Electronic design file archived
Preliminary Engineering											
Design/PS&E Elements											
Project Management	0106 Draft Project Mgmt Plan • Deliverable Expectation Matrix • Critical Path Schedule • Milestone Schedule • Budget Sheet 01A0 Scheduling and Reporting Confidence Reports Quarterly Performance 0169 Project Summary • Scope Validation • Estimate Validation • Verify Project Definition • Verify Environmental Review Summary • Verify Design Decisions Summary	0101 General Project Management • Electronic and hard copy file System Set Up • Bid Book and Change Management Book Set Up 0106 Endorsed PMP • Signed Team Agreements • Baseline schedule • Budget • Cash Flow Sheet • Risk assessment • Communication Plan • Change management plan • QA/QC plan 0121 Change Management • Project Change Log • Contingency Estimate 0166 Cost and Risk Estimating • Risk Modeling Spreadsheet	0123 Pre-Design Study • PDS Draft Narrative • Alternatives Analysis • Cost Benefit Analysis • PDS Revised per Mgmt Review • PDS Final Narrative • PDS Revised per Executive 0111 Communication Plan • Draft Public Involvement Plan 0172 Design Documentation Package (DDP) • Design Approval Submittal (Concept Drawings, Site Plans, Elevations, Project Analysis, Cost Estimate)	0111 Communication Plan • Key Messages • Outreach Schedule • Project Description (Simple) • Impact to the Public • Draft Operations Plan • Draft Traffic Control Plan • Stakeholder List 0181 PS&E Review • QAQC Cover Sheets for the Project		0111 Communication Summary • Record of Contact • Outreach Decisions • Outreach List • Public Meeting Minutes • Public Hearings Record 0172 Design Documentation Package (DDP) Design Approval Submittal **Design Approval Submittal Includes:** • Stamped cover sheet • Project Description • Concept Drawings • Site Plans and Elevations • Cost Estimate • Risk Cost & Confidence • Project Analysis • Design Criteria worksheets or equivalent: www.wsdot.wa.gov/design/projectdev • Design Variances Inventory	01A0 Scheduling and Reporting • Confidence Reports • Quarterly Performance • Monthly Statused Schedules and Project Control Spreadsheet		01A0 Scheduling and Reporting • Confidence Reports • Quarterly Performance • Monthly Statused Schedules and Project Control Spreadsheet 0172 DDP Project Development Approval Submittal **Project Development Submittal Includes:** • Stamped Cover Sheet • Design Approval Submittal • Environmental Permits • Design Variance Inventory • Cost Estimate • Cost Estimate Summary (for Nicole, with Budget Comparison Worksheet) • Contract	01A0 Scheduling and Reporting • Confidence Reports • Quarterly Performance • Monthly Statused Schedules and Project Control Spreadsheet	0101 Project Management • Lessons Learned • Design File Transferred to CN • Design Records to Library • Design Files Archived • Consultant Evaluations • Team Evaluations • Copy records to Z-PM standards historical data base • DDP finalized and in Design File

Wingwall Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	**Project Planning and Endorsement (PMP)** PE.PM.03.15	**Pre-Design Study (5%)** PE.PS.07	**Geometric Review (30%)** PE.PD.75.30 **Design Approval** PE.PD.42.10	**Environmental Review Documentation Complete** PE.EV.18	**General Plans Review (60%)** PE.PD.75.60	**Preliminary Contract Review (90%)** PE.PD.75.90	**Environmental Permits Received** PE.EV.29	**Project Development Approval (100%)** PE.PD.42.60	**Contract Ad and Award** PE.PD.90.35	**PE Phase End (Close Out and Archiving)** PE.PD.90.65
Environmental	0132 Endangered Species Act Compliance • Environmental Permit List 0138 Environmental Permits • Validate ERS (Environmental Review Summary) • Soil Boring Notice of Intent	0101 General Project Management • Team Agreement Validated	0138 Environmental Permits • Environmental Section of Pre-Design Study • Boring Permit	0138 Environmental Permits • Discipline studies, reports, and predecessor information completed • Noise Variance Application • JARPA Preparation • Eelgrass Survey	0132 Endangered Species Act Compliance • Biological Assessment or No Effect Letter • Drawings for Permits • Noise Test for Monitoring Zone • Permit Drawings for ESA (CAD) • SEPA Checklist and Determination		0138 Environmental Permits • All environmental special provisions approved and included in the PS&E plan set • Environmental Commitment Meetings Set Up • Water Quality Certification	0138 Environmental Permits • Validated ERS (NEPA CE) • HPA (Hydraulic Project Approval) • Section 402 NPDES Permit • Shoreline Permit • Section 106 Corps and Tribal Response • SEPA Response to Comments • Noise Variance • USFW Biological Opinion • Section 106 Agreement on Area of Potential Effect and • Action Area for ESA work • CZM Certification • NOAA Biological Opinion or • Concurrence Letter	0138 Environmental Permits • Environmental Commitment File Entered	0138 Environmental Permits • Environmental Commitment Meetings	
Tribal Outreach				0109 Tribal • Initial Letters to Tribes • Tribal Interim Notifications			0109 Tribal • Tribal MOUs			0138 Environmental Permits Environmental Commitment Meetings	
Geotechnical	0143 Geotechnical • Project Site Data to RME - Geotech Work • Onsite field investigation scheduled (schedule and initiate no sooner than 1 year prior to construction) • Topographic survey requested	0143 Geotechnical • Soil Boring Notice of Intent • Field and Core Investigation completed • Borings coordinated with aerial obstructions	0143 Geotechnical • Location of Borings	0143 Geotechnical • Soils and Geotechnical Report Received					0143 Geotechnical • Boring Logs Received	0143 Geotechnical • Geotechnical Report compiled for contractor review • Geotechnical Report & cross-sections posted on website	
Cost Estimate and Risk Management	0166 Cost and Risk Estimating • Risk Analysis: Self Modeling Spreadsheet (also see "Project Management" above)	0166 Cost and Risk Estimating • Scoping Level Cost Validation • Determine if project needs Value Engineering or Cost Risk Assessment/Cost Estimating Validation Process • Basis of Estimate (see Cost Estimating Manual) • Bid Book with Initial Estimate		0166 Cost and Risk Estimating - 60% • Ebase Setup • Permit Cost Estimate • Risk Cost, 60% level • Cost Est, 60% level • Operations Cost Est. (CN) • Outreach Cost Est. (PE & CN) • Env. Monitoring Est. • Traffic Control Est. • Discipline Cost Estimates		0166 Cost and Risk Estimating 90% • Pay groups and pay items determined • Summary of Quantities Draft • Lump sum cost detail	0166 Cost and Risk Estimating Final • Cost Estimate Final • Cost estimate below the line items (building permit, operations cost, risk cost, environmental and archaeological monitoring) • Summary of Quantities Final		0166 Cost and Risk Estimating Final • Construction Estimate Final Revisions		
Specifications				01F1 Special Provisions - 30% PSE Word Set Up Initial Run List		01F1 Special Provisions - 60% • Diver Provisions • Environmental Provisions Draft • GSPs • Penalties and Incentives Draft • Proprietary Item (Sole Source) Provisions • RGSPs Coordination with Disciplines • Staging Provisions Draft	01F1 Special Provisions - 90% • Environmental Provisions Final • GSPs check for updates • Penalties and Incentives Final • Proprietary Item (Sole Source) Provisions updates • RGSPs Coordination with Disciplines • Staging Provisions Final		01F1 Special Provisions - Final • Summary of Geotechnical Conditions Appendix • Environmental Appendix • Last Changes to Provisions		

Wingwall Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	Project Planning and Endorsement (PMP) PE.PM.03.15	Pre-Design Study (5%) PE.PS.07	Geometric Review (30%) PE.PD.75.30 Design Approval PE.PD.42.10	Environmental Review Documentation Complete PE.EV.18	General Plans Review (60%) PE.PD.75.60	Preliminary Contract Review (90%) PE.PD.75.90	Environmental Permits Received PE.EV.29	Project Development Approval (100%) PE.PD.42.60	Contract Ad and Award PE.PD.90.35	PE Phase End (Close Out and Archiving) PE.PD.90.65
Project Data, Survey and Basemap	0117 Project Data • Project survey requirements finalized, including areas that may be Project Limits • Potential utility relocations identified • Utilities within the project limits notified • Washington Utilities Transportation Commission (WUTC) permit application for railroad crossings submitted	0117 Project Data • Aerial Photographs Background Data • Final Basemap • Established Geodetic Survey Control - Document in Design File • Utility As-Builts requested		0117 Project Data • Record of Survey completed and filed • Utility Plan with as-built information completed and transmitted to Utilities • Preliminary Utility conflicts identified • Project Overview Meeting held with Utility Owners		0117 Project Data • Field review of proposed features completed • Utility conflicts confirmed and relocation letters sent to utilities • Utility relocation meeting held	0117 Project Data • DNR Permits to Destroy Monuments • Utility Relocation Plan information and specifications Incorporated in PS&E • Letters of Understanding issued to utilities requiring relocation • Construction Maintenance Agreement completed				
Traffic and Operations				0150 Operations Plan • Operations Project Review - Document Decisions • Terminal Traffic Analysis Report		0150 Traffic Analysis • Assumptions and conclusions in Traffic Analysis Report verified for consistency with design • Traffic control plans showing Construction Sequence and staging • Traffic Control Final Estimate	0150 PS&E • Staging and Channelization Plans • Traffic Control Plans • Traffic Control Provisions				
Design/PS&E Elements By Support Group											
01F1 Civil	0169 Project Summary • Civil Design Criteria • Project Analysis • Plans list with estimate of design hours	01F1 Civil Design • Construction Water Quality Monitoring Plan submitted • Civil Estimate 30% • Hydraulic and Water Quality issues identified • Stormwater Treatment Deficiencies Identified • Storm water Management and Report Requirements and type documented • Stormwater Management Strategy endorsed (HQ)		0172 Design Approval • Civil Design Criteria • Civil Concept Drawings • Civil Site Plans and Elevations • Preliminary Civil Item Estimate • DDP 01F1 Civil Design • Civil Plans 60% • Civil Specifications 30% • Civil Estimate 60%		01F1 Civil Design • Environmental Site Plans • Civil Plans 90% • Civil Details 60% • Civil Specifications 60% • Civil Estimate 90% • Civil Abbreviations & Symbols, General Notes 90% 0181 PS&E Review • Civil Design Peer Review	01F1 Civil Design • Environmental Site Plans 100% • Civil Plans 100% • Civil Details 90% • Civil Specifications 90% • Civil Estimate 100% 0181 PS&E Review • Civil QAQC		01F1 Civil Design • Final Environmental Site Plans • Final Civil Plans • Final Civil Details • Final Civil Specifications • Final Civil Estimate	01F1 Civil Design • Response to Bidder RFIs • Addendum Preparation	

Wingwall Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	Project Planning and Endorsement (PMP) PE.PM.03.15	Pre-Design Study (5%) PE.PS.07	Geometric Review (30%) PE.PD.75.30 Design Approval PE.PD.42.10	Environmental Review Documentation Complete PE.EV.18	General Plans Review (60%) PE.PD.75.60	Preliminary Contract Review (90%) PE.PD.75.90	Environmental Permits Received PE.EV.29	Project Development Approval (100%) PE.PD.42.60	Contract Ad and Award PE.PD.90.35	PE Phase End (Close Out and Archiving) PE.PD.90.65
01F3 Structural	0169 Project Summary • Plans list with estimate of design hours 01F3 Structural Design • Scope for TS&L Determined • Structural Input on Environmental Documentation and Permits	01F3 Structural Design • Structural Estimate 30% • 15% Structural Plan, Elevation, Phasing Plan	01F3 Structural Design • Structural Site Plans and Elevations • Preliminary Structural Item Estimate	0172 Design Approval • Structural Design Criteria • Structural TS&L • Project Analysis • Structural Concept Drawings 01F3 Structural Design • Structural Phasing Plan 30% • Structural Plans 60% • Structural Specifications 30% • Structural Estimate 60% • Structural Type, Size & Location • Structural Permitting Submittal Review (includes constructability review for viable construction method, sequence, and schedule)		01F3 Structural Design • Structural Phasing Plan 60% • Structural Plans 90% • Structural Sections 60% • Structural Details 60% • Structural Specifications 60% • Structural Estimate 90% • Structural Abbreviations & Symbols, General Notes 90% • Structural Demolition Plans • Bridge Seat, Headframe, Railings and Ladders, Trestle, Transfer Span, Materials Schedules • Possible: Dolphins, Wingwalls 0181 PS&E Review • Structural Design Peer Review	01F3 Structural Design • Structural Phasing Plan 90% • Structural Plans 100% • Structural Sections 90% • Structural Details 90% • Structural Specifications 90% • Structural Estimate 100% • Materials Schedules 0181 PS&E Review • Structural QAQC		01F3 Structural Design All plans, specs, and estimate 100%	01F3 Structural Design • Response to Bidder RFIs • Addendum Preparation	
01F5 Electrical PE.PD.30.05	0169 Project Summary • Plans list with estimate of design hours	01F5 Electrical Design • Electrical Concept Plans 15% • Utilities Basemap Update	0172 Design Documentation Package • Electrical Concept Drawings • Electrical Site Plans and Elevations • Preliminary Electrical Item Estimate 01F5 Electrical Design • Electrical Site Plans and Elevations • Preliminary Electrical Item Estimate	0172 Design Approval • Electrical Concept Drawings • Electrical Site Plans and Elevations • Preliminary Electrical Item Estimate • Electrical Design Criteria • Project Analysis 01F5 Electrical Design • Electrical Plans 60% • Utilities Plans • Electrical Specifications 30% • Electrical Estimate 60% • Lighting Plan 60% • One-Line & One-Line Demolition 60% • Temporary Power Plan 60% • 30% Range Lights and Fog Lights		01F5 Electrical Design • Electrical Plans 90% • Electrical Sections 60% • Electrical Details 60% • Electrical Specifications 60% • Electrical Estimate 90% • Electrical Abbreviations & Symbols, General Notes 90% • Electrical Demolition Plans • Lighting Plan 90% • One-Line & One-Line Demolition 90% • Temporary Power Plan 90% • 90% Electrical Plans 0181 PS&E Review • Electrical Design Peer Review	01F5 Electrical Design • Electrical Plans 100% • Electrical Sections 90% • Electrical Details 90% • Electrical Specifications 90% • Electrical Estimate 100% • Lighting Plan 90% • One-Line & One-Line Demolition Final • Temporary Power Plan Final • Final Electrical Plan & Schedules, Electrical Details, Conduit Block Diagram 0181 PS&E Review • Electrical QAQC		01F5 Electrical Design All plans, specs, and estimate 100%	01F5 Electrical Design • Response to Bidder RFIs • Addendum Preparation	

Wingwall Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	Project Planning and Endorsement (PMP) PE.PM.03.15	Pre-Design Study (5%) PE.PS.07	Geometric Review (30%) PE.PD.75.30 Design Approval PE.PD.42.10	Environmental Review Documentation Complete PE.EV.18	General Plans Review (60%) PE.PD.75.60	Preliminary Contract Review (90%) PE.PD.75.90	Environmental Permits Received PE.EV.29	Project Development Approval (100%) PE.PD.42.60	Contract Ad and Award PE.PD.90.35	PE Phase End (Close Out and Archiving) PE.PD.90.65
Reviews and QAQC				0181 PS&E Review • 30% Constructability Review • 30% Constructability Comments 0180 Constructability Review • 30% Constructability Review • 30% Constructability Comments • Draft Construction Schedule Review		0181 PS&E Review • 60% Constructability Review • 60% Constructability Comments • Discipline Peer Reviews 0180 Constructability Review • 60% Constructability Review • 60% Constructability Comments • Draft Construction Schedule Review	0181 PS&E Review • 90% PS&E Building Permit Application Package • State Materials Justification and Approval by ASDE • 90% Constructability Review • 90% Constructability Comments • Discipline QAQC Memos 0180 Constructability Review • 90% Constructability Review • 90% Constructability Comments • Draft Construction Schedule Review		0181 PS&E Review • File Review Comments and Designer Replies in Project File • Final PS&E Contract Packaged for Management Review • Contract Package QAQC Cover Sheet for Ad and Award		
PE Close Out											
Construction Preparation				01AC Construction Scheduling • Draft Construction Schedule		01AC Construction Scheduling • Draft Construction Schedule • Construction Phasing Alternatives	01AC Construction Scheduling • Final Construction Schedule			0189 Advertisement • Memo to OEO • Memo to Contract Ad & Award • Ad Package to HQ	0199 Construction Admin • Construction Funding Approval Work Order • Design Record Close Out • Funding Adjust-to-Award • Contract Addendum • Respond to Bidder RFIs 0101 Project Management • Lessons Learned • Design Records to Library

Tollbooth, Term Bldg Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	**Project Planning and Endorsement (PMP)** PE.PM.03.15	**Pre-Design Study (5%)** PE.PS.07	**Geometric Review (30%)** PE.PD.75.30 **Design Approval** PE.PD.42.10	**Environmental Review Documentation Complete** PE.EV.18	**General Plans Review (60%)** PE.PD.75.60	**Preliminary Contract Review (90%)** PE.PD.75.90	**Environmental Permits Received** PE.EV.29	**Project Development Approval (100%)** PE.PD.42.60	**Contract Ad and Award** PE.PD.90.35	**PE Phase End (Close Out and Archiving)** PE.PD.90.65
Milestone Purpose	Provides basis to charter project team and begin developing the PMP Review Scoping documents	PM validates the project scope, schedule, and budget Management endorses the project's work plan	Refine the scope, schedule, budget Evaluate Alternatives	Documents design criteria and major design decisions. Documents the project purpose, type, strategy, phase durations, budget, and recommended ad date.	Complete NEPA/SEPA environmental process Complete the permit applications for agency approvals	Design of major project elements completed, review for constructability, conformance with standards	100 % PS&E review. Items missing from design should be minor and should be documented to reviewers.	All permits necessary for the project are received.	Comments from 90% review are incorporated. No other major changes to 90% PS&E review documents. At the end of this review, Contract Plans are Ad Ready.	Submittal of all final deliverables to Olympia for ad and award	Archive project electronic and hard copy files Document project in Z-PM standards file historical data base. Close out project through Project Controls Group.
Decisions Frozen and Milestones Completed (Overview)	Legislative budget Legislative ad dates	PMP complete Milestone dates set Schedule baselined Environmental Process defined Assumptions defined Risks defined File system and Logs are set up	Preferred alternative identified Predesign Study document complete OFM endorsed Predesign Study	Design criteria completed Alternative Analysis completed Design concept fixed Design type, size and location fixed Approval to begin ROW acquisition process Design Approval Package stamped and signed Draft construction schedule and phasing complete	The environmental review documentation is considered complete on the date that all necessary NEPA/SEPA is complete Permits submitted to the agencies (excluding building and CZM permits)	All key project elements and features that drive the project outcome and costs are defined. Geometric Review comments resolved and documented. Design details to be completed identified	✓ The deliverables are substantially complete ✓ Review and acceptance of design detail of key elements and features ✓ Permits Obtained. All environmental permits are approved, verified, and accepted for inclusion into the plans ✓ General Plans Review comments resolved & documented.	Permits are included in the contract documents	PS&E deliverables are complete. All review comments adjudicated. Plans and specifications stamped and sealed at end. ROW Certification Final Project Approval	Owner accepts design Approval to advertise ROW is clear	Consultants/WSDOT staff forward all required project records and files to the Project Manager Project Manager sends design file to library / construction group Electronic design file archived
Preliminary Engineering											
Design/PS&E Elements											
Project Management	0106 Draft Project Mgmt Plan • Deliverable Expectation Matrix • Critical Path Schedule • Milestone Schedule • Budget Sheet 01A0 Scheduling and Reporting Confidence Reports Quarterly Performance 0169 Project Summary • Scope Validation • Estimate Validation • Verify Project Definition • Verify Environmental Review Summary • Verify Design Decisions Summary	0101 General Project Management • Electronic and hard copy file System Set Up • Bid Book and Change Management Book Set Up 0106 Endorsed PMP • Signed Team Agreements • Baseline schedule • Budget • Cash Flow Sheet • Risk assessment • Communication Plan • Change management plan • QA/QC plan 0121 Change Management • Project Change Log • Contingency Estimate 0166 Cost and Risk Estimating • Risk Modeling Spreadsheet	0123 Pre-Design Study • PDS Draft Narrative • Alternatives Analysis • Cost Benefit Analysis • PDS Revised per Mgmt Review • PDS Final Narrative • PDS Revised per Executive 0111 Communication Plan • Draft Public Involvement Plan 0172 Design Documentation Package (DDP) • Design Approval Submittal (Concept Drawings, Site Plans, Elevations, Project Analysis, Cost Estimate)	0111 Communication Plan • Key Messages • Outreach Schedule • Project Description (Simple) • Impact to the Public • Draft Operations Plan • Draft Traffic Control Plan • Stakeholder List 0181 PS&E Review • QAQC Cover Sheets for the Project		0111 Communication Summary • Record of Contact • Outreach Decisions • Outreach List • Public Meeting Minutes • Public Hearings Record 0172 Design Documentation Package (DDP) Design Approval Submittal **Design Approval Submittal Includes:** • Stamped cover sheet • Project Description • Concept Drawings • Site Plans and Elevations • Cost Estimate • Risk Cost & Confidence • Project Analysis • Design Criteria worksheets or equivalent: www.wsdot.wa.gov/design/projectdev • Design Variances Inventory	01A0 Scheduling and Reporting • Confidence Reports • Quarterly Performance • Monthly Statused Schedules and Project Control Spreadsheet		01A0 Scheduling and Reporting • Confidence Reports • Quarterly Performance • Monthly Statused Schedules and Project Control Spreadsheet 0172 DDP Project Development Approval Submittal **Project Development Submittal Includes:** • Stamped Cover Sheet • Design Approval Submittal • Environmental Permits • Design Variance Inventory • Cost Estimate • Cost Estimate Summary (for Nicole, with Budget Comparison Worksheet) • Contract	01A0 Scheduling and Reporting • Confidence Reports • Quarterly Performance • Monthly Statused Schedules and Project Control Spreadsheet	0101 Project Management • Lessons Learned • Design File Transferred to CN • Design Records to Library • Design Files Archived • Consultant Evaluations • Team Evaluations • Copy records to Z-PM standards historical data base • DDP finalized and in Design File

Tollbooth, Term Bldg Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	**Project Planning and Endorsement (PMP)** PE.PM.03.15	**Pre-Design Study (5%)** PE.PS.07	**Geometric Review (30%)** PE.PD.75.30 **Design Approval** PE.PD.42.10	**Environmental Review Documentation Complete** PE.EV.18	**General Plans Review (60%)** PE.PD.75.60	**Preliminary Contract Review (90%)** PE.PD.75.90	**Environmental Permits Received** PE.EV.29	**Project Development Approval (100%)** PE.PD.42.60	**Contract Ad and Award** PE.PD.90.35	**PE Phase End (Close Out and Archiving)** PE.PD.90.65
Environmental	0132 Endangered Species Act Compliance • Environmental Permit List 0138 Environmental Permits • Validate ERS (Environmental Review Summary) • Soil Boring Notice of Intent	0101 General Project Management • Team Agreement Validated	0138 Environmental Permits • Environmental Section of Pre-Design Study • Boring Permit	0138 Environmental Permits • Discipline studies, reports, and predecessor information completed • Noise Variance Application • JARPA Preparation • Eelgrass Survey	0132 Endangered Species Act Compliance • Biological Assessment or No Effect Letter • Drawings for Permits • Noise Test for Monitoring Zone • Permit Drawings for ESA (CAD) • SEPA Checklist and Determination		0138 Environmental Permits • All environmental special provisions approved and included in the PS&E plan set • Environmental Commitment Meetings Set Up • Water Quality Certification	0138 Environmental Permits • Validated ERS (NEPA CE) • HPA (Hydraulic Project Approval) • Section 402 NPDES Permit • Shoreline Permit • Section 106 Corps and Tribal Response • SEPA Response to Comments • Noise Variance • USFW Biological Opinion • Section 106 Agreement on Area of Potential Effect and • Action Area for ESA work • CZM Certification • NOAA Biological Opinion or • Concurrence Letter	0138 Environmental Permits • Environmental Commitment File Entered	0138 Environmental Permits • Environmental Commitment Meetings	
Tribal Outreach				0109 Tribal • Initial Letters to Tribes • Tribal Interim Notifications			0109 Tribal • Tribal MOUs			0138 Environmental Permits Environmental Commitment Meetings	
Geotechnical	0143 Geotechnical • Onsite field investigation scheduled (schedule and initiate no sooner than 1 year prior to construction) • Topographic survey requested	0143 Geotechnical • Soil Boring Notice of Intent • Field and Core Investigation completed • Borings coordinated with aerial obstructions	0143 Geotechnical • Project Site Data to Region Materials Engineer (RME) - Geotech Work • Archaeological Investigation	0143 Geotechnical • Soils and Geotechnical Report • Archaeological Report			0143 Geotechnical • Materials Source Report completed and submitted to State Material's Lab (for Paving)		0143 Geotechnical • Boring Logs Received	0143 Geotechnical • Geotechnical Report compiled for contractor review • Geotechnical Report & cross-sections posted on website	
Cost Estimate and Risk Management	0166 Cost and Risk Estimating • Risk Analysis: Self Modeling Spreadsheet (also see "Project Management" above)	0166 Cost and Risk Estimating • Scoping Level Cost Validation • Determine if project needs Value Engineering or Cost Risk Assessment/Cost Estimating Validation Process • Basis of Estimate (see Cost Estimating Manual) • Bid Book with Initial Estimate		0166 Cost and Risk Estimating - 60% • Ebase Setup • Permit Cost Estimate • Risk Cost, 60% level • Cost Est, 60% level • Operations Cost Est. (CN) • Outreach Cost Est. (PE & CN) • Env. Monitoring Est. • Traffic Control Est. • Discipline Cost Estimates		0166 Cost and Risk Estimating 90% • Pay groups and pay items determined • Summary of Quantities Draft • Lump sum cost detail	0166 Cost and Risk Estimating Final • Cost Estimate Final • Cost estimate below the line items (building permit, operations cost, risk cost, environmental and archaeological monitoring) • Summary of Quantities Final		0166 Cost and Risk Estimating Final • Construction Estimate Final Revisions		
Specifications				01F1 Special Provisions - 30% PSE Word Set Up Initial Run List		01F1 Special Provisions - 60% • Diver Provisions • Environmental Provisions Draft • GSPs • Penalties and Incentives Draft • Proprietary Item (Sole Source) Provisions • RGSPs Coordination with Disciplines • Staging Provisions Draft	01F1 Special Provisions - 90% • Environmental Provisions Final • GSPs check for updates • Penalties and Incentives Final • Proprietary Item (Sole Source) Provisions updates • RGSPs Coordination with Disciplines • Staging Provisions Final		01F1 Special Provisions - Final • Summary of Geotechnical Conditions Appendix • Environmental Appendix • Last Changes to Provisions		

Tollbooth, Term Bldg Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	Project Planning and Endorsement (PMP) PE.PM.03.15	Pre-Design Study (5%) PE.PS.07	Geometric Review (30%) PE.PD.75.30 Design Approval PE.PD.42.10	Environmental Review Documentation Complete PE.EV.18	General Plans Review (60%) PE.PD.75.60	Preliminary Contract Review (90%) PE.PD.75.90	Environmental Permits Received PE.EV.29	Project Development Approval (100%) PE.PD.42.60	Contract Ad and Award PE.PD.90.35	PE Phase End (Close Out and Archiving) PE.PD.90.65
Project Data, Survey and Basemap	0117 Project Data • Project survey requirements finalized, including areas that may be Project Limits • Potential utility relocations identified • Utilities within the project limits notified • Washington Utilities Transportation Commission (WUTC) permit application for railroad crossings submitted	0117 Project Data • Aerial Photographs Background Data • Final Basemap • Established Geodetic Survey Control - Document in Design File • Utility As-Builts requested		0117 Project Data • Record of Survey completed and filed • Utility Plan with as-built information completed and transmitted to Utilities • Preliminary Utility conflicts identified • Project Overview Meeting held with Utility Owners		0117 Project Data • Field review of proposed features completed • Utility conflicts confirmed and relocation letters sent to utilities • Utility relocation meeting held	0117 Project Data • DNR Permits to Destroy Monuments • Utility Relocation Plan information and specifications Incorporated in PS&E • Letters of Understanding issued to utilities requiring relocation • Construction Maintenance Agreement completed				
Traffic and Operations				0150 Operations Plan • Operations Project Review - Document Decisions • Terminal Traffic Analysis Report		0150 Traffic Analysis • Assumptions and conclusions in Traffic Analysis Report verified for consistency with design • Traffic control plans showing Construction Sequence and staging • Traffic Control Final Estimate	0150 PS&E • Staging and Channelization Plans • Traffic Control Plans • Traffic Control Provisions				
Design/PS&E Elements By Support Group											
01F1 Civil	0169 Project Summary • Civil Design Criteria • Project Analysis • Plans list with estimate of design hours	01F1 Civil Design • Construction Water Quality Monitoring Plan submitted • Civil Estimate 30% • Hydraulic and Water Quality issues identified • Stormwater Treatment Deficiencies Identified • Storm water Management and Report Requirements and type documented • Stormwater Management Strategy endorsed (HQ)		0172 Design Approval • Civil Design Criteria • Civil Concept Drawings • Civil Site Plans and Elevations • Preliminary Civil Item Estimate • DDP 01F1 Civil Design • Paving Plans • Stormwater Plans • TESC Plans & BMPs • Utilities Plans • Civil Plans 60% • Civil Specifications 30% • Civil Estimate 60% • Documented Minimum Requirements from Highway Runoff Manual		01F1 Civil Design • Environmental Site Plans • Civil Plans 90% • Civil Details 60% • Civil Specifications 60% • Civil Estimate 90% • Civil Abbreviations & Symbols, General Notes 90% 0181 PS&E Review • Civil Design Peer Review	01F1 Civil Design • Environmental Site Plans 100% • Civil Plans 100% • Civil Details 90% • Civil Specifications 90% • Civil Estimate 100% 0181 PS&E Review • Civil QAQC		01F1 Civil Design • Final Environmental Site Plans • Final Civil Plans • Final Civil Details • Final Civil Specifications • Final Civil Estimate	01F1 Civil Design • Response to Bidder RFIs • Addendum Preparation	

Tollbooth, Term Bldg Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	**Project Planning and Endorsement (PMP)** PE.PM.03.15	**Pre-Design Study (5%)** PE.PS.07	**Geometric Review (30%)** PE.PD.75.30 **Design Approval** PE.PD.42.10	**Environmental Review Documentation Complete** PE.EV.18	**General Plans Review (60%)** PE.PD.75.60	**Preliminary Contract Review (90%)** PE.PD.75.90	**Environmental Permits Received** PE.EV.29	**Project Development Approval (100%)** PE.PD.42.60	**Contract Ad and Award** PE.PD.90.35	**PE Phase End (Close Out and Archiving)** PE.PD.90.65
01F2 Architectural	0169 Project Summary • Plans list with estimate of design hours	01F2 Architectural Design • Architectural Estimate 30% • 15% Architectural Plan, Elevation, Phasing Plan • Fire Marshall Approval	01F2 Architectural Design • Architectural Site Plans and Elevations • Preliminary Architectural Item Estimate	0172 Design Approval • Architectural Design Criteria: View Corridor & Bldg Height • Project Analysis • Architectural Concept Drawings 01F2 Architectural Design • Building Permit Pre-Submittal Meeting with Pt. Townsend • Architectural Phasing Plan 30% • Architectural Plans 60% • Utilities Plans • Architectural Specifications 30% • Architectural Estimate 60%		01F2 Architectural Design • Architectural Phasing Plan 60% • Architectural Building Plans 90% • Architectural Security Plans 90% • Architectural Sections 60% • Architectural Details 60% • Architectural Specifications 60% • Architectural Estimate 90% • Architectural Abbreviations & Symbols, General Notes 90% • Architectural Demolition Plans 0181 PS&E Review • Architectural Design Peer Review	01F2 Architectural Design • Building Permit Submittal • Architectural Phasing Plan 90% • Architectural Plans 100% • Architectural Sections 90% • Architectural Details 90% • Architectural Specifications 90% • Architectural Estimate 100% 0181 PS&E Review • Architectural QAQC	01F2 Architectural Design • Building Permit Received	01F2 Architectural Design • All plans, specs, and estimate 100%	01F2 Architectural Design • Response to Bidder RFIs • Addendum Preparation	
01F3 Structural	0169 Project Summary • Plans list with estimate of design hours 01F3 Structural Design • Scope for TS&L Determined • Structural Input on Environmental Documentation and Permits	01F3 Structural Design • Structural Estimate 30% • 15% Structural Plan, Elevation, Phasing Plan	01F3 Structural Design • Structural Site Plans and Elevations • Preliminary Structural Item Estimate	0172 Design Approval • Structural Design Criteria • Structural TS&L • Project Analysis • Structural Concept Drawings 01F3 Structural Design • Building Permit Pre-Submittal Meeting with Dept of Development • Structural Phasing Plan 30% • Structural Plans 60% • Structural Specifications 30% • Structural Estimate 60% • Structural Type, Size & Location • Structural Permitting Submittal Review (includes constructability review for viable construction method, sequence, and schedule)		01F3 Structural Design • Structural Phasing Plan 60% • Structural Plans 90% • Structural Sections 60% • Structural Details 60% • Structural Specifications 60% • Structural Estimate 90% • Structural Abbreviations & Symbols, General Notes 90% • Structural Demolition Plans • Bridge Seat, Headframe, Railings and Ladders, Trestle, Transfer Span, Materials Schedules • Possible: Dolphins, Wingwalls 0181 PS&E Review • Structural Design Peer Review	01F3 Structural Design • Building Permit Submittal • Structural Phasing Plan 90% • Structural Plans 100% • Structural Sections 90% • Structural Details 90% • Structural Specifications 90% • Structural Estimate 100% 0181 PS&E Review • Structural QAQC		01F3 Structural Design • All plans, specs, and estimate 100%	01F3 Structural Design • Response to Bidder RFIs • Addendum Preparation	

Tollbooth, Term Bldg Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	**Project Planning and Endorsement (PMP)** PE.PM.03.15	**Pre-Design Study (5%)** PE.PS.07	**Geometric Review (30%)** PE.PD.75.30 **Design Approval** PE.PD.42.10	**Environmental Review Documentation Complete** PE.EV.18	**General Plans Review (60%)** PE.PD.75.60	**Preliminary Contract Review (90%)** PE.PD.75.90	**Environmental Permits Received** PE.EV.29	**Project Development Approval (100%)** PE.PD.42.60	**Contract Ad and Award** PE.PD.90.35	**PE Phase End (Close Out and Archiving)** PE.PD.90.65
01F4 Mechanical	0169 Project Summary • Plans list with estimate of design hours	01F4 Mechanical Design • Mechanical Estimate 30% • 15% Mechanical Plan, Elevation, Phasing Plan	01F4 Mechanical Design • Mechanical Site Plans and Elevations • Preliminary Mechanical Item Estimate	0172 Design Approval • Mechanical Concept Drawings • Mechanical Site Plans and Elevations • Preliminary Mechanical Item Estimate • Mechanical Design Criteria • Project Analysis 01F4 Mechanical Design • Mechanical Phasing Plan 30% • Mechanical Plans 60% • Utilities Plans • Mechanical Specifications 30% • Mechanical Estimate 60% • 30% Utilities Plans		01F4 Mechanical Design • Mechanical Phasing Plan 60% • Mechanical Plans 90% • Mechanical Sections 60% • Mechanical Details 60% • Mechanical Specifications 60% • Mechanical Estimate 90% • Mechanical Abbreviations & Symbols, General Notes 90% • Mechanical Demolition Plans 100% • 60% Water & Sewer Line Sections and Details 0181 PS&E Review • Mechanical Design Peer Review	01F4 Mechanical Design • Mechanical Phasing Plan 90% • Mechanical Plans 100% • Mechanical Sections 90% • Mechanical Details 90% • Mechanical Specifications 90% • Mechanical Estimate 100% • 90% Water & Sewer Line Sections and Details 0181 PS&E Review • Mechanical QAQC		01F4 Mechanical Design All plans, specs, and estimate 100%	01F4 Mechanical Design • Response to Bidder RFIs • Addendum Preparation	
01F5 Electrical PE.PD.30.05	0169 Project Summary • Plans list with estimate of design hours	01F5 Electrical Design • Electrical Plans 60% • Utilities Plans • Electrical Specifications 30% • Electrical Estimate 60% • 30% Hydraulic System	0172 Design Documentation Package • Electrical Concept Drawings • Electrical Site Plans and Elevations • Preliminary Electrical Item Estimate 01F5 Electrical Design • Electrical Site Plans and Elevations • Preliminary Electrical Item Estimate	0172 Design Approval • Electrical Concept Drawings • Electrical Site Plans and Elevations • Preliminary Electrical Item Estimate • Electrical Design Criteria • Project Analysis 01F5 Electrical Design • Electrical Plans 60% • Utilities Plans • Electrical Specifications 30% • Electrical Estimate 60% • Lighting Plan 60% • One-Line & One-Line Demolition 60% • Temporary Power Plan 60%		01F5 Electrical Design • Electrical Plans 90% • Electrical Sections 60% • Electrical Details 60% • Electrical Specifications 60% • Electrical Estimate 90% • Electrical Abbreviations & Symbols, General Notes 90% • Electrical Demolition Plans • Lighting Plan 90% • One-Line & One-Line Demolition 90% • Temporary Power Plan 90% • 90% Transfer Span Electrical Plan & Schedules, PLC Terminal Wiring, Electrical Details, Conduit Block Diagram 0181 PS&E Review • Electrical Design Peer Review	01F5 Electrical Design • Electrical Plans 100% • Electrical Sections 90% • Electrical Details 90% • Electrical Specifications 90% • Electrical Estimate 100% • Lighting Plan 90% • One-Line & One-Line Demolition Final • Temporary Power Plan Final • Final Transfer Span Electrical Plan & Schedules, Electrical Details, Conduit Block Diagram 0181 PS&E Review • Electrical QAQC		01F5 Electrical Design All plans, specs, and estimate 100%	01F5 Electrical Design • Response to Bidder RFIs • Addendum Preparation	

Tollbooth, Term Bldg Project

DELIVERABLE EXPECTATION MATRIX

	Begin Preliminary Engineering PE.PM.02.01	Project Planning and Endorsement (PMP) PE.PM.03.15	Pre-Design Study (5%) PE.PS.07	Geometric Review (30%) PE.PD.75.30 Design Approval PE.PD.42.10	Environmental Review Documentation Complete PE.EV.18	General Plans Review (60%) PE.PD.75.60	Preliminary Contract Review (90%) PE.PD.75.90	Environmental Permits Received PE.EV.29	Project Development Approval (100%) PE.PD.42.60	Contract Ad and Award PE.PD.90.35	PE Phase End (Close Out and Archiving) PE.PD.90.65
Reviews and QAQC				0181 PS&E Review • 30% Constructability Review • 30% Constructability Comments 0180 Constructability Review • 30% Constructability Review • 30% Constructability Comments • Draft Construction Schedule Review		0181 PS&E Review • 60% Constructability Review • 60% Constructability Comments • Discipline Peer Reviews 0180 Constructability Review • 60% Constructability Review • 60% Constructability Comments • Draft Construction Schedule Review	0181 PS&E Review • 90% PS&E Building Permit Application Package • State Materials Justification and Approval by ASDE • 90% Constructability Review • 90% Constructability Comments • Discipline QAQC Memos 0180 Constructability Review • 90% Constructability Review • 90% Constructability Comments • Draft Construction Schedule Review		0181 PS&E Review • File Review Comments and Designer Replies in Project File • Final PS&E Contract Packaged for Management Review • Contract Package QAQC Cover Sheet for Ad and Award		
PE Close Out											
Construction Preparation				01AC Construction Scheduling • Draft Construction Schedule		01AC Construction Scheduling • Draft Construction Schedule • Construction Phasing Alternatives	01AC Construction Scheduling • Final Construction Schedule			0189 Advertisement • Memo to OEO • Memo to Contract Ad & Award • Ad Package to HQ	0199 Construction Admin • Construction Funding Approval Work Order • Design Record Close Out • Funding Adjust-to-Award • Contract Addendum • Respond to Bidder RFIs 0101 Project Management • Lessons Learned • Design Records to Library

PROJECT STATUS REPORT May 11, 2012 **WSF**

Bid Open Date

County:

Enter_SR_and_MP

PROGRAM: **Programmed:** ☐ Yes ☐ No

WIN: **Current Ebase version #:**

FA/STATE **Job No.:**

Sheets **Status** **Reg. Rev.:**

Amount **Br. Rev.:**

Working Days: **Work Class:** **PM Rev:**

PS&E Received: Region: ☐ **Bridge:**

☐ **Review Pending: ( )**

☐ **Construction Management :** ☐ **CMP** ☐ **ECP/ECN**

☐ **Design:**

☐ **Permits:**

☐ **Environmental:**

☐ **NEPA** ☐ **SEPA:**

☐ **Federal Contract Prov. Req'd:** ☐ ☐ ☐

☐ **Agreements:**

☐ ☐ **Training:** ☐ **P&T:**

☐ **Utilities:**

☐ **R/W:**

Sp. Prov. Approval: ☐ Design PE ☐ Design EM ☐ Constr. PE ☐ Constr. EM ☐ HQ Constr.

☐ **Fund:**

☐ **Federal Funds:**

☐ **Work Order: W/O Ebase version #:**

Comments: **Addendum Deadline:** **Contract No.**

WSF Terminal Engineering

PS&E Turn-In QA/QC Process

This process and checklist has been developed for the purpose of turning contracts into the Contract Ad and Award office for advertisement and bid opening. This process is required in order to assure overall quality and consistency.

This has been reviewed and endorsed by:

_____

Nicole J. McIntosh, P.E.

Director of Terminal Engineering

WSF Terminal Engineering

PS&E Turn – In QA/QC Process

Use the instructions following this checklist during the final submittal of the Plans specifications and estimate for turn in for bid advertisement. This is not intended to

be a PS&E preparation process. Follow the instructions in G:\Admin\OLY_AD\Step-by-Step Instructions on Submitting a Contract for Advertisement.doc for preparing the required forms and documents.

Pre-Turn – In Check List

To be completed prior to submitting the proposal package to Contract Ad and Award.

Date: _____

Project Manager: _____

Project Title: _____

Design WOA Number: _____

The following items are submitted for advertisement:

_____1 set of camera-ready drawings with _____ plan sheets.

_____1 copy of the Special Provisions with stamp sheet.

_____Federal Specifications if there is any Federal funding applied to the project (including buy-America GSPs).

_____Complete E-Base file.

_____The PS&E has had _____ constructability reviews and all review comments and responses have been recorded.

_____Quantities and estimates are complete and match E-Base estimate with appropriate project mark-ups.

_____Work Order Authorization is complete and matches estimate with appropriate project mark-ups.

_____Right of Way is complete. Right of Way certification is needed.

_____Items of subcontractable work have been identified to establish MWBE goals.

_____Number of working days has been established and a construction schedule has been reviewed by the Terminal Construction Office.

_____Soil logs have been included.

_____Sole source justifications have been prepared.

The following permits are required and have been obtained:

_____HPA received on _____.

_____COE 404 / Section 10 received on _____.

_____Shoreline Permit received on _____.

_____DOE Water Quality Certification received on _____.

_____Other _____ (specify) received on _____.

_____SHPO – State Historic Preservation Office compliance, if needed.

ALL RELEVANT PERMIT CONDITIONS MUST BE INCLUDED IN THE CONTRACT SPECIAL PROVISIONS.

The following forms are complete:

_____Work Order Authorization (DOT form 120-020 EF)

_____Final Check Sheet (DOT Form 221-019 EF)

_____Check Ad and Award Manual to confirm that all requirements are met.

QA/QC Certified by _____
WSF Project Manager

Funding Authorized, Certified by _____

3

Location of Electronic Document Templates: G:\Admin\OLY_AD

PS&E Review for Constructability

Prior to turn in for advertisement, the PS&E are reviewed, a minimum of two times, comments recorded and responses recorded (maintenance projects will have a minimum of one review). Any unresolved comments or issues are escalated to the appropriate parties for resolution prior to advertisement. E-Base estimates are to be completed and reviewed at each stage, quantity estimates are recorded and checked and contingencies are included and adjusted. Follow the guidelines established in the Terminal Engineering Estimating Guidelines.

Funding is Available and Authorized

Ensure that estimates are within budget, or if possible, budget is adjusted. When preparing the estimate use appropriate sales tax rates and engineering. A Work Order Authorization is completed and signed prior to advertisement. The Budget Office will assign a contract number. For flexibility during advertisement and final reviews, round up the WOA amount to within five or ten thousand dollars (at the PM's discretion) to avoid having to adjust the WOA if a change is made that increases the estimate.

Funding Type

State Funds – MWBE Goals are required. Training goals letter must be sent at least 3 weeks before Ad date.

Federal Funds - Training Goals are required. Training goals letter must be sent at least 4 weeks before Ad date. Also check that buy-American GSPs are included.

Both State and Federal Funds – Submit letters for both types of goals.

Goals for Federal and State funding

If the project has state funding, electronically submit "Goals for MWBE - when State Funds.doc" to the WSDOT Office of Equal Opportunity in Olympia (PBX: 7092).

If the project has Federal funding, electronically submit "Goals for Training - when Federal Funds.doc" to the WSDOT Office of Equal Opportunity in Olympia (PBX: 7092).

Attach a PDF of the E-Base estimate and the Special Provisions. If the project has both funding types, submit both letters.

Prepare the PS&E Checklist

For final PS&E turn in, follow these instructions: Step-by-Step Instructions on Submitting a Contract for Advertisement.doc.

Prepare Run List for Special Provisions

Follow instructions in the Standard Specification amendments and GSP indices (WSDOT Project Development Branch). Be sure to include any items that are explicitly required. Follow the instructions for adding WSF GSPs in the WSF Index. Use the WSF specific GSPs first and if there are any conflicts, escalate to the Terminal Design Manager.

Notification of the Advertisement Date

Prepare a memo to the Contract Ad and Award office (PBX: 7017), using the template. Include contract number, proposed advertisement date and requested bid opening. Submit electronically, and copy the CAPS (printing) office at caps@wsdot.wa.gov.

Technical Appendixes

Make sure any appendixes referenced in the plans or special provisions are included. For example, include soils logs, but not the geotechnical report.

Permits, Utilities, Right of Way and Other Agreements

All permits must be in hand and the permit conditions included in the contract appendix. Any right of way is secured, or Possession and Use is obtained. Make sure all agreements are in place and executed, and that any utilities are identified and responsibility for relocation is clearly established.

Final Turn in for Advertisement

Review and follow instructions in the Ad and Award Manual. Select an appropriate advertisement period, with three weeks as the minimum and four to six weeks as the desirable period. Write a justification for use of sole source or proprietary items. Make sure quantities and estimates are up to date in E-Base prior to turn in.

Fill in the electronic file 221-019-FinalCheckSheet Copy.fp5 and print it out. Transmit the Final Check Sheet with the package.

Transmit the package to:

Transportation Building
Contract Ad and Award Office, Room 1A-23
310 Maple Park Avenue SE
PO Box 47300
Olympia, Washington 98504-7300

Final Check

After Plans are printed and returned from the Contract Ad and Award office, and prior to bid opening, review entire set of PS&E to be certain it was printed and published as submitted. If there are any omissions or mistakes, issue an addendum through the Contract Ad and Award office using this addendum template: Addendum Template.doc.

CIVIL PS&E REVIEW CHECKLIST

Legend:
☑ Acceptable
☒ Not Acceptable
■ Not Applicable

Project Title: _____ **Project Number:** _____
Submittal: _____

Plans – General

30%	60%	90%	Final	
☐	■	■	■	First sheet of plan set includes signature box for TE Director
☐	☐	■	■	Each sheet title block includes correct PSE project number and Federal Aid number if applicable
☐	☐	■	■	Each sheet title block includes correct project name
☐	☐	☐	☐	Each sheet title block includes correct drawing number (i.e. G01.01)
☐	☐	☐	☐	Each sheet title block includes correct Designed By, Drafted By and Checked By initials and dates
■	■	☐	☐	Each sheet title block includes appropriate engineer's seal
☐	☐	☐	■	Each sheet showing plan view includes north arrow and is shown with correct orientation
☐	☐	☐	■	Each sheet showing plan/elevation/details includes scale bar and is correct
☐	☐	☐	■	Each sheet showing horizontal and vertical control includes appropriate datum reference
☐	■	■	■	Order of precedence of Plans is logical and consistent with WSF CADD standards (G, C, A, S, M, E)
☐	☐	☐	☐	All indexed Plan sheets are included and sheet names/numbers are consistent with the Plans
■	☐	☐	☐	SOQ sheet is included with appropriate Groups assigned (*vital at Final)*
☐	☐	☐	☐	All Legend symbols and Abbreviations correspond with those shown in the Plans
☐	☐	☐	■	All General Notes correspond with the work of the Plans
☐	☐	☐	■	Plans conform to the presentation requirements of the WSF CADD standards
☐	☐	☐	■	Line weights are used properly to represent the work
☐	☐	☐	■	Scale is used properly to represent the work
☐	■	■	■	Check ADA Status Spreadsheet to verify any pertinent updates [G:\Admin\DESIGN\ADA\ADA Project Status 07-09]
☐	☐	☐	☐	All Details and Sections are correct for sheet reference numbers, limits, aspect, and orientation
☐	☐	☐	☐	_____
☐	☐	☐	☐	_____
☐	☐	☐	☐	_____
☐	☐	☐	☐	_____
☐	☐	☐	☐	_____

Plans – General (G) Series Sheets

30%	60%	90%	Final	
				Project Location and Vicinity Map Sheet
☐	■	■	■	Project location is accurately located
☐	■	■	■	Project location Latitude and Longitude has been verified by CAD Manager (Lat & Long required on Fed Aid projects)
				Index Sheets *(Not sealed by TE)*
☐	☐	☐	☐	Sheet order of precedence matches plan sequence
☐	☐	☐	☐	Volume references are correct
☐	☐	☐	☐	Each plan sheet is included, and sheet number, drawing number and title are consistent with the Plans
				Sundry Site Plan *(Not sealed by TE)*
☐	■	■	■	Sundry plan is the most current available

30% 60% 90% Final ***Summary of Quantities*** *(Not sealed by TE)*

■ ☐ ☐ ☐ All items are included, and quantities and units are consistent with estimate (*vital at Final)*

■ ☐ ☐ ☐ All appropriate groups are assigned (*vital at Final)*

■ ☐ ☐ ☐ Control Section and Tax Schedule for each group are correct (*vital at Final)*

30% 60% 90% Final ***Other***

☐ ☐ ☐ ☐ _____

☐ ☐ ☐ ☐ _____

☐ ☐ ☐ ☐ _____

Plans – Civil (C) Series Sheets

30% 60% 90% Final ***Legend, Abbreviations & General Notes***

☐ ☐ ☐ ☐ All symbols within the Plans are included and defined

☐ ☐ ☐ ☐ All abbreviations within the Plans are included and defined

☐ ☐ ☐ ☐ General notes are appropriate and applicable to work of the Plans

30% 60% 90% Final ***Existing Conditions***

☐ ☐ ☐ ■ Upland topography is shown with appropriate line weight and accurate

☐ ☐ ☐ ■ Bathymetry and elevations are shown with appropriate line weight and accurate

☐ ☐ ☐ ■ Boring locations are shown, identified and accurate in their location

☐ ☐ ☐ ■ R/W, DNR Lease, easements, and other property lines are shown and consistent with the Sundry Site Plan

☐ ☐ ☐ ■ All existing features and elements are clearly identified

☐ ☐ ☐ ■ Horizontal and vertical control is established

☐ ☐ ☐ ■ Horizontal and vertical datum is identified and includes epoch date

☐ ☐ ☐ ■ Survey monument identification is correct as compared to WSDOT Survey Monument Database (typically use ID#)

☐ ☐ ☐ ■ Survey monument coordinates are in English units and in the Washington State Plane coordinate system

☐ ☐ ☐ ■ Survey monument elevations are in English units and in the referenced vertical datum (typically MLLW)

30% 60% 90% Final ***Existing Utilities***

☐ ☐ ☐ ■ Upland topography is consistent with Existing Conditions sheets

☐ ☐ ☐ ■ Bathymetry and elevations are consistent with Existing Conditions sheets

☐ ☐ ☐ ■ Underground utilities are shown using appropriate symbols, line types and scales, and are complete

☐ ☐ ☐ ■ Overhead utilities are shown using appropriate symbols, line types and scales, and are complete

☐ ☐ ☐ ■ R/W, DNR Lease, easements, and other property lines are shown and consistent with Existing Conditions sheets

☐ ☐ ☐ ■ All applicable site and utility features and elements are clearly identified

30% 60% 90% Final ***Construction Phasing***

☐ ☐ ☐ ■ Existing conditions shown are consistent with Existing Conditions sheets

☐ ☐ ☐ ■ Bathymetry and elevations are consistent with Existing Conditions sheets

☐ ☐ ☐ ■ Entire project scope is included and phased

☐ ☐ ☐ ■ Phased work identified includes a sequenced phase note callout

☐ ☐ ☐ ■ Phasing Notes are include for all callouts

☐ ☐ ☐ ■ R/W, DNR Lease, easements, and other property lines are shown and consistent with Existing Conditions sheets

☐ ☐ ☐ ■ All applicable features and elements are clearly identified

☐ ☐ ☐ ■ Existing utilities shown only as applicable

30% 60% 90% Final ***Construction Staging***

☐ ☐ ☐ ■ Upland topography is consistent with Existing Conditions sheets
☐ ☐ ☐ ■ Bathymetry and elevations are consistent with Existing Conditions sheets
☐ ☐ ☐ ■ R/W, DNR Lease, easements, and other property lines are shown and consistent with Existing Conditions sheets
☐ ☐ ☐ ■ All applicable existing features and elements are clearly identified
☐ ☐ ☐ ■ Upland and in-water staging areas clearly identified including hatching, and dimensioned to local control
☐ ☐ ☐ ■ All access points are clearly identified
☐ ☐ ☐ ■ All restrictions are identified in the Notes

30% 60% 90% Final ***Demolition Plans***

☐ ☐ ☐ ■ Upland topography is consistent with Existing Conditions sheets
☐ ☐ ☐ ■ Bathymetry and elevations are consistent with Existing Conditions sheets
☐ ☐ ☐ ■ R/W, DNR Lease, easements, and other property lines are shown and consistent with Existing Conditions sheets
☐ ☐ ☐ ■ Existing utilities consistent with Existing Utilities sheets
☐ ☐ ☐ ■ All applicable existing features and elements are clearly identified
☐ ☐ ☐ ■ All demolition work of project is identified and appropriately referenced to discipline plan sheets (i.e. see Civil, Structural, Mechanical, or Electrical sheets)
☐ ☐ ☐ ■ Demolition call-outs accurately describe the nature and limits of the work
☐ ☐ ☐ ■ All salvage and relocation items are clearly identified
☐ ☐ ☐ ■ All utility demolition is identified by cross-hatch

30% 60% 90% Final ***Site Layout***

☐ ☐ ☐ ■ Upland topography is consistent with Existing Conditions sheets
☐ ☐ ☐ ■ Upland topography is consistent with new contours shown
☐ ☐ ☐ ■ Bathymetry and elevations are consistent with Existing Conditions sheets
☐ ☐ ☐ ■ R/W, DNR Lease, easements, and other property lines are shown and consistent with Existing Conditions sheets
☐ ☐ ☐ ■ Existing utilities consistent with Existing Utilities sheets
☐ ☐ ☐ ■ All applicable features and elements are clearly identified
☐ ☐ ☐ ■ Surveying information and applicable datum are shown
☐ ☐ ☐ ■ Vertical datum includes epic date (typically MLLW)
☐ ☐ ☐ ■ Work points are identified
☐ ☐ ☐ ■ Work point coordinates are in English units and in the Washington State Plane coordinate system
☐ ☐ ☐ ■ Work point elevations are in English units and in the referenced vertical datum (typically MLLW)
☐ ☐ ☐ ■ All new work of project is identified and appropriately referenced to discipline plan sheets (i.e. see Civil, Structural, Mechanical, or Electrical sheets)
☐ ☐ ☐ ■ All new work of project is coordinated between discipline plan sheets (i.e. see Civil, Structural, Mechanical, or Electrical sheets)
☐ ☐ ☐ ■ All new work is clearly delineated from existing conditions
☐ ☐ ☐ ■ Only new work is shown – i.e. All existing work replaced by new work is removed from plan sheets
☐ ☐ ☐ ■ New work call-outs accurately describe the nature and limits of the work

30% 60% 90% Final ***Civil Site Work***

☐ ☐ ☐ ■ Upland topography is consistent with Existing Conditions sheets
☐ ☐ ☐ ■ Bathymetry and elevations are consistent with Existing Conditions sheets
☐ ☐ ☐ ■ R/W, DNR Lease, easements, and other property lines are shown and consistent with Existing Conditions sheets
☐ ☐ ☐ ■ Existing utilities consistent with Existing Utilities sheets
☐ ☐ ☐ ■ All applicable features and elements are clearly identified
☐ ☐ ☐ ■ All civil work of project is identified
☐ ☐ ☐ ■ All new work is shown and clearly delineated from existing conditions
☐ ☐ ☐ ■ Only new work is shown – i.e. All existing work replaced by new work is removed from plan sheets
☐ ☐ ☐ ■ Civil work call-outs accurately describe the nature and limits of the work and are consistent with Site Layout

30% 60% 90% Final ***Civil Plans & Details***

☐ ☐ ☐ ■ Upland topography is consistent with Existing Conditions sheets
☐ ☐ ☐ ■ Bathymetry and elevations are consistent with Existing Conditions sheets
☐ ☐ ☐ ■ R/W, DNR Lease, easements, and other property lines are shown and consistent with Existing Conditions sheets
☐ ☐ ☐ ■ Existing utilities consistent with Existing Utilities sheets
☐ ☐ ☐ ■ All applicable features and elements are clearly identified
☐ ☐ ☐ ■ Civil work clearly identified and dimensioned in appropriate units/coordinates
☐ ☐ ☐ ■ Reference dimensions are indicated as appropriate
☐ ☐ ☐ ■ New utilities are shown and complete
☐ ☐ ☐ ■ Pavement removal limits are clearly shown and dimensioned
☐ ☐ ☐ ■ Grading limits are clearly shown and dimensioned
☐ ☐ ☐ ■ Trenching and cut and fill limits are shown
☐ ☐ ☐ ■ HMA limits are clearly shown and dimensioned
☐ ☐ ☐ ■ Slopes for drainage are shown and clear
☐ ☐ ☐ ■ Pavement sections are shown and detailed
☐ ☐ ☐ ■ Utility elevations are consistent between plans and profiles
☐ ☐ ☐ ■ Drainage structure grate and invert elevations are shown and in the referenced vertical datum
☐ ☐ ☐ ■ Signing and striping is shown and complete
☐ ☐ ☐ ■ ADA parking and access are shown and have been coordinated with Architecture

30% 60% 90% Final ***Other***

☐ ☐ ☐ ☐ _____
☐ ☐ ☐ ☐ _____
☐ ☐ ☐ ☐ _____

Plans – Biddability/Constructability

30%	60%	90%	Final	
■	☐	☐	■	Contractor staging is shown and adequate, and coordinated with Operations and the specifications
■	☐	☐	■	Phasing plans are shown and cover all work, and coordinated with Operations and the specifications
■	☐	☐	■	Traffic control is shown and complete, and coordinated with Operations
☐	☐	☐	■	Plans are consistent between all disciplines
☐	☐	☐	■	Plans are clear in representing/delineating the work
■	☐	☐	☐	SOQ items are consistent with Payment sections of the specifications in title and unit of measure (*vital at Final*)
☐	☐	■	■	Identify any Value Engineering Opportunities
☐	☐	☐	☐	_____
☐	☐	☐	☐	_____
☐	☐	☐	☐	_____
☐	☐	☐	☐	_____
☐	☐	☐	☐	_____

Specifications

30%	60%	90%	Final	
☐	☐	☐	☐	All work of the Plans is addressed by a specification
■	☐	☐	☐	All applicable, current Amendments to the Standard Specifications are included
☐	☐	☐	☐	All applicable WSDOT General Special Provisions are included
☐	☐	☐	☐	All applicable WSF Special Provisions are included
■	☐	☐	☐	Contract Working Days is consistent with the engineer's construction schedule
☐	☐	☐	☐	All indexed specifications are included and titles are consistent
☐	☐	☐	☐	All specifications contain Description, Materials, Construction Requirements, Measurement, and Payment sections
☐	☐	☐	☐	Description sections clearly and accurately define the scope of work
■	☐	☐	☐	Payment sections are consistent with the SOQ items in title and unit of measure (*vital at Final)*
■	☐	☐	☐	All lump sum items contain approximate quantities for bidding or are biddable from the contract documents
■	☐	☐	☐	All force account items are defined
■	■	☐	☐	All sole source/proprietary items have been approved by WSF or ASDE as appropriate, and documentation is in the project files
■	■	☐	☐	Soil boring logs are included in the Appendices
■	■	☐	☐	Environmental and Jurisdictional permits are included in the Appendices
■	☐	☐	☐	Hazardous Materials reports are included in the Appendices
■	☐	☐	☐	Federal Aid Special Training Provisions have been addressed
☐	☐	☐	☐	_____
☐	☐	☐	☐	_____
☐	☐	☐	☐	_____
☐	☐	☐	☐	_____
☐	☐	☐	☐	_____

Estimate

30%	60%	90%	Final	
■	☐	☐	■	All work of the Plans and specifications is included in the estimate
■	■	☐	■	All unit prices have been reviewed and verified by Project Controls
■	☐	☐	■	All lump sum items have backup estimates
■	☐	☐	■	All force account items have justification
■	☐	☐	■	All contingencies have been validated
■	☐	☐	■	Mobilization is included
■	☐	☐	☐	All EBase items are consistent with the SOQ items and Payment sections of the specifications (*vital at Final*)
■	☐	☐	☐	All EBase quantities & unit prices match the estimate
■	☐	☐	☐	The EBase contingencies match the estimate
☐	☐	☐	☐	_____
☐	☐	☐	☐	_____
☐	☐	☐	☐	_____
☐	☐	☐	☐	_____
☐	☐	☐	☐	_____

CIVIL CONSTRUCTABILITY REVIEW CHECKLIST

Legend:
☑ Acceptable
☒ Not Acceptable
■ Not Applicable

Project Title: _____ **Project Number:** _____
Submittal: _____

Plans – Constructability

60%	90%	
☐	☐	Entire project scope is shown
☐	☐	Upland topography shown is accurate
☐	☐	Existing conditions shown are accurate
☐	☐	Existing utilities shown are accurate
☐	☐	Verify connection points of all utilities
☐	☐	Verify all utility systems are shown are complete
☐	☐	Horizontal and vertical control shown is accurate and accessible
☐	☐	Contractor staging shown is adequate and accessible
☐	☐	Verify work areas defined are adequate
☐	☐	Verify work areas defined are accessible and free of horizontal and vertical site constraints
☐	☐	Verify work areas defined are free of dangerous conditions
☐	☐	All site features have been accounted for in demolition
☐	☐	All salvage items have been included
☐	☐	Phasing and schedule of work does not interfere with other disciplines
☐	☐	_____
☐	☐	_____
☐	☐	_____
☐	☐	_____
☐	☐	_____

Specifications – Constructability

60%	90%	
☐	☐	All work of the Plans is included in the specifications
☐	☐	All demolition work shown on the Plans matches the scope defined in the specifications
☐	☐	All necessary survey work is included and accessible
☐	☐	All salvage items have been included
☐	☐	All permits are included in the Appendices
☐	☐	_____
☐	☐	_____
☐	☐	_____
☐	☐	_____
☐	☐	_____

Estimate – Constructability

60%	90%	
☐	☐	All work of the Plans and specifications is included in the estimate
☐	☐	_____
☐	☐	_____
☐	☐	_____
☐	☐	_____
☐	☐	_____

CIVIL CHECK CHECKLIST

Legend:
☑ Acceptable
☒ Not Acceptable
■ Not Applicable

Project Title: _____ **Project Number:** _____
Submittal: _____

Plans - General
☐ Title block includes PSE project number
☐ Title block includes Designed By, Drafted By and Checked By initials and dates
☐ All line types and symbols are included on the Legend
☐ All abbreviations are included on the Abbreviations list
☐ General Notes are consistent with work shown
☐ General Notes include language requiring Contractor to verify existing underground utility locations prior to excavation
☐ All Plan sheet names/numbers are consistent with the Civil plan sheet index
☐ SOQ sheet includes all civil bid items
☐

Plans – Engineering
☐ All civil work is indicated on the Site Plan
☐ Demolition work is clearly shown
☐ All civil work is consistent with Environmental provisions
☐ Reference dimensions are indicated
☐ Upland topography is shown and accurate to existing conditions
☐ Bathymetry and elevations are shown and accurate
☐ Surveying information is shown and accurate to existing conditions
☐ Horizontal and vertical control is established, accurate and complete
☐ Boring locations are shown and accurate
☐ R/W, DNR Lease, easements, and other property lines are shown and accurate
☐ Grading limits are clearly shown and field measureable to established control
☐ Excavation and backfill limits are shown
☐ Pavement sections are shown and appropriate for the location
☐ Geotechnical recommendations have been incorporated
☐ Paving limits are shown and field measureable to established control
☐ Existing utilities are clearly shown and accurate to existing conditions and records
☐ New utilities are clearly shown and identified, and conflicts have been resolved
☐ Slopes for drainage are adequate and all areas drain to a collection point
☐ Drainage structures are located to established control
☐ Utility profile elevations are consistent with plan elevations
☐ Roadway, holding lane and parking improvements are shown and located to established control
☐ Curb, gutter, sidewalks and ramps are correctly located and identified to established control
☐ Signing and striping is identified and located to established control
☐ All references to Standard Plans are current and correct
☐ ADA requirements are identified and consistent with code
☐
☐ Storm Drain System
☐ Check water quality design and details
☐ Check that all materials used are appropriate for the application
☐ Check that pervious surface drainage is adequate and connected to storm system
☐ Check curb and gutter drain locations
☐ Crosscheck contours and grate spot elevations for proper drainage slopes
☐ Check number and locations of storm inlets

- ☐ Check size and slope of storm drains
- ☐ Crosscheck plan and profile horizontal dimensions and compare to established control
- ☐ Check storm drain invert elevations against contours (no exposed or shallow piping)
- ☐ Check drain grate and manhole rim elevations against topography
- ☐ Check that structure drain systems are connected to storm system
- ☐ Check storm drainage details
- ☐ Check cathodic protection system and details
- ☐

- ☐ Sanitary Sewer System
- ☐ Review adequacy of sewage system capacity
- ☐ Check lift station design and details.
- ☐ Check that point(s) of connection to existing system is shown
- ☐ Check flow velocity
- ☐ Check that mains provide gravity flow from laterals
- ☐ Check adequate separation from water lines
- ☐ Check inverts of mains and laterals for adequate drops
- ☐ Check adequate dimensions for manhole locations
- ☐ Check cleanout locations
- ☐ Check details
- ☐ Check that all materials used are appropriate for the application
- ☐ Check cathodic protection system and details
- ☐

Plans – Biddability/Constructability

- ☐ Civil work areas are adequate for type(s) of work to be performed
- ☐ Civil work areas are accessible and free of horizontal and vertical site constraints
- ☐ Civil work areas are free of dangerous conditions
- ☐ Check if shoring is required for excavation
- ☐ Check if dewatering is required for excavation
- ☐
- ☐

Specifications

- ☐ All civil work is included in the specifications
- ☐ Check for shoring and dewatering specification language
- ☐ Check that all civil quantities are obtainable from the Plans
- ☐ All civil special provisions contain Description, Materials, Construction Requirements, Measurement, and Payment sections
- ☐ Civil special provision description sections clearly and accurately define the scope of work
- ☐ Check that the term “shall” is used for all Contractor responsibilities
- ☐ Check that the term “will” is used for all State responsibilities
- ☐ Check that all items requiring submittal are identified
- ☐ Check that all testing requirements are identified
- ☐ Payment sections are consistent with the SOQ items in title and unit of measure
- ☐ All lump sum items contain approximate quantities for bidding
- ☐ All force account items are defined
- ☐ Appropriate environmental provisions and BMPs are included in special provisions
- ☐ Appropriate hazardous materials procedures are included in the special provisions
- ☐ Check that all references to Standard Specifications, Special Provisions, Standard Plans, and other standards and codes are current and correct
- ☐ Special Provisions contain applicable Regional Special Provisions for WSF projects
- ☐ Special Provisions contain applicable WSDOT General Special Provisions

Estimate

☐ All civil work is included in the estimate
☐ All unit prices are for in-place work, and *do not* include contingency or mobilization
☐ All lump sum prices are for in-place work, and *do not* include contingency or mobilization
☐ All force account items are identified
☐

Construction Schedule

☐ All civil work is included in the schedule
☐ Civil work activities occur in the appropriate order
☐ Civil work activities are assigned an appropriate duration
☐ Civil work activities are assigned appropriate logic based on project scope/phasing
☐

Projects With Construction Cost Greater Than $35,000

- **Location of Electronic Document Templates: G:\Admin\OLY_AD**
- **Call IT Department to have software installed: ext. 3800**
- **For detailed information on this topic, refer to the "Ad-Ready PS&E" at wwwi.wsdot.wa.gov/regions/Northwest/RP&S/Engineering_Services/PS&EReview/Documents/AdReadyNov2006Final.pdf.**
- **To open links in this document, right-click and select "Open Hyperlink"**

STEP 1. Project Status Report/Construction Work Order Setup

90 Days prior to the CPMS Ad Date, your project should appear on the weekly Project Status Report (PSR), compiled by Steve Levengood. For Capital Projects, all boxes on the PSR must be unchecked before a project can go to Ad. It is the responsibility of the Project Manager to notify Steve Levengood of the initial status and any subsequent changes.

In addition, the current status of pending or approved Proprietary Item Requests is also listed on the PSR. No project can go to Ad without approval of the request. Alternatively writing a performance specification, or listing 3 or more products is acceptable. (Listing 3 suppliers for a single product is not an allowable substitution.)

Cultural Resources Executive Order 05-05 (State funded) or Section 1-06 (Federally Funded) requirements must also be met before a project may be Advertised.

a. **Notification to Headquarters Ad & Award will occur via the Project Status Report.**

b. Ad dates, with the exception of weeks with a Monday holiday, are on Mondays. In addition, projects are often not Advertised Christmas or New Years week.

c. Bid openings, with the exception of some weeks with a holiday, are on Wednesdays. In addition, bids are often not opened Christmas or New Years week.

d. The Contract Ad and Award office must receive the package by the Wednesday before the planned ad date.

e. Seven weeks before advertisement, ensure the budget office has received approval for the Federal or state funds, or document package (NEPA, Design Approval, Project Development Approval, STIP inclusion, Biological assessment, Section 106) for FHWA funding obligation.Verify with the Budget Office that the work order is in the CAPS queue five weeks before advertisement. Until this happens, the contract cannot be advertised. If this step is not complete, check every week until you have verified it is complete.

f. Two weeks before advertisement, prepare a memo to the Contract Ad and Award office (PBX: 7017), using the template Notification Memo.doc. This memo is included with the PS&E package that is sent to Olympia. If federally funded, specify the grant originator (FHWA, FTA, DHS etc.)

g. As described in Appendix 1 of the *Advertisement and Award Manual* M 27-02, all projects must have formal approval action in order to be Advertised. In the event of outstanding issues, the Project Manager must justify the decision to Advertisement and receive concurrence from the Director of Terminal Engineering. The applicable risk level must be identified on the transmittal memo.

h. Indicate the period of time to advertise.

< $50,000 (State Funds Only)	2 weeks
< $50,000 (Federal Funds)	3 weeks
$50,000 – $1,000,000	3 weeks
$1,000,000 – $3,000,000	4 weeks
> $3,000,000	6 weeks

i. Include contract number, proposed advertisement date and requested bid opening. Submit electronically, and copy the CAPS (printing) office at caps@wsdot.wa.gov. Include a copy of the E-Base estimate.

j. For projects with construction cost between $35,000 and $200,000, the Project Manager has the option of advertising on the Small Works Roster. The Contract Ad and Award office should be advised whether or not to use that option.

k. The addendum deadline is the Friday 2 weeks prior to the bid opening date.

STEP 2. Notify Environmental Permitting Staff

a. Notify the Environmental Permitting staff of the approaching Ad date and provide the Environmental Permitting staff with the type of funding (state, federal, or both) and a project description.

b. Verify all permits will be obtained prior to the Ad date

STEP 3. Complete the Design Approval

a. See Chapter 220. Prior to submitting Design Documentation Approval and Project Development for signature approvals (see Appendix U of the TDM for cover sheet/ approval examples), give to Steve Levengood, and address all comments. Design Approval must be received before the project can go to Ad and is required to receive FHWA funding for construction. Notify Steve Levengood, who will note its completion in the Project Status Report, once approval is received.

STEP 4. Complete the Project Development Approval

a. See Chapter 220. Prior to submitting Project Development for signature approvals (see Appendix U of the TDM for cover sheet/approval examples), give to Steve Levengood, and address all comments. Project Development Approval must be received before the project can go to Ad and may be granted before all permits are received. Notify Steve Levengood, who will note its completion in the Project Status Report, once approval is received.

STEP 5. Compile Plan Sheets

a. Plans Preparation: Refer to WSDOT *Plans Preparation Manual* M 22-31 and TDM Division 8 for more detail.

b. The construction phase Federal Aid (FA) number, if applicable, is required to be printed on only the index sheet of the plan set.

STEP 6. Compile WSDOT Amendments and General Special Provisions

a. Compile WSDOT Amendments and General Special Provisions. The most recent are found at the Project Development website under "Amendments/GSPs." www.wsdot.wa.gov/design/projectdev

b. Go to the www.wsdot.wa.gov/publications/fulltext/projectdev/manuals/PS&EManual.pdf link and follow the instructions on assembly of GSPs.

c. For marine structures and items specific to ferry terminals, refer to the Regional General Special Provisions in W:\PSE\New Names\Ferries\RGSPS.

d. Environmental permits must be attached as an appendix to the Special Provisions.

e. Geotechnical data such as boring logs must be attached as an appendix.

f. All Proprietary/Sole Source Items must be approved by Greg Lippincott/ ASDE prior to Ad. The alternative is either a performance spec or listing 3 sources. (Listing one source then stating "or approved equal" is not allowed.) See Section 700.01(5) of the WSDOT *Plans Preparation Manual* M 22-31 for more information.

g. Project specific special provisions and modifications to GSPs or RGSPs require prior approval. Final approval for most special provisions will be from HQ, and need to be submitted no less than 2 weeks prior to Ad. Effectively, this requirement means that the special provisions must be finalized (other than issues arising from the final approval) 2 weeks before Ad.

h. Federally funded projects must meet *Buy America* or *Buy American* (generally only applies to Security projects) requirements. See Chapter 220 and Appendix Y for more information.

STEP 7. Prepare Estimates

a. At the Project Development site, www.wsdot.wa.gov/design/projectdev, select links in the "Engineering Apps" menu. Historical bid items are available in several formats.

b. Store all project estimate files in your project directory.

c. Use the E-Base software for compiling bid quantities. Directions can be found at the Project Development site. Select "E-Base" in the "Engineering Apps" menu.

d. Have the Chief Estimator (Steve Levengood) review the estimate, including PIN, SR number, and Fed Work Type in Ebase.

e. Fill in all fields of the E-Base file, with the exception of the contract number.

f. Prior to submittal of Work Order Request (Step 12), give copy of Summary of Quantities (and Quantity Tabulation Sheets, if used on the project) to CAD Group for quantity review, when applicable.

STEP 8. Conformance with Project Funding

a. **State Funds** – MWBE Goals are required. Electronically submit memo to request goals for MWBE with MWBE - when State Funds.doc five weeks before advertisement. Cesar Mayor (PBX: 3732) will forward to the WSDOT Office of Equal Opportunity in Olympia (PBX: 7092). **Attach a PDF of the E-Base estimate and the Special Provisions.**

b. **Federal Funds** – Training Goals are required. Electronically submit memo to request goals for training hours with Training-when_Federal_Funds.doc five weeks before advertisement. Cesar Mayor (PBX: 3732) will forward to the WSDOT Office of Equal Opportunity in Olympia (PBX: 7092). **Attach a PDF of the E-Base estimate with all prequal codes filled in, and the Special Provisions.**

c. **FHWA Funds** – Refer to WSDOT *Advertisement and Award Manual* M 27-02

d. **Both State and Federal Funds** – as per **Federal Funds** above.

e. **FHWA, FTA, DHS (etc.) Federally Funded Projects** – In Memo Template to Contract AD & Award, specify source of Federal Funds, and state that applicable federal provisions must be included with the project documents.

STEP 9. Send Plan Set to the Construction Group to Review

a. Deliver two (2) copies of the 90 percent PS&E to John Callahan (PBX: 3755) in the construction group for review, and bottom-up construction engineering estimates.

STEP 10. QA/QC Your Specs one last time before AD

a. Right before your AD submittal to Olympia, ensure that the latest Amendments are reflected in your specs.

b. Go through your Special Provisions and compare them with Amendments that are written about the same section of the *Standard Specifications*. Ensure that there are no conflicts or points of confusion between the two.

STEP 11. Prepare QA/QC Form

a. On completion of PS&E, and prior to sending the set to the Contract Ad and Award Office in Olympia, check off and submit the QAQC sheet PS&ETurn-In_QA-QC.doc.

b. Turn PS&ETurn-In_QA-QC.doc into the Terminal Engineering director for signature, along with the final plan set.

STEP 12. Lock E-Base Estimate

a. E-Base estimate must be locked before project can be advertised.

b. Ask lead estimator Steve Levengood (PBX: 8553) or office engineer Rachel Waitt (PBX: 3944) to lock the estimate.

c. If you need assistance or if Steve Levengood or Rachel Waitt is not available, call the E-Base help extension (PBX: 7456).

STEP 13. Submit Construction Work Order

a. Enter the project budget and estimate summary information in the "Budget Check" tab of the Terminal Estimating Spreadsheet.

b. Update the Primavera schedule with the construction estimate, contingency, and construction engineering costs.

c. Request authorization via email for a new construction work order from TE_WorkOrders@wsdot.wa.gov. Include backup (Primavera schedule printout, Construction Work Order Estimate, E-Base estimate, documents for NEPA, NMFS/USFW, Design Approval, Project Development Approval, Biological Assessment, Section 106, State force work description, HQ Project summary approval, Proviso Information, and RW certificate if exists).

STEP 14. Transmit PS&E Package

a. Print and attach a copy of the memo sent to the Contract Ad and Award office (Step 5), and send a PDF copy of the memo CAPS at the email address on the bottom of the memo template. Indicate source of funds. For Federally funded projects, applicable FHWA, FTA DHS etc. provisions must be included in the contract documents (See Step 7 above).

b. Fill in the electronic Form 221-019 and print it out. Transmit the Final Check Sheet with the package.

c. Transmit the package to:

Transportation Building
Contract Ad and Award Office, Room 1A-23
310 Maple Park Avenue SE
PO Box 47300
Olympia, Washington 98504-7300

STEP 15. Review Printed Contract

a. When advertising begins, the CAPS Office will print the Contract and send copies back to the Project Manager. Review the entire set.

b. If there are any omissions or mistakes, issue an addendum through the Contract Ad and Award office using this addendum template: Addendum_Template.doc.

Appendix N Environmental Compliance Plan

The draft Environmental Compliance Plan contained in this appendix was developed in 2011 and revised in 2016.

Washington State Department of Transportation

WSDOT Ferries Division (WSF) Terminal Engineering Environmental Compliance Plan

2014

Washington State Ferries

Table of Contents

1.0 INTRODUCTION 3
2.0 COMPLIANCE GOALS 4
Prevention 4
Response 5
Reporting 5
3.0 COMPLIANCE PLAN STRATEGIES 6
Incorporating Environmental Commitments into Contracts 6
Improving Contract Documents 6
Improving Communication and Understanding 7
4.0 CLARIFYING COMPLIANCE ASSURANCE ROLES 8
5.0 COMPLIANCE TRAINING OPPORTUNITIES 10
6.0 PROJECT COMPLIANCE PROCESSES 12
7.0 CONCLUSION 13

Introduction

WSDOT's statewide environmental permit compliance strategy directs regions and modes to develop specific environmental compliance plans. WSDOT WSF Division (WSF) endorses this environmental compliance plan to ensure projects are designed, constructed and maintained in accordance with environmental commitments made through the environmental documentation and permitting process. It is the intent of WSF to seek environmental permits and consistently deliver projects in an environmentally responsible manner.

This plan has been developed for use by WSF Terminal Engineering (TE) from project initiation and design kick-off, through construction to project closeout and transfer to Maintenance.

Purpose

The purpose of this environmental compliance plan is to have an effective plan in place outlining a strategy for reduction of environmental permit non-compliance incidents. The strategy includes a scalable step-by-step process for each stage in the project life cycle. Following the plan's steps is meant to promote proactive communication among the TE environmental staff, design and construction personnel for effective resolution of project environmental issues with minimal effects to the environment, if avoidance is not possible.

Goals

The goal of the WSF environmental compliance plan is to achieve 100% Program compliance through appropriate Prevention, Response and Reporting.

This Plan establishes a standard method for taking advantage of all project opportunities to incorporate environmental commitments and include lessons learned from previous project experiences. Compliance planning starts early and occurs throughout the project life cycle for continuous improvement. This method also reiterates shared responsibility for compliance by all staff, contractors and their sub contractors. This is imperative to maintain and improve on the high level of permit compliance on WSF projects, prevent environmental non-compliance events from happening during construction, and avoiding resource agency formal actions.

Prevention

The WSF preventative Program approach includes existing compliance systems for design and construction.

By incorporating environmental commitments into contracts, using WSDOT guidance, WSF proactively addresses Project commitments during design, and assign contractual responsibility to contractors and sub-contractors for compliance. The following Prevention elements establish a process for environmental compliance for each project team:

- Discussing the commitment documents with design and construction Program Management (program directors and managers supporting all programmed projects) for appropriate incorporation into contracts;
- Creating a Commitment File/environmental compliance checklist enumerating WSDOT Project commitments to be completed in construction;
- Developing contracts which use environmental GSPs and special provisions to specifically enumerate contractor and sub contractor responsibilities for compliant Project construction;
- Conducting a Project environmental pre-construction meeting to identify Project compliance roles and responsibilities and appropriate communication pathways for staff;
- Creating and using tools that clearly communicate WSF's compliance responsibilities;
- Anticipating situations that could result in non-compliance events and have contingency plans in place to implement preventative solutions when necessary;
- Providing compliance support and training to environmental, design and construction staff;
- Planning for and therefore eliminating non-compliance situations that can be avoided;
- Minimizing impacts caused by unavoidable non-compliance situations;
- Learning from past mistakes and updating plans to reflect new understanding.

Response

WSF construction teams and environmental staff provide prompt and appropriate response to compliance issues arising during construction. All Project staff have a role and a responsibility in establishing compliance. Contractors and their subcontractors are expected to strictly comply with contract provisions specifying compliant construction activities and necessary response actions to non-compliant events which occur. WSF' environmental and construction inspection staff lead communications related to these events. In this way WSF environmental staff can ensure response actions are performed expeditiously per Project plans, and that those actions are in compliance with Project commitments.

By communicating effectively and coordinating well between construction and environmental staff prior to acting WSF can prevent small events from having large impacts which are harder to control.

Reporting

For permits/approvals that are issued to WSF Projects, environmental and construction staff report non-compliance events within the program team and externally to resource agencies within required timeframes. In doing so, WSF ensures good communication pathways and stay in compliance with established agency reporting timelines. Good communication facilitates speedy consultation with outside agencies and internally on Project non-compliance triggers. Appropriate documentation of non-compliance events is necessary not only for Project records and also for outside agency and HQ environmental reporting purposes.

Compliance Plan Strategies

Incorporating Environmental Commitments into Contracts

The following is excerpted from WSDOT *Project Delivery Memo, #09-01-Incorporating Environmental Commitments into WSDOT Contracts*, broken down into its main points. This proactive compliance strategy is meant to reduce the number and severity of non-compliance incidents on WSF Projects. This strategy also allows WSF to promote flexibility, be adaptable, and incorporate lessons-learned into environmental compliance planning.

- A *Commitment Meeting* is held at design kick off when environmental commitment documents are first identified for a project.
- Project commitments are incorporated into the contract as part of design development.
- Using a *Commitment Tracking System (Environmental compliance checklist)*, environmental commitments are developed into the project Commitment File/ Environmental Compliance Checklist.
- *Commitment File* follows the project from design into construction. Commitment tracking is performed through construction to project closeout. Consistent tracking of commitment status and completion provides us lessons learned to be incorporated into future projects.

Improving Contract Documents

By improving project processes for achieving environmental compliance including incorporating commitments into WSF contracts, WSF will improve the way commitments are enacted during construction. This also improves contract administration consistency and project successful completion.

Implementing good process throughout design development helps address project-specific environmental challenges, and develops specifications that are clearer for Construction staff to administer, and easier for Contractors and their subs-contractors to understand and abide by.

Improving Communication and Understanding

Disseminating this plan to WSF design and construction teams for review and feedback in addition to coordinating on environmental impact resolution during project design and development accomplishes a few important things;

- WSF Project teams are made aware of necessary compliance processes as early as possible during project design.
- The Plan serves as a resource and guidance on group and individual responsibility for design and construction compliance planning and coordination.
- Facilitates Project team communication between diverse disciplines regarding what project commitments exist, how they're being addressed in the Contract, and how implementation will be managed during construction.

This approach toward environmental compliance throughout the Project lifecycle proactively reduces human error, and enhances WSF's ability to anticipate issues and prepares for appropriate field responses.

Compliance Assurance Roles

Each project member at WSF plays a role in compliance, though it may not be their primary job. Because all WSF project staff bear responsibility for compliance, it is important to clearly identify project commitments and each team member's responsibility for commitment fulfillment throughout the Project life cycle.

Key dedicated Design, Environmental and Construction Compliance Roles

- *Project Manager (PM)*, is responsible for project design development. The PM holds the initial environmental commitment meeting for the project, establishing environmental commitments to be incorporated into the project, holds compliance meeting with Construction Manager and Environmental Coordinator for constructability review and to discuss commitment and responsibilities for individual commitments.

- *Construction Manager (CM)*, is responsible for implementation of design as it relates to the administration of the contract during construction. The CM also coordinates with environmental coordinator during construction to assure environmental compliance with commitments and when necessary permit modifications are needed.
- *Environmental Manager (EM)*, is responsible for consultation with resource agencies to procure permits and approvals for the project. The EM's role is also to coordinate with PM staff during design to include and develop appropriate and applicable environmental contract provisions, and with CM staff during construction to help with commitment compliance and assist with modifications on permits as necessary. The EC will help confirm commitment completion and streamline closeout of the project.
- *Construction Inspector (CI)* acts as a part of the environmental compliance effort in their day to day construction inspection. The CI directly oversees contractor implementation of environmental work elements and performs inspections using the environmental checklist. The CI coordinates with the EC on compliance issues which arise to plan necessary corrective actions, and document those for the project file and for agency reporting.

Compliance Training Opportunities

WSF supports environmental training for design engineers, construction inspectors and environmental staff. It is the intent of the TE office to provide training related to environmental compliance for project design, inspection and environmental staff as it currently exists and becomes further available.

The Training Plan will include but is not limited to:

- Erosion Control Design
- Spill Plan Reviewer Training
- Eelgrass Recognition, Regulations and Resource Value
- Environmental Permit Overview for Environmental Practitioners
- Environmental Compliance for Construction Inspectors
- Cultural Resources Training
- Applying Maintenance BMPs
- CESCL Certification

- Marine mammal monitoring
- Marbled Murrelet monitoring training

The following courses can be made available at HQ's Environmental Services Office upon request:

- Cultural Resources Overview for Construction
- Hazardous Materials identification
- Stream Diversion/Bypass
- Fish Exclusions
- Calibration of Turbidimeter
- Water Quality Sampling and Reporting.

Additional Just-In-Time Training Opportunities
Environmental leads can provide 'just in time' training for those who will be directly responsible for environmental compliance during construction on how to use and implement this plan. Leads can also provide updates on new or changing regulations and awareness program information including adding environmental compliance topics to safety meeting discussions and offering brownbag lunch presentations upon request.

Project Compliance Processes

To ensure WSF projects are developed and constructed with appropriate consideration of environmental documentation commitments and permit conditions, WSF staff will coordinate in the following:

Programming Phase – Scoping Project Manager

- Identify environmental deficiencies (e.g. stormwater treatment), limitations or constraints (e.g. overwater coverage or eelgrass presence)
- Development of project milestones and AD dates including environmental document completion and permit dates

Scoping Phase – Environmental Manager

- ERS/ECS completed to determine level of environmental documentation and permitting requirements
- Review planned AD date

- Provide environmental input to Project Management Plan (PMP), negotiate level of efforts milestones and cost, and sign PMP
- The TE environmental staff will coordinate an initial project environmental review at the time scoping information is submitted.

Pre-Design Studies Phase - Environmental Manger

- Provide input and review alternative evaluation, permitting needs and environmental regulations, identify stakeholders, and review site analysis

Preliminary Engineering Phase - Design Team

Initial Project Review

This project review process will vary from project to project depending upon individual needs, but generally should involve a detailed review focusing upon potential project environmental impacts, critical design elements, avoidance/minimization/mitigation options. Stormwater treatment facilities should be included. Participants should include project design, construction, maintenance and environmental office staff.

Design

- Review and provide comments on project purpose and need, project description, design alternatives, construction methods, duration and environmental mitigation.
- Initiate environmental documentation and permit application at 15% design.

Plans, Specifications and Estimate Development

The TE environmental staff will work collaboratively with TE Design and Construction to ensure that all environmental permit provisions are adequately incorporated into PS&E's prior to conducting WSF review. All permit conditions will be incorporated into contract provisions and copies of all permits will be included in contracts.

30% Design –

Design Team (PM, CM, CI and EC) hold environmental commitment meeting to:

- Review environmental documents and known and potential permits for the project

Following the environmental commitment meeting the environmental coordinator applies for the permits and approvals.

60% Design –

- Review existing WSDOT Environmental General Provisions for applicability to the project

- Identify necessary/appropriate environmental special provisions for incorporation into the contract in coordination with draft permit conditions made available by resource agencies

90% Design –

- Develop environmental contract specifications from permit and other environmental commitments

The PM will coordinate a meeting with project environmental and construction staff to review and incorporate environmental documentation and permit conditions and commitments into contract special provisions.

- Hold environmental compliance (constructability) meeting

Project Development will ensure that a constructability review for all work covered by environmental documentation and permits have been completed prior to finalizing the PS&E. At a minimum, representatives from the environmental, design, maintenance, and construction must participate in this review.

- Develop commitment file for the project

A commitment tracking system (i.e, Environmental Checklist) will be used to record all environmental commitments. The resulting report is called the Commitment File or Commitment Tracking System (CTS). This electronic file is transferred from design to construction prior to AD and construction.

