Washington State Department of Transportation

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
FERRIES DIVISION

FINAL LONG-RANGE PLAN

APPENDIX F
RIDERSHIP FORECASTING TECHNICAL REPORT

WSDOT Ferries Division Final Long-Range Plan:

Ridership Forecasting Technical Report

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WSDOT Ferries Division Final Long-Range Plan:

Ridership Forecasting Technical Report

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1.0 INTRODUCTION 1

2.0 FERRY RIDERSHIP MODELING/FORECASTING ANALYSIS 2

3.0 RIDERSHIP FORECASTING ANALYSIS - "RECONCILIATION" BETWEEN PLANNING & REVENUE MODELS 20

4.0 RIDERSHIP FORECASTING ANALYSIS - SUMMER PEAK PERIODS & RECREATIONAL TRAVEL 23

5.0 TIME-OF-DAY/FARE ELASTICITY ESTIMATION 44

1.0 INTRODUCTION

This appendix describes the overall survey/counts data, analytical procedures, and major assumptions used to produce ferry ridership forecasts in support of the Long-Range Strategic Plan (LRSP) for the Ferries Division of the Washington State Department of Transportation (WSF). The ferry ridership forecasting benefited greatly from constant oversight of a peer review team who met regularly for over a year from fall 2007 throughout 2008. The peer review team was comprised of travel demand modeling/forecasting specialists representing public agencies and consulting firms. Basic assumptions underpinning the ridership ridership forecasting analysis included, but not limited to, the following:

- Fares are expected to grow at the rate of 2.5% annually.
- Service remains similar to current, with some modest capacity improvements on some routes resulting from replacing retiring vessels with ones slightly larger.
- Population in the Central Puget Sound area is expected to grow by 0.9 million in 2006 to 4.4 million in 2030, and employment by 0.6 million to 2.5 million in 2030, providing more demand for ferry transportation.

This appendix is organized into five sections. Overview of the ferry travel demand modeling procedures including base year validation and ferry ridership forecasting analysis results are described in the next section. “Reconciliation” analysis of forecasts between the WSF planning and revenue models is presented in section three. Forecasting analysis pertaining to summer peak periods and recreational travel is included in section four. Analyses related to estimation of price elasticities are presented in the final section.

2.0 FERRY RIDERSHIP MODELING/FORECASTING ANALYSIS

The primary planning tool employed to perform ferry ridership forecasting analysis was the updated WSF Travel Forecasting (Planning) EMME[1] Model. This Model was initially developed in 1994/1995 and has been successively updated to reflect availability of new ferry travel survey data as well as for consistency with latest regional model databases and those from the outlying jurisdictions. WSF Model uses incremental choice methods and a two-staged forecasting analysis procedure that relies on actual ferry travel patterns and survey-based estimation of parameters such travel time and cost elasticities. Specific details are included in the *"Washington State Ferries Travel Forecasting Methodology Report,"* prepared by Parsons Brinckerhoff, Inc., Seattle, Washington, March 2005. The year 2005 version of the WSF model and its databases were updated in 2007/2008 to suit the current LRSP. Key features that were incorporated into the updated WSF Model included the following:

- Data from the 2006 Origin-Destination Onboard Survey that reflects current ferry travel patterns. A detailed report on this survey is available at the WSF website www.wsdot.wa.gov/ferries/planning/odsurvey. This survey data was expanded to reflect average annual weekday PM peak ridership experienced in 2006. Subsequently, base year (2006) PM peak ferry trip matrices were developed representing auto-board passengers and vehicles as well as walk-board by mode of access and egress. The total expanded base year (2006) PM peak ferry travel survey amounted to about 23,200 person trips of which 16,200 (or 70%) was auto-board riders and the remaining 7,000 (or 30%) walk-board riders.
- Validation analysis for the base year (2006). This involved making necessary updates to the EMME macros to conform to the new base year conditions as well as to the relevant interface with the Puget Sound Regional Council (PSRC) model.
- Latest land-use forecasts available in spring 2008 from PSRC and the outlying jurisdictions.
- A new procedure to establish total ferry ridership in a future year. This is referred to as Stage 1 Forecasting Analysis.
- Reliance on a cost-feasible transportation network that was defined and prepared by PSRC. In addition, zonal parking costs were updated to conform to those in the PSRC model for both base year and future years.

2.1 Validation Results

The validation analysis process included an update to the highway and transit networks to reflect base year (2006) PM peak conditions. Land side networks were developed using conventions used in the new PSRC model (Version 1.0), including volume-delay functions. Background (non-ferry) vehicle trips were extracted from the PSRC model database. The actual boardings used to compare the model results are primarily based on fare revenue (i.e., the number of tickets sold) collected by WSF during the PM peak period on the survey day. Pertinent information from the WSF traffic database was obtained, and actual boardings were

[1] EMME is a travel modeling software package, developed by INRO, Montreal, Canada. Additional information about this software is available at the INRO's website below: software is available to the licensed users at the website: http://www.inro.ca/en/products/emme/index.php

calculated for the purpose of analyzing the 2006 O/D Travel Survey. Actual boardings, however, were not available for all routes and directions. This is due to the nature of the WSF fare collection system, where passenger fares (and in a few cases vehicle fares) are only collected in one direction for a round trip. For cases where data was not available, best estimates were made to represent actual boardings.

The base year model update also involved using ferry trip tables representing the expanded 2006 ferry travel survey data. Subsequently, the updated WSF model was run to produce route level ridership and an overall validation test of reasonableness. Tables 2.1a and 2.1b show PM peak auto-board and walk-on board ferry riders for 2006, respectively. Estimated PM peak ridership volumes are within 10 percentage points of actual ridership for most routes for both auto-board as well as walk-on board riders.

Table 2.1a - Comparison Between 2006 Actual Counts and Estimated PM Peak (3:00-7:00) Weekday Total Auto-Board Ferry Ridership

	Actual Ridership			Estimated (Modeled) Ridership			Estimated/Actual		
Ferry Routes	EB	WB	Total	EB	WB	Total	EB	WB	Total
Point Defiance-Tahlequah	100	270	370	160	280	440	1.60	1.04	1.19
Vashon-Southworth	70	60	130	80	60	140	1.14	1.00	1.08
Fauntleroy-Vashon	760	740	1,500	770	760	1