See also *Project Delivery Memo, #09-01- Incorporating Environmental Commitments into WSDOT Contracts* for additional guidance.

Construction Phase: Construction Manager

In construction, the commitment file is managed by the CM, closing out commitments regularly as they've been implemented by the contractor. The file is a tool documenting final project completion

Pre-Construction Meetings:

TE Environmental staff will participate in all pre-construction meetings and, when appropriate for projects with substantial environmental risk, will hold a stand-alone environmental pre-construction meeting. Additionally, TE Environmental staff will support project construction offices for task specific site review meetings for critical construction elements.

- Attend Pre-construction meeting with the CI and contractor to ensure compliance and review the environmental commitments which must be complied with during work activities
- Provide a copy of the Environmental Notebook/Binder (see below) to the Contractor which is to be available on site

Environmental Notebook/Binder

The TE Environmental staff will provide an environmental notebook/binder for each construction contract. This notebook/binder will include both standardized information relating to contact information, monitoring and reporting procedures as well as project specific requirements. Specific chain of communication and authority for contract changes requiring environmental input will be specified in the notebook/binder. The notebooks/binders will include but are not limited to the following information:

- Contact numbers for agency personnel
- WSF environmental and resource agency contacts
- Emergency contacts
- Permits and summary conditions
- Non-compliance notification triggers and notification requirements
- Water Quality Sampling and Reporting, if required
- Approved Contractor's SPCC Plan
- Contractor Contact Information
- Other Contractor Procedures

Notify resources agencies about construction start if required

Environmental On-Call

A TE Environmental staff member will be designated to support each construction project and will be the single point of contact for all environmental compliance. This staff member will be familiar with the project and associated permits and approvals. This staff member will provide assistance with interpretation of environmental permits and approvals and be able to answer general questions regarding environmental permits and commitments. This staff member will conduct a minimum of one environmental compliance field review for each capital construction contract.

Environmental Compliance Assurance Procedure (ECAP) Reporting

- Construction Inspector completes the compliance checklist regularly and coordinates with the environmental manager on resolution of issues which arise.
- Environmental manager will follow ECAP and other pertinent incidence reporting protocols. These protocols can be found on HQ Environmental Services site on the intranet.

Substantial Completion – Construction Project Manager

- Environmental Office reviews Compliance checklist and files it
- Does lessons learned if there were any substantial changes or incidences.

- Environmental coordinator to complete post-construction notification when required.

Construction Close-out

- Via the Commitment File, document that all environmental commitments have been met upon completion of the project. Transfer responsibility for all long-term compliance commitments, if any to WSF Maintenance and Operations and send commitment file to the corresponding groups. Upon receipt make sure appropriate leads understand commitments for the project and have appropriate points of contact who is the EM within environmental should issues arise for consultation and coordination.
- Closure and final records

Tracking and Reporting

Tracking Success

Tracking and documenting the success of WSF environmental compliance will help us assess the effectiveness of the program, provide us with information to help make improvements and increase WSF's credibility with the resource agencies.

Reporting Non-compliance Incidents

TE Environmental will track and report environmental non-compliance events. It is the responsibility of each Project Engineer/CM to report each non-compliance event. It is the responsibility of the TE Environmental staff to maintain detailed records of non-compliance events and report to Headquarters Environmental Services Office per ECAP, and on an annual basis for the Gray Notebook. Additionally, the TE Environmental staff will coordinate an annual review meeting with TE Construction to review non-compliance events.

Conclusion

The WSF compliance process helps achieve compliance goals by making continuous compliance improvements from previous Project challenges. Of course, the goal is 100% compliance with all applicable laws and regulations and elimination of environmental non-compliant events caused by human error. WSF moves closer to reaching that goal by following the steps outlined in this plan, and by always making an effort to improve WSF's internal communications related to commitment responsibilities.

Appendix O Vessel Data for Terminal Design

The vessel data contained in this appendix was provided by the WSF Vessel Engineering Department and is current as of December 2015.

APPENDIX O: VESSEL DATA FOR TERMINAL DESIGN

VESSEL CLASS		JUMBO MARK II			JUMBO		SUPER			SUPER (SOLAS)	ISSAQUAH			
VESSEL NAME	UNITS	TACOMA	WENATCHEE	PUYALLUP	SPOKANE	WALLA WALLA	HYAK	KALEETAN	YAKIMA	ELWHA	ISSAQUAH	KITSAP	KITTITAS	CATHLAMET
PRINCIPAL DIMENSIONS														
LENGTH	FEET	460.17	460.17	460.17	440.00	440.00	382.17	382.17	382.17	382.17	382.50	382.50	382.50	382.50
BREADTH	FEET	90.00	90.00	90.00	87.00	87.00	73.17	73.17	73.17	73.17	78.67	78.67	78.67	78.67
DEPTH	FEET	25.25	25.25	25.25	24.75	24.75	24.25	24.25	24.25	24.25	23.00	23.00	23.00	23.00
VEHICLE-TO-PASSENGER DECK DISTANCE	FEET	20.00	20.00	20.00	20.00	20.00	17.00	17.00	17.00	17.00	18.75	18.75	18.75	18.75
TUNNEL VERTICAL CLEARANCE	FEET	15.50	15.33	15.50	15.69	15.50	15.50	14.42	15.50	15.08	15.67	15.50	15.83	15.50
OPERATIONAL VESSEL														
DISPLACEMENT	LONG TONS	5254	5254	5254	4312	4312	3251	3251	3251	3439	2947	2947	2947	2947
PASSENGER DECK FREEBOARD	FEET	28.25	28.25	28.25	27.75	27.75	24.25	24.25	24.25	23.25	26.25	26.25	26.25	26.25
VEHICLE DECK FREEBOARD	FEET	8.25	8.25	8.25	7.75	7.75	7.25	7.25	7.25	6.25	7.50	7.50	7.50	7.50
DRAFT	FEET	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	18.00	15.50	15.50	15.50	15.50
LAY-UP VESSEL														
DISPLACEMENT	LONG TONS	4946	4998	4938	4014	4019	3016	3038	2990	3260	2735	2750	2735	2735
PASSENGER DECK FREEBOARD	FEET	28.77	28.68	28.79	28.33	28.32	24.39	24.33	24.47	23.72	26.87	26.82	26.87	26.87
VEHICLE DECK FREEBOARD	FEET	8.77	8.68	8.79	8.33	8.32	7.39	7.33	7.47	6.72	8.12	8.07	8.12	8.12
DRAFT	FEET	16.48	16.57	16.46	16.42	16.43	16.86	16.92	16.78	17.53	14.88	14.93	14.88	14.88
WINDAGES														
VESSEL WINDAGE FROM FRONT	SQUARE FEET	4805	4798	4806	3932	3932	3582	3579	3587	3543	3436	3433	3436	3436
VESSEL WINDAGE FROM SIDE	SQUARE FEET	21160	21120	21170	18080	18075	15673	15650	15703	15420	12902	12886	12902	12902
CAPACITIES														
VEHICLE CAPACITY	VEHICLES	202	202	202	188	188	144	144	144	144	124	124	124	124
PASSENGER CAPACITY	PASSENGERS	2499	2499	2499	2000	2000	2000	1868	2000	2000 / 1076 SOLAS	1200	1200	1200	1200
MECHANICAL														
WATER TANK CAPACITY	GALLONS	21460	21460	18270	24038	24038	9200	9200	9100	9767	14476	14476	14476	14476
NUMBER OF SEWAGE PUMPS		4	4	4	4	4	2	2	2	2	2	2	2	2
SEWAGE TANK CAPACITY	GALLONS	21460	21460	21460	27222	27222	10596	10596	10596	10086	14476	14476	14476	14476
SEWAGE DISCHARGE RATE	GPM	500	500	500	500	500	400	400	400	400	400	400	400	400

NOTES:
DISPLACEMENT VALUES ARE IN LONG TONS
SALT WATER (LTSW) EXCEPT SANPOIL
FERRY DISPLACEMENT IS IN LONG TONS
FRESH WATER (LTFW)

THE CHIMACUM VESSEL IS UNDER CONSTRUCTION. DATA ARE PRELIMINARY.

Appendix O_Vessels Rev 2.xlsx
Vessel Data for Terminal Eng
12/23/2015

APPENDIX O: VESSEL DATA FOR TERMINAL DESIGN

VESSEL CLASS		ISSAQUAH	ISSAQUAH (SOLAS)	OLYMPIC			EVERGREEN STATE			KWA-DI TABIL				
VESSEL NAME	UNITS	SEALTH	CHELAN	TOKITAE	SAMISH	CHIMACUM (SEE NOTE)	EVERGREEN STATE	KLAHOWYA	TILLIKUM	CHETZEMOKA	SALISH	KENNEWICK	HIYU	SANPOIL
PRINCIPAL DIMENSIONS														
LENGTH	FEET	382.50	382.50	362.25	362.25	362.25	310.17	310.17	310.17	273.75	273.75	273.75	162.00	116.00
BREADTH	FEET	78.67	78.67	83.17	83.17	83.17	73.17	73.17	73.17	64.08	64.08	64.08	63.00	45.67
DEPTH	FEET	23.00	23.00	24.50	24.50	24.50	23.25	23.25	23.25	17.58	17.58	17.58	17.00	11.50
VEHICLE-TO-PASSENGER DECK DISTANCE	FEET	18.75	18.75	18.50	18.50	18.50	16.92	15.50	15.50	19.00	19.00	19.00	9.00	N/A
TUNNEL VERTICAL CLEARANCE	FEET	15.17	15.67	16.00	16.00	16.00	13.58	13.50	13.50	16.00	16.00	16.00	15.00	15.50
OPERATIONAL VESSEL														
DISPLACEMENT	LONG TONS	2947	2947	4333	4333	4333	2276	2276	2276	2075	2075	2075	534	202
PASSENGER DECK FREEBOARD	FEET	26.25	26.00	26.55	26.55	26.55	24.42	23.00	23.00	25.58	25.58	25.58	15.50	N/A
VEHICLE DECK FREEBOARD	FEET	7.50	7.25	8.05	8.05	8.05	7.50	7.50	7.50	6.58	6.58	6.58	6.50	4.50
DRAFT	FEET	15.50	15.75	16.45	16.45	16.45	15.75	15.75	15.75	11.00	11.00	11.00	10.50	7.00
LAY-UP VESSEL														
DISPLACEMENT	LONG TONS	2692	2866	3866	3866	3866	1962	2099	2027	1630	1639	1639	483	127
PASSENGER DECK FREEBOARD	FEET	26.99	26.48	27.53	27.53	27.53	25.53	23.62	23.87	27.15	27.11	27.11	15.99	N/A
VEHICLE DECK FREEBOARD	FEET	8.24	7.73	9.03	9.03	9.03	8.61	8.12	8.37	8.15	8.11	8.11	6.99	6.08
DRAFT	FEET	14.76	15.27	15.47	15.47	15.47	14.64	15.13	14.88	9.44	9.47	9.47	10.01	5.42
WINDAGES														
VESSEL WINDAGE FROM FRONT	SQUARE FEET	3444	3413	4128	4128	4128	2996	2969	2983	3399	3397	3397	1691	1136
VESSEL WINDAGE FROM SIDE	SQUARE FEET	12941	12777	16534	16534	16534	10405	10262	10336	10762	10755	10755	3223	1621
CAPACITIES														
VEHICLE CAPACITY	VEHICLES	90	124	144	144	144	87	87	87	64	64	64	34	20
PASSENGER CAPACITY	PASSENGERS	1200	1200 / 1076 SOLAS	1500	1500	1500	854	792	1061	748	748	750	199	149
MECHANICAL														
WATER TANK CAPACITY	GALLONS	14476	14476	16206	16206	16206	12388	12327	13056	6064	6064	6064	420	N/A
NUMBER OF SEWAGE PUMPS		2	2	2	2	2	2	2	2	2	2	2	2	1
SEWAGE TANK CAPACITY	GALLONS	14476	14160	17060	17060	17060	10000	10022	9699	8182	8182	8182	1052	304
SEWAGE DISCHARGE RATE	GPM	400	400	500	500	500	400	400	400	175	175	175	75	100

NOTES:
DISPLACEMENT VALUES ARE IN LONG TONS
SALT WATER (LTSW) EXCEPT SANPOIL
FERRY DISPLACEMENT IS IN LONG TONS
FRESH WATER (LTFW)

THE CHIMACUM VESSEL IS UNDER CONSTRUCTION. DATA ARE PRELIMINARY.

Appendix O_Vessels Rev 2.xlsx
Vessel Data for Terminal Eng
12/23/2015

Appendix P Route Information

The information contained in this appendix is from Washington State Ferries' Route Reference Book, June 2006 and updated November 2013. Note that the Keystone Terminal has since been renamed the Coupeville Terminal.

Anacortes/San Juan Islands/Sidney Route Overview

- Anacortes
- Lopez
- Shaw
- Orcas
- Friday Harbor
- Sidney, B.C.

Coupeville (Keystone)/Port Townsend Route Overview

- Coupeville (Keystone)
- Port Townsend

Mukilteo/Clinton Route Overview

- Mukilteo
- Clinton

Edmonds/Kingston Route Overview

- Edmonds
- Kingston

Seattle/Bainbridge Island/Bremerton Route Overview

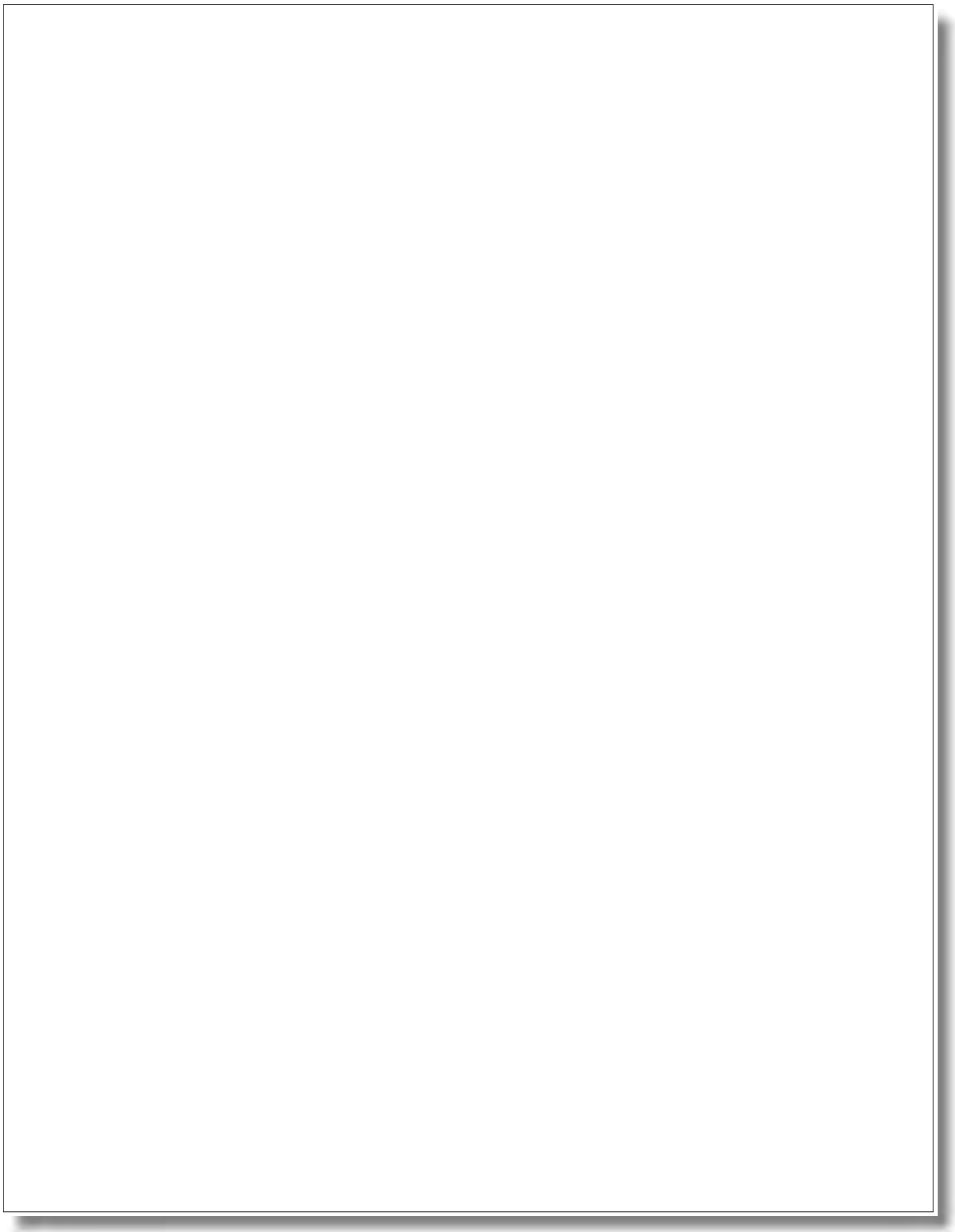
- Seattle
- Bainbridge Island
- Bremerton

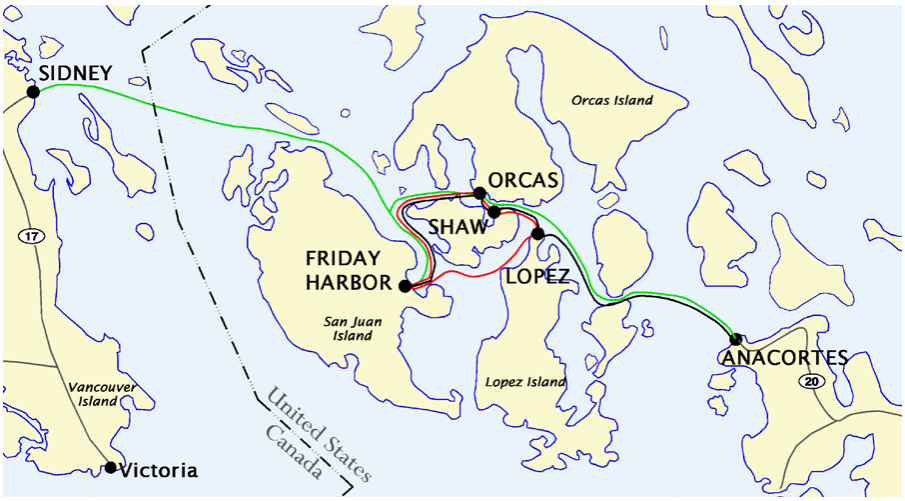
Fauntleroy/Vashon/Southworth Route Overview

- Fauntleroy
- Vashon
- Southworth

Point Defiance/Tahlequah Route Overview

- Point Defiance
- Tahlequah





ANACORTES / SAN JUAN ISLANDS / SIDNEY
ROUTE OVERVIEW

This ferry route connects Anacortes (approximately 80 miles northwest of Seattle), to the San Juan Island ferry terminals (Friday Harbor, Orcas, Shaw and Lopez) and to Sidney B.C. This route has the only international ferry service with WSF. There are three separate runs: the Anacortes to Friday Harbor Service (stopping at Orcas, Shaw and Lopez – shown in black above), the Inter-Island Service (running only between Friday Harbor, Orcas, Shaw and Lopez – shown in red above), and the International Service (running from Anacortes to Sidney, B.C., with stops at Orcas and Friday Harbor – shown in green above). The crossing time between Anacortes and Sidney, B.C. is approximately 2½ hours.

The annual ridership for Anacortes/San Juan Islands (including inter-island travel) has grown from 711,500 riders in 1975 to about 1.6 million riders with more than 751,000 vehicles in 2007 (not including 91,000 inter-island riders/vehicles). However, annual ridership for Anacortes/Sidney, B.C. has dropped from 195,000 in 1975 to 113,000 (with 39,000 vehicles) in 2007. All four San Juan Island terminals are run by private contractors.

Washington State Ferries

Anacortes

HISTORY

The west timber trestle was built in 1959, with the east timber trestle added in 1971. The main transfer span was constructed in 1959 and rebuilt as a steel structure in 1994. The auxiliary transfer span was constructed in 1970 and rebuilt in 2002, with the overhead loading also added in 1970.

The terminal has a combination of steel and timber dolphins. The steel wingwalls were built in 1997 on the main and auxiliary slips. A half-wing was added in 1971 on Tie-up Slip 1 and a timber wingwall on Tie-up Slip 2 in 1978.

FACILITY

- Serves 5 terminals (with routes to the San Juan Islands and Sidney, B.C.)
- Two slip facility with overhead loading (and two tie-up slips)
- Holding lanes capacity – 15 lanes holding approximately 450 vehicles
- There are 4 auto toll booths
- Terminal employs 23 people
- 2007 ridership (not including inter-island): 1,630,230 riders and 751,756 vehicles for Anacortes/San Juan Islands; 113,460 riders and 39,020 vehicles for Anacortes/Sidney, B.C.

GEOGRAPHIC DATA

Terminal Contact: Anacortes Ferry Terminal
2100 Ferry Terminal Road Suite A
Anacortes, WA 98221-4057
(206) 264-3560; (206) 264-3561 fax

County: Skagit

Section, Township, Range: 22, 35N, 01E

Latitude/Longitude: 48° 30′ 26″ N / 122° 40′ 30″ W

Zoning Designation: Commercial Marine

Comprehensive Plan Designation: Commercial Marine

Property Owner: Port of Anacortes
PO Box 297
Anacortes, WA 98221

Tax Parcel Number(s): P31577, P31548, P31561, P31672, P31668

Jurisdiction: City of Anacortes
Director
Planning & Community Development
PO Box 547
Anacortes, WA 98221
(360) 299-1942; (360) 293-1928 (fax)

Fire Dept. Contact: Senior Plans Examiner
Building Department
(360) 293-1901

Adjacent Parcels:

WEST: TP#: P31560	SOUTH: TP#: P58127	SOUTHWEST: TP#: P58918
SOUTH: TP#: P58126	SOUTH: TP#: P58128	EAST: TP#s: P31667, P31576, P31670

See Skagit County Assessor Office for current ownership information

ENGINEERING DATA

See latest Life Cycle Cost Model (LCCM) for information

ENVIRONMENTAL DATA

Environmental Notes:

Water Body: Guemes Channel (Rosario Strait tributary)

Shoreline Designation: Urban II

Shorelines Contact: Land Use Permit Manager
Anacortes Planning Department
(360) 299-1943

Area Habitat Biologist: Washington Department of Fish and Wildlife
PO Box 1100
La Conner, WA 98257
(360) 466-4345

CONTRIBUTING PARK & RIDES

NAME	LOCATION	CAPACITY	COST	UTILIZATION
Parking Lot A	At terminal; west of terminal building	231*	Note***	100%* (summer wknd)
Parking Lot B	At terminal; west of exit lanes	106*	Note***	100%* (summer wknd)
Parking Lot C	At terminal; east of tollbooth	115*	Note***	100%* (summer wknd)
Parking Lot D	At terminal; upland from tollbooth	791	Note***	New lot; unknown
March's Point Park & Ride	March Point Rd. (off of Hwy. 20)	135		75-100% (May-Sept.)** 20-25% (Oct.-April)**

*Figures based on terminal supervisor's statement
**Figures based on transit agent's statement; shuttle to ferry terminal runs May-Sept.
***Up to 24 hours - $10.00; Three days - $20.00; One week - $30.00; Monthly - $75.00

Lopez

HISTORY

The ferry terminal was built in 1980, including the steel transfer span, steel towers, floating concrete wingwalls and concrete floating dolphins.

FACILITY

- Has routes to Anacortes and inter-island transportation between the San Juan Islands
- One slip facility
- Holding lanes capacity – 4 lanes holding approximately 88 vehicles
- There are no auto tollbooths
- Terminal operated by private contractors
- 2007 ridership: 314,476 riders and 151,054 vehicles (not including inter-island riders/vehicles)

GEOGRAPHIC DATA

Terminal Contact: Lopez Ferry Terminal
Ferry Road
Lopez Island, WA 98261
(206) 515-3941; (360) 676-2228 fax

County: San Juan

Section, Township, Range: 36, 36, 02W

Latitude/Longitude: 48° 34′ 13″ N / 122° 51′ 35″ W

Zoning Designation: Rural General

Comprehensive Plan Designation: Rural General

Property Owner: State of Washington (State Lands Div. & DOT)

Tax Parcel Number(s): 263632003000
(Holding, Park 'n Ride; State Lands Div.)
263632004000
(Parking Lot; DOT)
263632001000
(Undevel. Residential Property; DOT)

Jurisdiction: San Juan County
San Juan County Permit Center
PO Box 947
Friday Harbor, WA 98250
permits@sanjuanco.com
(360) 378-2354

Fire Dept. Contact: Robert Low, SJ County Fire Marshal
(360) 378-3473

Adjacent Parcels:

WEST:
TP#: 263650015000

SOUTHWEST:
TP#: 263633018000

SOUTHWEST, WEST, NORTHWEST, NORTH:
TP#s: 263650012000
263650013000
263632009000
263632006000
263632002000
263650009000
263650011000

EAST:
Dept. of Nat. Resources

SOUTH:
TP#: 263633001000

See San Juan County Assessor Office for current ownership information

ENGINEERING DATA

See latest Life Cycle Cost Model (LCCM) for information

ENVIRONMENTAL DATA

Water Body: Harney Channel

Shoreline Designation: Conservancy

Shorelines Contact: San Juan County Permit Center
permits@sanjuanco.com
(360) 378-2354

Area Habitat Biologist: Washington Department of Fish and Wildlife
PO Box 1100
La Conner, WA 98257
(360) 466-4345

Environmental Notes:

Environmentally sensitive area – FEMA flood zone

CONTRIBUTING PARK & RIDES

NAME	LOCATION	CAPACITY	COST	UTILIZATION
Terminal Parking	East of holding lanes	50		100+%*
Drop-off Terminal Parking	West of dock	17		100%*

*Figures based on terminal agent's statement

Shaw

HISTORY

The timber trestle was built in 1974 and then upgraded in 2003. Also built in 2003 were the concrete & steel towers, the timber bridge seat with 30" pipe (w/anchors) piling, and the steel transfer span. Steel wingwalls were built in 2003/2004. The right inner and outer steel dolphins were constructed in 2010.

FACILITY

- Has routes to Anacortes and inter-island transportation between the San Juan Islands
- One slip facility
- Holding lanes capacity – 2 lanes holding approximately 22 vehicles
- There are no auto tollbooths
- Terminal operated by private contractors
- 2007 ridership: 30,682 riders and 15,834 vehicles (not including inter-island riders/vehicles)

GEOGRAPHIC DATA

Terminal Contact: Shaw Island Ferry Terminal
Ferry Dock Road
Shaw Island, WA 98286
(206) 515-3964; (360) 468-4660 fax

County: San Juan

Section, Township, Range: 27, 36N, 02W

Latitude/Longitude: 48° 35′ 87″ N / 122° 55′ 40″ W

Zoning Designation: Rural Farm Forest

Comprehensive Plan Designation: Rural Farm Forest

Property Owner: State of Washington
State Lands Division
PO Box 47014
Olympia, WA 98504-7014

Tax Parcel Number(s): 262712002000

Jurisdiction: San Juan County
San Juan County Permit Center
PO Box 947
Friday Harbor, WA 98250
permits@sanjuanco.com
(360) 378-2354

Fire Dept. Contact: Robert Low, SJ County Fire Marshal
(360) 378-3473

Adjacent Parcels:

EAST:
TP#: 262712001000

SOUTH:
TP#: 262712003000

See San Juan County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Water Body: Harney Channel

Shoreline Designation: Rural

Shorelines Contact: San Juan County Permit Center
permits@sanjuanco.com
(360) 378-2354

Area Habitat Biologist: Washington Department of Fish and Wildlife
PO Box 1100
La Conner, WA 98257
(360) 466-4345

Environmental Notes:

Species include: Puget Sound/Strait of Georgia coast coho, sockeye, chinook, chum, and sea-run cutthroat trout (NMFS 1997).

CONTRIBUTING PARK & RIDES

NAME	LOCATION	CAPACITY	COST	UTILIZATION
Terminal Parking	South of dock	5		80%*
Pay parking	Southeast of dock	16	$40/mo	60%*

*Figures based on terminal agent's statement

Shaw-2

Orcas

HISTORY

The timber trestle was built in 1959, and then upgraded in 1987. The steel transfer span was built in 1979 and then upgraded in 1987 as well. There is also one right-inner steel dolphin that was built in 2013. The steel wingwalls and the concrete/steel towers were built in 1999. There are two floating outer dolphins. Both were installed in 2008.

FACILITY

- Has routes to Anacortes, Friday Harbor, and Sidney B.C., as well as inter-island transportation between the San Juan Islands
- One slip facility
- Holding lanes capacity – 8 lanes holding approximately 120 vehicles
- There is one auto tollbooth
- Terminal operated by private contractors
- 2007 ridership: 565,904 riders and 274,224 vehicles (not including inter-island riders/vehicles)

GEOGRAPHIC DATA

Terminal Contact: Orcas Ferry Terminal
1 Waterfront Street
Orcas Island, WA 98280
(206) 515-3942; (360) 376-6334 fax

County: San Juan

Section, Township, Range: 22, 36, 02W

Latitude/Longitude: 48° 35′ 51″ N / 122° 56′ 33″ W

Zoning Designation: Village

Comprehensive Plan Designation: Activity Center

Property Owner: State of Washington
State Lands Division
PO Box 47014
Olympia, WA 98504-7014

Tax Parcel Number(s): 262222022000 (dock? – not on map)
262114012000, 262222024000,
262222021000, 262222023000
(various parking & holding)

Jurisdiction: San Juan County
San Juan County Permit Center
PO Box 947
Friday Harbor, WA 98250
permits@sanjuanco.com
(360) 378-2354

Fire Dept. Contact: SJ County Fire Marshal
(360) 378-3473

Adjacent Parcels:

NORTHWEST (of dock):
TP#: 262222014000

NORTHWEST (of holding lane):
TP#: 262111011000

NORTH (of dock):
TP#s: 262222015000

EAST (of holding):
TP#: 262222012000

NORTH (of holding):
TP#: 262222026000

SOUTH (of holding lane):
TP#: 262114010000

WEST (of holding area):
TP#: 262222009000

See San Juan County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Environmental Notes:

Water Body: Harney Channel

Shoreline Designation: Urban

Shorelines Contact: San Juan County Permit Center
permits@sanjuanco.com
(360) 378-2354

Area Habitat Biologist: Washington Department of Fish and Wildlife
PO Box 1100
La Conner, WA 98257
(360) 466-4345

CONTRIBUTING PARK & RIDES

NAME	LOCATION	CAPACITY	COST	UTILIZATION
Terminal Parking	South of holding lanes	38		100%*
Terminal Parking	Southwest of tollbooth	16		50-75%*
Public Pay Parking	East of dock (off-site near post office)	20	Unknown	Unknown
Public Parking	Lot up the hill from Orcas Hotel	20 (approx.)		Unknown

*Figures based on terminal agent's statement

Friday Harbor

HISTORY

The timber trestle and steel transfer span were built in 1968, with the timber trestle being upgraded in 1992. A steel wingwall was built on the main slip in 1995, and a half-wing was built on the tie-up slip in 1982 and then upgraded in 1999. On the main slip, two steel dolphins were built in 2013, with a steel dolphin built in 1995. On the tie-up slip, two timber dolphins were built in 1982, with a third built in 1991.

FACILITY

- Has routes to Anacortes, the San Juan Islands and Sidney B.C.
- One slip facility (and one tie-up slip)
- Holding lanes capacity – 12 lanes holding approximately 136 vehicles
- There are no auto tollbooths
- Terminal operated by private contractors
- 2007 ridership: 719,168 riders and 310,644 vehicles (not including inter-island & Sidney B.C. passengers/vehicles)

GEOGRAPHIC DATA

Terminal Contact: Friday Harbor Ferry Terminal
91 Front Street
Friday Harbor, WA 98250
(206) 515-3924; (360) 676-2225 (fax)

County: San Juan

Section, Township, Range: 13, 35, 03W

Latitude/Longitude: 48° 32′ 10″ N / 123° 00′ 50″ W

Zoning Designation: Commercial

Comprehensive Plan Designation: Commercial

Property Owner: State of Washington (State Lands Div. & DOT)

State Lands Division
P.O. Box 47014
Olympia, WA 98504-7014

WSDOT
P.O. Box 330310
Seattle, WA 98133

Tax Parcel Number(s): 351354002000 (Terminal; State Lands Div.)
351352002000 (Holding; State Lands Div.)
351391119000 (Holding; DOT)
351391108000 (Park n′ Ride; DOT)

Jurisdiction: Town of Friday Harbor
Zoning Coordinator
Town of Friday Harbor
PO Box 219
Friday Harbor, WA 98250
(360) 378-2810; (360) 378-8723 (fax)

Fire Dept. Contact: Code Compliance Officer
Building Department
(360) 378-2810 x234

Adjacent Parcels:

NORTHWEST:
TP#: 351354001000

NORTHEAST:
TP#: 351391122000

SOUTHWEST:
TP#: 351350104000

SOUTHWEST:
TP#: 351350106000

SOUTHWEST:
TP#: 351350105000

SOUTHWEST:
TP#: 351350103000

SOUTHWEST:
TP#: 351350101000

SOUTHEAST:
TP#: 351391101000

EAST:
TP#: 351391104000

SOUTH:
TP#: 351356103000 (not found)

SOUTH:
TP#: 351356101000

See San Juan County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Water Body: Friday Harbor

Shoreline Designation: Urban

Shorelines Contact: Town of Friday Harbor
Zoning Coordinator
60 Second Street
PO Box 219
Friday Harbor, WA 98250
(360) 378-2810; (360) 378-8723 (fax)

Area Habitat Biologist: Washington Department of Fish and Wildlife
PO Box 1100
La Conner, WA 98257
(360) 466-4345

Environmental Notes:

Regulated by Compliance Assistance Office (CAO), Ch. 18.08, Ord. 1051, §6, 1997

CONTRIBUTING PARK & RIDES

NAME	LOCATION	CAPACITY	COST	UTILIZATION
WSF Commuter Parking (Lot C)	East of remote holding lanes	65-70*		50%*
Port of Friday Harbor Parking	West of dock	Unknown	Unknown	Unknown
Remote Fairgrounds parking	Fairgrounds	Unknown	Unknown	Unknown

*Figures based on terminal agent's statement

Sidney, B.C.

HISTORY

The timber trestle was demolished and rebuilt as a concrete box girder in 2003. The wingwalls, ramp and apron, floating leads and inner dolphin were all constructed in 2003.

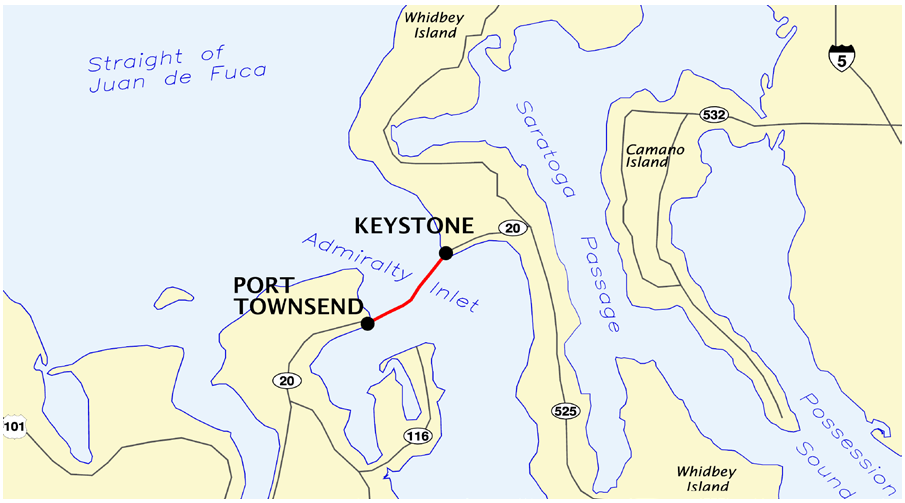
FACILITY

- Has routes to Anacortes, Orcas and Friday Harbor (does not run during winter months)
- One slip facility
- Holding lanes capacity – 22 lanes holding approximately 242 vehicles
- There is one auto tollbooth
- Terminal operated by private contractors
- 2007 ridership: 134,417 riders and 45,519 vehicles

GEOGRAPHIC DATA

Terminal Contact: Sidney, B.C. Terminal
2499 Ocean Avenue
Sidney, B.C. V8L1T3 Canada
(250) 656-1831; (250) 656-3760 fax

Located on Vancouver Island in British Columbia, Canada.



KEYSTONE / PORT TOWNSEND
ROUTE OVERVIEW

This ferry route connects Port Townsend (located on the northeast corner of the Olympic Peninsula) and Keystone (located on the west side of Whidbey Island). This run provides connection from the northern Olympic Peninsula to the mainland by way of Clinton and Whidbey Island. The crossing time between Port Townsend and Keystone is approximately 30 minutes.

The annual ridership for Port Townsend/Keystone has grown from 200,000 riders in 1975 to more than 688,000 riders with 326,000 vehicles in 2007.

Washington State Ferries

Coupeville (Formerly Keystone)

HISTORY

There is no trestle at this facility. The concrete bridge seat was built in 1979 (at the shoreline) along with the steel transfer span. Timber dolphins were built in 1979 & 1982, and a steel pile dolphin was built in 2002. The steel wingwalls were constructed in 2010.

FACILITY

- One slip facility
- Holding lanes capacity – 10 lanes holding approximately 120 vehicles
- There are 2 auto toll booths
- Terminal employs 8 people
- 2007 ridership: 688,616 riders and 326,603 vehicles

GEOGRAPHIC DATA

Terminal Contact: Coupeville Ferry Terminal
1400 South State Route 20
Coupeville, WA 98239
(206) 264-3565; (206) 264-3566 fax

County: Island

Section, Township, Range: 22, 31, 01E

Latitude/Longitude: 48° 09′ 33″ N / 122° 40′ 14″ W

Zoning Designation: Park

Comprehensive Plan Designation: Park

Property Owner: Wash. St. Parks & Rec. Commission
P.O. Box 42650
Olympia, WA 98504

Tax Parcel Number(s): R13122-250-2950

Jurisdiction: Island County
Director
Planning and Community Development
PO Box 5000
Coupeville, WA 98239-5000
(360) 679-7344

Fire Dept. Contact: Building Official
(360) 679-7308

Adjacent Parcels:

EAST:
TP#: R13122-250-3200

NORTHWEST:
TP#: R13122-310-2600

See Island County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Water Body: Admiralty Inlet

Shoreline Designation: Urban

Shorelines Contact: Development Coord.
Island County Planning &
Community Development
(360) 678-7812

Area Habitat Biologist: Washington Department of Fish and Wildlife
PO Box 1100
La Conner, WA 98257
(360) 466-4345

Environmental Notes:

Marine Fish & Wildlife Habitat Conservation Area; rare plants protected by the Washington State Heritage Program

CONTRIBUTING PARK & RIDES

NAME	LOCATION	CAPACITY	COST	UTILIZATION
Coupeville P&R Lot	SR 20 & Main Street	66		100%* **
Street parking	North of holding lanes	22		100%***
Street parking (lot)	East of holding lanes	14		100%***
State Park recreational parking	East of dock	Unknown	$5/day	Unknown

*Figures based on transit agent's statement
**Used mostly by teachers from nearby school
***Figures based on terminal agent's statement

Port Townsend

HISTORY

The concrete trestle, and the timber towers & wingwalls were all built in 1982. The main transfer span (steel) was replaced in 2013. The auxiliary transfer span is a truss from pre-1964 and was also rebuilt in 1982. The Slip 1 timber dolphins were replaced with steel dolphins in 2011. The timber dolphins on the auxiliary slips were built in 1984, and the main slip also has a floating dolphin from an unspecified year.

FACILITY

- Two slip facility
- Holding lanes capacity – 10 lanes holding approximately 110 vehicles
- There are 2 auto toll booths
- Terminal employs 8 people
- 2007 ridership*: 688,616 riders and 326,603 vehicles

*An additional 8,172 riders were transported on a temporary passenger-only run between Port Townsend/Seattle

GEOGRAPHIC DATA

Terminal Contact: Port Townsend Ferry Terminal
Water Street
Port Townsend, WA 98368
(206) 264-3597; (206) 264-3598 fax

County: Jefferson

Section, Township, Range: 11, 30, 01W

Latitude/Longitude: 48° 06′ 50″ N / 122° 45′ 62″ W

Zoning Designation: None

Comprehensive Plan Designation: Urban Shoreline

Property Owner: State Of Washington
Natural Resources
PO Box 47014
Olympia, WA 98504

Tax Parcel Number(s): 989701301

Jurisdiction: City of Port Townsend
Development Services
250 Madison Street, Suite 1
Port Townsend, WA 98368
(360) 385-0644

Fire Dept. Contact: Assistant Chief
City Fire Department
(360) 385-2626

Adjacent Parcels:

EAST:
TP#: 989701302

WEST:
TP#: 989701401

NORTHWEST:
TP#: 989703601

See Jefferson County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Environmental Notes:

Water Body: Port Townsend Bay

Shoreline Designation: Over-the-water structure in the Urban/Aquatic Environment

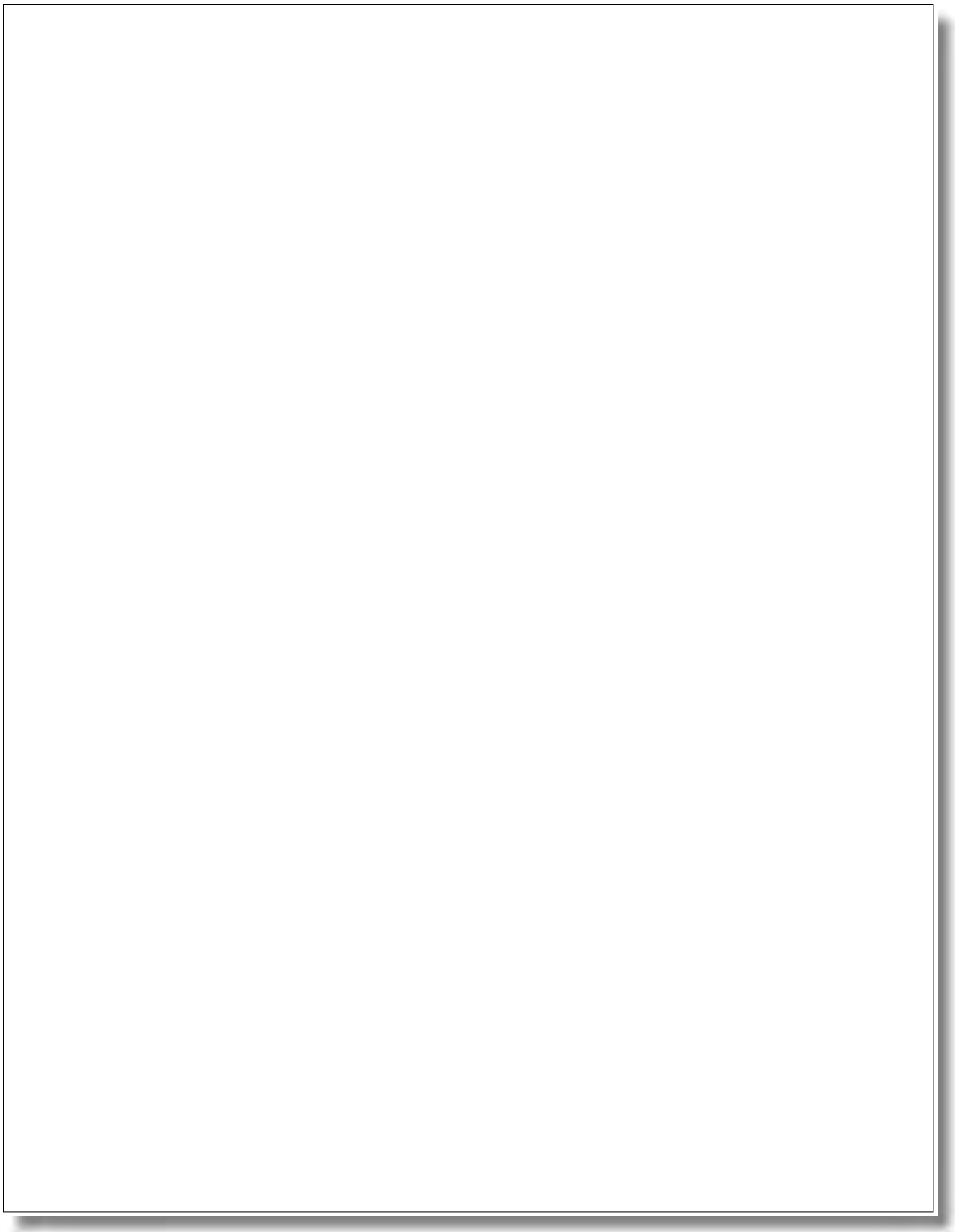
Shorelines Contact: City of Port Townsend
250 Madison Street
Port Townsend WA 98368
(360)379-5047

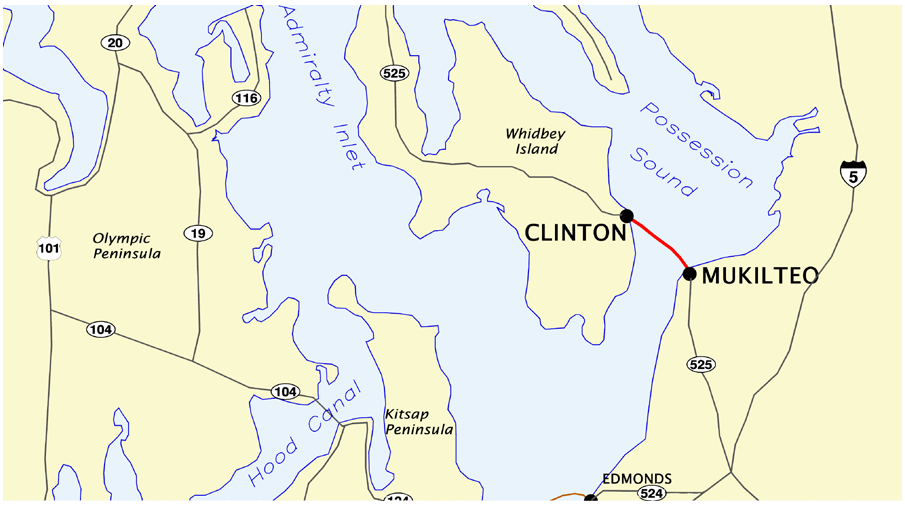
Area Habitat Biologist: Washington Department of Fish and Wildlife
414 W Business Park Rd
Shelton, WA 98584
(360) 427-2179

CONTRIBUTING PARK & RIDES

NAME	LOCATION	CAPACITY	COST	UTILIZATION
Haines Place Park & Ride	Haines Place & 12th	270		20%*

*Figures based on transit agent's statement





MUKILTEO / CLINTON
ROUTE OVERVIEW

This ferry route connects Mukilteo (approximately 25 miles north of Seattle) and Clinton (located on Whidbey Island). This run is a main route providing access for commuters from the south end of Whidbey Island to the greater Seattle/Everett metropolitan area. The crossing time between Mukilteo and Clinton is approximately 20 minutes, with a ferry leaving every half hour.

The annual ridership for Mukilteo/Clinton has grown from 2 million riders in 1975 to just over 4 million riders with 2.2 million vehicles in 2007.

Washington State Ferries

Mukilteo

HISTORY

The timber trestle was constructed in 1982. In 1983, the original 1952 steel truss transfer span was rebuilt with a new deck. The left inner dolphin was constructed in 1982. The right inner dolphin was built in 2008. The floating dolphin was constructed in 2011. In 2000, the wingwalls were built.

FACILITY

- One slip facility
- Holding lanes capacity – 12 lanes holding approximately 103 vehicles
- There are 3 auto toll booths
- Terminal employs 19 people
- 2007 ridership: 4,036,352 riders and 2,224,979 vehicles

GEOGRAPHIC DATA

Terminal Contact: Mukilteo Ferry Terminal
State Route 525
701 Front Street
Mukilteo, WA 98204
(206) 264-3567; (206) 545-6695 fax

County: Snohomish

Section, Township, Range: 04, 28, 04E, Gov lot 2

Latitude/Longitude: 47° 57′ 00″ N / 122° 18′ 12″ W

Zoning Designation: Downtown Business

Comprehensive Plan Designation: Commercial

Property Owner: Port of Everett (dock land)
P.O. Box 538
Everett, WA 98206
City of Mukilteo (surrounding water)
4480 Chennault Beach Rd
Mukilteo, WA 98275
WA State of Parks & Rec. (south part of holding)
P.O. Box 42650
Olympia, WA 98275

Tax Parcel Number(s): 28040400200100 (dock land)
28040400203400 (surrounding water)
00450900200100 (south part of holding)
00450900200300 (south part of holding)

Jurisdiction: City of Mukilteo
4480 Chennault Beach Rd.
Mukilteo, WA 98275
(425) 355-4141

Fire Dept. Contact: Fire Chief
(425) 348-3591

Adjacent Property Owners:

WEST:
(Various Indiv. Owners)

WEST (of dock):
TP#: 28040400203000

EAST (of holding lane):
TP#: 00450900200500

EAST (of dock):
TP#s: 28040400102300
28040400202800

EAST (of holding lot):
TP#: 00451300100100

WEST (of holding lot):
TP#: 00459800100600

WEST (of holding lane):
TP#: 00593400000100

WEST (of holding lane):
TP#: 00459800200000

WEST:
(not listed on map)

See Snohomish County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Water Body: Possession Sound

Shoreline Designation: Downtown Business

Shorelines Contact:

Shorelines Planner
City of Mukilteo
(425) 355-4141
(425) 357-4457 (fax)

Area Habitat Biologist: Washington Department of Fish and Wildlife
16018 Mill Creek Blvd.
Mill Creek, WA 98012
(425) 379-2306; (425) 379-2323 fax

Environmental Notes:

Environmentally sensitive area – all shoreline is under Compliance Assistance Office (CAO).

Affected Tribe: Tulalip
Environmental Coordinator
6700 Totem Beach Rd.
Tulalip, WA 98271
(360) 651-4476

Clinton

HISTORY

The concrete trestle for this terminal was built in 2000 and then expanded in 2003. The transfer spans are concrete & steel structures. The main transfer span was constructed in 1987, and then rebuilt in 2000. The north transfer span was built in 2003. The towers and wingwalls were built in 2000 and 2003, respectively. All the steel pile dolphins were built since 2000.

FACILITY

- Two slip facility
- Holding lanes capacity – 10 lanes holding approximately 190 vehicles
- There are 4 auto toll booths
- Terminal employs 16 people
- 2007 ridership: 4,036,352 riders and 2,224,979 vehicles

GEOGRAPHIC DATA

Terminal Contact: Clinton Ferry Terminal
64 S. Ferrydock Road
Clinton, WA 98236
(206) 264-3599; (206) 264-3564 fax

County: Island

Section, Township, Range: 30, 29N, 04E

Latitude/Longitude: 47° 58′ 30″ N / 122° 21′ 11″ W

Zoning Designation: State highway Right of Way

Comprehensive Plan Designation: Federal lands

Property Owner: Washington State Ferries
2901 3rd Ave Suite 5000
Seattle, WA 98121

Tax Parcel Number(s): R42930-413-0940

Jurisdiction: Island County
Director
Planning and Community Development
PO Box 5000
Coupeville, WA 98239-5000
(360) 679-7344

Fire Dept. Contact: Building Official
(360) 679-7308

Adjacent Property Owners:

NORTH & SOUTH:
TP#: R42930-399-0870
See Island County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Water Body: Possession Sound

Shoreline Designation: Urban

Shorelines Contact: Development Coordinator
Island County Planning &
Community Development
(360) 678-7812

Area Habitat Biologist: Washington Department of Fish and Wildlife
PO Box 1100
La Conner, WA 98257
(360) 466-4345

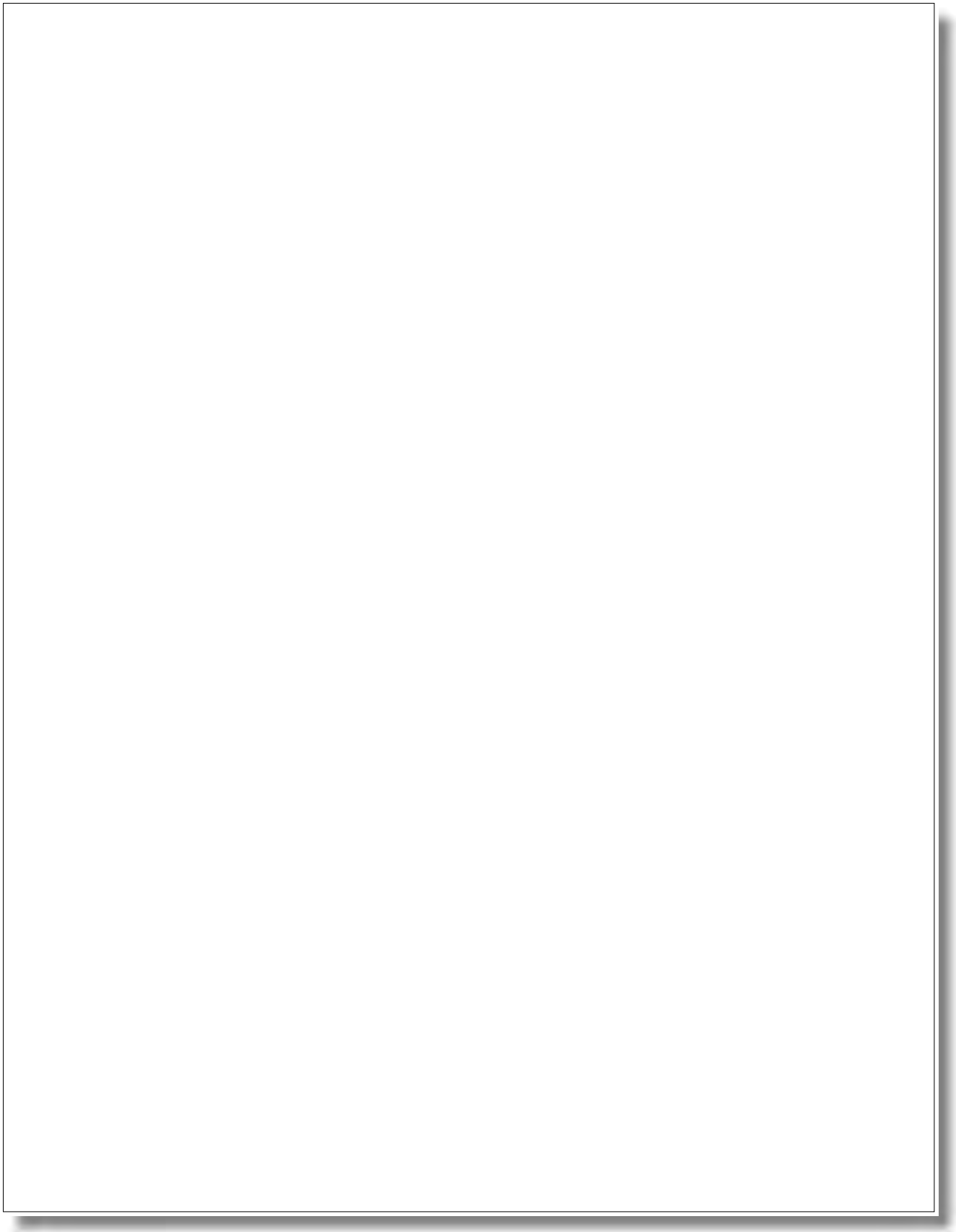
Environmental Notes:

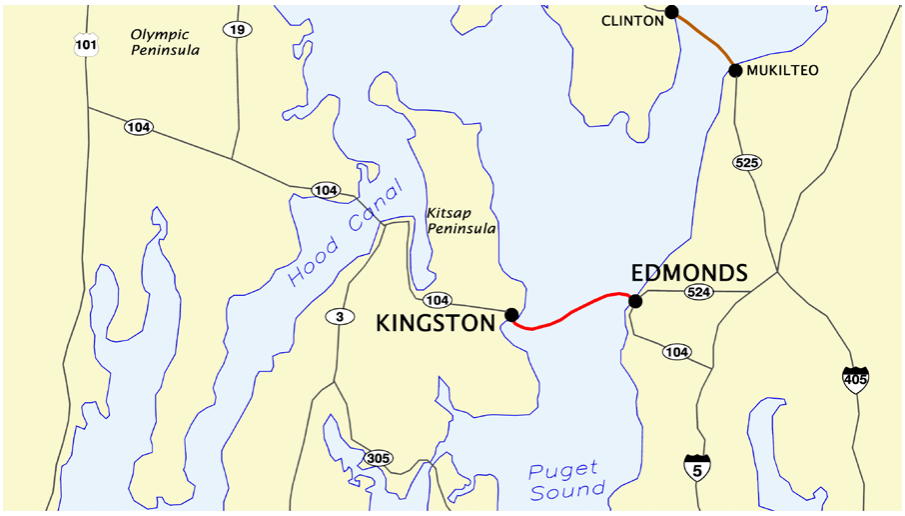
Marine fish & wildlife habitat conservation area; substantial eelgrass beds

CONTRIBUTING PARK & RIDES

NAME	LOCATION	CAPACITY	COST	UTILIZATION
Clinton P&R Lot	525 / SR 20 & Deer Lake Rd.	200		120%
Langley P&R Lot	Anthes & Third Street	33		100%
Clinton Landing Paid Parking***	North of tollbooths	36	$5/day	25%
Paid Parking	South of tollbooths	38	$6/day	45%
Paid Parking	South of tollbooths	8	Yes; $?	63%
Paid Parking (monthly)	South of tollbooths	7	Yes; $?	71%
Bayview P&R Lot	525 / SR 20 & Bayview Rd.	85		75%
Greenback P&R Lot	525 / SR 20 & Bakken Rd.	20		50-60%*
Coupeville P&R Lot	SR 20 & Main Street	66		100%*/**
Patty's Parking	Humphrey Rd.	225/209****	$1	95%/61%
Freeland P&R Lot - Trinity Lutheran	SR 20 & Woodard Rd.	70		90%

*Figures based on transit agent's statement
**Used mostly by teachers from nearby school
***Future site of park (Clinton Beach)
****Numbers to right of / are from 2/8/05 site visit





EDMONDS / KINGSTON
ROUTE OVERVIEW

This ferry route connects Edmonds (approximately 18 miles north of Seattle) and Kingston (located on the Kitsap Peninsula). This run is a main route providing commuter and recreational access from the Kitsap Peninsula, as well as the Olympic Peninsula (via the Hood Canal Bridge), to Edmonds and the greater Seattle/Everett area beyond. It also provides a freight route for a significant amount of trucking traffic. Crossing time between Edmonds and Kingston is approximately 30 minutes.

The annual ridership for Edmonds/Kingston has grown from 1.7 million riders in 1975 to 4.3 million riders with 2.3 million vehicles in 2007.

Washington State Ferries

Edmonds

HISTORY

The current timber trestle was built in 1952 near the original 1923 terminal, after acquisition by the State of Washington. The wingwalls, towers, bridge seat and transfer span were replaced in 1995. One steel dolphin was constructed in 2011, while all the other steel pile dolphins were built in 1998. The overhead loading with an integrated terminal building was constructed in 1999.

FACILITY

- One slip facility with overhead loading
- Holding lanes capacity – 5 lanes upland holding approximately 120 vehicles and 3 lanes on dock holding approximately 54 vehicles
- There are 3 auto toll booths
- Terminal employs 28 people
- 2007 ridership: 4,292,762 riders and 2,262,764 vehicles

GEOGRAPHIC DATA

Terminal Contact: Edmonds Ferry Terminal
71 Main Street
Edmonds, WA 98020
(206) 264-3571; (206) 587-5686 fax

County: Snohomish

Section, Township, Range: 23, 27N, 03E

Latitude/Longitude: 47° 48′ 47″ N / 122° 23′ 04″ W

Zoning Designation: Ferry Right of Way

Comprehensive Plan Designation: Mixed Use Commercial

Property Owner: State Dept. Of Transportation
PO Box 47300
Olympia, WA 98504
(parking lot & holding lanes)

Tax Parcel Number(s): 00454800300100 (parking lot)
00454800201901 (holding lanes)
*No TP# for dock itself on file

Jurisdiction: City of Edmonds
Building Division
121 5th Avenue North, 2nd Floor
Edmonds, WA 98020
(425) 771-0220; (425) 771-0221 fax

Fire Dept. Contact: Fire Dept. Inspector
(425) 771-0215

Adjacent Parcels:

East (of dock):
TP#: 27032300105700

East (of dock):
TP#: 00984023128000 (not found)

North & South (of dock):

TP#s: 27032300102800
27032300103800

West (of parking lot):

TP#: 27032300104300

West (of holding):
0
TP#: 00454800300700

Southwest (of parking lot):
TP#: 27032300104500

Northwest (of holding):
TP#s: 00434401300101
00434401300102

Northwest (of holding):
TP#: 27032300105800

Northeast (of holding):
TP#: 00434401201202

East (of holding):
TP#: 00863300020100

East (of holding):
TP#: 00863300020200

East (of holding):
TP#: 00863300020300

East (of holding):
TP#: 00454800201700

East (of holding):
TP#: 00454800201900

East (of holding):
TP#: 00863300010100

East (of holding):
TP#s: 00864100010000
00864100020000
00864100030000

East (of holding):
TP#: 00864100020100

East (of holding):

TP#: 00864100020200

East (of holding):
TP#: 00864100020300

East (of holding):
TP#: 00864100020400

East (of holding):
TP#: 00864100020500

East (of holding):
TP#: 00864100030100

East (of holding):
TP#: 00864100030200

East (of holding):
TP#: 00864100030300

East (of holding):
TP#: 00864100030400

East (of holding):
TP#: 27032300409000

See Snohomish County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Water Body: Puget Sound

Shoreline Designation: Urban Marine

Shorelines Contact: City of Edmonds Planning Division
(425) 771-0220; (425) 771-0221 fax

Area Habitat Biologist: Washington Department of Fish and Wildlife
16018 Mill Creek Blvd.
Mill Creek, WA 98012
(425) 379-2306; (425) 379-2323 fax

Environmental Notes:

Environmentally sensitive area – Wetland/wildlife habitat. Baseline eelgrass studies in Overhead Loading file.

Kingston

HISTORY

Ferry service to Edmonds began in 1923. The current facility's concrete trestle was built in 1986 and then expanded in 1990. The ferry dock has two steel transfer spans: one built in 1990, the other in 2001. A single overhead loading structure was built in 1993 and serves both auto slips.

Slip 1 has the two shared steel dolphins built in 2000 and 2002, inner steel dolphins built in 1996 and 2002, an outer steel dolphin built in 2002, and a floating dolphin from an unspecified year.

The main slip (Slip 2) shares two double-sided steel dolphins with the auxiliary slip (Slip 1), the outer built in 2000 and the intermediate in 2002. Slip 2 also has two inner steel dolphins built in 2002, and an outer steel dolphin built in 2000. An inner 100 timber pile dolphin will be removed and fender system will be installed on the backside of the existing right inner steel dolphin at Slip 2 in 2014 as a shared double sided inner dolphin with Slip 3

The tie-up slip (Slip 3) has two steel dolphins from 2000. A fender system will also be installed on the back side of the left outer dolphin of Slip 3 as a shared double sided dolphin with Slip 2 in 2014.

FACILITY

- Two slip facility with overhead loading (and one tie-up slip)
- Holding lanes capacity – 24 lanes holding approximately 288
- There are 3 auto toll booths
- Terminal employs 24 people
- 2007 ridership: 4,292,762 riders and 2,262,764 vehicles

GEOGRAPHIC DATA

Terminal Contact: Kingston Ferry Terminal
11264 State Route 104
Kingston, WA 98346
(206) 264-3573; (206) 545-6698

County: Kitsap

Section, Township, Range: 25, 27, 2E (Gov. Lot 4)

Latitude/Longitude: 47° 47′ 36″ N / 122° 24′ 44″ W

Zoning Designation: Public Facility

Comprehensive Plan Designation: Urban

Property Owner: Port of Kingston Ferry & Marina
Department of Natural Resources

Tax Parcel Number(s): 4316-101-001-0006

Jurisdiction: Kitsap County
Kitsap County Community Development
614 Division Street, MS-36
Port Orchard, WA 98366
(360) 337-7181

Fire Dept. Contact: Kistap County Fire Marshal
Kitsap County
(360) 337-7181

Adjacent Parcels:

EAST, WEST & NORTHWEST:	NORTHWEST:	NORTH:
TP#s: 4316-101-001-0006	TP#: 4316-100-001-0107	TP#: 4316-100-001-0008

See Kitsap County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Water Body: Appletree Cove (tributary of Puget Sound)

Shoreline Designation: Urban

Shorelines Contact: Kitsap County Community Devel.
(360) 337-4967

Area Habitat Biologist: Washington Department of Fish and Wildlife
502 High Street, Suite 108
Port Orchard, WA 98366
(360) 895-6123; (360) 876-1894 (fax)

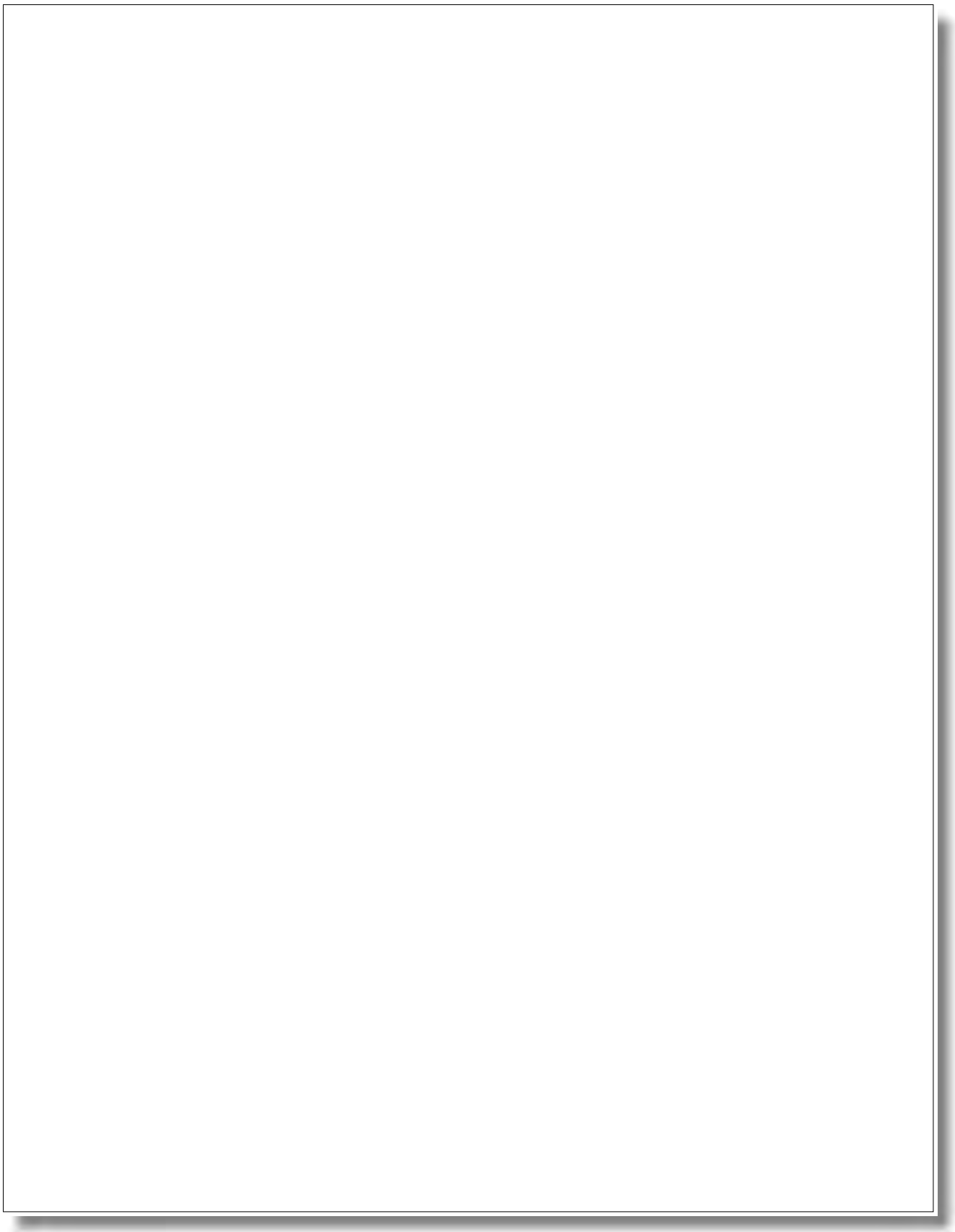
Environmental Notes:

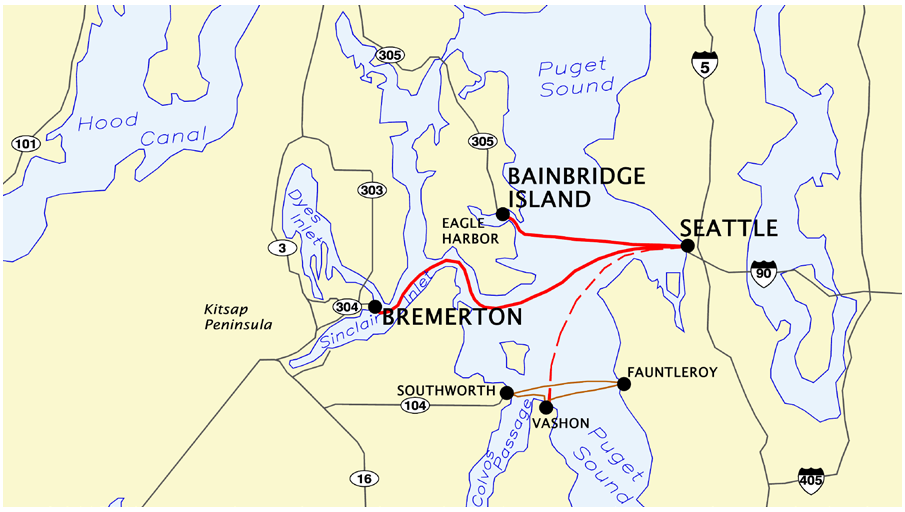
Environmentally sensitive area – Shoreline, with steep slopes to the northeast and geoduck beds and eelgrass nearby.

CONTRIBUTING PARK & RIDES

NAME	LOCATION	CAPACITY	COST	UTILIZATION
Kingston Commuter Park & Ride	1st and Ohio St.	73	$4/day	41%*
Agate Pass	SR 305 & Suquamish Way, Suquamish	80		81%*
George's Corners	SR 104 and Hansville Rd.	225		50%*
Suquamish Community Congregational	Division and Geneva, Suquamish	56		95%*

*Figures based on Kitsap transit study





SEATTLE / BAINBRIDGE ISLAND / BREMERTON ROUTE
ROUTE REFERENCE BOOK

This ferry route has auto ferry runs connecting Seattle (Colman Dock) to both Bainbridge Island and Bremerton. The Passenger Only Ferry (POF) service connecting Seattle and Vashon is now managed by King County. The crossing time between Seattle and Bainbridge Island is approximately 35 minutes, with the crossing between Seattle and Bremerton lasting approximately 60 minutes. The crossing time between Seattle and Vashon is approximately 35 minutes.

Colman Dock in downtown Seattle handles the largest volume of any ferry terminal in the WSF system, with the majority of passengers made up of commuters and tourists. The annual ridership for Seattle/Bainbridge Island has grown from 3.6 million riders in 1975 to 6.4 million riders with 2.1 million vehicles in 2007. The annual ridership for Seattle/Bremerton has grown from 2.2 million riders in 1975 (including the no longer existing passenger-only ferry run) to nearly 2.5 million riders with 734,000 vehicles in 2007. The Seattle/Vashon POF transported 125,000 riders in 2007.

Washington State Ferries

Seattle – Colman Dock

HISTORY

With the original facility constructed in 1882, Colman Dock was one of many new docks built along the Seattle waterfront. In 1908, a new larger terminal was constructed at the current site, consolidating many lines into one facility. The facility was amended in 1913 when a steamship rammed the dock and building. In 1937, the terminal was once again rebuilt to better accommodate automobiles. By 1964, more room was needed and the currently existing terminal was constructed.

Parts of the existing timber trestle were built in 1938. It was then reconstructed in 1964 and expanded in 1971, with some restoration taking place in 1988. Additional stub pile work was performed in 1997, 1998, and 2002.

The south trestle was reconstructed and expanded in 1990 with a concrete deck and piling. However, the remainder of the dock, including the portion under the existing terminal, is constructed on the original timber piling and requires constant maintenance. An elevator structure was added at the east end of the terminal building in 1996.

Steel wingwalls were built in 1993 (Slip 1), 1998 (Slip 2) and 1996 (Slip 3), and the towers in 1993 (Slip 1), 1998 (Slip 2) and 1964 (Slip 3). Overhead loading structures for Slip 2 & 3 were built in 1964, with that for Slip 2 rebuilt in 1998. The overhead loading for Slip 1 was constructed in 2002. Two dogleg timber dolphins were built in 1998, and two concrete double-sided floating dolphins were built in 1984 and 1990.

FACILITY

- Serves 3 ferry runs (with passenger/vehicle routes to Bainbridge Island & Bremerton and a passenger-only route to Vashon)
- Three vehicle slips (Pier 52) and 2 POF landings (Pier 50)
- Holding lanes capacity – 40 lanes holding approximately 650 vehicles
- There are 4 auto toll booths
- Terminal employs 51 people
- 2007 ridership*: 2,498,756 riders and 734,378 vehicles for Seattle/Bremerton; 6,412,504 riders and 2,070,386 vehicles for Seattle/Bainbridge Island; 125,024 passengers for Seattle/Vashon POF

*An additional 8,172 passengers were transported on a temporary passenger-only run between Seattle/Port Townsend

GEOGRAPHIC DATA

Terminal Contact: Seattle Ferry Terminal, Colman Dock
801 Alaskan Way, Pier 52
Seattle, WA 98104
(206) 515-3442; (206) 515-3880 fax

County: King

Section, Township, Range: 06, 24, 04E

Latitude/Longitude: 47° 36′ 9″ N / 122° 20′ 17″ W

Zoning Designation: DH1/45

Comprehensive Plan Designation: Urban Harborfront

Property Owner: Washington State Ferries
2901 3rd Ave, Suite 500
Seattle, WA 98121

Tax Parcel Number(s): 7666202620
7666202625 (DNR)
7666202612 (WSDOT Real Estate Svcs)
7666202622 (not on record)

Jurisdiction: City of Seattle
Dept. of Construction and Land Use
700 Fifth Ave, Suite 200
Seattle, WA 98104
(206) 233-3851

Fire Dept. Contact: Deputy Fire Chief
(206) 386-1453

Adjacent Parcels:

NORTH:
TP#s: 7666202500
7666202501

SOUTH:
TP#: 7666202632

SOUTH:
TP#: 7666202630

EAST:
TP#: 5247800025

EAST:
TP#: 7666202525

EAST:
TP#: 7666202565

EAST:

EAST:
TP#: 7666202560

EAST:
TP#: 7666202575

EAST:

TP#: 5247800015

EAST:
TP#s: 7666202545

EAST:
TP#: 7666202570

EAST:
TP#: 7666202594

EAST:
TP#: 5247800030

See King County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Water Body: Elliot Bay

Shoreline Designation: Urban Harborfront

Shorelines Contact: Fisheries Biologist, DPD Planner
Dept. of Planning & Development
(206) 386-4036

Area Habitat Biologist: Washington Department of Fish and Wildlife
16018 Mill Creek Blvd.
Mill Creek, WA 98012
(425) 379-2306; (425) 379-2323 fax

Environmental Notes:

Critical area.

Seattle-2

Bainbridge Island

HISTORY	FACILITY
The terminal building for this facility was built in the 1950's. The timber trestle was built in 1966, with the majority of it replaced with concrete in 1984 and 1995. A timber approach bridge to the pedestrian overhead loading was built in 1972. The pedestrian overhead loading cabs and support structure were replaced in 1988. Steel dolphins were built in both 1998 and 2002, and the four timber wingwalls for Slips 1 & 2 (main slip & auxiliary slip, respectively) were rebuilt as steel structures in 1995.	• Two slip facility with overhead loading (and one tie-up slip) • Holding lanes capacity – 14 lanes holding approximately 212 vehicles • There are 4 auto toll booths • Terminal employs 23 people • 2007 ridership: 6,412,504 riders and 2,070,386 vehicles

GEOGRAPHIC DATA

Terminal Contact: Bainbridge Island Ferry Terminal
270 Olympic Drive SE
Bainbridge Island, WA 98110
(206) 264-3562; (206) 464-6260 fax

Property Owner: State of WA DOT
Washington State Ferries
2911 2nd Ave.
Seattle, WA 98121

County: Kitsap

Tax Parcel Number(s): 262502-3-108-2000

Section, Township, Range: 26, 25N, 02E

Latitude/Longitude: 47° 37′ 21″ N / 122° 30″ W

Zoning Designation: Ferry Terminal District Overlay
Parcel to East is Commercial FTD
Parcel to West is residential R-14

Comprehensive Plan Designation: FTD Overlay

Jurisdiction: City of Bainbridge Island
Building Official
Planning and Community Development
280 Madison Avenue North
Bainbridge Island, WA 98110-1812
(206) 780-3750

Fire Dept. Contact: Fire Marshal
(206) 842-7686

Adjacent Parcels:

SOUTHWEST & EAST:
TP#s: 8021-000-000-0008
8050-000-000-0002
8060-000-000-0000

NORTHEAST:
TP#: 262502-4-075-2007

NORTHEAST:
TP#: 262502-4-076-2006

NORTHEAST:
TP#: 262502-4-074-2008

NORTH:
TP#s: 262502-3-110-2006
262502-3-109-2009

NORTH:
TP#: 8125-000-000-0003

NORTH:
TP#: 262502-3-009-2000

WEST & NORTH:
TP#s: 262502-3-149-2001
262502-3-150-2007

See Kitsap County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Environmental Notes:

Water Body: Eagle Harbor

Shoreline Designation: Urban

Shorelines Contact:
City of Bainbridge Island
Planning and Community Development
(206) 842-2552

Area Habitat Biologist: Washington Department of Fish and Wildlife
502 High Street, Suite 108
Port Orchard, WA 98366
(360) 895-6123; (360) 876-1894 (fax)

CONTRIBUTING PARK & RIDES

NAME	LOCATION	CAPACITY	COST	UTILIZATION
Agate Pass	SR 305 & Suquamish Way	80		81%*
Christ Memorial Church	Hostmark & Eighth Ave., Poulsbo	137		96%*
George's Corners	SR 104 and Hansville Road, Kingston	225		50%*
Liberty Bay Presbyterian Church	Harrison & Hwy. 305, Poulsbo	61		46%*/69%**
North Kitsap Baptist Church	20516 Little Valley Rd., Poulsbo	57		23%*
St. Charles Episcopal Church	20516 Little Valley Rd., Poulsbo	23		26%*
Poulsbo Junction	Viking Ave. & Lindvig, Poulsbo	27		85%*
Poulsbo Nazarene Church	Viking Ave. N. & SR 305, Poulsbo	77		60%*
Suquamish Community Congregational	Division St. and Geneva, Suquamish	56		95%*
American Legion Post	7880 NE Bucklin Hill Rd.	24		8%*
Bainbridge Alliance Church	Sportsman Club Road, near SR 305	57		79%*
Bethany Lutheran Church	Finch and High School Rd.	120		63%*
Diamond Pay Parking Lot (Lot A)	North of terminal	142	$8.75	84%**
Torch Investment Pay Parking (Lot B)	North of terminal	44	$9	73%**
City Parking Pay Parking Lot (Lot C)	North of terminal	76	$10	66%**
Diamond Pay Parking Lot (Lot D)	North of terminal	70	$8	89%**
Diamond Pay Parking Lot (Lot E)	North of terminal	465	$9	77%**

*Figures based on Kitsap transit study
**Figures based on Demich Engineering field survey (2/4/05 - between 11am and 2pm)

Bremerton

HISTORY

Bremerton was established as a public port authority in 1913. In 1921, ferry operators were authorized to build a vehicle capable ferry slip, with a second built in 1942. In 1951, the Puget Sound Navigation Company sold all its terminal facilities and ferries to what became WSF.

The terminal's concrete trestle was built in 1990. The main transfer span was built in 1990 as a steel structure, with the towers also being built that year. The auxiliary truss transfer span was built pre-1964. The two timber dolphins were built in 1980 and 1990, and the four steel dolphins were built between 1997 and 1999. The overhead loading was constructed in 1999.

FACILITY

- Two slip facility with overhead loading
- Holding lanes capacity – 13 lanes holding approximately 230 vehicles
- There are 3 auto toll booths
- Terminal employs 18 people
- 2007 ridership: 2,498,756 riders and 734,378 vehicles

GEOGRAPHIC DATA

Terminal Contact: Bremerton Ferry Terminal
210 First Street
Bremerton, WA 98337
(206) 264-3569; (206) 264-3570 fax

County: Kitsap

Section, Township, Range: 24, 24N, 01E

Latitude/Longitude: 47° 33′ 44″ N / 122° 37′ 23″ W

Zoning Designation: Urban Renewal District
(1998 Zoning Atlas)

Comprehensive Plan Designation: Urban Renewal District

Property Owner: State Dept. of Transportation

Tax Parcel Number(s): 242401-2-012-2001

Jurisdiction: City of Bremerton
Building Inspector
Dept. of Community Development
345 6th Street
Bremerton, WA 98337
(360) 473-5212

Fire Dept. Contact: Fire Marshal
(360) 478-5384

Adjacent Property Owners:

WEST: TP#: 232401-1-001-2007	NORTHEAST: TP#: 242401-2-015-2008	NORTH: TP#: 3718-009-023-0001	NORTH: TP#: 3718-009-025-0009
EAST: TP#: 242401-2-007-2008	NORTHEAST: TP#: 242401-2-014-2009	NORTH: TP#s: 3718-009-026-0008 3718-009-022-0002	NORTH: TP#: 3718-009-021-0003

See Kitsap County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Water Body: Sinclair Inlet

Shoreline Designation: Downtown Waterfront Upland
DW/U (May not be current)

Shorelines Contact: Environmental Planner
Dept. of Community Development (360) 473-5845

Area Habitat Biologist: Washington Department of Fish and Wildlife
502 High Street, Suite 108
Port Orchard, WA 98366
(360) 895-6123; (360) 876-1894 (fax)

Environmental Notes:

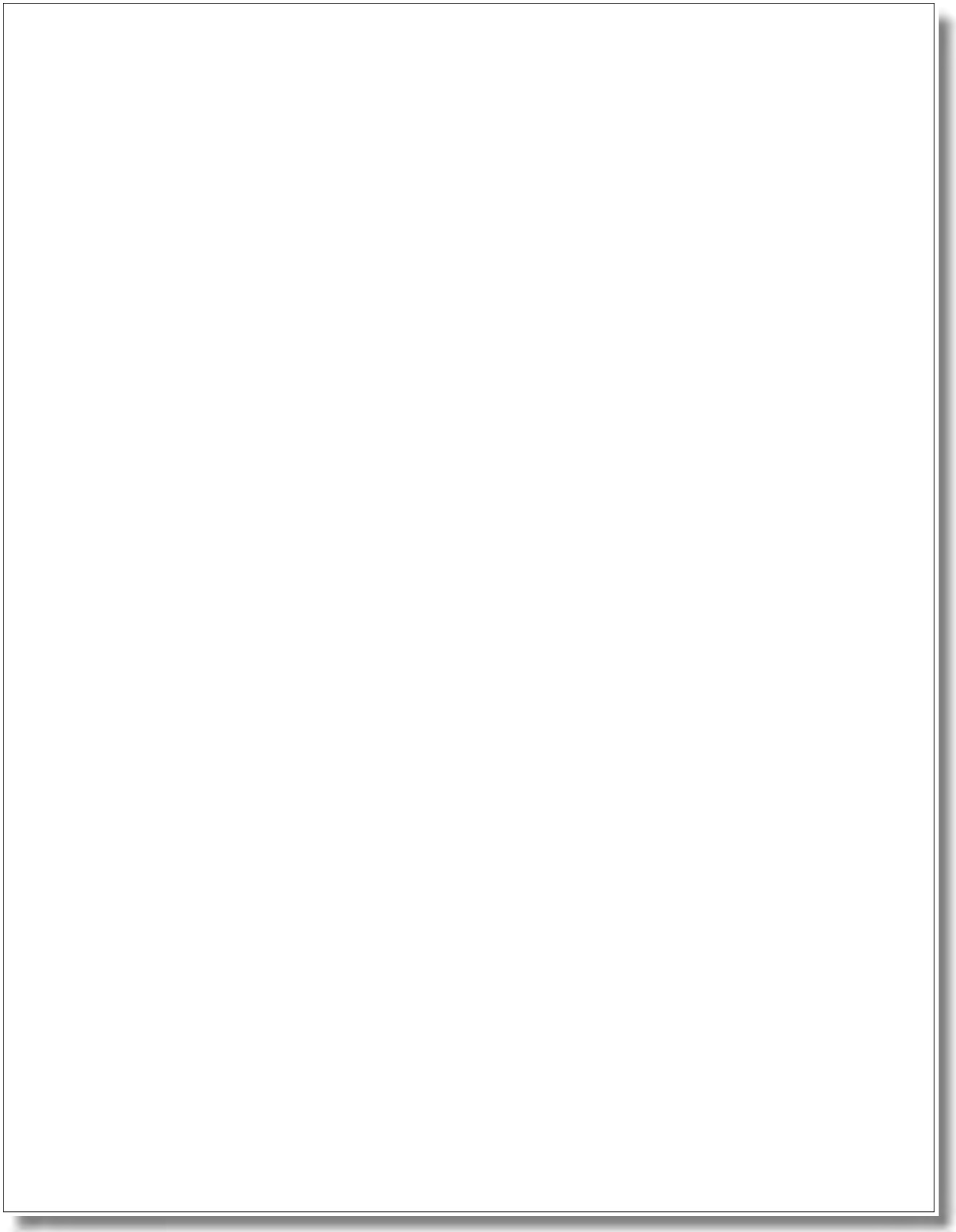
Species in the area include: chinook, pink, coho, sockeye, and chum, steelhead, sea-run cutthroat, glaucous-winged gulls, red breasted mergansers, western grebes, guillemots, cormorants, and great blue heron. Goldeneyes, surf and common scooters are nearby (NMFS 1995).

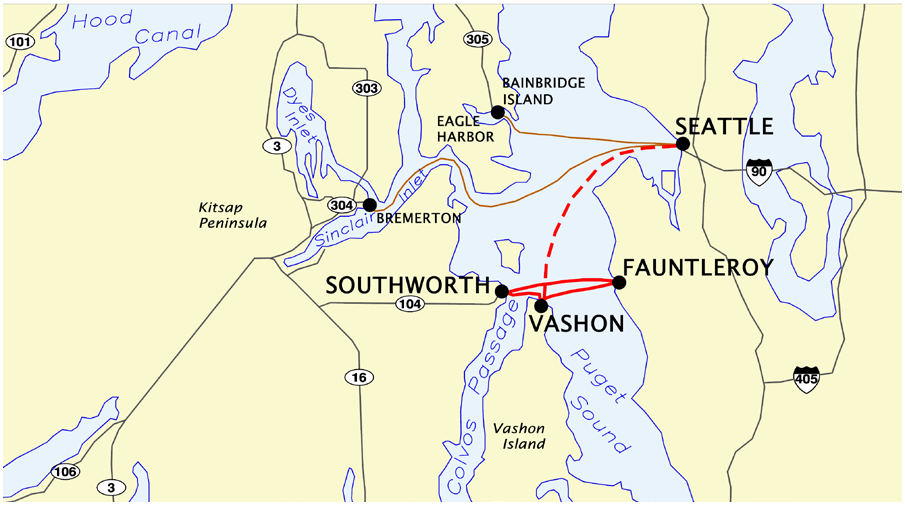
CONTRIBUTING PARK & RIDES

NAME	LOCATION	CAPACITY	COST	UTILIZATION
Crossroads Neighborhood Church	7555 Old Military Road	152		62%*
Evergreen Lutheran Church	3200 Seabeck Holly Road	20		50%*
First United Methodist Church	Marine Drive and Dora Street	51		51%*
Gateway (for Kitsap Transit only)	6th St. & Montgomery	106		77%*
Kitsap Square Dance Hall	6800 West Belfair Valley Road, Bremerton	50		16%*
McWilliams Road	SR 303 (Wheaton Way) & McWilliams Rd.	153		76%*
St. Luke's Methodist Church	1547 Sheridan Road, Bremerton	12		0%*

*Figures based on Kitsap transit study

Bremerton-2





FAUNTLEROY / VASHON / SOUTHWORTH ROUTE
ROUTE REFERENCE BOOK

This ferry route connects Fauntleroy (approximately 8 miles south of Seattle), Vashon (on the northern end of Vashon Island) and Southworth (located on the Kitsap Peninsula). This run is a main route providing connections both from south Kitsap County via Southworth and from Vashon Island to the greater Seattle metropolitan area. The route also supplies freight and service access to Vashon Island. The route is typically served by an *Issaquah 130 Class* (holding 124 vehicles), and two *Evergreen State Class* (holding 87 vehicles each). This route also utilizes a *Steel Electric Class* as a relief vessel (holding 68 vehicles). The crossing time between Fauntleroy and Southworth is approximately 40 minutes, between Fauntleroy and Vashon approximately 20 minutes, and between Southworth and Vashon 10 minutes. Vashon also offers a Passenger-Only Ferry (POF) route to Seattle, utilizing a *POF* (holding 250 passengers) with a crossing time of approximately 35 minutes.

The annual ridership for the Fauntleroy/Vashon/Southworth routes has grown from 2.2 million riders in 1975 to over 3.1 million riders with over 1.8 million vehicles in 2003.

Washington State Ferries

Fauntleroy

HISTORY	FACILITY
The timber trestle was constructed in 1957 and then expanded in 1984. The terminal building was renovated in 1990. The towers were replaced in 1994, and the headframe and counterweights were upgraded in 2002. Toll booths were replaced in 1999, and the dolphins were replaced in both 1999 and 2000. The bridge seat and steel wingwalls were built in 2002.	• Has routes to Southworth and Vashon • One slip facility • Holding lanes capacity – 4 lanes holding approximately 84 vehicles • There are 2 auto toll booths • Terminal employs 20 people • 2007 ridership: 3,138,578 riders and 1,784,535 vehicles

GEOGRAPHIC DATA

Terminal Contact: Fauntleroy Ferry Terminal
4829 SW Barton
Seattle, WA 98136
(206) 515-3916; (206) 764-4026 fax

County: King

Section, Township, Range: 35, 24, 03E WM
Government Lot 2

Latitude/Longitude: 47° 31′ 24″ N / 122° 23′ 37″ W

Zoning Designation: Single Family -7500 sf

Comprehensive Plan Designation: Single Family -7500 sf

Property Owner: State of Washington

Tax Parcel Number(s): 7666708065

Jurisdiction: City of Seattle
Dept. of Planning & Development
700 Fifth Ave, Suite 2000
Seattle, WA 98104-5070
(206) 233-3851

Fire Dept. Contact: Deputy Fire Chief
(206) 386-1453

Adjacent Parcels:

SOUTH:	NORTH:	NORTH:	NORTH:
TP#: 2487201245	TP#: 3524039059	TP#: 3524039112	TP#: 3524039113

See King County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Water Body: Fauntleroy Cove / Puget Sound

Shoreline Designation: Urban Residential
Conservancy Recreation

Shorelines Contact: Margaret (Maggie) Glowacki
Fisheries Biologist
Dept. of Planning & Development
(206) 386-4036
margaret.glowacki@ci.seattle.wa.us

Area Habitat Biologist: Washington Department of Fish and Wildlife
16018 Mill Creek Blvd.
Mill Creek, WA 98012
(425) 379-2306; (425) 379-2323 fax

Environmental Notes:

Critical area

CONTRIBUTING PARK & RIDES

NAME	LOCATION	CAPACITY	COST	UTILIZATION
Van Pool Parking	At entrance to terminal	21		100%*

*Figures based on terminal agent's statement

Vashon

HISTORY	FACILITY
The new ferry terminal was constructed in 1957 (with one slip) and then expanded in 1974. The second operating slip and tie-up slip were added in 1975. The terminal building was first modified in 1982. The passenger-only facility was built in 1988 and the trestle was redecked in 1990. The main slip timber wingwalls were replaced with steel in 1996. The main slip has four steel dolphins built in 2009. The auxiliary slip and the tie-up slip share two double sided steel dolphins, built in 1996 and 2002. The auxiliary slip has two additional steel dolphins built in 1997 and 2009. The tie-up slip has a timber dolphin and a composite dolphin built in 1979 and 1992 respectively. The auxiliary (east) slip and wingwalls were replaced in 1993 and the main (west) slip was replaced in 1997.	• Has routes to Southworth and Tahlequah, as well as passenger-only service to Seattle • Two slip facility plus a passenger-only facility (and one tie-up slip) • Holding lanes capacity – 4 lanes holding approximately 80 vehicles • There are no auto toll booths • Terminal employs 7 people • 2007 ridership: 2,004,974 riders and 1,120,050 vehicles for Fauntleroy/Vashon; 176,408 riders and 111,246 vehicles for Southworth/Vashon; 125,024 riders for Seattle/Vashon POF

GEOGRAPHIC DATA

Terminal Contact: Vashon Ferry Terminal
10800 North Vashon Highway
Vashon, WA 98070
(206) 515-3927; (206) 764-4070 fax

County: King

Section, Township, Range: 06, 23, 03E

Latitude/Longitude: 47° 30′ 32″ N / 122° 27′ 46″ W

Zoning Designation: None (within ROW)

Comprehensive Plan Designation: Rural Residential

Property Owner: State of Washington

Tax Parcel Number(s): 0623039006

Jurisdiction: King County Dept. of Development and Environmental Services
900 Oaksdale Ave. SW
Renton WA 98055-1219
(206) 296-6600

Fire Dept. Contact: Deputy Fire Marshal
(206) 296-6741

Adjacent Parcels:

SOUTHWEST:
TP#: 8887000130

See King County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Water Body: Puget Sound

Shoreline Designation: Conservancy

Shorelines Contact: Shorelines Administrator
King County DDES
(206) 296-7119

Area Habitat Biologist: Washington Department of Fish and Wildlife
16018 Mill Creek Blvd.
Mill Creek, WA 98012
(425) 379-2306; (425) 379-2323 fax

Environmental Notes:

Environmentally sensitive area: wetland, landslide hazard, erosion hazard, at least partially within FEMA 100-yr flood plain.

CONTRIBUTING PARK & RIDES

NAME	LOCATION	CAPACITY	COST	UTILIZATION
North End Parking Lot (Vashon Heights)	1 Block from terminal on hill (off 103rd)	230		160%* **
Ober Park P&R	17106 99th Ave. SW	48		92%*
Ober Park Annex	17130 Vashon Hwy. SW	9		78%*
Valley Center P&R	20221 99th Ave. SW	55		67%*
Vashon Episcopal Church of the Holy Spirit	15420 Vashon Hwy. SW	23		57%*

*Figures based on transit agent's statement **Includes street parking between P&R lot and ferry terminal

Southworth

HISTORY	FACILITY
The terminal was constructed in 1958, with the trestle being resurfaced and the tollbooths upgraded in 1991. The timber wingwalls were replaced with steel wingwalls in 2000. The headframe and towers, transfer span, dolphins and a portion of the trestle were replaced in 2002.	• Has routes to Fauntleroy and Vashon • One slip facility • Holding lanes capacity – 7 lanes upland and two lanes on dock holding approximately 160 vehicles • There are 2 auto toll booths • Terminal employs 12 people • 2007 ridership: 176,408 riders and 111,246 vehicles for Southworth/Vashon; 957,196 riders and 553,239 vehicles for Southworth/Fauntleroy

GEOGRAPHIC DATA

Terminal Contact: Southworth Ferry Terminal
11564 S.E. State Highway 160
Seattle, WA 98121
(206) 515-3921; (360) 769-5406 fax

County: Kitsap

Section, Township, Range: 01, 23, 02E

Latitude/Longitude: 47° 30′ 46″ N / 122° 29′ 42″ W

Zoning Designation: RR/Residential Rural

Comprehensive Plan Designation: Rural Residential

Property Owner: Washington State DOT
WS Ferries Southworth Ferry
2911 2nd Ave.
Seattle, WA 98121

Tax Parcel Number(s): 012302-3-004-2006 (dock & parking)
012302-3-027-2009 (parking)
012302-3-003-2007 (parking)

Jurisdiction: Kitsap County
Kitsap County Community Development
614 Division Street, MS-36
Port Orchard, WA 98366
(360) 337-7181

Fire Dept. Contact: Chief Deputy Fire Marshal
(360) 337-4442

Adjacent Parcels:

NORTH:
TP#: 012302-2-021-2007
012302-2-022-2006

NORTH:
TP#: 012302-2-019-2001
012302-2-018-2002
012302-2-020-2008

NORTH:
TP#: 4787-000-015-0004

WEST:
TP#: 012302-3-002-2008

SOUTH:
TP#: 012302-3-029-2007

SOUTH:
TP#: 4809-000-001-0103

SOUTH:
TP#: 4809-000-002-0003

SOUTH:
TP#: 4809-000-003-0002

SOUTH:
TP#: 4809-000-004-0001

SOUTH:
TP#: 4809-000-005-0000

SOUTH:
TP#: 4809-000-006-0009

SOUTH:
TP#: 4809-000-007-0008

SOUTH:
TP#: 4809-000-008-0007

SOUTH:
TP#: 4809-000-019-0004

SOUTHWEST:
TP#: 8009-000-000-0004

OFFSHORE:
TP#: not listed

See Kitsap County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Water Body: Colvos Passage

Shoreline Designation: Rural - 1977 SMP and Draft 1998 SMP

Shorelines Contact:
Kitsap County Community Devel.
(360) 337-7181

Area Habitat Biologist: Washington Department of Fish and Wildlife
502 High Street, Suite 108
Port Orchard, WA 98366
(360) 895-6123; (360) 876-1894 (fax)

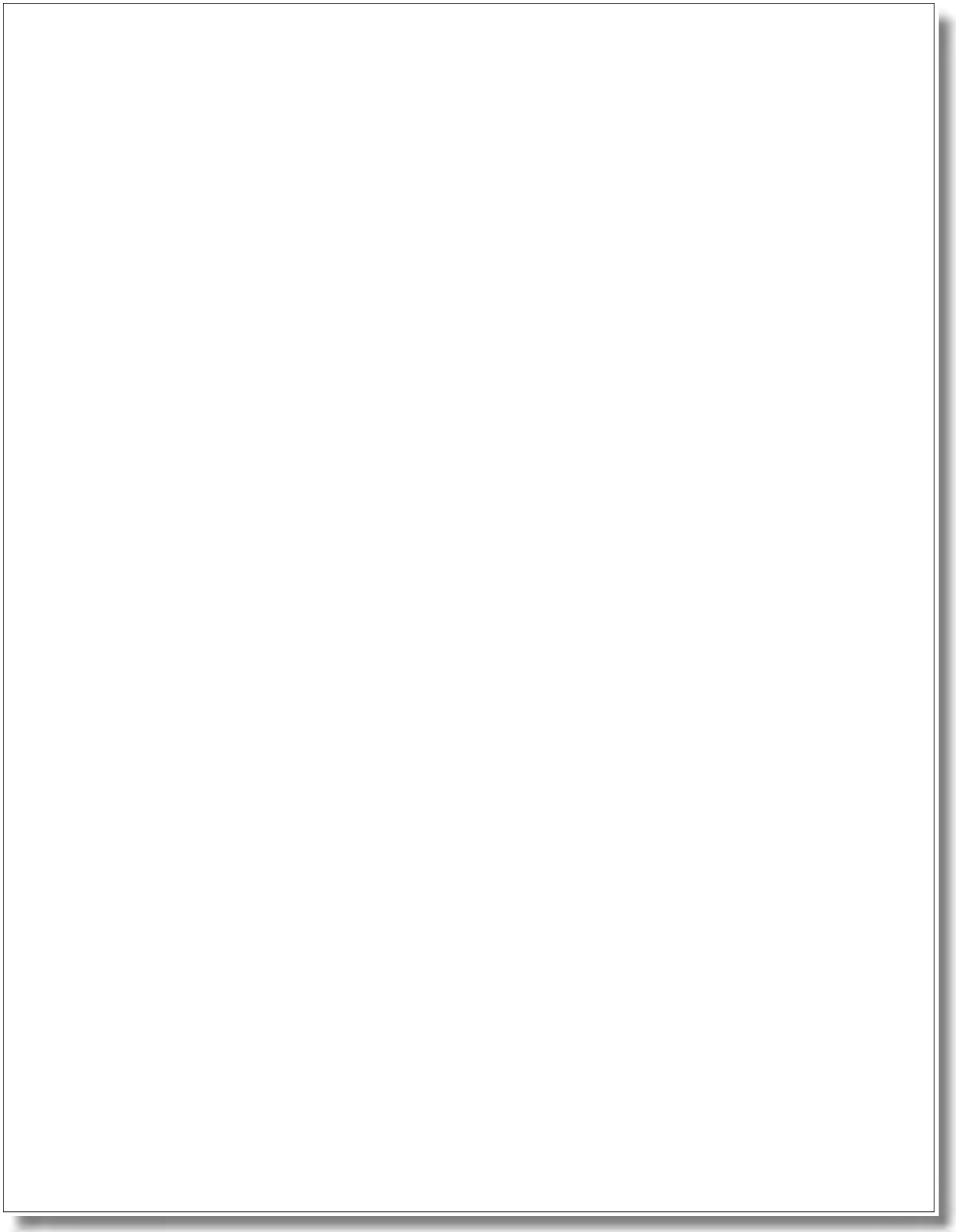
Environmental Notes:

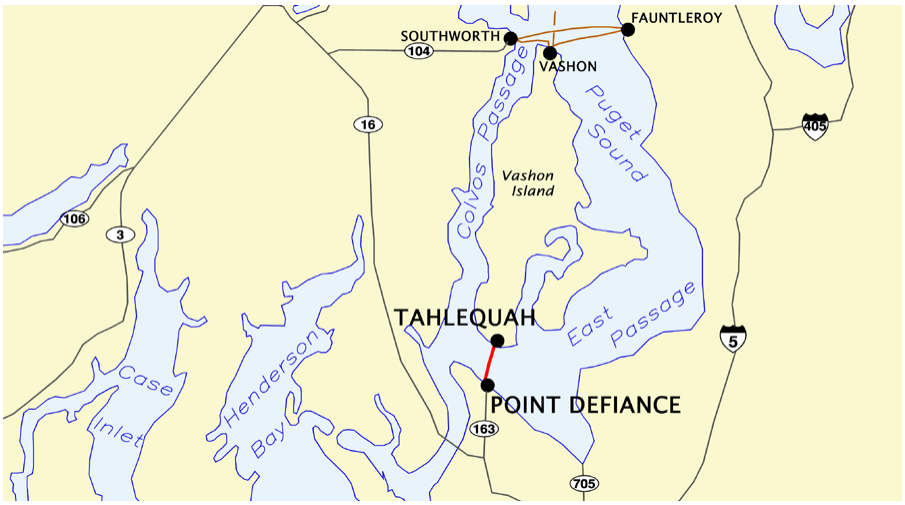
Environmentally sensitive area: shoreline with abundant eelgrass and steep and eroding bluff slopes to the south.

CONTRIBUTING PARK & RIDES

NAME	LOCATION	CAPACITY	COST	UTILIZATION
Southworth Ferry Terminal	SE Sebring & Southworth Dr., Port Orchard	336	$4/day	50%*
Burley Bible Church	14687 Olympic Dr. SE, South Kitsap	33		58%*
First Lutheran Church	2483 Mitchell Road SE, Port Orchard	24		0%*
Kitsap Square Dance Hall	6800 West Belfair Valley Road, Bremerton	50		16%*
Harper Free Evangelical Church	Wilson Creek & Sedgwick Rd.	170		100%*
Mullenix and Highway 16	SR16 & Mullenix Rd., Port Orchard	108		75%*
Olalla Valley Fire Station (FS-12)	Mullenix Rd. & Olalla Valley Rd., Olalla	23		104%*
Port Orchard Armory	Mile Hill & Karcher, Port Orchard	109		77%*

*Figures based on Kitsap transit study





POINT DEFIANCE / TAHLEQUAH
ROUTE REFERENCE BOOK

This ferry route connects Point Defiance (located in Tacoma) and Tahlequah (located at the south end of Vashon Island). This run provides commuter access to Tacoma as well as service access to Vashon Island. The route is typically served by the M/V Rhododendron (holding 60 vehicles). During the summer months a *Steel Electric Class* (holding 68 vehicles) is added to the run. The crossing time between Point Defiance and Tahlequah is approximately 15 minutes.

The annual ridership for Point Defiance/Tahlequah has grown from 324,000 riders in 1975 to 720,000 riders with 417,000 vehicles in 2003.

Washington State Ferries

Point Defiance

HISTORY	FACILITY
The timber trestle was built in 1958, and then expanded to accommodate two-lane loading in 1994. A terminal building, bus turnout and pedestrian walkway were constructed in 1976, and then upgraded in 1994 as well. Also in 1994, the existing timber bridge seat and wingwalls were replaced with new steel and concrete structures. A public restroom facility was added in 1985. There are two dolphins, one steel-pile built in 1995 and one timber floating from an unspecified year.	• One slip facility • Holding lanes capacity – 2 lanes holding approximately 50 vehicles • There is 1 auto toll booth • Terminal employs 9 people • 2007 ridership: 652,376 riders and 381,936 vehicles

GEOGRAPHIC DATA

Terminal Contact: Point Defiance Ferry Terminal
5810 North Pearl Street
Tacoma, WA 98405
(206) 515-3920; (206) 515-3919 fax

County: Pierce

Section, Township, Range: 14, 21, 02E

Latitude/Longitude: 47° 18′ 22″ N / 122° 30′ 46″ W

Zoning Designation: S-5

Comprehensive Plan Designation: Conservancy S-5

Property Owner: Metropolitan Park Board
Point Defiance Park
4702 S 19th Street
Tacoma, WA 98405-1175

Tax Parcel Number(s): 0221103000
(listed as Park Aquarium)

Jurisdiction: City of Tacoma
Civil Engineering Supervisor
Building and Land Use Services Division
747 Market Street, Room 300
Tacoma, WA 98402
(253) 591-5019

Fire Dept. Contact: Deputy Fire Marshal
(253) 591-5740

Adjacent Property Owners:

SURROUNDING:
TP#: 0221103000

See Pierce County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Environmental Notes:

Water Body: Dalco Passage

Shoreline Designation: S-5 Point Defiance (Conservancy)

Shorelines Contact: Land Use Planner
Building and Land Use Services Div.
(253) 591-5387

Area Habitat Biologist: Washington Department of Fish and Wildlife
Habitat Management Division
600 Capitol Way N.
Olympia, WA 98501-1091
(360) 902-8303; (360) 902-8305 fax

Tahlequah

HISTORY	FACILITY
The timber trestle was built in 1958, and then upgraded in 1994. The steel transfer span and bridge seat & towers were built in 1994. There are two steel pile dolphins built in 1995 and a timber floating dolphin from an unspecified year.	• One slip facility • Holding lanes capacity – 1 lane holding approximately 4 vehicles, with additional holding along county road • There are no auto toll booths • No employees at terminal • 2007 ridership: 652,376 riders and 381,936 vehicles

GEOGRAPHIC DATA

Terminal Contact: Tahlequah Ferry Terminal
Wax Orchard Road
Vashon, WA 98070
(206) 515-3923

County: King

Section, Township, Range: 02, 21, 02E

Latitude/Longitude: 47° 20′ 2″ N / 122° 30′ 29″ W

Zoning Designation: 2.5 (RA)

Comprehensive Plan Designation: Rural Residential

Property Owner: State of Washington
& State of Washington – DOT

Tax Parcel Number(s): 0221029133 (dock)
0221029066 (Southeast of dock)
0221029071
0221029102
0221029103
(all parking lot – DOT)

Jurisdiction: King County Dept. of Development & Environmental Services
900 Oaksdale Ave. SW
Renton, WA 98055-1219
(206) 296-6600

Fire Dept. Contact: Deputy Fire Marshal
(206) 296-6741

Adjacent Property Owners:

NORTHWEST: TP#: 0221029045	SOUTHEAST: TP#: 0221020092	SOUTHEAST (of DOT land): TP#: 0221029090	SOUTH (of DOT land): TP#: 0221029067
SOUTHEAST: TP#: 0221029092	NORTH (of DOT land): TP#: 0221029014	SOUTH (of DOT land): TP#: 0221029097	

See King County Assessor Office for current ownership information

ENVIRONMENTAL DATA

Water Body: Dalco Passage

Shoreline Designation: Rural

Shorelines Contact:
Shorelines Administrator
King County DDES
(206) 296-7119

Environmental Notes:

Environmentally sensitive area – wetland, landslide hazard, erosion hazard, at least partially within FEMA 100-yr flood plain.

Area Habitat Biologist: Washington Department of Fish and Wildlife
16018 Mill Creek Blvd.
Mill Creek, WA 98012
(425) 379-2306; (425) 379-2323 fax

CONTRIBUTING PARK & RIDES

NAME	LOCATION	CAPACITY	COST	UTILIZATION
Tahlequah P&R	Vashon Hwy. SW & SW Tahlequah Rd.	36		180%* **
Ober Park P&R	17106 99th Ave. SW	48		92%*
Ober Park Annex	17130 Vashon Hwy. SW	9		78%*
Valley Center P&R	20221 99th Ave. SW	55		67%*
Vashon Episcopal Church of the Holy Spirit	15420 Vashon Hwy. SW	23		57%*

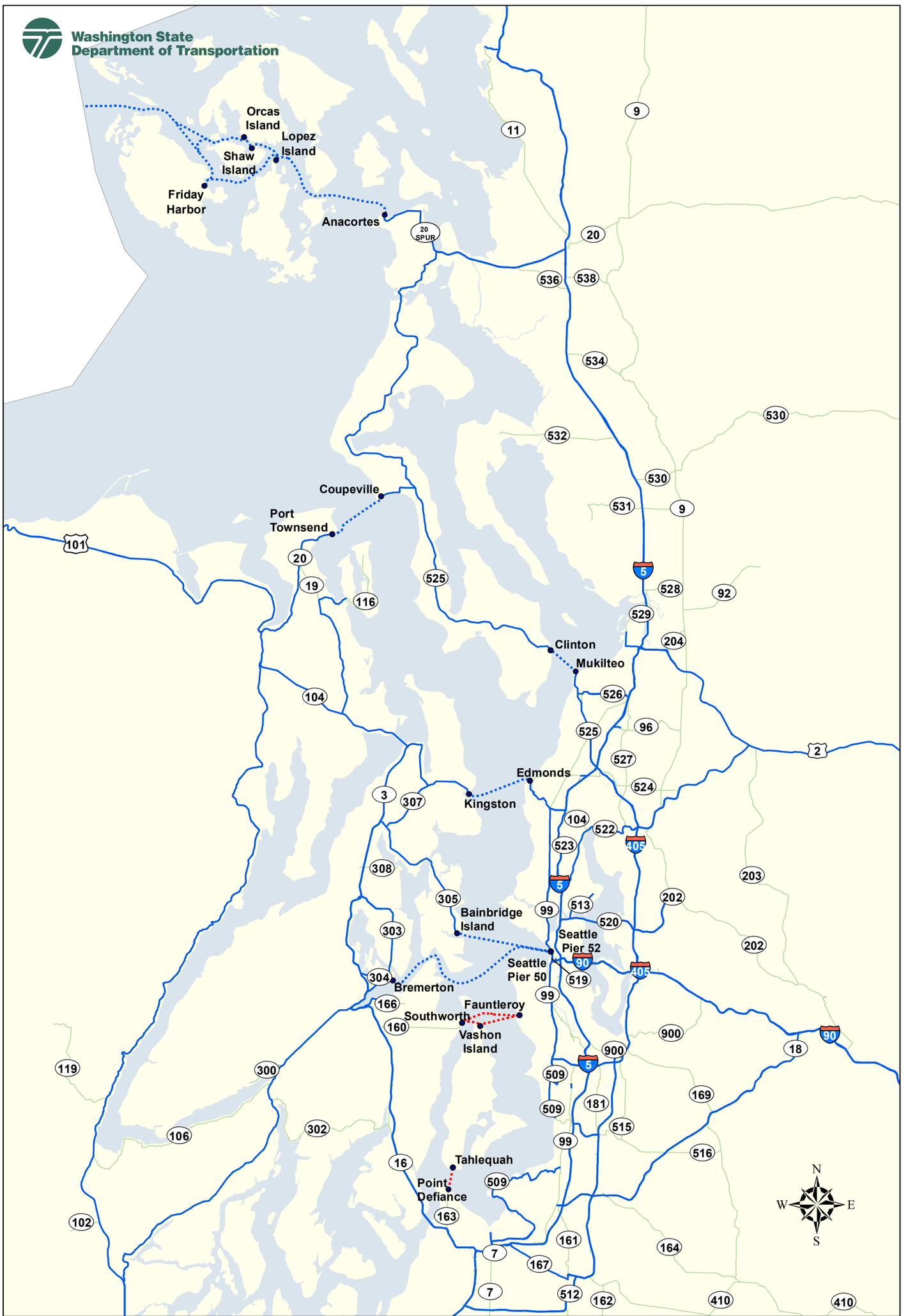
*Figures based on transit agent's statement
**Includes street parking between P&R lot and ferry terminal

The information contained in this appendix was last updated in 2011.

Terminal	Location (as per RCW when given)	RCW State Route Designations	State Route	SR No.	Related Roadway Type (RRT)	Related Roadway Qualifier (RRQ)	Begin SRMP	A/B Indicator	End SRMP	A/B Indicator	Functional Class Code	Functional Class Description
Anacortes	**Anacortes**	47.17.081	SR 20 Spur	20	FT	ANACOR	0.00		55.67		6	PRINCIPAL ARTERIAL/EXPRESS, NHS
Bainbridge	**Bainbridge Island**	47.17.560	SR 305	305	FT	WINSLO	0.00		0.02		1	PRINCIPAL ARTERIAL, NHS
Bremerton	**Bremerton**	47.17.556	SR 304	304	FT	BREMER	0.00		3.51		1	PRINCIPAL ARTERIAL, NHS
Clinton	**Clinton**	47.17.735	SR 525	525	FT	CLINTN	0.00		8.48		1	PRINCIPAL ARTERIAL, NHS
Coupeville	**Keystone**	47.17.080	SR 20	20	FT	KEYSTO	0.00		12.88		1	PRINCIPAL ARTERIAL, NHS
Eagle Harbor	**Eagle Harbor**	WSDOT BPO	SR 305	305	FT	EAGHBR	0.00		0.13		2	MINOR ARTERIAL, NON-NHS
Edmonds	**Edmonds**	47.17.175	SR 104	104	FT	EDMOND	0.00		24.45		1	PRINCIPAL ARTERIAL, NHS
Fauntleroy	**Fauntleroy**	47.17.305	SR 160	160	FT	FAUNTL	0.00		7.47		2	MINOR ARTERIAL, NON-NHS
Friday Harbor	**Friday Harbor**	47.17.081	SR 20 Spur	20	FT	FRIDAY	0.00		55.67		1	PRINCIPAL ARTERIAL, NHS
Kingston	**Kingston**	47.17.175	SR 104	104	FT	KINGST	0.00		24.53	B	1	PRINCIPAL ARTERIAL, NHS
Lopez	**Lopez Island**	47.17.081	SR 20 Spur	20	FT	LOPEZ	0.00		55.67		1	PRINCIPAL ARTERIAL, NHS
Mukilteo	**Mukilteo**	47.17.735	SR 525	525	FT	MUKILT	0.00		8.47		1	PRINCIPAL ARTERIAL, NHS
Orcas	**Orcas Island**	47.17.081	SR 20 Spur	20	FT	ORCAS	0.00		55.67		1	PRINCIPAL ARTERIAL, NHS
Point Defiance	**Point Defiance**	47.17.317	SR 163	163	FT	PTDEFI	0.00		3.37		4	PRINCIPAL ARTERIAL, NON-NHS
Port Townsend	**Port Townsend**	47.17.080	SR 20	20	FT	PTTOWN	0.00		12.56		1	PRINCIPAL ARTERIAL, NHS
Seattle	**Colman Dock**	47.17.717	SR 519	519	FT	SEATTL	0.00		1.14		1	PRINCIPAL ARTERIAL, NHS
Shaw	**Shaw Island**	47.17.081	SR 20 Spur	20	FT	SHAW	0.00		55.67		1	PRINCIPAL ARTERIAL, NHS
Sidney	**Sidney, BC**	FHWA/WSDOT TDO	SR 20 Spur	20	FT	SIDNEY	0.00		55.67		1	PRINCIPAL ARTERIAL, NHS
Southworth	**Point Southworth**	47.17.305	SR 160	160	FT	SOUTHW	0.00		7.47		2	MINOR ARTERIAL, NON-NHS
Tahlequah	**Tahlequah**	47.17.317	SR 163	163	FT	TAHLEQ	0.00		3.37		4	PRINCIPAL ARTERIAL, NON-NHS
Vashon	**Vashon Heights**	47.17.305	SR 160	160	FT	VASHON	0.00		7.47		2	MINOR ARTERIAL, NON-NHS

Terminal	Control Section	NHS	Federal Aid System	Legislative District	Congressional District	Area - Rural Urban		Urban Area - Req'd if U or D		County	
						Code	Description	Code	Description	Code	Description
Anacortes	298000	Y	Y	40	2	U	Urban (roadway in an urban area)	21	Anacortes	29	Skagit
Bainbridge Island	188300	Y	Y	23	1	U	Urban (roadway in an urban area)	7	Bremerton-Port Orchard-Bainbridge	18	Kitsap
Bremerton	188000	Y	Y	26	6	U	Urban (roadway in an urban area)	7	Bremerton-Port Orchard-Bainbridge	18	Kitsap
Clinton	158000	Y	Y	10	2	R	Rural (roadway in a rural area)			15	Island
Coupeville	158100	Y	Y	10	2	R	Rural (roadway in a rural area)			15	Island
Eagle Harbor	188400	N	N	23	1	U	Urban (roadway in an urban area)	7	Bremerton-Port Orchard-Bainbridge	18	Kitsap
Edmonds	318000	Y	Y	21	1	U	Urban (roadway in an urban area)	1	Seattle-Tacoma-Everett	31	Snohomish
Fauntleroy	178000	N	Y	34	7	U	Urban (roadway in an urban area)	1	Seattle-Tacoma-Everett	17	King
Friday Harbor	288000	Y	Y	40	2	R	Rural (roadway in a rural area)			28	San Juan
Kingston	188100	Y	Y	23	1	R	Rural (roadway in a rural area)			18	Kitsap
Lopez Island	288100	Y	Y	40	2	R	Rural (roadway in a rural area)			28	San Juan
Mukilteo	318100	Y	Y	21	2	U	Urban (roadway in an urban area)	1	Seattle-Tacoma-Everett	31	Snohomish
Orcas Island	288300	Y	Y	40	2	R	Rural (roadway in a rural area)			28	San Juan
Point Defiance	278000	N	Y	27	6	U	Urban (roadway in an urban area)	1	Seattle-Tacoma-Everett	27	Pierce
Port Townsend	168000	Y	Y	24	6	U	Urban (roadway in an urban area)	28	Port Townsend	16	Jefferson
Seattle	178100	Y	Y	43	7	U	Urban (roadway in an urban area)	1	Seattle-Tacoma-Everett	17	King
Shaw Island	288200	Y	Y	40	2	R	Rural (roadway in a rural area)			28	San Juan
Sidney	288400	Y	Y								
Southworth	188200	N	Y	26	6	U	Urban (roadway in an urban area)	7	Bremerton-Port Orchard-Bainbridge	18	Kitsap
Tahlequah	178200	N	Y	34	7	R	Urban (roadway in an urban area)			17	King
Vashon Island	178300	N	Y	34	7	U	Urban (roadway in an urban area)	40	Vashon Island	17	King

Note 1: Refer to 2009 State Highway Log for guidance re: RRT/ RRQ, conventions for Ferry Terminals, and End SRMPs (derived from SR Mainline data).
Note 2: State Functional Class Codes derived from Bridge Report (WSBIS) Fed. Functional Class coding data; assumed for Sidney based on Shaw, Lopez, Friday harbor, and Orcas designations.
Note 3: Eagle Harbor Maintenance Facility is recorded as being on SR 305 (Access SR 305/non-NHS) in the WSDOT Bridge Inspection Reports and State Bridge List (M 23-09.01).
Note 4: End SRMPs as recorded in Highway Log / Bridge Inspection Reports, typically 'Begin Ferry Zone MPs' (not to be used in CPMS).
Note 5: NHS Status and Federal Aid System Eligibility status as determined by FHWA Washington Division / WSDOT Statewide Travel & Collision Data Office.
Note 6: The congressional/legislative districts are based on the 2000 census.



National Highway System (NHS) Route events depict the FHWA approved National Highway System for Washington State Highways as reported in the Highway Performance Monitoring System (HPMS). For this update, all approved NHS routes for calendar year 2010 are included.
SR 20 Spur added via FHA Direction

Legend

- NHS Ferry Route (2010 HPMS)
- Ferry Route not on NHS
- National Highway System (NHS), 2010

National Highway System
Puget Sound

DRAFT

LSH: NHS_FerryV4

Appendix R Terminal Site Plans

The terminal site plans contained in this appendix are from Washington State Ferries' *Route Reference Book*, June 2006. Note that the Keystone Terminal has since been renamed the Coupeville Terminal.

Anacortes

Bainbridge Island

Bremerton

Clinton

Coupeville (Keystone)

Edmonds

Fauntleroy

Friday Harbor

Kingston

Lopez Island

Mukilteo

Orcas Island

Point Defiance

Port Townsend

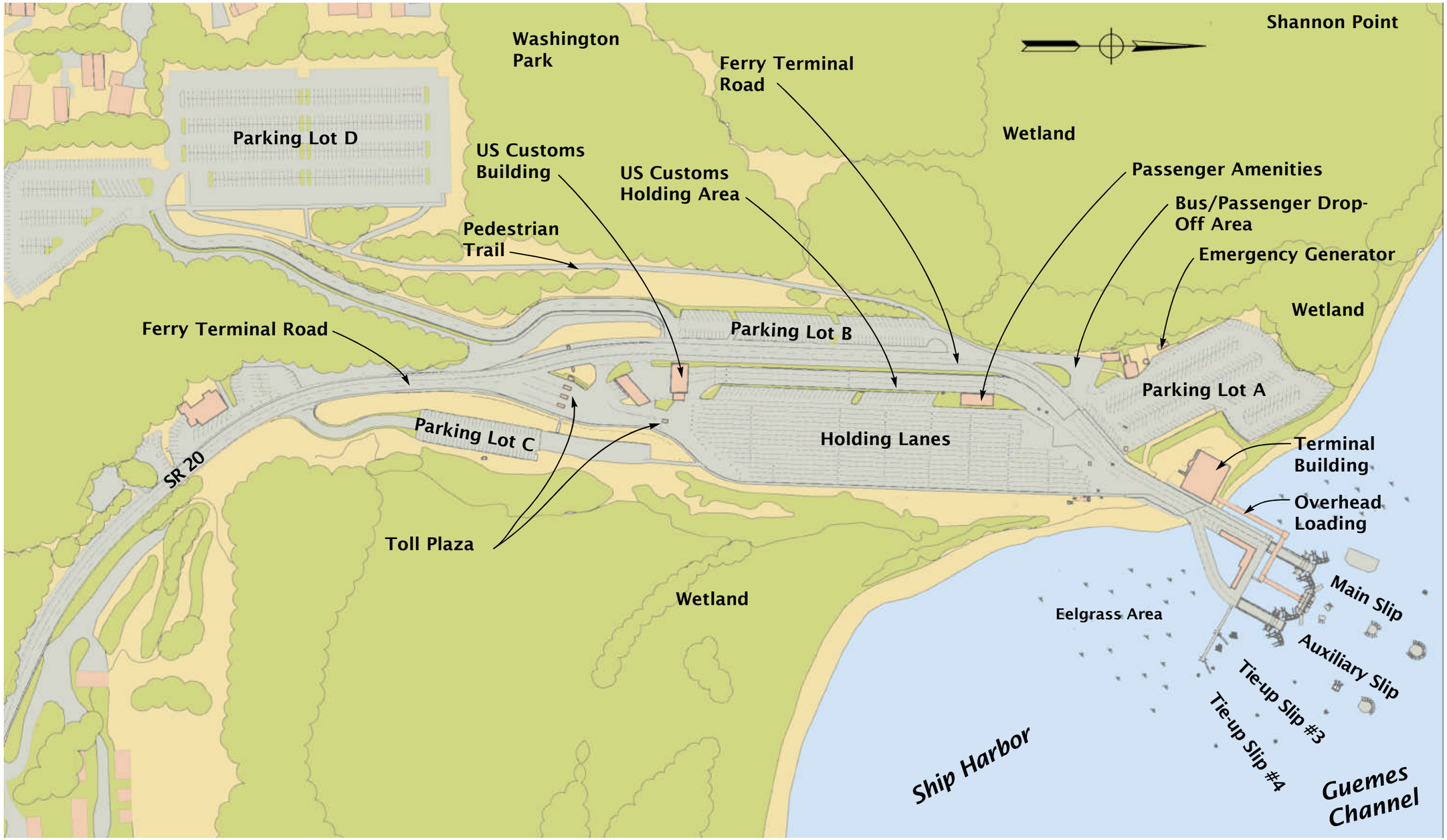
Seattle

Shaw Island

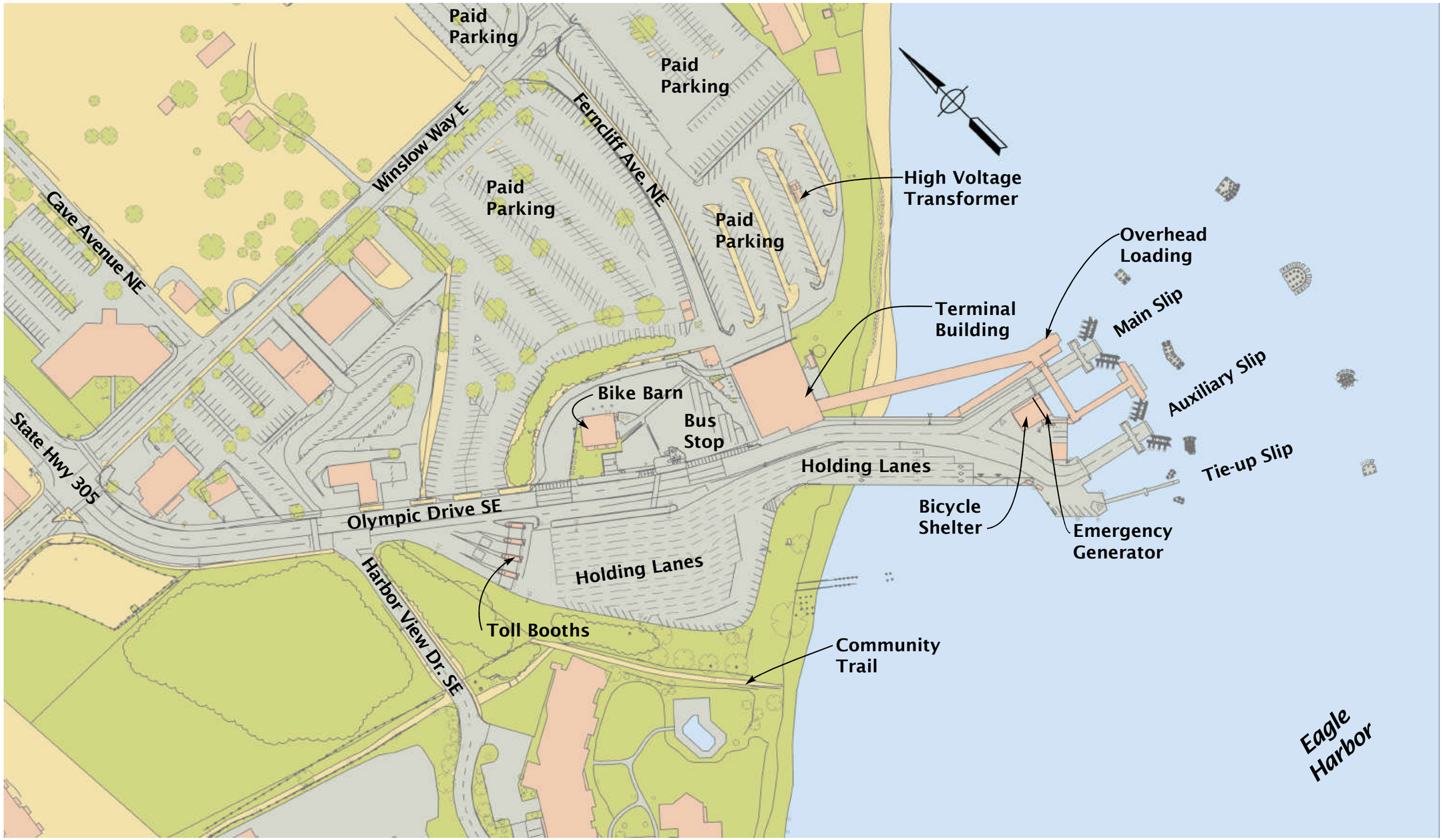
Southworth

Tahlequah

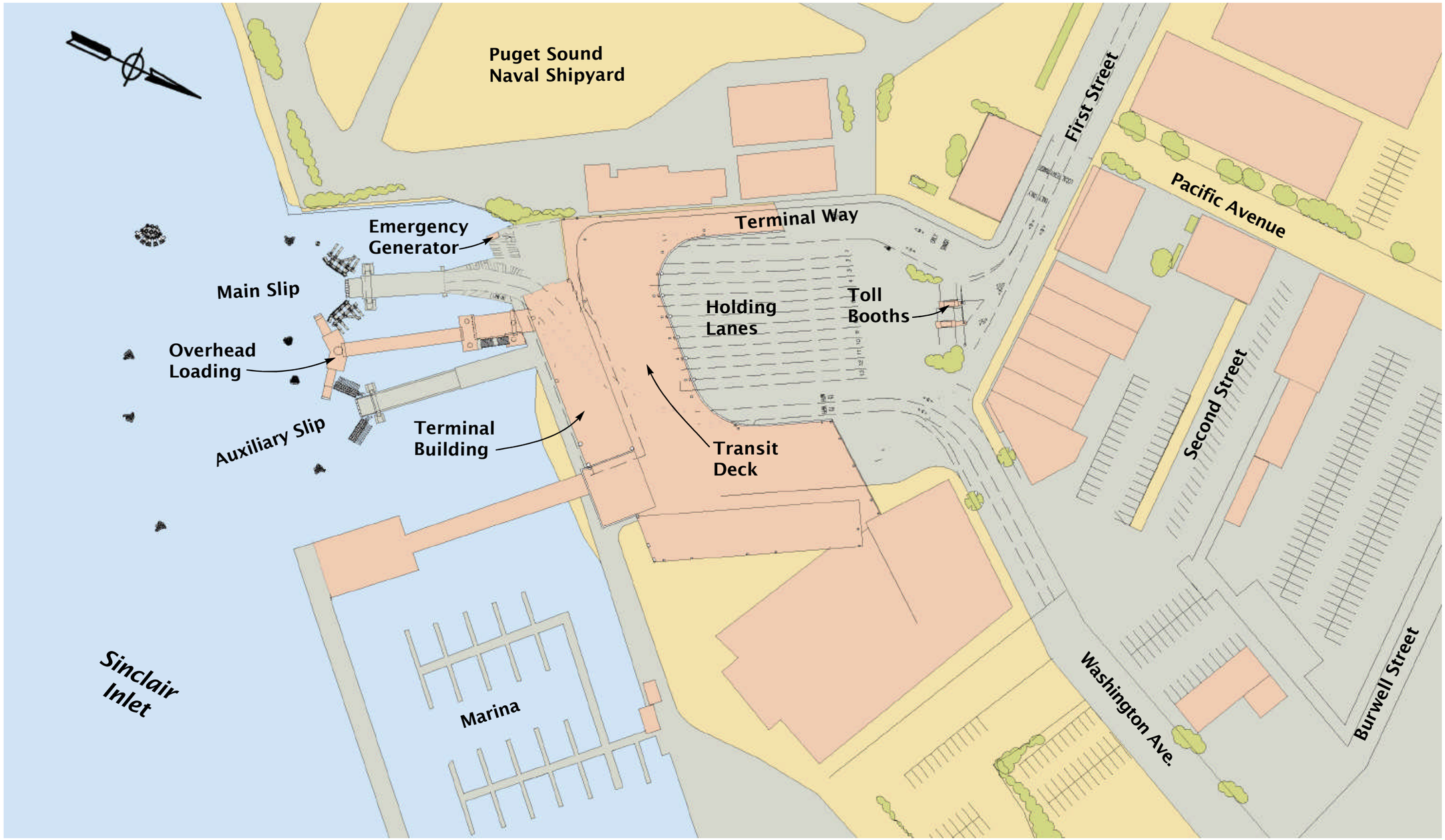
Vashon Island



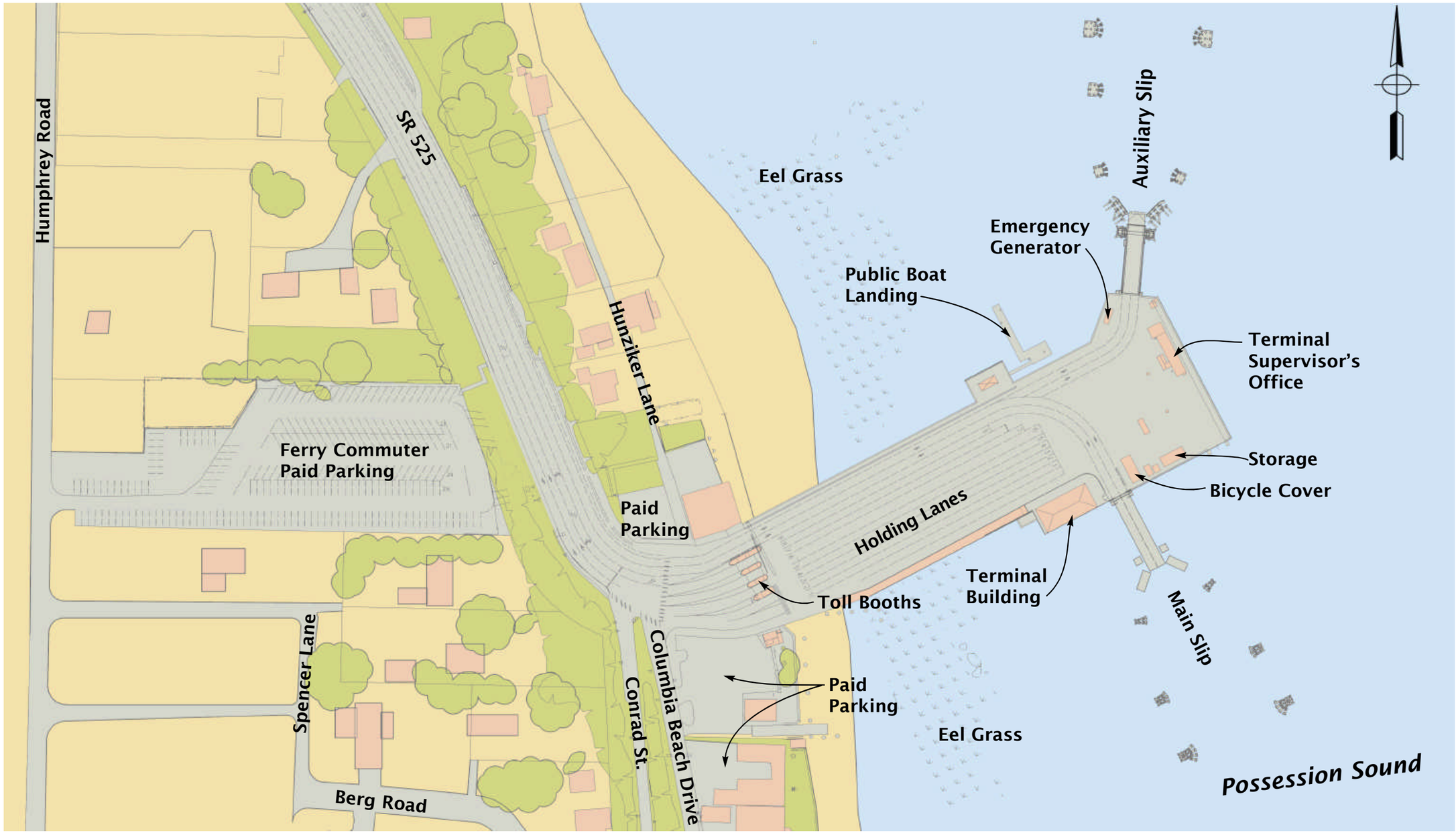
Anacortes Ferry Terminal



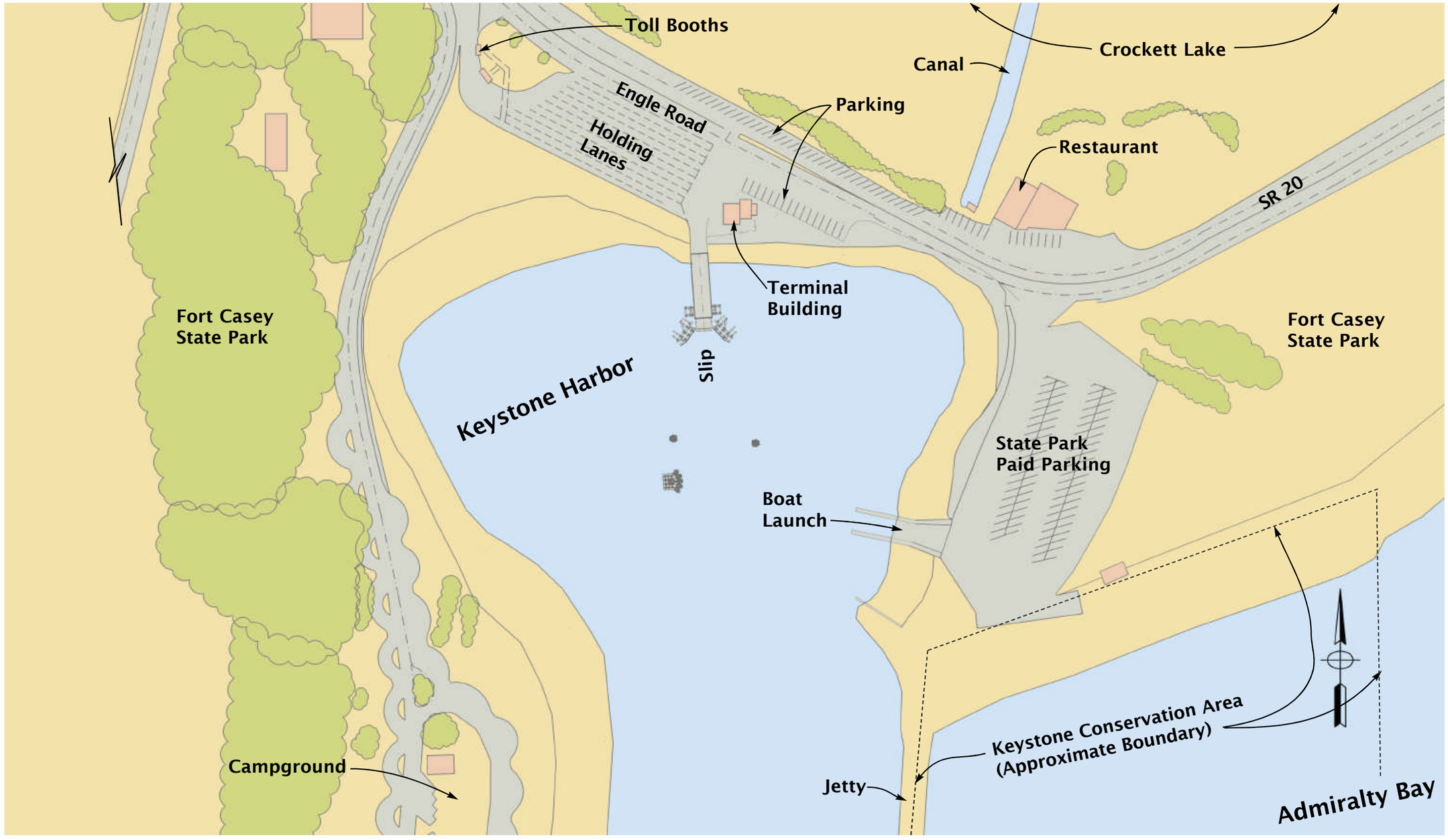
Bainbridge Island


Puget Sound
Naval Shipyard
First Street
Pacific Avenue
Terminal Way
Emergency
Generator
Main Slip
Holding
Lanes
Toll
Booths
Overhead
Loading
Second Street
Auxiliary Slip
Terminal
Building
Transit
Deck
Sinclair
Inlet
Marina
Washington Ave.
Burwell Street

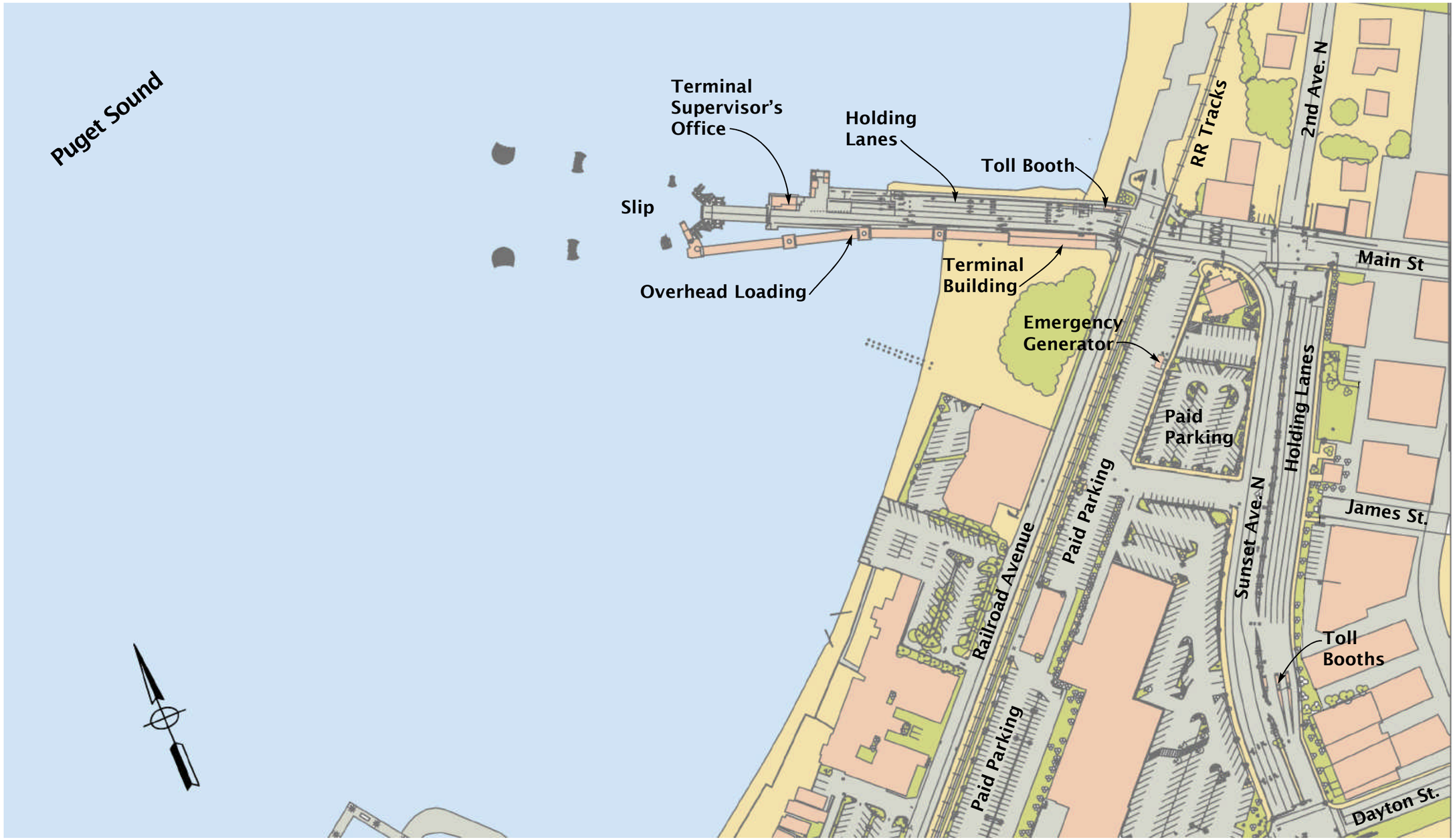
Bremerton


Humphrey Road
SR 525
Hunziker Lane
Ferry Commuter
Paid Parking
Paid
Parking
Eel Grass
Auxiliary Slip
Emergency
Generator
Public Boat
Landing
Terminal
Supervisor's
Office
Storage
Bicycle Cover
Holding Lanes
Terminal
Building
Toll Booths
Main Slip
Spencer Lane
Conrad St.
Columbia Beach Drive
Paid
Parking
Eel Grass
Berg Road
Possession Sound

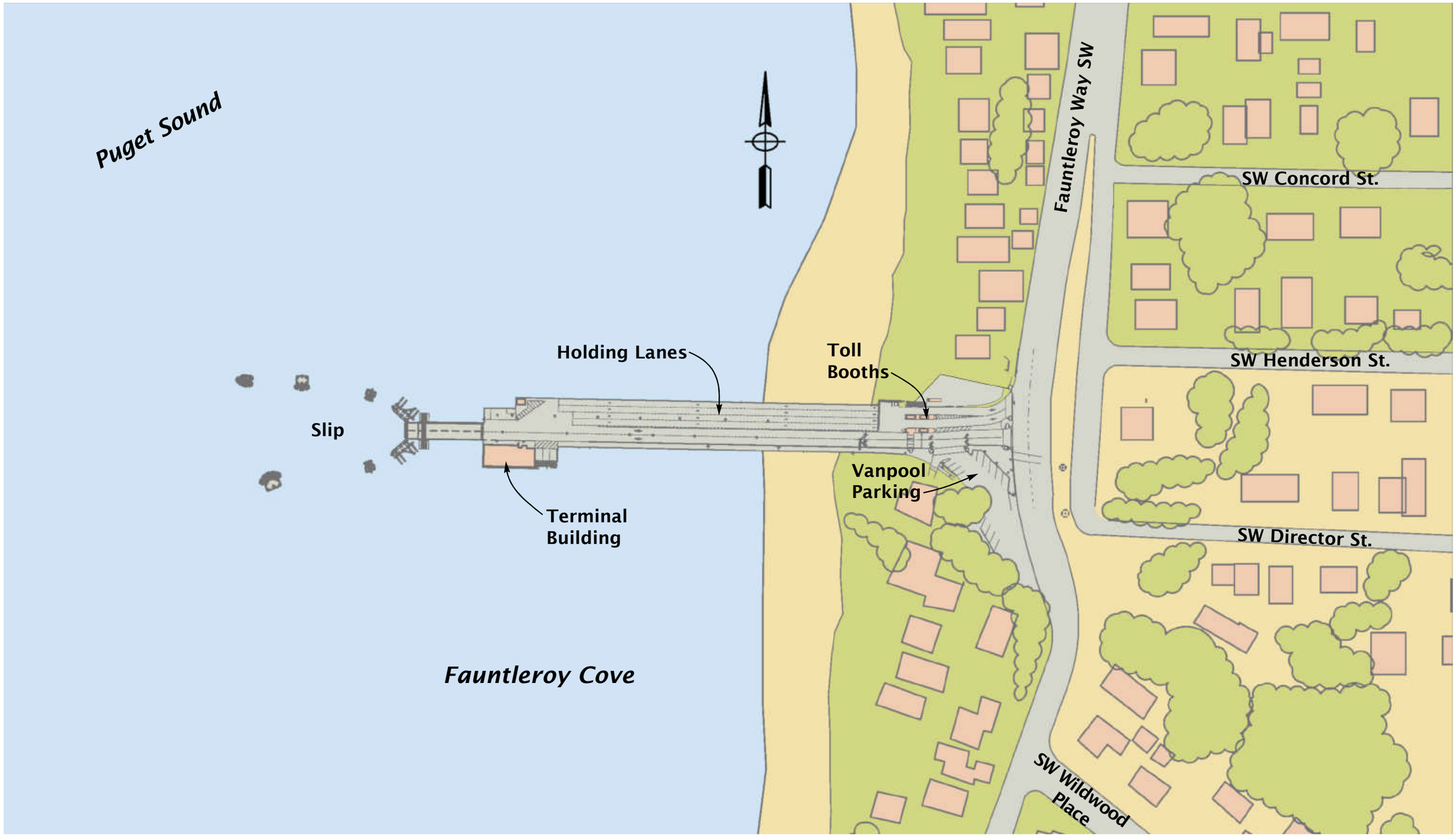
Clinton


Toll Booths
Crockett Lake
Canal
Engle Road
Holding Lanes
Parking
Restaurant
SR 20
Terminal Building
Fort Casey State Park
Keystone Harbor
Slip
Fort Casey State Park
State Park Paid Parking
Boat Launch
Keystone Conservation Area (Approximate Boundary)
Campground
Jetty
Admiralty Bay

Keystone


Puget Sound
Terminal Supervisor's Office
Holding Lanes
Toll Booth
Slip
Overhead Loading
Terminal Building
Emergency Generator
RR Tracks
2nd Ave. N
Main St
Holding Lanes
Paid Parking
Paid Parking
Railroad Avenue
Paid Parking
Sunset Ave. N
James St.
Toll Booths
Dayton St.

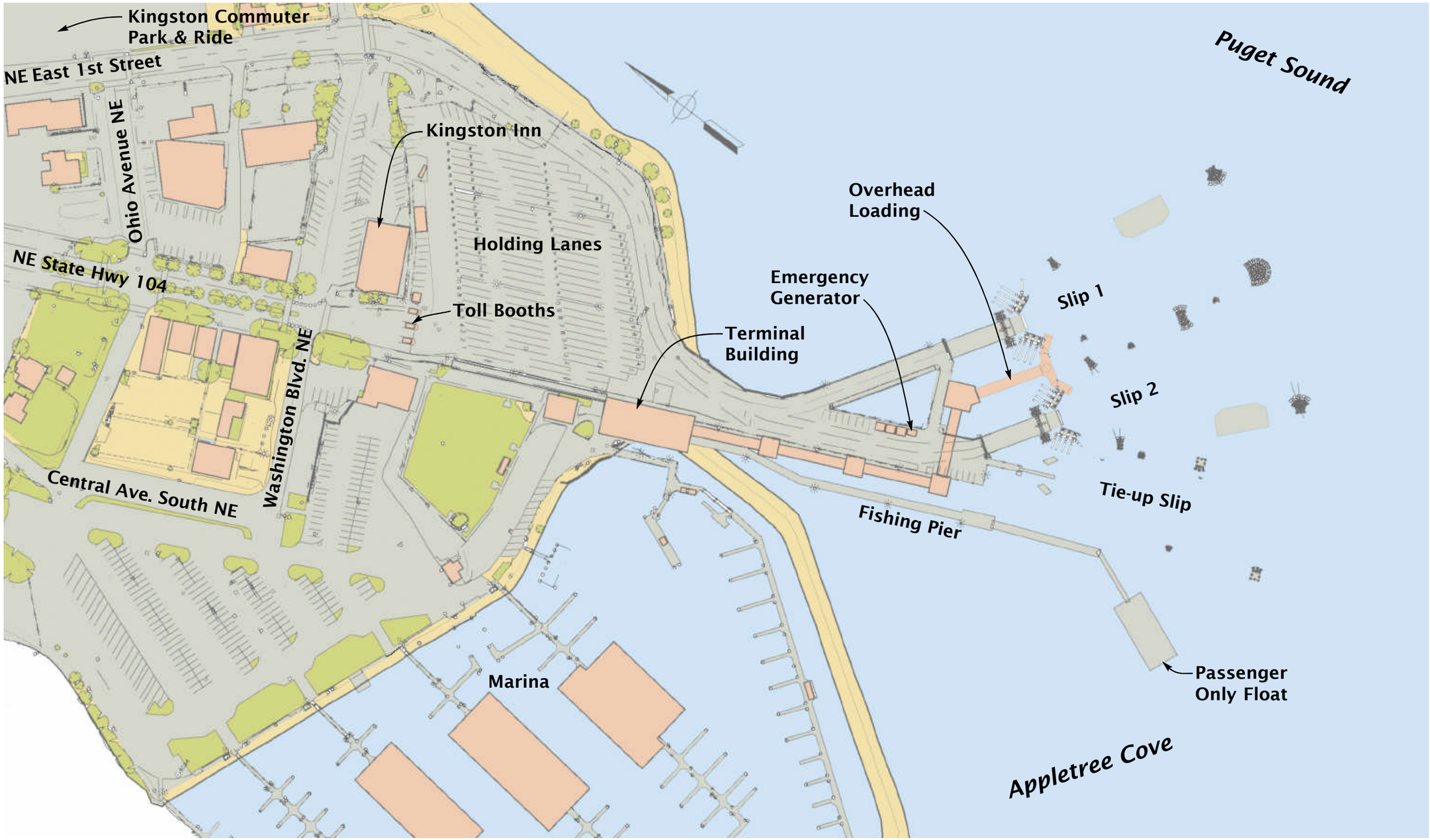
Edmonds


Puget Sound
Fauntleroy Way SW
SW Concord St.
SW Henderson St.
SW Director St.
SW Wildwood Place
Holding Lanes
Toll Booths
Vanpool Parking
Slip
Terminal Building
Fauntleroy Cove

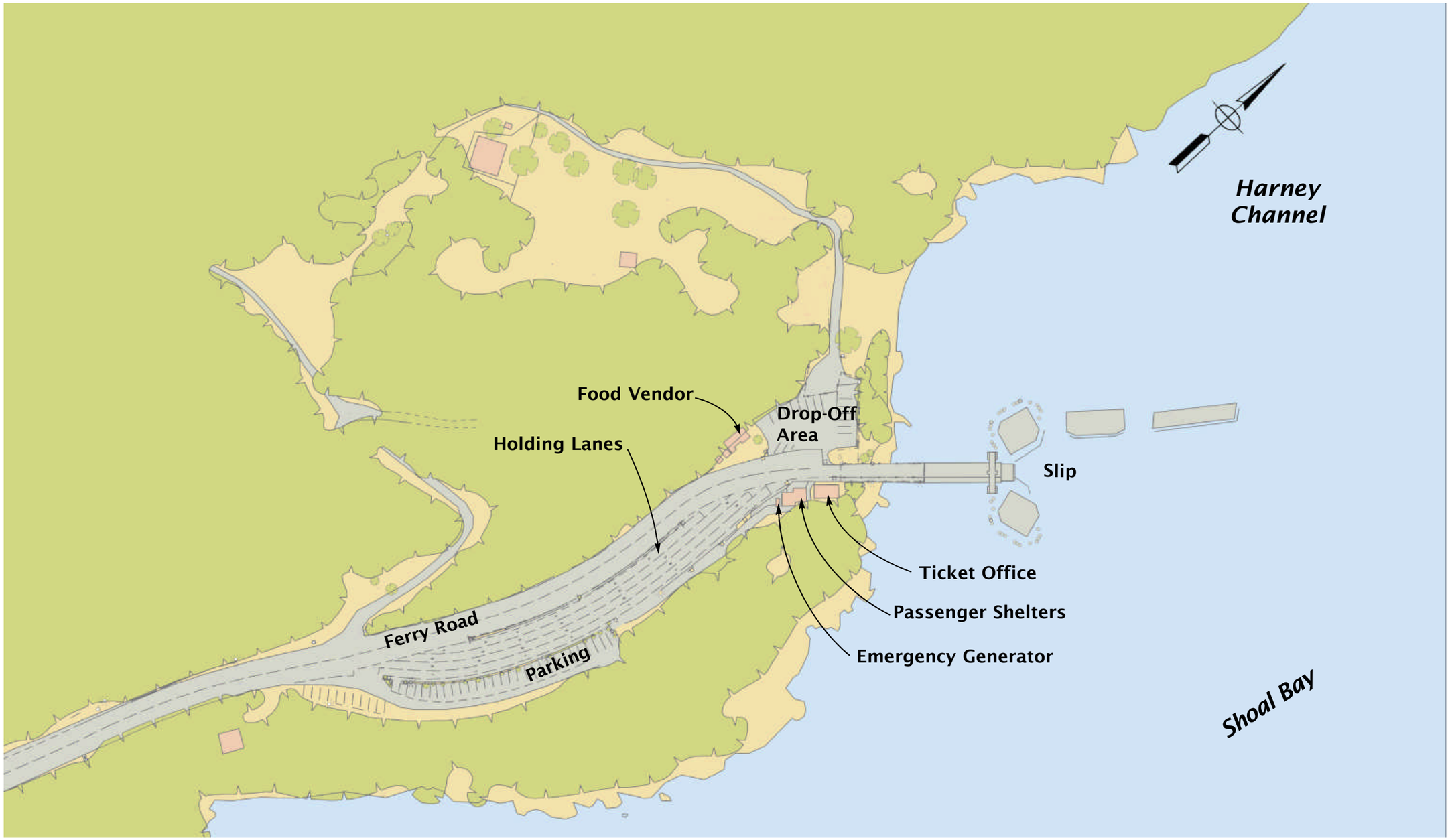
Fauntleroy



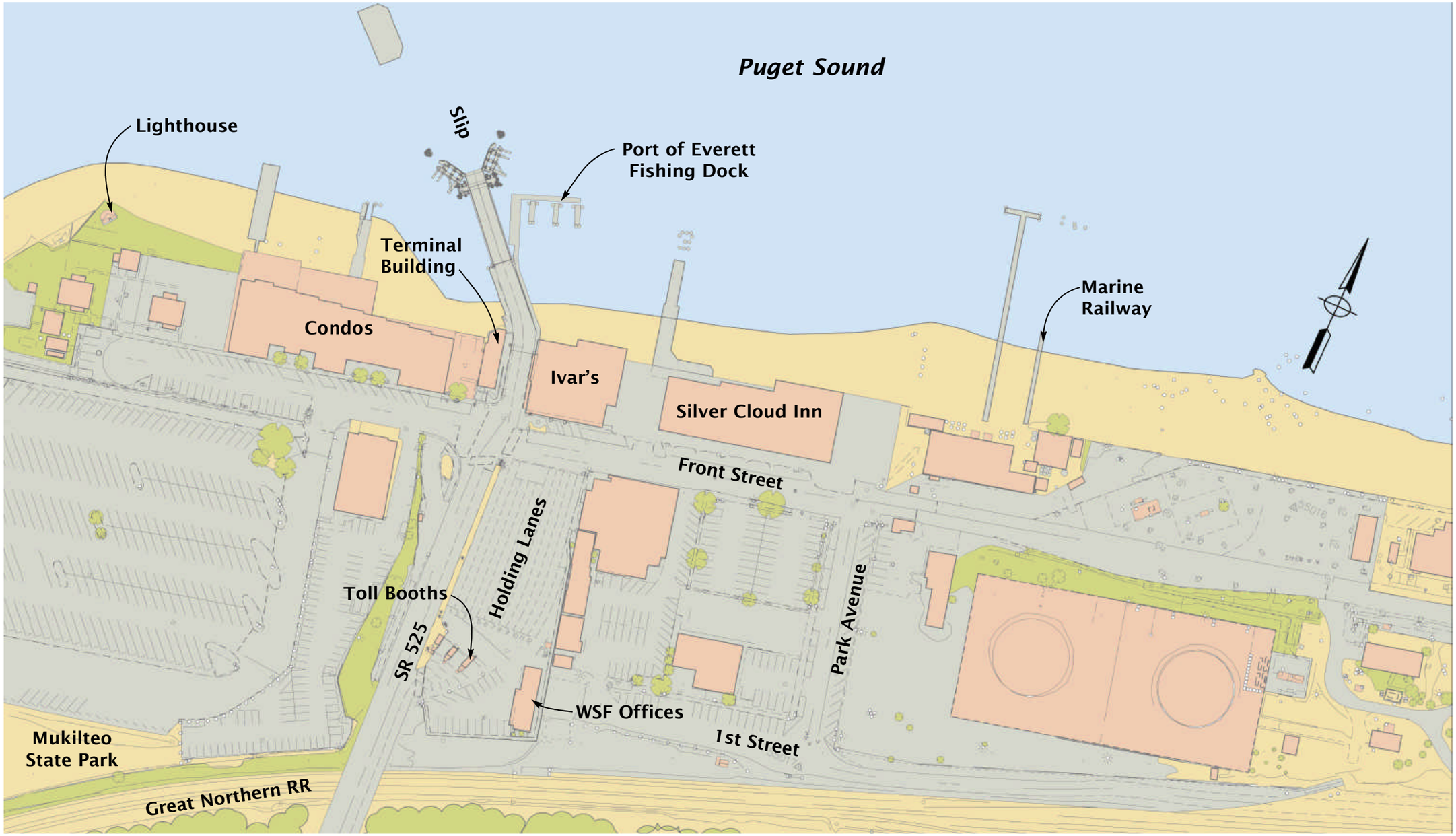
Friday Harbor


Kingston Commuter
Park & Ride
NE East 1st Street
Ohio Avenue NE
Kingston Inn
Holding Lanes
NE State Hwy 104
Toll Booths
Washington Blvd. NE
Central Ave. South NE
Overhead
Loading
Emergency
Generator
Terminal
Building
Puget Sound
Slip 1
Slip 2
Tie-up Slip
Fishing Pier
Passenger
Only Float
Marina
Appletree Cove

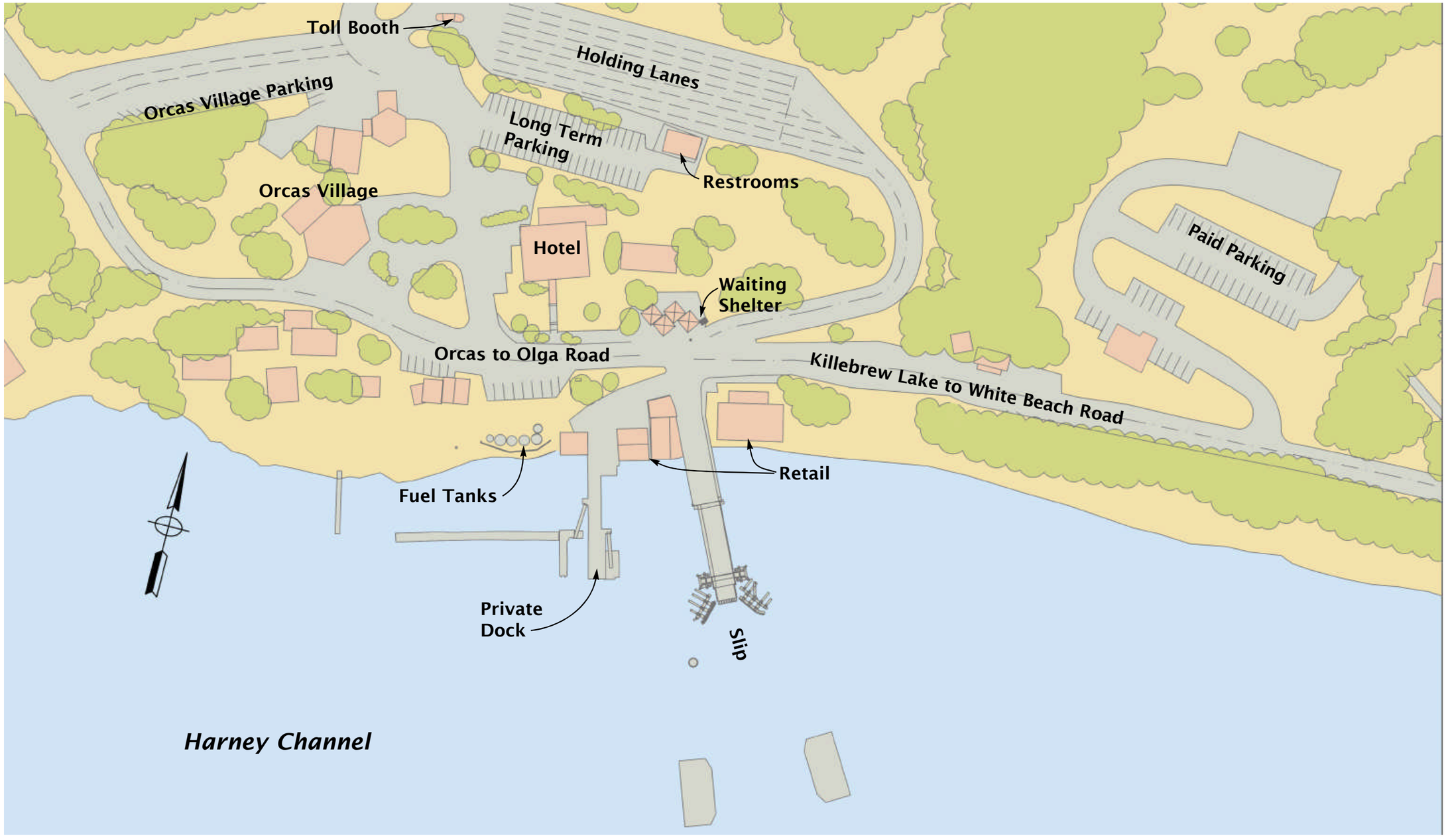
Kingston



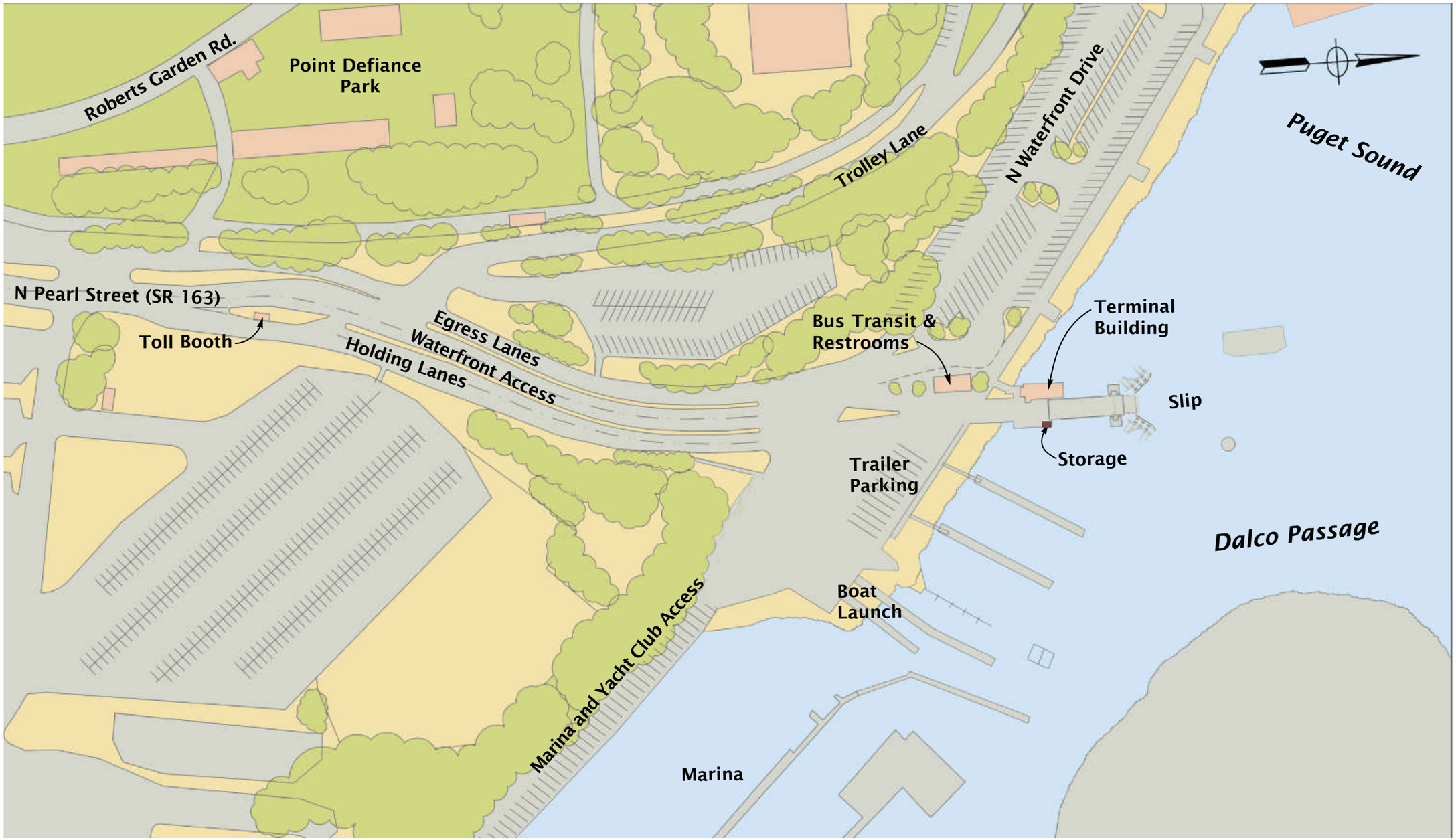
Lopez Island


Puget Sound
Lighthouse
Slip
Port of Everett
Fishing Dock
Terminal
Building
Condos
Ivar's
Silver Cloud Inn
Marine
Railway
Front Street
Holding Lanes
Toll Booths
SR 525
WSF Offices
Park Avenue
1st Street
Mukilteo
State Park
Great Northern RR

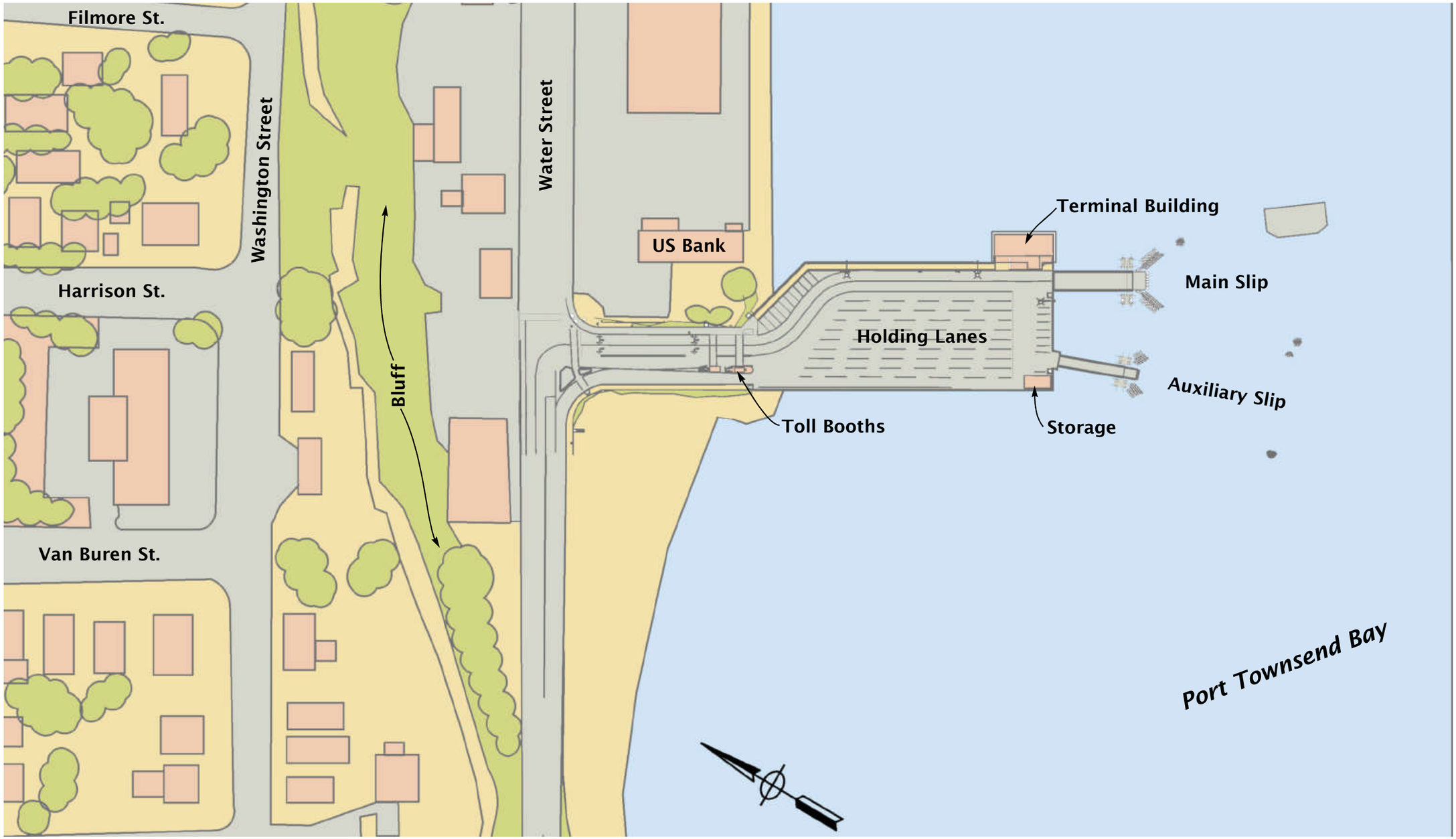
Mukilteo



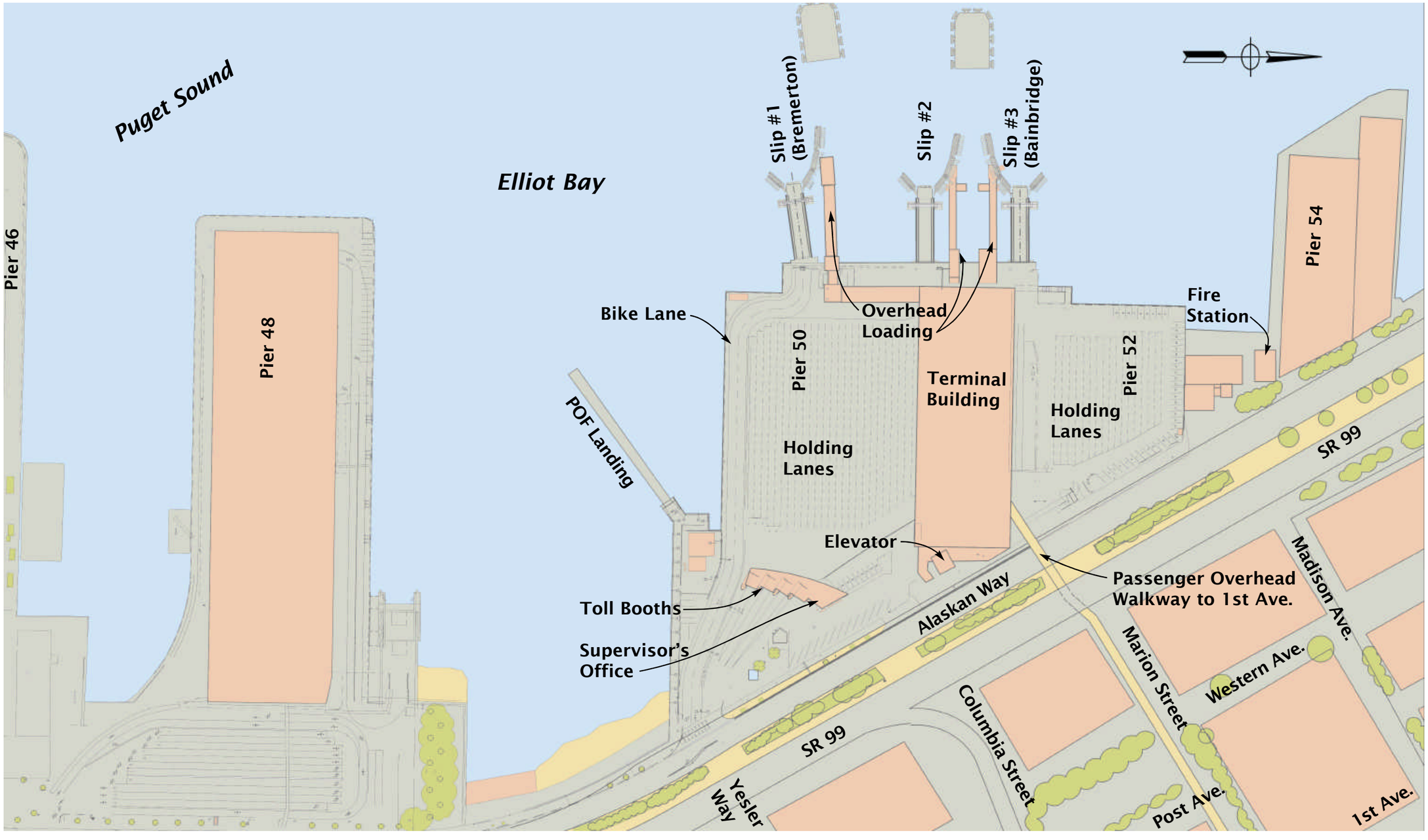
Orcas Island



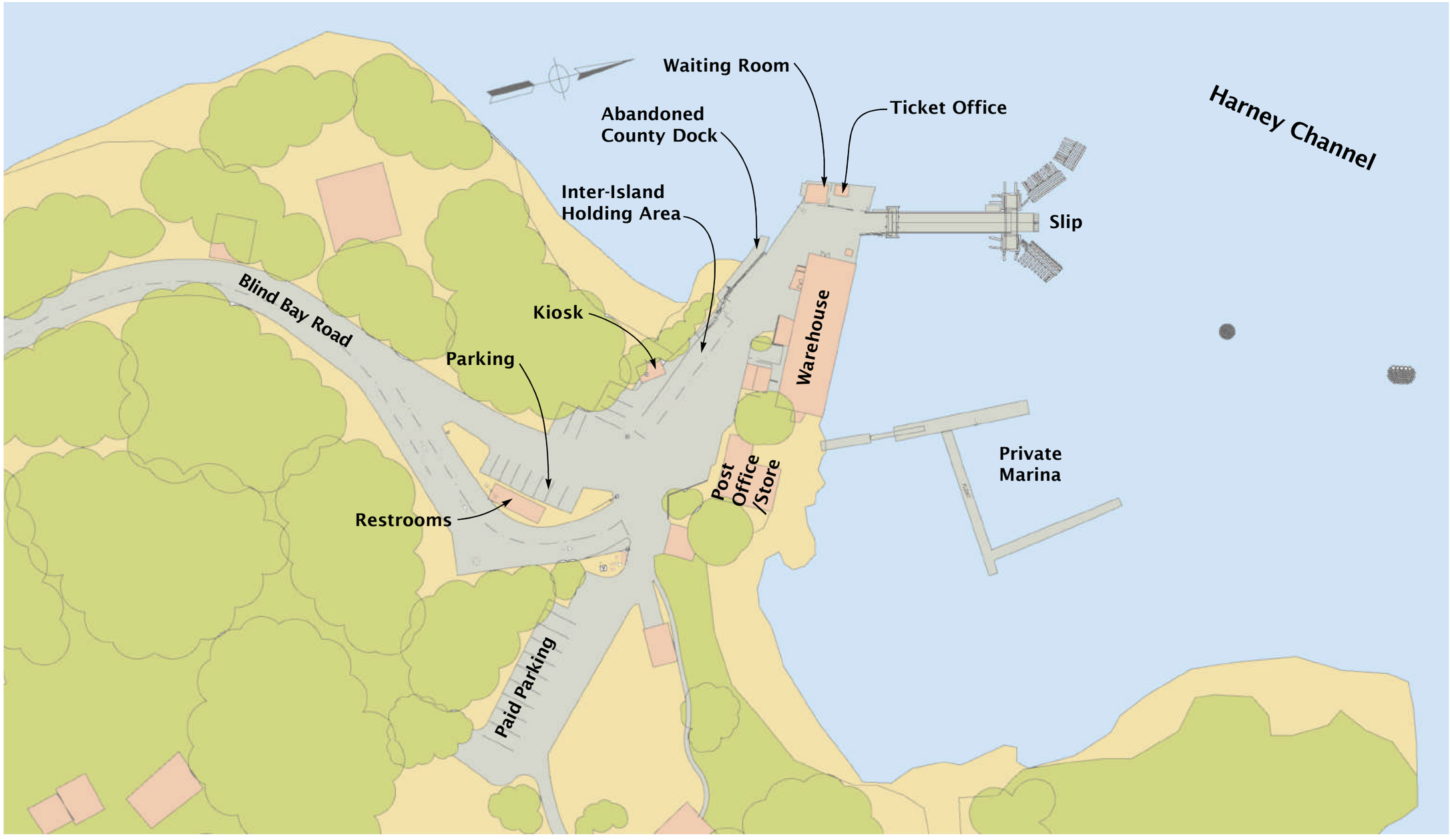
Point Defiance



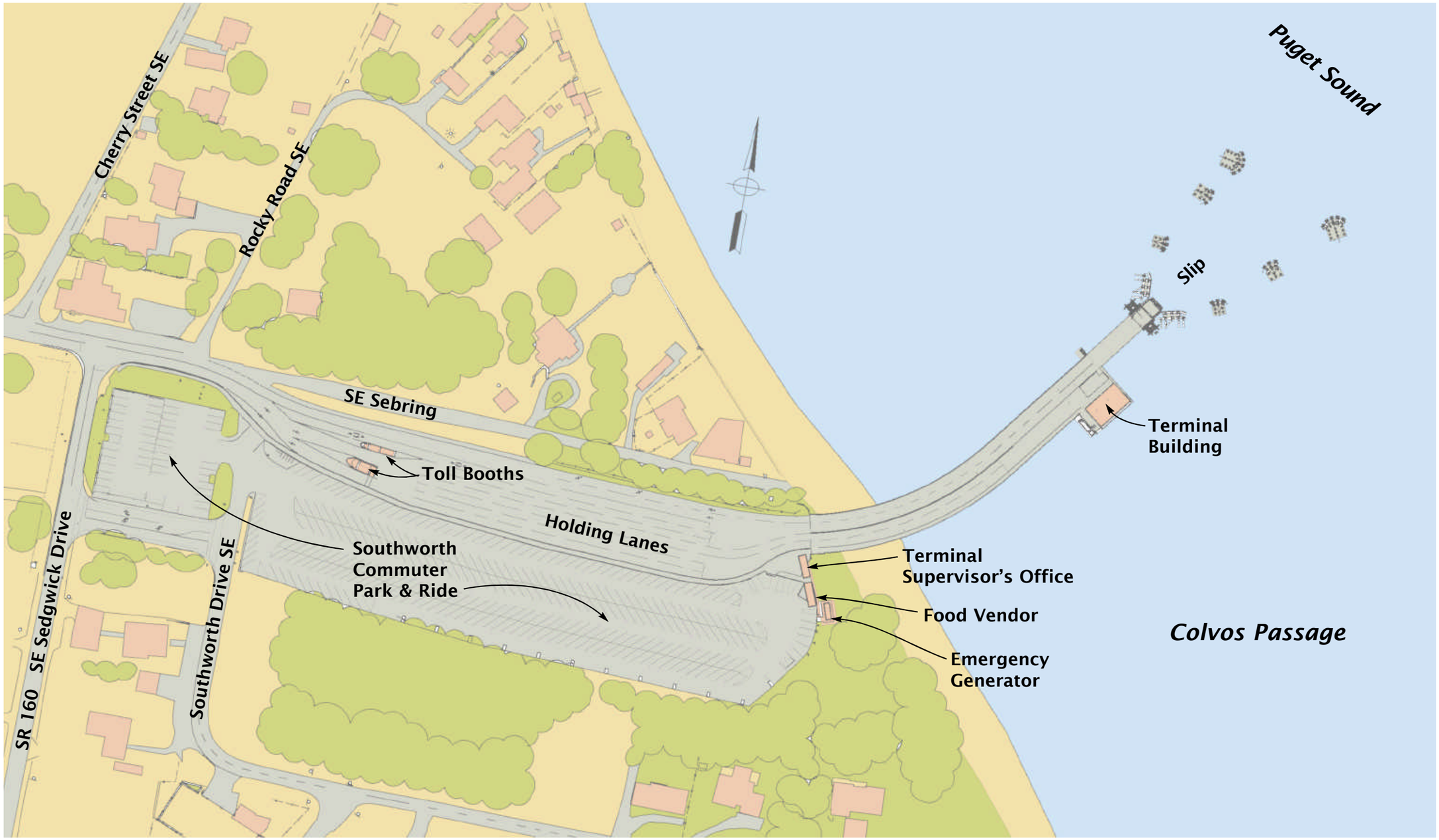
Port Townsend


Puget Sound
Elliot Bay
Pier 46
Pier 48
Slip #1 (Bremerton)
Slip #2
Slip #3 (Bainbridge)
Pier 54
Bike Lane
Overhead Loading
Pier 50
Terminal Building
Pier 52
Fire Station
POF Landing
Holding Lanes
Holding Lanes
SR 99
Elevator
Toll Booths
Supervisor's Office
Alaskan Way
Passenger Overhead Walkway to 1st Ave.
Madison Ave.
Marion Street
Western Ave.
Columbia Street
SR 99
Yesler Way
Post Ave.
1st Ave.

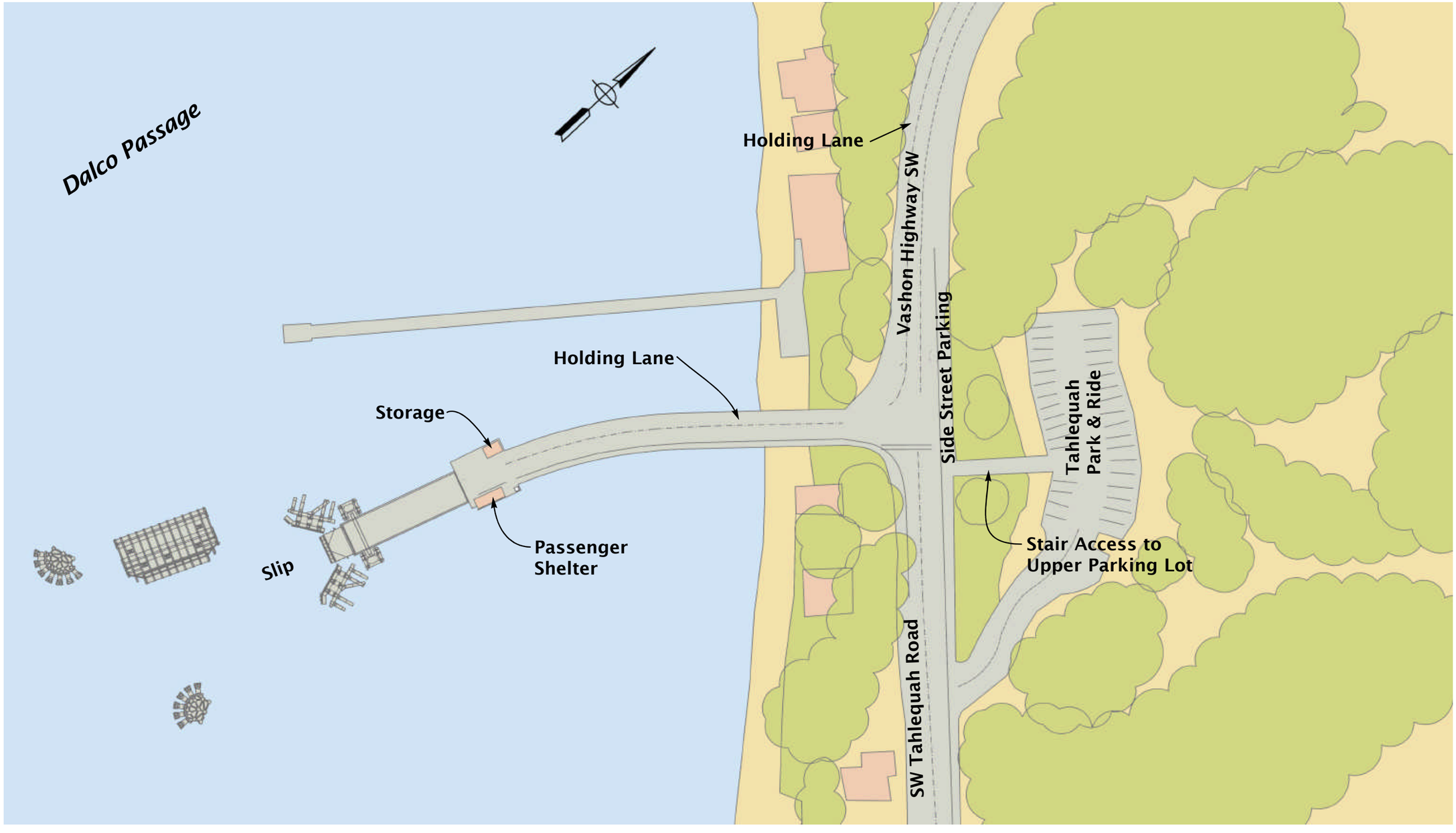
Seattle


Waiting Room
Ticket Office
Abandoned
County Dock
Inter-Island
Holding Area
Harney Channel
Slip
Blind Bay Road
Kiosk
Warehouse
Parking
Restrooms
Post
Office
/Store
Private
Marina
Paid Parking

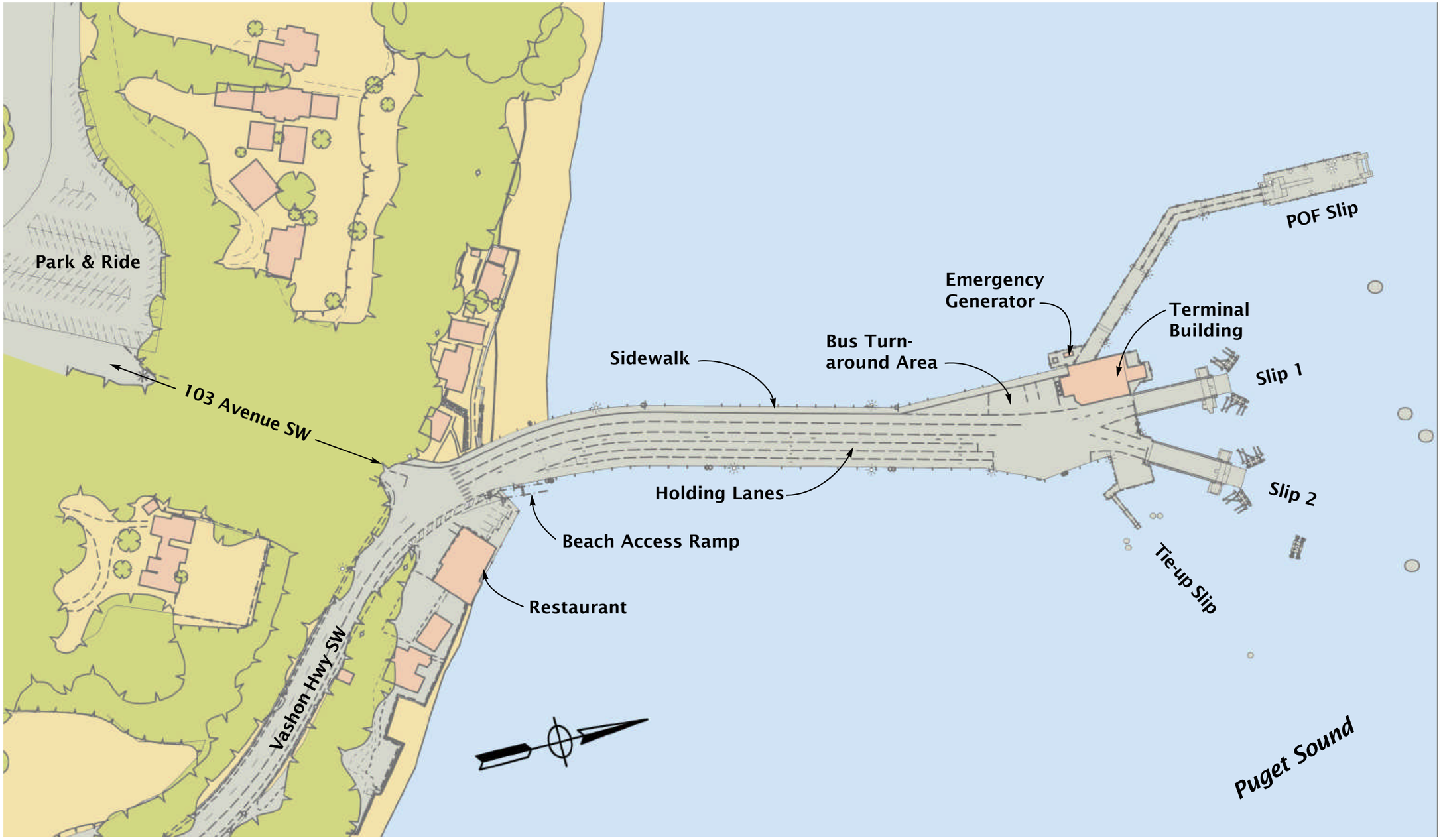
Shaw Island


Puget Sound
Cherry Street SE
Rocky Road SE
SE Sebring
Slip
Terminal Building
Toll Booths
Holding Lanes
Southworth Commuter Park & Ride
Terminal Supervisor's Office
Food Vendor
Emergency Generator
Colvos Passage
SR 160 SE Sedgwick Drive
Southworth Drive SE

Southworth


Dalco Passage
Holding Lane
Vashon Highway SW
Holding Lane
Storage
Side Street Parking
Tahlequah Park & Ride
Passenger Shelter
Slip
Stair Access to Upper Parking Lot
SW Tahlequah Road

Tahlequah



Vashon Island

Appendix S Terminal Building Programs

The information contained in this appendix was developed by WSF Terminal Engineering in early 2012.

TERMINAL BUILDINGS & ENCLOSURES SPACE SUMMARY			Typical Size [1] (SF per each)	Anacortes	Lopez	Shaw	Orcas	Friday Harbor	Sidney	Port Townsend	Keystone	Mukilteo	Clinton	Edmonds	Kingston	Seattle	Bainbridge Island	Bremerton	Southworth	Fauntleroy	Vashon	Point Defiance	Tahlequah
Chapter 400 Passenger Buildings	**400**	**Passenger Building**																					
		Facility Entry																					
		Facility Entry/Vestibule	See Note [2]	E				E		E	E		E	E	E	E	E	E		E	E	E	
		Customer Information																					
		Customer Information Booth	120	E												E							
		Certified Folders/Brochures	72	E					E	E	E	E	E	E		E	E	E	E	E	E	E	E
		Ticketing & Queuing																					
		Passenger Ticket Sales Area	96	E	E	E	E	E	E		D	E		E		E		E		E		E	
		Electronic Fare System (EFS) Kiosk	6	E	E		E	E		E	E	E	E	E	E	E	E	E	E	E	E	E	
		Ticket Sales Queuing	See Note [3]	R								R		R		R				R		R	
		EFS Kiosk Queuing	30	R						R	R	R		R		R				R		R	
		Passenger Waiting Areas																					
		Indoor Passenger Waiting Area	See Note [4]	E	E	E	E	E	E	E	E	E	E	E	D	E	E	E	E	E	E	E	
		Outdoor Passenger Waiting Area	See Note [4]	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
		Passenger Conveniences	50-100																				
		Food & Snack Vending	See Note [5]	E			E	E	E	E	E			E		E	E	E	E	E	E	E	
		Newspaper & Magazine Vending	See Note [5]	E	E		E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
		ATM Machine	See Note [5]	E												E							
		Change Machine	See Note [5]	Provide a change machine wherever arcade games are provided																			
		Telephone Area	See Note [5]	E	E		E	E	E		E	E	E	E	E	E	E	E	E	E	E	E	
		Passenger Security Screening Area																					
		Passenger Security Screening Area	See Note [6]	Consult with WSF Company Security Officer for security requirements at time of design																			
		Lost and Found																					
		Lost and Found	64 [7]	E					E							E							
		Attendant Control Station																					
		Attendant Control Station	30													E							
		Passenger Control Point																					
		Standard Turnstiles (3-ft opening)	20	E						E	E	E		E		E				E	E		
		Paddle Turnstiles (4-foot opening)	30	R						D	D	R	R			E							
		Manual Gate (4-ft opening)	30	E						E	E	E								E	E		
		Turnstiles Queuing Area	30-40 [8]	R						R	R	R		R		R				R	R		
		Turnstile Mixing Area	30-40 [8]	R						R	R	R		R		R				R			
		Storage																					
		Luggage Cart & Wheelchair Storage	72	E	R		R	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	
		Security Interview Room																					
		Security Interview Room	80						E														
		Restrooms & Water Fountains																					
		Terminal Building - Public Restrooms	See Note [9]	E		E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	
		Terminal Building - ADA Restrooms	64	E	R	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	
		Water Fountains		E	D	D	D	E	D	D	D	D	D	E	E	E	E	E	D	D	D	D	
		Janitor Storage																					
		Janitor Storage	100	E	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	
		IT Equipment Network Room																					
		IT Equipment Network Room	120	E	R	R	R	E	R	E	E	E	E	E	E	E	E	E	E	E	E	R	
		Terminal Electrical Room																					
		Terminal Electrical Room	200	E				E					E		E			E			E		
		Retail, Concessions, and Lease Space																					
		Coffee Cart Concession	36	E												E							
		Retail Space (without seating)	650	Justification for providing retail includes predesign study and return on investment business case analysis, refer to Ch 420. (existing retail at Anacortes, Lopez and Seattle)																			
		Retail Space (with seating)	850																				

TERMINAL BUILDINGS & ENCLOSURES SPACE SUMMARY			Typical Size [1] (SF per each)	Anacortes	Lopez	Shaw	Orcas	Friday Harbor	Sidney	Port Townsend	Keystone	Mukilteo	Clinton	Edmonds	Kingston	Seattle	Bainbridge Island	Bremerton	Southworth	Fauntleroy	Vashon	Point Defiance	Tahlequah
		Public Display / Art																					
		Terminal Building Public Display / Art	0-120	See Chapter 620 for more information																			
		Circulation																					
		Stairs	See Note [11]																				
		Elevators	80 per floor													E							
		Elevator Machine Room	80													E							
		Escalators (sf/ea)	230 [12]									R				R							
		Building Circulation, Structure, and Envelope Multiplier (25%)	See Note [13]																				
Chapter 500 Terminal Supervisor Building	500	**Terminal Supervisor Building**																					
		Terminal Supervisor Building Spaces																					
		Terminal Supervisor Office	224	E	R		R	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	
		Accounting / Safe Room	96	E						E	E	E	E	E	E	E	E	E	E	E		E	
		Seller Safe Room	120	E						E	E	E	E	E	E	E	E	E	E	E		E	
		Facility Engineer Office	64	E																			
		Visiting Manager Office	150	E												E		E					
		Employee Restrooms	64 [14]	E						D	D	E	E	E	D	E	D	E	D	D	D	D	
		Janitor Storage	80	E	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
		VATS Room	120									D	E	D	E	E	E	E					
		Conference Room / Training Room / Library	300	E								E	E			E		E					
		Employee Lunch/Break Room	100 [15]	E						E		E	E	E	E	E	E	E					
		Employee Locker Room	See Note [16]	E						E	E	E	E	E	E	E	E	E	E	E	E	E	
		Overnight Employee Room	100	E																			
		Vessel Crew Room	150																				
		Office Storage	80	E	D		D	E	E	E	E	E	E	E	E	E	E	E	E		E	E	E
		Shower Facility	64													E							
		Circulation																					
		Stairs	See Note [11]																				
		Elevators	80 per floor																				
		Elevator Machine Room (see Chapter 400)	80																				
		Building Circulation, Structure, and Envelope Multiplier (25%)	See Note [17]																				
Chapter 510 Maintenance Buildings, Enclosures & Support Areas	510	**Maintenance Buildings, Enclosures & Support Areas**																					
		Terminal Maintenance Building																					
		Terminal Maintenance Storage	120																				
		Cone/Barrel & Sign Storage	48	E	E		D	E	E	E	E	E	E	E	E	E	E	E	E	E			
		Building Electrical Room	64	E									E		E	E		E					
		Building Mechanical Room	80													E		E					
		Dock Bull Garage	120	E						E	E		E										
		Structure, and Envelope Multiplier (7%)	See Note [18]																				
		Vessel Maintenance Building																					
		Vessel Rope /Supplies Locker	120	E						E	E		E		E		E	E				R	
		Vessel Linens Locker	120	E						E		E			E	E		E					
		Breathing Pack Bottle Storage	15	E						E			E		E	E	E	E	E		E	E	
		Oil Boom Containers	190	E						E			E		E		E	E			E	E	
		Man Lift Storage	16	E									E		E	E		E					
		Structure, and Envelope Multiplier (7%)	See Note [19]																				
		Miscellaneous Structures, Enclosures and Support Areas																					
		Operator Control Station for OHL	48	E										E	E	E	E	E					
		Vehicle Tollbooths	68	E			E		E	E	E	E	E	E	E	E	E	E	E	E		E	
		Vehicle / Traffic Attendant Booth	48	E													R	E					

TERMINAL BUILDINGS & ENCLOSURES SPACE SUMMARY

			Typical Size [1] (SF per each)	Anacortes	Lopez	Shaw	Orcas	Friday Harbor	Sidney	Port Townsend	Keystone	Mukilteo	Clinton	Edmonds	Kingston	Seattle	Bainbridge Island	Bremerton	Southworth	Fauntleroy	Vashon	Point Defiance	Tahlequah
Chapter 510 Maintenance Buildings, Enclosures & Support Areas		Traffic Attendant Office	120	E					E	E	E	E	E	E	E	E	E	E	E	E	E		
		Vehicle/Passenger Staff Restroom	64 [14]	E				E					E	E	E			E	E	E			
		Vessel Hazardous Materials Storage Locker	120	E						E			E		E	E	E	E			E	E	
		Flammable Materials Locker	12	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
		Oil Spill Supply Barrel	9	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
		Oil Spill Response Kit	6	E	E	E	E	E	R	E	E	E	E	E	E	E	E	E	E	E	E	E	E
		TE Damage Assessment Kit	9	E	E	E	E	E		E	E	E	E	E	E	E	E	E	E	E	E	E	E
		Garbage & Recycling	1200	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
		Cart Storage	128	E												E	E	E					
		Vendor Storage & Office Space	See Note [20]	E												E							
		Service Transformer Area	204	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
		Emergency Generator	450	E	E	D	E	E	D	R	E	E	E	E	E		E	E	E	D	E	R	D
		Isolation Transformers	40 [21]	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
		Transfer Span Electrical Enclosures	200	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
		Hydraulic Power Unit Enclosures	96														E						
		Backflow Preventer Enclosures	64	E				E					E	E		E	E	E		E	E	E	
		Sewage/Storm Water Lift Station	90	E				E		E		E		E	E	E		E	E	E	E	E	
		Structure, and Envelope Multiplier (7%)	See Note [22]																				

Notes:

[1] Typical size given is an approximate number for scoping purposes; actual size will vary.
[2] 6' minimum running dimension x width of existing
[3] Ticket sales queuing is included in calculated passenger waiting
[4] Refer to Chapter 410 for waiting area sizing guidelines
[5] Refer to Chapter 410 for individual amenity space requirements
[6] Coordinate with WSF Company Security Officer (CSO) for requirements
[7] Typically included in Customer Information Area
[8] 10 feet deep by width of all turnstiles, redundant turnstiles and manual gate.
[9] Minimum size per UPC or current IBC requirement with terminal occupant load.
[10] Not used
[11] Number and width of stairs sized per IBC and caluculated occupancy load
[12] Seattle will have up and down. Mukilteo may only have up.
[13] Apply 25% multiplier to sum of all spaces under Passenger Building except the Passenger Waiting Area.
[14] If under 10 employees the building official may allow one unisex restrom. Otherwise two restrooms will be required.
[15] Assume 30 sf per employee + 30 sf of counter/refrigerator space (15'x2').
[16] Assume 15 sf per employee.
[17] Apply 25% multiplier to sum of all spaces under Terminal Supervisor Building
[18] Apply 7% multiplier to sum of all spaces under Terminal Maintenance Building
[19] Apply 7% multiplier to sum of all spaces under Vessel Maintenance Building
[20] Provide space for min. convenience coffee and news sales area (100 sf/ea); office space if available
[21] One per slip
[22] Apply 7% multiplier to sum of all spaces under Miscellaneous Structures, Enclosures & Support Areas

Notes

LEGEND

E Existing Space at Terminal

R Required Space at Future Terminal

D Desired Space at Future Terminal

Appendix T Terminal Signage Plan

The draft *Southworth Ferry Terminal Sign Program Implementation* plans contained in this appendix were developed in February 1998.

SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION

DEPARTMENT OF TRANSPORTATION

To be used in conjunction with
Washington State Ferries
Systemwide Signage
Volume 2
Terminal Signage Standards Manual

February 6, 1998

K I A I D G

Kent Allan Design Group
Suite 208, 5800 2nd Street SW
Calgary AB T2H 0H2
Tel 403 640 4100

DRAFT

Signal	Sign Type	Message			Layout	Specs	Notes
1	MUTCD	(MUTCD ferry symbol) → Park & Ride Drop Off Pick Up			SW-5	SW-6	MUTCD sign to be ordered by WSF directly, center on existing post
2	MUTCD	(MUTCD ferry symbol) ← Park & Ride Drop Off Pick Up			SW-5	SW-6	MUTCD sign to be ordered by WSF directly, center on existing post
3	MUTCD	(MUTCD ferry symbol) → Park & Ride Drop Off Pick Up			SW-5	SW-6	MUTCD sign to be ordered by WSF directly, center on existing post
4	MUTCD	(RideShare logo) ← Park & Ride			SW-5	SW-6	MUTCD sign to be ordered by WSF directly Mount side-by-side with Sign 5, on left side
5	MUTCD	Southworth Drive S.E. →			SW-5	SW-6	MUTCD sign to be ordered by WSF directly Mount side-by-side with Sign 4, on right side
6	MUTCD	Southworth Ferry Terminal →			SW-5	SW-6	MUTCD sign to be ordered by WSF directly Center on existing pole, above Highway 160 East sign
7	MUTCD	No Drop Off or Pick Up ahead			SW-5	SW-6	MUTCD sign to be ordered by WSF directly
8	MUTCD	(no parking symbol) ← →			SW-5	SW-6	Remove all other No Parking signs, center on existing post. Option: use one of existing signs, reposition in middle of No Parking area
9	ST 7	(ticket purchase symbol) Vashon passengers must pay fare at booth			SW-8	SW-9-1	Mount details see SW-7-1
10	ST 7	(bicycle symbol) ↙ Bicycle parking			SW-8	SW-9-1	Double flag mount to left of Sign 11, see SW-7-8
11	ST 7	(motorcycle symbol) ↘ Motorcycle parking			SW-7	SW-9-1	Double flag mount to right of Sign 10, see SW-7-8
12	ST 1	(Washington State Ferries logo) Southworth Ferry Terminal To Vashon, Fauntleroy (parking symbol) Park & Ride			SW-4	SW-4-2	
13	ST 7	(Do not enter symbol) Authorized personnel only			SW-5	SW-9-1	Mount on chain link fence at left entrance to employee parking
14	ST 16 customized	Fares	Fauntleroy	Vashon	SW-9	SW-9-2	Changeable fare panel must be sized to fit 2 destinations
		Vehicle and driver	$5.90	$7.85			Custom reverse text at bottom of panel to emphasize
		Vehicle and reduced fare driver senior(65), disabled	$5.05	$6.85			Vashon passengers must pay fare
		Overheight surcharge (over 7'-6"-under 20'-0")	$5.90	$7.85			Confirm fares at time of manufacture Position see SW-10
		Passenger	n/c	$2.30			
		Reduced fare passengers senior(65), disabled, children 5 thru 11	n/c	$1.15			
		Children under 5	free	free			
		Vashon passengers	must pay fare				
15	ST 16 customized	Fares Vehicle and driver Vehicle and reduced fare driver senior(65), disabled Overheight surcharge (over 7'-6"-under 20'-0") Passenger Reduced fare passengers senior(65), disabled, children 5 thru 11 Children under 5 Vashon passengers	Fauntleroy $5.90 $5.05 $5.90 n/c n/c free	Vashon $7.85 $6.85 $7.85 $2.30 $1.15 free must pay fare	SW-9	SW-9-1	Changeable fare panel must be sized to fit 2 destinations Custom reverse text at bottom of panel to emphasize Vashon passengers must pay fare Confirm fares at time of manufacture Position see SW-11; this sign mounted with Sign 23 above
16	ST 14	(departure lane symbol) Vashon cut-off Loading of vehicles for Vashon ends 2 minutes before departure time on multi-destination sailings			SW-12	SW-12-4	
17	ST 14	(departure lane symbol) Vashon cut-off Loading of vehicles for Vashon ends 2 minutes before departure time on multi-destination sailings			SW-12	SW-12-4	
18	ST 13	(ticket purchase symbol) Please walk here to pay fare			SW-13	SW-13-3	Material to be determined, mount with suction cup in window Symbol size and layout have been revised to accommodate 3 lines of text Position see SW-10
18a	ST 13	(ticket purchase symbol) Please walk here to pay fare			SW-13	SW-13-3	Material to be determined, mount with suction cup in window Symbol size and layout have been revised to accommodate 3 lines of text Position see SW-10
19	ST 13	(ticket purchase symbol) Please walk here to pay fare			SW-13	SW-13-3	Material to be determined, mount with suction cup in window Symbol size and layout have been revised to accommodate 3 lines of text Position ewer SW-11
20	ST 8	(ticket purchase symbol) Vashon passengers All Vashon bound passengers must pay fare at booth			SW-14	SW-14-1	One of a variety of changeable message panels mounted on a portable sandwich board or similar mount, to be determined Other message panels to be added to inventory as required
21	ST 8	(ticket purchase symbol) Vashon passengers All Vashon bound passengers must pay fare at booth			SW-14	SW-14-1	One of a variety of changeable message panels mounted on a portable sandwich board or similar mount, to be determined Other message panels to be added to inventory as required
22	ST 7	(ticket purchase symbol) Vashon passengers must pay fare at booth			SW-9	SW-9-1	Check with WSF for final positioning and angle of sign face for maximum readability Mount details see SW-7
23	custom	(RideShare logo) Registered RideShare ↙			SW-9	SW-9-1	Position above Sign 15 on Toll Booth 2
24	ST 6	Vashon Fauntleroy ↙ ↘ Lanes 1-2 Lanes 3-8			SW-17	SW-17	Layout has been customized to accommodate lane identification
25	ST 7	(ticket purchase symbol) Vashon passengers must pay fare at booth			SW-9	SW-9-1	Double flag mount to left of Sign 25a, see SW-7-6
25a	ST 7	(walk symbol) Did you remember to pay for your parking?			SW-9	SW-9-1	Double flag mount to right of Sign 25, see SW-7-6

WASHINGTON STATE FERRIES

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

K'A'D'G Root Allen Design Group Suite 200, 5800 2nd Street SW Calgary AB T2H 0H2 Tel 403 640-1100

SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION

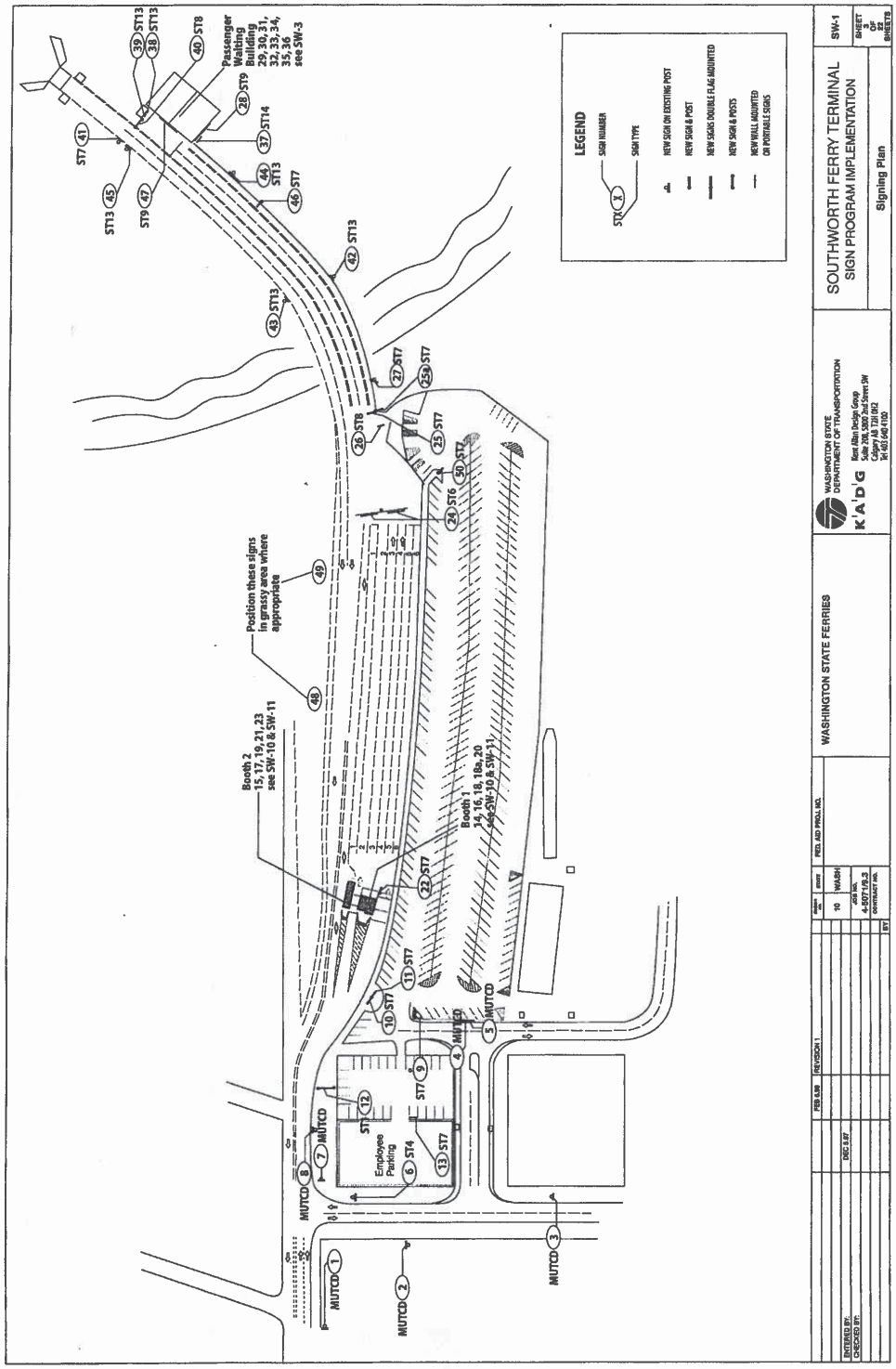
SIGN SCHEDULE

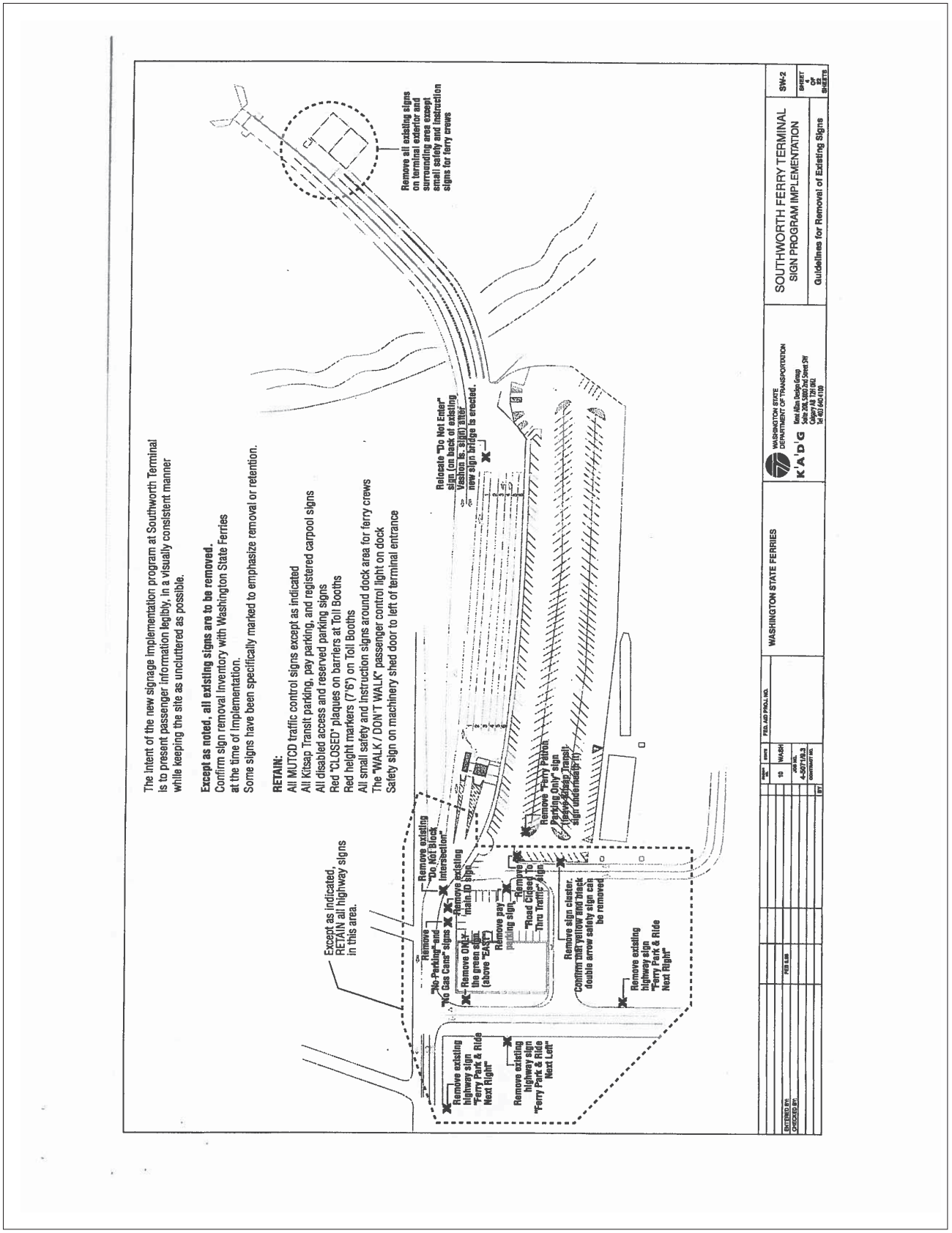
SW-I

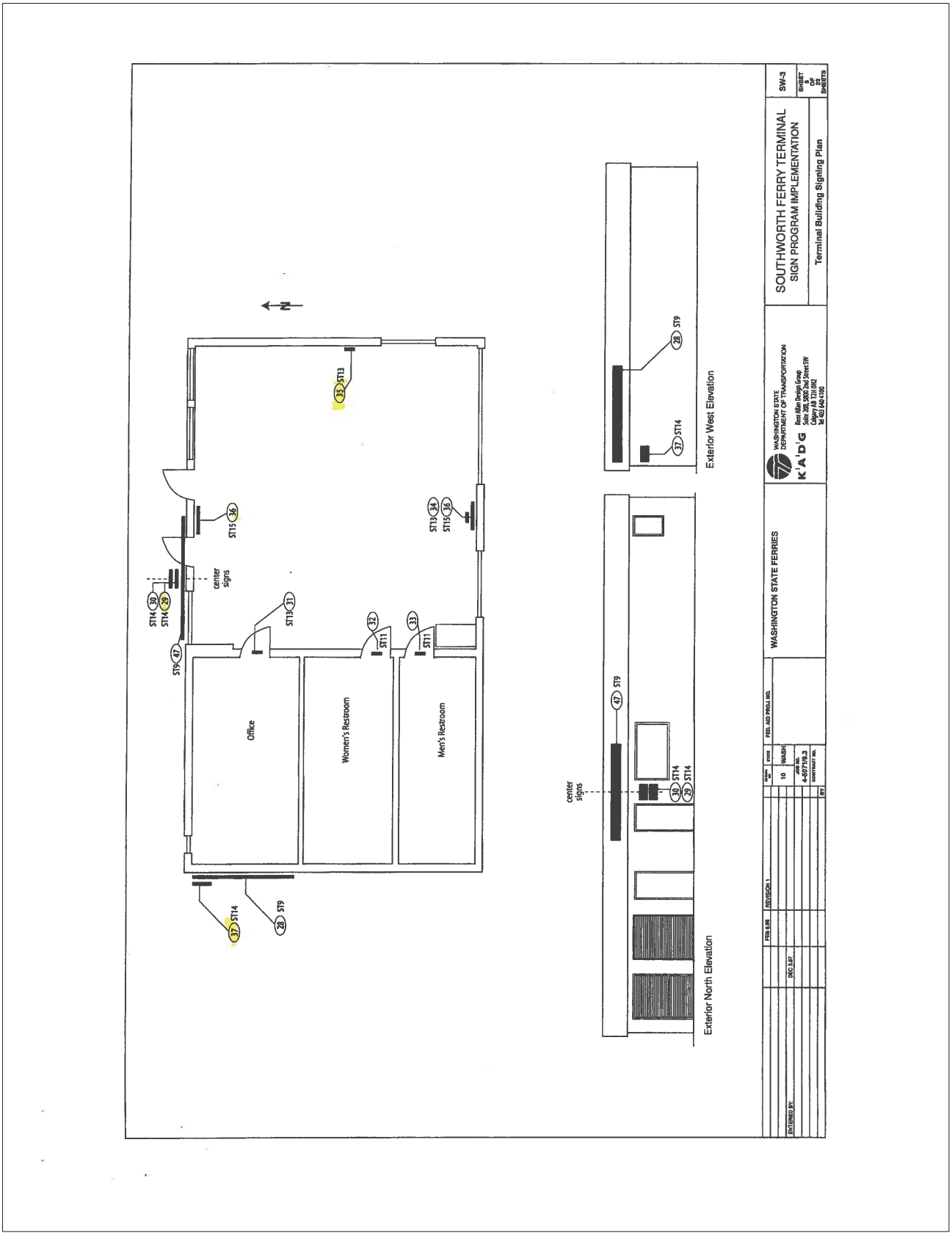
Signal	Sign Type	Message	Layout	Specs	Notes
26	ST 8	(Washington State Ferries symbol) Expect schedule delays	SW-14	SW-14-2	One of a variety of changeable message panels mounted on a portable sandwich board or similar mount, to be determined Other message panels to be added to inventory as required
27	ST 7	(no fishing symbol) No fishing from bridge and dock	SW-6	SW-6-1	Mount on existing pole
28	ST 9	(restrooms and accessibility symbols) Passenger Terminal	SW-18	SW-18-1	
29	ST 14	(accessibility symbol) Need Assistance? Call 1-800-84-FERRY in advance if you require assistance	SW-12	SW-12-1	Check phone number with WSF, mount below Sign 30
30	ST 14	(ticket purchase symbol) Transferring at Vashon? For assured boarding on the Vashon to Seattle passenger ferry, you must get a transfer from the toll booth. Failure to present a transfer may result in a refusal of service.	SW-12	SW-12-2	Mount above Sign 29
31	ST 13	(Do not enter symbol) AUTHORIZED PERSONNEL	SW-13	SW-13-4	Repaint door same colour as restroom doors
32	ST 11	(woman's restroom, baby change, accessibility symbols) WOMEN, braille	SW-19	SW-19-3	Repaint doors to eliminate large word "WOMEN"
33	ST 11	(man's restroom, baby change, accessibility symbols) MEN, braille	SW-19	SW-19-2	Repaint doors to eliminate large word "MEN"
34	ST 13	(no smoking symbol) NO SMOKING	SW-13	SW-13-2	Position above Sign 36
35	ST 13	(no smoking symbol) NO SMOKING	SW-13	SW-13-2	
36	ST 15	(information Display and Display Case)	SW-20	SW-20	Information display is on one wall of terminal, display case is on the other
37	ST 14	No smoking (no smoking symbol) No fishing (no fishing symbol) No skating (no skating symbol)	SW-12	SW-12-3	
38	ST 13	(flammable symbol) FLAMMABLE MATERIALS	SW-13	SW-13-4	Mount on door of yellow shed where gas cans are stored
39	ST 13	(gas can symbol) DISCARDED AFTER 24 HOURS	SW-13	SW-13-1	Mount beside Sign 38
40	ST 8 large WITH LED	Fuel/ferry proceed on green (ticket purchase symbol) Vashon passengers must pay fare at booth (No gas cans symbol) No gas cans aboard ferry	SW-15	SW-15-1	Read layout and mount with/without traffic light to be selected from SW-16
41	ST 7	(wait symbol) Wait for all traffic to clear before walking on bridge	SW-9	SW-9-1	To be determined if mounted on existing post or on new one
42	ST 13	(life buoy ring with rope symbol) LIFE BUOY RING	SW-13	SW-13-7	

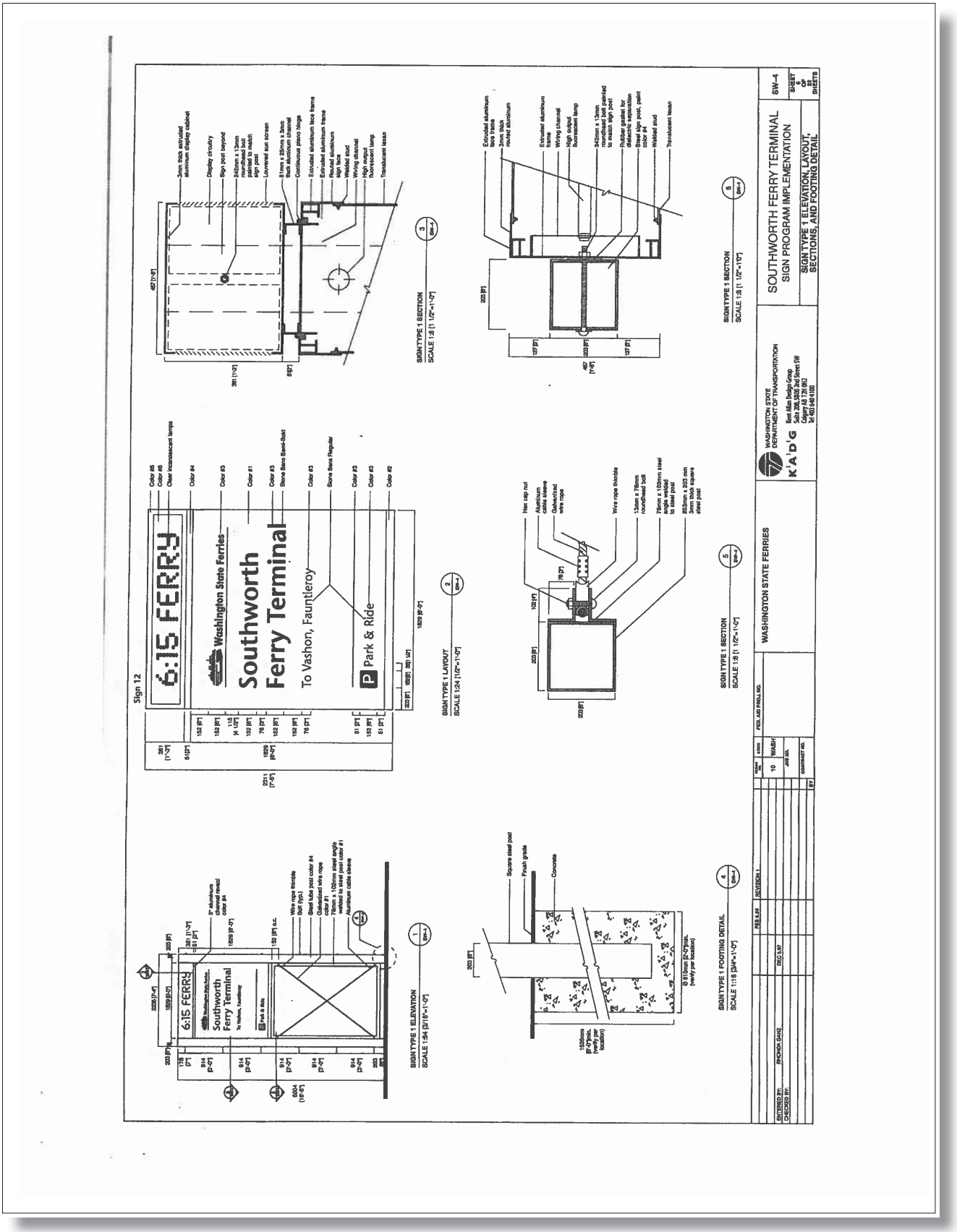
Signal	Sign Type	Message	Layout	Specs	Notes
43	ST 13	(life buoy ring with rope symbol) LIFE BUOY RING	SW-13	SW-13-7	
44	ST 13	(life buoy ring with rope symbol) LIFE BUOY RING	SW-13	SW-13-7	
45	ST 13	(life buoy ring with rope symbol) LIFE BUOY RING	SW-13	SW-13-7	
46	ST 7	(bus symbol) Kitsap transit	SW-9	SW-9-1	This sign is double-faced, mount details see SW-7-1 Apply vinyl graphics to both sides of sign
47	ST 9	(restrooms and accessibility symbols) Passenger Terminal	SW-18	SW-18-1	
48	ST 7	(clean up after your dog symbol) wording to come from Blum/WSF	SW-9	SW-9-1	Locate in appropriate grassy area at border of holding area Mount details see SW-7-1
49	ST 7	(clean up after your dog symbol) wording to come from Blum/WSF	SW-9	SW-9-1	Locate in appropriate grassy area at border of holding area Mount details see SW-7-1
50	ST7	(Washington State Ferries logo) Passenger drop off and pick up area	SW-9	SW-9-1	This sign is double-faced Apply vinyl graphics to both sides of sign Mount details see SW-7-1
NOTICES		Each toll booth requires two plexi-holders on each side of the booth, to display 11 x 17 notices. Total of eight plexi-holders on this site. See SW-10 and SW-11 for positioning guidelines.			

| | | |

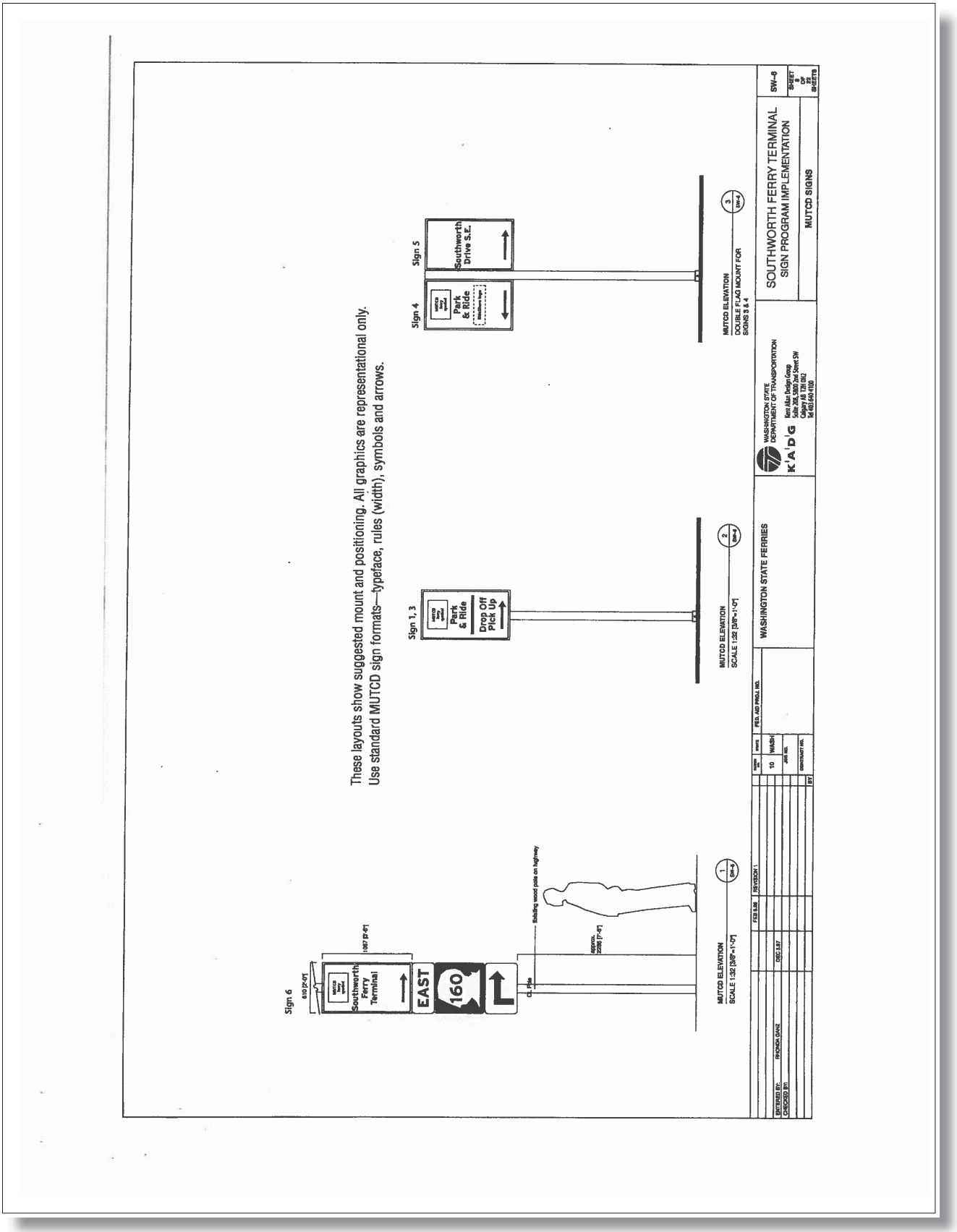

LEGEND
SIGN NUMBER
SIGN TYPE
NEW SIGN ON EXISTING POST
NEW SIGN & POST
NEW SIGNS DOUBLE FLAG MOUNTED
NEW SIGNS & POSTS
NEW WALL MOUNTED OR PORTABLE SIGNS
Passenger Waiting Building 29, 30, 31, 32, 33, 34, 35, 36 see SW-3
Position these signs in grassy area where appropriate
Booth 2 15, 17, 19, 21, 23 see SW-10 & SW-11
Booth 1 14, 16, 18, 18a, 20 see SW-10 & SW-11
Employee Parking
WASHINGTON STATE FERRIES
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
Signing Plan
SW-1
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
K'A'D'G

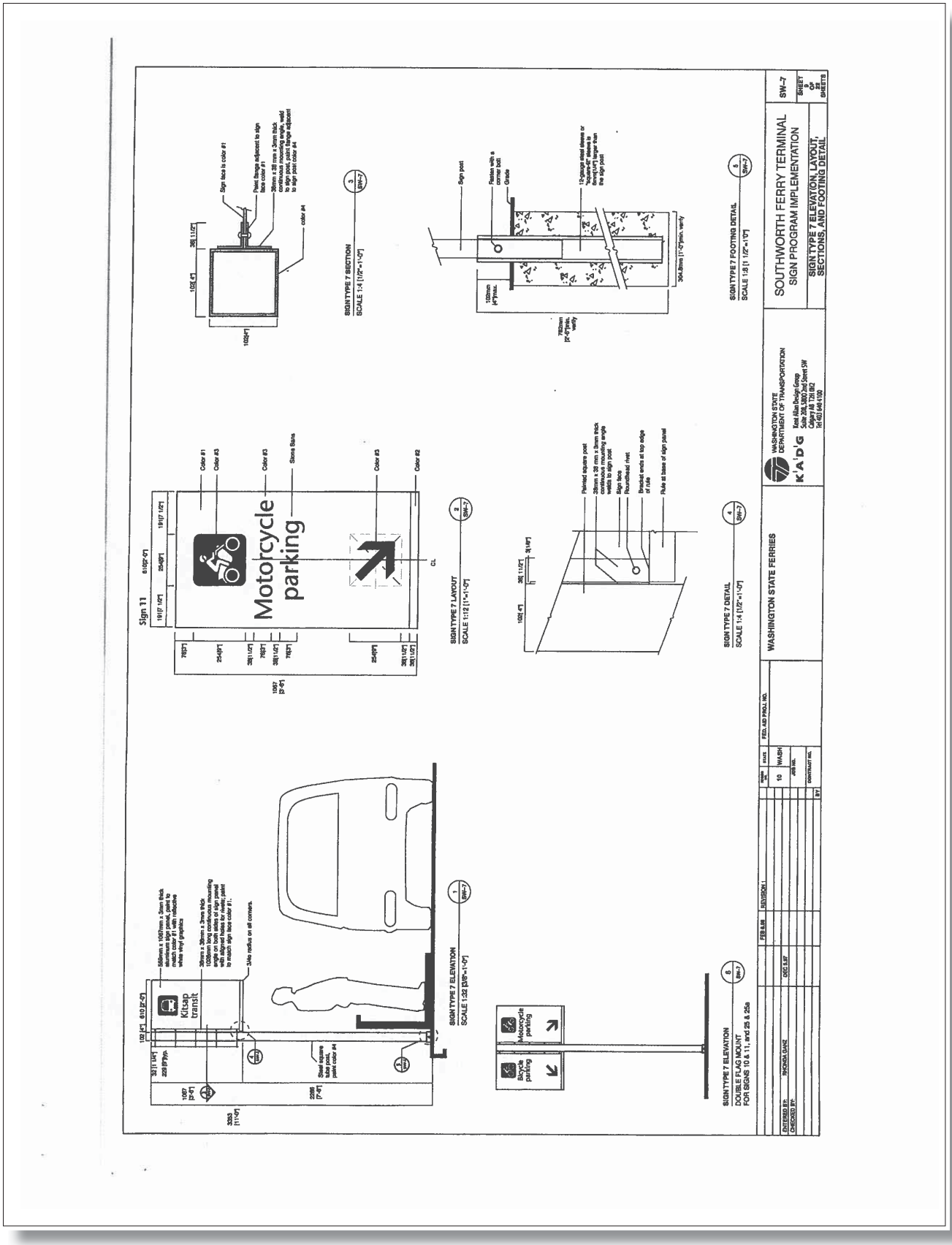

The intent of the new signage implementation program at Southworth Terminal is to present passenger information legibly, in a visually consistent manner while keeping the site as uncluttered as possible.
Except as noted, all existing signs are to be removed.
Confirm sign removal inventory with Washington State Ferries at the time of Implementation.
Some signs have been specifically marked to emphasize removal or retention.
RETAIN:
All MUTCD traffic control signs except as indicated
All Kitsap Transit parking, pay parking, and registered carpool signs
All disabled access and reserved parking signs
Red "CLOSED" plaques on barriers at Toll Booths
Red height markers (7'6") on Toll Booths
All small safety and instruction signs around dock area for ferry crews
The "WALK / DON'T WALK" passenger control light on dock
Safety sign on machinery shed door to left of terminal entrance
Except as indicated, RETAIN all highway signs in this area.
Remove all existing signs on terminal exterior and surrounding area except small safety and instruction signs for ferry crews
Relocate "Do Not Enter" sign (on back of existing Vashon Is. sign) after new sign bridge is erected.
Remove existing "Do Not Block Intersection"
Remove "No Parking" and "No Gas Cans" signs
Remove existing main ID sign
Remove ONLY the green sign (above "EXIT")
Remove pay parking sign
Remove "Road Closed To Thru Traffic" sign
Remove "Ferry Patron Parking Only" sign (leave Kitsap Transit sign underneath it)
Remove sign cluster. Confirm that yellow and black double arrow safety sign can be removed
Remove existing highway sign "Ferry Park & Ride Next Right"
Remove existing highway sign "Ferry Park & Ride Next Left"
Remove existing highway sign "Ferry Park & Ride Next Right"
WASHINGTON STATE FERRIES
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
K'A'D'G
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
Guidelines for Removal of Existing Signs
SW-2

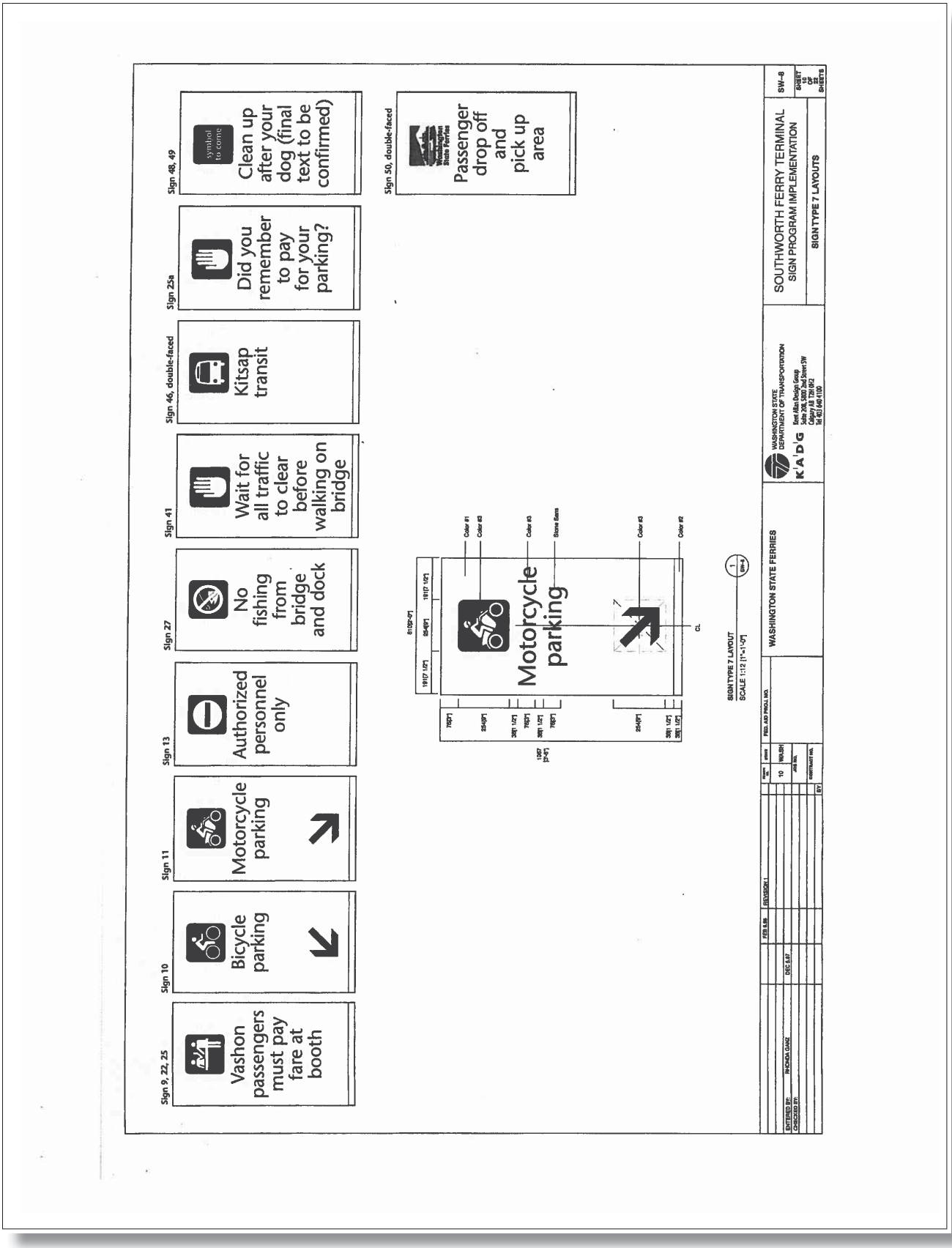

N
ST13
35
ST15
36
ST13
34
ST15
36
center
signs
30
ST14
29
ST14
ST13
31
32
ST11
33
ST11
47
ST9
Office
Women's Restroom
Men's Restroom
37
ST14
28
ST9
Exterior West Elevation
28
ST9
37
ST14
Exterior North Elevation
47
ST9
center
signs
30
ST14
29
ST14
WASHINGTON STATE FERRIES
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
Terminal Building Signing Plan
WASHINGTON STATE
DEPARTMENT OF TRANSPORTATION
K'A'D'G
SW-3

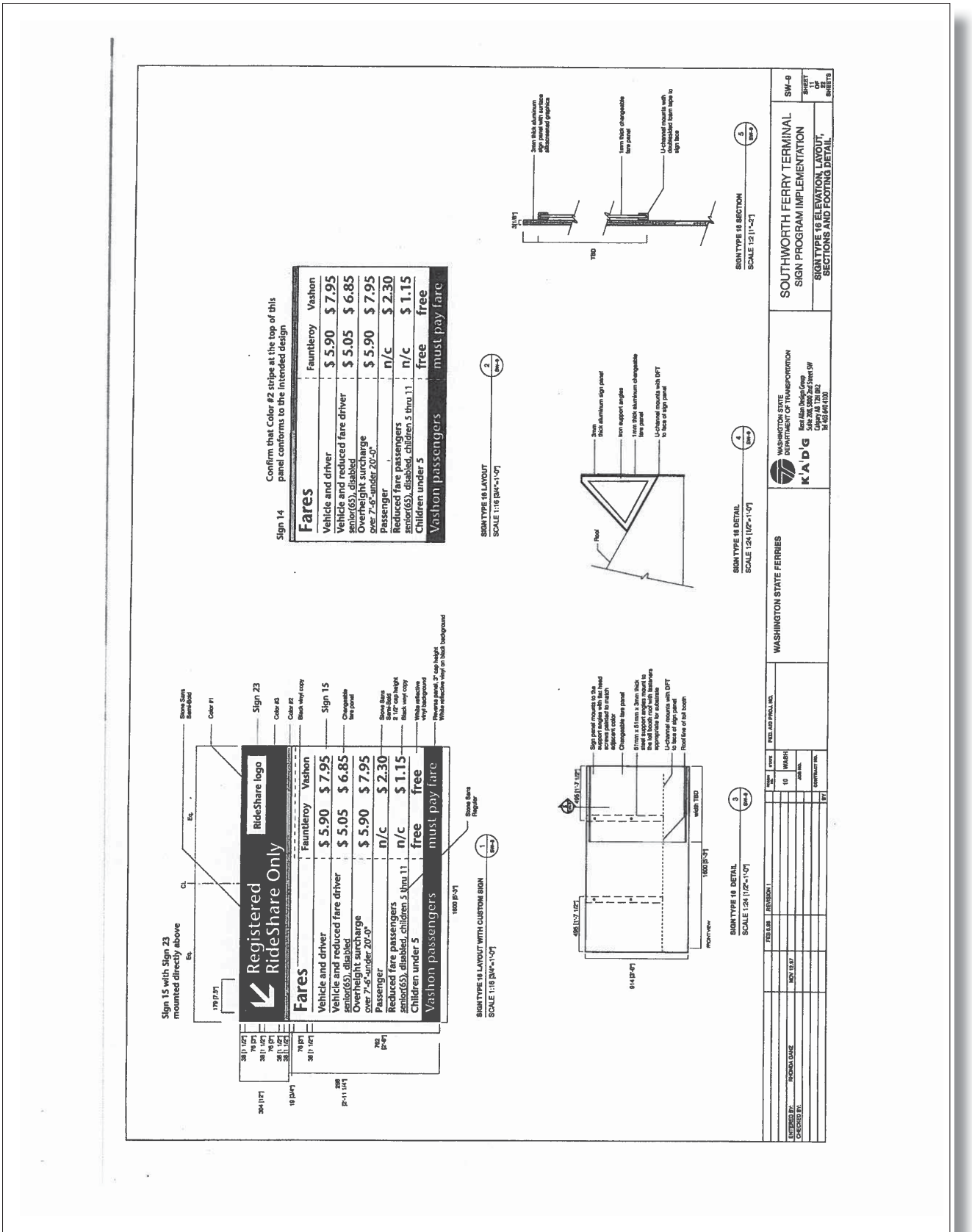

Sign 12
6:15 FERRY
Washington State Ferries
Southworth
Ferry Terminal
To Vashon, Fauntleroy
Park & Ride
SIGN TYPE 1 ELEVATION
SCALE 1:64 [3/16"=1'-0"]
SIGN TYPE 1 LAYOUT
SCALE 1:24 [1/2"=1'-0"]
SIGN TYPE 1 SECTION
SCALE 1:8 [1 1/2"=1'-0"]
SIGN TYPE 1 FOOTING DETAIL
SCALE 1:16 [3/4"=1'-0"]
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
SIGN TYPE 1 ELEVATION, LAYOUT, SECTIONS, AND FOOTING DETAIL
WASHINGTON STATE FERRIES
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
K'A'D'G
SW-4

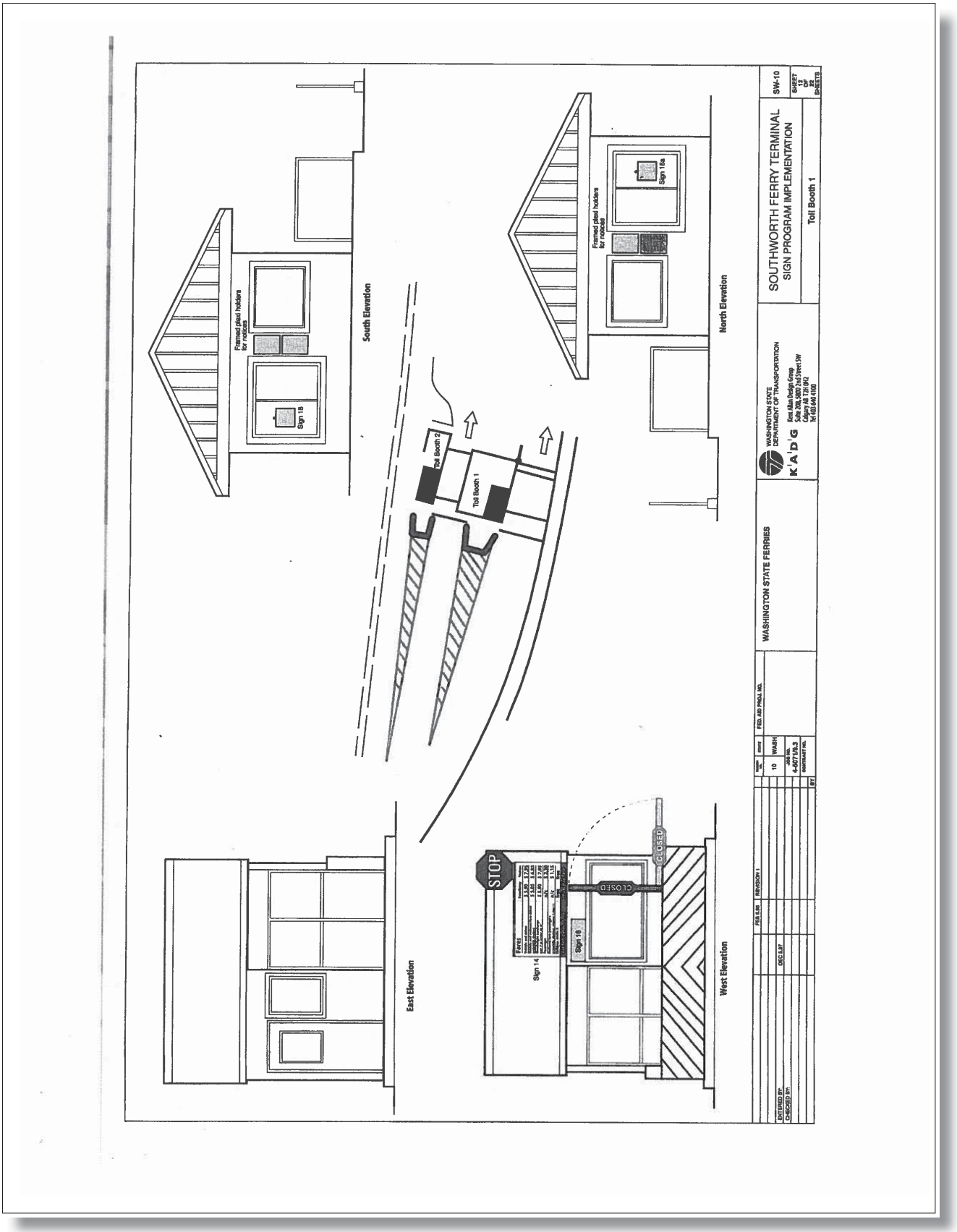
Sign 1 & 3
MUTCD ferry symbol
Park & Ride
Drop Off Pick Up
Sign 2
MUTCD ferry symbol
Park & Ride
Drop Off Pick Up
Sign 4
MUTCD ferry symbol
Park & Ride
RideShare logo
Sign 5
Southworth Drive S.E.
Sign 6
MUTCD ferry symbol
Southworth Ferry Terminal
Sign 7
No Drop Off or Pick Up ahead
1067 [3'-5"]
610 [2'-0"]
Sign 8
These layouts show size and suggested layout. All graphics are representational only.
Use standard MUTCD sign formats—typeface, rules (width), symbols and arrows.
WASHINGTON STATE FERRIES
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
K'A'D'G
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
MUTCD LAYOUTS
SW–5

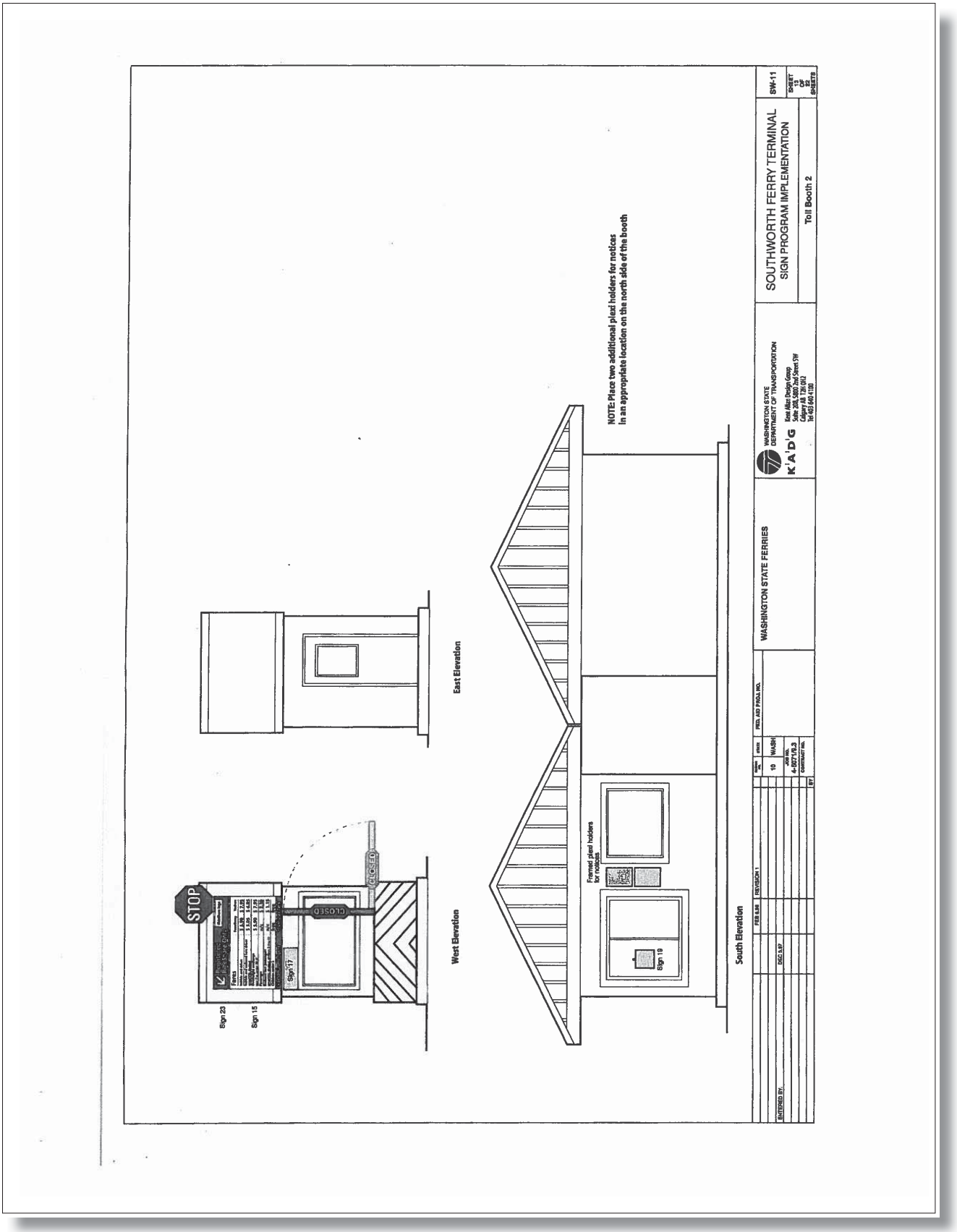

These layouts show suggested mount and positioning. All graphics are representational only.
Use standard MUTCD sign formats—typeface, rules (width), symbols and arrows.
Sign 6
Southworth Ferry Terminal
EAST
160
Sign 1, 3
Park & Ride
Drop Off Pick Up
Sign 4
Park & Ride
Sign 5
Southworth Drive S.E.
MUTCD ELEVATION
SCALE 1:32
MUTCD ELEVATION
DOUBLE FLAG MOUNT FOR SIGNS 3 & 4
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
MUTCD SIGNS
WASHINGTON STATE FERRIES
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
K'A'D'G
SW-6

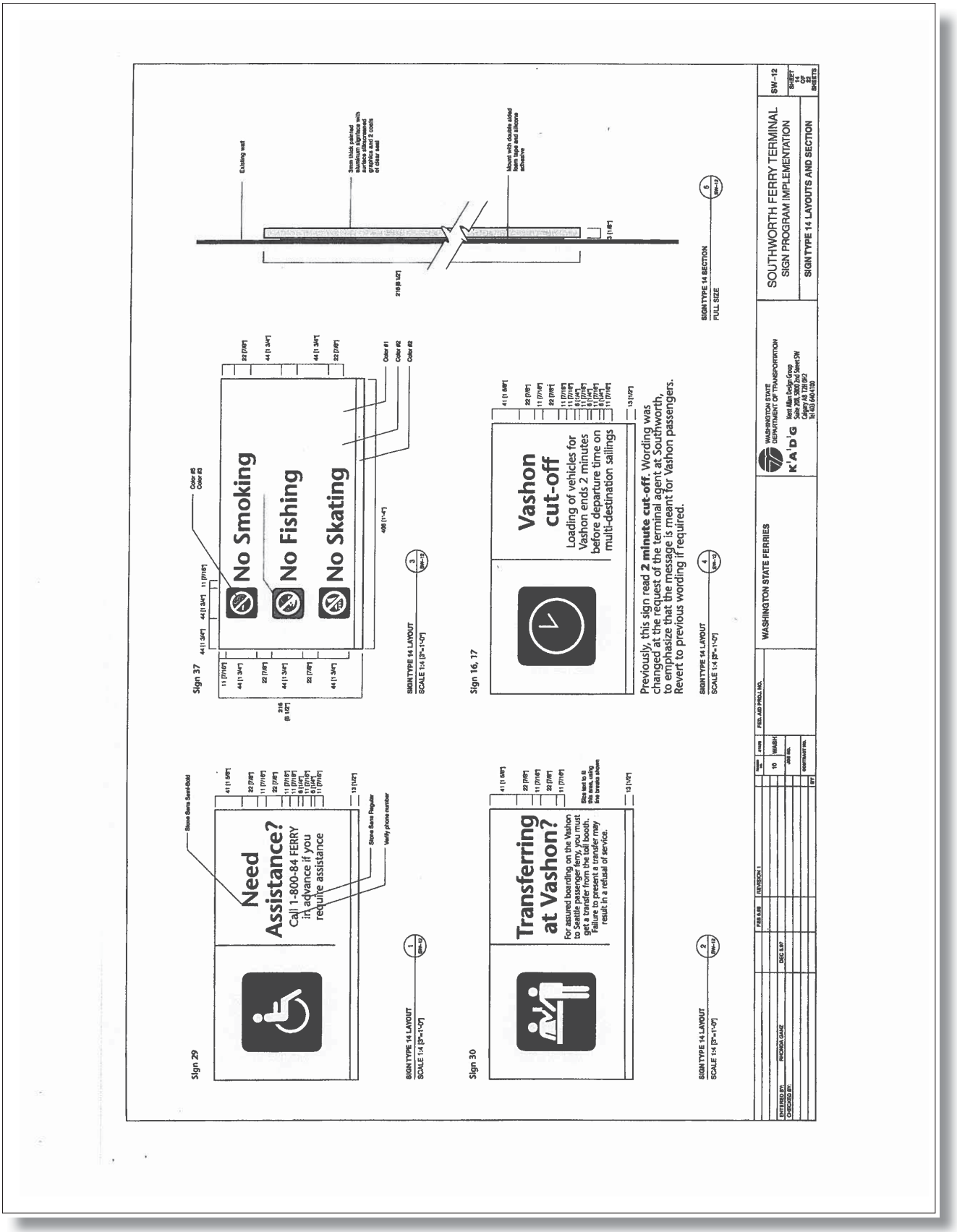

Motorcycle parking
Sign 11
Kitsap transit
SIGN TYPE 7 ELEVATION
SCALE 1:32 [3/8"=1'-0"]
SIGN TYPE 7 LAYOUT
SCALE 1:12 [1"=1'-0"]
SIGN TYPE 7 SECTION
SCALE 1:4 [1/2"=1'-0"]
SIGN TYPE 7 DETAIL
SCALE 1:4 [1/2"=1'-0"]
SIGN TYPE 7 FOOTING DETAIL
SCALE 1:8 [1 1/2"=1'-0"]
SIGN TYPE 7 ELEVATION
DOUBLE FLAG MOUNT
FOR SIGNS 10 & 11, and 25 & 25a
WASHINGTON STATE FERRIES
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
SIGN TYPE 7 ELEVATION, LAYOUT, SECTIONS, AND FOOTING DETAIL
SW-7

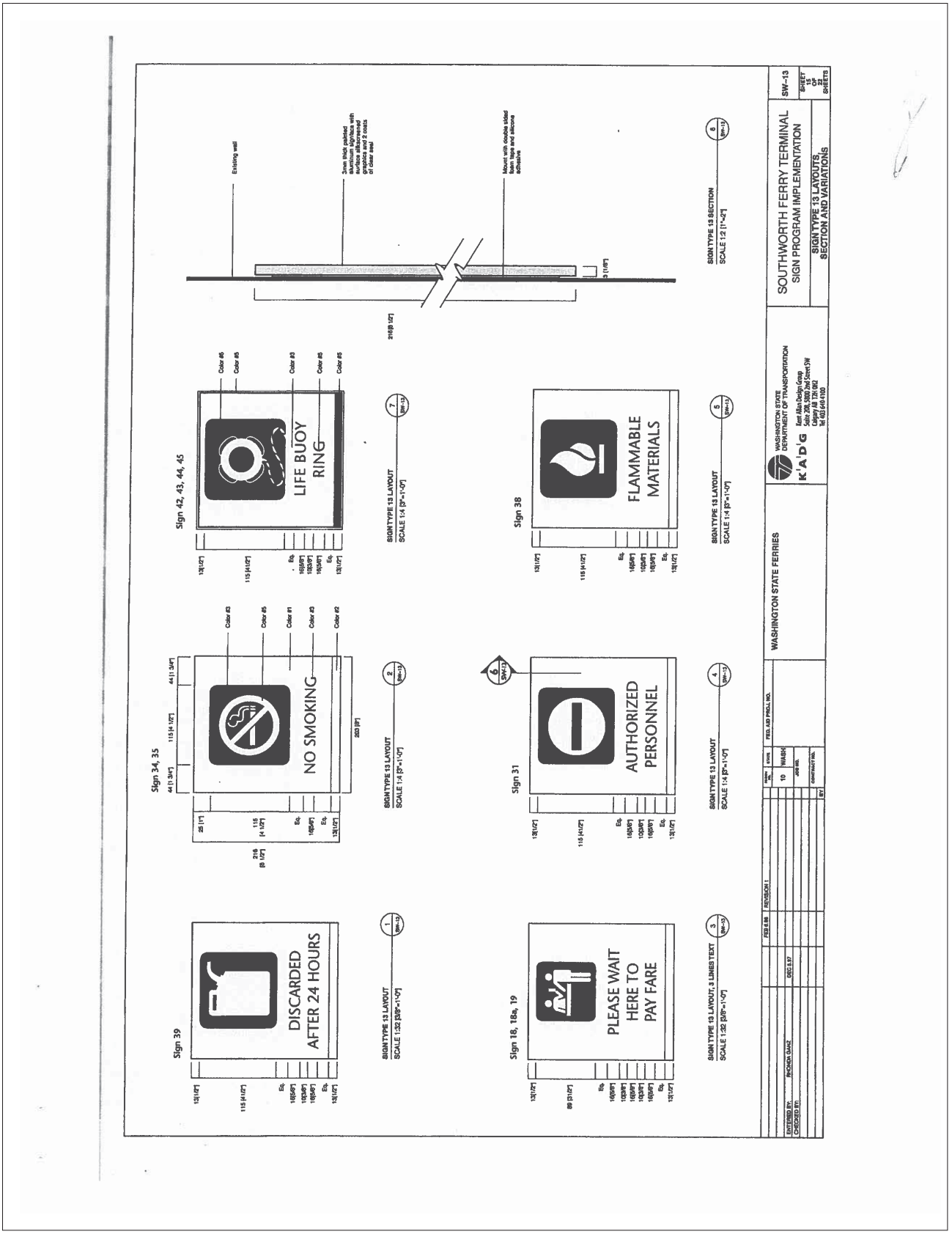

Sign 9, 22, 25
Vashon passengers must pay fare at booth
Sign 10
Bicycle parking
Sign 11
Motorcycle parking
Sign 13
Authorized personnel only
Sign 27
No fishing from bridge and dock
Sign 41
Wait for all traffic to clear before walking on bridge
Sign 46, double-faced
Kitsap transit
Sign 25a
Did you remember to pay for your parking?
Sign 48, 49
symbol to come
Clean up after your dog (final text to be confirmed)
Sign 50, double-faced
Passenger drop off and pick up area
Motorcycle parking
Color #1
Color #3
Color #3
Stone Bans
Color #3
Color #2
SIGN TYPE 7 LAYOUT
SCALE 1:12 [1"=1'-0"]
WASHINGTON STATE FERRIES
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
SIGN TYPE 7 LAYOUTS
SW-8

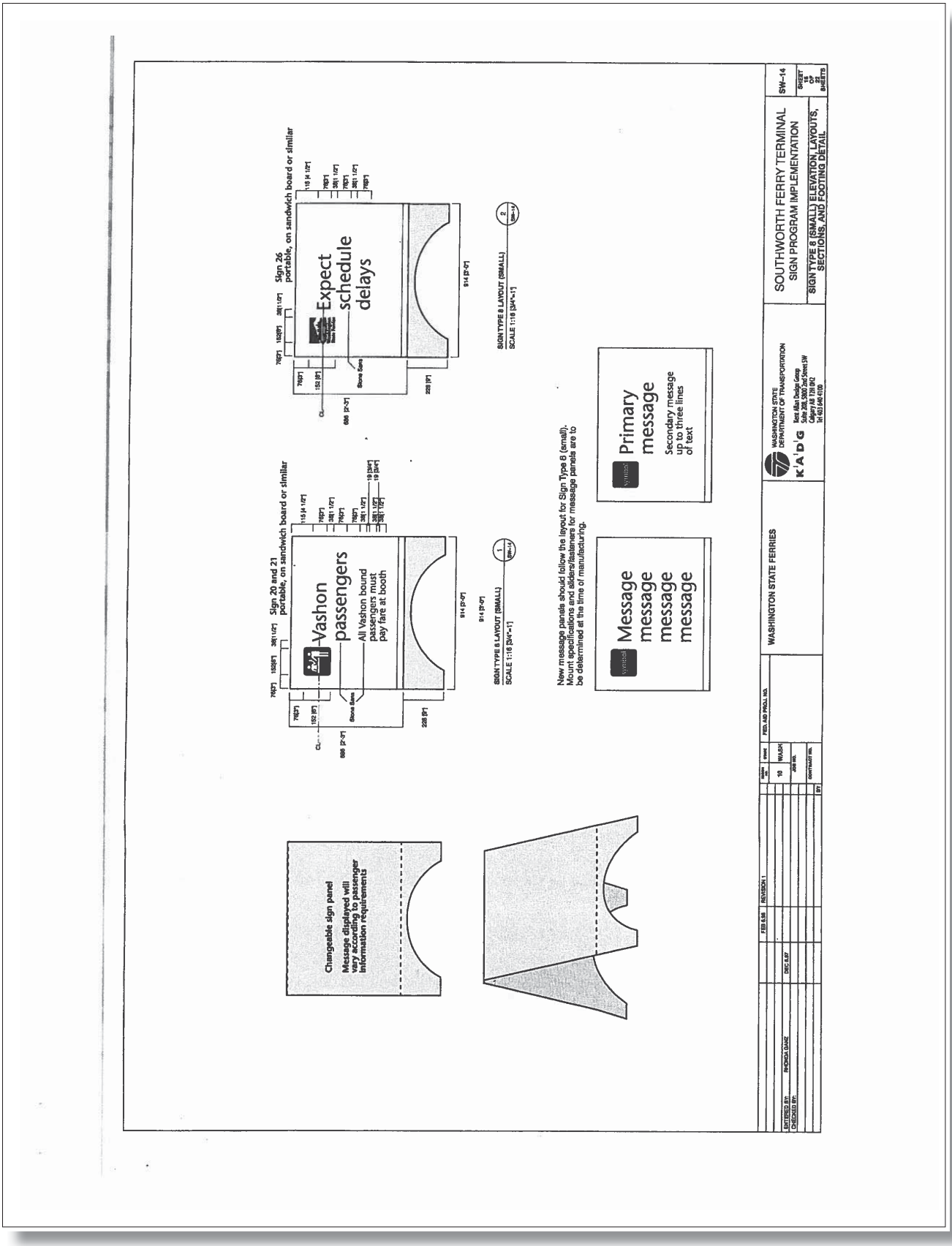

Sign 15 with Sign 23 mounted directly above
Registered RideShare Only
RideShare logo
Sign 23
Sign 15
Fares
Fauntleroy Vashon
Vehicle and driver $ 5.90 $ 7.95
Vehicle and reduced fare driver $ 5.05 $ 6.85
Overheight surcharge over 7'-6"-under 20'-0" $ 5.90 $ 7.95
Passenger n/c $ 2.30
Reduced fare passengers n/c $ 1.15
Children under 5 free free
Vashon passengers must pay fare
Sign 14
Confirm that Color #2 strips at the top of this panel conforms to the intended design
SIGN TYPE 16 LAYOUT WITH CUSTOM SIGN
SIGN TYPE 16 LAYOUT
SIGN TYPE 16 DETAIL
SIGN TYPE 16 SECTION
WASHINGTON STATE FERRIES
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
SIGN TYPE 16 ELEVATION, LAYOUT, SECTIONS AND FOOTING DETAIL
SW-9

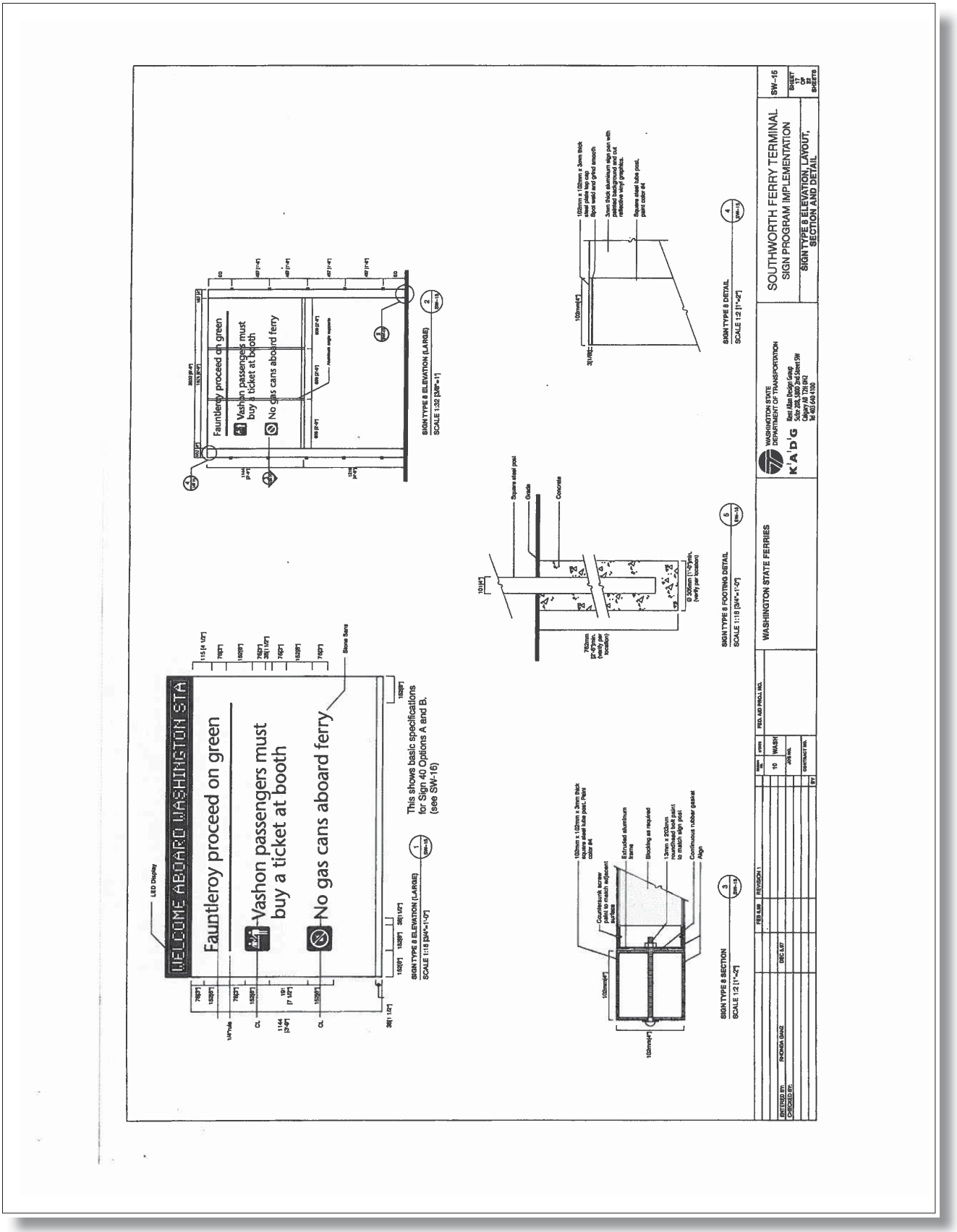

South Elevation
Framed plexi holders for notices
Sign 18
Toll Booth 2
Toll Booth 1
North Elevation
Framed plexi holders for notices
Sign 18a
East Elevation
Sign 14
Fares
STOP
CLOSED
CLOSED
Sign 16
West Elevation
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
Toll Booth 1
SW-10
WASHINGTON STATE FERRIES
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
K'A'D'G

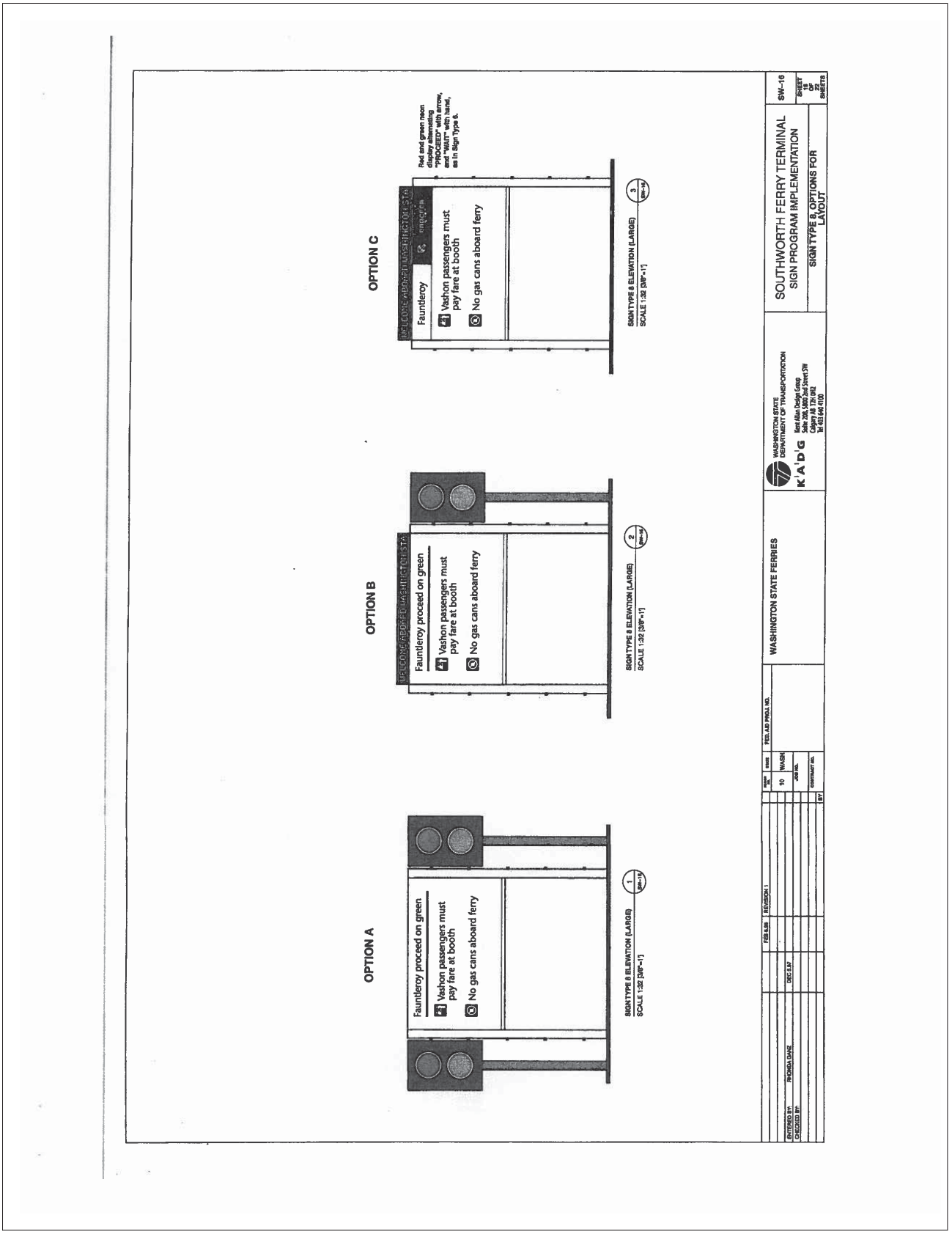

NOTE: Place two additional plexi holders for notices
in an appropriate location on the north side of the booth
East Elevation
West Elevation
South Elevation
Framed plexi holders for notices
Sign 19
Sign 17
Sign 23
Sign 15
STOP
CLOSED
WASHINGTON STATE FERRIES
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
Toll Booth 2
SW-11
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
K'A'D'G

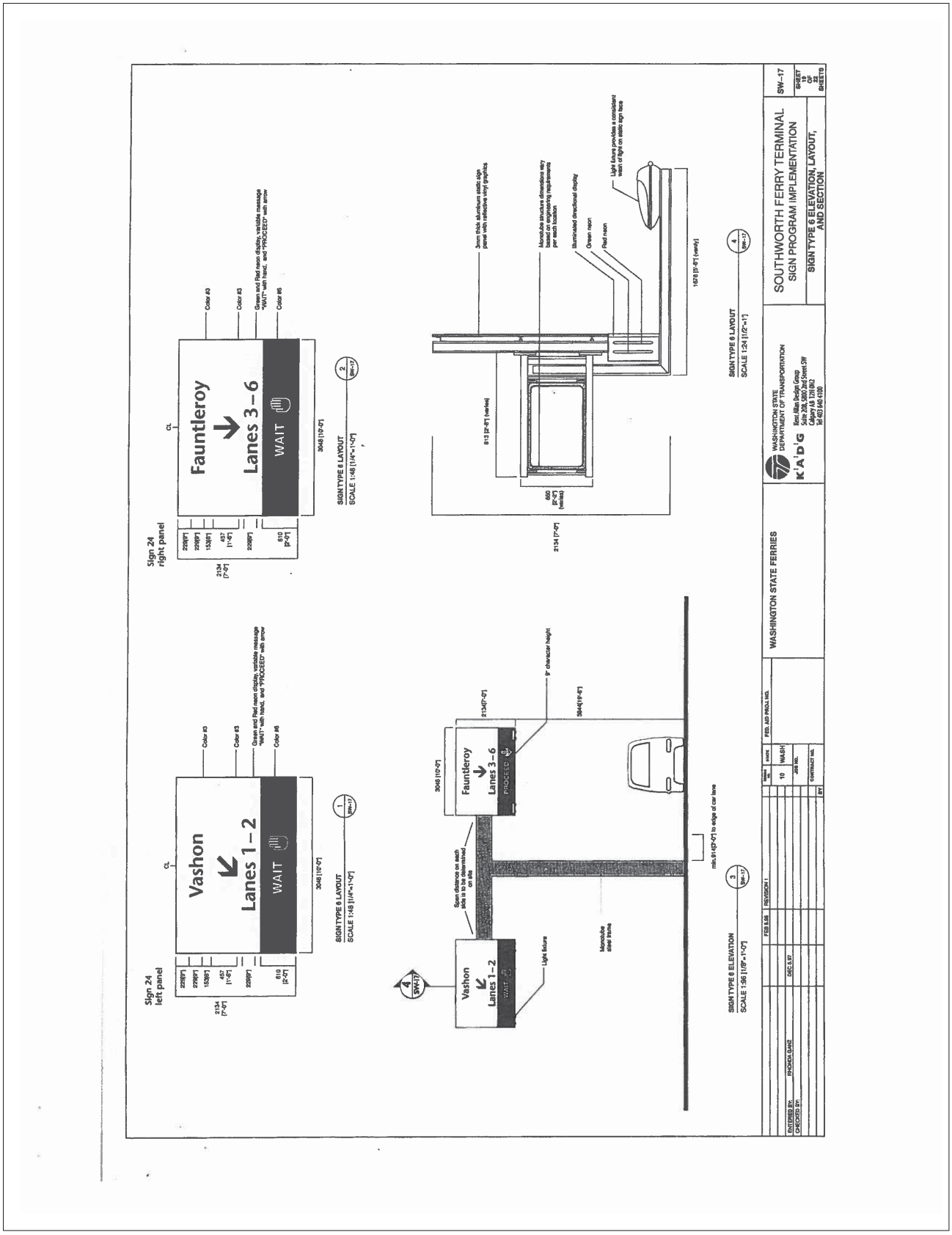

Sign 29
Need Assistance?
Call 1-800-84 FERRY in advance if you require assistance
Sign 30
Transferring at Vashon?
For assured boarding on the Vashon to Seattle passenger ferry, you must get a transfer from the toll booth. Failure to present a transfer may result in a refusal of service.
Sign 37
No Smoking
No Fishing
No Skating
Sign 16, 17
Vashon cut-off
Loading of vehicles for Vashon ends 2 minutes before departure time on multi-destination sailings
Previously, this sign read 2 minute cut-off. Wording was changed at the request of the terminal agent at Southworth, to emphasize that the message is meant for Vashon passengers. Revert to previous wording if required.
SIGN TYPE 14 LAYOUT SCALE 1:4 [3"=1'-0"]
SIGN TYPE 14 SECTION FULL SIZE
Existing wall
Mount with double sided foam tape and silicone adhesive
WASHINGTON STATE FERRIES
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
K'A'D'G
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
SIGN TYPE 14 LAYOUTS AND SECTION
SW-12

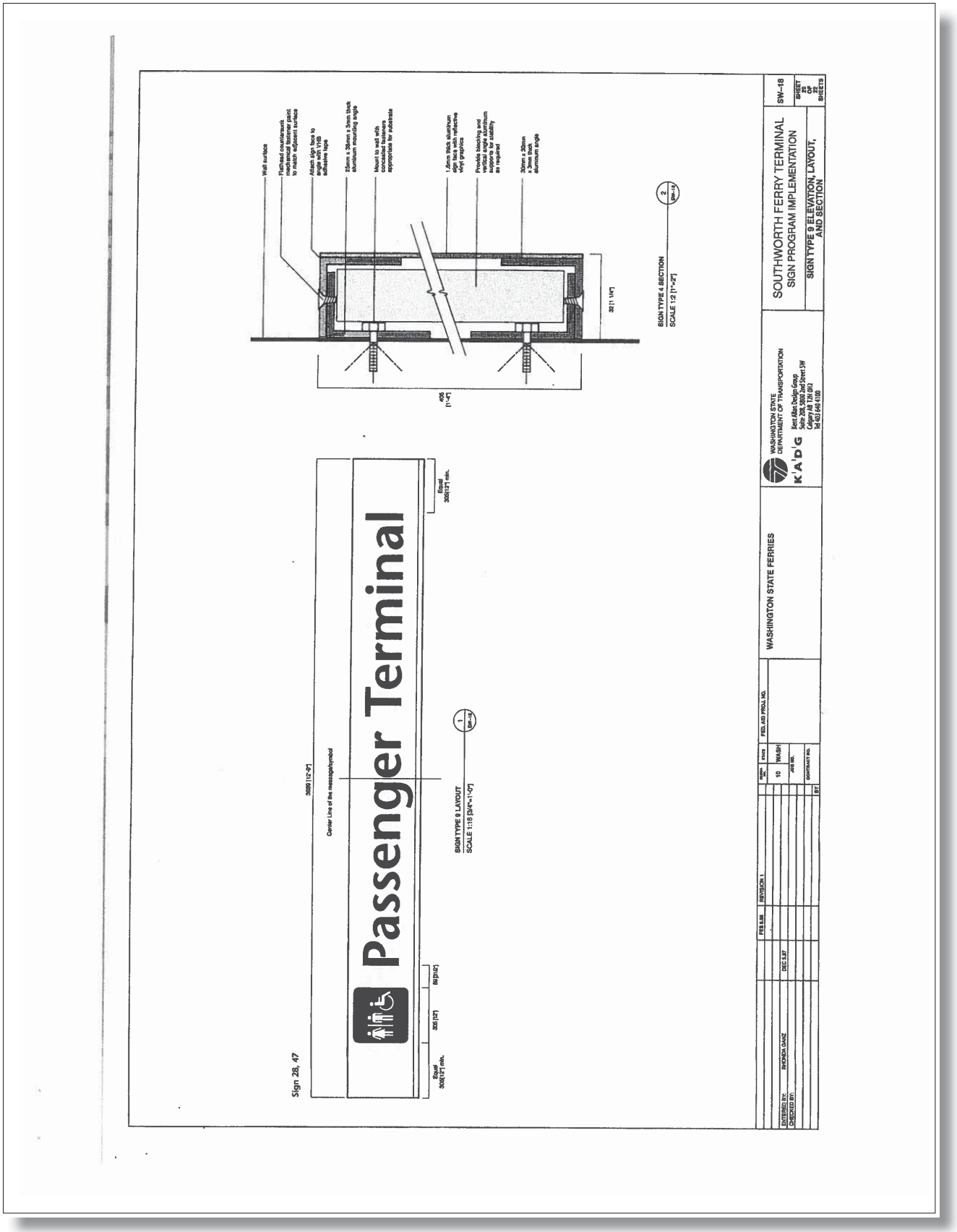

Sign 39
DISCARDED AFTER 24 HOURS
SIGN TYPE 13 LAYOUT
SCALE 1:32 [3/8"=1'-0"]
Sign 34, 35
NO SMOKING
SIGN TYPE 13 LAYOUT
SCALE 1:4 [3"=1'-0"]
Sign 18, 18a, 19
PLEASE WAIT HERE TO PAY FARE
SIGN TYPE 13 LAYOUT, 3 LINES TEXT
SCALE 1:32 [3/8"=1'-0"]
Sign 31
AUTHORIZED PERSONNEL
SIGN TYPE 13 LAYOUT
SCALE 1:4 [3"=1'-0"]
Sign 38
FLAMMABLE MATERIALS
SIGN TYPE 13 LAYOUT
SCALE 1:4 [3"=1'-0"]
Sign 42, 43, 44, 45
LIFE BUOY RING
SIGN TYPE 13 LAYOUT
SCALE 1:4 [3"=1'-0"]
Existing wall
3mm thick painted aluminum signface with screen printed graphics and 2 coats of clear seal
Mount with double sided foam tape and silicone adhesive
SIGN TYPE 13 SECTION
SCALE 1:2 [1"=1'-0"]
WASHINGTON STATE FERRIES
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
SIGN TYPE 13 LAYOUTS, SECTION AND VARIATIONS
SW-13

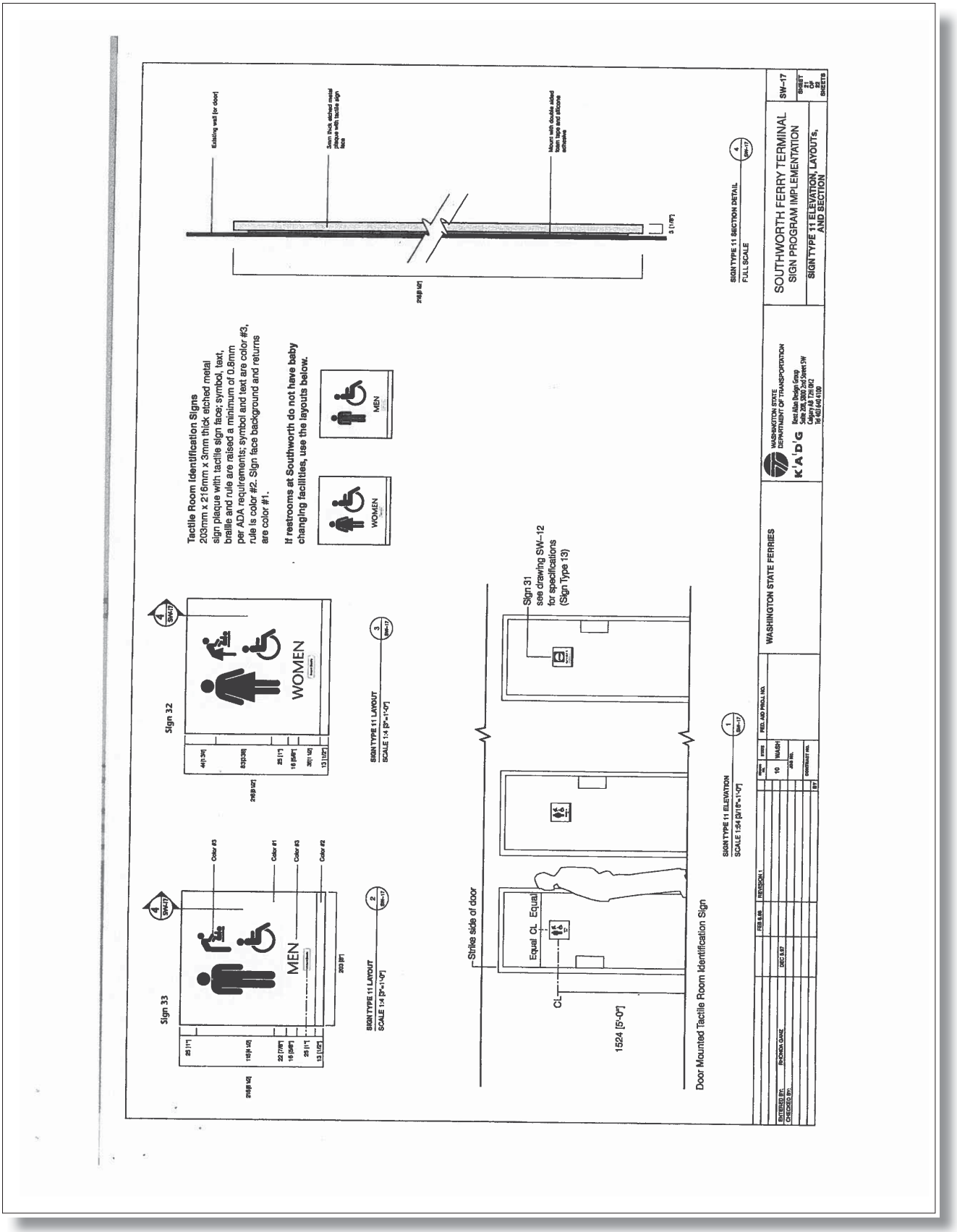

Changeable sign panel
Message displayed will vary according to passenger information requirements
Sign 20 and 21 portable, on sandwich board or similar
Vashon passengers
All Vashon bound passengers must pay fare at booth
Sign 26 portable, on sandwich board or similar
Expect schedule delays
SIGN TYPE 8 LAYOUT (SMALL)
SCALE 1:10
SIGN TYPE 8 LAYOUT (SMALL)
SCALE 1:10
New message panels should follow the layout for Sign Type 8 (small). Mount specifications and sliders/fasteners for message panels are to be determined at the time of manufacturing.
Message message message message
Primary message
Secondary message up to three lines of text
WASHINGTON STATE FERRIES
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
K'A'D'G
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
SIGN TYPE 8 (SMALL) ELEVATION, LAYOUTS, SECTIONS, AND FOOTING DETAIL
SW-14

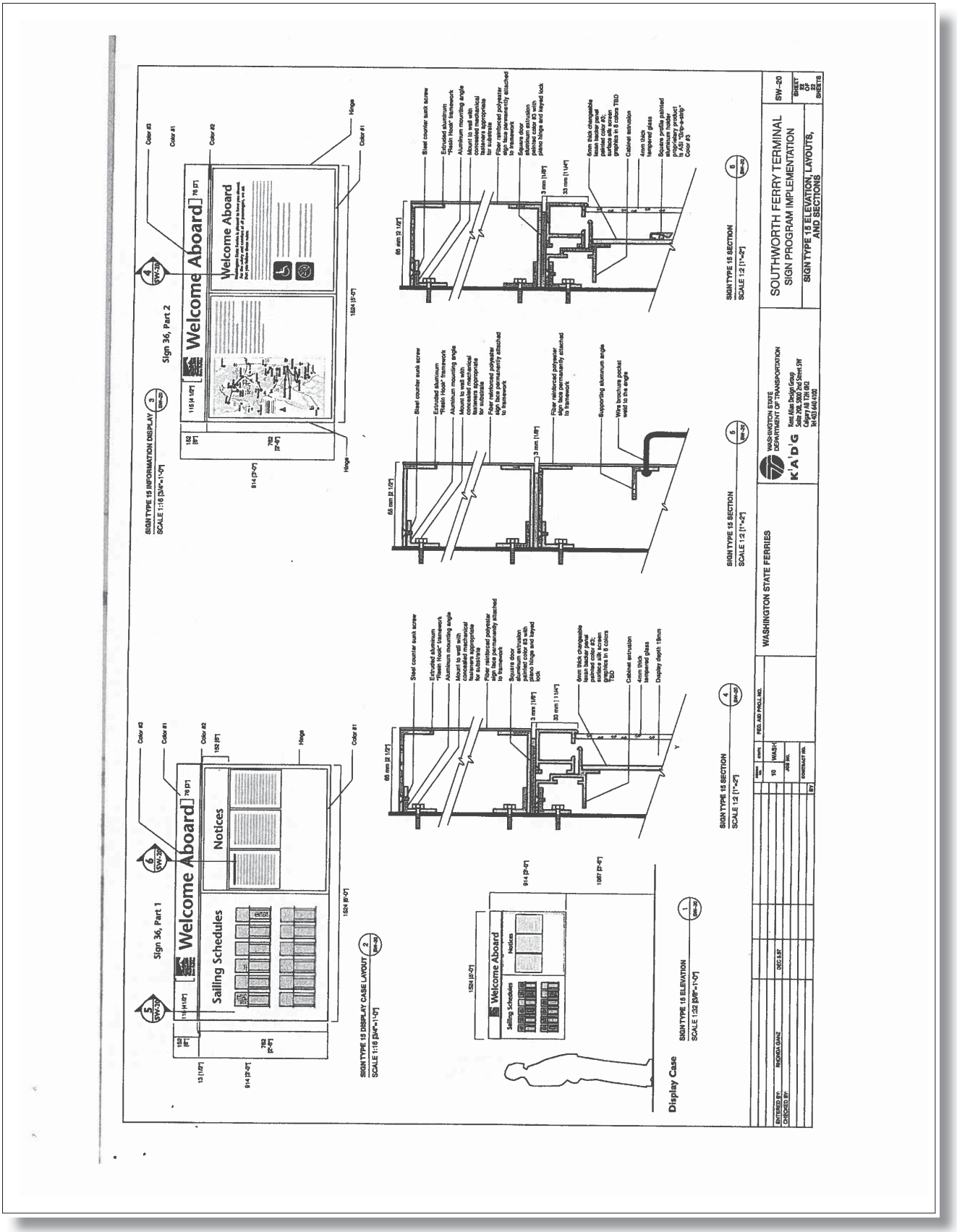

WELCOME ABOARD WASHINGTON STA
LED Display
Fauntleroy proceed on green
Vashon passengers must buy a ticket at booth
No gas cans aboard ferry
Stone Sans
This shows basic specifications for Sign 40 Options A and B. (see SW-16)
SIGN TYPE B ELEVATION (LARGE)
SCALE 1:10 [3/4"=1'-0"]
SIGN TYPE B ELEVATION (LARGE)
SCALE 1:32 [3/8"=1']
SIGN TYPE B SECTION
SCALE 1:2 [1"=2"]
SIGN TYPE B FOOTING DETAIL
SCALE 1:10 [3/4"=1'-0"]
SIGN TYPE B DETAIL
SCALE 1:2 [1"=2"]
Square steel post
Grade
Concrete
Extruded aluminum frame
Blocking as required
Continuous rubber gasket
Align
WASHINGTON STATE FERRIES
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
K'A'D'G
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
SIGN TYPE B ELEVATION, LAYOUT, SECTION AND DETAIL
SW-16


OPTION A
Faunteroy proceed on green
Vashon passengers must pay fare at booth
No gas cans aboard ferry
SIGN TYPE B ELEVATION (LARGE)
SCALE 1:32 [36"=1']
OPTION B
Faunteroy proceed on green
Vashon passengers must pay fare at booth
No gas cans aboard ferry
SIGN TYPE B ELEVATION (LARGE)
SCALE 1:32 [36"=1']
OPTION C
Faunteroy
Vashon passengers must pay fare at booth
No gas cans aboard ferry
Red and green neon display alternating "PROCEED" with arrow, and "WAIT" with hand, as in Sign Type 8.
SIGN TYPE B ELEVATION (LARGE)
SCALE 1:32 [36"=1']
WASHINGTON STATE FERRIES
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
K'A'D'G
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
SIGN TYPE 8, OPTIONS FOR LAYOUT
SW-16


Sign 24
left panel
Vashon
Lanes 1 – 2
WAIT
Sign 24
right panel
Fauntleroy
Lanes 3 – 6
WAIT
SIGN TYPE 6 LAYOUT
SCALE 1:48 [1/4"=1'-0"]
SIGN TYPE 6 ELEVATION
SCALE 1:96 [1/8"=1'-0"]
SIGN TYPE 6 LAYOUT
SCALE 1:24 [1/2"=1']
WASHINGTON STATE FERRIES
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
SIGN TYPE 6 ELEVATION, LAYOUT, AND SECTION
SW-17


Passenger Terminal
Sign 28, 47
Center Line of the message/symbol
SIGN TYPE 9 LAYOUT
SCALE 1:16 [3/4"=1'-0"]
SIGN TYPE 4 SECTION
SCALE 1:2 [1"=2"]
Wall surface
Flathead countersunk mechanical fastener paint to match adjacent surface
Attach sign face to angle with VHB adhesive tape
25mm x 38mm x 3mm thick aluminum mounting angle
Mount to wall with concealed fasteners appropriate for substrate
1.5mm thick aluminum sign face with reflective vinyl graphics
Provide blocking and vertical angle aluminum supports for stability as required
30mm x 30mm x 3mm thick aluminum angle
WASHINGTON STATE FERRIES
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
K'A'D'G
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
SIGN TYPE 9 ELEVATION, LAYOUT, AND SECTION
SW-18
SHEET 23 OF 22 SHEETS
ENTERED BY: RHONDA GANZ
CHECKED BY:
REVISION 1
FED. AID PROJ. NO.
10
WASH
JOB NO.
CONTRACT NO.
BY


Tactile Room Identification Signs
203mm x 216mm x 3mm thick etched metal sign plaque with tactile sign face; symbol, text, braille and rule are raised a minimum of 0.8mm per ADA requirements; symbol and text are color #3, rule is color #2. Sign face background and returns are color #1.
If restrooms at Southworth do not have baby changing facilities, use the layouts below.
WOMEN
MEN
Sign 32
Sign 33
Color #3
Color #1
Color #2
SIGN TYPE 11 LAYOUT
SCALE 1:4 [3"=1'-0"]
SIGN TYPE 11 ELEVATION
SCALE 1:64 [3/16"=1'-0"]
SIGN TYPE 11 SECTION DETAIL
FULL SCALE
Existing wall (or door)
3mm thick etched metal plaque with tactile sign face
Mount with double sided foam tape and silicone sealants
Sign 31
see drawing SW-12
for specifications
(Sign Type 13)
Strike side of door
Equal
Equal
CL
CL
1524 [5'-0"]
Door Mounted Tactile Room Identification Sign
WASHINGTON STATE FERRIES
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
SIGN TYPE 11 ELEVATION, LAYOUTS, AND SECTION
SW-17
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
K'A'D'G


Welcome Aboard
Sailing Schedules
Notices
Sign 36, Part 1
Sign 36, Part 2
SIGN TYPE 15 DISPLAY CASE LAYOUT
SIGN TYPE 15 INFORMATION DISPLAY
SIGN TYPE 15 ELEVATION
SIGN TYPE 15 SECTION
Display Case
WASHINGTON STATE FERRIES
SOUTHWORTH FERRY TERMINAL
SIGN PROGRAM IMPLEMENTATION
SIGN TYPE 15 ELEVATION, LAYOUTS, AND SECTIONS
SW-20

Appendix U Design/Project Development Approval Templates

Appendix U contains Cover sheet templates for Design and Project Development Approval efforts described in Chapter 220.

Design Approval

Project Title Line 1
Project Title Line 2
Project Title Line 3

XL0000 WIN-M00000A PIN-900000A

Month 20XX

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
Ferries Division – Terminal Engineering
Seattle, Washington

Project Engineer, P.E.
Project Engineer

Project Manager, P.E.
Project Manager

Design Approval:

Date _____

By _____, P.E.
Assistant State Design Engineer

Place PE Stamp Below, Sign & Date

Design Concurrence:

Date _____

By _____ , P.E.
Marine Project Engineer

Date _____

By _____ , P.E.
Engineering Manager

Date_____

By _____ , P.E.
Director of Terminal Engineering

Date_____

By _____
Operations Director

Thru _____
Operations/Terminal Engineering Liaison

Washington State Department of Transportation

Washington State Ferries

Project Development Approval

Project Title Line 1
Project Title Line 2
Project Title Line 3

XL0000 WIN-M00000A PIN-900000A

Month 20XX

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
Ferries Division – Terminal Engineering
Seattle, Washington

Project Engineer, P.E.
Project Engineer

Project Manager, P.E.
Project Manager

Project Development Approval:

Date _____

By _____, P.E.
Assistant State Design Engineer

Place PE Stamp Below, Sign & Date

Design Concurrence:

Date _____

By _____, P.E.
Marine Project Engineer

Date _____

By _____, P.E.
Engineering Manager

Date _____

By _____, P.E.
Director of Terminal Engineering

Date _____

By _____
Operations Director

Thru _____
Operations/Terminal Engineering Liaison

Washington State Department of Transportation

Washington State Ferries

Design/Project Development Approval

Project Title Line 1
Project Title Line 2
Project Title Line 3

XL0000 WIN-M00000A PIN-900000A

Month 20XX

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
Ferries Division – Terminal Engineering
Seattle, Washington

Project Engineer, P.E.
Project Engineer

Project Manager, P.E.
Project Manager

Design/Project Development Approval:

Date _____

By _____, P.E.
Assistant State Design Engineer

Place PE Stamp Below, Sign & Date

Design Concurrence:

Date _____

By _____, P.E.
Marine Project Engineer

Date _____

By _____, P.E.
Engineering Manager

Date_____

By _____, P.E.
Director of Terminal Engineering

Date_____

By _____
Operations Director

Thru _____
Operations/Terminal Engineering Liaison

Washington State Department of Transportation

Washington State Ferries

Appendix V

Memorandum of Understanding Arts in Public Places Washington Arts Commission and Washington State Department of Transportation

Appendix V contains the Memo of Understanding between WSDOT and WAC regarding incorporating art in public projects. See also Chapter 470.

Memorandum of Understanding
Arts in Public Places

Washington Arts Commission
and
Washington State Department of Transportation

Whereas, per RCW 17.200, each state agency is required to set aside one-half of one percent of the funds to be expended on the original construction of public buildings for acquisition of works of art, and

Whereas, per the 18th Amendment to the States Constitution, Motor Vehicle Funds are restricted to use for highway purposes only, and

Whereas, per RCW 43.17.210, the Washington Arts Commission has the responsibility for determining funding amounts, selection of projects and sites, and selection, commissioning and installation of works of art funded for the moneys set aside for the acquisition of works of art, and

Whereas, per RCW 43.17.210, the Washington Arts Commission is to accomplish the above outline responsibilities in consultation with the directors of the state agencies;

Now Therefore, the Washington State Department of Transportation (WSDOT) and the Washington Arts Commission (WSAC) mutually agree that:

- The comptroller for WSDOT, following each legislative session, will identify, in conjunction with WSDOT program managers, the amount of funds to be set aside for purchase of works of art. In addition, the comptroller for WSDOT will earmark these funds for use by WSAC. These moneys will be held by WSDOT which will reimburse WSAC for expenses incurred within the biennium on art projects for WSDOT sites and/or projects.

- When determining the amount of funds to be set aside by WSDOT, capital funds for the following will not be considered under the provision of "original construction of public buildings":
  - Highways, trails, paths, bridges and related structures
  - Ferry and other marine vessels
  - Renovations to existing capital facilities
  - Highway construction sheds; warehouses, maintenance sheds and shops, and temporary buildings

- The comptroller for WDOT will, at the beginning of each biennium and as appropriate thereafter, identify to WSAC the amount of funds set aside for that biennium for the acquisition of works of arts.

- The roles and responsibilities for the acquisition, installation, display, maintenance and use of works of arts shall be detailed in an interagency agreement signed by WSAC and WSDOT.

- WSDOT shall have the right to select its own members for art selection panels which have the responsibility to select sites, artists, and works of art. WSAC will provide a project manager who will facilitate the work of the art selection panels. WSDOT recognizes WSAC's recommendation that art selection panels should normally contain 3 to 7 members. In order to ensure proper representation by WSDOT staff, the following WSDOT members or their designees shall be represented on art selection panels as appropriate:

  Manager, Communications and Public Involvement
  Manager, Architecture
  Regional Administrator or other Appropriate Executive

  However, for all projects the Manager, Architecture or other designee shall be the point of contact for WSAC for each specific project.

- WSAC shall keep the WSDOT point of contact informed of all WSAC procedures and guidelines.

Agreed to by:

Washington State Department of Transportation — Date: 11/7/94

Washington State Arts Commission — Date: 3/15/95

APPROVED AS TO FORM ONLY
15th DAY OF Dec 19 94
ATTORNEY GENERAL
BY Maryne Smith
ASSISTANT ATTORNEY GENERAL

APPROVED AS TO FORM: OCT. 24, 1994
ASSISTANT ATTORNEY GENERAL
WA. ST. DEPT. OF TRANS.

Appendix W Trestle Pavement Depths

Terminal	Type	Pavement Area (sq ft)	Pavement Thickness (in) Values(s) (ave)
Anacortes (AUX)	Timber	15180	1.5 - 3 (2.25)
Anacortes (MAIN)	Timber		3
Bainbridge (N)	Concrete	38430	1.5 - 3 (2.25)
Bainbridge (C)	Concrete		4
Bainbridge (S)	Concrete		2.5 - 6 (4.25)
Bremerton	Concrete	9600	2.5
Clinton (N)	Concrete	113900	2.5 - 8.5 (5.5)
Clinton (S)	Concrete		3 - 8 (5.5)
Coupeville	N/A	0	N/A
Eagle Harbor	Timber	84500	2
Edmonds	Timber	14900	1.5 - 3 (2.25)
Fauntleroy (N)	Timber	43000	1.5 - 3 (2.25)
Fauntleroy (S)			1.5 - 5.25 (3.5)
Friday Harbor	Timber	8366	2
Kingston (AUX-South)	Concrete	32670	2.5
Kingston (MAIN-North)	Concrete		5
Lopez	Timber	2000	2
Mukilteo	Timber	6000	1.5 - 3 (2.25)
Orcas	Timber	3000	2 - 3 (2.5)
Point Defiance	Timber	2700	2 - 3 (2.5)
Port Townsend	Concrete	53800	2 - 4
Seattle (N)	Timber	113000	2
Seattle (S)	Concrete	133000	2-3+
Shaw	Timber	2650	NA
Southworth	Timber	22100	1.5 - 3 (2.25)
Tahlequah	Timber	4200	1.5 - 3 (2.25)
Vashon	Timber	42200	1.5 - 3 (2.25)

Appendix X Terminal Tidal Information

Appendix X describes the means, methods and sources for developing Exhibit 330-11 Terminal Tidal Datums and Exhibit 330-12 Design Tidal Ranges. Additional information is found in the following tables and graphics.

Terminal Tidal Datums were developed from two sources:

1. North American Vertical Datum of 1988 (NAVD 88) values were determined from survey data provided by the WSDOT GeoMetrix Geodetic Survey Office in 2013 and tabulated in Exhibit 340-3 and illustrated in Appendix Z.
2. Mean High Water (MHW) and Mean Higher High Water (MHHW) values were calculated using NOAA's VDatum 3.2 program using bridge seat coordinates established for the 2013 survey for each terminal as listed in Exhibit 340-3.

Design Tidal Ranges were developed by the following steps:

1. For each terminal, the appropriate NOAA Reference Station was determined. For all terminals, except Friday Harbor, either Port Townsend or Seattle is the Reference Station. Friday Harbor, Port Townsend and Seattle are each their own Reference Station.
2. Based on the past 17 years of NOAA tidal data, Low and High Reference Water Levels for the three Reference Stations were calculated for a 75-year return period using a Log-Pearson Type III Analysis.
3. Height offset factors were tabulated for each terminal based on NOAA Tide Prediction Tables. These factors were used to convert the minimum and maximum Reference Water Level for each NOAA Reference Station to the NOAA Subordinate Station at or near each terminal. The appropriate height offset factor for each NOAA Subordinate Station was applied to the Reference Water Levels to get the Minimum and Maximum Design Water Levels.
4. The Estimated Projected Medium Change in Sea Level from the WSDOT Climate Impacts Vulnerability Assessment Report Appendix A was determined to be 13 inches at the year 2100. This 13-inch Sea Level Rise (SLR) was added to only the Maximum Design Water Level.

APPENDIX X: TERMINAL TIDAL INFORMATION
TERMINAL TIDAL DATUMS

TERMINAL	NORTHING (FEET)	EASTING (FEET)	LONGITUDE	LATITUDE	ELEVATION (FEET)			
					MLLW	NAVD 88	MHW	MHHW
ANACORTES	555,118.591	1,193,345.946	-122 40 39.89973	48 30 25.59002	0.00	0.55	7.31	8.05
BAINBRIDGE ISLAND	231,594.001	1,227,009.972	-122 30 35.43267	47 37 21.21008	0.00	2.51	10.50	11.31
BREMERTON	210,152.600	1,198,069.985	-122 37 30.49696	47 33 43.21549	0.00	2.50	10.86	11.74
CLINTON	359,334.347	1,269,055.959	-122 20 58.50264	47 58 30.24625	0.00	2.05	10.23	11.10
COUPEVILLE	428,258.521	1,191,534.484	-122 40 21.76856	48 09 27.40000	0.00	1.12	7.78	8.59
EDMONDS	300,486.626	1,259,178.327	-122 23 06.21164	47 48 47.64105	0.00	2.05	10.07	10.93
FAUNTLEROY	194,761.325	1,254,308.356	-122 23 46.09482	47 31 23.44583	0.00	2.43	10.67	11.55
FRIDAY HARBOR	567,584.984	1,112,106.527	-123 00 51.10937	48 32 07.60201	0.00	0.49	7.08	7.72
KINGSTON	294,447.798	1,232,044.946	-122 29 41.75869	47 47 42.46505	0.00	2.05	10.14	10.99
LOPEZ	579,546.063	1,144,138.170	-122 53 00.06277	48 34 14.27481	0.00	0.52	7.11	7.82
MUKILTEO	349,711.970	1,279,904.395	-122 18 16.38255	47 56 57.37809	0.00	2.06	10.19	11.05
ORCAS	589,759.042	1,129,780.997	-122 56 37.62261	48 35 51.18770	0.00	0.58	7.17	7.88
POINT DEFIANCE	116,178.976	1,223,430.655	-122 30 50.87590	47 18 21.64154	0.00	2.49	11.06	11.94
PORT TOWNSEND	411,277.068	1,169,980.504	-122 45 33.32613	48 06 40.87547	0.00	1.11	7.86	8.55
SEATTLE	223,419.724	1,268,887.331	-122 20 21.88875	47 36 09.09811	0.00	2.33	10.49	11.36
SHAW	584,895.599	1,133,024.810	-122 55 47.41215	48 35 04.08944	0.00	0.52	7.14	7.84
SOUTHWORTH	191,480.176	1,229,538.675	-122 29 45.87608	47 30 45.94736	0.00	2.51	10.69	11.58
TAHLEQUAH	125,719.268	1,225,240.566	-122 30 27.63234	47 19 56.16433	0.00	2.49	11.01	11.89
VASHON	190,530.458	1,237,485.872	-122 27 49.84015	47 30 38.25451	0.00	2.53	10.66	11.53

ALL ELEVATIONS IN FEET

ALL NAVD 88 ELEVATIONS FROM WSDOT GEOMETRIX OFFICE SURVEY OF TERMINAL BRIDGE SEAT ELEVATIONS. SEE EXHIBIT 340-3 AND APPENDIX Z.

ALL OTHER DATUMS (MLLW, MHW AND MHHW) FROM NOAA VDATUM V3.2
- HORIZONTAL DATUM: NAD83(2011/2007/CORS96HARN) - NORTH AMERICA
- COORDINATE SYSTEM: GEOGRAPHIC (LONGITUDE AND LATITUDE)
- LONGITUDE AND LATITUDE IN DDD MM SS.SSSSS
- SOURCE VERTICAL DATUM: MLLW
- TARGET VERTICAL DATUMS: MHW AND MHHW
- UNIT: FOOT (INTERNATIONAL)

ASCII FILE CONVERSION SETTINGS (TO CREATE BATCH FILE OUTPUT)
- FILE NAME: TERMINALS.TXT
- DELIMITER COMMA
- LON/EAST/Y 1
- LAT/NORTH/X 2
- HEIGHT/Z 3
- SKIP (LINES) 0
- OUTPUT FILE NAME: VDATUM RESULTS.TXT

COUPEVILLE LATITUDE ADJUSTED FROM TERMINAL COORDINATES BY 6.22" SOUTHWARD TO YIELD VALID TIDAL DATUM TRANSFORMATIONS. COORDINATES AT THE BRIDGE SEAT ARE TOO FAR INLAND FROM THE NATURAL COASTLINE (I.E., OUTSIDE OF THE TIDAL TRANSFORMATION GRID).

APPENDIX X: TERMINAL VDATUM RESULTS

INPUT

```
TERMINAL,LONGITUDE,LATITUDE,MLLW
ANACORTES,-122 40 39.89973,48 30 25.59002,0.00
BAINBRIDGE ISLAND,-122 30 35.43267,47 37 21.21008,0.00
BREMERTON,-122 37 30.49696,47 33 43.21549,0.00
CLINTON,-122 20 58.50264,47 58 30.24625,0.00
COUPEVILLE,-122 40 21.76856,48 09 27.40000,0.00
EDMONDS,-122 23 06.21164,47 48 47.64105,0.00
FAUNTLEROY,-122 23 46.09482,47 31 23.44583,0.00
FRIDAY HARBOR,-123 00 51.10937,48 32 07.60201,0.00
KINGSTON,-122 29 41.75869,47 47 42.46505,0.00
LOPEZ,-122 53 00.06277,48 34 14.27481,0.00
MUKILTEO,-122 18 16.38255,47 56 57.37809,0.00
ORCAS,-122 56 37.62261,48 35 51.18770,0.00
POINT DEFIANCE,-122 30 50.87590,47 18 21.64154,0.00
PORT TOWNSEND,-122 45 33.32613,48 06 40.87547,0.00
SEATTLE,-122 20 21.88875,47 36 09.09811,0.00
SHAW,-122 55 47.41215,48 35 04.08944,0.00
SOUTHWORTH,-122 29 45.87608,47 30 45.94736,0.00
TAHLEQUAH,-122 30 27.63234,47 19 56.16433,0.00
VASHON,-122 27 49.84015,47 30 38.25451,0.00
```

OUTPUT

```
TERMINAL,MHW
ANACORTES,-7.3069
BAINBRIDGE ISLAND,-10.5018
BREMERTON,-10.8596
CLINTON,-10.2339
COUPEVILLE,-7.7820
EDMONDS,-10.0674
FAUNTLEROY,-10.6694
FRIDAY HARBOR,-7.0837
KINGSTON,-10.1395
LOPEZ,-7.1102
MUKILTEO,-10.1931
ORCAS,-7.1702
POINT DEFIANCE,-11.0578
PORT TOWNSEND,-7.8649
SEATTLE,-10.4928
SHAW,-7.1445
SOUTHWORTH,-10.6942
TAHLEQUAH,-11.0105
VASHON,-10.6594

TERMINAL,MHHW
ANACORTES,-8.0470
BAINBRIDGE ISLAND,-11.3113
BREMERTON,-11.7388
CLINTON,-11.0973
COUPEVILLE,-8.5892
EDMONDS,-10.9331
FAUNTLEROY,-11.5450
FRIDAY HARBOR,-7.7182
KINGSTON,,-10.9895
LOPEZ,-7.8169
MUKILTEO,-11.0522
ORCAS,-7.8769
POINT DEFIANCE,-11.9372
PORT TOWNSEND,-8.5539
SEATTLE,-11.3589
SHAW,-7.8385
SOUTHWORTH,-11.5785
TAHLEQUAH,-11.8898
VASHON,-11.5289
```

VDatum results.txt

APPENDIX X: TERMINAL TIDAL INFORMATION
DESIGN TIDAL RANGES

TERMINAL	NOAA REFERENCE STATION	REFERENCE WATER LEVEL		HEIGHT OFFSET FACTOR		SLR	DESIGN TIDAL RANGE		
		MIN	MAX	LOW	HIGH		MIN	MAX	W/ SLR
ANACORTES	PORT TOWNSEND	-4.36	11.60	1.00	0.94	1.08	-4.36	10.90	11.98
BAINBRIDGE ISLAND	SEATTLE	-4.88	14.60	1.02	1.00	1.08	-4.98	14.60	15.68
BREMERTON	SEATTLE	-4.88	14.60	1.00	1.04	1.08	-4.88	15.18	16.26
CLINTON	SEATTLE	-4.88	14.60	0.99	0.97	1.08	-4.83	14.16	15.24
COUPEVILLE	PORT TOWNSEND	-4.36	11.60	-0.10	0.00	1.08	-4.46	11.60	12.68
EDMONDS	SEATTLE	-4.88	14.60	0.99	0.96	1.08	-4.83	14.02	15.10
FAUNTLEROY	SEATTLE	-4.88	14.60	1.01	1.02	1.08	-4.93	14.89	15.97
FRIDAY HARBOR	FRIDAY HARBOR	-4.09	10.90	1.00	1.00	1.08	-4.09	10.90	11.98
KINGSTON	SEATTLE	-4.88	14.60	1.00	0.97	1.08	-4.88	14.16	15.24
LOPEZ	PORT TOWNSEND	-4.36	11.60	0.93	0.93	1.08	-4.05	10.79	11.87
MUKILTEO	SEATTLE	-4.88	14.60	0.99	0.97	1.08	-4.83	14.16	15.24
ORCAS	PORT TOWNSEND	-4.36	11.60	0.90	0.90	1.08	-3.92	10.44	11.52
POINT DEFIANCE	SEATTLE	-4.88	14.60	1.01	1.05	1.08	-4.93	15.33	16.41
PORT TOWNSEND	PORT TOWNSEND	-4.36	11.60	1.00	1.00	1.08	-4.36	11.60	12.68
SEATTLE	SEATTLE	-4.88	14.60	1.00	1.00	1.08	-4.88	14.60	15.68
SHAW	PORT TOWNSEND	-4.36	11.60	0.99	0.90	1.08	-4.32	10.44	11.52
SOUTHWORTH	SEATTLE	-4.88	14.60	0.99	1.02	1.08	-4.83	14.89	15.97
TAHLEQUAH	SEATTLE	-4.88	14.60	1.01	1.05	1.08	-4.93	15.33	16.41
VASHON	SEATTLE	-4.88	14.60	1.01	1.02	1.08	-4.93	14.89	15.97

ALL WATER LEVELS ARE IN FEET

REFERENCE WATER LEVELS FROM 17 YEARS OF VERIFIED LOW AND HIGH TIDE DATA

NOAA REFERENCE STATION	75-YEAR RETURN PERIOD	
	LOW	HIGH
FRIDAY HARBOR	-4.09	10.90
PORT TOWNSEND	-4.36	11.60
SEATTLE	-4.88	14.60

HEIGHT OFFSET FACTORS FROM NOAA TIDE PREDICTION TABLES

SEA LEVEL RISE (SLR) FROM CLIMATE IMPACTS VULNERABILITY ASSESSMENT REPORT (APPENDIX A), WSDOT, NOVEMBER 2011

PROJECTED MEDIUM CHANGE IN WA SEA LEVEL IN 2050: 6 INCHES
PROJECTED MEDIUM CHANGE IN WA SEA LEVEL IN 2100: 13 INCHES
FOR SEA LEVEL RISE USE: **13** INCHES

SEA LEVEL RISE ADDED TO MAX WATER LEVEL ONLY

ALL DESIGN TIDAL RANGES = REFERENCE WATER LEVEL X HEIGHT OFFSET FACTOR EXCEPT
COUPEVILLE DESIGN TIDAL RANGE = REFERENCE WATER LEVEL + HEIGHT OFFSET FACTOR

WSF Tidal Data.xlsx
APP X DESIGN TIDAL RANGES
8/7/2013

Reference Water Levels

The Log-Pearson Type III Distribution was used to calculate the return periods for the below reference tidal stations. This statistical analysis is often used to calculate river stream flow return periods to estimate the frequency of flooding. However for this application it was used to determine return periods for tidal levels.

In order to account for tidal anomalies, such as storm surges, actual verified data from NOAA was used for analysis instead of predicted tidal data. Predicted tidal data is derived from a fixed multivariable equation and does not take into account atmospheric weather conditions which can significantly affect actual tide levels.

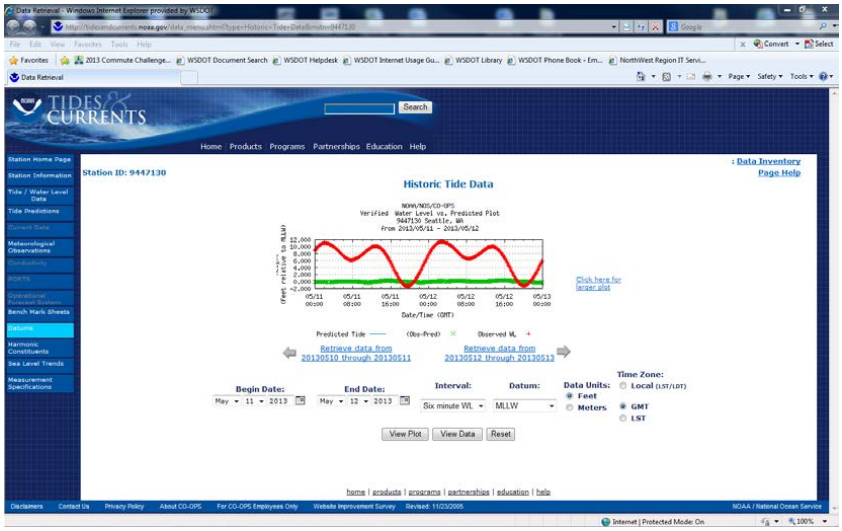
Data Acquisition and Analysis

1. Visit NOAA's website using the following links to the NOAA Reference Stations:

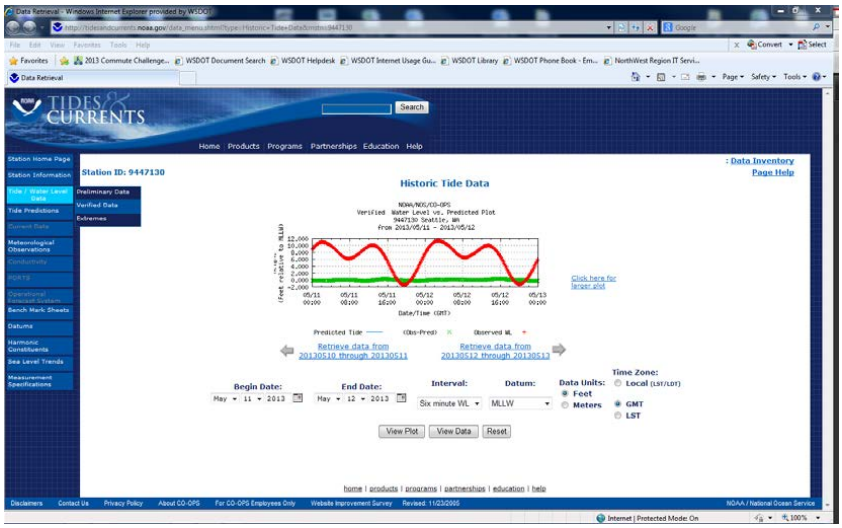
    a. Friday Harbor:
    http://tidesandcurrents.noaa.gov/data_menu.shtml?stn=9449880 Friday Harbor, WA&type=Historic+Tide+Data

    b. Port Townsend:
    http://tidesandcurrents.noaa.gov/data_menu.shtml?type=Historic+Tide+Data&mstn=9444900

    c. Seattle:
    http://tidesandcurrents.noaa.gov/data_menu.shtml?type=Historic+Tide+Data&mstn=9447130

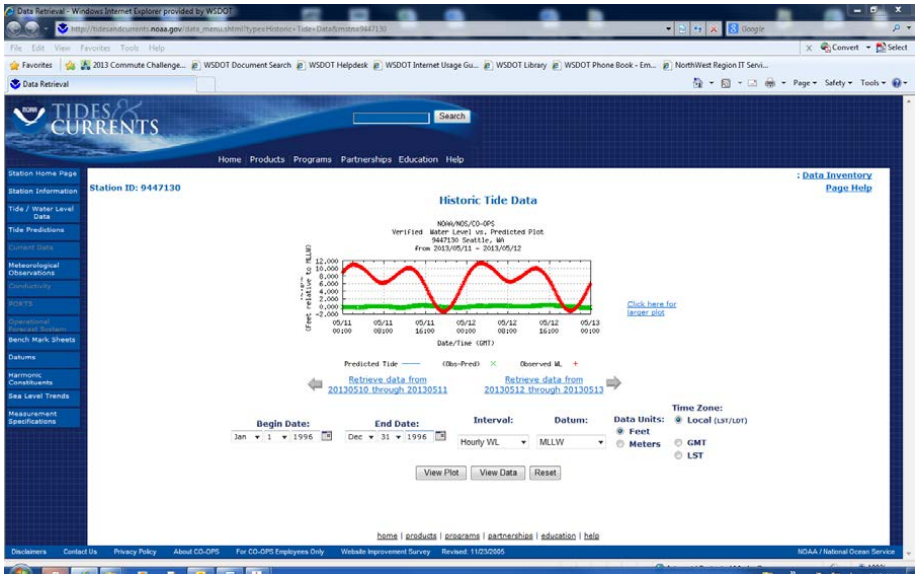


2. Click on **"Tide / Water Level Data"** on the left and select **"Verified Data"**

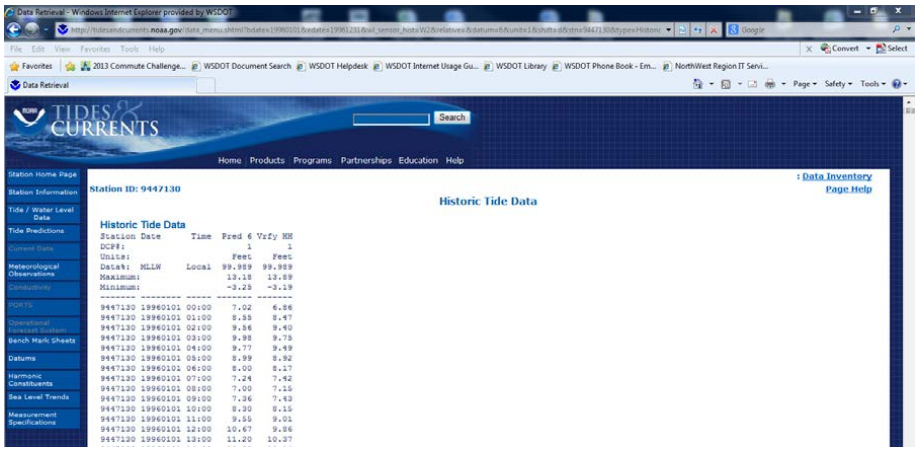


3. As an example, input the following settings

Begin Date = **Jan 1, 2012**
End Date = **Dec 31, 2012**
Interval = **Hourly WL**
Datum = **MLLW**
Data Units = **Feet**
Time Zone = **Local (LST/LDT)**
Note: NOAA's website allows data output for 1 year only using the "Hourly WL" setting. Therefore data can only be downloaded 1 year at a time. Alternatively, data may be ordered from NOAA at a cost of $50 for the first year and $5 for each additional year.



4. Click on **"View Data"** and copy/paste all data below the "Historic Tide Data" header to an Excel file. (Only "year" and the "verified tidal data" will be required for the analysis)



5. Repeat Steps 3 and 4 until you have all the data required (Must have data in whole year increments). Use the "Text to Columns" function in MS Excel to covert the single column text data into a table. The total number of "whole" years gathered will equal "n." For example, if you collected 25 years of data, n=25.

6. Summarize your data by the Mean, Max, and Min tidal values for each year captured.

	A	B	C	D
1	**Seattle, WA**			
2	Station ID: 9447130			
3	Historic Tide Data			
4				
5		Seattle		
6	Year	Mean	Max	Min
7	1996	6.66	13.89	-3.19
8	1997	6.87	14.01	-3.23
9	1998	6.83	13.78	-3.12
10	1999	6.64	13.17	-4.27
11	2000	6.57	12.83	-3.82
12	2001	6.52	13.10	-3.88
13	2002	6.61	13.53	-3.39
14	2003	6.74	14.22	-4.14
15	2004	6.68	13.07	-4.13
16	2005	6.71	14.07	-4.07
17	2006	6.80	13.93	-3.76
18	2007	6.60	13.68	-4.58
19	2008	6.56	13.47	-4.32
20	2009	6.57	13.36	-4.57
21	2010	6.80	13.90	-3.65
22	2011	6.68	13.58	-3.95
23	2012	6.80	14.47	-3.67

7. Copy the year and Max tidal (T_{max}) values into a new table and rank the tidal values from high to low (see columns A, B, and C below).

	A	B	C	D	E	F
4	**Step 7**			**Step 8**	**Step 9**	**Step 10**
5		Verified	Max Tide (T_{max})			
6	Rank	Year	MLLW (ft)	log T_{max}	$(\log T_{max} - \text{avg}(\log T_{max}))^2$	$(\log T_{max} - \text{avg}(\log T_{max}))^3$
7	1	2012	14.47	1.1605E+00	6.5214E-04	1.6654E-05
8	2	2003	14.22	1.1529E+00	3.2285E-04	5.8011E-06
9	3	2005	14.07	1.1483E+00	1.7856E-04	2.3860E-06
10	4	1997	14.01	1.1464E+00	1.3240E-04	1.5235E-06
11	5	2006	13.93	1.1440E+00	8.1354E-05	7.3379E-07
12	6	2010	13.9	1.1430E+00	6.5340E-05	5.2817E-07
13	7	1996	13.89	1.1427E+00	6.0385E-05	4.6924E-07
14	8	1998	13.78	1.1392E+00	1.8643E-05	8.0496E-08
15	9	2007	13.68	1.1361E+00	1.3332E-06	1.5394E-09
16	10	2011	13.58	1.1329E+00	4.1278E-06	-8.3863E-09
17	11	2002	13.53	1.1313E+00	1.3203E-05	-4.7977E-08
18	12	2008	13.47	1.1294E+00	3.0957E-05	-1.7224E-07
19	13	2009	13.36	1.1258E+00	8.3266E-05	-7.5980E-07
20	14	1999	13.17	1.1196E+00	2.3549E-04	-3.6138E-06
21	15	2001	13.1	1.1173E+00	3.1188E-04	-5.5079E-06
22	16	2004	13.07	1.1163E+00	3.4804E-04	-6.4930E-06
23	17	2000	12.83	1.1082E+00	7.1315E-04	-1.9044E-05
24			**Average**	**Average**	**Sum**	**Sum**
25			**13.651**	**1.135**	**0.003253**	**-0.000007**

8. Calculate the Log of each ranked tidal value in column D and average all the Log tidal values at the bottom of column D.

9. In column E, subtract the average log tide value calculated in step 8 from each ranked log tide value. Sum all the squared differences at the bottom of column E.

10. In column F, repeat step 9 but cube each difference. Sum all the cubed differences at the bottom of column F.

11. Calculate the **Variance** by dividing the sum of the values calculated in step 9 (cell E25) by the total number of data years collected minus 1.

$$\frac{\sum_1^n (logT_{max} - avg(logT_{max}))^2}{n-1}$$

Variable Definitions:

σ = standard deviation
C_s = Skew Coefficient
n = number of years analyzed
T_{max} = Max Tide Data

	A	B	C	D	E	F
4	**Step 7**			**Step 8**	**Step 9**	**Step 10**
5		Verified	Max Tide (T_{max})			
6	Rank	Year	MLLW (ft)	log T_{max}	(log T_{max}- avg(log T_{max}))^2	(log T_{max}- avg(log T_{max}))^3
7	1	2012	14.47	1.1605E+00	6.5214E-04	1.6654E-05
8	2	2003	14.22	1.1529E+00	3.2285E-04	5.8011E-06
9	3	2005	14.07	1.1483E+00	1.7856E-04	2.3860E-06
10	4	1997	14.01	1.1464E+00	1.3240E-04	1.5235E-06
11	5	2006	13.93	1.1440E+00	8.1354E-05	7.3379E-07
12	6	2010	13.9	1.1430E+00	6.5340E-05	5.2817E-07
13	7	1996	13.89	1.1427E+00	6.0385E-05	4.6924E-07
14	8	1998	13.78	1.1392E+00	1.8643E-05	8.0496E-08
15	9	2007	13.68	1.1361E+00	1.3332E-06	1.5394E-09
16	10	2011	13.58	1.1329E+00	4.1278E-06	-8.3863E-09
17	11	2002	13.53	1.1313E+00	1.3203E-05	-4.7977E-08
18	12	2008	13.47	1.1294E+00	3.0957E-05	-1.7224E-07
19	13	2009	13.36	1.1258E+00	8.3266E-05	-7.5980E-07
20	14	1999	13.17	1.1196E+00	2.3549E-04	-3.6138E-06
21	15	2001	13.1	1.1173E+00	3.1188E-04	-5.5079E-06
22	16	2004	13.07	1.1163E+00	3.4804E-04	-6.4930E-06
23	17	2000	12.83	1.1082E+00	7.1315E-04	-1.9044E-05
24			**Average**	**Average**	**Sum**	**Sum**
25			**13.651**	**1.135**	**0.003253**	**-0.000007**
26						
27						
28	**Step 11**		Variance	0.00020	=$E$25/($B$2-1)	
29	**Step 12**		Standard Deviation	0.01426	=$D$28^0.5	
30	**Step 13**		Skew Coefficient	-0.18250	=($B$2*F25)/(((B$2-1)*($B$2-2)*($D$29^3)))	

12. Calculate the **Standard Deviation** by taking the square root of the value calculated in step 11.

$$\sigma logT_{max} = \sqrt{variance}$$

13. Calculate the Skew Coefficient by using the below formula:

$$C_s = \frac{n \times \sum_1^n (logT_{max} - avg(logT_{max}))^3}{(n-1)(n-2)(\sigma logT_{max})^3}$$

14. Use the frequency factor table (Haan, 1977, Table 7.7) and the skew coefficient to find the k values for the 2, 5, 10, 25, 50, 100, and 200 recurrence intervals. If the calculated skew coefficient is between two given skew coefficients in the Haan frequency factor table, you can linearly interpolate between the two skew coefficients to the get the interpolated k values.

	A	B	C	D	E	F
24			**Average**	**Average**	**Sum**	**Sum**
25			**13.651**	**1.135**	**0.003253**	**-0.000007**
26						
27						
28	**Step 11**		Variance	0.00020	=$E$25/($B$2-1)	
29	**Step 12**		Standard Deviation	0.01426	=$D$28^0.5	
30	**Step 13**		Skew Coefficient	-0.18250	=($B$2*F25)/((($B$2-1)*($B$2-2)*($D$29^3)))	
31						
32						
33				**Step 14**	**Step 15**	
34		-0.2	-0.1	-0.18250		
35	T_r (yr)	K (lower)*	K (upper)*	K (actual)	T_{max} MLLW (ft)	
36	2	0.033	0.017	0.030	13.7	=10^($D$25+D36*$D$29)
37	5	0.850	0.846	0.849	14.0	=10^($D$25+D37*$D$29)
38	10	1.258	1.270	1.260	14.2	=10^($D$25+D38*$D$29)
39	25	1.680	1.716	1.686	14.4	=10^($D$25+D39*$D$29)
40	50	1.945	2.000	1.955	14.5	=10^($D$25+D40*$D$29)
41	100	2.178	2.252	2.191	14.7	=10^($D$25+D41*$D$29)
42	200	2.388	2.482	2.404	14.8	=10^($D$25+D42*$D$29)
43	*75*	*N/A*	*N/A*	*N/A*	*14.60***	
44	*lower and upper K factors for each return period are from Haan's 1977 "K" factor table.					
45	**T_{max} for 75 years was read off the data plots.					

Variable Definitions:

σ = standard deviation
C_s = Skew Coefficient
K= frequency factor
n = number of years analyzed
T_{max} = Max Tide Data
T_r = Return Period

15. Solve for the Max tide using the following formula

$$logT_{max} = avg(logT_{max}) + [K(T_r, C_s)] \times \sigma logT_{max}$$

16. In order to calculate return periods for low tides, Start from step 7 but use the min tidal (T_{min}) data and multiply the values by negative 1 (-1) to remove the negative sign.

17. Repeat Steps 8 through 15.

18. Finally, multiply the calculated return periods for Min tides (T_{min}) by negative 1.

19. See archived Excel files for template and formulas.

Glossary:

The selected definitions are copied from NOAA's "Tide and Current Glossary" published in January 2000.
http://tidesandcurrents.noaa.gov/publications/glossary2.pdf

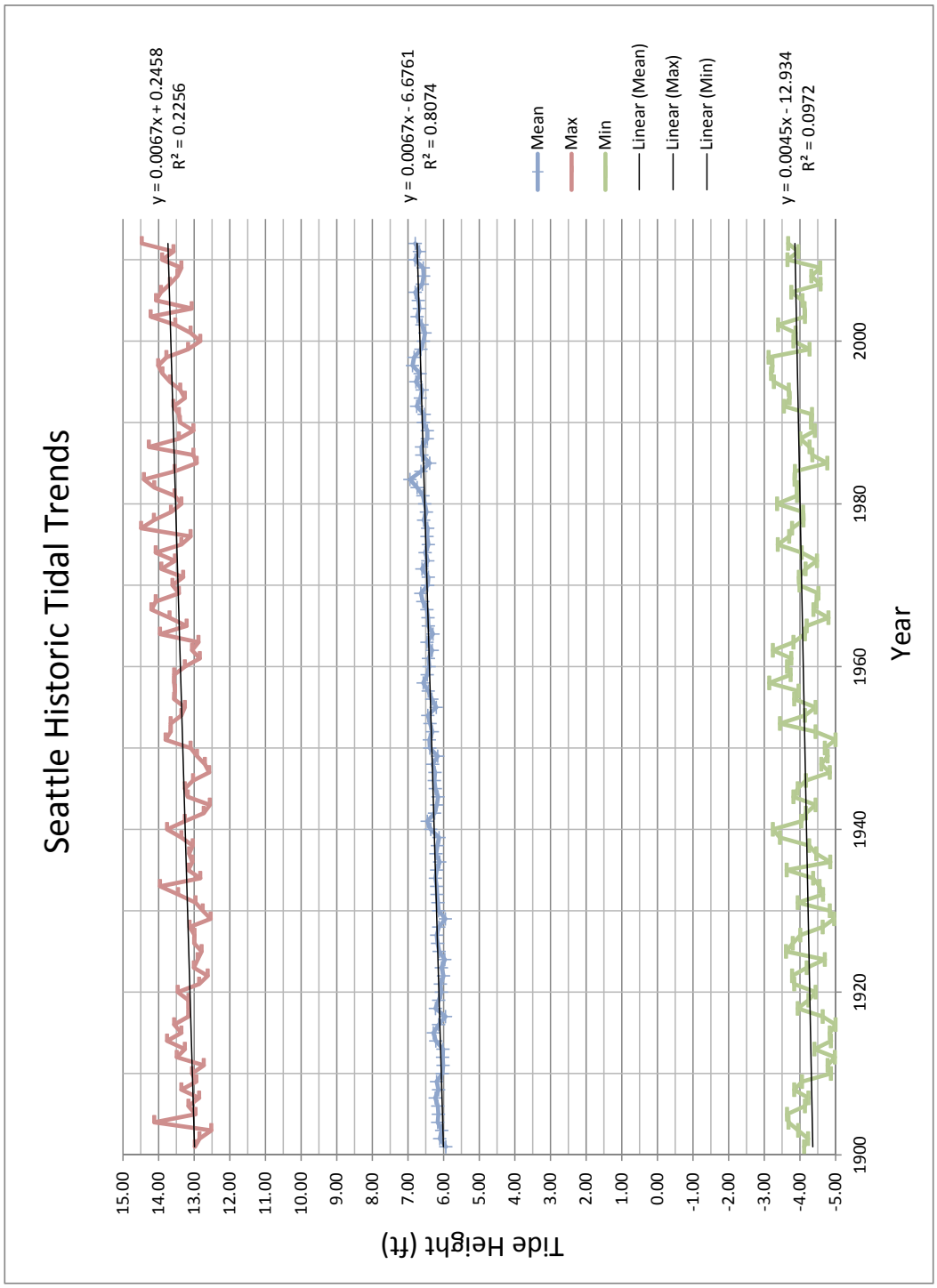
datum (vertical)—For marine applications, a base elevation used as a reference from which to reckon heights or depths. It is called a tidal datum when defined in terms of a certain phase of the tide. Tidal datums are local datums and should not be extended into areas which have differing hydrographic characteristics without substantiating measurements. In order that they may be recovered when needed, such datums are referenced to fixed points known as bench marks. See chart datum.

National Tidal Datum Epoch—The specific 19-year period adopted by the National Ocean Service as the official time segment over which tide observations are taken and reduced to obtain mean values (e.g., mean lower low water, etc.) for tidal datums. It is necessary for standardization because of periodic and apparent secular trends in sea level. The present National Tidal Datum Epoch is 1960 through 1978. It is reviewed annually for possible revision and must be actively considered for revision every 25 years.

North American Vertical Datum of 1988 [NAVD 1988]—A fixed reference for elevations determined by geodetic leveling. The datum was derived from a general adjustment of the first-order terrestrial leveling nets of the United States, Canada, and Mexico. In the adjustment, only the height of the primary tidal bench mark, referenced to the International Great Lakes Datum of 1985 (IGLD 1985) local mean sea level height value, at Father Point, Rimouski, Quebec, Canada was held fixed, thus providing minimum constraint. NAVD 1988 and IGLD 1985 are not identical. However, NAVD 1988 bench mark values are given in Helmert orthometric height units while IGLD 1985 values are in dynamic heights. See International Great Lakes Datum of 1985, National Geodetic Vertical Datum of 1929, and geopotential difference.

mean higher high water (MHHW)—A tidal datum. The average of the higher high water height of each tidal day observed over the National Tidal Datum Epoch. For stations with shorter series, comparison of simultaneous observations with a control tide station is made in order to derive the equivalent datum of the National Tidal Datum Epoch.

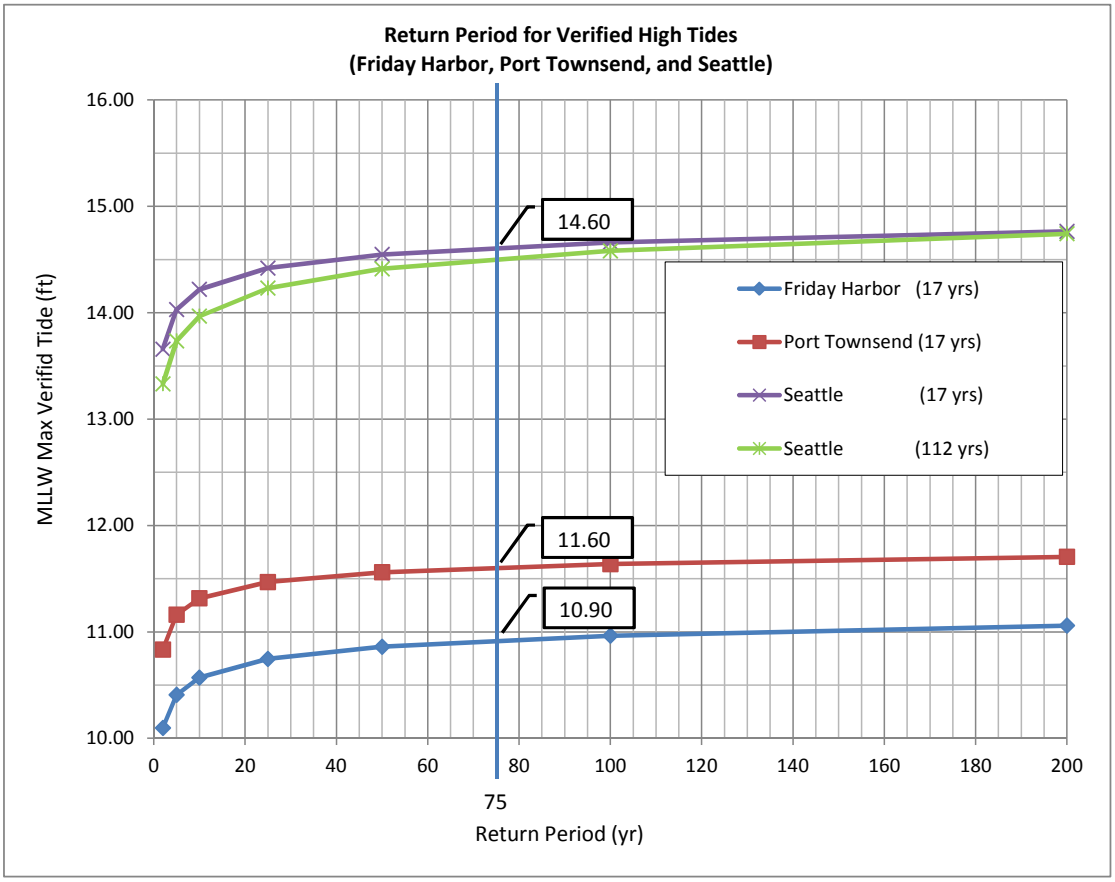
mean lower low water (MLLW)—A tidal datum. The average of the lower low water height of each tidal day observed over the National Tidal Datum Epoch. For stations with shorter series, comparison of simultaneous observations with a control tide station is made in order to derive the equivalent datum of the National Tidal Datum Epoch.


Seattle Historic Tidal Trends
y = 0.0067x + 0.2458
R² = 0.2256
y = 0.0067x - 6.6761
R² = 0.8074
y = 0.0045x - 12.934
R² = 0.0972
Mean
Max
Min
Linear (Mean)
Linear (Max)
Linear (Min)
Tide Height (ft)
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
1900
1920
1940
1960
1980
2000
Year

Verified High Tide Return Periods using Log-Pearson Type III Analysis

Jun-13

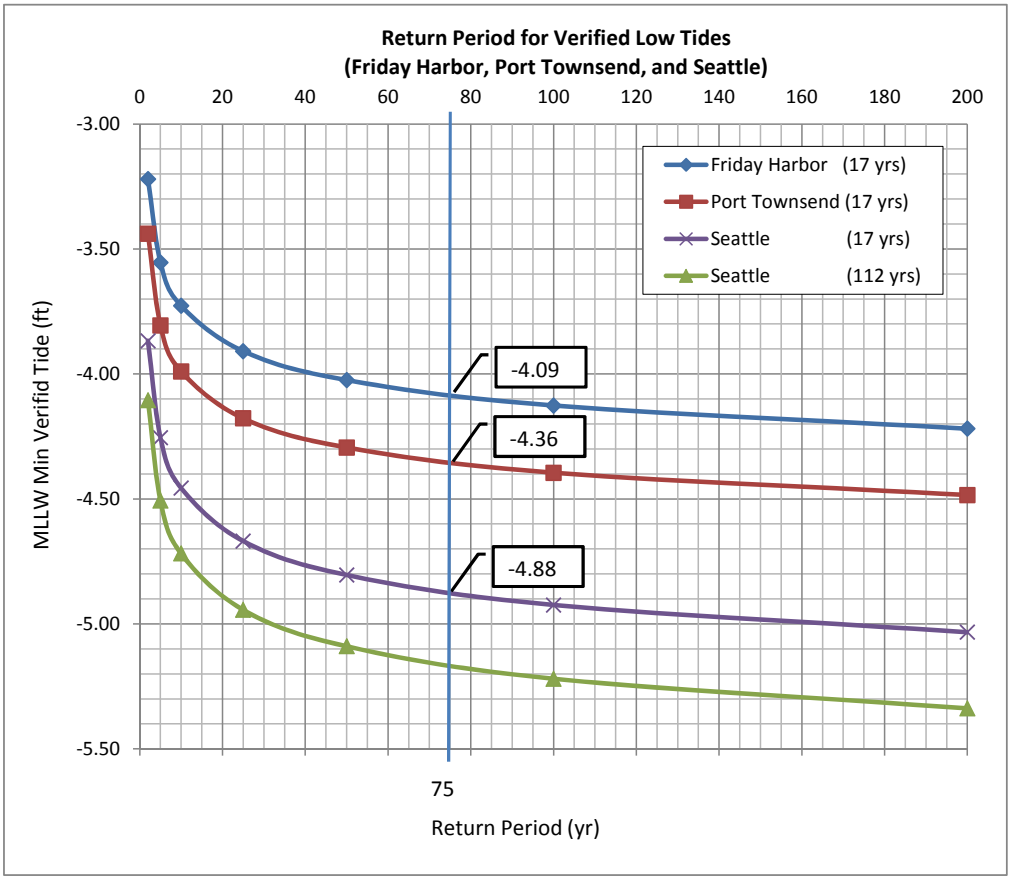
Year	Friday Harbor (17 yrs)	Port Townsend (17 yrs)	Seattle (17 yrs)	Seattle (112 yrs)
2	10.10	10.83	13.66	13.33
5	10.41	11.16	14.03	13.74
10	10.57	11.32	14.22	13.97
25	10.75	11.47	14.42	14.23
50	10.86	11.56	14.55	14.41
100	10.96	11.64	14.66	14.58
200	11.06	11.71	14.76	14.74



Verified Low Tide Return Periods using Log Pearson Type III Analysis

Jun-13

Return Period	Friday Harbor (17 yrs)	Port Townsend (17 yrs)	Seattle (17 yrs)	Seattle (112 yrs)
2	-3.22	-3.44	-3.87	-4.11
5	-3.55	-3.81	-4.26	-4.51
10	-3.73	-3.99	-4.46	-4.72
25	-3.91	-4.18	-4.67	-4.94
50	-4.02	-4.29	-4.80	-5.09
100	-4.13	-4.40	-4.92	-5.22
200	-4.22	-4.48	-5.03	-5.34



Friday Harbor Verified Max

n= 17

Rank	Verified Year	Max Tide (T_{max}) MLLW (ft)	log T_{max}	(log T_{max}- avg(log T_{max}))^2	(log T_{max}- avg(log T_{max}))^3	Return Period T_r=(n+1)/m	Exceedance Probability $1/T_r$
1	2006	10.78	1.0326E+00	8.1603E-04	2.3311E-05	18.0	0.056
2	2005	10.53	1.0224E+00	3.3767E-04	6.2050E-06	9.0	0.111
3	2003	10.51	1.0216E+00	3.0801E-04	5.4056E-06	6.0	0.167
4	2010	10.37	1.0158E+00	1.3750E-04	1.6124E-06	4.5	0.222
5	1997	10.36	1.0154E+00	1.2785E-04	1.4457E-06	3.6	0.278
6	2012	10.35	1.0149E+00	1.1854E-04	1.2907E-06	3.0	0.333
7	2007	10.31	1.0133E+00	8.4752E-05	7.8024E-07	2.6	0.389
8	2008	10.21	1.0090E+00	2.4732E-05	1.2300E-07	2.3	0.444
9	2002	9.98	9.9913E-01	2.4226E-05	-1.1924E-07	2.0	0.500
10	2009	9.98	9.9913E-01	2.4226E-05	-1.1924E-07	1.8	0.556
11	2001	9.96	9.9826E-01	3.3561E-05	-1.9443E-07	1.6	0.611
12	1998	9.94	9.9739E-01	4.4438E-05	-2.9623E-07	1.5	0.667
13	2011	9.94	9.9739E-01	4.4438E-05	-2.9623E-07	1.4	0.722
14	1996	9.78	9.9034E-01	1.8807E-04	-2.5791E-06	1.3	0.778
15	2004	9.62	9.8318E-01	4.3587E-04	-9.0999E-06	1.2	0.833
16	1999	9.61	9.8272E-01	4.5493E-04	-9.7034E-06	1.1	0.889
17	2000	9.47	9.7635E-01	7.6743E-04	-2.1260E-05	1.1	0.944
		Average	**Average**	**Sum**	**Sum**		
		10.100	**1.004**	**0.003972**	**-0.000003**		

Variance	0.00025
Standard Deviation	0.01576
Skew Coefficient	-0.06327

	-0.1	0	-0.06327	
T_r (yr)	K (lower)*	K (upper)*	K (actual)	T_{max} MLLW (ft)
2	0.017	0.000	0.011	10.10
5	0.846	0.842	0.845	10.41
10	1.270	1.282	1.274	10.57
25	1.716	1.751	1.729	10.75
50	2.000	2.054	2.020	10.86
100	2.252	2.326	2.279	10.96
200	2.482	2.576	2.517	11.06

Port Townsend Verified Max

n= 17

Rank	Verified Year	Max Tide (T_{max}) MLLW (ft)	log T_{max}	(log T_{max} - avg(log T_{max}))^2	(log T_{max} - avg(log T_{max}))^3	Return Period T_r=(n+1)/m	Exceedance Probability $1/T_r$
1	2006	11.38	1.0561E+00	5.1916E-04	1.1829E-05	18.0	0.056
2	2003	11.36	1.0554E+00	4.8493E-04	1.0679E-05	9.0	0.111
3	2012	11.26	1.0515E+00	3.3056E-04	6.0100E-06	6.0	0.167
4	1997	11.18	1.0484E+00	2.2755E-04	3.4325E-06	4.5	0.222
5	2005	11.18	1.0484E+00	2.2755E-04	3.4325E-06	3.6	0.278
6	2010	11	1.0414E+00	6.4571E-05	5.1886E-07	3.0	0.333
7	2007	10.99	1.0410E+00	5.8379E-05	4.4605E-07	2.6	0.389
8	2008	10.8	1.0334E+00	4.4437E-09	2.9622E-13	2.3	0.444
9	1998	10.79	1.0330E+00	1.1266E-07	-3.7815E-11	2.0	0.500
10	2002	10.78	1.0326E+00	5.4514E-07	-4.0249E-10	1.8	0.556
11	2011	10.78	1.0326E+00	5.4514E-07	-4.0249E-10	1.6	0.611
12	2009	10.69	1.0290E+00	1.9179E-05	-8.3993E-08	1.5	0.667
13	1996	10.64	1.0269E+00	4.1158E-05	-2.6405E-07	1.4	0.722
14	2001	10.47	1.0199E+00	1.7984E-04	-2.4117E-06	1.3	0.778
15	2004	10.23	1.0099E+00	5.5138E-04	-1.2947E-05	1.2	0.833
16	1999	10.18	1.0077E+00	6.5584E-04	-1.6796E-05	1.1	0.889
17	2000	9.99	9.9957E-01	1.1419E-03	-3.8586E-05	1.1	0.944
		Average	**Average**	**Sum**	**Sum**		
		10.806	**1.033**	**0.004503**	**-0.000035**		

Variance	0.00028
Standard Deviation	0.01678
Skew Coefficient	-0.52117

	-0.6	-0.5	-0.52117	
T_r (yr)	K (lower)*	K (upper)*	K (actual)	T_{max} MLLW (ft)
2	0.099	0.083	0.086	10.83
5	0.857	0.856	0.856	11.16
10	1.200	1.216	1.213	11.32
25	1.528	1.567	1.559	11.47
50	1.720	1.777	1.765	11.56
100	1.880	1.955	1.939	11.64
200	2.016	2.108	2.089	11.71

Seattle Verified Max

n= 17

Step 7			Step 8	Step 9	Step 10
Rank	Verified Year	Max Tide (T_{max}) MLLW (ft)	log T_{max}	(log T_{max}- avg(log T_{max}))^2	(log T_{max}- avg(log T_{max}))^3
1	2012	14.47	1.1605E+00	6.5214E-04	1.6654E-05
2	2003	14.22	1.1529E+00	3.2285E-04	5.8011E-06
3	2005	14.07	1.1483E+00	1.7856E-04	2.3860E-06
4	1997	14.01	1.1464E+00	1.3240E-04	1.5235E-06
5	2006	13.93	1.1440E+00	8.1354E-05	7.3379E-07
6	2010	13.9	1.1430E+00	6.5340E-05	5.2817E-07
7	1996	13.89	1.1427E+00	6.0385E-05	4.6924E-07
8	1998	13.78	1.1392E+00	1.8643E-05	8.0496E-08
9	2007	13.68	1.1361E+00	1.3332E-06	1.5394E-09
10	2011	13.58	1.1329E+00	4.1278E-06	-8.3863E-09
11	2002	13.53	1.1313E+00	1.3203E-05	-4.7977E-08
12	2008	13.47	1.1294E+00	3.0957E-05	-1.7224E-07
13	2009	13.36	1.1258E+00	8.3266E-05	-7.5980E-07
14	1999	13.17	1.1196E+00	2.3549E-04	-3.6138E-06
15	2001	13.1	1.1173E+00	3.1188E-04	-5.5079E-06
16	2004	13.07	1.1163E+00	3.4804E-04	-6.4930E-06
17	2000	12.83	1.1082E+00	7.1315E-04	-1.9044E-05
		Average 13.651	**Average 1.135**	**Sum 0.003253**	**Sum -0.000007**

Step 11	Variance	0.00020	=$E$25/($B$2-1)
Step 12	Standard Deviation	0.01426	=$D$28^0.5
Step 13	Skew Coefficient	-0.18250	=($B$2*F25)/((($B$2-1)*($B$2-2)*($D$29^3)))

			Step 14	Step 15	
	-0.2	-0.1	-0.18250		
T_r (yr)	K (lower)*	K (upper)*	K (actual)	T_{max} MLLW (ft)	
2	0.033	0.017	0.030	13.7	=10^($D$25+D36*$D$29)
5	0.850	0.846	0.849	14.0	=10^($D$25+D37*$D$29)
10	1.258	1.270	1.260	14.2	=10^($D$25+D38*$D$29)
25	1.680	1.716	1.686	14.4	=10^($D$25+D39*$D$29)
50	1.945	2.000	1.955	14.5	=10^($D$25+D40*$D$29)
100	2.178	2.252	2.191	14.7	=10^($D$25+D41*$D$29)
200	2.388	2.482	2.404	14.8	=10^($D$25+D42*$D$29)
75	*N/A*	*N/A*	*N/A*	*14.60***	

*lower and upper K factors for each return period are from Haan's 1977 "K" factor table.

**T_{max} for 75 years was read off the data plots.

Friday Harbor Verified Min

n= 17

Rank	Verified Year	Min Tide (T_{min}) MLLW (ft)	log Tmax	$(\log T_{min} - \text{avg}(\log T_{min}))^2$	$(\log T_{min} - \text{avg}(\log T_{min}))^3$	Return Period $T_r=(n+1)/m$	Exceedance Probability $1/T_r$
1	2009	-3.79	5.7864E-01	5.4853E-03	4.0625E-04	18.0	0.056
2	2007	-3.68	5.6585E-01	3.7541E-03	2.3002E-04	9.0	0.111
3	2003	-3.64	5.6110E-01	3.1950E-03	1.8060E-04	6.0	0.167
4	1999	-3.59	5.5509E-01	2.5520E-03	1.2892E-04	4.5	0.222
5	2004	-3.57	5.5267E-01	2.3128E-03	1.1123E-04	3.6	0.278
6	2008	-3.56	5.5145E-01	2.1971E-03	1.0299E-04	3.0	0.333
7	2005	-3.41	5.3275E-01	7.9398E-04	2.2373E-05	2.6	0.389
8	2006	-3.31	5.1983E-01	2.3260E-04	3.5475E-06	2.3	0.444
9	2001	-3.27	5.1455E-01	9.9422E-05	9.9134E-07	2.0	0.500
10	2011	-3.15	4.9831E-01	3.9265E-05	-2.4604E-07	1.8	0.556
11	2010	-3.01	4.7857E-01	6.7653E-04	-1.7597E-05	1.6	0.611
12	2012	-3	4.7712E-01	7.5380E-04	-2.0696E-05	1.5	0.667
13	2000	-2.99	4.7567E-01	8.3553E-04	-2.4151E-05	1.4	0.722
14	2002	-2.85	4.5484E-01	2.4733E-03	-1.2300E-04	1.3	0.778
15	1998	-2.68	4.2813E-01	5.8434E-03	-4.4668E-04	1.2	0.833
16	1997	-2.64	4.2160E-01	6.8845E-03	-5.7122E-04	1.1	0.889
17	1996	-2.58	4.1162E-01	8.6410E-03	-8.0324E-04	1.1	0.944
		Average	**Average**	**Sum**	**Sum**		
		-3.219	**0.505**	**0.046770**	**-0.000820**		

Variance	0.00292
Standard Deviation	0.05407
Skew Coefficient	-0.36749

	-0.4	-0.3	-0.36749		
T_r (yr)	K (lower)*	K (upper)*	K (actual)	T_{min} MLLW (ft)	T_{min} MLLW (ft)
2	0.066	0.050	0.061	3.2	-3.2
5	0.855	0.853	0.854	3.6	-3.6
10	1.231	1.245	1.236	3.7	-3.7
25	1.606	1.643	1.618	3.9	-3.9
50	1.834	1.890	1.852	4.0	-4.0
100	2.029	2.104	2.053	4.1	-4.1
200	2.201	2.294	2.231	4.2	-4.2

Port Townsend Verified Min

n= 17

Rank	Verified Year	Min Tide (T_{min}) MLLW (ft)	log Tmax	$(\log T_{min} - \text{avg}(\log T_{min}))^2$	$(\log T_{min} - \text{avg}(\log T_{min}))^3$	Return Period $T_r=(n+1)/m$	Exceedance Probability $1/T_r$
1	2007	-4.16	6.1909E-01	7.6375E-03	6.6746E-04	18.0	0.056
2	2009	-3.96	5.9770E-01	4.3553E-03	2.8743E-04	9.0	0.111
3	1999	-3.89	5.8995E-01	3.3929E-03	1.9764E-04	6.0	0.167
4	2008	-3.88	5.8883E-01	3.2640E-03	1.8647E-04	4.5	0.222
5	2003	-3.69	5.6703E-01	1.2479E-03	4.4083E-05	3.6	0.278
6	2004	-3.67	5.6467E-01	1.0867E-03	3.5824E-05	3.0	0.333
7	2005	-3.56	5.5145E-01	3.9004E-04	7.7031E-06	2.6	0.389
8	2006	-3.52	5.4654E-01	2.2029E-04	3.2695E-06	2.3	0.444
9	2011	-3.41	5.3275E-01	1.1105E-06	1.1703E-09	2.0	0.500
10	2000	-3.39	5.3020E-01	2.2526E-06	-3.3809E-09	1.8	0.556
11	2001	-3.39	5.3020E-01	2.2526E-06	-3.3809E-09	1.6	0.611
12	2010	-3.35	5.2504E-01	4.4299E-05	-2.9484E-07	1.5	0.667
13	2012	-3.18	5.0243E-01	8.5693E-04	-2.5085E-05	1.4	0.722
14	2002	-2.99	4.7567E-01	3.1393E-03	-1.7589E-04	1.3	0.778
15	1996	-2.85	4.5484E-01	5.9068E-03	-4.5397E-04	1.2	0.833
16	1997	-2.76	4.4091E-01	8.2431E-03	-7.4840E-04	1.1	0.889
17	1998	-2.64	4.2160E-01	1.2121E-02	-1.3345E-03	1.1	0.944
		Average	**Average**	**Sum**	**Sum**		
		-3.429	**0.532**	**0.051912**	**-0.001308**		

Variance	0.00324
Standard Deviation	0.05696
Skew Coefficient	-0.50144

	-0.6	-0.5	-0.50144		
T_r (yr)	K (lower)*	K (upper)*	K (actual)	T_{min} MLLW (ft)	T_{min} MLLW (ft)
2	0.099	0.083	0.083	3.4	-3.4
5	0.857	0.856	0.856	3.8	-3.8
10	1.200	1.216	1.216	4.0	-4.0
25	1.528	1.567	1.566	4.2	-4.2
50	1.720	1.777	1.776	4.3	-4.3
100	1.880	1.955	1.954	4.4	-4.4
200	2.016	2.108	2.107	4.5	-4.5

Seattle Verified Min

n= 17

Rank	Verified Year	Min Tide (T_{min}) MLLW (ft)	log Tmax	$(\log T_{min} - \text{avg}(\log T_{min}))^2$	$(\log T_{min} - \text{avg}(\log T_{min}))^3$	Return Period $T_r=(n+1)/m$	Exceedance Probability $1/T_r$
1	2007	-4.58	6.6087E-01	5.8342E-03	4.4562E-04	18.0	0.056
2	2009	-4.57	6.5992E-01	5.6900E-03	4.2921E-04	9.0	0.111
3	2008	-4.32	6.3548E-01	2.6010E-03	1.3265E-04	6.0	0.167
4	1999	-4.27	6.3043E-01	2.1109E-03	9.6981E-05	4.5	0.222
5	2003	-4.14	6.1700E-01	1.0573E-03	3.4381E-05	3.6	0.278
6	2004	-4.13	6.1595E-01	9.9013E-04	3.1156E-05	3.0	0.333
7	2005	-4.07	6.0959E-01	6.3054E-04	1.5833E-05	2.6	0.389
8	2011	-3.95	5.9660E-01	1.4673E-04	1.7774E-06	2.3	0.444
9	2001	-3.88	5.8883E-01	1.8904E-05	8.2195E-08	2.0	0.500
10	2000	-3.82	5.8206E-01	5.8585E-06	-1.4180E-08	1.8	0.556
11	2006	-3.76	5.7519E-01	8.6415E-05	-8.0331E-07	1.6	0.611
12	2012	-3.67	5.6467E-01	3.9274E-04	-7.7833E-06	1.5	0.667
13	2010	-3.65	5.6229E-01	4.9244E-04	-1.0928E-05	1.4	0.722
14	2002	-3.39	5.3020E-01	2.9468E-03	-1.5996E-04	1.3	0.778
15	1997	-3.23	5.0920E-01	5.6673E-03	-4.2664E-04	1.2	0.833
16	1996	-3.19	5.0379E-01	6.5114E-03	-5.2542E-04	1.1	0.889
17	1998	-3.12	4.9415E-01	8.1594E-03	-7.3703E-04	1.1	0.944
		Average	**Average**	**Sum**	**Sum**		
		-3.867	**0.584**	**0.043342**	**-0.000681**		

Variance	0.00271
Standard Deviation	0.05205
Skew Coefficient	-0.34208

	-0.4	-0.3	-0.34208		
T_r (yr)	K (lower)*	K (upper)*	K (actual)	T_{min} MLLW (ft)	T_{min} MLLW (ft)
2	0.066	0.050	0.057	3.9	-3.9
5	0.855	0.853	0.854	4.3	-4.3
10	1.231	1.245	1.239	4.5	-4.5
25	1.606	1.643	1.627	4.7	-4.7
50	1.834	1.890	1.866	4.8	-4.8
100	2.029	2.104	2.072	4.9	-4.9
200	2.201	2.294	2.255	5.0	-5.0

Frequency Factors K for Gamma and log-Pearson Type III Distributions (Haan, 1977, Table 7.7)

	Recurrence Interval In Years							
	1.0101	2	5	10	25	50	100	200
SKEW COEFFICIENT Cs	Percent Chance (>=) = 1-F							
	99	50	20	10	4	2	1	0.5
3.0	-0.667	-0.396	0.420	1.180	2.278	3.152	4.051	4.970
2.9	-0.690	-0.390	0.440	1.195	2.277	3.134	4.013	4.904
2.8	-0.714	-0.384	0.460	1.210	2.275	3.114	3.973	4.847
2.7	-0.740	-0.376	0.479	1.224	2.272	3.093	3.932	4.783
2.6	-0.769	-0.368	0.499	1.238	2.267	3.071	3.889	4.718
2.5	-0.799	-0.360	0.518	1.250	2.262	3.048	3.845	4.652
2.4	-0.832	-0.351	0.537	1.262	2.256	3.023	3.800	4.584
2.3	-0.867	-0.341	0.555	1.274	2.248	2.997	3.753	4.515
2.2	-0.905	-0.330	0.574	1.284	2.240	2.970	3.705	4.444
2.1	-0.946	-0.319	0.592	1.294	2.230	2.942	3.656	4.372
2.0	-0.990	-0.307	0.609	1.302	2.219	2.912	3.605	4.298
1.9	-1.037	-0.294	0.627	1.310	2.207	2.881	3.553	4.223
1.8	-1.087	-0.282	0.643	1.318	2.193	2.848	3.499	4.147
1.7	-1.140	-0.268	0.660	1.324	2.179	2.815	3.444	4.069
1.6	-1.197	-0.254	0.675	1.329	2.163	2.780	3.388	3.990
1.5	-1.256	-0.240	0.690	1.333	2.146	2.743	3.330	3.910
1.4	-1.318	-0.225	0.705	1.337	2.128	2.706	3.271	3.828
1.3	-1.383	-0.210	0.719	1.339	2.108	2.666	3.211	3.745
1.2	-1.449	-0.195	0.732	1.340	2.087	2.626	3.149	3.661
1.1	-1.518	-0.180	0.745	1.341	2.066	2.585	3.087	3.575
1.0	-1.588	-0.164	0.758	1.340	2.043	2.542	3.022	3.489
0.9	-1.660	-0.148	0.769	1.339	2.018	2.498	2.957	3.401
0.8	-1.733	-0.132	0.780	1.336	1.993	2.453	2.891	3.312
0.7	-1.806	-0.116	0.790	1.333	1.967	2.407	2.824	3.223
0.6	-1.880	-0.099	0.800	1.328	1.939	2.359	2.755	3.132
0.5	-1.955	-0.083	0.808	1.323	1.910	2.311	2.686	3.041
0.4	-2.029	-0.066	0.816	1.317	1.880	2.261	2.615	2.949
0.3	-2.104	-0.050	0.824	1.309	1.849	2.211	2.544	2.856
0.2	-2.178	-0.033	0.830	1.301	1.818	2.159	2.472	2.763
0.1	-2.252	-0.017	0.836	1.292	1.785	2.107	2.400	2.670
0.0	-2.326	0.000	0.842	1.282	1.751	2.054	2.326	2.576
-0.1	-2.400	0.017	0.846	1.270	1.716	2.000	2.252	2.482
-0.2	-2.472	0.033	0.850	1.258	1.680	1.945	2.178	2.388
-0.3	-2.544	0.050	0.853	1.245	1.643	1.890	2.104	2.294
-0.4	-2.615	0.066	0.855	1.231	1.606	1.834	2.029	2.201
-0.5	-2.686	0.083	0.856	1.216	1.567	1.777	1.955	2.108
-0.6	-2.755	0.099	0.857	1.200	1.528	1.720	1.880	2.016
-0.7	-2.824	0.116	0.857	1.183	1.488	1.663	1.806	1.926
-0.8	-2.891	0.132	0.856	1.166	1.448	1.606	1.733	1.837
-0.9	-2.957	0.148	0.854	1.147	1.407	1.549	1.660	1.749
-1.0	-3.022	0.164	0.852	1.128	1.366	1.492	1.588	1.664
-1.1	-3.087	0.180	0.848	1.107	1.324	1.435	1.518	1.581
-1.2	-3.149	0.195	0.844	1.086	1.282	1.379	1.449	1.501
-1.3	-3.211	0.210	0.838	1.064	1.240	1.324	1.383	1.424
-1.4	-3.271	0.225	0.832	1.041	1.198	1.270	1.318	1.351
-1.5	-3.330	0.240	0.825	1.018	1.157	1.217	1.256	1.282
-1.6	-3.880	0.254	0.817	0.994	1.116	1.166	1.197	1.216
-1.7	-3.444	0.268	0.808	0.970	1.075	1.116	1.140	1.155
-1.8	-3.499	0.282	0.799	0.945	1.035	1.069	1.087	1.097
-1.9	-3.553	0.294	0.788	0.920	0.996	1.023	1.037	1.044
-2.0	-3.605	0.307	0.777	0.895	0.959	0.980	0.990	0.995
-2.1	-3.656	0.319	0.765	0.869	0.923	0.939	0.946	0.949
-2.2	-3.705	0.330	0.752	0.844	0.888	0.900	0.905	0.907
-2.3	-3.753	0.341	0.739	0.819	0.855	0.864	0.867	0.869
-2.4	-3.800	0.351	0.725	0.795	0.823	0.830	0.832	0.833
-2.5	-3.845	0.360	0.711	0.711	0.793	0.798	0.799	0.800
-2.6	-3.899	0.368	0.696	0.747	0.764	0.768	0.769	0.769
-2.7	-3.932	0.376	0.681	0.724	0.738	0.740	0.740	0.741
-2.8	-3.973	0.384	0.666	0.702	0.712	0.714	0.714	0.714
-2.9	-4.013	0.390	0.651	0.681	0.683	0.689	0.690	0.690
-3.0	-4.051	0.396	0.636	0.660	0.666	0.666	0.667	0.667

APPENDIX X: TERMINAL TIDAL INFORMATION
NOAA TIDE PREDICTION DATA

TERMINAL	LATITUDE	LONGITUDE	NOAA SUBORDINATE OR (HARMONIC) STATION	STATION ID	LATITUDE	LONGITUDE	NOAA REFERENCE (HARMONIC) STATION	HEIGHT OFFSET FACTOR		TIME OFFSET (MIN)		Δ LATITUDE	Δ LONGITUDE
								LOW	HIGH	LOW	HIGH		
ANACORTES	48° 30' 26" N	122° 40' 40" W	SHIP HARBOR, FIDALGO ISLAND	9448772	48° 30' 24" N	122° 40' 37" W	PORT TOWNSEND	*1.00	*0.94	25	16	2"	3"
BAINBRIDGE ISLAND	47° 37' 21" N	122° 30' 35" W	EAGLE HARBOR, BAINBRIDGE ISLAND	9445882	47° 37' 12" N	122° 30' 54" W	SEATTLE	*1.02	*1.00	5	4	9"	19"
BREMERTON	47° 33' 43" N	122° 37' 30" W	BREMERTON, SINCLAIR INL, PT ORCHARD	9445958	47° 33' 42" N	122° 37' 23" W	SEATTLE	*1.00	*1.04	18	11	1"	7"
CLINTON	47° 58' 30" N	122° 20' 59" W	GLENDALE, WHIDBEY ISLAND	9447814	47° 56' 24" N	122° 21' 25" W	SEATTLE	*0.99	*0.97	-3	1	2' 6"	26"
COUPEVILLE	48° 09' 34" N	122° 40' 22" W	ADMIRALTY HEAD	9447905	48° 09' 30" N	122° 40' 05" W	PORT TOWNSEND	-0.10	+0.00	20	-11	4"	17"
EAGLE HARBOR	47° 37' 18" N	122° 30' 51" W	EAGLE HARBOR, BAINBRIDGE ISLAND	9445882	47° 37' 12" N	122° 30' 54" W	SEATTLE	*1.02	*1.00	5	4	6"	3"
EDMONDS	47° 48' 48" N	122° 23' 06" W	EDMONDS	9447427	47° 48' 48" N	122° 22' 59" W	SEATTLE	*0.99	*0.96	-4	0	0"	7"
FAUNTLEROY	47° 31' 23" N	122° 23' 46" W	POINT VASHON, VASHON ISLAND	9446025	47° 30' 42" N	122° 27' 47" W	SEATTLE	*1.01	*1.02	2	2	41"	4' 1"
FRIDAY HARBOR	48° 32' 08" N	123° 00' 51" W	(FRIDAY HARBOR)	9449880	48° 32' 48" N	123° 00' 36" W	FRIDAY HARBOR	NA	NA	NA	NA	40"	15"
KINGSTON	47° 47' 42" N	122° 29' 42" W	KINGSTON, APPLETREE COVE	9445639	47° 47' 48" N	122° 29' 35" W	SEATTLE	*1.00	*0.97	-5	-5	6"	7"
LOPEZ	48° 34' 14" N	122° 53' 00" W	UPRIGHT HEAD, LOPEZ ISLAND	9449911	48° 34' 18" N	122° 53' 06" W	PORT TOWNSEND	*0.93	*0.93	44	26	4"	6"
MUKILTEO	47° 56' 57" N	122° 18' 16" W	GLENDALE, WHIDBEY ISLAND	9447814	47° 56' 24" N	122° 21' 25" W	SEATTLE	*0.99	*0.97	-3	1	33"	3' 9"
ORCAS	48° 35' 51" N	122° 56' 38" W	ORCAS, ORCAS ISLAND	9449798	48° 36' 00" N	122° 57' 00" W	PORT TOWNSEND	*0.90	*0.90	56	33	9"	22"
POINT DEFIANCE	47° 18' 22" N	122° 30' 51" W	TAHLEQUAH, NEIL PT, DALCO PASS, VASHON I	9446375	47° 20' 00" N	122° 30' 25" W	SEATTLE	*1.01	*1.05	5	4	1'38"	26"
PORT TOWNSEND	48° 06' 41" N	122° 45' 33" W	(PORT TOWNSEND)	9444900	48° 06' 42" N	122° 45' 29" W	PORT TOWNSEND	NA	NA	NA	NA	1"	4"
SEATTLE	47° 36' 09" N	122° 20' 22" W	(SEATTLE)	9447130	47° 36' 09" N	122° 20' 21" W	SEATTLE	NA	NA	NA	NA	0	1"
SHAW	48° 35' 04" N	122° 55' 47" W	SHAW ISLAND,FERRY TERM,HARNEY CHANN	9449904	48° 35' 06" N	122° 55' 41" W	PORT TOWNSEND	*0.99	*0.90	56	31	2"	6"
SOUTHWORTH	47° 30' 46" N	122° 29' 46" W	HARPER, YUKON HARBOR	9445993	47° 31' 24" N	122° 31' 01" W	SEATTLE	*0.99	*1.02	-1	-6	38"	1' 15"
TAHLEQUAH	47° 19' 56" N	122° 30' 28" W	TAHLEQUAH,NEIL PT,DALCO PASS,VASHON I	9446375	47° 20' 00" N	122° 30' 25" W	SEATTLE	*1.01	*1.05	5	4	4"	3"
VASHON	47° 30' 38" N	122° 27' 50" W	POINT VASHON, VASHON ISLAND	9446025	47° 30' 42" N	122° 27' 47" W	SEATTLE	*1.01	*1.02	2	2	4"	3"

NOAA USES HEIGHT OFFSET FACTORS AND TIME OFFSETS TO CONVERT TIDE PREDICTION DATA FROM ITS REFERENCE (HARMONIC) STATIONS TO SUBORDINATE STATIONS.
THESE HEIGHT OFFSET FACTORS ARE USED TO CONVERT THE 17-YEAR MINIMUM AND MAXIMUM REFERENCE WATER LEVELS AT THE THREE REFERENCE STATIONS TO SUBORDINATE STATIONS AT OR NEAR THE TERMINALS.

Δ INDICATES THE DISTANCE IN LATITUDE AND LONGITUDE FROM THE TERMINAL TO ITS NEAREST SUBORDINATE STATION.
FOR EXAMPLE, THE ANACORTES TERMINAL IS WITHIN 3 SECONDS (~ 220 FEET) OF THE SHIP HARBOR, FIDALGO ISLAND SUBORDINATE STATION. THE FAUNTLEROY TERMINAL IS OVER 4 MINUTES (~ 3 MILES) FROM THE NEAREST SUBORDINATE STATION, POINT VASHON, VASHON ISLAND.

WSF Tidal Data.xlsx
APP X NOAA TIDE PREDICTION DATA
8/7/2013

NOAA Tide Predictions

Admiralty Head,Washington,2013

The NOAA Tide Predictions application provides predictions in both graphical and tabular formats, with many user selected options, for over 3000 stations broken down by key areas in each state. Users can also access stations via the Google map interface. Additional information can be found in the help page.

Station Types: The NOAA Tide Predictions application provides predictions from 2 distinct categories of stations at over 3000 locations:
Harmonic - The predicted height values for Harmonic stations are conducted by combining the harmonic constituents into a single tide curve.
Subordinate - The high and low height values for Subordinate stations are obtained by means and differences, and ratios applied to the full harmonic constant predictions at a specific Harmonic station (a Reference station).

Disclaimer: The official Tide prediction tables are published annually on October 1, for the following calendar year. Tide predictions generated prior to the publishing date of the official tables are subject to change. The predictions from the web based NOAA Tidal Predictions are based upon the latest information available as of the date of your request. Tide predictions generated may differ from the official published predictions if information for the station requested has been updated since the publishing date of the official published tables.

Generated On: Mon Jun 17 22:33:15 GMT 2013

Page 1 of 5

StationId:9447905
Source:NOAA/NOS/CO-OPS
Station Type:Subordinate
Time Zone:LST/LDT
Datum:mean lower low water (MLLW) which is the chart datum of soundings

NOAA Tide Predictions

Admiralty Head,Washington,2013

Times and Heights of High and Low Waters

January

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Tu	12:02 AM -0.3 -9 07:19 AM 9.3 283 01:25 PM 5.2 158 05:46 PM 6.6 201		**16** W	12:46 AM 0.8 24 07:39 AM 9.5 290 02:20 PM 3.4 104 07:28 PM 6.2 189	
2 W	12:39 AM 0.4 12 07:49 AM 9.3 283 02:16 PM 4.5 137 06:48 PM 6.1 186		**17** Th	01:30 AM 2.2 67 08:11 AM 9.3 283 03:22 PM 2.7 82 08:54 PM 5.8 177	
3 Th	01:18 AM 1.4 43 08:19 AM 9.3 283 03:09 PM 3.6 110 08:02 PM 5.6 171		**18** F	02:17 AM 3.5 107 08:44 AM 9.1 277 04:23 PM 2.1 64 11:00 PM 5.8 177	
4 F	01:59 AM 2.5 76 08:51 AM 9.2 280 04:02 PM 2.6 79 09:33 PM 5.4 165		**19** Sa	03:11 AM 4.8 146 09:17 AM 8.8 268 05:20 PM 1.5 46	
5 Sa	02:46 AM 3.7 113 09:25 AM 9.2 280 04:55 PM 1.5 46 11:36 PM 5.7 174		**20** Su	12:58 AM 6.4 195 04:19 AM 5.8 177 09:52 AM 8.5 259 06:11 PM 1.1 34	
6 Su	03:47 AM 4.9 149 10:02 AM 9.2 280 05:47 PM 0.4 12		**21** M	02:10 AM 7.2 219 05:42 AM 6.5 198 10:32 AM 8.2 250 06:57 PM 0.6 18	
7 M	01:34 AM 6.6 201 05:02 AM 5.9 180 10:43 AM 9.2 280 06:38 PM -0.7 -21		**22** Tu	03:00 AM 7.9 241 07:05 AM 6.8 207 11:17 AM 8.1 247 07:38 PM 0.3 9	
8 Tu	02:38 AM 7.6 232 06:19 AM 6.5 198 11:30 AM 9.2 280 07:28 PM -1.6 -49		**23** W	03:38 AM 8.3 253 08:11 AM 6.9 210 12:07 PM 8.0 244 08:15 PM -0.1 -3	
9 W	03:24 AM 8.4 256 07:29 AM 6.8 207 12:24 PM 9.2 280 08:16 PM -2.2 -67		**24** Th	04:10 AM 8.6 262 08:58 AM 6.7 204 12:57 PM 7.9 241 08:50 PM -0.3 -9	
10 Th	04:05 AM 9.0 274 08:31 AM 6.7 204 01:21 PM 9.1 277 09:03 PM -2.6 -79		**25** F	04:37 AM 8.7 265 09:34 AM 6.5 198 01:45 PM 7.9 241 09:23 PM -0.5 -15	
11 F	04:43 AM 9.4 287 09:29 AM 6.4 195 02:19 PM 8.9 271 09:49 PM -2.5 -76		**26** Sa	05:00 AM 8.8 268 10:06 AM 6.1 186 02:32 PM 7.8 238 09:57 PM -0.5 -15	
12 Sa	05:20 AM 9.6 293 10:25 AM 6.0 183 03:17 PM 8.6 262 10:34 PM -2.1 -64		**27** Su	05:20 AM 8.9 271 10:40 AM 5.7 174 03:19 PM 7.7 235 10:30 PM -0.4 -12	
13 Su	05:56 AM 9.7 296 11:21 AM 5.4 165 04:16 PM 8.1 247 11:18 PM -1.4 -43		**28** M	05:41 AM 9.0 274 11:16 AM 5.1 155 04:07 PM 7.5 229 11:05 PM -0.1 -3	
14 M	06:31 AM 9.7 296 12:19 PM 4.7 143 05:16 PM 7.5 229		**29** Tu	06:04 AM 9.1 277 11:56 AM 4.5 137 04:59 PM 7.2 219 11:40 PM 0.5 15	
15 Tu	12:02 AM -0.4 -12 07:06 AM 9.7 296 01:19 PM 4.0 122 06:19 PM 6.9 210		**30** W	06:31 AM 9.1 277 12:39 PM 3.8 116 05:54 PM 6.9 210	
			31 Th	12:17 AM 1.3 40 06:59 AM 9.2 280 01:25 PM 3.0 91 06:56 PM 6.5 198	

February

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	12:55 AM 2.4 73 07:30 AM 9.2 280 02:16 PM 2.2 67 08:07 PM 6.2 189		**16** Sa	01:53 AM 4.5 137 07:44 AM 8.5 259 03:08 PM 1.6 49 10:24 PM 6.4 195	
2 Sa	01:37 AM 3.5 107 08:02 AM 9.1 277 03:11 PM 1.4 43 09:36 PM 6.1 186		**17** Su	02:48 AM 5.4 165 08:18 AM 8.2 250 04:05 PM 1.5 46	
3 Su	02:25 AM 4.7 143 08:38 AM 9.0 274 04:10 PM 0.6 18 11:41 PM 6.3 192		**18** M	12:20 AM 6.8 207 04:01 AM 6.1 186 08:56 AM 7.9 241 05:05 PM 1.3 40	
4 M	03:29 AM 5.7 174 09:19 AM 8.9 271 05:11 PM -0.1 -3		**19** Tu	01:34 AM 7.3 223 05:32 AM 6.5 198 09:44 AM 7.6 232 06:04 PM 1.1 34	
5 Tu	01:24 AM 7.1 216 04:51 AM 6.4 195 10:09 AM 8.8 268 06:11 PM -0.7 -21		**20** W	02:22 AM 7.7 235 07:00 AM 6.5 198 10:42 AM 7.4 226 06:56 PM 0.9 27	
6 W	02:21 AM 7.8 238 06:16 AM 6.7 204 11:10 AM 8.6 262 07:08 PM -1.2 -37		**21** Th	02:58 AM 8.0 244 07:59 AM 6.3 192 11:46 AM 7.3 223 07:42 PM 0.6 18	
7 Th	03:03 AM 8.4 256 07:29 AM 6.5 198 12:18 PM 8.6 262 08:01 PM -1.4 -43		**22** F	03:26 AM 8.1 247 08:37 AM 5.9 180 12:47 PM 7.4 226 08:21 PM 0.4 12	
8 F	03:40 AM 8.8 268 08:30 AM 6.0 183 01:26 PM 8.5 259 08:49 PM -1.5 -46		**23** Sa	03:48 AM 8.2 250 09:06 AM 5.5 168 01:43 PM 7.5 229 08:57 PM 0.4 12	
9 Sa	04:14 AM 9.1 277 09:23 AM 5.4 165 02:29 PM 8.4 256 09:34 PM -1.2 -37		**24** Su	04:06 AM 8.3 253 09:34 AM 4.9 149 02:35 PM 7.6 232 09:32 PM 0.5 15	
10 Su	04:45 AM 9.2 280 10:12 AM 4.6 140 03:28 PM 8.2 250 10:17 PM -0.6 -18		**25** M	04:24 AM 8.5 259 10:05 AM 4.2 128 03:25 PM 7.6 232 10:06 PM 0.7 21	
11 M	05:16 AM 9.3 283 11:00 AM 3.9 119 04:26 PM 7.9 241 10:59 PM 0.2 6		**26** Tu	04:45 AM 8.6 262 10:40 AM 3.4 104 04:16 PM 7.6 232 10:42 PM 1.2 37	
12 Tu	05:46 AM 9.3 283 11:48 AM 3.2 98 05:23 PM 7.5 229 11:41 PM 1.2 37		**27** W	05:10 AM 8.7 265 11:18 AM 2.5 76 05:09 PM 7.6 232 11:19 PM 1.9 58	
13 W	06:15 AM 9.2 280 12:36 PM 2.6 79 06:22 PM 7.1 216		**28** Th	05:38 AM 8.8 268 12:00 PM 1.7 52 06:05 PM 7.4 226 11:58 PM 2.8 85	
14 Th	12:23 AM 2.3 70 06:44 AM 9.0 274 01:24 PM 2.2 67 07:25 PM 6.8 207				
15 F	01:06 AM 3.4 104 07:13 AM 8.8 268 02:15 PM 1.8 55 08:40 PM 6.5 198				

March

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	06:08 AM 8.8 268 12:46 PM 1.0 30 07:06 PM 7.3 223		**16** Sa	01:49 AM 4.6 140 07:16 AM 8.1 247 02:19 PM 0.8 24 09:24 PM 7.3 223	
2 Sa	12:40 AM 3.7 113 06:41 AM 8.8 268 01:35 PM 0.5 15 08:16 PM 7.1 216		**17** Su	02:40 AM 5.3 162 07:49 AM 7.8 238 03:07 PM 0.9 27 10:40 PM 7.2 219	
3 Su	01:27 AM 4.6 140 07:17 AM 8.7 265 02:31 PM 0.1 3 09:40 PM 7.0 213		**18** M	03:41 AM 5.8 177 08:25 AM 7.5 229 03:59 PM 1.1 34	
4 M	02:24 AM 5.5 168 07:58 AM 8.5 259 03:32 PM -0.1 -3 11:23 PM 7.2 219		**19** Tu	12:13 AM 7.2 219 05:02 AM 6.1 186 09:09 AM 7.1 216 04:58 PM 1.3 40	
5 Tu	03:39 AM 6.1 186 08:49 AM 8.2 250 04:37 PM -0.2 -6		**20** W	01:29 AM 7.4 226 06:38 AM 6.1 186 10:04 AM 6.8 207 06:01 PM 1.4 43	
6 W	12:47 AM 7.6 232 05:08 AM 6.3 192 09:54 AM 7.9 241 05:44 PM -0.3 -9		**21** Th	02:19 AM 7.6 232 07:53 AM 5.8 177 11:12 AM 6.6 201 07:01 PM 1.4 43	
7 Th	01:42 AM 8.0 244 06:34 AM 6.0 183 11:12 AM 7.6 232 06:47 PM -0.3 -9		**22** F	02:54 AM 7.7 235 08:38 AM 5.3 162 12:28 PM 6.5 198 07:55 PM 1.4 43	
8 F	02:24 AM 8.3 253 07:41 AM 5.4 165 12:32 PM 7.6 232 07:42 PM -0.1 -3		**23** Sa	03:19 AM 7.8 238 09:06 AM 4.8 146 01:41 PM 6.7 204 08:40 PM 1.4 43	
9 Sa	03:00 AM 8.6 262 08:32 AM 4.6 140 01:45 PM 7.7 235 08:32 PM 0.2 6		**24** Su	03:38 AM 7.9 241 09:32 AM 4.0 122 02:44 PM 6.9 210 09:21 PM 1.6 49	
10 Su	04:31 AM 8.7 265 10:16 AM 3.7 113 03:49 PM 7.8 238 10:16 PM 0.7 21		**25** M	03:57 AM 8.0 244 10:00 AM 3.2 98 03:40 PM 7.3 223 10:00 PM 1.9 58	
11 M	05:00 AM 8.8 268 10:56 AM 2.9 88 04:47 PM 7.8 238 10:59 PM 1.3 40		**26** Tu	04:19 AM 8.2 250 10:32 AM 2.2 67 04:33 PM 7.6 232 10:38 PM 2.3 70	
12 Tu	05:26 AM 8.7 265 11:36 AM 2.1 64 05:41 PM 7.8 238 11:40 PM 2.1 64		**27** W	04:44 AM 8.4 256 11:07 AM 1.2 37 05:26 PM 7.9 241 11:18 PM 2.9 88	
13 W	05:52 AM 8.7 265 12:15 PM 1.5 46 06:34 PM 7.8 238		**28** Th	05:13 AM 8.5 259 11:46 AM 0.3 9 06:20 PM 8.0 244 11:59 PM 3.6 110	
14 Th	12:21 AM 2.9 88 06:19 AM 8.6 262 12:55 PM 1.1 34 07:27 PM 7.6 232		**29** F	05:44 AM 8.6 262 12:28 PM -0.4 -12 07:16 PM 8.1 247	
15 F	01:04 AM 3.8 116 06:46 AM 8.4 256 01:36 PM 0.9 27 08:23 PM 7.5 229		**30** Sa	12:43 AM 4.3 131 06:18 AM 8.5 259 01:14 PM -0.9 -27 08:16 PM 8.1 247	
			31 Su	01:32 AM 5.0 152 06:56 AM 8.4 256 02:04 PM -1.0 -30 09:21 PM 8.0 244	

Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.
Referenced to Station: PORT TOWNSEND (9444900) Height offset in feet (low:-0.10 high: +0.00) Time offset in mins (low:20 high: -11)

Generated On: Mon Jun 17 22:33:15 GMT 2013

Page 2 of 5

StationId:9445958
Source:NOAA/NOS/CO-OPS
Station Type:Subordinate
Time Zone:LST/LDT
Datum:mean lower low water (MLLW) which is the chart datum of soundings

NOAA Tide Predictions

Bremerton, Sinclair Inlet, Port Orchard,Washington,2013

Times and Heights of High and Low Waters

January

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Tu	12:58 AM -0.2 -6 07:57 AM 12.9 393 02:07 PM 5.6 171 07:02 PM 9.6 293		**16** W	01:45 AM 1.0 30 08:26 AM 13.3 405 03:01 PM 3.6 110 08:30 PM 9.5 290	
2 W	01:37 AM 0.6 18 08:29 AM 12.9 393 02:53 PM 4.9 149 07:58 PM 9.2 280		**17** Th	02:31 AM 2.7 82 09:04 AM 12.9 393 03:55 PM 3.0 91 09:44 PM 8.9 271	
3 Th	02:17 AM 1.8 55 09:04 AM 12.9 393 03:43 PM 4.0 122 09:04 PM 8.8 268		**18** F	03:20 AM 4.3 131 09:44 AM 12.5 381 04:52 PM 2.5 76 11:16 PM 8.7 265	
4 F	03:01 AM 3.1 94 09:42 AM 12.8 390 04:37 PM 3.0 91 10:23 PM 8.6 262		**19** Sa	04:17 AM 5.9 180 10:28 AM 11.9 363 05:50 PM 2.0 61	
5 Sa	03:52 AM 4.6 140 10:23 AM 12.6 384 05:34 PM 1.9 58 11:55 PM 8.8 268		**20** Su	01:08 AM 9.0 274 05:35 AM 7.1 216 11:16 AM 11.4 347 06:47 PM 1.5 46	
6 Su	04:56 AM 6.1 186 11:08 AM 12.5 381 06:32 PM 0.7 21		**21** M	02:39 AM 9.8 299 07:13 AM 7.7 235 12:07 PM 11.0 335 07:38 PM 1.0 30	
7 M	01:32 AM 9.5 290 06:15 AM 7.2 219 11:59 AM 12.4 378 07:27 PM -0.5 -15		**22** Tu	03:37 AM 10.6 323 08:35 AM 7.8 238 01:00 PM 10.7 326 08:23 PM 0.6 18	
8 Tu	02:54 AM 10.6 323 07:38 AM 7.7 235 12:53 PM 12.4 378 08:20 PM -1.5 -46		**23** W	04:19 AM 11.2 341 09:32 AM 7.7 235 01:50 PM 10.6 323 09:03 PM 0.1 3	
9 W	03:52 AM 11.6 354 08:50 AM 7.7 235 01:49 PM 12.4 378 09:11 PM -2.4 -73		**24** Th	04:51 AM 11.6 354 10:13 AM 7.4 226 02:36 PM 10.6 323 09:40 PM -0.2 -6	
10 Th	04:39 AM 12.4 378 09:51 AM 7.4 226 02:44 PM 12.4 378 09:59 PM -2.8 -85		**25** F	05:17 AM 11.9 363 10:46 AM 7.1 216 03:19 PM 10.7 326 10:15 PM -0.5 -15	
11 F	05:20 AM 13.0 396 10:46 AM 6.9 210 03:39 PM 12.3 375 10:46 PM -2.8 -85		**26** Sa	05:38 AM 12.1 369 11:15 AM 6.7 204 03:59 PM 10.8 329 10:50 PM -0.5 -15	
12 Sa	05:59 AM 13.4 408 11:37 AM 6.3 192 04:34 PM 12.0 366 11:32 PM -2.4 -73		**27** Su	05:58 AM 12.3 375 11:44 AM 6.2 189 04:40 PM 10.8 329 11:25 PM -0.4 -12	
13 Su	06:36 AM 13.6 415 12:27 PM 5.6 171 05:29 PM 11.6 354		**28** M	06:21 AM 12.5 381 12:16 PM 5.5 168 05:22 PM 10.7 326	
14 M	12:17 AM -1.6 -49 07:13 AM 13.6 415 01:17 PM 4.9 149 06:26 PM 10.9 332		**29** Tu	12:00 AM -0.1 -3 06:46 AM 12.7 387 12:52 PM 4.8 146 06:07 PM 10.5 320	
15 Tu	01:01 AM -0.4 -12 07:49 AM 13.5 411 02:08 PM 4.2 128 07:26 PM 10.2 311		**30** W	12:37 AM 0.6 18 07:15 AM 12.9 393 01:31 PM 3.9 119 06:56 PM 10.3 314	
			31 Th	01:15 AM 1.6 49 07:45 AM 12.9 393 02:14 PM 3.1 94 07:51 PM 10.0 305	

February

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	01:55 AM 2.8 85 08:19 AM 12.9 393 03:02 PM 2.3 70 08:54 PM 9.6 293		**16** Sa	02:52 AM 5.2 158 08:51 AM 11.7 357 03:48 PM 1.9 58 10:31 PM 9.3 283	
2 Sa	02:39 AM 4.2 128 08:56 AM 12.7 387 03:55 PM 1.6 49 10:08 PM 9.3 283		**17** Su	03:47 AM 6.4 195 09:35 AM 11.1 338 04:43 PM 1.9 58	
3 Su	03:30 AM 5.6 171 09:39 AM 12.4 378 04:54 PM 0.9 27 11:39 PM 9.4 287		**18** M	12:10 AM 9.3 283 05:04 AM 7.3 223 10:26 AM 10.5 320 05:43 PM 1.8 55	
4 M	04:37 AM 6.9 210 10:30 AM 12.0 366 05:57 PM 0.3 9		**19** Tu	01:51 AM 9.8 299 06:52 AM 7.7 235 11:26 AM 10.0 305 06:44 PM 1.6 49	
5 Tu	01:24 AM 9.9 302 06:06 AM 7.7 235 11:31 AM 11.8 360 07:01 PM -0.4 -12		**20** W	02:55 AM 10.3 314 08:18 AM 7.5 229 12:30 PM 9.8 299 07:41 PM 1.3 40	
6 W	02:45 AM 10.8 329 07:38 AM 7.8 238 12:38 PM 11.6 354 08:01 PM -1.1 -34		**21** Th	03:36 AM 10.8 329 09:10 AM 7.0 213 01:30 PM 9.9 302 08:29 PM 0.9 27	
7 Th	03:39 AM 11.6 354 08:51 AM 7.3 223 01:44 PM 11.7 357 08:55 PM -1.5 -46		**22** F	04:06 AM 11.1 338 09:45 AM 6.5 198 02:22 PM 10.1 308 09:11 PM 0.6 18	
8 F	04:20 AM 12.2 372 09:48 AM 6.5 198 02:45 PM 11.7 357 09:45 PM -1.7 -52		**23** Sa	04:28 AM 11.4 347 10:13 AM 5.9 180 03:09 PM 10.4 317 09:49 PM 0.4 12	
9 Sa	04:55 AM 12.7 387 10:36 AM 5.7 174 03:42 PM 11.8 360 10:32 PM -1.5 -46		**24** Su	04:48 AM 11.7 357 10:40 AM 5.3 162 03:52 PM 10.6 323 10:26 PM 0.5 15	
10 Su	05:28 AM 13.0 396 11:21 AM 4.8 146 04:37 PM 11.7 357 11:16 PM -0.9 -27		**25** M	05:09 AM 11.9 363 11:09 AM 4.4 134 04:34 PM 10.9 332 11:02 PM 0.7 21	
11 M	06:00 AM 13.1 399 12:04 PM 3.9 119 05:30 PM 11.4 347 11:59 PM 0.0 0		**26** Tu	05:32 AM 12.2 372 11:41 AM 3.5 107 05:18 PM 11.0 335 11:39 PM 1.2 37	
12 Tu	06:31 AM 13.1 399 12:47 PM 3.2 98 06:23 PM 11.0 335		**27** W	05:59 AM 12.4 378 12:17 PM 2.6 79 06:04 PM 11.1 338	
13 W	12:41 AM 1.2 37 07:04 AM 13.0 396 01:30 PM 2.6 79 07:17 PM 10.6 323		**28** Th	12:17 AM 2.0 61 06:28 AM 12.5 381 12:57 PM 1.7 52 06:54 PM 11.0 335	
14 Th	01:22 AM 2.5 76 07:37 AM 12.7 387 02:13 PM 2.2 67 08:13 PM 10.1 308				
15 F	02:05 AM 3.9 119 08:13 AM 12.3 375 02:59 PM 1.9 58 09:16 PM 9.6 293				

March

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	12:57 AM 3.0 91 07:00 AM 12.5 381 01:40 PM 0.9 27 07:48 PM 10.8 329		**16** Sa	02:46 AM 5.0 152 08:23 AM 11.3 344 03:09 PM 0.8 24 09:50 PM 10.4 317	
2 Sa	01:40 AM 4.1 125 07:36 AM 12.4 378 02:27 PM 0.4 12 08:49 PM 10.5 320		**17** Su	03:33 AM 5.9 180 09:02 AM 10.7 326 03:53 PM 1.0 30 10:50 PM 10.1 308	
3 Su	02:28 AM 5.3 162 08:17 AM 12.0 366 03:20 PM 0.2 6 10:00 PM 10.2 311		**18** M	04:29 AM 6.6 201 09:46 AM 10.0 305 04:43 PM 1.3 40	
4 M	03:26 AM 6.4 195 09:05 AM 11.6 354 04:20 PM 0.1 3 11:26 PM 10.1 308		**19** Tu	12:02 AM 9.9 302 05:44 AM 7.1 216 10:40 AM 9.4 287 05:40 PM 1.7 52	
5 Tu	04:42 AM 7.1 216 10:06 AM 11.0 335 05:27 PM 0.1 3		**20** W	01:26 AM 9.9 302 07:27 AM 7.1 216 11:47 AM 9.0 274 06:44 PM 1.9 58	
6 W	01:02 AM 10.4 317 06:19 AM 7.3 223 11:20 AM 10.6 323 06:36 PM 0.0 0		**21** Th	02:37 AM 10.1 308 08:47 AM 6.7 204 01:00 PM 8.8 268 07:47 PM 1.9 58	
7 Th	02:15 AM 11.0 335 07:47 AM 6.8 207 12:38 PM 10.5 320 07:41 PM -0.1 -3		**22** F	03:23 AM 10.4 317 09:33 AM 6.0 183 02:08 PM 9.0 274 08:44 PM 1.8 55	
8 F	03:05 AM 11.5 351 08:50 AM 5.8 177 01:51 PM 10.6 323 08:39 PM -0.2 -6		**23** Sa	03:55 AM 10.7 326 10:06 AM 5.3 162 03:06 PM 9.4 287 09:33 PM 1.7 52	
9 Sa	03:44 AM 11.9 363 09:39 AM 4.8 146 02:55 PM 10.9 332 09:30 PM 0.0 0		**24** Su	04:21 AM 11.0 335 10:33 AM 4.4 134 03:57 PM 9.9 302 10:16 PM 1.8 55	
10 Su	05:17 AM 12.2 372 11:21 AM 3.7 113 04:52 PM 11.1 338 11:16 PM 0.5 15		**25** M	04:45 AM 11.3 344 11:02 AM 3.3 101 04:44 PM 10.5 320 10:57 PM 2.0 61	
11 M	05:46 AM 12.4 378 12:00 PM 2.8 85 05:44 PM 11.3 344		**26** Tu	05:11 AM 11.6 354 11:33 AM 2.2 67 05:29 PM 11.0 335 11:37 PM 2.4 73	
12 Tu	12:00 AM 1.2 37 06:15 AM 12.4 378 12:37 PM 2.0 61 06:33 PM 11.3 344		**27** W	05:38 AM 11.9 363 12:07 PM 1.1 34 06:15 PM 11.4 347	
13 W	12:41 AM 2.0 61 06:44 AM 12.3 375 01:14 PM 1.3 40 07:21 PM 11.2 341		**28** Th	12:17 AM 3.0 91 06:08 AM 12.1 369 12:45 PM 0.1 3 07:03 PM 11.6 354	
14 Th	01:22 AM 3.0 91 07:15 AM 12.1 369 01:51 PM 0.9 27 08:09 PM 11.0 335		**29** F	01:00 AM 3.7 113 06:41 AM 12.1 369 01:26 PM -0.7 -21 07:54 PM 11.7 357	
15 F	02:03 AM 4.0 122 07:48 AM 11.7 357 02:29 PM 0.7 21 08:58 PM 10.8 329		**30** Sa	01:44 AM 4.5 137 07:18 AM 12.0 366 02:11 PM -1.2 -37 08:48 PM 11.7 357	
			31 Su	02:33 AM 5.3 162 07:59 AM 11.7 357 03:00 PM -1.3 -40 09:48 PM 11.4 347	

Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.
Referenced to Station: SEATTLE (Madison St.), Elliott Bay (9447130) Height offset in feet (low:*1.00 high: * 1.04) Time offset in mins (low:18 high: 11)

Generated On: Mon Jun 17 22:35:05 GMT 2013

StationId:9445882
Source:NOAA/NOS/CO-OPS
Station Type:Subordinate
Time Zone:LST/LDT
Datum:mean lower low water (MLLW) which is the chart datum of soundings

NOAA Tide Predictions

Eagle Harbor, Bainbridge Island,Washington,2013

Times and Heights of High and Low Waters

January

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Tu	12:45 AM -0.2 -6 07:50 AM 12.4 378 01:54 PM 5.7 174 06:55 PM 9.2 280		**16** W	01:32 AM 1.0 30 08:19 AM 12.8 390 02:48 PM 3.6 110 08:23 PM 9.1 277	
2 W	01:24 AM 0.7 21 08:22 AM 12.4 378 02:40 PM 5.0 152 07:51 PM 8.8 268		**17** Th	02:18 AM 2.7 82 08:57 AM 12.4 378 03:42 PM 3.1 94 09:37 PM 8.6 262	
3 Th	02:04 AM 1.8 55 08:57 AM 12.4 378 03:30 PM 4.1 125 08:57 PM 8.4 256		**18** F	03:07 AM 4.4 134 09:37 AM 12.0 366 04:39 PM 2.6 79 11:09 PM 8.3 253	
4 F	02:48 AM 3.2 98 09:35 AM 12.3 375 04:24 PM 3.1 94 10:16 PM 8.2 250		**19** Sa	04:04 AM 6.0 183 10:21 AM 11.5 351 05:37 PM 2.1 64	
5 Sa	03:39 AM 4.7 143 10:16 AM 12.1 369 05:21 PM 2.0 61 11:48 PM 8.4 256		**20** Su	01:01 AM 8.7 265 05:22 AM 7.2 219 11:09 AM 10.9 332 06:34 PM 1.6 49	
6 Su	04:43 AM 6.2 189 11:01 AM 12.0 366 06:19 PM 0.7 21		**21** M	02:32 AM 9.5 290 07:00 AM 7.9 241 12:00 PM 10.5 320 07:25 PM 1.0 30	
7 M	01:25 AM 9.2 280 06:02 AM 7.3 223 11:52 AM 11.9 363 07:14 PM -0.5 -15		**22** Tu	03:30 AM 10.2 311 08:22 AM 8.0 244 12:53 PM 10.3 314 08:10 PM 0.6 18	
8 Tu	02:47 AM 10.2 311 07:25 AM 7.9 241 12:46 PM 11.9 363 08:07 PM -1.6 -49		**23** W	04:12 AM 10.8 329 09:19 AM 7.8 238 01:43 PM 10.2 311 08:50 PM 0.1 3	
9 W	03:45 AM 11.2 341 08:37 AM 7.9 241 01:42 PM 12.0 366 08:58 PM -2.4 -73		**24** Th	04:44 AM 11.2 341 10:00 AM 7.6 232 02:29 PM 10.2 311 09:27 PM -0.2 -6	
10 Th	04:32 AM 11.9 363 09:38 AM 7.6 232 02:37 PM 11.9 363 09:46 PM -2.9 -88		**25** F	05:10 AM 11.4 347 10:33 AM 7.2 219 03:12 PM 10.3 314 10:02 PM -0.5 -15	
11 F	05:13 AM 12.5 381 10:33 AM 7.1 216 03:32 PM 11.8 360 10:33 PM -2.9 -88		**26** Sa	05:31 AM 11.6 354 11:02 AM 6.8 207 03:52 PM 10.3 314 10:37 PM -0.6 -18	
12 Sa	05:52 AM 12.8 390 11:24 AM 6.4 195 04:27 PM 11.6 354 11:19 PM -2.5 -76		**27** Su	05:51 AM 11.8 360 11:31 AM 6.3 192 04:33 PM 10.3 314 11:12 PM -0.4 -12	
13 Su	06:29 AM 13.0 396 12:14 PM 5.7 174 05:22 PM 11.1 338		**28** M	06:14 AM 12.0 366 12:03 PM 5.6 171 05:15 PM 10.3 314 11:47 PM -0.1 -3	
14 M	12:04 AM -1.6 -49 07:06 AM 13.1 399 01:04 PM 5.0 152 06:19 PM 10.5 320		**29** Tu	06:39 AM 12.2 372 12:39 PM 4.9 149 06:00 PM 10.1 308	
15 Tu	12:48 AM -0.4 -12 07:42 AM 13.0 396 01:55 PM 4.3 131 07:19 PM 9.8 299		**30** W	12:24 AM 0.6 18 07:08 AM 12.4 378 01:18 PM 4.0 122 06:49 PM 9.9 302	
			31 Th	01:02 AM 1.6 49 07:38 AM 12.4 378 02:01 PM 3.2 98 07:44 PM 9.6 293	

February

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	01:42 AM 2.8 85 08:12 AM 12.4 378 02:49 PM 2.4 73 08:47 PM 9.2 280		**16** Sa	02:39 AM 5.3 162 08:44 AM 11.2 341 03:35 PM 1.9 58 10:24 PM 9.0 274	
2 Sa	02:26 AM 4.3 131 08:49 AM 12.2 372 03:42 PM 1.6 49 10:01 PM 9.0 274		**17** Su	03:34 AM 6.6 201 09:28 AM 10.6 323 04:30 PM 1.9 58	
3 Su	03:17 AM 5.7 174 09:32 AM 11.9 363 04:41 PM 1.0 30 11:32 PM 9.0 274		**18** M	12:03 AM 9.0 274 04:51 AM 7.5 229 10:19 AM 10.1 308 05:30 PM 1.8 55	
4 M	04:24 AM 7.0 213 10:23 AM 11.6 354 05:44 PM 0.3 9		**19** Tu	01:44 AM 9.4 287 06:39 AM 7.8 238 11:19 AM 9.6 293 06:31 PM 1.6 49	
5 Tu	01:17 AM 9.5 290 05:53 AM 7.8 238 11:24 AM 11.3 344 06:48 PM -0.4 -12		**20** W	02:48 AM 9.9 302 08:05 AM 7.6 232 12:23 PM 9.4 287 07:28 PM 1.3 40	
6 W	02:38 AM 10.4 317 07:25 AM 7.9 241 12:31 PM 11.2 341 07:48 PM -1.1 -34		**21** Th	03:29 AM 10.4 317 08:57 AM 7.2 219 01:23 PM 9.5 290 08:16 PM 0.9 27	
7 Th	03:32 AM 11.2 341 08:38 AM 7.4 226 01:37 PM 11.2 341 08:42 PM -1.5 -46		**22** F	03:59 AM 10.7 326 09:32 AM 6.7 204 02:15 PM 9.7 296 08:58 PM 0.6 18	
8 F	04:13 AM 11.8 360 09:35 AM 6.7 204 02:38 PM 11.3 344 09:32 PM -1.7 -52		**23** Sa	04:21 AM 11.0 335 10:00 AM 6.1 186 03:02 PM 10.0 305 09:36 PM 0.5 15	
9 Sa	04:48 AM 12.2 372 10:23 AM 5.8 177 03:35 PM 11.3 344 10:19 PM -1.5 -46		**24** Su	04:41 AM 11.2 341 10:27 AM 5.4 165 03:45 PM 10.2 311 10:13 PM 0.5 15	
10 Su	05:21 AM 12.5 381 11:08 AM 4.9 149 04:30 PM 11.2 341 11:03 PM -0.9 -27		**25** M	05:02 AM 11.5 351 10:56 AM 4.5 137 04:27 PM 10.5 320 10:49 PM 0.7 21	
11 M	05:53 AM 12.6 384 11:51 AM 4.0 122 05:23 PM 11.0 335 11:46 PM 0.0 0		**26** Tu	05:25 AM 11.7 357 11:28 AM 3.6 110 05:11 PM 10.6 323 11:26 PM 1.3 40	
12 Tu	06:24 AM 12.6 384 12:34 PM 3.2 98 06:16 PM 10.6 323		**27** W	05:52 AM 11.9 363 12:04 PM 2.6 79 05:57 PM 10.7 326	
13 W	12:28 AM 1.2 37 06:57 AM 12.5 381 01:17 PM 2.6 79 07:10 PM 10.2 311		**28** Th	12:04 AM 2.0 61 06:21 AM 12.1 369 12:44 PM 1.7 52 06:47 PM 10.6 323	
14 Th	01:09 AM 2.5 76 07:30 AM 12.2 372 02:00 PM 2.2 67 08:06 PM 9.7 296				
15 F	01:52 AM 3.9 119 08:06 AM 11.8 360 02:46 PM 2.0 61 09:09 PM 9.3 283				

March

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	12:44 AM 3.0 91 06:53 AM 12.1 369 01:27 PM 1.0 30 07:41 PM 10.4 317		**16** Sa	02:33 AM 5.1 155 08:16 AM 10.8 329 02:56 PM 0.8 24 09:43 PM 10.0 305	
2 Sa	01:27 AM 4.2 128 07:29 AM 11.9 363 02:14 PM 0.4 12 08:42 PM 10.1 308		**17** Su	03:20 AM 6.0 183 08:55 AM 10.3 314 03:40 PM 1.0 30 10:43 PM 9.7 296	
3 Su	02:15 AM 5.4 165 08:10 AM 11.6 354 03:07 PM 0.2 6 09:53 PM 9.8 299		**18** M	04:16 AM 6.8 207 09:39 AM 9.6 293 04:30 PM 1.4 43 11:55 PM 9.5 290	
4 M	03:13 AM 6.5 198 08:58 AM 11.1 338 04:07 PM 0.1 3 11:19 PM 9.7 296		**19** Tu	05:31 AM 7.3 223 10:33 AM 9.1 277 05:27 PM 1.7 52	
5 Tu	04:29 AM 7.3 223 09:59 AM 10.6 323 05:14 PM 0.1 3		**20** W	01:19 AM 9.5 290 07:14 AM 7.3 223 11:40 AM 8.6 262 06:31 PM 1.9 58	
6 W	12:55 AM 10.0 305 06:06 AM 7.5 229 11:13 AM 10.2 311 06:23 PM 0.0 0		**21** Th	02:30 AM 9.7 296 08:34 AM 6.8 207 12:53 PM 8.5 259 07:34 PM 1.9 58	
7 Th	02:08 AM 10.6 323 07:34 AM 6.9 210 12:31 PM 10.1 308 07:28 PM -0.1 -3		**22** F	03:16 AM 10.0 305 09:20 AM 6.1 186 02:01 PM 8.7 265 08:31 PM 1.8 55	
8 F	02:58 AM 11.1 338 08:37 AM 6.0 183 01:44 PM 10.2 311 08:26 PM -0.2 -6		**23** Sa	03:48 AM 10.3 314 09:53 AM 5.4 165 02:59 PM 9.1 277 09:20 PM 1.8 55	
9 Sa	03:37 AM 11.5 351 09:26 AM 4.9 149 02:48 PM 10.5 320 09:17 PM 0.0 0		**24** Su	04:14 AM 10.6 323 10:20 AM 4.4 134 03:50 PM 9.5 290 10:03 PM 1.8 55	
10 Su	05:10 AM 11.8 360 11:08 AM 3.8 116 04:45 PM 10.7 326 11:03 PM 0.5 15		**25** M	04:38 AM 10.9 332 10:49 AM 3.4 104 04:37 PM 10.1 308 10:44 PM 2.0 61	
11 M	05:39 AM 11.9 363 11:47 AM 2.8 85 05:37 PM 10.8 329 11:47 PM 1.2 37		**26** Tu	05:04 AM 11.2 341 11:20 AM 2.3 70 05:22 PM 10.5 320 11:24 PM 2.5 76	
12 Tu	06:08 AM 11.9 363 12:24 PM 2.0 61 06:26 PM 10.8 329		**27** W	05:31 AM 11.4 347 11:54 AM 1.1 34 06:08 PM 10.9 332	
13 W	12:28 AM 2.1 64 06:37 AM 11.9 363 01:01 PM 1.4 43 07:14 PM 10.8 329		**28** Th	12:04 AM 3.1 94 06:01 AM 11.6 354 12:32 PM 0.1 3 06:56 PM 11.2 341	
14 Th	01:09 AM 3.1 94 07:08 AM 11.6 354 01:38 PM 0.9 27 08:02 PM 10.6 323		**29** F	12:47 AM 3.8 116 06:34 AM 11.7 357 01:13 PM -0.7 -21 07:47 PM 11.3 344	
15 F	01:50 AM 4.1 125 07:41 AM 11.3 344 02:16 PM 0.8 24 08:51 PM 10.3 314		**30** Sa	01:31 AM 4.6 140 07:11 AM 11.6 354 01:58 PM -1.2 -37 08:41 PM 11.2 341	
			31 Su	02:20 AM 5.4 165 07:52 AM 11.3 344 02:47 PM -1.3 -40 09:41 PM 11.0 335	

Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.
Referenced to Station: SEATTLE (Madison St.), Elliott Bay (9447130) Height offset in feet (low:*1.02 high: * 1.00) Time offset in mins (low:5 high: 4)

Generated On: Mon Jun 17 22:34:48 GMT 2013

StationId:9447427
Source:NOAA/NOS/CO-OPS
Station Type:Subordinate
Time Zone:LST/LDT
Datum:mean lower low water (MLLW) which is the chart datum of soundings

NOAA Tide Predictions

Edmonds,Washington,2013

Times and Heights of High and Low Waters

January

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Tu	12:36 AM -0.2 -6 07:46 AM 11.9 363 01:45 PM 5.6 171 06:51 PM 8.9 271		**16** W	01:23 AM 1.0 30 08:15 AM 12.3 375 02:39 PM 3.5 107 08:19 PM 8.7 265	
2 W	01:15 AM 0.6 18 08:18 AM 11.9 363 02:31 PM 4.8 146 07:47 PM 8.5 259		**17** Th	02:09 AM 2.6 79 08:53 AM 11.9 363 03:33 PM 3.0 91 09:33 PM 8.2 250	
3 Th	01:55 AM 1.8 55 08:53 AM 11.9 363 03:21 PM 4.0 122 08:53 PM 8.1 247		**18** F	02:58 AM 4.3 131 09:33 AM 11.5 351 04:30 PM 2.5 76 11:05 PM 8.0 244	
4 F	02:39 AM 3.1 94 09:31 AM 11.8 360 04:15 PM 3.0 91 10:12 PM 7.9 241		**19** Sa	03:55 AM 5.8 177 10:17 AM 11.0 335 05:28 PM 2.0 61	
5 Sa	03:30 AM 4.6 140 10:12 AM 11.7 357 05:12 PM 1.9 58 11:44 PM 8.1 247		**20** Su	12:57 AM 8.3 253 05:13 AM 7.0 213 11:05 AM 10.5 320 06:25 PM 1.5 46	
6 Su	04:34 AM 6.0 183 10:57 AM 11.5 351 06:10 PM 0.7 21		**21** M	02:28 AM 9.1 277 06:51 AM 7.7 235 11:56 AM 10.1 308 07:16 PM 1.0 30	
7 M	01:21 AM 8.8 268 05:53 AM 7.1 216 11:48 AM 11.5 351 07:05 PM -0.5 -15		**22** Tu	03:26 AM 9.8 299 08:13 AM 7.8 238 12:49 PM 9.9 302 08:01 PM 0.5 15	
8 Tu	02:43 AM 9.8 299 07:16 AM 7.6 232 12:42 PM 11.4 347 07:58 PM -1.5 -46		**23** W	04:08 AM 10.4 317 09:10 AM 7.6 232 01:39 PM 9.8 299 08:41 PM 0.1 3	
9 W	03:41 AM 10.7 326 08:28 AM 7.7 235 01:38 PM 11.5 351 08:49 PM -2.3 -70		**24** Th	04:40 AM 10.7 326 09:51 AM 7.3 223 02:25 PM 9.8 299 09:18 PM -0.2 -6	
10 Th	04:28 AM 11.5 351 09:29 AM 7.4 226 02:33 PM 11.5 351 09:37 PM -2.8 -85		**25** F	05:06 AM 11.0 335 10:24 AM 7.0 213 03:08 PM 9.9 302 09:53 PM -0.5 -15	
11 F	05:09 AM 12.0 366 10:24 AM 6.9 210 03:28 PM 11.4 347 10:24 PM -2.8 -85		**26** Sa	05:27 AM 11.2 341 10:53 AM 6.6 201 03:48 PM 9.9 302 10:28 PM -0.5 -15	
12 Sa	05:48 AM 12.3 375 11:15 AM 6.2 189 04:23 PM 11.1 338 11:10 PM -2.4 -73		**27** Su	05:47 AM 11.4 347 11:22 AM 6.1 186 04:29 PM 9.9 302 11:03 PM -0.4 -12	
13 Su	06:25 AM 12.5 381 12:05 PM 5.5 168 05:18 PM 10.7 326 11:55 PM -1.6 -49		**28** M	06:10 AM 11.6 354 11:54 AM 5.5 168 05:11 PM 9.9 302 11:38 PM -0.1 -3	
14 M	07:02 AM 12.6 384 12:55 PM 4.8 146 06:15 PM 10.1 308		**29** Tu	06:35 AM 11.8 360 12:30 PM 4.7 143 05:56 PM 9.7 296	
15 Tu	12:39 AM -0.4 -12 07:38 AM 12.5 381 01:46 PM 4.1 125 07:15 PM 9.4 287		**30** W	12:15 AM 0.6 18 07:04 AM 11.9 363 01:09 PM 3.9 119 06:45 PM 9.5 290	
			31 Th	12:53 AM 1.6 49 07:34 AM 11.9 363 01:52 PM 3.1 94 07:40 PM 9.2 280	

February

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	01:33 AM 2.8 85 08:08 AM 11.9 363 02:40 PM 2.3 70 08:43 PM 8.9 271		**16** Sa	02:30 AM 5.2 158 08:40 AM 10.8 329 03:26 PM 1.8 55 10:20 PM 8.6 262	
2 Sa	02:17 AM 4.1 125 08:45 AM 11.7 357 03:33 PM 1.6 49 09:57 PM 8.6 262		**17** Su	03:25 AM 6.4 195 09:24 AM 10.2 311 04:21 PM 1.8 55 11:59 PM 8.6 262	
3 Su	03:08 AM 5.6 171 09:28 AM 11.4 347 04:32 PM 0.9 27 11:28 PM 8.7 265		**18** M	04:42 AM 7.3 223 10:15 AM 9.7 296 05:21 PM 1.8 55	
4 M	04:15 AM 6.8 207 10:19 AM 11.1 338 05:35 PM 0.3 9		**19** Tu	01:40 AM 9.0 274 06:30 AM 7.6 232 11:15 AM 9.2 280 06:22 PM 1.6 49	
5 Tu	01:13 AM 9.2 280 05:44 AM 7.6 232 11:20 AM 10.9 332 06:39 PM -0.4 -12		**20** W	02:44 AM 9.5 290 07:56 AM 7.4 226 12:19 PM 9.1 277 07:19 PM 1.3 40	
6 W	02:34 AM 10.0 305 07:16 AM 7.7 235 12:27 PM 10.7 326 07:39 PM -1.0 -30		**21** Th	03:25 AM 10.0 305 08:48 AM 7.0 213 01:19 PM 9.1 277 08:07 PM 0.9 27	
7 Th	03:28 AM 10.7 326 08:29 AM 7.2 219 01:33 PM 10.8 329 08:33 PM -1.5 -46		**22** F	03:55 AM 10.3 314 09:23 AM 6.5 198 02:11 PM 9.3 283 08:49 PM 0.6 18	
8 F	04:09 AM 11.3 344 09:26 AM 6.5 198 02:34 PM 10.8 329 09:23 PM -1.6 -49		**23** Sa	04:17 AM 10.5 320 09:51 AM 5.9 180 02:58 PM 9.6 293 09:27 PM 0.4 12	
9 Sa	04:44 AM 11.7 357 10:14 AM 5.6 171 03:31 PM 10.9 332 10:10 PM -1.4 -43		**24** Su	04:37 AM 10.8 329 10:18 AM 5.2 158 03:41 PM 9.8 299 10:04 PM 0.5 15	
10 Su	05:17 AM 12.0 366 10:59 AM 4.7 143 04:26 PM 10.8 329 10:54 PM -0.9 -27		**25** M	04:58 AM 11.0 335 10:47 AM 4.4 134 04:23 PM 10.0 305 10:40 PM 0.7 21	
11 M	05:49 AM 12.1 369 11:42 AM 3.9 119 05:19 PM 10.5 320 11:37 PM 0.0 0		**26** Tu	05:21 AM 11.3 344 11:19 AM 3.5 107 05:07 PM 10.2 311 11:17 PM 1.2 37	
12 Tu	06:20 AM 12.1 369 12:25 PM 3.2 98 06:12 PM 10.2 311		**27** W	05:48 AM 11.5 351 11:55 AM 2.5 76 05:53 PM 10.2 311 11:55 PM 2.0 61	
13 W	12:19 AM 1.1 34 06:53 AM 12.0 366 01:08 PM 2.6 79 07:06 PM 9.8 299		**28** Th	06:17 AM 11.6 354 12:35 PM 1.7 52 06:43 PM 10.2 311	
14 Th	01:00 AM 2.4 73 07:26 AM 11.7 357 01:51 PM 2.2 67 08:02 PM 9.3 283				
15 F	01:43 AM 3.8 116 08:02 AM 11.3 344 02:37 PM 1.9 58 09:05 PM 8.9 271				

March

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	12:35 AM 2.9 88 06:49 AM 11.6 354 01:18 PM 0.9 27 07:37 PM 10.0 305		**16** Sa	02:24 AM 5.0 152 08:12 AM 10.4 317 02:47 PM 0.8 24 09:39 PM 9.6 293	
2 Sa	01:18 AM 4.1 125 07:25 AM 11.4 347 02:05 PM 0.4 12 08:38 PM 9.7 296		**17** Su	03:11 AM 5.9 180 08:51 AM 9.8 299 03:31 PM 1.0 30 10:39 PM 9.3 283	
3 Su	02:06 AM 5.2 158 08:06 AM 11.1 338 02:58 PM 0.2 6 09:49 PM 9.4 287		**18** M	04:07 AM 6.6 201 09:35 AM 9.3 283 04:21 PM 1.3 40 11:51 PM 9.1 277	
4 M	03:04 AM 6.3 192 08:54 AM 10.7 326 03:58 PM 0.1 3 11:15 PM 9.3 283		**19** Tu	05:22 AM 7.1 216 10:29 AM 8.7 265 05:18 PM 1.6 49	
5 Tu	04:20 AM 7.1 216 09:55 AM 10.2 311 05:05 PM 0.1 3		**20** W	01:15 AM 9.1 277 07:05 AM 7.1 216 11:36 AM 8.3 253 06:22 PM 1.9 58	
6 W	12:51 AM 9.6 293 05:57 AM 7.2 219 11:09 AM 9.8 299 06:14 PM 0.0 0		**21** Th	02:26 AM 9.3 283 08:25 AM 6.6 201 12:49 PM 8.2 250 07:25 PM 1.9 58	
7 Th	02:04 AM 10.1 308 07:25 AM 6.7 204 12:27 PM 9.7 296 07:19 PM -0.1 -3		**22** F	03:12 AM 9.6 293 09:11 AM 6.0 183 01:57 PM 8.3 253 08:22 PM 1.8 55	
8 F	02:54 AM 10.6 323 08:28 AM 5.8 177 01:40 PM 9.8 299 08:17 PM -0.2 -6		**23** Sa	03:44 AM 9.9 302 09:44 AM 5.2 158 02:55 PM 8.7 265 09:11 PM 1.7 52	
9 Sa	03:33 AM 11.0 335 09:17 AM 4.7 143 02:44 PM 10.1 308 09:08 PM 0.0 0		**24** Su	04:10 AM 10.2 311 10:11 AM 4.3 131 03:46 PM 9.2 280 09:54 PM 1.7 52	
10 Su	05:06 AM 11.3 344 10:59 AM 3.7 113 04:41 PM 10.3 314 10:54 PM 0.5 15		**25** M	04:34 AM 10.5 320 10:40 AM 3.3 101 04:33 PM 9.6 293 10:35 PM 2.0 61	
11 M	05:35 AM 11.4 347 11:38 AM 2.7 82 05:33 PM 10.4 317 11:38 PM 1.2 37		**26** Tu	05:00 AM 10.7 326 11:11 AM 2.2 67 05:18 PM 10.1 308 11:15 PM 2.4 73	
12 Tu	06:04 AM 11.5 351 12:15 PM 1.9 58 06:22 PM 10.4 317		**27** W	05:27 AM 11.0 335 11:45 AM 1.1 34 06:04 PM 10.5 320 11:55 PM 3.0 91	
13 W	12:19 AM 2.0 61 06:33 AM 11.4 347 12:52 PM 1.3 40 07:10 PM 10.3 314		**28** Th	05:57 AM 11.1 338 12:23 PM 0.1 3 06:52 PM 10.7 326	
14 Th	01:00 AM 3.0 91 07:04 AM 11.2 341 01:29 PM 0.9 27 07:58 PM 10.2 311		**29** F	12:38 AM 3.7 113 06:30 AM 11.2 341 01:04 PM -0.7 -21 07:43 PM 10.8 329	
15 F	01:41 AM 4.0 122 07:37 AM 10.8 329 02:07 PM 0.7 21 08:47 PM 9.9 302		**30** Sa	01:22 AM 4.5 137 07:07 AM 11.1 338 01:49 PM -1.1 -34 08:37 PM 10.8 329	
			31 Su	02:11 AM 5.3 162 07:48 AM 10.8 329 02:38 PM -1.2 -37 09:37 PM 10.5 320	

Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.
Referenced to Station: SEATTLE (Madison St.), Elliott Bay (9447130) Height offset in feet (low:*0.99 high: * 0.96) Time offset in mins (low:-4 high: 0)

Generated On: Mon Jun 17 22:33:37 GMT 2013

StationId:9449880
Source:NOAA/NOS/CO-OPS
Station Type:Harmonic
Time Zone:LST/LDT
Datum:mean lower low water (MLLW) which is the chart datum of soundings

NOAA Tide Predictions

FRIDAY HARBOR,Washington,2013

Times and Heights of High and Low Waters

January

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Tu	12:22 AM	0.0 0	**16** W	01:02 AM	1.6 49
	08:20 AM	8.6 262		08:30 AM	9.1 277
	02:22 PM	5.1 155		03:15 PM	3.6 110
	05:54 PM	5.7 174		08:21 PM	5.5 168
2 W	12:57 AM	0.6 18	**17** Th	01:40 AM	2.8 85
	08:44 AM	8.5 259		09:01 AM	8.9 271
	03:11 PM	4.4 134		04:12 PM	2.9 88
	07:08 PM	5.1 155		09:59 PM	5.2 158
3 Th	01:32 AM	1.5 46	**18** F	02:18 AM	4.0 122
	09:09 AM	8.5 259		09:31 AM	8.6 262
	04:00 PM	3.5 107		05:06 PM	2.2 67
	08:40 PM	4.7 143			
4 F	02:10 AM	2.5 76	**19** Sa	12:06 AM	5.4 165
	09:35 AM	8.4 256		03:00 AM	5.1 155
	04:48 PM	2.4 73		10:01 AM	8.3 253
	10:35 PM	4.6 140		05:56 PM	1.5 46
5 Sa	02:54 AM	3.6 110	**20** Su	02:22 AM	6.1 186
	10:02 AM	8.3 253		04:05 AM	6.0 183
	05:35 PM	1.3 40		10:31 AM	7.9 241
				06:42 PM	1.0 30
6 Su	12:50 AM	5.1 155	**21** M	03:32 AM	6.8 207
	03:50 AM	4.7 143		05:57 AM	6.7 204
	10:32 AM	8.3 253		11:03 AM	7.6 232
	06:23 PM	0.2 6		07:25 PM	0.5 15
7 M	02:39 AM	6.0 183	**22** Tu	04:11 AM	7.4 226
	05:10 AM	5.8 177		07:41 AM	6.9 210
	11:07 AM	8.3 253		11:38 AM	7.4 226
	07:11 PM	-0.7 -21		08:05 PM	0.1 3
8 Tu	03:44 AM	7.0 213	**23** W	04:44 AM	7.7 235
	06:42 AM	6.6 201		08:56 AM	6.9 210
	11:48 AM	8.3 253		12:21 PM	7.2 219
	07:59 PM	-1.6 -49		08:42 PM	-0.2 -6
9 W	04:30 AM	7.8 238	**24** Th	05:13 AM	7.9 241
	08:05 AM	6.9 210		09:46 AM	6.7 204
	12:37 PM	8.3 253		01:10 PM	7.1 216
	08:46 PM	-2.1 -64		09:17 PM	-0.4 -12
10 Th	05:11 AM	8.4 256	**25** F	05:39 AM	8.0 244
	09:16 AM	7.0 213		10:23 AM	6.5 198
	01:33 PM	8.2 250		02:00 PM	7.0 213
	09:33 PM	-2.3 -70		09:51 PM	-0.5 -15
11 F	05:48 AM	8.9 271	**26** Sa	06:02 AM	8.1 247
	10:20 AM	6.8 207		10:55 AM	6.1 186
	02:33 PM	8.0 244		02:50 PM	6.8 207
	10:18 PM	-2.1 -64		10:23 PM	-0.4 -12
12 Sa	06:23 AM	9.1 277	**27** Su	06:23 AM	8.1 247
	11:19 AM	6.4 195		11:28 AM	5.7 174
	03:36 PM	7.7 235		03:40 PM	6.6 201
	11:01 PM	-1.6 -49		10:55 PM	-0.2 -6
13 Su	06:56 AM	9.2 280	**28** M	06:44 AM	8.2 250
	12:18 PM	5.8 177		12:04 PM	5.1 155
	04:41 PM	7.2 219		04:32 PM	6.4 195
	11:43 PM	-0.7 -21		11:27 PM	0.1 3
14 M	07:28 AM	9.2 280	**29** Tu	07:04 AM	8.2 250
	01:16 PM	5.1 155		12:43 PM	4.5 137
	05:48 PM	6.6 201		05:27 PM	6.1 186
15 Tu	12:23 AM	0.4 12	**30** W	12:01 AM	0.7 21
	07:59 AM	9.2 280		07:26 AM	8.3 253
	02:16 PM	4.4 134		01:25 PM	3.8 116
	06:59 PM	6.0 183		06:28 PM	5.8 177
			31 Th	12:36 AM	1.4 43
				07:49 AM	8.3 253
				02:10 PM	3.0 91
				07:38 PM	5.5 168

February

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	01:12 AM	2.4 73	**16** Sa	02:01 AM	4.8 146
	08:14 AM	8.3 253		08:29 AM	7.9 241
	03:00 PM	2.2 67		03:49 PM	1.7 52
	09:01 PM	5.3 162		11:27 PM	6.0 183
2 Sa	01:52 AM	3.4 104	**17** Su	02:51 AM	5.6 171
	08:41 AM	8.2 250		08:58 AM	7.5 229
	03:53 PM	1.4 43		04:44 PM	1.4 43
	10:45 PM	5.3 162			
3 Su	02:37 AM	4.5 137	**18** M	01:22 AM	6.4 195
	09:11 AM	8.1 247		04:09 AM	6.2 189
	04:49 PM	0.6 18		09:29 AM	7.2 219
				05:40 PM	1.1 34
4 M	12:51 AM	5.8 177	**19** Tu	02:40 AM	6.8 207
	03:37 AM	5.5 168		06:02 AM	6.4 195
	09:46 AM	8.1 247		10:07 AM	6.9 210
	05:47 PM	-0.2 -6		06:34 PM	0.8 24
5 Tu	02:31 AM	6.6 201	**20** W	03:26 AM	7.1 216
	05:10 AM	6.3 192		07:37 AM	6.4 195
	10:29 AM	8.0 244		10:59 AM	6.7 204
	06:44 PM	-0.8 -24		07:24 PM	0.5 15
6 W	03:28 AM	7.3 223	**21** Th	03:59 AM	7.2 219
	06:50 AM	6.7 204		08:36 AM	6.1 186
	11:23 AM	7.8 238		12:06 PM	6.5 198
	07:38 PM	-1.2 -37		08:08 PM	0.3 9
7 Th	04:08 AM	7.8 238	**22** F	04:25 AM	7.3 223
	08:13 AM	6.6 201		09:14 AM	5.8 177
	12:29 PM	7.7 235		01:13 PM	6.4 195
	08:29 PM	-1.4 -43		08:47 PM	0.2 6
8 F	04:43 AM	8.2 250	**23** Sa	04:47 AM	7.3 223
	09:18 AM	6.3 192		09:44 AM	5.3 162
	01:41 PM	7.5 229		02:15 PM	6.3 192
	09:17 PM	-1.3 -40		09:23 PM	0.2 6
9 Sa	05:14 AM	8.4 256	**24** Su	05:06 AM	7.3 223
	10:13 AM	5.7 174		10:14 AM	4.7 143
	02:52 PM	7.3 223		03:11 PM	6.3 192
	10:02 PM	-0.8 -24		09:57 PM	0.4 12
10 Su	05:43 AM	8.5 259	**25** M	05:24 AM	7.4 226
	11:02 AM	5.0 152		10:46 AM	4.1 125
	04:00 PM	7.1 216		04:05 PM	6.3 192
	10:44 PM	-0.2 -6		10:31 PM	0.7 21
11 M	06:11 AM	8.6 262	**26** Tu	05:43 AM	7.5 229
	11:49 AM	4.3 131		11:21 AM	3.3 101
	05:04 PM	6.8 207		04:59 PM	6.3 192
	11:23 PM	0.7 21		11:06 PM	1.2 37
12 Tu	06:38 AM	8.6 262	**27** W	06:04 AM	7.6 232
	12:36 PM	3.6 110		11:58 AM	2.6 79
	06:08 PM	6.5 198		05:55 PM	6.2 189
				11:43 PM	1.8 55
13 W	12:02 AM	1.7 52	**28** Th	06:26 AM	7.7 235
	07:06 AM	8.5 259		12:39 PM	1.9 58
	01:22 PM	3.0 91		06:55 PM	6.2 189
	07:13 PM	6.3 192			
14 Th	12:40 AM	2.8 85			
	07:33 AM	8.4 256			
	02:09 PM	2.5 76			
	08:24 PM	6.0 183			
15 F	01:19 AM	3.8 116			
	08:01 AM	8.2 250			
	02:57 PM	2.0 61			
	09:46 PM	5.9 180			

March

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	12:22 AM	2.6 79	**16** Sa	02:11 AM	4.7 143
	06:51 AM	7.8 238		07:57 AM	7.3 223
	01:24 PM	1.2 37		02:53 PM	1.0 30
	08:01 PM	6.2 189		10:28 PM	6.7 204
2 Sa	01:04 AM	3.6 110	**17** Su	03:02 AM	5.3 162
	07:19 AM	7.8 238		08:24 AM	7.0 213
	02:13 PM	0.6 18		03:40 PM	1.0 30
	09:18 PM	6.2 189		11:44 PM	6.6 201
3 Su	01:50 AM	4.5 137	**18** M	04:06 AM	5.7 174
	07:50 AM	7.7 235		08:52 AM	6.7 204
	03:08 PM	0.2 6		04:33 PM	1.0 30
	10:49 PM	6.3 192			
4 M	02:48 AM	5.3 162	**19** Tu	01:08 AM	6.6 201
	08:26 AM	7.5 229		05:37 AM	5.9 180
	04:08 PM	-0.1 -3		09:25 AM	6.3 192
				05:32 PM	1.0 30
5 Tu	12:29 AM	6.6 201	**20** W	02:21 AM	6.7 204
	04:09 AM	5.9 180		07:19 AM	5.8 177
	09:10 AM	7.3 223		10:13 AM	6.0 183
	05:12 PM	-0.4 -12		06:32 PM	1.0 30
6 W	01:49 AM	7.0 213	**21** Th	03:12 AM	6.7 204
	05:51 AM	6.1 186		08:29 AM	5.5 168
	10:08 AM	7.0 213		11:30 AM	5.7 174
	06:16 PM	-0.5 -15		07:29 PM	1.0 30
7 Th	02:43 AM	7.3 223	**22** F	03:47 AM	6.7 204
	07:21 AM	5.9 180		09:09 AM	5.0 152
	11:25 AM	6.7 204		01:01 PM	5.5 168
	07:15 PM	-0.4 -12		08:19 PM	1.0 30
8 F	03:23 AM	7.5 229	**23** Sa	04:13 AM	6.7 204
	08:26 AM	5.4 165		09:38 AM	4.4 134
	12:53 PM	6.5 198		02:22 PM	5.5 168
	08:09 PM	-0.2 -6		09:04 PM	1.1 34
9 Sa	03:55 AM	7.7 235	**24** Su	04:34 AM	6.7 204
	09:17 AM	4.7 143		10:06 AM	3.7 113
	02:15 PM	6.5 198		03:30 PM	5.6 171
	08:58 PM	0.3 9		09:45 PM	1.3 40
10 Su	05:24 AM	7.7 235	**25** M	04:52 AM	6.7 204
	11:00 AM	3.9 119		10:36 AM	2.9 88
	04:26 PM	6.5 198		04:30 PM	5.8 177
	10:43 PM	0.9 27		10:24 PM	1.6 49
11 M	05:50 AM	7.8 238	**26** Tu	05:11 AM	6.9 210
	11:40 AM	3.1 94		11:08 AM	2.0 61
	05:30 PM	6.6 201		05:25 PM	6.1 186
	11:24 PM	1.6 49		11:04 PM	2.0 61
12 Tu	06:16 AM	7.8 238	**27** W	05:33 AM	7.0 213
	12:18 PM	2.4 73		11:43 AM	1.2 37
	06:29 PM	6.7 204		06:20 PM	6.4 195
				11:45 PM	2.6 79
13 W	12:05 AM	2.4 73	**28** Th	05:56 AM	7.2 219
	06:41 AM	7.8 238		12:21 PM	0.4 12
	12:55 PM	1.8 55		07:15 PM	6.7 204
	07:26 PM	6.7 204			
14 Th	12:45 AM	3.2 98	**29** F	12:28 AM	3.3 101
	07:06 AM	7.7 235		06:23 AM	7.3 223
	01:32 PM	1.4 43		01:03 PM	-0.2 -6
	08:23 PM	6.7 204		08:13 PM	7.0 213
15 F	01:27 AM	4.0 122	**30** Sa	01:14 AM	4.0 122
	07:31 AM	7.5 229		06:53 AM	7.3 223
	02:11 PM	1.2 37		01:48 PM	-0.7 -21
	09:22 PM	6.7 204		09:16 PM	7.1 216
			31 Su	02:05 AM	4.7 143
				07:26 AM	7.3 223
				02:38 PM	-0.9 -27
				10:24 PM	7.1 216

Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.

Generated On: Mon Jun 17 22:29:30 GMT 2013

Page 2 of 5

StationId:9447814
Source:NOAA/NOS/CO-OPS
Station Type:Subordinate
Time Zone:LST/LDT
Datum:mean lower low water (MLLW) which is the chart datum of soundings

NOAA Tide Predictions

Glendale, Whidbey Island,Washington,2013

Times and Heights of High and Low Waters

January

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Tu	12:37 AM -0.2 -6 07:47 AM 12.0 366 01:46 PM 5.6 171 06:52 PM 9.0 274		**16** W	01:24 AM 1.0 30 08:16 AM 12.4 378 02:40 PM 3.5 107 08:20 PM 8.8 268	
2 W	01:16 AM 0.6 18 08:19 AM 12.0 366 02:32 PM 4.8 146 07:48 PM 8.6 262		**17** Th	02:10 AM 2.6 79 08:54 AM 12.1 369 03:34 PM 3.0 91 09:34 PM 8.3 253	
3 Th	01:56 AM 1.8 55 08:54 AM 12.0 366 03:22 PM 4.0 122 08:54 PM 8.2 250		**18** F	02:59 AM 4.3 131 09:34 AM 11.6 354 04:31 PM 2.5 76 11:06 PM 8.1 247	
4 F	02:40 AM 3.1 94 09:32 AM 11.9 363 04:16 PM 3.0 91 10:13 PM 8.0 244		**19** Sa	03:56 AM 5.8 177 10:18 AM 11.1 338 05:29 PM 2.0 61	
5 Sa	03:31 AM 4.6 140 10:13 AM 11.8 360 05:13 PM 1.9 58 11:45 PM 8.2 250		**20** Su	12:58 AM 8.4 256 05:14 AM 7.0 213 11:06 AM 10.6 323 06:26 PM 1.5 46	
6 Su	04:35 AM 6.0 183 10:58 AM 11.7 357 06:11 PM 0.7 21		**21** M	02:29 AM 9.2 280 06:52 AM 7.7 235 11:57 AM 10.2 311 07:17 PM 1.0 30	
7 M	01:22 AM 8.9 271 05:54 AM 7.1 216 11:49 AM 11.6 354 07:06 PM -0.5 -15		**22** Tu	03:27 AM 9.9 302 08:14 AM 7.8 238 12:50 PM 10.0 305 08:02 PM 0.5 15	
8 Tu	02:44 AM 9.9 302 07:17 AM 7.6 232 12:43 PM 11.6 354 07:59 PM -1.5 -46		**23** W	04:09 AM 10.5 320 09:11 AM 7.6 232 01:40 PM 9.9 302 08:42 PM 0.1 3	
9 W	03:42 AM 10.8 329 08:29 AM 7.7 235 01:39 PM 11.6 354 08:50 PM -2.3 -70		**24** Th	04:41 AM 10.9 332 09:52 AM 7.3 223 02:26 PM 9.9 302 09:19 PM -0.2 -6	
10 Th	04:29 AM 11.6 354 09:30 AM 7.4 226 02:34 PM 11.6 354 09:38 PM -2.8 -85		**25** F	05:07 AM 11.1 338 10:25 AM 7.0 213 03:09 PM 10.0 305 09:54 PM -0.5 -15	
11 F	05:10 AM 12.1 369 10:25 AM 6.9 210 03:29 PM 11.5 351 10:25 PM -2.8 -85		**26** Sa	05:28 AM 11.3 344 10:54 AM 6.6 201 03:49 PM 10.0 305 10:29 PM -0.5 -15	
12 Sa	05:49 AM 12.5 381 11:16 AM 6.2 189 04:24 PM 11.2 341 11:11 PM -2.4 -73		**27** Su	05:48 AM 11.5 351 11:23 AM 6.1 186 04:30 PM 10.0 305 11:04 PM -0.4 -12	
13 Su	06:26 AM 12.6 384 12:06 PM 5.5 168 05:19 PM 10.8 329 11:56 PM -1.6 -49		**28** M	06:11 AM 11.7 357 11:55 AM 5.5 168 05:12 PM 10.0 305 11:39 PM -0.1 -3	
14 M	07:03 AM 12.7 387 12:56 PM 4.8 146 06:16 PM 10.2 311		**29** Tu	06:36 AM 11.9 363 12:31 PM 4.7 143 05:57 PM 9.8 299	
15 Tu	12:40 AM -0.4 -12 07:39 AM 12.6 384 01:47 PM 4.1 125 07:16 PM 9.5 290		**30** W	12:16 AM 0.6 18 07:05 AM 12.0 366 01:10 PM 3.9 119 06:46 PM 9.6 293	
			31 Th	12:54 AM 1.6 49 07:35 AM 12.1 369 01:53 PM 3.1 94 07:41 PM 9.3 283	

February

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	01:34 AM 2.8 85 08:09 AM 12.0 366 02:41 PM 2.3 70 08:44 PM 9.0 274		**16** Sa	02:31 AM 5.2 158 08:41 AM 10.9 332 03:27 PM 1.8 55 10:21 PM 8.7 265	
2 Sa	02:18 AM 4.1 125 08:46 AM 11.8 360 03:34 PM 1.6 49 09:58 PM 8.7 265		**17** Su	03:26 AM 6.4 195 09:25 AM 10.3 314 04:22 PM 1.8 55	
3 Su	03:09 AM 5.6 171 09:29 AM 11.5 351 04:33 PM 0.9 27 11:29 PM 8.8 268		**18** M	12:00 AM 8.7 265 04:43 AM 7.3 223 10:16 AM 9.8 299 05:22 PM 1.8 55	
4 M	04:16 AM 6.8 207 10:20 AM 11.2 341 05:36 PM 0.3 9		**19** Tu	01:41 AM 9.1 277 06:31 AM 7.6 232 11:16 AM 9.3 283 06:23 PM 1.6 49	
5 Tu	01:14 AM 9.3 283 05:45 AM 7.6 232 11:21 AM 11.0 335 06:40 PM -0.4 -12		**20** W	02:45 AM 9.6 293 07:57 AM 7.4 226 12:20 PM 9.2 280 07:20 PM 1.3 40	
6 W	02:35 AM 10.1 308 07:17 AM 7.7 235 12:28 PM 10.8 329 07:40 PM -1.0 -30		**21** Th	03:26 AM 10.1 308 08:49 AM 7.0 213 01:20 PM 9.2 280 08:08 PM 0.9 27	
7 Th	03:29 AM 10.8 329 08:30 AM 7.2 219 01:34 PM 10.9 332 08:34 PM -1.5 -46		**22** F	03:56 AM 10.4 317 09:24 AM 6.5 198 02:12 PM 9.4 287 08:50 PM 0.6 18	
8 F	04:10 AM 11.4 347 09:27 AM 6.5 198 02:35 PM 11.0 335 09:24 PM -1.6 -49		**23** Sa	04:18 AM 10.6 323 09:52 AM 5.9 180 02:59 PM 9.7 296 09:28 PM 0.4 12	
9 Sa	04:45 AM 11.8 360 10:15 AM 5.6 171 03:32 PM 11.0 335 10:11 PM -1.4 -43		**24** Su	04:38 AM 10.9 332 10:19 AM 5.2 158 03:42 PM 9.9 302 10:05 PM 0.5 15	
10 Su	05:18 AM 12.1 369 11:00 AM 4.7 143 04:27 PM 10.9 332 10:55 PM -0.9 -27		**25** M	04:59 AM 11.1 338 10:48 AM 4.4 134 04:24 PM 10.1 308 10:41 PM 0.7 21	
11 M	05:50 AM 12.2 372 11:43 AM 3.9 119 05:20 PM 10.6 323 11:38 PM 0.0 0		**26** Tu	05:22 AM 11.4 347 11:20 AM 3.5 107 05:08 PM 10.3 314 11:18 PM 1.2 37	
12 Tu	06:21 AM 12.2 372 12:26 PM 3.2 98 06:13 PM 10.3 314		**27** W	05:49 AM 11.6 354 11:56 AM 2.5 76 05:54 PM 10.4 317 11:56 PM 2.0 61	
13 W	12:20 AM 1.1 34 06:54 AM 12.1 369 01:09 PM 2.6 79 07:07 PM 9.9 302		**28** Th	06:18 AM 11.7 357 12:36 PM 1.7 52 06:44 PM 10.3 314	
14 Th	01:01 AM 2.4 73 07:27 AM 11.8 360 01:52 PM 2.2 67 08:03 PM 9.4 287				
15 F	01:44 AM 3.8 116 08:03 AM 11.4 347 02:38 PM 1.9 58 09:06 PM 9.0 274				

March

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	12:36 AM 2.9 88 06:50 AM 11.7 357 01:19 PM 0.9 27 07:38 PM 10.1 308		**16** Sa	02:25 AM 5.0 152 08:13 AM 10.5 320 02:48 PM 0.8 24 09:40 PM 9.7 296	
2 Sa	01:19 AM 4.1 125 07:26 AM 11.5 351 02:06 PM 0.4 12 08:39 PM 9.8 299		**17** Su	03:12 AM 5.9 180 08:52 AM 9.9 302 03:32 PM 1.0 30 10:40 PM 9.4 287	
3 Su	02:07 AM 5.2 158 08:07 AM 11.2 341 02:59 PM 0.2 6 09:50 PM 9.5 290		**18** M	04:08 AM 6.6 201 09:36 AM 9.4 287 04:22 PM 1.3 40 11:52 PM 9.2 280	
4 M	03:05 AM 6.3 192 08:55 AM 10.8 329 03:59 PM 0.1 3 11:16 PM 9.4 287		**19** Tu	05:23 AM 7.1 216 10:30 AM 8.8 268 05:19 PM 1.6 49	
5 Tu	04:21 AM 7.1 216 09:56 AM 10.3 314 05:06 PM 0.1 3		**20** W	01:16 AM 9.2 280 07:06 AM 7.1 216 11:37 AM 8.4 256 06:23 PM 1.9 58	
6 W	12:52 AM 9.7 296 05:58 AM 7.2 219 11:10 AM 9.9 302 06:15 PM 0.0 0		**21** Th	02:27 AM 9.4 287 08:26 AM 6.6 201 12:50 PM 8.2 250 07:26 PM 1.9 58	
7 Th	02:05 AM 10.2 311 07:26 AM 6.7 204 12:28 PM 9.8 299 07:20 PM -0.1 -3		**22** F	03:13 AM 9.7 296 09:12 AM 6.0 183 01:58 PM 8.4 256 08:23 PM 1.8 55	
8 F	02:55 AM 10.7 326 08:29 AM 5.8 177 01:41 PM 9.9 302 08:18 PM -0.2 -6		**23** Sa	03:45 AM 10.0 305 09:45 AM 5.2 158 02:56 PM 8.8 268 09:12 PM 1.7 52	
9 Sa	03:34 AM 11.1 338 09:18 AM 4.7 143 02:45 PM 10.2 311 09:09 PM 0.0 0		**24** Su	04:11 AM 10.3 314 10:12 AM 4.3 131 03:47 PM 9.3 283 09:55 PM 1.7 52	
10 Su	05:07 AM 11.4 347 11:00 AM 3.7 113 04:42 PM 10.4 317 10:55 PM 0.5 15		**25** M	04:35 AM 10.6 323 10:41 AM 3.3 101 04:34 PM 9.8 299 10:36 PM 2.0 61	
11 M	05:36 AM 11.5 351 11:39 AM 2.7 82 05:34 PM 10.5 320 11:39 PM 1.2 37		**26** Tu	05:01 AM 10.8 329 11:12 AM 2.2 67 05:19 PM 10.2 311 11:16 PM 2.4 73	
12 Tu	06:05 AM 11.6 354 12:16 PM 1.9 58 06:23 PM 10.5 320		**27** W	05:28 AM 11.1 338 11:46 AM 1.1 34 06:05 PM 10.6 323 11:56 PM 3.0 91	
13 W	12:20 AM 2.0 61 06:34 AM 11.5 351 12:53 PM 1.3 40 07:11 PM 10.4 317		**28** Th	05:58 AM 11.3 344 12:24 PM 0.1 3 06:53 PM 10.9 332	
14 Th	01:01 AM 3.0 91 07:05 AM 11.3 344 01:30 PM 0.9 27 07:59 PM 10.3 314		**29** F	12:39 AM 3.7 113 06:31 AM 11.3 344 01:05 PM -0.7 -21 07:44 PM 11.0 335	
15 F	01:42 AM 4.0 122 07:38 AM 11.0 335 02:08 PM 0.7 21 08:48 PM 10.0 305		**30** Sa	01:23 AM 4.5 137 07:08 AM 11.2 341 01:50 PM -1.1 -34 08:38 PM 10.9 332	
			31 Su	02:12 AM 5.3 162 07:49 AM 10.9 332 02:39 PM -1.2 -37 09:38 PM 10.6 323	

Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.
Referenced to Station: SEATTLE (Madison St.), Elliott Bay (9447130) Height offset in feet (low:*0.99 high: * 0.97) Time offset in mins (low:-3 high: 1)

Generated On: Mon Jun 17 22:36:54 GMT 2013

StationId:9445993
Source:NOAA/NOS/CO-OPS
Station Type:Subordinate
Time Zone:LST/LDT
Datum:mean lower low water (MLLW) which is the chart datum of soundings

NOAA Tide Predictions

Harper, Yukon Harbor,Washington,2013

Times and Heights of High and Low Waters

January

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Tu	12:39 AM -0.2 -6 07:40 AM 12.6 384 01:48 PM 5.6 171 06:45 PM 9.4 287		**16** W	01:26 AM 1.0 30 08:09 AM 13.1 399 02:42 PM 3.5 107 08:13 PM 9.3 283	
2 W	01:18 AM 0.6 18 08:12 AM 12.7 387 02:34 PM 4.8 146 07:41 PM 9.0 274		**17** Th	02:12 AM 2.6 79 08:47 AM 12.7 387 03:36 PM 3.0 91 09:27 PM 8.7 265	
3 Th	01:58 AM 1.8 55 08:47 AM 12.6 384 03:24 PM 4.0 122 08:47 PM 8.6 262		**18** F	03:01 AM 4.3 131 09:27 AM 12.2 372 04:33 PM 2.5 76 10:59 PM 8.5 259	
4 F	02:42 AM 3.1 94 09:25 AM 12.5 381 04:18 PM 3.0 91 10:06 PM 8.4 256		**19** Sa	03:58 AM 5.8 177 10:11 AM 11.7 357 05:31 PM 2.0 61	
5 Sa	03:33 AM 4.6 140 10:06 AM 12.4 378 05:15 PM 1.9 58 11:38 PM 8.6 262		**20** Su	12:51 AM 8.9 271 05:16 AM 7.0 213 10:59 AM 11.2 341 06:28 PM 1.5 46	
6 Su	04:37 AM 6.0 183 10:51 AM 12.3 375 06:13 PM 0.7 21		**21** M	02:22 AM 9.7 296 06:54 AM 7.7 235 11:50 AM 10.8 329 07:19 PM 1.0 30	
7 M	01:15 AM 9.3 283 05:56 AM 7.1 216 11:42 AM 12.2 372 07:08 PM -0.5 -15		**22** Tu	03:20 AM 10.4 317 08:16 AM 7.8 238 12:43 PM 10.5 320 08:04 PM 0.5 15	
8 Tu	02:37 AM 10.4 317 07:19 AM 7.6 232 12:36 PM 12.2 372 08:01 PM -1.5 -46		**23** W	04:02 AM 11.0 335 09:13 AM 7.6 232 01:33 PM 10.4 317 08:44 PM 0.1 3	
9 W	03:35 AM 11.4 347 08:31 AM 7.7 235 01:32 PM 12.2 372 08:52 PM -2.3 -70		**24** Th	04:34 AM 11.4 347 09:54 AM 7.3 223 02:19 PM 10.4 317 09:21 PM -0.2 -6	
10 Th	04:22 AM 12.2 372 09:32 AM 7.4 226 02:27 PM 12.2 372 09:40 PM -2.8 -85		**25** F	05:00 AM 11.7 357 10:27 AM 7.0 213 03:02 PM 10.5 320 09:56 PM -0.5 -15	
11 F	05:03 AM 12.7 387 10:27 AM 6.9 210 03:22 PM 12.1 369 10:27 PM -2.8 -85		**26** Sa	05:21 AM 11.9 363 10:56 AM 6.6 201 03:42 PM 10.5 320 10:31 PM -0.5 -15	
12 Sa	05:42 AM 13.1 399 11:18 AM 6.2 189 04:17 PM 11.8 360 11:13 PM -2.4 -73		**27** Su	05:41 AM 12.1 369 11:25 AM 6.1 186 04:23 PM 10.6 323 11:06 PM -0.4 -12	
13 Su	06:19 AM 13.3 405 12:08 PM 5.5 168 05:12 PM 11.3 344 11:58 PM -1.6 -49		**28** M	06:04 AM 12.3 375 11:57 AM 5.5 168 05:05 PM 10.5 320 11:41 PM -0.1 -3	
14 M	06:56 AM 13.4 408 12:58 PM 4.8 146 06:09 PM 10.7 326		**29** Tu	06:29 AM 12.5 381 12:33 PM 4.7 143 05:50 PM 10.3 314	
15 Tu	12:42 AM -0.4 -12 07:32 AM 13.3 405 01:49 PM 4.1 125 07:09 PM 10.0 305		**30** W	12:18 AM 0.6 18 06:58 AM 12.6 384 01:12 PM 3.9 119 06:39 PM 10.1 308	
			31 Th	12:56 AM 1.6 49 07:28 AM 12.7 387 01:55 PM 3.1 94 07:34 PM 9.8 299	

February

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	01:36 AM 2.8 85 08:02 AM 12.6 384 02:43 PM 2.3 70 08:37 PM 9.4 287		**16** Sa	02:33 AM 5.2 158 08:34 AM 11.5 351 03:29 PM 1.8 55 10:14 PM 9.1 277	
2 Sa	02:20 AM 4.1 125 08:39 AM 12.4 378 03:36 PM 1.6 49 09:51 PM 9.2 280		**17** Su	03:28 AM 6.4 195 09:18 AM 10.8 329 04:24 PM 1.8 55 11:53 PM 9.1 277	
3 Su	03:11 AM 5.6 171 09:22 AM 12.1 369 04:35 PM 0.9 27 11:22 PM 9.2 280		**18** M	04:45 AM 7.3 223 10:09 AM 10.3 314 05:24 PM 1.8 55	
4 M	04:18 AM 6.8 207 10:13 AM 11.8 360 05:38 PM 0.3 9		**19** Tu	01:34 AM 9.6 293 06:33 AM 7.6 232 11:09 AM 9.8 299 06:25 PM 1.6 49	
5 Tu	01:07 AM 9.7 296 05:47 AM 7.6 232 11:14 AM 11.5 351 06:42 PM -0.4 -12		**20** W	02:38 AM 10.1 308 07:59 AM 7.4 226 12:13 PM 9.6 293 07:22 PM 1.3 40	
6 W	02:28 AM 10.6 323 07:19 AM 7.7 235 12:21 PM 11.4 347 07:42 PM -1.0 -30		**21** Th	03:19 AM 10.6 323 08:51 AM 7.0 213 01:13 PM 9.7 296 08:10 PM 0.9 27	
7 Th	03:22 AM 11.4 347 08:32 AM 7.2 219 01:27 PM 11.4 347 08:36 PM -1.5 -46		**22** F	03:49 AM 10.9 332 09:26 AM 6.5 198 02:05 PM 9.9 302 08:52 PM 0.6 18	
8 F	04:03 AM 12.0 366 09:29 AM 6.5 198 02:28 PM 11.5 351 09:26 PM -1.6 -49		**23** Sa	04:11 AM 11.2 341 09:54 AM 5.9 180 02:52 PM 10.2 311 09:30 PM 0.4 12	
9 Sa	04:38 AM 12.4 378 10:17 AM 5.6 171 03:25 PM 11.5 351 10:13 PM -1.4 -43		**24** Su	04:31 AM 11.4 347 10:21 AM 5.2 158 03:35 PM 10.4 317 10:07 PM 0.5 15	
10 Su	05:11 AM 12.7 387 11:02 AM 4.7 143 04:20 PM 11.4 347 10:57 PM -0.9 -27		**25** M	04:52 AM 11.7 357 10:50 AM 4.4 134 04:17 PM 10.7 326 10:43 PM 0.7 21	
11 M	05:43 AM 12.9 393 11:45 AM 3.9 119 05:13 PM 11.2 341 11:40 PM 0.0 0		**26** Tu	05:15 AM 12.0 366 11:22 AM 3.5 107 05:01 PM 10.8 329 11:20 PM 1.2 37	
12 Tu	06:14 AM 12.9 393 12:28 PM 3.2 98 06:06 PM 10.8 329		**27** W	05:42 AM 12.2 372 11:58 AM 2.5 76 05:47 PM 10.9 332 11:58 PM 2.0 61	
13 W	12:22 AM 1.1 34 06:47 AM 12.7 387 01:11 PM 2.6 79 07:00 PM 10.4 317		**28** Th	06:11 AM 12.3 375 12:38 PM 1.7 52 06:37 PM 10.8 329	
14 Th	01:03 AM 2.4 73 07:20 AM 12.5 381 01:54 PM 2.2 67 07:56 PM 9.9 302				
15 F	01:46 AM 3.8 116 07:56 AM 12.0 366 02:40 PM 1.9 58 08:59 PM 9.5 290				

March

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	12:38 AM 2.9 88 06:43 AM 12.3 375 01:21 PM 0.9 27 07:31 PM 10.6 323		**16** Sa	02:27 AM 5.0 152 08:06 AM 11.0 335 02:50 PM 0.8 24 09:33 PM 10.2 311	
2 Sa	01:21 AM 4.1 125 07:19 AM 12.1 369 02:08 PM 0.4 12 08:32 PM 10.3 314		**17** Su	03:14 AM 5.9 180 08:45 AM 10.5 320 03:34 PM 1.0 30 10:33 PM 9.9 302	
3 Su	02:09 AM 5.2 158 08:00 AM 11.8 360 03:01 PM 0.2 6 09:43 PM 10.0 305		**18** M	04:10 AM 6.6 201 09:29 AM 9.8 299 04:24 PM 1.3 40 11:45 PM 9.7 296	
4 M	03:07 AM 6.3 192 08:48 AM 11.3 344 04:01 PM 0.1 3 11:09 PM 9.9 302		**19** Tu	05:25 AM 7.1 216 10:23 AM 9.2 280 05:21 PM 1.6 49	
5 Tu	04:23 AM 7.1 216 09:49 AM 10.8 329 05:08 PM 0.1 3		**20** W	01:09 AM 9.7 296 07:08 AM 7.1 216 11:30 AM 8.8 268 06:25 PM 1.9 58	
6 W	12:45 AM 10.2 311 06:00 AM 7.2 219 11:03 AM 10.4 317 06:17 PM 0.0 0		**21** Th	02:20 AM 9.9 302 08:28 AM 6.6 201 12:43 PM 8.7 265 07:28 PM 1.9 58	
7 Th	01:58 AM 10.8 329 07:28 AM 6.7 204 12:21 PM 10.3 314 07:22 PM -0.1 -3		**22** F	03:06 AM 10.2 311 09:14 AM 6.0 183 01:51 PM 8.8 268 08:25 PM 1.8 55	
8 F	02:48 AM 11.3 344 08:31 AM 5.8 177 01:34 PM 10.4 317 08:20 PM -0.2 -6		**23** Sa	03:38 AM 10.5 320 09:47 AM 5.2 158 02:49 PM 9.2 280 09:14 PM 1.7 52	
9 Sa	03:27 AM 11.7 357 09:20 AM 4.7 143 02:38 PM 10.7 326 09:11 PM 0.0 0		**24** Su	04:04 AM 10.8 329 10:14 AM 4.3 131 03:40 PM 9.7 296 09:57 PM 1.7 52	
10 Su	05:00 AM 12.0 366 11:02 AM 3.7 113 04:35 PM 10.9 332 10:57 PM 0.5 15		**25** M	04:28 AM 11.1 338 10:43 AM 3.3 101 04:27 PM 10.3 314 10:38 PM 2.0 61	
11 M	05:29 AM 12.1 369 11:41 AM 2.7 82 05:27 PM 11.0 335 11:41 PM 1.2 37		**26** Tu	04:54 AM 11.4 347 11:14 AM 2.2 67 05:12 PM 10.7 326 11:18 PM 2.4 73	
12 Tu	05:58 AM 12.2 372 12:18 PM 1.9 58 06:16 PM 11.1 338		**27** W	05:21 AM 11.7 357 11:48 AM 1.1 34 05:58 PM 11.1 338 11:58 PM 3.0 91	
13 W	12:22 AM 2.0 61 06:27 AM 12.1 369 12:55 PM 1.3 40 07:04 PM 11.0 335		**28** Th	05:51 AM 11.8 360 12:26 PM 0.1 3 06:46 PM 11.4 347	
14 Th	01:03 AM 3.0 91 06:58 AM 11.9 363 01:32 PM 0.9 27 07:52 PM 10.8 329		**29** F	12:41 AM 3.7 113 06:24 AM 11.9 363 01:07 PM -0.7 -21 07:37 PM 11.5 351	
15 F	01:44 AM 4.0 122 07:31 AM 11.5 351 02:10 PM 0.7 21 08:41 PM 10.6 323		**30** Sa	01:25 AM 4.5 137 07:01 AM 11.8 360 01:52 PM -1.1 -34 08:31 PM 11.4 347	
			31 Su	02:14 AM 5.3 162 07:42 AM 11.5 351 02:41 PM -1.2 -37 09:31 PM 11.2 341	

Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.
Referenced to Station: SEATTLE (Madison St.), Elliott Bay (9447130) Height offset in feet (low:*0.99 high: * 1.02) Time offset in mins (low:-1 high: -6)

Generated On: Mon Jun 17 22:35:31 GMT 2013

StationId:9445639
Source:NOAA/NOS/CO-OPS
Station Type:Subordinate
Time Zone:LST/LDT
Datum:mean lower low water (MLLW) which is the chart datum of soundings

NOAA Tide Predictions

Kingston, Appletree Cove,Washington,2013

Times and Heights of High and Low Waters

January

	Time	Height			Time	Height			Time	Height			Time	Height		
	h m	ft	cm		h m	ft	cm		h m	ft	cm		h m	ft	cm	
1 Tu	12:35 AM	-0.2	-6	**16** W	01:22 AM	1.0	30	**1** F	01:32 AM	2.8	85	**16** Sa	02:29 AM	5.2	158	
	07:41 AM	12.0	366		08:10 AM	12.4	378		08:03 AM	12.0	366		08:35 AM	10.9	332	
	01:44 PM	5.6	171		02:38 PM	3.6	110		02:39 PM	2.3	70		03:25 PM	1.9	58	
	06:46 PM	9.0	274		08:14 PM	8.8	268		08:38 PM	9.0	274		10:15 PM	8.7	265	
2 W	01:14 AM	0.6	18	**17** Th	02:08 AM	2.7	82	**2** Sa	02:16 AM	4.2	128	**17** Su	03:24 AM	6.4	195	
	08:13 AM	12.0	366		08:48 AM	12.1	369		08:40 AM	11.8	360		09:19 AM	10.3	314	
	02:30 PM	4.9	149		03:32 PM	3.0	91		03:32 PM	1.6	49		04:20 PM	1.9	58	
	07:42 PM	8.6	262		09:28 PM	8.3	253		09:52 PM	8.7	265		11:54 PM	8.7	265	
3 Th	01:54 AM	1.8	55	**18** F	02:57 AM	4.3	131	**3** Su	03:07 AM	5.6	171	**18** M	04:41 AM	7.3	223	
	08:48 AM	12.0	366		09:28 AM	11.6	354		09:23 AM	11.5	351		10:10 AM	9.8	299	
	03:20 PM	4.0	122		04:29 PM	2.5	76		04:31 PM	0.9	27		05:20 PM	1.8	55	
	08:48 PM	8.2	250		11:00 PM	8.1	247		11:23 PM	8.8	268					
4 F	02:38 AM	3.1	94	**19** Sa	03:54 AM	5.9	180	**4** M	04:14 AM	6.9	210	**19** Tu	01:35 AM	9.1	277	
	09:26 AM	11.9	363		10:12 AM	11.1	338		10:14 AM	11.2	341		06:29 AM	7.7	235	
	04:14 PM	3.0	91		05:27 PM	2.0	61		05:34 PM	0.3	9		11:10 AM	9.3	283	
	10:07 PM	8.0	244										06:21 PM	1.6	49	
5 Sa	03:29 AM	4.6	140	**20** Su	12:52 AM	8.4	256	**5** Tu	01:08 AM	9.3	283	**20** W	02:39 AM	9.6	293	
	10:07 AM	11.8	360		05:12 AM	7.1	216		05:43 AM	7.7	235		07:55 AM	7.5	229	
	05:11 PM	1.9	58		11:00 AM	10.6	323		11:15 AM	11.0	335		12:14 PM	9.2	280	
	11:39 PM	8.2	250		06:24 PM	1.5	46		06:38 PM	-0.4	-12		07:18 PM	1.3	40	
6 Su	04:33 AM	6.1	186	**21** M	02:23 AM	9.2	280	**6** W	02:29 AM	10.1	308	**21** Th	03:20 AM	10.1	308	
	10:52 AM	11.7	357		06:50 AM	7.7	235		07:15 AM	7.8	238		08:47 AM	7.0	213	
	06:09 PM	0.7	21		11:51 AM	10.2	311		12:22 PM	10.8	329		01:14 PM	9.2	280	
					07:15 PM	1.0	30		07:38 PM	-1.1	-34		08:06 PM	0.9	27	
7 M	01:16 AM	8.9	271	**22** Tu	03:21 AM	9.9	302	**7** Th	03:23 AM	10.8	329	**22** F	03:50 AM	10.4	317	
	05:52 AM	7.2	219		08:12 AM	7.8	238		08:28 AM	7.3	223		09:22 AM	6.5	198	
	11:43 AM	11.6	354		12:44 PM	10.0	305		01:28 PM	10.9	332		02:06 PM	9.4	287	
	07:04 PM	-0.5	-15		08:00 PM	0.6	18		08:32 PM	-1.5	-46		08:48 PM	0.6	18	
8 Tu	02:38 AM	9.9	302	**23** W	04:03 AM	10.5	320	**8** F	04:04 AM	11.4	347	**23** Sa	04:12 AM	10.6	323	
	07:15 AM	7.7	235		09:09 AM	7.7	235		09:25 AM	6.5	198		09:50 AM	5.9	180	
	12:37 PM	11.6	354		01:34 PM	9.9	302		02:29 PM	11.0	335		02:53 PM	9.7	296	
	07:57 PM	-1.5	-46		08:40 PM	0.1	3		09:22 PM	-1.7	-52		09:26 PM	0.4	12	
9 W	03:36 AM	10.8	329	**24** Th	04:35 AM	10.9	332	**9** Sa	04:39 AM	11.8	360	**24** Su	04:32 AM	10.9	332	
	08:27 AM	7.7	235		09:50 AM	7.4	226		10:13 AM	5.7	174		10:17 AM	5.3	162	
	01:33 PM	11.6	354		02:20 PM	9.9	302		03:26 PM	11.0	335		03:36 PM	9.9	302	
	08:48 PM	-2.4	-73		09:17 PM	-0.2	-6		10:09 PM	-1.5	-46		10:03 PM	0.5	15	
10 Th	04:23 AM	11.6	354	**25** F	05:01 AM	11.1	338	**10** Su	05:12 AM	12.1	369	**25** M	04:53 AM	11.1	338	
	09:28 AM	7.4	226		10:23 AM	7.1	216		10:58 AM	4.8	146		10:46 AM	4.4	134	
	02:28 PM	11.6	354		03:03 PM	10.0	305		04:21 PM	10.9	332		04:18 PM	10.1	308	
	09:36 PM	-2.8	-85		09:52 PM	-0.5	-15		10:53 PM	-0.9	-27		10:39 PM	0.7	21	
11 F	05:04 AM	12.1	369	**26** Sa	05:22 AM	11.3	344	**11** M	05:44 AM	12.2	372	**26** Tu	05:16 AM	11.4	347	
	10:23 AM	6.9	210		10:52 AM	6.7	204		11:41 AM	3.9	119		11:18 AM	3.5	107	
	03:23 PM	11.5	351		03:43 PM	10.0	305		05:14 PM	10.6	323		05:02 PM	10.3	314	
	10:23 PM	-2.8	-85		10:27 PM	-0.5	-15		11:36 PM	0.0	0		11:16 PM	1.2	37	
12 Sa	05:43 AM	12.5	381	**27** Su	05:42 AM	11.5	351	**12** Tu	06:15 AM	12.2	372	**27** W	05:43 AM	11.6	354	
	11:14 AM	6.3	192		11:21 AM	6.2	189		12:24 PM	3.2	98		11:54 AM	2.6	79	
	04:18 PM	11.2	341		04:24 PM	10.0	305		06:07 PM	10.3	314		05:48 PM	10.4	317	
	11:09 PM	-2.4	-73		11:02 PM	-0.4	-12						11:54 PM	2.0	61	
13 Su	06:20 AM	12.6	384	**28** M	06:05 AM	11.7	357	**13** W	12:18 AM	1.2	37	**28** Th	06:12 AM	11.7	357	
	12:04 PM	5.6	171		11:53 AM	5.5	168		06:48 AM	12.1	369		12:34 PM	1.7	52	
	05:13 PM	10.8	329		05:06 PM	10.0	305		01:07 PM	2.6	79		06:38 PM	10.3	314	
	11:54 PM	-1.6	-49		11:37 PM	-0.1	-3		07:01 PM	9.9	302					
14 M	06:57 AM	12.7	387	**29** Tu	06:30 AM	11.9	363	**14** Th	12:59 AM	2.5	76					
	12:54 PM	4.9	149		12:29 PM	4.8	146		07:21 AM	11.8	360					
	06:10 PM	10.2	311		05:51 PM	9.8	299		01:50 PM	2.2	67					
									07:57 PM	9.4	287					
15 Tu	12:38 AM	-0.4	-12	**30** W	12:14 AM	0.6	18	**15** F	01:42 AM	3.9	119					
	07:33 AM	12.6	384		06:59 AM	12.0	366		07:57 AM	11.4	347					
	01:45 PM	4.2	128		01:08 PM	3.9	119		02:36 PM	1.9	58					
	07:10 PM	9.5	290		06:40 PM	9.6	293		09:00 PM	9.0	274					
				31 Th	12:52 AM	1.6	49									
					07:29 AM	12.1	369									
					01:51 PM	3.1	94									
					07:35 PM	9.3	283									

February

	Time	Height			Time	Height			Time	Height			Time	Height		
	h m	ft	cm		h m	ft	cm		h m	ft	cm		h m	ft	cm	
1 F	12:34 AM	3.0	91	**16** Sa	02:23 AM	5.0	152	**1** Su	02:05 AM	5.3	162	**16** M	04:06 AM	6.6	201	
	06:44 AM	11.7	357		08:07 AM	10.5	320		08:01 AM	11.2	341		09:30 AM	9.4	287	
	01:17 PM	0.9	27		02:46 PM	0.8	24		02:57 PM	0.2	6		04:20 PM	1.3	40	
	07:32 PM	10.1	308		09:34 PM	9.7	296		09:44 PM	9.5	290		11:46 PM	9.2	280	
2 Sa	01:17 AM	4.1	125	**17** Su	03:10 AM	5.9	180	**2** M	03:03 AM	6.4	195	**17** Tu	05:21 AM	7.1	216	
	07:20 AM	11.5	351		08:46 AM	9.9	302		08:49 AM	10.8	329		10:24 AM	8.8	268	
	02:04 PM	0.4	12		03:30 PM	1.0	30		03:57 PM	0.1	3		05:17 PM	1.7	52	
	08:33 PM	9.8	299		10:34 PM	9.4	287		11:10 PM	9.4	287					
3 Su	02:05 AM	5.3	162	**18** M	04:06 AM	6.6	201	**3** Tu	04:19 AM	7.1	216	**18** W	01:10 AM	9.2	280	
	08:01 AM	11.2	341		09:30 AM	9.4	287		09:50 AM	10.3	314		07:04 AM	7.1	216	
	02:57 PM	0.2	6		04:20 PM	1.3	40		05:04 PM	0.1	3		11:31 AM	8.4	256	
	09:44 PM	9.5	290		11:46 PM	9.2	280						06:21 PM	1.9	58	
4 M	03:03 AM	6.4	195	**19** Tu	05:21 AM	7.1	216	**4** W	12:46 AM	9.7	296	**19** Th	02:21 AM	9.4	287	
	08:49 AM	10.8	329		10:24 AM	8.8	268		05:56 AM	7.3	223		08:24 AM	6.7	204	
	03:57 PM	0.1	3		05:17 PM	1.7	52		11:04 AM	9.9	302		12:44 PM	8.2	250	
	11:10 PM	9.4	287						06:13 PM	0.0	0		07:24 PM	1.9	58	
5 Tu	04:19 AM	7.1	216	**20** W	01:10 AM	9.2	280	**5** Th	01:59 AM	10.2	311	**20** F	03:07 AM	9.7	296	
	09:50 AM	10.3	314		07:04 AM	7.1	216		07:24 AM	6.8	207		09:10 AM	6.0	183	
	05:04 PM	0.1	3		11:31 AM	8.4	256		12:22 PM	9.8	299		01:52 PM	8.4	256	
					06:21 PM	1.9	58		07:18 PM	-0.1	-3		08:21 PM	1.8	55	
6 W	12:46 AM	9.7	296	**21** Th	02:21 AM	9.4	287	**6** F	02:49 AM	10.7	326	**21** Sa	03:39 AM	10.0	305	
	05:56 AM	7.3	223		08:24 AM	6.7	204		08:27 AM	5.8	177		09:43 AM	5.3	162	
	11:04 AM	9.9	302		12:44 PM	8.2	250		01:35 PM	9.9	302		02:50 PM	8.8	268	
	06:13 PM	0.0	0		07:24 PM	1.9	58		08:16 PM	-0.2	-6		09:10 PM	1.7	52	
7 Th	01:59 AM	10.2	311	**22** F	03:07 AM	9.7	296	**7** Sa	03:28 AM	11.1	338	**22** Su	04:05 AM	10.3	314	
	07:24 AM	6.8	207		09:10 AM	6.0	183		09:16 AM	4.8	146		10:10 AM	4.4	134	
	12:22 PM	9.8	299		01:52 PM	8.4	256		02:39 PM	10.2	311		03:41 PM	9.3	283	
	07:18 PM	-0.1	-3		08:21 PM	1.8	55		09:07 PM	0.0	0		09:53 PM	1.8	55	
8 F	02:49 AM	10.7	326	**23** Sa	03:39 AM	10.0	305	**8** Su	04:05 AM	11.4	347	**23** M	04:29 AM	10.6	323	
	08:27 AM	5.8	177		09:43 AM	5.3	162		10:58 AM	3.7	113		10:39 AM	3.3	101	
	01:35 PM	9.9	302		02:50 PM	8.8	268		04:36 PM	10.4	317		04:28 PM	9.8	299	
	08:16 PM	-0.2	-6		09:10 PM	1.7	52		10:53 PM	0.5	15		10:34 PM	2.0	61	
9 Sa	03:28 AM	11.1	338	**24** Su	04:05 AM	10.3	314	**9** M	05:01 AM	11.4	347	**24** Tu	04:55 AM	10.8	329	
	09:16 AM	4.8	146		10:10 AM	4.4	134		10:58 AM	3.7	113		11:10 AM	2.2	67	
	02:39 PM	10.2	311		03:41 PM	9.3	283		04:36 PM	10.4	317		05:13 PM	10.2	311	
	09:07 PM	0.0	0		09:53 PM	1.8	55		10:53 PM	0.5	15		11:14 PM	2.4	73	
10 Su	04:29 AM	10.6	323	**25** M	04:29 AM	10.6	323	**10** Tu	05:01 AM	11.4	347	**25** W	05:22 AM	11.1	338	
	10:39 AM	3.3	101		10:39 AM	3.3	101		10:58 AM	3.7	113		11:44 AM	1.1	34	
	04:28 PM	9.8	299		04:28 PM	9.8	299		04:36 PM	10.4	317		05:59 PM	10.6	323	
	10:34 PM	2.0	61		10:34 PM	2.0	61		10:53 PM	0.5	15		11:54 PM	3.0	91	
11 M	05:04 AM	12.1	369	**26** Tu	04:55 AM	10.8	329	**11** W	05:30 AM	11.5	351	**26** Th	05:52 AM	11.3	344	
	10:23 AM	6.9	210		11:10 AM	2.2	67		11:37 AM	2.8	85		12:22 PM	0.1	3	
	03:23 PM	11.5	351		05:13 PM	10.2	311		05:28 PM	10.5	320		06:47 PM	10.9	332	
	10:23 PM	-2.8	-85		11:14 PM	2.4	73		11:37 PM	1.2	37					
12 Tu	05:43 AM	12.5	381	**27** W	05:22 AM	11.1	338	**12** Th	05:59 AM	11.6	354	**27** F	01:03 AM	-0.7	-21	
	11:14 AM	6.3	192		11:44 AM	1.1	34		12:14 PM	2.0	61		07:38 PM	11.0	335	
	04:18 PM	11.2	341		05:59 PM	10.6	323		06:17 PM	10.5	320					
	11:09 PM	-2.4	-73		11:54 PM	3.0	91									
13 W	06:20 AM	12.6	384	**28** Th	05:52 AM	11.3	344	**13** F	12:18 AM	2.0	61	**28** Sa	01:21 AM	4.5	137	
	12:04 PM	5.6	171		12:22 PM	0.1	3		06:28 AM	11.5	351		07:02 AM	11.2	341	
	05:13 PM	10.8	329		06:47 PM	10.9	332		12:51 PM	1.3	40		01:48 PM	-1.2	-37	
	11:54 PM	-1.6	-49						07:05 PM	10.4	317		08:32 PM	10.9	332	
14 Th	06:57 AM	12.7	387	**29** F	12:37 AM	3.7	113	**14** Sa	12:59 AM	3.0	91	**29** Su	02:10 AM	5.3	162	
	12:54 PM	4.9	149		06:25 AM	11.3	344		06:59 AM	11.3	344		07:43 AM	10.9	332	
	06:10 PM	10.2	311		01:03 PM	-0.7	-21		01:28 PM	0.9	27		02:37 PM	-1.3	-40	
					07:38 PM	11.0	335		07:53 PM	10.3	314		09:32 PM	10.6	323	
15 F	01:40 AM	4.0	122	**30** Sa	01:21 AM	4.5	137	**15** Su	01:40 AM	4.0	122					
	07:32 AM	11.0	335		07:02 AM	11.2	341		07:32 AM	11.0	335					
	02:06 PM	0.7	21		01:48 PM	-1.2	-37		02:06 PM	0.7	21					
	08:42 PM	10.0	305		08:32 PM	10.9	332		08:42 PM	10.0	305					
				31 Su	02:10 AM	5.3	162									
					07:43 AM	10.9	332									
					02:37 PM	-1.3	-40									
					09:32 PM	10.6	323									

March

	Time	Height			Time	Height			Time	Height			Time	Height		
	h m	ft	cm		h m	ft	cm		h m	ft	cm		h m	ft	cm	
1 F	12:34 AM	3.0	91	**16** Sa	02:23 AM	5.0	152	**1** Su	01:17 AM	4.1	125	**16** M	03:10 AM	5.9	180	
	06:44 AM	11.7	357		08:07 AM	10.5	320		07:20 AM	11.5	351		08:46 AM	9.9	302	
	01:17 PM	0.9	27		02:46 PM	0.8	24		02:04 PM	0.4	12		03:30 PM	1.0	30	
	07:32 PM	10.1	308		09:34 PM	9.7	296		08:33 PM	9.8	299		10:34 PM	9.4	287	
2 Sa	01:17 AM	4.1	125	**17** Su	03:10 AM	5.9	180	**2** M	02:05 AM	5.3	162	**17** Tu	04:06 AM	6.6	201	
	07:20 AM	11.5	351		08:46 AM	9.9	302		08:01 AM	11.2	341		09:30 AM	9.4	287	
	02:04 PM	0.4	12		03:30 PM	1.0	30		02:57 PM	0.2	6		04:20 PM	1.3	40	
	08:33 PM	9.8	299		10:34 PM	9.4	287		09:44 PM	9.5	290		11:46 PM	9.2	280	
3 Su	02:05 AM	5.3	162	**18** M	04:06 AM	6.6	201	**3** Tu	03:03 AM	6.4	195	**18** W	05:21 AM	7.1	216	
	08:01 AM	11.2	341		09:30 AM	9.4	287		08:49 AM	10.8	329		10:24 AM	8.8	268	
	02:57 PM	0.2	6		04:20 PM	1.3	40		03:57 PM	0.1	3		05:17 PM	1.7	52	
	09:44 PM	9.5	290		11:46 PM	9.2	280		11:10 PM	9.4	287					
4 M	03:03 AM	6.4	195	**19** Tu	05:21 AM	7.1	216	**4** W	04:19 AM	7.1	216	**19** Th	01:10 AM	9.2	280	
	08:49 AM	10.8	329		10:24 AM	8.8	268		09:50 AM	10.3	314		07:04 AM	7.1	216	
	03:57 PM	0.1	3		05:17 PM	1.7	52		05:04 PM	0.1	3		11:31 AM	8.4	256	
	11:10 PM	9.4	287										06:21 PM	1.9	58	
5 Tu	04:19 AM	7.1	216	**20** W	01:10 AM	9.2	280	**5** Th	12:46 AM	9.7	296	**20** F	02:21 AM	9.4	287	
	09:50 AM	10.3	314		07:04 AM	7.1	216		05:56 AM	7.3	223		08:24 AM	6.7	204	
	05:04 PM	0.1	3		11:31 AM	8.4	256		11:04 AM	9.9	302		12:44 PM	8.2	250	
					06:21 PM	1.9	58		06:13 PM	0.0	0		07:24 PM	1.9	58	
6 W	12:46 AM	9.7	296	**21** Th	02:21 AM	9.4	287	**6** F	01:59 AM	10.2	311	**21** Sa	03:07 AM	9.7	296	
	05:56 AM	7.3	223		08:24 AM	6.7	204		07:24 AM	6.8	207		09:10 AM	6.0	183	
	11:04 AM	9.9	302		12:44 PM	8.2	250		12:22 PM	9.8	299		01:52 PM	8.4	256	
	06:13 PM	0.0	0		07:24 PM	1.9	58		07:18 PM	-0.1	-3		08:21 PM	1.8	55	
7 Th	01:59 AM	10.2	311	**22** F	03:07 AM	9.7	296	**7** Sa	02:49 AM	10.7	326	**22** Su	03:39 AM	10.0	305	
	07:24 AM	6.8	207		09:10 AM	6.0	183		08:27 AM	5.8	177		09:43 AM	5.3	162	
	12:22 PM	9.8	299		01:52 PM	8.4	256		01:35 PM	9.9	302		02:50 PM	8.8	268	
	07:18 PM	-0.1	-3		08:21 PM	1.8	55		08:16 PM	-0.2	-6		09:10 PM	1.7	52	
8 F	02:49 AM	10.7	326	**23** Sa	03:39 AM	10.0	305	**8** Su	03:28 AM	11.1	338	**23** M	03:39 AM	10.0	305	
	08:27 AM	5.8	177		09:43 AM	5.3	162		09:16 AM	4.8	146		09:43 AM	5.3	162	
	01:35 PM	9.9	302		02:50 PM	8.8	268		02:39 PM	10.2	311		02:50 PM	8.8	268	
	08:16 PM	-0.2	-6		09:10 PM	1.7	52		09:07 PM	0.0	0		09:10 PM	1.7	52	
9 Sa	03:28 AM	11.1	338	**24** Su	04:05 AM	10.3	314	**9** M	04:05 AM	10.6	323	**24** Tu	04:05 AM	10.3	314	
	09:16 AM	4.8	146		10:10 AM	4.4	134		09:43 AM	5.3	162		10:10 AM	4.4	134	
	02:39 PM	10.2	311		03:41 PM	9.3	283		02:50 PM	8.8	268		03:41 PM	9.3	283	
	09:07 PM	0.0	0		09:53 PM	1.8	55		09:10 PM	1.7	52		09:53 PM	1.8	55	
10 Su	04:29 AM	10.6	323	**25** M	04:29 AM	10.6	323	**10** Tu	04:29 AM	10.6	323	**25** W	04:29 AM	10.6	323	
	10:39 AM	3.3	101		10:39 AM	3.3	101		10:39 AM	3.3	101		10:39 AM	3.3	101	
	04:28 PM	9.8	299		04:28 PM	9.8	299		04:28 PM	9.8	299		04:28 PM	9.8	299	
	10:34 PM	2.0	61		10:34 PM	2.0	61		10:34 PM	2.0	61		10:34 PM	2.0	61	
11 M	05:30 AM	11.5	351	**26** Tu	04:55 AM	10.8	329	**11** W	05:30 AM	11.5	351	**26** Th	04:55 AM	10.8	329	
	11:37 AM	2.8	85		11:10 AM	2.2	67		11:37 AM	2.8	85		11:10 AM	2.2	67	
	05:28 PM	10.5	320		05:13 PM	10.2	311		05:28 PM	10.5	320		05:13 PM	10.2	311	
	11:37 PM	1.2	37		11:14 PM	2.4	73		11:37 PM	1.2	37		11:14 PM	2.4	73	
12 Tu	05:59 AM	11.6	354	**27** W	05:22 AM	11.1	338	**12** Th	05:59 AM	11.6	354	**27** F	05:22 AM	11.1	338	
	12:14 PM	2.0	61		11:44 AM	1.1	34		12:14 PM	2.0	61		11:44 AM	1.1	34	
	06:17 PM	10.5	320		05:59 PM	10.6	323		06:17 PM	10.5	320		05:59 PM	10.6	323	
					11:54 PM	3.0	91						11:54 PM	3.0	91	
13 W	12:18 AM	2.0	61	**28** Th	05:52 AM	11.3	344	**13** F	12:18 AM	2.0	61	**28** Sa	05:52 AM	11.3	344	
	06:28 AM	11.5	351		12:22 PM	0.1	3		06:28 AM	11.5	351		12:22 PM	0.1	3	
	12:51 PM	1.3	40		06:47 PM	10.9	332		12:51 PM	1.3	40		06:47 PM	10.9	332	
	07:05 PM	10.4	317						07:05 PM	10.4	317					
14 Th	12:59 AM	3.0	91	**29** F	12:37 AM	3.7	113	**14** Sa	12:59 AM	3.0	91	**29** Su	12:37 AM	3.7	113	
	06:59 AM	11.3	344		06:25 AM	11.3	344		06:59 AM	11.3	344		06:25 AM	11.3	344	
	01:28 PM	0.9	27		01:03 PM	-0.7	-21		01:28 PM	0.9	27		01:03 PM	-0.7	-21	
	07:53 PM	10.3	314		07:38 PM	11.0	335		07:53 PM	10.3	314		07:38 PM	11.0	335	
15 F	01:40 AM	4.0	122	**30** Sa	01:21 AM	4.5	137	**15** Su	01:40 AM	4.0	122					
	07:32 AM	11.0	335		07:02 AM	11.2	341		07:32 AM	11.0	335					
	02:06 PM	0.7	21		01:48 PM	-1.2	-37		02:06 PM	0.7	21					
	08:42 PM	10.0	305		08:32 PM	10.9	332		08:42 PM	10.0	305					
				31 Su	02:10 AM	5.3	162									
					07:43 AM	10.9	332									
					02:37 PM	-1.3	-40									
					09:32 PM	10.6	323									

Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.
Referenced to Station: SEATTLE (Madison St.), Elliott Bay (9447130) Height offset in feet (low:*1.00 high: * 0.97) Time offset in mins (low:-5 high: -5)

Generated On: Mon Jun 17 22:34:32 GMT 2013

StationId:9449798
Source:NOAA/NOS/CO-OPS
Station Type:Subordinate
Time Zone:LST/LDT
Datum:mean lower low water (MLLW) which is the chart datum of soundings

NOAA Tide Predictions

Orcas, Orcas Island,Washington,2013

Times and Heights of High and Low Waters

January

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Tu	12:38 AM	-0.2 -6	**16** W	01:22 AM	0.9 27
	08:03 AM	8.3 253		08:23 AM	8.6 262
	02:01 PM	4.8 146		02:56 PM	3.1 94
	06:30 PM	5.9 180		08:12 PM	5.6 171
2 W	01:15 AM	0.5 15	**17** Th	02:06 AM	2.1 64
	08:33 AM	8.3 253		08:55 AM	8.4 256
	02:52 PM	4.1 125		03:58 PM	2.5 76
	07:32 PM	5.5 168		09:38 PM	5.2 158
3 Th	01:54 AM	1.3 40	**18** F	02:53 AM	3.3 101
	09:03 AM	8.3 253		09:28 AM	8.1 247
	03:45 PM	3.4 104		04:59 PM	2.0 61
	08:46 PM	5.1 155		11:44 PM	5.2 158
4 F	02:35 AM	2.3 70	**19** Sa	03:47 AM	4.4 134
	09:35 AM	8.3 253		10:01 AM	7.9 241
	04:38 PM	2.4 73		05:56 PM	1.5 46
	10:17 PM	4.9 149			
5 Sa	03:22 AM	3.4 104	**20** Su	01:42 AM	5.8 177
	10:09 AM	8.3 253		04:55 AM	5.3 162
	05:31 PM	1.4 43		10:36 AM	7.6 232
				06:47 PM	1.0 30
6 Su	12:20 AM	5.1 155	**21** M	02:54 AM	6.5 198
	04:23 AM	4.5 137		06:18 AM	6.0 183
	10:46 AM	8.3 253		11:16 AM	7.4 226
	06:23 PM	0.4 12		07:33 PM	0.7 21
7 M	02:18 AM	5.9 180	**22** Tu	03:44 AM	7.1 216
	05:38 AM	5.4 165		07:41 AM	6.2 189
	11:27 AM	8.3 253		12:01 PM	7.2 219
	07:14 PM	-0.5 -15		08:14 PM	0.3 9
8 Tu	03:22 AM	6.8 207	**23** W	04:22 AM	7.5 229
	06:55 AM	6.0 183		08:47 AM	6.3 192
	12:14 PM	8.3 253		12:51 PM	7.2 219
	08:04 PM	-1.3 -40		08:51 PM	0.0 0
9 W	04:08 AM	7.5 229	**24** Th	04:54 AM	7.7 235
	08:05 AM	6.2 189		09:34 AM	6.1 186
	01:08 PM	8.3 253		01:41 PM	7.1 216
	08:52 PM	-1.9 -58		09:26 PM	-0.2 -6
10 Th	04:49 AM	8.1 247	**25** F	05:21 AM	7.8 238
	09:07 AM	6.1 186		10:10 AM	5.9 180
	02:05 PM	8.2 250		02:29 PM	7.1 216
	09:39 PM	-2.2 -67		09:59 PM	-0.4 -12
11 F	05:27 AM	8.4 256	**26** Sa	05:44 AM	7.9 241
	10:05 AM	5.9 180		10:42 AM	5.6 171
	03:03 PM	8.1 247		03:16 PM	7.1 216
	10:25 PM	-2.2 -67		10:33 PM	-0.4 -12
12 Sa	06:04 AM	8.6 262	**27** Su	06:04 AM	8.0 244
	11:01 AM	5.4 165		11:16 AM	5.2 158
	04:01 PM	7.8 238		04:03 PM	6.9 210
	11:10 PM	-1.8 -55		11:06 PM	-0.3 -9
13 Su	06:40 AM	8.7 265	**28** M	06:25 AM	8.1 247
	11:57 AM	4.9 149		11:52 AM	4.7 143
	05:00 PM	7.3 223		04:51 PM	6.8 207
	11:54 PM	-1.2 -37		11:41 PM	0.0 0
14 M	07:15 AM	8.7 265	**29** Tu	06:48 AM	8.2 250
	12:55 PM	4.3 131		12:32 PM	4.1 125
	06:00 PM	6.8 207		05:43 PM	6.5 198
15 Tu	12:38 AM	-0.3 -9	**30** W	12:16 AM	0.6 18
	07:50 AM	8.7 265		07:15 AM	8.2 250
	01:55 PM	3.7 113		01:15 PM	3.5 107
	07:03 PM	6.2 189		06:38 PM	6.2 189
			31 Th	12:53 AM	1.3 40
				07:43 AM	8.3 253
				02:01 PM	2.8 85
				07:40 PM	5.9 180

February

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	01:31 AM	2.2 67	**16** Sa	02:29 AM	4.1 125
	08:14 AM	8.2 250		08:28 AM	7.7 235
	02:52 PM	2.0 61		03:44 PM	1.5 46
	08:51 PM	5.6 171		11:08 PM	5.8 177
2 Sa	02:13 AM	3.2 98	**17** Su	03:24 AM	5.0 152
	08:46 AM	8.2 250		09:02 AM	7.4 226
	03:47 PM	1.3 40		04:41 PM	1.4 43
	10:20 PM	5.5 168			
3 Su	03:01 AM	4.3 131	**18** M	01:04 AM	6.1 186
	09:22 AM	8.1 247		04:37 AM	5.6 171
	04:46 PM	0.6 18		09:40 AM	7.1 216
				05:41 PM	1.3 40
4 M	12:25 AM	5.7 174	**19** Tu	02:18 AM	6.6 201
	04:05 AM	5.2 158		06:08 AM	5.9 180
	10:03 AM	8.0 244		10:28 AM	6.8 207
	05:47 PM	0.0 0		06:40 PM	1.1 34
5 Tu	02:08 AM	6.4 195	**20** W	03:06 AM	6.9 210
	05:27 AM	5.9 180		07:36 AM	5.9 180
	10:53 AM	7.9 241		11:26 AM	6.7 204
	06:47 PM	-0.5 -15		07:32 PM	0.9 27
6 W	03:05 AM	7.0 213	**21** Th	03:42 AM	7.2 219
	06:52 AM	6.1 186		08:35 AM	5.7 174
	11:54 AM	7.8 238		12:30 PM	6.6 201
	07:44 PM	-1.0 -30		08:18 PM	0.7 21
7 Th	03:47 AM	7.6 232	**22** F	04:10 AM	7.3 223
	08:05 AM	5.9 180		09:13 AM	5.4 165
	01:02 PM	7.7 235		01:31 PM	6.6 201
	08:37 PM	-1.2 -37		08:57 PM	0.5 15
8 F	04:24 AM	7.9 241	**23** Sa	04:32 AM	7.4 226
	09:06 AM	5.5 168		09:42 AM	5.0 152
	02:10 PM	7.6 232		02:27 PM	6.7 204
	09:25 PM	-1.2 -37		09:33 PM	0.4 12
9 Sa	04:58 AM	8.2 250	**24** Su	04:50 AM	7.5 229
	09:59 AM	4.9 149		10:10 AM	4.5 137
	03:13 PM	7.6 232		03:19 PM	6.8 207
	10:10 PM	-1.0 -30		10:08 PM	0.5 15
10 Su	05:29 AM	8.3 253	**25** M	05:08 AM	7.6 232
	10:48 AM	4.3 131		10:41 AM	3.8 116
	04:12 PM	7.4 226		04:09 PM	6.9 210
	10:53 PM	-0.5 -15		10:42 PM	0.7 21
11 M	06:00 AM	8.3 253	**26** Tu	05:29 AM	7.7 235
	11:36 AM	3.6 110		11:16 AM	3.1 94
	05:10 PM	7.1 216		05:00 PM	6.9 210
	11:35 PM	0.2 6		11:18 PM	1.2 37
12 Tu	06:30 AM	8.3 253	**27** W	05:54 AM	7.9 241
	12:24 PM	3.0 91		11:54 AM	2.4 73
	06:07 PM	6.8 207		05:53 PM	6.8 207
				11:55 PM	1.8 55
13 W	12:17 AM	1.1 34	**28** Th	06:22 AM	7.9 241
	06:59 AM	8.3 253		12:36 PM	1.7 52
	01:12 PM	2.4 73		06:49 PM	6.7 204
	07:06 PM	6.4 195			
14 Th	12:59 AM	2.1 64			
	07:28 AM	8.1 247			
	02:00 PM	2.0 61			
	08:09 PM	6.1 186			
15 F	01:42 AM	3.1 94			
	07:57 AM	7.9 241			
	02:51 PM	1.7 52			
	09:24 PM	5.8 177			

March

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	12:34 AM	2.6 79	**16** Sa	02:25 AM	4.2 128
	06:52 AM	8.0 244		08:00 AM	7.3 223
	01:22 PM	1.0 30		02:55 PM	0.8 24
	07:50 PM	6.5 198		10:08 PM	6.6 201
2 Sa	01:16 AM	3.4 104	**17** Su	03:16 AM	4.8 146
	07:25 AM	7.9 241		08:33 AM	7.0 213
	02:11 PM	0.5 15		03:43 PM	0.9 27
	09:00 PM	6.4 195		11:24 PM	6.5 198
3 Su	02:03 AM	4.3 131	**18** M	04:17 AM	5.3 162
	08:01 AM	7.8 238		09:09 AM	6.7 204
	03:07 PM	0.2 6		04:35 PM	1.1 34
	10:24 PM	6.3 192			
4 M	03:00 AM	5.0 152	**19** Tu	12:57 AM	6.5 198
	08:42 AM	7.6 232		05:38 AM	5.6 171
	04:08 PM	0.0 0		09:53 AM	6.4 195
				05:34 PM	1.2 37
5 Tu	12:07 AM	6.4 195	**20** W	02:13 AM	6.6 201
	04:15 AM	5.6 171		07:14 AM	5.6 171
	09:33 AM	7.4 226		10:48 AM	6.1 186
	05:13 PM	-0.1 -3		06:37 PM	1.3 40
6 W	01:31 AM	6.8 207	**21** Th	03:03 AM	6.8 207
	05:44 AM	5.7 174		08:29 AM	5.3 162
	10:38 AM	7.1 216		11:56 AM	5.9 180
	06:20 PM	-0.2 -6		07:37 PM	1.4 43
7 Th	02:26 AM	7.2 219	**22** F	03:38 AM	6.9 210
	07:10 AM	5.5 168		09:14 AM	4.9 149
	11:56 AM	6.9 210		01:12 PM	5.9 180
	07:23 PM	-0.1 -3		08:31 PM	1.4 43
8 F	03:08 AM	7.5 229	**23** Sa	04:03 AM	7.0 213
	08:17 AM	4.9 149		09:42 AM	4.4 134
	01:16 PM	6.8 207		02:25 PM	6.0 183
	08:18 PM	0.0 0		09:16 PM	1.4 43
9 Sa	03:44 AM	7.7 235	**24** Su	04:22 AM	7.1 216
	09:08 AM	4.2 128		10:08 AM	3.7 113
	02:29 PM	6.9 210		03:28 PM	6.2 189
	09:08 PM	0.2 6		09:57 PM	1.5 46
10 Su	05:15 AM	7.8 238	**25** M	04:41 AM	7.2 219
	10:52 AM	3.4 104		10:36 AM	2.9 88
	04:33 PM	7.0 213		04:24 PM	6.5 198
	10:52 PM	0.7 21		10:36 PM	1.8 55
11 M	05:44 AM	7.9 241	**26** Tu	05:03 AM	7.4 226
	11:32 AM	2.7 82		11:08 AM	2.1 64
	05:31 PM	7.0 213		05:17 PM	6.8 207
	11:35 PM	1.3 40		11:14 PM	2.2 67
12 Tu	06:10 AM	7.9 241	**27** W	05:28 AM	7.5 229
	12:12 PM	2.0 61		11:43 AM	1.2 37
	06:25 PM	7.0 213		06:10 PM	7.1 216
				11:54 PM	2.7 82
13 W	12:16 AM	2.0 61	**28** Th	05:57 AM	7.6 232
	06:36 AM	7.8 238		12:22 PM	0.4 12
	12:51 PM	1.4 43		07:04 PM	7.2 219
	07:18 PM	7.0 213			
14 Th	12:57 AM	2.7 82	**29** F	12:35 AM	3.3 101
	07:03 AM	7.7 235		06:28 AM	7.7 235
	01:31 PM	1.1 34		01:04 PM	-0.3 -9
	08:11 PM	6.9 210		08:00 PM	7.3 223
15 F	01:40 AM	3.5 107	**30** Sa	01:19 AM	4.0 122
	07:30 AM	7.5 229		07:02 AM	7.7 235
	02:12 PM	0.9 27		01:50 PM	-0.7 -21
	09:07 PM	6.7 204		09:00 PM	7.3 223
			31 Su	02:08 AM	4.6 140
				07:40 AM	7.5 229
				02:40 PM	-0.9 -27
				10:05 PM	7.2 219

Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.
Referenced to Station: PORT TOWNSEND (9444900) Height offset in feet (low:*0.90 high: * 0.90) Time offset in mins (low:56 high: 33)

Generated On: Mon Jun 17 22:38:09 GMT 2013

Page 2 of 5

StationId:9446025
Source:NOAA/NOS/CO-OPS
Station Type:Subordinate
Time Zone:LST/LDT
Datum:mean lower low water (MLLW) which is the chart datum of soundings

NOAA Tide Predictions

Point Vashon, Vashon Island,Washington,2013

Times and Heights of High and Low Waters

January

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Tu	12:42 AM -0.2 -6 07:48 AM 12.6 384 01:51 PM 5.7 174 06:53 PM 9.4 287		**16** W	01:29 AM 1.0 30 08:17 AM 13.1 399 02:45 PM 3.6 110 08:21 PM 9.3 283	
2 W	01:21 AM 0.7 21 08:20 AM 12.7 387 02:37 PM 4.9 149 07:49 PM 9.0 274		**17** Th	02:15 AM 2.7 82 08:55 AM 12.7 387 03:39 PM 3.0 91 09:35 PM 8.7 265	
3 Th	02:01 AM 1.8 55 08:55 AM 12.6 384 03:27 PM 4.1 125 08:55 PM 8.6 262		**18** F	03:04 AM 4.4 134 09:35 AM 12.2 372 04:36 PM 2.5 76 11:07 PM 8.5 259	
4 F	02:45 AM 3.2 98 09:33 AM 12.5 381 04:21 PM 3.1 94 10:14 PM 8.4 256		**19** Sa	04:01 AM 5.9 180 10:19 AM 11.7 357 05:34 PM 2.0 61	
5 Sa	03:36 AM 4.7 143 10:14 AM 12.4 378 05:18 PM 1.9 58 11:46 PM 8.6 262		**20** Su	12:59 AM 8.9 271 05:19 AM 7.2 219 11:07 AM 11.2 341 06:31 PM 1.5 46	
6 Su	04:40 AM 6.1 186 10:59 AM 12.3 375 06:16 PM 0.7 21		**21** M	02:30 AM 9.7 296 06:57 AM 7.8 238 11:58 AM 10.8 329 07:22 PM 1.0 30	
7 M	01:23 AM 9.3 283 05:59 AM 7.2 219 11:50 AM 12.2 372 07:11 PM -0.5 -15		**22** Tu	03:28 AM 10.4 317 08:19 AM 7.9 241 12:51 PM 10.5 320 08:07 PM 0.6 18	
8 Tu	02:45 AM 10.4 317 07:22 AM 7.8 238 12:44 PM 12.2 372 08:04 PM -1.6 -49		**23** W	04:10 AM 11.0 335 09:16 AM 7.7 235 01:41 PM 10.4 317 08:47 PM 0.1 3	
9 W	03:43 AM 11.4 347 08:34 AM 7.8 238 01:40 PM 12.2 372 08:55 PM -2.4 -73		**24** Th	04:42 AM 11.4 347 09:57 AM 7.5 229 02:27 PM 10.4 317 09:24 PM -0.2 -6	
10 Th	04:30 AM 12.2 372 09:35 AM 7.5 229 02:35 PM 12.2 372 09:43 PM -2.8 -85		**25** F	05:08 AM 11.7 357 10:30 AM 7.2 219 03:10 PM 10.5 320 09:59 PM -0.5 -15	
11 F	05:11 AM 12.7 387 10:30 AM 7.0 213 03:30 PM 12.1 369 10:30 PM -2.9 -88		**26** Sa	05:29 AM 11.9 363 10:59 AM 6.7 204 03:50 PM 10.5 320 10:34 PM -0.6 -18	
12 Sa	05:50 AM 13.1 399 11:21 AM 6.3 192 04:25 PM 11.8 360 11:16 PM -2.5 -76		**27** Su	05:49 AM 12.1 369 11:28 AM 6.2 189 04:31 PM 10.6 323 11:09 PM -0.4 -12	
13 Su	06:27 AM 13.3 405 12:11 PM 5.6 171 05:20 PM 11.3 344		**28** M	06:12 AM 12.3 375 12:00 PM 5.6 171 05:13 PM 10.5 320 11:44 PM -0.1 -3	
14 M	12:01 AM -1.6 -49 07:04 AM 13.4 408 01:01 PM 4.9 149 06:17 PM 10.7 326		**29** Tu	06:37 AM 12.5 381 12:36 PM 4.8 146 05:58 PM 10.3 314	
15 Tu	12:45 AM -0.4 -12 07:40 AM 13.3 405 01:52 PM 4.2 128 07:17 PM 10.0 305		**30** W	12:21 AM 0.6 18 07:06 AM 12.6 384 01:15 PM 4.0 122 06:47 PM 10.1 308	
			31 Th	12:59 AM 1.6 49 07:36 AM 12.7 387 01:58 PM 3.2 98 07:42 PM 9.8 299	

February

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	01:39 AM 2.8 85 08:10 AM 12.6 384 02:46 PM 2.4 73 08:45 PM 9.4 287		**16** Sa	02:36 AM 5.3 162 08:42 AM 11.5 351 03:32 PM 1.9 58 10:22 PM 9.1 277	
2 Sa	02:23 AM 4.2 128 08:47 AM 12.4 378 03:39 PM 1.6 49 09:59 PM 9.2 280		**17** Su	03:31 AM 6.5 198 09:26 AM 10.8 329 04:27 PM 1.9 58	
3 Su	03:14 AM 5.7 174 09:30 AM 12.1 369 04:38 PM 1.0 30 11:30 PM 9.2 280		**18** M	12:01 AM 9.1 277 04:48 AM 7.4 226 10:17 AM 10.3 314 05:27 PM 1.8 55	
4 M	04:21 AM 7.0 213 10:21 AM 11.8 360 05:41 PM 0.3 9		**19** Tu	01:42 AM 9.6 293 06:36 AM 7.8 238 11:17 AM 9.8 299 06:28 PM 1.6 49	
5 Tu	01:15 AM 9.7 296 05:50 AM 7.8 238 11:22 AM 11.5 351 06:45 PM -0.4 -12		**20** W	02:46 AM 10.1 308 08:02 AM 7.5 229 12:21 PM 9.6 293 07:25 PM 1.3 40	
6 W	02:36 AM 10.6 323 07:22 AM 7.9 241 12:29 PM 11.4 347 07:45 PM -1.1 -34		**21** Th	03:27 AM 10.6 323 08:54 AM 7.1 216 01:21 PM 9.7 296 08:13 PM 0.9 27	
7 Th	03:30 AM 11.4 347 08:35 AM 7.4 226 01:35 PM 11.4 347 08:39 PM -1.5 -46		**22** F	03:57 AM 10.9 332 09:29 AM 6.6 201 02:13 PM 9.9 302 08:55 PM 0.6 18	
8 F	04:11 AM 12.0 366 09:32 AM 6.6 201 02:36 PM 11.5 351 09:29 PM -1.7 -52		**23** Sa	04:19 AM 11.2 341 09:57 AM 6.0 183 03:00 PM 10.2 311 09:33 PM 0.5 15	
9 Sa	04:46 AM 12.4 378 10:20 AM 5.7 174 03:33 PM 11.5 351 10:16 PM -1.5 -46		**24** Su	04:39 AM 11.4 347 10:24 AM 5.3 162 03:43 PM 10.4 317 10:10 PM 0.5 15	
10 Su	05:19 AM 12.7 387 11:05 AM 4.8 146 04:28 PM 11.4 347 11:00 PM -0.9 -27		**25** M	05:00 AM 11.7 357 10:53 AM 4.5 137 04:25 PM 10.7 326 10:46 PM 0.7 21	
11 M	05:51 AM 12.9 393 11:48 AM 4.0 122 05:21 PM 11.2 341 11:43 PM 0.0 0		**26** Tu	05:23 AM 12.0 366 11:25 AM 3.5 107 05:09 PM 10.8 329 11:23 PM 1.3 40	
12 Tu	06:22 AM 12.9 393 12:31 PM 3.2 98 06:14 PM 10.8 329		**27** W	05:50 AM 12.2 372 12:01 PM 2.6 79 05:55 PM 10.9 332	
13 W	12:25 AM 1.2 37 06:55 AM 12.7 387 01:14 PM 2.6 79 07:08 PM 10.4 317		**28** Th	12:01 AM 2.0 61 06:19 AM 12.3 375 12:41 PM 1.7 52 06:45 PM 10.8 329	
14 Th	01:06 AM 2.5 76 07:28 AM 12.5 381 01:57 PM 2.2 67 08:04 PM 9.9 302				
15 F	01:49 AM 3.9 119 08:04 AM 12.0 366 02:43 PM 2.0 61 09:07 PM 9.5 290				

March

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	12:41 AM 3.0 91 06:51 AM 12.3 375 01:24 PM 1.0 30 07:39 PM 10.6 323		**16** Sa	02:30 AM 5.1 155 08:14 AM 11.0 335 02:53 PM 0.8 24 09:41 PM 10.2 311	
2 Sa	01:24 AM 4.1 125 07:27 AM 12.1 369 02:11 PM 0.4 12 08:40 PM 10.3 314		**17** Su	03:17 AM 6.0 183 08:53 AM 10.5 320 03:37 PM 1.0 30 10:41 PM 9.9 302	
3 Su	02:12 AM 5.3 162 08:08 AM 11.8 360 03:04 PM 0.2 6 09:51 PM 10.0 305		**18** M	04:13 AM 6.7 204 09:37 AM 9.8 299 04:27 PM 1.3 40 11:53 PM 9.7 296	
4 M	03:10 AM 6.4 195 08:56 AM 11.3 344 04:04 PM 0.1 3 11:17 PM 9.9 302		**19** Tu	05:28 AM 7.2 219 10:31 AM 9.2 280 05:24 PM 1.7 52	
5 Tu	04:26 AM 7.2 219 09:57 AM 10.8 329 05:11 PM 0.1 3		**20** W	01:17 AM 9.7 296 07:11 AM 7.2 219 11:38 AM 8.8 268 06:28 PM 1.9 58	
6 W	12:53 AM 10.2 311 06:03 AM 7.4 226 11:11 AM 10.4 317 06:20 PM 0.0 0		**21** Th	02:28 AM 9.9 302 08:31 AM 6.7 204 12:51 PM 8.7 265 07:31 PM 1.9 58	
7 Th	02:06 AM 10.8 329 07:31 AM 6.8 207 12:29 PM 10.3 314 07:25 PM -0.1 -3		**22** F	03:14 AM 10.2 311 09:17 AM 6.1 186 01:59 PM 8.8 268 08:28 PM 1.8 55	
8 F	02:56 AM 11.3 344 08:34 AM 5.9 180 01:42 PM 10.4 317 08:23 PM -0.2 -6		**23** Sa	03:46 AM 10.5 320 09:50 AM 5.3 162 02:57 PM 9.2 280 09:17 PM 1.7 52	
9 Sa	03:35 AM 11.7 357 09:23 AM 4.8 146 02:46 PM 10.7 326 09:14 PM 0.0 0		**24** Su	04:12 AM 10.8 329 10:17 AM 4.4 134 03:48 PM 9.7 296 10:00 PM 1.8 55	
10 Su	05:08 AM 12.0 366 11:05 AM 3.8 116 04:43 PM 10.9 332 11:00 PM 0.5 15		**25** M	04:36 AM 11.1 338 10:46 AM 3.4 104 04:35 PM 10.3 314 10:41 PM 2.0 61	
11 M	05:37 AM 12.1 369 11:44 AM 2.8 85 05:35 PM 11.0 335 11:44 PM 1.2 37		**26** Tu	05:02 AM 11.4 347 11:17 AM 2.2 67 05:20 PM 10.7 326 11:21 PM 2.4 73	
12 Tu	06:06 AM 12.2 372 12:21 PM 2.0 61 06:24 PM 11.1 338		**27** W	05:29 AM 11.7 357 11:51 AM 1.1 34 06:06 PM 11.1 338	
13 W	12:25 AM 2.1 64 06:35 AM 12.1 369 12:58 PM 1.3 40 07:12 PM 11.0 335		**28** Th	12:01 AM 3.0 91 05:59 AM 11.8 360 12:29 PM 0.1 3 06:54 PM 11.4 347	
14 Th	01:06 AM 3.1 94 07:06 AM 11.9 363 01:35 PM 0.9 27 08:00 PM 10.8 329		**29** F	12:44 AM 3.8 116 06:32 AM 11.9 363 01:10 PM -0.7 -21 07:45 PM 11.5 351	
15 F	01:47 AM 4.1 125 07:39 AM 11.5 351 02:13 PM 0.7 21 08:49 PM 10.6 323		**30** Sa	01:28 AM 4.6 140 07:09 AM 11.8 360 01:55 PM -1.2 -37 08:39 PM 11.4 347	
			31 Su	02:17 AM 5.4 165 07:50 AM 11.5 351 02:44 PM -1.3 -40 09:39 PM 11.2 341	

Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.
Referenced to Station: SEATTLE (Madison St.), Elliott Bay (9447130) Height offset in feet (low:*1.01 high: * 1.02) Time offset in mins (low:2 high: 2)

Generated On: Mon Jun 17 22:35:59 GMT 2013

StationId:9444900
Source:NOAA/NOS/CO-OPS
Station Type:Harmonic
Time Zone:LST/LDT
Datum:mean lower low water (MLLW) which is the chart datum of soundings

NOAA Tide Predictions

PORT TOWNSEND,Washington,2013

Times and Heights of High and Low Waters

January

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Tu	07:30 AM	9.3 283	**16** W	12:26 AM	0.9 27
	01:05 PM	5.3 162		07:50 AM	9.5 290
	05:57 PM	6.6 201		02:00 PM	3.5 107
				07:39 PM	6.2 189
2 W	12:19 AM	0.5 15	**17** Th	01:10 AM	2.3 70
	08:00 AM	9.3 283		08:22 AM	9.3 283
	01:56 PM	4.6 140		03:02 PM	2.8 85
	06:59 PM	6.1 186		09:05 PM	5.8 177
3 Th	12:58 AM	1.5 46	**18** F	01:57 AM	3.6 110
	08:30 AM	9.3 283		08:55 AM	9.1 277
	02:49 PM	3.7 113		04:03 PM	2.2 67
	08:13 PM	5.6 171		11:11 PM	5.8 177
4 F	01:39 AM	2.6 79	**19** Sa	02:51 AM	4.9 149
	09:02 AM	9.2 280		09:28 AM	8.8 268
	03:42 PM	2.7 82		05:00 PM	1.6 49
	09:44 PM	5.4 165			
5 Sa	02:26 AM	3.8 116	**20** Su	01:09 AM	6.4 195
	09:36 AM	9.2 280		03:59 AM	5.9 180
	04:35 PM	1.6 49		10:03 AM	8.5 259
	11:47 PM	5.7 174		05:51 PM	1.2 37
6 Su	03:27 AM	5.0 152	**21** M	02:21 AM	7.2 219
	10:13 AM	9.2 280		05:22 AM	6.6 201
	05:27 PM	0.5 15		10:43 AM	8.2 250
				06:37 PM	0.7 21
7 M	01:45 AM	6.6 201	**22** Tu	03:11 AM	7.9 241
	04:42 AM	6.0 183		06:45 AM	6.9 210
	10:54 AM	9.2 280		11:28 AM	8.1 247
	06:18 PM	-0.6 -18		07:18 PM	0.4 12
8 Tu	02:49 AM	7.6 232	**23** W	03:49 AM	8.3 253
	05:59 AM	6.6 201		07:51 AM	7.0 213
	11:41 AM	9.2 280		12:18 PM	8.0 244
	07:08 PM	-1.5 -46		07:55 PM	0.0 0
9 W	03:35 AM	8.4 256	**24** Th	04:21 AM	8.6 262
	07:09 AM	6.9 210		08:38 AM	6.8 207
	12:35 PM	9.2 280		01:08 PM	7.9 241
	07:56 PM	-2.1 -64		08:30 PM	-0.2 -6
10 Th	04:16 AM	9.0 274	**25** F	04:48 AM	8.7 265
	08:11 AM	6.8 207		09:14 AM	6.6 201
	01:32 PM	9.1 277		01:56 PM	7.9 241
	08:43 PM	-2.5 -76		09:03 PM	-0.4 -12
11 F	04:54 AM	9.4 287	**26** Sa	05:11 AM	8.8 268
	09:09 AM	6.5 198		09:46 AM	6.2 189
	02:30 PM	8.9 271		02:43 PM	7.8 238
	09:29 PM	-2.4 -73		09:37 PM	-0.4 -12
12 Sa	05:31 AM	9.6 293	**27** Su	05:31 AM	8.9 271
	10:05 AM	6.1 186		10:20 AM	5.8 177
	03:28 PM	8.6 262		03:30 PM	7.7 235
	10:14 PM	-2.0 -61		10:10 PM	-0.3 -9
13 Su	06:07 AM	9.7 296	**28** M	05:52 AM	9.0 274
	11:01 AM	5.5 168		10:56 AM	5.2 158
	04:27 PM	8.1 247		04:18 PM	7.5 229
	10:58 PM	-1.3 -40		10:45 PM	0.0 0
14 M	06:42 AM	9.7 296	**29** Tu	06:15 AM	9.1 277
	11:59 AM	4.8 146		11:36 AM	4.6 140
	05:27 PM	7.5 229		05:10 PM	7.2 219
	11:42 PM	-0.3 -9		11:20 PM	0.6 18
15 Tu	07:17 AM	9.7 296	**30** W	06:42 AM	9.1 277
	12:59 PM	4.1 125		12:19 PM	3.9 119
	06:30 PM	6.9 210		06:05 PM	6.9 210
				11:57 PM	1.4 43
			31 Th	07:10 AM	9.2 280
				01:05 PM	3.1 94
				07:07 PM	6.5 198

February

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	12:35 AM	2.5 76	**16** Sa	01:33 AM	4.6 140
	07:41 AM	9.2 280		07:55 AM	8.5 259
	01:56 PM	2.3 70		02:48 PM	1.7 52
	08:18 PM	6.2 189		10:35 PM	6.4 195
2 Sa	01:17 AM	3.6 110	**17** Su	02:28 AM	5.5 168
	08:13 AM	9.1 277		08:29 AM	8.2 250
	02:51 PM	1.5 46		03:45 PM	1.6 49
	09:47 PM	6.1 186			
3 Su	02:05 AM	4.8 146	**18** M	12:31 AM	6.8 207
	08:49 AM	9.0 274		03:41 AM	6.2 189
	03:50 PM	0.7 21		09:07 AM	7.9 241
	11:52 PM	6.3 192		04:45 PM	1.4 43
4 M	03:09 AM	5.8 177	**19** Tu	01:45 AM	7.3 223
	09:30 AM	8.9 271		05:12 AM	6.6 201
	04:51 PM	0.0 0		09:55 AM	7.6 232
				05:44 PM	1.2 37
5 Tu	01:35 AM	7.1 216	**20** W	02:33 AM	7.7 235
	04:31 AM	6.5 198		06:40 AM	6.6 201
	10:20 AM	8.8 268		10:53 AM	7.4 226
	05:51 PM	-0.6 -18		06:36 PM	1.0 30
6 W	02:32 AM	7.8 238	**21** Th	03:09 AM	8.0 244
	05:56 AM	6.8 207		07:39 AM	6.4 195
	11:21 AM	8.6 262		11:57 AM	7.3 223
	06:48 PM	-1.1 -34		07:22 PM	0.7 21
7 Th	03:14 AM	8.4 256	**22** F	03:37 AM	8.2 250
	07:09 AM	6.6 201		08:17 AM	6.0 183
	12:29 PM	8.6 262		12:58 PM	7.4 226
	07:41 PM	-1.3 -40		08:01 PM	0.5 15
8 F	03:51 AM	8.8 268	**23** Sa	03:59 AM	8.2 250
	08:10 AM	6.1 186		08:46 AM	5.6 171
	01:37 PM	8.5 259		01:54 PM	7.5 229
	08:29 PM	-1.4 -43		08:37 PM	0.5 15
9 Sa	04:25 AM	9.1 277	**24** Su	04:17 AM	8.3 253
	09:03 AM	5.5 168		09:14 AM	5.0 152
	02:40 PM	8.4 256		02:46 PM	7.6 232
	09:14 PM	-1.1 -34		09:12 PM	0.6 18
10 Su	04:56 AM	9.2 280	**25** M	04:35 AM	8.5 259
	09:52 AM	4.7 143		09:45 AM	4.3 131
	03:39 PM	8.2 250		03:36 PM	7.6 232
	09:57 PM	-0.5 -15		09:46 PM	0.8 24
11 M	05:27 AM	9.3 283	**26** Tu	04:56 AM	8.6 262
	10:40 AM	4.0 122		10:20 AM	3.5 107
	04:37 PM	7.9 241		04:27 PM	7.6 232
	10:39 PM	0.3 9		10:22 PM	1.3 40
12 Tu	05:57 AM	9.3 283	**27** W	05:21 AM	8.7 265
	11:28 AM	3.3 101		10:58 AM	2.6 79
	05:34 PM	7.5 229		05:20 PM	7.6 232
	11:21 PM	1.3 40		10:59 PM	2.0 61
13 W	06:26 AM	9.2 280	**28** Th	05:49 AM	8.8 268
	12:16 PM	2.7 82		11:40 AM	1.8 55
	06:33 PM	7.1 216		06:16 PM	7.4 226
				11:38 PM	2.9 88
14 Th	12:03 AM	2.4 73			
	06:55 AM	9.0 274			
	01:04 PM	2.3 70			
	07:36 PM	6.8 207			
15 F	12:46 AM	3.5 107			
	07:24 AM	8.8 268			
	01:55 PM	1.9 58			
	08:51 PM	6.5 198			

March

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	06:19 AM	8.8 268	**16** Sa	01:29 AM	4.7 143
	12:26 PM	1.1 34		07:27 AM	8.1 247
	07:17 PM	7.3 223		01:59 PM	0.9 27
				09:35 PM	7.3 223
2 Sa	12:20 AM	3.8 116	**17** Su	02:20 AM	5.4 165
	06:52 AM	8.8 268		08:00 AM	7.8 238
	01:15 PM	0.6 18		02:47 PM	1.0 30
	08:27 PM	7.1 216		10:51 PM	7.2 219
3 Su	01:07 AM	4.8 146	**18** M	03:21 AM	5.9 180
	07:28 AM	8.7 265		08:36 AM	7.5 229
	02:11 PM	0.2 6		03:39 PM	1.2 37
	09:51 PM	7.0 213			
4 M	02:04 AM	5.6 171	**19** Tu	12:24 AM	7.2 219
	08:09 AM	8.5 259		04:42 AM	6.2 189
	03:12 PM	0.0 0		09:20 AM	7.1 216
	11:34 PM	7.2 219		04:38 PM	1.4 43
5 Tu	03:19 AM	6.2 189	**20** W	01:40 AM	7.4 226
	09:00 AM	8.2 250		06:18 AM	6.2 189
	04:17 PM	-0.1 -3		10:15 AM	6.8 207
				05:41 PM	1.5 46
6 W	12:58 AM	7.6 232	**21** Th	02:30 AM	7.6 232
	04:48 AM	6.4 195		07:33 AM	5.9 180
	10:05 AM	7.9 241		11:23 AM	6.6 201
	05:24 PM	-0.2 -6		06:41 PM	1.5 46
7 Th	01:53 AM	8.0 244	**22** F	03:05 AM	7.7 235
	06:14 AM	6.1 186		08:18 AM	5.4 165
	11:23 AM	7.6 232		12:39 PM	6.5 198
	06:27 PM	-0.2 -6		07:35 PM	1.5 46
8 F	02:35 AM	8.3 253	**23** Sa	03:30 AM	7.8 238
	07:21 AM	5.5 168		08:46 AM	4.9 149
	12:43 PM	7.6 232		01:52 PM	6.7 204
	07:22 PM	0.0 0		08:20 PM	1.5 46
9 Sa	03:11 AM	8.6 262	**24** Su	03:49 AM	7.9 241
	08:12 AM	4.7 143		09:12 AM	4.1 125
	01:56 PM	7.7 235		02:55 PM	6.9 210
	08:12 PM	0.3 9		09:01 PM	1.7 52
10 Su	04:42 AM	8.7 265	**25** M	04:08 AM	8.0 244
	09:56 AM	3.8 116		09:40 AM	3.3 101
	04:00 PM	7.8 238		03:51 PM	7.3 223
	09:56 PM	0.8 24		09:40 PM	2.0 61
11 M	05:11 AM	8.8 268	**26** Tu	04:30 AM	8.2 250
	10:36 AM	3.0 91		10:12 AM	2.3 70
	04:58 PM	7.8 238		04:44 PM	7.6 232
	10:39 PM	1.4 43		10:18 PM	2.4 73
12 Tu	05:37 AM	8.7 265	**27** W	04:55 AM	8.4 256
	11:16 AM	2.2 67		10:47 AM	1.3 40
	05:52 PM	7.8 238		05:37 PM	7.9 241
	11:20 PM	2.2 67		10:58 PM	3.0 91
13 W	06:03 AM	8.7 265	**28** Th	05:24 AM	8.5 259
	11:55 AM	1.6 49		11:26 AM	0.4 12
	06:45 PM	7.8 238		06:31 PM	8.0 244
				11:39 PM	3.7 113
14 Th	12:01 AM	3.0 91	**29** F	05:55 AM	8.6 262
	06:30 AM	8.6 262		12:08 PM	-0.3 -9
	12:35 PM	1.2 37		07:27 PM	8.1 247
	07:38 PM	7.6 232			
15 F	12:44 AM	3.9 119	**30** Sa	12:23 AM	4.4 134
	06:57 AM	8.4 256		06:29 AM	8.5 259
	01:16 PM	1.0 30		12:54 PM	-0.8 -24
	08:34 PM	7.5 229		08:27 PM	8.1 247
			31 Su	01:12 AM	5.1 155
				07:07 AM	8.4 256
				01:44 PM	-0.9 -27
				09:32 PM	8.0 244

Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.

Generated On: Mon Jun 17 22:32:17 GMT 2013

StationId:9447130
Source:NOAA/NOS/CO-OPS
Station Type:Harmonic
Time Zone:LST/LDT
Datum:mean lower low water (MLLW) which is the chart datum of soundings

NOAA Tide Predictions

SEATTLE, PUGET SOUND,Washington,2013

Times and Heights of High and Low Waters

January

	Time	Height		Time	Height
	h m	ft	cm	h m	ft	cm
1 Tu	12:40 AM	-0.2	-6	**16** W	01:27 AM	1.0	30
	07:46 AM	12.4	378		08:15 AM	12.8	390
	01:49 PM	5.6	171		02:43 PM	3.6	110
	06:51 PM	9.2	280		08:19 PM	9.1	277
2 W	01:19 AM	0.6	18	**17** Th	02:13 AM	2.6	79
	08:18 AM	12.4	378		08:53 AM	12.4	378
	02:35 PM	4.9	149		03:37 PM	3.0	91
	07:47 PM	8.8	268		09:33 PM	8.6	262
3 Th	01:59 AM	1.8	55	**18** F	03:02 AM	4.3	131
	08:53 AM	12.4	378		09:33 AM	12.0	366
	03:25 PM	4.0	122		04:34 PM	2.5	76
	08:53 PM	8.4	256		11:05 PM	8.3	253
4 F	02:43 AM	3.1	94	**19** Sa	03:59 AM	5.9	180
	09:31 AM	12.3	375		10:17 AM	11.5	351
	04:19 PM	3.0	91		05:32 PM	2.0	61
	10:12 PM	8.2	250				
5 Sa	03:34 AM	4.6	140	**20** Su	12:57 AM	8.7	265
	10:12 AM	12.1	369		05:17 AM	7.1	216
	05:16 PM	1.9	58		11:05 AM	10.9	332
	11:44 PM	8.4	256		06:29 PM	1.5	46
6 Su	04:38 AM	6.1	186	**21** M	02:28 AM	9.5	290
	10:57 AM	12.0	366		06:55 AM	7.7	235
	06:14 PM	0.7	21		11:56 AM	10.5	320
					07:20 PM	1.0	30
7 M	01:21 AM	9.2	280	**22** Tu	03:26 AM	10.2	311
	05:57 AM	7.2	219		08:17 AM	7.8	238
	11:48 AM	11.9	363		12:49 PM	10.3	314
	07:09 PM	-0.5	-15		08:05 PM	0.5	15
8 Tu	02:43 AM	10.2	311	**23** W	04:08 AM	10.8	329
	07:20 AM	7.7	235		09:14 AM	7.7	235
	12:42 PM	11.9	363		01:39 PM	10.2	311
	08:02 PM	-1.5	-46		08:45 PM	0.1	3
9 W	03:41 AM	11.2	341	**24** Th	04:40 AM	11.2	341
	08:32 AM	7.7	235		09:55 AM	7.4	226
	01:38 PM	11.9	363		02:25 PM	10.2	311
	08:53 PM	-2.4	-73		09:22 PM	-0.2	-6
10 Th	04:28 AM	11.9	363	**25** F	05:06 AM	11.4	347
	09:33 AM	7.4	226		10:28 AM	7.1	216
	02:33 PM	11.9	363		03:08 PM	10.3	314
	09:41 PM	-2.8	-85		09:57 PM	-0.5	-15
11 F	05:09 AM	12.5	381	**26** Sa	05:27 AM	11.6	354
	10:28 AM	6.9	210		10:57 AM	6.7	204
	03:28 PM	11.8	360		03:48 PM	10.3	314
	10:28 PM	-2.8	-85		10:32 PM	-0.6	-18
12 Sa	05:48 AM	12.8	390	**27** Su	05:47 AM	11.8	360
	11:19 AM	6.3	192		11:26 AM	6.2	189
	04:23 PM	11.6	354		04:29 PM	10.3	314
	11:14 PM	-2.4	-73		11:07 PM	-0.4	-12
13 Su	06:25 AM	13.0	396	**28** M	06:10 AM	12.0	366
	12:09 PM	5.6	171		11:58 AM	5.5	168
	05:18 PM	11.1	338		05:11 PM	10.3	314
	11:59 PM	-1.6	-49		11:42 PM	-0.1	-3
14 M	07:02 AM	13.1	399	**29** Tu	06:35 AM	12.2	372
	12:59 PM	4.9	149		12:34 PM	4.8	146
	06:15 PM	10.5	320		05:56 PM	10.1	308
15 Tu	12:43 AM	-0.4	-12	**30** W	12:19 AM	0.6	18
	07:38 AM	13.0	396		07:04 AM	12.4	378
	01:50 PM	4.2	128		01:13 PM	3.9	119
	07:15 PM	9.8	299		06:45 PM	9.9	302
				31 Th	12:57 AM	1.6	49
					07:34 AM	12.4	378
					01:56 PM	3.1	94
					07:40 PM	9.6	293

February

	Time	Height		Time	Height
	h m	ft	cm	h m	ft	cm
1 F	01:37 AM	2.8	85	**16** Sa	02:34 AM	5.2	158
	08:08 AM	12.4	378		08:40 AM	11.2	341
	02:44 PM	2.3	70		03:30 PM	1.9	58
	08:43 PM	9.2	280		10:20 PM	9.0	274
2 Sa	02:21 AM	4.2	128	**17** Su	03:29 AM	6.4	195
	08:45 AM	12.2	372		09:24 AM	10.6	323
	03:37 PM	1.6	49		04:25 PM	1.8	55
	09:57 PM	9.0	274		11:59 PM	9.0	274
3 Su	03:12 AM	5.6	171	**18** M	04:46 AM	7.3	223
	09:28 AM	11.9	363		10:15 AM	10.1	308
	04:36 PM	0.9	27		05:25 PM	1.8	55
	11:28 PM	9.0	274				
4 M	04:19 AM	6.9	210	**19** Tu	01:40 AM	9.4	287
	10:19 AM	11.6	354		06:34 AM	7.7	235
	05:39 PM	0.3	9		11:15 AM	9.6	293
					06:26 PM	1.6	49
5 Tu	01:13 AM	9.5	290	**20** W	02:44 AM	9.9	302
	05:48 AM	7.7	235		08:00 AM	7.5	229
	11:20 AM	11.3	344		12:19 PM	9.4	287
	06:43 PM	-0.4	-12		07:23 PM	1.3	40
6 W	02:34 AM	10.4	317	**21** Th	03:25 AM	10.4	317
	07:20 AM	7.8	238		08:52 AM	7.0	213
	12:27 PM	11.2	341		01:19 PM	9.5	290
	07:43 PM	-1.1	-34		08:11 PM	0.9	27
7 Th	03:28 AM	11.2	341	**22** F	03:55 AM	10.7	326
	08:33 AM	7.3	223		09:27 AM	6.5	198
	01:33 PM	11.2	341		02:11 PM	9.7	296
	08:37 PM	-1.5	-46		08:53 PM	0.6	18
8 F	04:09 AM	11.8	360	**23** Sa	04:17 AM	11.0	335
	09:30 AM	6.5	198		09:55 AM	5.9	180
	02:34 PM	11.3	344		02:58 PM	10.0	305
	09:27 PM	-1.7	-52		09:31 PM	0.4	12
9 Sa	04:44 AM	12.2	372	**24** Su	04:37 AM	11.2	341
	10:18 AM	5.7	174		10:22 AM	5.2	158
	03:31 PM	11.3	344		03:41 PM	10.2	311
	10:14 PM	-1.5	-46		10:08 PM	0.5	15
10 Su	05:17 AM	12.5	381	**25** M	04:58 AM	11.5	351
	11:03 AM	4.8	146		10:51 AM	4.4	134
	04:26 PM	11.2	341		04:23 PM	10.5	320
	10:58 PM	-0.9	-27		10:44 PM	0.7	21
11 M	05:49 AM	12.6	384	**26** Tu	05:21 AM	11.7	357
	11:46 AM	3.9	119		11:23 AM	3.5	107
	05:19 PM	11.0	335		05:07 PM	10.6	323
	11:41 PM	0.0	0		11:21 PM	1.2	37
12 Tu	06:20 AM	12.6	384	**27** W	05:48 AM	11.9	363
	12:29 PM	3.2	98		11:59 AM	2.6	79
	06:12 PM	10.6	323		05:53 PM	10.7	326
					11:59 PM	2.0	61
13 W	12:23 AM	1.1	34	**28** Th	06:17 AM	12.1	369
	06:53 AM	12.5	381		12:39 PM	1.7	52
	01:12 PM	2.6	79		06:43 PM	10.6	323
	07:06 PM	10.2	311				
14 Th	01:04 AM	2.5	76				
	07:26 AM	12.2	372				
	01:55 PM	2.2	67				
	08:02 PM	9.7	296				
15 F	01:47 AM	3.9	119				
	08:02 AM	11.8	360				
	02:41 PM	1.9	58				
	09:05 PM	9.3	283				

March

	Time	Height		Time	Height
	h m	ft	cm	h m	ft	cm
1 F	12:39 AM	3.0	91	**16** Sa	02:28 AM	5.0	152
	06:49 AM	12.0	366		08:12 AM	10.8	329
	01:22 PM	0.9	27		02:51 PM	0.8	24
	07:37 PM	10.4	317		09:39 PM	10.0	305
2 Sa	01:22 AM	4.1	125	**17** Su	03:15 AM	5.9	180
	07:25 AM	11.9	363		08:51 AM	10.3	314
	02:09 PM	0.4	12		03:35 PM	1.0	30
	08:38 PM	10.1	308		10:39 PM	9.7	296
3 Su	02:10 AM	5.3	162	**18** M	04:11 AM	6.6	201
	08:06 AM	11.6	354		09:35 AM	9.6	293
	03:02 PM	0.2	6		04:25 PM	1.3	40
	09:49 PM	9.8	299		11:51 PM	9.5	290
4 M	03:08 AM	6.4	195	**19** Tu	05:26 AM	7.1	216
	08:54 AM	11.1	338		10:29 AM	9.1	277
	04:02 PM	0.1	3		05:22 PM	1.7	52
	11:15 PM	9.7	296				
5 Tu	04:24 AM	7.1	216	**20** W	01:15 AM	9.5	290
	09:55 AM	10.6	323		07:09 AM	7.1	216
	05:09 PM	0.1	3		11:36 AM	8.6	262
					06:26 PM	1.9	58
6 W	12:51 AM	10.0	305	**21** Th	02:26 AM	9.7	296
	06:01 AM	7.3	223		08:29 AM	6.7	204
	11:09 AM	10.2	311		12:49 PM	8.5	259
	06:18 PM	0.0	0		07:29 PM	1.9	58
7 Th	02:04 AM	10.6	323	**22** F	03:12 AM	10.0	305
	07:29 AM	6.8	207		09:15 AM	6.0	183
	12:27 PM	10.1	308		01:57 PM	8.7	265
	07:23 PM	-0.1	-3		08:26 PM	1.8	55
8 F	02:54 AM	11.1	338	**23** Sa	03:44 AM	10.3	314
	08:32 AM	5.8	177		09:48 AM	5.3	162
	01:40 PM	10.2	311		02:55 PM	9.1	277
	08:21 PM	-0.2	-6		09:15 PM	1.7	52
9 Sa	03:33 AM	11.5	351	**24** Su	04:10 AM	10.6	323
	09:21 AM	4.8	146		10:15 AM	4.4	134
	02:44 PM	10.5	320		03:46 PM	9.5	290
	09:12 PM	0.0	0		09:58 PM	1.8	55
10 Su	05:06 AM	11.8	360	**25** M	04:34 AM	10.9	332
	11:03 AM	3.7	113		10:44 AM	3.3	101
	04:41 PM	10.7	326		04:33 PM	10.1	308
	10:58 PM	0.5	15		10:39 PM	2.0	61
11 M	05:35 AM	11.9	363	**26** Tu	05:00 AM	11.2	341
	11:42 AM	2.8	85		11:15 AM	2.2	67
	05:33 PM	10.8	329		05:18 PM	10.5	320
	11:42 PM	1.2	37		11:19 PM	2.4	73
12 Tu	06:04 AM	11.9	363	**27** W	05:27 AM	11.4	347
	12:19 PM	2.0	61		11:49 AM	1.1	34
	06:22 PM	10.8	329		06:04 PM	10.9	332
					11:59 PM	3.0	91
13 W	12:23 AM	2.0	61	**28** Th	05:57 AM	11.6	354
	06:33 AM	11.8	360		12:27 PM	0.1	3
	12:56 PM	1.3	40		06:52 PM	11.2	341
	07:10 PM	10.8	329				
14 Th	01:04 AM	3.0	91	**29** F	12:42 AM	3.7	113
	07:04 AM	11.6	354		06:30 AM	11.7	357
	01:33 PM	0.9	27		01:08 PM	-0.7	-21
	07:58 PM	10.6	323		07:43 PM	11.3	344
15 F	01:45 AM	4.0	122	**30** Sa	01:26 AM	4.5	137
	07:37 AM	11.3	344		07:07 AM	11.6	354
	02:11 PM	0.7	21		01:53 PM	-1.2	-37
	08:47 PM	10.3	314		08:37 PM	11.2	341
				31 Su	02:15 AM	5.3	162
					07:48 AM	11.3	344
					02:42 PM	-1.3	-40
					09:37 PM	11.0	335

Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.

Generated On: Mon Jun 17 22:33:53 GMT 2013

StationId:9449904
Source:NOAA/NOS/CO-OPS
Station Type:Subordinate
Time Zone:LST/LDT
Datum:mean lower low water (MLLW) which is the chart datum of soundings

NOAA Tide Predictions

Shaw Island, Ferry Terminal, Harney Channel,Washington,2013

Times and Heights of High and Low Waters

January

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Tu	12:38 AM	-0.2 -6	**16** W	01:22 AM	0.9 27
	08:01 AM	8.3 253		08:21 AM	8.6 262
	02:01 PM	5.3 162		02:56 PM	3.4 104
	06:28 PM	5.9 180		08:10 PM	5.6 171
2 W	01:15 AM	0.5 15	**17** Th	02:06 AM	2.3 70
	08:31 AM	8.3 253		08:53 AM	8.4 256
	02:52 PM	4.6 140		03:58 PM	2.8 85
	07:30 PM	5.5 168		09:36 PM	5.2 158
3 Th	01:54 AM	1.4 43	**18** F	02:53 AM	3.6 110
	09:01 AM	8.3 253		09:26 AM	8.1 247
	03:45 PM	3.7 113		04:59 PM	2.2 67
	08:44 PM	5.1 155		11:42 PM	5.2 158
4 F	02:35 AM	2.5 76	**19** Sa	03:47 AM	4.8 146
	09:33 AM	8.3 253		09:59 AM	7.9 241
	04:38 PM	2.7 82		05:56 PM	1.6 49
	10:15 PM	4.9 149			
5 Sa	03:22 AM	3.8 116	**20** Su	01:40 AM	5.8 177
	10:07 AM	8.3 253		04:55 AM	5.9 180
	05:31 PM	1.6 49		10:34 AM	7.6 232
				06:47 PM	1.2 37
6 Su	12:18 AM	5.1 155	**21** M	02:52 AM	6.5 198
	04:23 AM	4.9 149		06:18 AM	6.6 201
	10:44 AM	8.3 253		11:14 AM	7.4 226
	06:23 PM	0.5 15		07:33 PM	0.7 21
7 M	02:16 AM	5.9 180	**22** Tu	03:42 AM	7.1 216
	05:38 AM	5.9 180		07:41 AM	6.9 210
	11:25 AM	8.3 253		11:59 AM	7.2 219
	07:14 PM	-0.6 -18		08:14 PM	0.4 12
8 Tu	03:20 AM	6.8 207	**23** W	04:20 AM	7.5 229
	06:55 AM	6.6 201		08:47 AM	6.9 210
	12:12 PM	8.3 253		12:49 PM	7.2 219
	08:04 PM	-1.5 -46		08:51 PM	0.0 0
9 W	04:06 AM	7.5 229	**24** Th	04:52 AM	7.7 235
	08:05 AM	6.8 207		09:34 AM	6.7 204
	01:06 PM	8.3 253		01:39 PM	7.1 216
	08:52 PM	-2.1 -64		09:26 PM	-0.2 -6
10 Th	04:47 AM	8.1 247	**25** F	05:19 AM	7.8 238
	09:07 AM	6.8 207		10:10 AM	6.5 198
	02:03 PM	8.2 250		02:27 PM	7.1 216
	09:39 PM	-2.4 -73		09:59 PM	-0.4 -12
11 F	05:25 AM	8.4 256	**26** Sa	05:42 AM	7.9 241
	10:05 AM	6.5 198		10:42 AM	6.2 189
	03:01 PM	8.1 247		03:14 PM	7.1 216
	10:25 PM	-2.4 -73		10:33 PM	-0.4 -12
12 Sa	06:02 AM	8.6 262	**27** Su	06:02 AM	8.0 244
	11:01 AM	6.0 183		11:16 AM	5.7 174
	03:59 PM	7.8 238		04:01 PM	6.9 210
	11:10 PM	-2.0 -61		11:06 PM	-0.3 -9
13 Su	06:38 AM	8.7 265	**28** M	06:23 AM	8.1 247
	11:57 AM	5.4 165		11:52 AM	5.2 158
	04:58 PM	7.3 223		04:49 PM	6.8 207
	11:54 PM	-1.3 -40		11:41 PM	0.0 0
14 M	07:13 AM	8.7 265	**29** Tu	06:46 AM	8.2 250
	12:55 PM	4.8 146		12:32 PM	4.6 140
	05:58 PM	6.8 207		05:41 PM	6.5 198
15 Tu	12:38 AM	-0.3 -9	**30** W	12:16 AM	0.6 18
	07:48 AM	8.7 265		07:13 AM	8.2 250
	01:55 PM	4.1 125		01:15 PM	3.8 116
	07:01 PM	6.2 189		06:36 PM	6.2 189
			31 Th	12:53 AM	1.4 43
				07:41 AM	8.3 253
				02:01 PM	3.0 91
				07:38 PM	5.9 180

February

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	01:31 AM	2.4 73	**16** Sa	02:29 AM	4.5 137
	08:12 AM	8.2 250		08:26 AM	7.7 235
	02:52 PM	2.2 67		03:44 PM	1.7 52
	08:49 PM	5.6 171		11:06 PM	5.8 177
2 Sa	02:13 AM	3.6 110	**17** Su	03:24 AM	5.5 168
	08:44 AM	8.2 250		09:00 AM	7.4 226
	03:47 PM	1.5 46		04:41 PM	1.5 46
	10:18 PM	5.5 168			
3 Su	03:01 AM	4.7 143	**18** M	01:02 AM	6.1 186
	09:20 AM	8.1 247		04:37 AM	6.2 189
	04:46 PM	0.7 21		09:38 AM	7.1 216
				05:41 PM	1.4 43
4 M	12:23 AM	5.7 174	**19** Tu	02:16 AM	6.6 201
	04:05 AM	5.7 174		06:08 AM	6.5 198
	10:01 AM	8.0 244		10:26 AM	6.8 207
	05:47 PM	0.0 0		06:40 PM	1.2 37
5 Tu	02:06 AM	6.4 195	**20** W	03:04 AM	6.9 210
	05:27 AM	6.4 195		07:36 AM	6.5 198
	10:51 AM	7.9 241		11:24 AM	6.7 204
	06:47 PM	-0.6 -18		07:32 PM	1.0 30
6 W	03:03 AM	7.0 213	**21** Th	03:40 AM	7.2 219
	06:52 AM	6.7 204		08:35 AM	6.3 192
	11:52 AM	7.8 238		12:28 PM	6.6 201
	07:44 PM	-1.1 -34		08:18 PM	0.7 21
7 Th	03:45 AM	7.6 232	**22** F	04:08 AM	7.3 223
	08:05 AM	6.5 198		09:13 AM	6.0 183
	01:00 PM	7.7 235		01:29 PM	6.6 201
	08:37 PM	-1.3 -40		08:57 PM	0.5 15
8 F	04:22 AM	7.9 241	**23** Sa	04:30 AM	7.4 226
	09:06 AM	6.0 183		09:42 AM	5.5 168
	02:08 PM	7.6 232		02:25 PM	6.7 204
	09:25 PM	-1.4 -43		09:33 PM	0.5 15
9 Sa	04:56 AM	8.2 250	**24** Su	04:48 AM	7.5 229
	09:59 AM	5.4 165		10:10 AM	4.9 149
	03:11 PM	7.6 232		03:17 PM	6.8 207
	10:10 PM	-1.1 -34		10:08 PM	0.5 15
10 Su	05:27 AM	8.3 253	**25** M	05:06 AM	7.6 232
	10:48 AM	4.7 143		10:41 AM	4.2 128
	04:10 PM	7.4 226		04:07 PM	6.9 210
	10:53 PM	-0.5 -15		10:42 PM	0.8 24
11 M	05:58 AM	8.3 253	**26** Tu	05:27 AM	7.7 235
	11:36 AM	3.9 119		11:16 AM	3.4 104
	05:08 PM	7.1 216		04:58 PM	6.9 210
	11:35 PM	0.3 9		11:18 PM	1.3 40
12 Tu	06:28 AM	8.3 253	**27** W	05:52 AM	7.9 241
	12:24 PM	3.3 101		11:54 AM	2.6 79
	06:05 PM	6.8 207		05:51 PM	6.8 207
				11:55 PM	2.0 61
13 W	12:17 AM	1.2 37	**28** Th	06:20 AM	7.9 241
	06:57 AM	8.3 253		12:36 PM	1.8 55
	01:12 PM	2.7 82		06:47 PM	6.7 204
	07:04 PM	6.4 195			
14 Th	12:59 AM	2.3 70			
	07:26 AM	8.1 247			
	02:00 PM	2.2 67			
	08:07 PM	6.1 186			
15 F	01:42 AM	3.5 107			
	07:55 AM	7.9 241			
	02:51 PM	1.9 58			
	09:22 PM	5.8 177			

March

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	12:34 AM	2.8 85	**16** Sa	02:25 AM	4.6 140
	06:50 AM	8.0 244		07:58 AM	7.3 223
	01:22 PM	1.1 34		02:55 PM	0.9 27
	07:48 PM	6.5 198		10:06 PM	6.6 201
2 Sa	01:16 AM	3.8 116	**17** Su	03:16 AM	5.3 162
	07:23 AM	7.9 241		08:31 AM	7.0 213
	02:11 PM	0.6 18		03:43 PM	1.0 30
	08:58 PM	6.4 195		11:22 PM	6.5 198
3 Su	02:03 AM	4.7 143	**18** M	04:17 AM	5.8 177
	07:59 AM	7.8 238		09:07 AM	6.7 204
	03:07 PM	0.2 6		04:35 PM	1.2 37
	10:22 PM	6.3 192			
4 M	03:00 AM	5.5 168	**19** Tu	12:55 AM	6.5 198
	08:40 AM	7.6 232		05:38 AM	6.1 186
	04:08 PM	0.0 0		09:51 AM	6.4 195
				05:34 PM	1.4 43
5 Tu	12:05 AM	6.4 195	**20** W	02:11 AM	6.6 201
	04:15 AM	6.1 186		07:14 AM	6.1 186
	09:31 AM	7.4 226		10:46 AM	6.1 186
	05:13 PM	-0.1 -3		06:37 PM	1.5 46
6 W	01:29 AM	6.8 207	**21** Th	03:01 AM	6.8 207
	05:44 AM	6.3 192		08:29 AM	5.8 177
	10:36 AM	7.1 216		11:54 AM	5.9 180
	06:20 PM	-0.2 -6		07:37 PM	1.5 46
7 Th	02:24 AM	7.2 219	**22** F	03:36 AM	6.9 210
	07:10 AM	6.0 183		09:14 AM	5.4 165
	11:54 AM	6.9 210		01:10 PM	5.9 180
	07:23 PM	-0.2 -6		08:31 PM	1.5 46
8 F	03:06 AM	7.5 229	**23** Sa	04:01 AM	7.0 213
	08:17 AM	5.4 165		09:42 AM	4.8 146
	01:14 PM	6.8 207		02:23 PM	6.0 183
	08:18 PM	0.0 0		09:16 PM	1.5 46
9 Sa	03:42 AM	7.7 235	**24** Su	04:20 AM	7.1 216
	09:08 AM	4.6 140		10:08 AM	4.1 125
	02:27 PM	6.9 210		03:26 PM	6.2 189
	09:08 PM	0.3 9		09:57 PM	1.7 52
10 Su	05:13 PM	7.8 238	**25** M	04:39 AM	7.2 219
	10:52 AM	3.8 116		10:36 AM	3.2 98
	04:31 PM	7.0 213		04:22 PM	6.5 198
	10:52 PM	0.8 24		10:36 PM	2.0 61
11 M	05:42 AM	7.9 241	**26** Tu	05:01 AM	7.4 226
	11:32 AM	2.9 88		11:08 AM	2.3 70
	05:29 PM	7.0 213		05:15 PM	6.8 207
	11:35 PM	1.4 43		11:14 PM	2.4 73
12 Tu	06:08 AM	7.9 241	**27** W	05:26 AM	7.5 229
	12:12 PM	2.2 67		11:43 AM	1.3 40
	06:23 PM	7.0 213		06:08 PM	7.1 216
				11:54 PM	3.0 91
13 W	12:16 AM	2.2 67	**28** Th	05:55 AM	7.6 232
	06:34 AM	7.8 238		12:22 PM	0.4 12
	12:51 PM	1.6 49		07:02 PM	7.2 219
	07:16 PM	7.0 213			
14 Th	12:57 AM	3.0 91	**29** F	12:35 AM	3.6 110
	07:01 AM	7.7 235		06:26 AM	7.7 235
	01:31 PM	1.2 37		01:04 PM	-0.3 -9
	08:09 PM	6.9 210		07:58 PM	7.3 223
15 F	01:40 AM	3.8 116	**30** Sa	01:19 AM	4.3 131
	07:28 AM	7.5 229		07:00 AM	7.7 235
	02:12 PM	1.0 30		01:50 PM	-0.8 -24
	09:05 PM	6.7 204		08:58 PM	7.3 223
			31 Su	02:08 AM	5.0 152
				07:38 AM	7.5 229
				02:40 PM	-0.9 -27
				10:03 PM	7.2 219

Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.
Referenced to Station: PORT TOWNSEND (9444900) Height offset in feet (low:*0.99 high: * 0.90) Time offset in mins (low:56 high: 31)

Generated On: Mon Jun 17 22:38:24 GMT 2013

StationId:9448772
Source:NOAA/NOS/CO-OPS
Station Type:Subordinate
Time Zone:LST/LDT
Datum:mean lower low water (MLLW) which is the chart datum of soundings

NOAA Tide Predictions

Ship Harbor, Fidalgo Island,Washington,2013

Times and Heights of High and Low Waters

January

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Tu	12:07 AM	-0.2 -6	**16** W	12:51 AM	0.9 27
	07:46 AM	8.7 265		08:06 AM	8.9 271
	01:30 PM	5.3 162		02:25 PM	3.5 107
	06:13 PM	6.2 189		07:55 PM	5.9 180
2 W	12:44 AM	0.5 15	**17** Th	01:35 AM	2.3 70
	08:16 AM	8.7 265		08:38 AM	8.8 268
	02:21 PM	4.6 140		03:27 PM	2.8 85
	07:15 PM	5.7 174		09:21 PM	5.4 165
3 Th	01:23 AM	1.5 46	**18** F	02:22 AM	3.6 110
	08:46 AM	8.7 265		09:11 AM	8.5 259
	03:14 PM	3.7 113		04:28 PM	2.2 67
	08:29 PM	5.3 162		11:27 PM	5.5 168
4 F	02:04 AM	2.6 79	**19** Sa	03:16 AM	4.9 149
	09:18 AM	8.7 265		09:44 AM	8.2 250
	04:07 PM	2.7 82		05:25 PM	1.6 49
	10:00 PM	5.1 155			
5 Sa	02:51 AM	3.8 116	**20** Su	01:25 AM	6.1 186
	09:52 AM	8.6 262		04:24 AM	5.9 180
	05:00 PM	1.6 49		10:19 AM	8.0 244
				06:16 PM	1.2 37
6 Su	12:03 AM	5.4 165	**21** M	02:37 AM	6.8 207
	03:52 AM	5.0 152		05:47 AM	6.6 201
	10:29 AM	8.6 262		10:59 AM	7.7 235
	05:52 PM	0.5 15		07:02 PM	0.7 21
7 M	02:01 AM	6.2 189	**22** Tu	03:27 AM	7.4 226
	05:07 AM	6.0 183		07:10 AM	6.9 210
	11:10 AM	8.6 262		11:44 AM	7.6 232
	06:43 PM	-0.6 -18		07:43 PM	0.4 12
8 Tu	03:05 AM	7.1 216	**23** W	04:05 AM	7.8 238
	06:24 AM	6.6 201		08:16 AM	7.0 213
	11:57 AM	8.6 262		12:34 PM	7.5 229
	07:33 PM	-1.5 -46		08:20 PM	0.0 0
9 W	03:51 AM	7.9 241	**24** Th	04:37 AM	8.1 247
	07:34 AM	6.9 210		09:03 AM	6.8 207
	12:51 PM	8.6 262		01:24 PM	7.4 226
	08:21 PM	-2.1 -64		08:55 PM	-0.2 -6
10 Th	04:32 AM	8.4 256	**25** F	05:04 AM	8.2 250
	08:36 AM	6.8 207		09:39 AM	6.6 201
	01:48 PM	8.6 262		02:12 PM	7.4 226
	09:08 PM	-2.5 -76		09:28 PM	-0.4 -12
11 F	05:10 AM	8.8 268	**26** Sa	05:27 AM	8.3 253
	09:34 AM	6.5 198		10:11 AM	6.2 189
	02:46 PM	8.4 256		02:59 PM	7.4 226
	09:54 PM	-2.4 -73		10:02 PM	-0.4 -12
12 Sa	05:47 AM	9.0 274	**27** Su	05:47 AM	8.3 253
	10:30 AM	6.1 186		10:45 AM	5.8 177
	03:44 PM	8.1 247		03:46 PM	7.3 223
	10:39 PM	-2.0 -61		10:35 PM	-0.3 -9
13 Su	06:23 AM	9.1 277	**28** M	06:08 AM	8.4 256
	11:26 AM	5.5 168		11:21 AM	5.2 158
	04:43 PM	7.7 235		04:34 PM	7.1 216
	11:23 PM	-1.3 -40		11:10 PM	0.0 0
14 M	06:58 AM	9.1 277	**29** Tu	06:31 AM	8.5 259
	12:24 PM	4.8 146		12:01 PM	4.6 140
	05:43 PM	7.1 216		05:26 PM	6.8 207
				11:45 PM	0.6 18
15 Tu	12:07 AM	-0.3 -9	**30** W	06:58 AM	8.6 262
	07:33 AM	9.1 277		12:44 PM	3.9 119
	01:24 PM	4.1 125		06:21 PM	6.5 198
	06:46 PM	6.5 198			
			31 Th	12:22 AM	1.4 43
				07:26 AM	8.6 262
				01:30 PM	3.1 94
				07:23 PM	6.1 186

February

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	01:00 AM	2.5 76	**16** Sa	01:58 AM	4.6 140
	07:57 AM	8.6 262		08:11 AM	8.0 244
	02:21 PM	2.3 70		03:13 PM	1.7 52
	08:34 PM	5.8 177		10:51 PM	6.1 186
2 Sa	01:42 AM	3.6 110	**17** Su	02:53 AM	5.5 168
	08:29 AM	8.6 262		08:45 AM	7.7 235
	03:16 PM	1.5 46		04:10 PM	1.6 49
	10:03 PM	5.7 174			
3 Su	02:30 AM	4.8 146	**18** M	12:47 AM	6.4 195
	09:05 AM	8.5 259		04:06 AM	6.2 189
	04:15 PM	0.7 21		09:23 AM	7.4 226
				05:10 PM	1.4 43
4 M	12:08 AM	6.0 183	**19** Tu	02:01 AM	6.9 210
	03:34 AM	5.8 177		05:37 AM	6.6 201
	09:46 AM	8.4 256		10:11 AM	7.1 216
	05:16 PM	0.0 0		06:09 PM	1.2 37
5 Tu	01:51 AM	6.7 204	**20** W	02:49 AM	7.3 223
	04:56 AM	6.5 198		07:05 AM	6.6 201
	10:36 AM	8.2 250		11:09 AM	7.0 213
	06:16 PM	-0.6 -18		07:01 PM	1.0 30
6 W	02:48 AM	7.4 226	**21** Th	03:25 AM	7.5 229
	06:21 AM	6.8 207		08:04 AM	6.4 195
	11:37 AM	8.1 247		12:13 PM	6.9 210
	07:13 PM	-1.1 -34		07:47 PM	0.7 21
7 Th	03:30 AM	7.9 241	**22** F	03:53 AM	7.7 235
	07:34 AM	6.6 201		08:42 AM	6.0 183
	12:45 PM	8.0 244		01:14 PM	6.9 210
	08:06 PM	-1.3 -40		08:26 PM	0.5 15
8 F	04:07 AM	8.3 253	**23** Sa	04:15 AM	7.8 238
	08:35 AM	6.1 186		09:11 AM	5.6 171
	01:53 PM	8.0 244		02:10 PM	7.0 213
	08:54 PM	-1.4 -43		09:02 PM	0.5 15
9 Sa	04:41 AM	8.5 259	**24** Su	04:33 AM	7.8 238
	09:28 AM	5.5 168		09:39 AM	5.0 152
	02:56 PM	7.9 241		03:02 PM	7.1 216
	09:39 PM	-1.1 -34		09:37 PM	0.6 18
10 Su	05:12 AM	8.7 265	**25** M	04:51 AM	8.0 244
	10:17 AM	4.7 143		10:10 AM	4.3 131
	03:55 PM	7.7 235		03:52 PM	7.2 219
	10:22 PM	-0.5 -15		10:11 PM	0.8 24
11 M	05:43 AM	8.7 265	**26** Tu	05:12 AM	8.1 247
	11:05 AM	4.0 122		10:45 AM	3.5 107
	04:53 PM	7.4 226		04:43 PM	7.2 219
	11:04 PM	0.3 9		10:47 PM	1.3 40
12 Tu	06:13 AM	8.7 265	**27** W	05:37 AM	8.2 250
	11:53 AM	3.3 101		11:23 AM	2.6 79
	05:50 PM	7.1 216		05:36 PM	7.1 216
	11:46 PM	1.3 40		11:24 PM	2.0 61
13 W	06:42 AM	8.6 262	**28** Th	06:05 AM	8.3 253
	12:41 PM	2.7 82		12:05 PM	1.8 55
	06:49 PM	6.7 204		06:32 PM	7.0 213
14 Th	12:28 AM	2.4 73			
	07:11 AM	8.5 259			
	01:29 PM	2.3 70			
	07:52 PM	6.4 195			
15 F	01:11 AM	3.5 107			
	07:40 AM	8.3 253			
	02:20 PM	1.9 58			
	09:07 PM	6.1 186			

March

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	12:03 AM	2.9 88	**16** Sa	01:54 AM	4.7 143
	06:35 AM	8.3 253		07:43 AM	7.6 232
	12:51 PM	1.1 34		02:24 PM	0.9 27
	07:33 PM	6.8 207		09:51 PM	6.9 210
2 Sa	12:45 AM	3.8 116	**17** Su	02:45 AM	5.4 165
	07:08 AM	8.3 253		08:16 AM	7.4 226
	01:40 PM	0.6 18		03:12 PM	1.0 30
	08:43 PM	6.6 201		11:07 PM	6.8 207
3 Su	01:32 AM	4.7 143	**18** M	03:46 AM	5.9 180
	07:44 AM	8.2 250		08:52 AM	7.0 213
	02:36 PM	0.2 6		04:04 PM	1.2 37
	10:07 PM	6.6 201			
4 M	02:29 AM	5.6 171	**19** Tu	12:40 AM	6.8 207
	08:25 AM	8.0 244		05:07 AM	6.2 189
	03:37 PM	0.0 0		09:36 AM	6.7 204
	11:50 PM	6.7 204		05:03 PM	1.4 43
5 Tu	03:44 AM	6.2 189	**20** W	01:56 AM	6.9 210
	09:16 AM	7.7 235		06:43 AM	6.2 189
	04:42 PM	-0.1 -3		10:31 AM	6.4 195
				06:06 PM	1.5 46
6 W	01:14 AM	7.1 216	**21** Th	02:46 AM	7.1 216
	05:13 AM	6.4 195		07:58 AM	5.9 180
	10:21 AM	7.4 226		11:39 AM	6.2 189
	05:49 PM	-0.2 -6		07:06 PM	1.5 46
7 Th	02:09 AM	7.5 229	**22** F	03:21 AM	7.2 219
	06:39 AM	6.1 186		08:43 AM	5.4 165
	11:39 AM	7.2 219		12:55 PM	6.1 186
	06:52 PM	-0.2 -6		08:00 PM	1.5 46
8 F	02:51 AM	7.8 238	**23** Sa	03:46 AM	7.3 223
	07:46 AM	5.5 168		09:11 AM	4.9 149
	12:59 PM	7.1 216		02:08 PM	6.3 192
	07:47 PM	0.0 0		08:45 PM	1.5 46
9 Sa	03:27 AM	8.0 244	**24** Su	04:05 AM	7.4 226
	08:37 AM	4.7 143		09:37 AM	4.1 125
	02:12 PM	7.2 219		03:11 PM	6.5 198
	08:37 PM	0.3 9		09:26 PM	1.7 52
10 Su	04:58 AM	8.2 250	**25** M	04:24 AM	7.5 229
	10:21 AM	3.8 116		10:05 AM	3.3 101
	04:16 PM	7.3 223		04:07 PM	6.8 207
	10:21 PM	0.8 24		10:05 PM	2.0 61
11 M	05:27 AM	8.2 250	**26** Tu	04:46 AM	7.7 235
	11:01 AM	3.0 91		10:37 AM	2.3 70
	05:14 PM	7.4 226		05:00 PM	7.1 216
	11:04 PM	1.4 43		10:43 PM	2.4 73
12 Tu	05:53 AM	8.2 250	**27** W	05:11 AM	7.9 241
	11:41 AM	2.2 67		11:12 AM	1.3 40
	06:08 PM	7.4 226		05:53 PM	7.4 226
	11:45 PM	2.2 67		11:23 PM	3.0 91
13 W	06:19 AM	8.2 250	**28** Th	05:40 AM	8.0 244
	12:20 PM	1.6 49		11:51 AM	0.4 12
	07:01 PM	7.3 223		06:47 PM	7.6 232
14 Th	12:26 AM	3.0 91	**29** F	12:04 AM	3.7 113
	06:46 AM	8.0 244		06:11 AM	8.0 244
	01:00 PM	1.2 37		12:33 PM	-0.3 -9
	07:54 PM	7.2 219		07:43 PM	7.6 232
15 F	01:09 AM	3.9 119	**30** Sa	12:48 AM	4.4 134
	07:13 AM	7.9 241		06:45 AM	8.0 244
	01:41 PM	1.0 30		01:19 PM	-0.8 -24
	08:50 PM	7.0 213		08:43 PM	7.6 232
			31 Su	01:37 AM	5.1 155
				07:23 AM	7.9 241
				02:09 PM	-0.9 -27
				09:48 PM	7.5 229

Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.
Referenced to Station: PORT TOWNSEND (9444900) Height offset in feet (low:*1.00 high: * 0.94) Time offset in mins (low:25 high: 16)

Generated On: Mon Jun 17 22:37:28 GMT 2013

StationId:9446375
Source:NOAA/NOS/CO-OPS
Station Type:Subordinate
Time Zone:LST/LDT
Datum:mean lower low water (MLLW) which is the chart datum of soundings

NOAA Tide Predictions

Tahlequah, Neil Pt., Dalco Passage, Vashon I.,Washington,2013

Times and Heights of High and Low Waters

January

	Time	Height		Time	Height
	h m	ft	cm	h m	ft	cm
1 Tu	12:45 AM	-0.2	-6	**16** W	01:32 AM	1.0	30
	07:50 AM	13.0	396		08:19 AM	13.4	408
	01:54 PM	5.7	174		02:48 PM	3.6	110
	06:55 PM	9.7	296		08:23 PM	9.6	293
2 W	01:24 AM	0.7	21	**17** Th	02:18 AM	2.7	82
	08:22 AM	13.0	396		08:57 AM	13.1	399
	02:40 PM	4.9	149		03:42 PM	3.0	91
	07:51 PM	9.3	283		09:37 PM	9.0	274
3 Th	02:04 AM	1.8	55	**18** F	03:07 AM	4.4	134
	08:57 AM	13.0	396		09:37 AM	12.6	384
	03:30 PM	4.1	125		04:39 PM	2.5	76
	08:57 PM	8.8	268		11:09 PM	8.8	268
4 F	02:48 AM	3.2	98	**19** Sa	04:04 AM	5.9	180
	09:35 AM	12.9	393		10:21 AM	12.0	366
	04:24 PM	3.1	94		05:37 PM	2.0	61
	10:16 PM	8.6	262				
5 Sa	03:39 AM	4.7	143	**20** Su	01:01 AM	9.1	277
	10:16 AM	12.8	390		05:22 AM	7.2	219
	05:21 PM	1.9	58		11:09 AM	11.5	351
	11:48 PM	8.9	271		06:34 PM	1.5	46
6 Su	04:43 AM	6.1	186	**21** M	02:32 AM	9.9	302
	11:01 AM	12.6	384		07:00 AM	7.8	238
	06:19 PM	0.7	21		12:00 PM	11.1	338
					07:25 PM	1.0	30
7 M	01:25 AM	9.6	293	**22** Tu	03:30 AM	10.8	329
	06:02 AM	7.2	219		08:22 AM	7.9	241
	11:52 AM	12.5	381		12:53 PM	10.8	329
	07:14 PM	-0.5	-15		08:10 PM	0.6	18
8 Tu	02:47 AM	10.7	326	**23** W	04:12 AM	11.4	347
	07:25 AM	7.8	238		09:19 AM	7.7	235
	12:46 PM	12.5	381		01:43 PM	10.7	326
	08:07 PM	-1.6	-49		08:50 PM	0.1	3
9 W	03:45 AM	11.7	357	**24** Th	04:44 AM	11.8	360
	08:37 AM	7.8	238		10:00 AM	7.5	229
	01:42 PM	12.5	381		02:29 PM	10.7	326
	08:58 PM	-2.4	-73		09:27 PM	-0.2	-6
10 Th	04:32 AM	12.5	381	**25** F	05:10 AM	12.0	366
	09:38 AM	7.5	229		10:33 AM	7.2	219
	02:37 PM	12.5	381		03:12 PM	10.8	329
	09:46 PM	-2.8	-85		10:02 PM	-0.5	-15
11 F	05:13 AM	13.1	399	**26** Sa	05:31 AM	12.2	372
	10:33 AM	7.0	213		11:02 AM	6.7	204
	03:32 PM	12.4	378		03:52 PM	10.9	332
	10:33 PM	-2.9	-88		10:37 PM	-0.6	-18
12 Sa	05:52 AM	13.5	411	**27** Su	05:51 AM	12.4	378
	11:24 AM	6.3	192		11:31 AM	6.2	189
	04:27 PM	12.1	369		04:33 PM	10.9	332
	11:19 PM	-2.5	-76		11:12 PM	-0.4	-12
13 Su	06:29 AM	13.7	418	**28** M	06:14 AM	12.7	387
	12:14 PM	5.6	171		12:03 PM	5.6	171
	05:22 PM	11.7	357		05:15 PM	10.8	329
					11:47 PM	-0.1	-3
14 M	12:04 AM	-1.6	-49	**29** Tu	06:39 AM	12.9	393
	07:06 AM	13.7	418		12:39 PM	4.8	146
	01:04 PM	4.9	149		06:00 PM	10.6	323
	06:19 PM	11.0	335				
15 Tu	12:48 AM	-0.4	-12	**30** W	12:24 AM	0.6	18
	07:42 AM	13.7	418		07:08 AM	13.0	396
	01:55 PM	4.2	128		01:18 PM	4.0	122
	07:19 PM	10.3	314		06:49 PM	10.4	317
				31 Th	01:02 AM	1.6	49
					07:38 AM	13.1	399
					02:01 PM	3.2	98
					07:44 PM	10.1	308

February

	Time	Height		Time	Height
	h m	ft	cm	h m	ft	cm
1 F	01:42 AM	2.8	85	**16** Sa	02:39 AM	5.3	162
	08:12 AM	13.0	396		08:44 AM	11.8	360
	02:49 PM	2.4	73		03:35 PM	1.9	58
	08:47 PM	9.7	296		10:24 PM	9.4	287
2 Sa	02:26 AM	4.2	128	**17** Su	03:34 AM	6.5	198
	08:49 AM	12.8	390		09:28 AM	11.2	341
	03:42 PM	1.6	49		04:30 PM	1.9	58
	10:01 PM	9.4	287				
3 Su	03:17 AM	5.7	174	**18** M	12:03 AM	9.4	287
	09:32 AM	12.5	381		04:51 AM	7.4	226
	04:41 PM	1.0	30		10:19 AM	10.6	323
	11:32 PM	9.5	290		05:30 PM	1.8	55
4 M	04:24 AM	7.0	213	**19** Tu	01:44 AM	9.9	302
	10:23 AM	12.1	369		06:39 AM	7.8	238
	05:44 PM	0.3	9		11:19 AM	10.1	308
					06:31 PM	1.6	49
5 Tu	01:17 AM	10.0	305	**20** W	02:48 AM	10.4	317
	05:53 AM	7.8	238		08:05 AM	7.5	229
	11:24 AM	11.9	363		12:23 PM	9.9	302
	06:48 PM	-0.4	-12		07:28 PM	1.3	40
6 W	02:38 AM	10.9	332	**21** Th	03:29 AM	10.9	332
	07:25 AM	7.9	241		08:57 AM	7.1	216
	12:31 PM	11.7	357		01:23 PM	10.0	305
	07:48 PM	-1.1	-34		08:16 PM	0.9	27
7 Th	03:32 AM	11.7	357	**22** F	03:59 AM	11.2	341
	08:38 AM	7.4	226		09:32 AM	6.6	201
	01:37 PM	11.8	360		02:15 PM	10.2	311
	08:42 PM	-1.5	-46		08:58 PM	0.6	18
8 F	04:13 AM	12.3	375	**23** Sa	04:21 AM	11.5	351
	09:35 AM	6.6	201		10:00 AM	6.0	183
	02:38 PM	11.9	363		03:02 PM	10.5	320
	09:32 PM	-1.7	-52		09:36 PM	0.5	15
9 Sa	04:48 AM	12.8	390	**24** Su	04:41 AM	11.8	360
	10:23 AM	5.7	174		10:27 AM	5.3	162
	03:35 PM	11.9	363		03:45 PM	10.7	326
	10:19 PM	-1.5	-46		10:13 PM	0.5	15
10 Su	05:21 AM	13.1	399	**25** M	05:02 AM	12.0	366
	11:08 AM	4.8	146		10:56 AM	4.5	137
	04:30 PM	11.8	360		04:27 PM	11.0	335
	11:03 PM	-0.9	-27		10:49 PM	0.7	21
11 M	05:53 AM	13.2	402	**26** Tu	05:25 AM	12.3	375
	11:51 AM	4.0	122		11:28 AM	3.5	107
	05:23 PM	11.5	351		05:11 PM	11.1	338
	11:46 PM	0.0	0		11:26 PM	1.3	40
12 Tu	06:24 AM	13.2	402	**27** W	05:52 AM	12.5	381
	12:34 PM	3.2	98		12:04 PM	2.6	79
	06:16 PM	11.1	338		05:57 PM	11.2	341
13 W	12:28 AM	1.2	37	**28** Th	12:04 AM	2.0	61
	06:57 AM	13.1	399		06:21 AM	12.7	387
	01:17 PM	2.6	79		12:44 PM	1.7	52
	07:10 PM	10.7	326		06:47 PM	11.1	338
14 Th	01:09 AM	2.5	76				
	07:30 AM	12.8	390				
	02:00 PM	2.2	67				
	08:06 PM	10.2	311				
15 F	01:52 AM	3.9	119				
	08:06 AM	12.4	378				
	02:46 PM	2.0	61				
	09:09 PM	9.7	296				

March

	Time	Height		Time	Height
	h m	ft	cm	h m	ft	cm
1 F	12:44 AM	3.0	91	**16** Sa	02:33 AM	5.1	155
	06:53 AM	12.7	387		08:16 AM	11.4	347
	01:27 PM	1.0	30		02:56 PM	0.8	24
	07:41 PM	10.9	332		09:43 PM	10.5	320
2 Sa	01:27 AM	4.1	125	**17** Su	03:20 AM	6.0	183
	07:29 AM	12.5	381		08:55 AM	10.8	329
	02:14 PM	0.4	12		03:40 PM	1.0	30
	08:42 PM	10.6	323		10:43 PM	10.2	311
3 Su	02:15 AM	5.3	162	**18** M	04:16 AM	6.7	204
	08:10 AM	12.1	369		09:39 AM	10.1	308
	03:07 PM	0.2	6		04:30 PM	1.3	40
	09:53 PM	10.3	314		11:55 PM	10.0	305
4 M	03:13 AM	6.4	195	**19** Tu	05:31 AM	7.2	219
	08:58 AM	11.7	357		10:33 AM	9.5	290
	04:07 PM	0.1	3		05:27 PM	1.7	52
	11:19 PM	10.2	311				
5 Tu	04:29 AM	7.2	219	**20** W	01:19 AM	10.0	305
	09:59 AM	11.1	338		07:14 AM	7.2	219
	05:14 PM	0.1	3		11:40 AM	9.1	277
					06:31 PM	1.9	58
6 W	12:55 AM	10.5	320	**21** Th	02:30 AM	10.2	311
	06:06 AM	7.4	226		08:34 AM	6.7	204
	11:13 AM	10.7	326		12:53 PM	8.9	271
	06:23 PM	0.0	0		07:34 PM	1.9	58
7 Th	02:08 AM	11.1	338	**22** F	03:16 AM	10.5	320
	07:34 AM	6.8	207		09:20 AM	6.1	186
	12:31 PM	10.6	323		02:01 PM	9.1	277
	07:28 PM	-0.1	-3		08:31 PM	1.8	55
8 F	02:58 AM	11.6	354	**23** Sa	03:48 AM	10.8	329
	08:37 AM	5.9	180		09:53 AM	5.3	162
	01:44 PM	10.7	326		02:59 PM	9.5	290
	08:26 PM	-0.2	-6		09:20 PM	1.7	52
9 Sa	03:37 AM	12.1	369	**24** Su	04:14 AM	11.1	338
	09:26 AM	4.8	146		10:20 AM	4.4	134
	02:48 PM	11.0	335		03:50 PM	10.0	305
	09:17 PM	0.0	0		10:03 PM	1.8	55
10 Su	05:10 AM	12.3	375	**25** M	04:38 AM	11.4	347
	11:08 AM	3.8	116		10:49 AM	3.4	104
	04:45 PM	11.2	341		04:37 PM	10.6	323
	11:03 PM	0.5	15		10:44 PM	2.0	61
11 M	05:39 AM	12.5	381	**26** Tu	05:04 AM	11.7	357
	11:47 AM	2.8	85		11:20 AM	2.2	67
	05:37 PM	11.4	347		05:22 PM	11.1	338
	11:47 PM	1.2	37		11:24 PM	2.4	73
12 Tu	06:08 AM	12.5	381	**27** W	05:31 AM	12.0	366
	12:24 PM	2.0	61		11:54 AM	1.1	34
	06:26 PM	11.4	347		06:08 PM	11.5	351
13 W	12:28 AM	2.1	64	**28** Th	12:04 AM	3.0	91
	06:37 AM	12.4	378		06:01 AM	12.2	372
	01:01 PM	1.3	40		12:32 PM	0.1	3
	07:14 PM	11.3	344		06:56 PM	11.8	360
14 Th	01:09 AM	3.1	94	**29** F	12:47 AM	3.8	116
	07:08 AM	12.2	372		06:34 AM	12.2	372
	01:38 PM	0.9	27		01:13 PM	-0.7	-21
	08:02 PM	11.1	338		07:47 PM	11.9	363
15 F	01:50 AM	4.1	125	**30** Sa	01:31 AM	4.6	140
	07:41 AM	11.9	363		07:11 AM	12.1	369
	02:16 PM	0.7	21		01:58 PM	-1.2	-37
	08:51 PM	10.9	332		08:41 PM	11.8	360
				31 Su	02:20 AM	5.4	165
					07:52 AM	11.8	360
					02:47 PM	-1.3	-40
					09:41 PM	11.5	351

Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.
Referenced to Station: SEATTLE (Madison St.), Elliott Bay (9447130) Height offset in feet (low:*1.01 high: * 1.05) Time offset in mins (low:5 high: 4)

Generated On: Mon Jun 17 22:36:15 GMT 2013

StationId:9449911
Source:NOAA/NOS/CO-OPS
Station Type:Subordinate
Time Zone:LST/LDT
Datum:mean lower low water (MLLW) which is the chart datum of soundings

NOAA Tide Predictions

Upright Head, Lopez Island,Washington,2013

Times and Heights of High and Low Waters

January

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Tu	12:26 AM	-0.2 -6	**16** W	01:10 AM	0.9 27
	07:56 AM	8.6 262		08:16 AM	8.9 271
	01:49 PM	5.0 152		02:44 PM	3.2 98
	06:23 PM	6.1 186		08:05 PM	5.8 177
2 W	01:03 AM	0.5 15	**17** Th	01:54 AM	2.1 64
	08:26 AM	8.6 262		08:48 AM	8.7 265
	02:40 PM	4.3 131		03:46 PM	2.6 79
	07:25 PM	5.7 174		09:31 PM	5.4 165
3 Th	01:42 AM	1.3 40	**18** F	02:41 AM	3.4 104
	08:56 AM	8.6 262		09:21 AM	8.4 256
	03:33 PM	3.5 107		04:47 PM	2.0 61
	08:39 PM	5.2 158		11:37 PM	5.4 165
4 F	02:23 AM	2.4 73	**19** Sa	03:35 AM	4.6 140
	09:28 AM	8.6 262		09:54 AM	8.2 250
	04:26 PM	2.5 76		05:44 PM	1.5 46
	10:10 PM	5.0 152			
5 Sa	03:10 AM	3.5 107	**20** Su	01:35 AM	6.0 183
	10:02 AM	8.5 259		04:43 AM	5.5 168
	05:19 PM	1.5 46		10:29 AM	7.9 241
				06:35 PM	1.1 34
6 Su	12:13 AM	5.3 162	**21** M	02:47 AM	6.7 204
	04:11 AM	4.6 140		06:06 AM	6.2 189
	10:39 AM	8.5 259		11:09 AM	7.7 235
	06:11 PM	0.4 12		07:21 PM	0.7 21
7 M	02:11 AM	6.1 186	**22** Tu	03:37 AM	7.3 223
	05:26 AM	5.6 171		07:29 AM	6.4 195
	11:20 AM	8.5 259		11:54 AM	7.5 229
	07:02 PM	-0.6 -18		08:02 PM	0.3 9
8 Tu	03:15 AM	7.0 213	**23** W	04:15 AM	7.7 235
	06:43 AM	6.2 189		08:35 AM	6.5 198
	12:07 PM	8.5 259		12:44 PM	7.4 226
	07:52 PM	-1.4 -43		08:39 PM	0.0 0
9 W	04:01 AM	7.8 238	**24** Th	04:47 AM	8.0 244
	07:53 AM	6.4 195		09:22 AM	6.3 192
	01:01 PM	8.5 259		01:34 PM	7.4 226
	08:40 PM	-2.0 -61		09:14 PM	-0.2 -6
10 Th	04:42 AM	8.3 253	**25** F	05:14 AM	8.1 247
	08:55 AM	6.3 192		09:58 AM	6.1 186
	01:58 PM	8.5 259		02:22 PM	7.3 223
	09:27 PM	-2.3 -70		09:47 PM	-0.4 -12
11 F	05:20 AM	8.7 265	**26** Sa	05:37 AM	8.2 250
	09:53 AM	6.1 186		10:30 AM	5.8 177
	02:56 PM	8.3 253		03:09 PM	7.3 223
	10:13 PM	-2.3 -70		10:21 PM	-0.4 -12
12 Sa	05:57 AM	8.9 271	**27** Su	05:57 AM	8.2 250
	10:49 AM	5.6 171		11:04 AM	5.4 165
	03:54 PM	8.0 244		03:56 PM	7.2 219
	10:58 PM	-1.9 -58		10:54 PM	-0.3 -9
13 Su	06:33 AM	9.0 274	**28** M	06:18 AM	8.3 253
	11:45 AM	5.1 155		11:40 AM	4.9 149
	04:53 PM	7.6 232		04:44 PM	7.0 213
	11:42 PM	-1.2 -37		11:29 PM	0.0 0
14 M	07:08 AM	9.0 274	**29** Tu	06:41 AM	8.4 256
	12:43 PM	4.5 137		12:20 PM	4.3 131
	05:53 PM	7.0 213		05:36 PM	6.7 204
15 Tu	12:26 AM	-0.3 -9	**30** W	12:04 AM	0.6 18
	07:43 AM	9.0 274		07:08 AM	8.5 259
	01:43 PM	3.9 119		01:03 PM	3.6 110
	06:56 PM	6.4 195		06:31 PM	6.4 195
			31 Th	12:41 AM	1.3 40
				07:36 AM	8.5 259
				01:49 PM	2.9 88
				07:33 PM	6.1 186

February

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	01:19 AM	2.3 70	**16** Sa	02:17 AM	4.2 128
	08:07 AM	8.5 259		08:21 AM	7.9 241
	02:40 PM	2.1 64		03:32 PM	1.6 49
	08:44 PM	5.8 177		11:01 PM	6.0 183
2 Sa	02:01 AM	3.3 101	**17** Su	03:12 AM	5.1 155
	08:39 AM	8.5 259		08:55 AM	7.6 232
	03:35 PM	1.4 43		04:29 PM	1.4 43
	10:13 PM	5.6 171			
3 Su	02:49 AM	4.4 134	**18** M	12:57 AM	6.3 192
	09:15 AM	8.4 256		04:25 AM	5.8 177
	04:34 PM	0.7 21		09:33 AM	7.3 223
				05:29 PM	1.3 40
4 M	12:18 AM	5.9 180	**19** Tu	02:11 AM	6.8 207
	03:53 AM	5.4 165		05:56 AM	6.1 186
	09:56 AM	8.3 253		10:21 AM	7.1 216
	05:35 PM	0.0 0		06:28 PM	1.1 34
5 Tu	02:01 AM	6.6 201	**20** W	02:59 AM	7.2 219
	05:15 AM	6.1 186		07:24 AM	6.1 186
	10:46 AM	8.1 247		11:19 AM	6.9 210
	06:35 PM	-0.5 -15		07:20 PM	0.9 27
6 W	02:58 AM	7.3 223	**21** Th	03:35 AM	7.4 226
	06:40 AM	6.3 192		08:23 AM	5.9 180
	11:47 AM	8.0 244		12:23 PM	6.8 207
	07:32 PM	-1.0 -30		08:06 PM	0.7 21
7 Th	03:40 AM	7.8 238	**22** F	04:03 AM	7.6 232
	07:53 AM	6.1 186		09:01 AM	5.6 171
	12:55 PM	8.0 244		01:24 PM	6.9 210
	08:25 PM	-1.3 -40		08:45 PM	0.5 15
8 F	04:17 AM	8.2 250	**23** Sa	04:25 AM	7.7 235
	08:54 AM	5.7 174		09:30 AM	5.2 158
	02:03 PM	7.9 241		02:20 PM	6.9 210
	09:13 PM	-1.3 -40		09:21 PM	0.4 12
9 Sa	04:51 AM	8.4 256	**24** Su	04:43 AM	7.8 238
	09:47 AM	5.1 155		09:58 AM	4.6 140
	03:06 PM	7.8 238		03:12 PM	7.0 213
	09:58 PM	-1.0 -30		09:56 PM	0.5 15
10 Su	05:22 AM	8.6 262	**25** M	05:01 AM	7.9 241
	10:36 AM	4.4 134		10:29 AM	4.0 122
	04:05 PM	7.6 232		04:02 PM	7.1 216
	10:41 PM	-0.5 -15		10:30 PM	0.8 24
11 M	05:53 AM	8.6 262	**26** Tu	05:22 AM	8.0 244
	11:24 AM	3.7 113		11:04 AM	3.2 98
	05:03 PM	7.4 226		04:53 PM	7.1 216
	11:23 PM	0.2 6		11:06 PM	1.2 37
12 Tu	06:23 AM	8.6 262	**27** W	05:47 AM	8.1 247
	12:12 PM	3.1 94		11:42 AM	2.5 76
	06:00 PM	7.0 213		05:46 PM	7.0 213
				11:43 PM	1.9 58
13 W	12:05 AM	1.2 37	**28** Th	06:15 AM	8.2 250
	06:52 AM	8.5 259		12:24 PM	1.7 52
	01:00 PM	2.5 76		06:42 PM	6.9 210
	06:59 PM	6.6 201			
14 Th	12:47 AM	2.2 67			
	07:21 AM	8.4 256			
	01:48 PM	2.1 64			
	08:02 PM	6.3 192			
15 F	01:30 AM	3.2 98			
	07:50 AM	8.2 250			
	02:39 PM	1.8 55			
	09:17 PM	6.0 183			

March

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	12:22 AM	2.7 82	**16** Sa	02:13 AM	4.3 131
	06:45 AM	8.2 250		07:53 AM	7.6 232
	01:10 PM	1.0 30		02:43 PM	0.9 27
	07:43 PM	6.7 204		10:01 PM	6.8 207
2 Sa	01:04 AM	3.5 107	**17** Su	03:04 AM	5.0 152
	07:18 AM	8.2 250		08:26 AM	7.3 223
	01:59 PM	0.5 15		03:31 PM	0.9 27
	08:53 PM	6.6 201		11:17 PM	6.7 204
3 Su	01:51 AM	4.4 134	**18** M	04:05 AM	5.5 168
	07:54 AM	8.1 247		09:02 AM	7.0 213
	02:55 PM	0.2 6		04:23 PM	1.1 34
	10:17 PM	6.5 198			
4 M	02:48 AM	5.2 158	**19** Tu	12:50 AM	6.7 204
	08:35 AM	7.9 241		05:26 AM	5.8 177
	03:56 PM	0.0 0		09:46 AM	6.6 201
				05:22 PM	1.3 40
5 Tu	12:00 AM	6.7 204	**20** W	02:06 AM	6.9 210
	04:03 AM	5.8 177		07:02 AM	5.7 174
	09:26 AM	7.6 232		10:41 AM	6.3 192
	05:01 PM	-0.1 -3		06:25 PM	1.4 43
6 W	01:24 AM	7.0 213	**21** Th	02:56 AM	7.0 213
	05:32 AM	5.9 180		08:17 AM	5.5 168
	10:31 AM	7.3 223		11:49 AM	6.1 186
	06:08 PM	-0.2 -6		07:25 PM	1.4 43
7 Th	02:19 AM	7.4 226	**22** F	03:31 AM	7.2 219
	06:58 AM	5.7 174		09:02 AM	5.1 155
	11:49 AM	7.1 216		01:05 PM	6.1 186
	07:11 PM	-0.2 -6		08:19 PM	1.4 43
8 F	03:01 AM	7.8 238	**23** Sa	03:56 AM	7.2 219
	08:05 AM	5.1 155		09:30 AM	4.5 137
	01:09 PM	7.1 216		02:18 PM	6.2 189
	08:06 PM	0.0 0		09:04 PM	1.4 43
9 Sa	03:37 AM	8.0 244	**24** Su	04:15 AM	7.3 223
	08:56 AM	4.3 131		09:56 AM	3.8 116
	02:22 PM	7.1 216		03:21 PM	6.4 195
	08:56 PM	0.2 6		09:45 PM	1.6 49
10 Su	05:08 AM	8.1 247	**25** M	04:34 AM	7.5 229
	10:40 AM	3.5 107		10:24 AM	3.0 91
	04:26 PM	7.2 219		04:17 PM	6.7 204
	10:40 PM	0.7 21		10:24 PM	1.8 55
11 M	05:37 AM	8.1 247	**26** Tu	04:56 AM	7.6 232
	11:20 AM	2.7 82		10:56 AM	2.1 64
	05:24 PM	7.3 223		05:10 PM	7.1 216
	11:23 PM	1.3 40		11:02 PM	2.2 67
12 Tu	06:03 AM	8.1 247	**27** W	05:21 AM	7.8 238
	12:00 PM	2.1 64		11:31 AM	1.2 37
	06:18 PM	7.3 223		06:03 PM	7.3 223
				11:42 PM	2.8 85
13 W	12:04 AM	2.0 61	**28** Th	05:50 AM	7.9 241
	06:29 AM	8.1 247		12:10 PM	0.4 12
	12:39 PM	1.5 46		06:57 PM	7.5 229
	07:11 PM	7.2 219			
14 Th	12:45 AM	2.8 85	**29** F	12:23 AM	3.4 104
	06:56 AM	8.0 244		06:21 AM	8.0 244
	01:19 PM	1.1 34		12:52 PM	-0.3 -9
	08:04 PM	7.1 216		07:53 PM	7.6 232
15 F	01:28 AM	3.6 110	**30** Sa	01:07 AM	4.1 125
	07:23 AM	7.8 238		06:55 AM	7.9 241
	02:00 PM	0.9 27		01:38 PM	-0.7 -21
	09:00 PM	7.0 213		08:53 PM	7.5 229
			31 Su	01:56 AM	4.7 143
				07:33 AM	7.8 238
				02:28 PM	-0.9 -27
				09:58 PM	7.4 226

Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.
Referenced to Station: PORT TOWNSEND (9444900) Height offset in feet (low:*0.93 high: * 0.93) Time offset in mins (low:44 high: 26)

Generated On: Mon Jun 17 22:37:56 GMT 2013

Page 2 of 5



Climate Impacts Vulnerability Assessment

REPORT

Prepared by the Washington State Department of Transportation for submittal to the Federal Highway Administration

In fulfillment of the matching grant of Surface Transportation Research, Development, and Deployment funds as obligated by the FHWA-Washington Division, FHWA program code 4L30.

November 2011

Washington State Department of Transportation

Appendix A Summary of Projected Pacific Northwest Climate Change Impacts

Climate information used in the WSDOT pilot project was prepared by the University of Washington Climate Impacts Group.

December 16, 2010

The following information is largely assembled from work completed for the 2009 Washington Climate Change Impacts Assessment. Other sources have been used where relevant, but this summary should not be viewed as a comprehensive literature review of Pacific Northwest climate change impacts. Confidence statements are strictly qualitative, with the exception of IPCC text regarding rates of 20th century global sea level rise. Note that periods of months are abbreviated by each month's first letter (DJF = Dec, Jan, Feb).

Climate Variable	General Change Expected	Specific Change Expected	Size of Projected Change Compared to Recent Changes	Information About Seasonal Patterns of Change	Confidence	Sources
					contributions in any given basin may affect late summer flows. For all changes in streamflow, confidence in *specific* projected values is low due to high uncertainty about changes in precipitation and decadal variability.	
SEA LEVEL	Varying amounts of sea level rise (or decline) projected in Washington due to regional variations in land movement and coastal winds.	Projected global change (2090-2099) according to the IPCC: 7-23", relative to 1980-99 average *(Solomon et al. 2007)*** 2050: Projected medium change in Washington sea level (with range) *(Mote et al. 2008)*: • NW Olympic Pen: 0" (-5-14") • Central & So. Coast: 5" (1-18") • Puget Sound: 6" (3-22") 2100: Projected medium change in WA sea level (with range) *(Mote et al. 2008)*: • NW Olympic Peninsula: 2" (-9-35")	Relative change in Washington varies by location. Globally, the average rate of sea level rise during the 21st century very likely[‡] (>90%) exceeds the 1961-2003 average rate (0.07 ± 0.02 in/year) *(Solomon et al. 2007)* --- [‡] *= as defined by the IPCC's treatment of uncertainties. (Solomon et al. 2007, Box TS1)*	Wind-driven enhancement of PNW sea level is common during winter months (even more so during El Niño events). On the whole, analysis of more than 30 scenarios found minimal changes in average wintertime northward winds in the PNW. However, several models produced strong increases. These potential increases contribute to the upper estimates for WA sea level rise. *(Mote et al. 2008)*	High confidence that sea level will rise globally. Confidence in the amount of change at any specific location in Washington varies depending on the amount of uncertainty associated with the global and local/regional factors affecting rates of sea level rise. Regionally, there is high confidence that	Mote et al. 2008 Solomon et al. 2007

Climate Variable	General Change Expected	Specific Change Expected	Size of Projected Change Compared to Recent Changes	Information About Seasonal Patterns of Change	Confidence	Sources
		• Central & So. Coast: 11" (2-43") • Puget Sound: 13" (6-50") ---------- *** Since 2008, numerous peer-reviewed studies have offered alternate estimates of global sea level rise. The basis for these updates are known deficiencies in the IPCC's 2007 approach to calculating of global sea level rise, including assumptions of a near-zero net contribution from the Greenland and Antarctic ice sheets to 21st century sea level rise. A comparison of several studies in Rahmstorf 2010 (Figure 1) shows projections in the range of 1.5ft to over 6ft. Overall, recent studies appear to be converging on projected increases in the range of 2-4ft (e.g., Vermeer and Rahmstorf (2009), Pfeffer et al. 2008, Grinsted et al. 2009, Jevrejeva et al. 2010).*			the NW Olympic Peninsula is experiencing uplift at >2 mm/yr. There is less confidence about rates of uplift along the central and southern WA coast due to sparse data, but available data generally indicate uplift in range of 0-2mm/yr. There is high uncertainty about subsidence, and rates of subsidence where it exists, in the Puget Sound region. Although annual rates of current and future uplift and subsidence (a.k.a. "VLM") are well established at large geographic scales, determining rates at specific locations requires additional analysis and/or monitoring.	

Climate Variable	General Change Expected	Specific Change Expected	Size of Projected Change Compared to Recent Changes	Information About Seasonal Patterns of Change	Confidence	Sources
					Uncertainties around future rates are unknown and would be affected by the occurrence of a subduction zone earthquake.	
WAVE HEIGHTS	Increase in "significant wave height" ** expected in the near term (through 2020s) based on research showing that a future warmer climate may contain fewer overall extra-tropical cyclones but an increased frequency of very intense extra-tropical cyclones (which may affect the extreme wave climate). ----------	Based on extrapolation of historical data‡ and assumptions that the historical trends continue into the future, the 25-, 50-, and 100-year significant wave height events are projected to increase approximately 0.07m/yr (2.8 in/yr) through 2020s. ---------- ‡ *The five highest significant wave heights measured at Washington NDBC Buoy #46005 (at the WA/OR border)*	Projected changes through 2020 are comparable to the observed increase in the average of the five highest significant wave heights for the mid 1970s-2007 (0.07m/yr, or 2.6 in/yr). *More on past changes:* Over the last 30 years, the rate of increase for more extreme wave heights has been greater than the rate of increase in average winter wave height. For the WA/OR outer coast	These findings relate to the winter season (Oct-March), which is the dominant season of strong storms	*Regarding general trend:* There is low confidence that significant wave height will increase given the dependence of this increase on a limited number of studies showing potential increases in the intensity of the extra-tropical cyclones that can affect the extreme wave climate. *Regarding specific projected increases in wave height:* There is low confidence in the calculated trend for 25-, 50-, and 100-year significant wave	Ruggiero et al. 2010

Appendix Y *Vacant*

Appendix Z Terminal Vertical Datums

Appendix Z tabulates the elevations (referenced to NAVD 88 and to MLLW) of all of the vehicle transfer span bridge seats located at the nineteen terminals and the Eagle Harbor Maintenance Facility. The photos show the locations of the points from which the bridge seat elevations and horizontal and vertical datums were established. The elevations tabulated in Exhibit 340-3 correspond to each terminal's Slip 1 (or Main Slip) bridge seat.

Ferry Terminals 2013

- Anacortes
- Bainbridge Island
- Bremerton
- Clinton
- Coupeville
- Eagle Harbor
- Edmonds
- Fauntleroy
- Friday Harbor
- Kingston
- Lopez
- Mukilteo
- Orcas
- Point Defiance
- Port Townsend
- Seattle
- Shaw
- Southworth
- Tahlequah
- Vashon

Anacortes

SLIP A1	
	
NAVD 88 ORTHO: 4.977 (M) 16.33 (FT)	MLLW: 5.144 (M) 16.88 (FT)

SLIP A2	
	
NAVD 88 ORTHO: 4.869 (M) 15.97(FT)	MLLW: 5.036 (M) 16.52 (FT)

Bainbridge Island

SLIP 1	
	
NAVD 88 ORTHO: 4.831 (M) 15.85 (FT)	MLLW: 5.596 (M) 18.36 (FT)

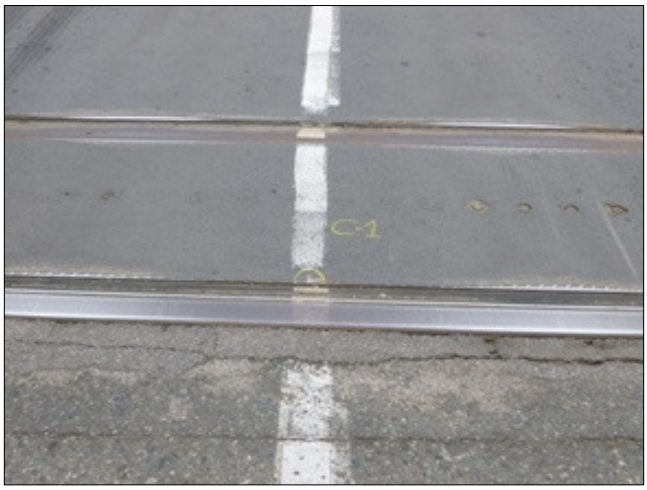
SLIP 2	
	
NAVD 88 ORTHO: 4.835 (M) 15.86 (FT)	MLLW: 5.600 (M) 18.37 (FT)

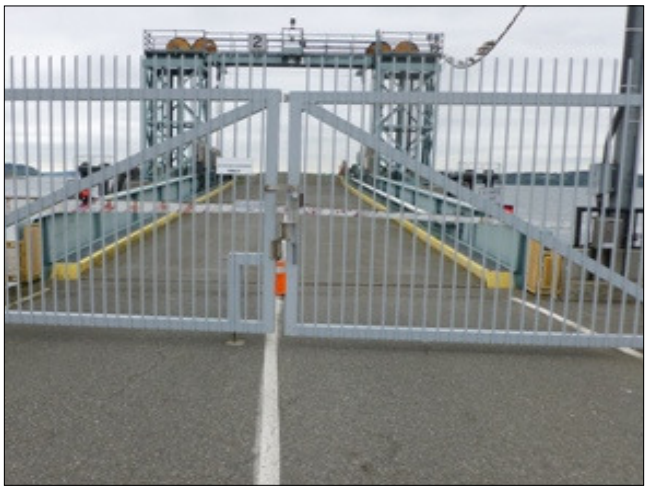
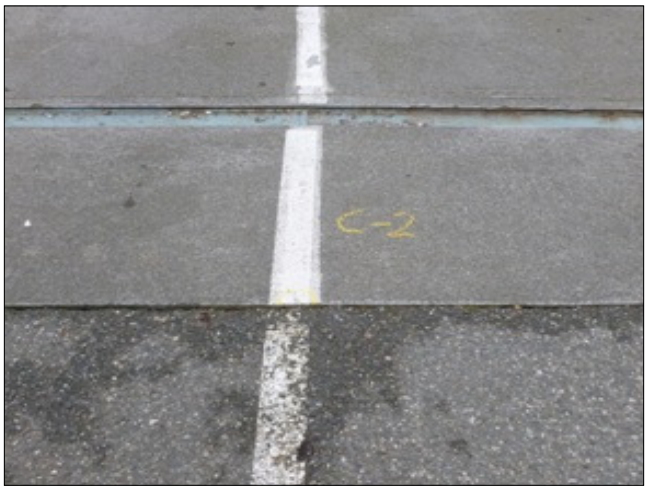
Bremerton

BREMS 1	
	
NAVD 88 ORTHO: 4.537 (M) 14.89 (FT)	MLLW: 5.299 (M) 17.39 (FT)

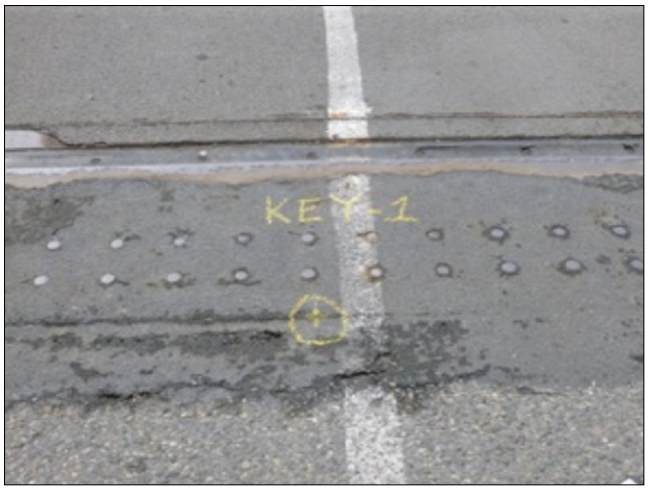
BREMS 2	
	
NAVD 88 ORTHO: 4.337 (M) 14.23 (FT)	MLLW: 5.099 (M) 16.73 (FT)

Clinton

SLIP C1	
	
NAVD 88 ORTHO: 4.725 (M) 15.50 (FT)	MLLW: 5.350 (M) 17.55 (FT)

SLIP C2	
	
NAVD 88 ORTHO: 4.747 (M) 15.57 (FT)	MLLW: 5.372 (M) 17.62 (FT)

Coupeville

SLIP KEY 1	
	
NAVD 88 ORTHO: 3.984 (M) 13.07 (FT)	MLLW: 4.324 (M) 14.19 (FT)

Eagle Harbor

SLIP B	
	
NAVD 88 ORTHO: 4.305 (M) 14.12 (FT)	MLLW: 5.072 (M) 16.64 (FT)

SLIP E	
	
NAVD 88 ORTHO: 3.765 (M) 12.35 (FT)	MLLW: 4.532 (M) 14.87 (FT)

Edmonds

SLIP ED 1	
	
NAVD 88 ORTHO: 4.483 (M) 14.71 (FT)	MLLW: 5.108 (M) 16.76 (FT)

Fauntleroy

SLIP A1	
	
NAVD 88 ORTHO: 4.030 (M) 13.22 (FT)	MLLW: 4.771 (M) 15.65 (FT)

Friday Harbor

SLIP 01	
	
NAVD 88 ORTHO: 5.010 (M) 16.44 (FT)	MLLW: 5.159 (M) 16.93 (FT)

Kingston

SLIP 1	
	
NAVD 88 ORTHO: 4.877 (M) 16.00 (FT)	MLLW: 5.502 (M) 18.05 (FT)

SLIP 2	
	
NAVD 88 ORTHO: 4.688(M) 15.38 (FT)	MLLW: 5.313 (M) 17.43 (FT)

Lopez

SLIP 01	
	
NAVD 88 ORTHO: 5.531 (M) 18.15 (FT)	MLLW: 5.692 (M) 18.67 (FT)

Mukilteo

SLIP M1	
	
NAVD 88 ORTHO: 4.672 (M) 15.33 (FT)	MLLW: 5.299 (M) 17.39 (FT)

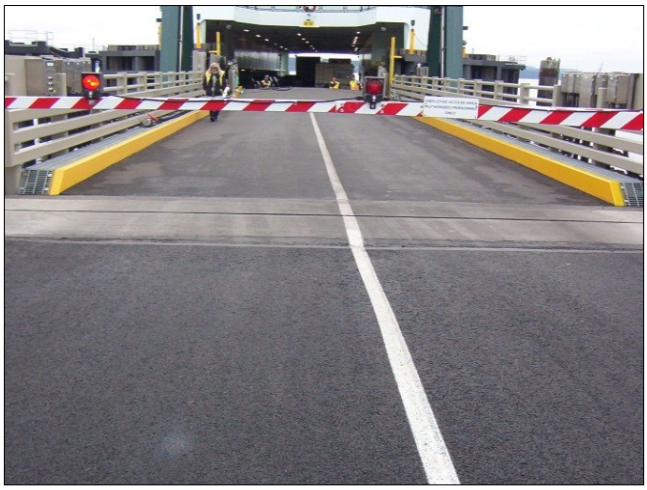
Orcas

SLIP 01	
	
NAVD 88 ORTHO: 5.596 (M) 18.36 (FT)	MLLW: 5.772 (M) 18.94 (FT)

Point Defiance

SLIP PD 1	
	
NAVD 88 ORTHO: 4.933 (M) 16.18 (FT)	MLLW: 5.691 (M) 18.67 (FT)

Port Townsend

SLIP 1A	
	
NAVD 88 ORTHO: 4.710 (M) 15.45 (FT)	MLLW: 5.048 (M) 16.56 (FT)

SLIP 2	
	
NAVD 88 ORTHO: 4.717 (M) 15.48 (FT)	MLLW: 5.055 (M) 16.58 (FT)

Seattle

SLIP C1	
	
NAVD 88 ORTHO: 4.973 (M) 16.32 (FT)	MLLW: 5.684 (M) 18.65 (FT)

SLIP C2	
	
NAVD 88 ORTHO: 4.936 (M) 16.19 (FT)	MLLW: 5.647 (M) 18.53 (FT)

SLIP C3	
	
NAVD 88 ORTHO: 4.962 (M) 16.28 (FT)	MLLW: 5.673 (M) 18.61 (FT)

Shaw

SLIP S1A	
	
NAVD 88 ORTHO: 3.760 (M) 12.34 (FT)	MLLW: 3.921 (M) 12.86 (FT)

Southworth

SLIP SW1	
	
NAVD 88 ORTHO: 4.919 (M) 16.14 (FT)	MLLW: 5.686 (M) 18.65 (FT)

Tahlequah

SLIP TLQ1	
	
NAVD 88 ORTHO: 4.646 (M) 15.24 (FT)	MLLW: 5.404 (M) 17.73 (FT)

Vashon

SLIP V 1	
	
NAVD 88 ORTHO: 5.054 (M) 16.58 (FT)	MLLW: 5.826 (M) 19.11 (FT)

SLIP V 2	
	
NAVD 88 ORTHO: 4.993 (M) 16.38 (FT)	MLLW: 5.765 (M) 18.91 (FT)

Appendix AA Vehicle Transfer Span Gradients

Vehicle Transfer Span Gradients as described in Section 610.05 and summarized in Exhibit 610-7 are calculated from Design Vessel Freeboards, Minimum and Maximum Water Levels, Span and Apron Lengths and other adjustments as tabulated on the following tables.

TRANSFER SPAN GEOMETRY
TRANSFER SPAN AND APRON GRADIENTS
DESIGN CONDITIONS (MAX AND MIN WATER LEVELS AND CAT 1 DESIGN VESSELS)

Made by T Bertucci
Checked by J Bernstein

Terminal	Slip	Bridge Seat Elev (A)	Span Type	Apron Type	Span Length	Apron Length	Total Length	Apron Near End Height	Apron Far End Height	Vessel Class (Cat I only)	Lay-up (Max) Freeboard	Max Water Level (Excl SLR)	Max Deck	Max Apron Near End (B)	Max Apron Far End (C)	Max Span Vertical (B) - (A)	Max Apron Vertical (B) - (C)	Max Span Gradient	Max Apron Gradient	Max Gradient Change	Vessel Class (Cat I only)	Operational (Min) Freeboard	Min Water Level	Min Deck	Min Apron Far End (D)	Min Span Vertical (A) - (D)	Min Span/Apron Gradient
		Feet MLLW			Feet	Feet	Feet	Feet	Feet		Feet	Feet MLLW	Feet MLLW	Feet MLLW	Feet MLLW	Feet	Feet	%	%	%		Feet	Feet MLLW	Feet MLLW	Feet MLLW	Feet	%
Anacortes	1	16.88	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	10.90	19.93	21.47	20.43	4.59	1.04	5	-7	12	Super (SOLAS)	6.25	-4.36	1.89	2.39	14.49	-14
Anacortes	2	16.52	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	10.90	19.93	21.47	20.43	4.95	1.04	5	-7	12	Super (SOLAS)	6.25	-4.36	1.89	2.39	14.13	-13
Bainbridge Island	1	18.36	Girder	3/8" Pan	90.64	14.92	105.56	1.54	0.35	Jumbo Mark II	8.79	14.60	23.39	24.93	23.74	6.57	1.19	7	-8	15	Jumbo Mark II	8.25	-4.98	3.27	3.62	14.74	-14
Bainbridge Island	2	18.37	Box	Diagonal	90.69	15.75	106.44	1.42	0.50	Jumbo Mark II	8.79	14.60	23.39	24.81	23.89	6.44	0.92	7	-6	13	Jumbo Mark II	8.25	-4.98	3.27	3.77	14.60	-14
Bremerton	1	17.39	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	15.18	24.21	25.75	24.71	8.36	1.04	9	-7	16	Super	7.25	-4.88	2.37	2.87	14.52	-14
Bremerton	2	16.73	Truss	1/2" Pan	90.83	15.25	106.08	1.54	0.50	Olympic	9.03	15.18	24.21	25.75	24.71	9.02	1.04	10	-7	17	Super	7.25	-4.88	2.37	2.87	13.86	-13
Clinton	1	17.55	Girder	1/2" Pan	90.64	14.50	105.14	1.42	0.58	Olympic	9.03	14.16	23.19	24.61	23.77	7.06	0.84	8	-6	14	Issaquah (SOLAS)	7.25	-4.83	2.42	3.00	14.55	-14
Clinton	2	17.62	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	14.16	23.19	24.73	23.69	7.11	1.04	8	-7	15	Issaquah (SOLAS)	7.25	-4.83	2.42	2.92	14.70	-14
Coupeville	1	14.19	Girder	1/2" Pan	90.64	15.25	105.89	1.54	0.58	Kwa-di Tabil	8.15	11.60	19.75	21.29	20.33	7.1	0.96	8	-6	14	Kwa-di Tabil	6.58	-4.46	2.12	2.70	11.49	-11
Edmonds	1	16.76	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Jumbo Mark II	8.79	14.02	22.81	24.35	23.31	7.59	1.04	8	-7	15	Jumbo	7.75	-4.83	2.92	3.42	13.34	-13
Fauntleroy	1	15.65	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Evergreen St	8.61	14.89	23.50	25.04	24.00	9.39	1.04	10	-7	17	Issaquah (SOLAS)	7.25	-4.93	2.32	2.82	12.83	-12
Friday Harbor	1	16.93	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	10.90	19.93	21.47	20.43	4.54	1.04	5	-7	12	Super (SOLAS)	6.25	-4.09	2.16	2.66	14.27	-14
Kingston	1	18.05	Girder	1/2" Pan	90.64	14.96	105.60	1.54	0.35	Jumbo Mark II	8.79	14.16	22.95	24.49	23.30	6.44	1.19	7	-8	15	Jumbo	7.75	-4.88	2.87	3.22	14.83	-14
Kingston	2	17.43	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Jumbo Mark II	8.79	14.16	22.95	24.49	23.45	7.06	1.04	8	-7	15	Jumbo	7.75	-4.88	2.87	3.37	14.06	-13
Lopez	1	18.67	Girder	1/2" Pan	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	10.79	19.82	21.36	20.32	2.69	1.04	3	-7	10	Super (SOLAS)	6.25	-4.05	2.20	2.70	15.97	-15
Mukilteo	1	17.39	Truss	Channel	96.58	14.50	111.08	1.42	0.58	Olympic	9.03	14.16	23.19	24.61	23.77	7.22	0.84	7	-6	13	Issaquah (SOLAS)	7.25	-4.83	2.42	3.00	14.39	-13
Orcas	1	18.94	Girder	1/2" Pan	90.64	14.92	105.56	1.54	0.58	Olympic	9.03	10.44	19.47	21.01	20.05	2.07	0.96	2	-6	9	Super (SOLAS)	6.25	-3.92	2.33	2.91	16.03	-15
Point Defiance	1	18.67	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Kwa-di Tabil	8.15	15.33	23.48	25.02	23.98	6.35	1.04	7	-7	14	Kwa-di Tabil	6.58	-4.93	1.65	2.15	16.52	-16
Port Townsend	1	16.56	Box	Diagonal	90.69	15.75	106.44	1.54	0.50	Kwa-di Tabil	8.15	11.60	19.75	21.29	20.25	4.73	1.04	5	-7	12	Kwa-di Tabil	6.58	-4.36	2.22	2.72	13.84	-13
Port Townsend	2	16.58	Truss	3/8" Pan	75.00	14.73	89.73	1.42	0.35	Kwa-di Tabil	8.15	11.60	19.75	21.17	20.10	4.59	1.07	6	-7	13	Kwa-di Tabil	6.58	-4.36	2.22	2.57	14.01	-16
Seattle	1	18.65	Girder	3/8" Pan	90.64	14.92	105.56	1.54	0.35	Olympic	9.03	14.60	23.63	25.17	23.98	6.52	1.19	7	-8	15	Super	7.25	-4.88	2.37	2.72	15.93	-15
Seattle	2	18.53	Girder	Channel	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	14.60	23.63	25.17	24.13	6.64	1.04	7	-7	14	Super	7.25	-4.88	2.37	2.87	15.66	-15
Seattle	3	18.61	Girder	Channel	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	14.60	23.63	25.17	24.13	6.56	1.04	7	-7	14	Super	7.25	-4.88	2.37	2.87	15.74	-15
Shaw	1	12.86	Short Girder	Diagonal	80.64	15.25	95.89	1.54	0.50	Olympic	9.03	10.44	19.47	21.01	19.97	8.15	1.04	10	-7	17	Super (SOLAS)	6.25	-4.32	1.93	2.43	10.43	-11
Southworth	1	18.65	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Issaquah 100	8.24	14.89	23.13	24.67	23.63	6.02	1.04	7	-7	13	Issaquah (SOLAS)	7.25	-4.83	2.42	2.92	15.73	-15
Tahlequah	1	17.73	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Kwa-di Tabil	8.15	15.33	23.48	25.02	23.98	7.29	1.04	8	-7	15	Kwa-di Tabil	6.58	-4.93	1.65	2.15	15.58	-15
Vashon	1	19.11	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Evergreen St	8.61	14.89	23.50	25.04	24.00	5.93	1.04	7	-7	13	Issaquah (SOLAS)	7.25	-4.93	2.32	2.82	16.29	-16
Vashon	2	18.91	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Evergreen St	8.61	14.89	23.50	25.04	24.00	6.13	1.04	7	-7	14	Issaquah (SOLAS)	7.25	-4.93	2.32	2.82	16.09	-15

This table provides the extreme slopes based on the following:
Design Vessel Classes include only Category I vessels per TDM Exhibit 330-4
Min Tide is Minimum Water Level and Max Tide is Maximum Water (Excluding Sea Level Rise) per TDM Exhibit 330-11
Span Length is defined as the distance between Transfer Span Hinge and Apron Hinge centerlines
Apron Length is defined as the distance between Apron Hinge and Apron Lip Hinge centerlines
Standard Apron Near End Height is 1.04 feet plus following adjustment value:
Apron Near End Height adjustment 0.5 foot
H-Span Apron Near End Height is actual height of 1.42 feet with no adjustment since span can be adjusted

WSF Span Gradients.xlsx
SPAN GRADIENTS DESIGN
8/11/2015

TRANSFER SPAN GEOMETRY
TRANSFER SPAN AND APRON GRADIENTS
NORMAL CONDITIONS (MHHW AND MLLW WATER LEVELS AND CAT I AND CAT 2 DESIGN VESSELS)

Made by T Bertucci
Checked by J Bernstein

Terminal	Slip	Bridge Seat Elev (A)	Span Type	Apron Type	Span Length	Apron Length	Total Length	Apron Near End Height	Apron Far End Height	Vessel Class (Cat I and II)	Lay-up (Max) Freeboard	Max Water Level (MHHW)	Max Deck	Max Apron Near End (B)	Max Apron Far End (C)	Max Span Vertical (B) - (A)	Max Apron Vertical (B) - (C)	Max Span Gradient	Max Apron Gradient	Max Gradient Change	Vessel Class (Cat I and II)	Operational (Min) Freeboard	Min Water Level (MLLW)	Min Deck	Min Apron Far End (D)	Min Span Vertical (A) - (D)	Min Span/Apron Gradient
		Feet MLLW			Feet	Feet	Feet	Feet	Feet		Feet	Feet MLLW	Feet MLLW	Feet MLLW	Feet MLLW	Feet	Feet	%	%	%		Feet	Feet MLLW	Feet MLLW	Feet MLLW	Feet	%
Anacortes	1	16.88	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	8.05	17.08	18.62	17.58	1.74	1.04	2	-7	9	Super (SOLAS)	6.25	0.00	6.25	6.75	10.13	-10
Anacortes	2	16.52	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	8.05	17.08	18.62	17.58	2.10	1.04	2	-7	9	Super (SOLAS)	6.25	0.00	6.25	6.75	9.77	-9
Bainbridge Island	1	18.36	Girder	3/8" Pan	90.64	14.92	105.56	1.54	0.35	Jumbo Mark II	8.79	11.31	20.10	21.64	20.45	3.28	1.19	4	-8	12	Super	7.25	0.00	7.25	7.60	10.76	-10
Bainbridge Island	2	18.37	Box	Diagonal	90.69	15.75	106.44	1.42	0.50	Jumbo Mark II	8.79	11.31	20.10	21.52	20.60	3.15	0.92	3	-6	9	Super	7.25	0.00	7.25	7.75	10.62	-10
Bremerton	1	17.39	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	11.74	20.77	22.31	21.27	4.92	1.04	5	-7	12	Super	7.25	0.00	7.25	7.75	9.64	-9
Bremerton	2	16.73	Girder	1/2" Pan	90.83	15.25	106.08	1.54	0.50	Olympic	9.03	11.74	20.77	22.31	21.27	5.58	1.04	6	-7	13	Super	7.25	0.00	7.25	7.75	8.98	-8
Clinton	1	17.55	Girder	1/2" Pan	90.64	14.50	105.14	1.42	0.58	Olympic	9.03	11.10	20.13	21.55	20.71	4.00	0.84	4	-6	10	Kwa-di Tabil	6.58	0.00	6.58	7.16	10.39	-10
Clinton	2	17.62	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	11.10	20.13	21.67	20.63	4.05	1.04	4	-7	11	Kwa-di Tabil	6.58	0.00	6.58	7.08	10.54	-10
Coupeville	1	14.19	Girder	1/2" Pan	90.64	15.25	105.89	1.54	0.58	Kwa-di Tabil	8.15	8.59	16.74	18.28	17.32	4.09	0.96	5	-6	11	Kwa-di Tabil	6.58	0.00	6.58	7.16	7.03	-7
Edmonds	1	16.76	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	10.93	19.96	21.50	20.46	4.74	1.04	5	-7	12	Super	7.25	0.00	7.25	7.75	9.01	-9
Fauntleroy	1	15.65	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Evergreen St	8.61	11.55	20.16	21.70	20.66	6.05	1.04	7	-7	14	Kwa-di Tabil	6.58	0.00	6.58	7.08	8.57	-8
Friday Harbor	1	16.93	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	7.72	16.75	18.29	17.25	1.36	1.04	1	-7	8	Super (SOLAS)	6.25	0.00	6.25	6.75	10.18	-10
Kingston	1	18.05	Girder	1/2" Pan	90.64	14.96	105.60	1.54	0.35	Olympic	9.03	10.99	20.02	21.56	20.37	3.51	1.19	4	-8	12	Super	7.25	0.00	7.25	7.60	10.45	-10
Kingston	2	17.43	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	10.99	20.02	21.56	20.52	4.13	1.04	5	-7	11	Super	7.25	0.00	7.25	7.75	9.68	-9
Lopez	1	18.67	Girder	1/2" Pan	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	7.82	16.85	18.39	17.35	-0.28	1.04	0	-7	7	Super (SOLAS)	6.25	0.00	6.25	6.75	11.92	-11
Mukilteo	1	17.39	Truss	Channel	96.58	14.50	111.08	1.42	0.58	Olympic	9.03	11.05	20.08	21.50	20.66	4.11	0.84	4	-6	10	Kwa-di Tabil	6.58	0.00	6.58	7.16	10.23	-9
Orcas	1	18.94	Girder	1/2" Pan	90.64	14.92	105.56	1.54	0.58	Olympic	9.03	7.88	16.91	18.45	17.49	-0.49	0.96	-1	-6	6	Super (SOLAS)	6.25	0.00	6.25	6.83	12.11	-12
Point Defiance	1	18.67	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Evergreen St	8.61	11.94	20.55	22.09	21.05	3.42	1.04	4	-7	11	Hiyu	6.50	0.00	6.50	7.00	11.67	-11
Port Townsend	1	16.56	Box	Diagonal	90.69	15.75	106.44	1.54	0.50	Kwa-di Tabil	8.15	8.55	16.70	18.24	17.20	1.68	1.04	2	-7	8	Kwa-di Tabil	6.58	0.00	6.58	7.08	9.48	-9
Port Townsend	2	16.58	Truss	3/8" Pan	75.00	14.73	89.73	1.42	0.35	Kwa-di Tabil	8.15	8.55	16.70	18.12	17.05	1.54	1.07	2	-7	9	Kwa-di Tabil	6.58	0.00	6.58	6.93	9.65	-11
Seattle	1	18.65	Girder	3/8" Pan	90.64	14.92	105.56	1.54	0.35	Olympic	9.03	11.36	20.39	21.93	20.74	3.28	1.19	4	-8	12	Super	7.25	0.00	7.25	7.60	11.05	-11
Seattle	2	18.53	Girder	Channel	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	11.36	20.39	21.93	20.89	3.40	1.04	4	-7	11	Super	7.25	0.00	7.25	7.75	10.78	-10
Seattle	3	18.61	Girder	Channel	90.64	15.25	105.89	1.54	0.50	Olympic	9.03	11.36	20.39	21.93	20.89	3.32	1.04	4	-7	10	Super	7.25	0.00	7.25	7.75	10.86	-10
Shaw	1	12.86	Short Girder	Diagonal	80.64	15.25	95.89	1.54	0.50	Olympic	9.03	7.84	16.87	18.41	17.37	5.55	1.04	7	-7	14	Super (SOLAS)	6.25	0.00	6.25	6.75	6.11	-6
Southworth	1	18.65	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Issaquah 100	8.24	11.58	19.82	21.36	20.32	2.71	1.04	3	-7	10	Kwa-di Tabil	6.58	0.00	6.58	7.08	11.57	-11
Tahlequah	1	17.73	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Evergreen St	8.61	11.89	20.50	22.04	21.00	4.31	1.04	5	-7	12	Hiyu	6.50	0.00	6.50	7.00	10.73	-10
Vashon	1	19.11	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Evergreen St	8.61	11.53	20.14	21.68	20.64	2.57	1.04	3	-7	10	Kwa-di Tabil	6.58	0.00	6.58	7.08	12.03	-11
Vashon	2	18.91	Girder	Diagonal	90.64	15.25	105.89	1.54	0.50	Evergreen St	8.61	11.53	20.14	21.68	20.64	2.77	1.04	3	-7	10	Kwa-di Tabil	6.58	0.00	6.58	7.08	11.83	-11

This table provides the normal slopes based on the following:
Design Vessel Classes include both Category I and II vessels per TDM Exhibit 330-4
Min Tide is MLLW and Max Tide is MHHW per TDM Exhibit 330-11
Span Length is defined as the distance between Transfer Span Hinge and Apron Hinge centerlines
Apron Length is defined as the distance between Apron Hinge and Apron Lip Hinge centerlines
Standard Apron Near End Height is 1.04 feet plus following adjustment value:
Apron Near End Height adjustment 0.5 foot
H-Span Apron Near End Height is actual height of 1.42 feet with no adjustment since span can be adjusted

WSF Span Gradients.xlsx
SPAN GRADIENTS NORMAL
8/11/2015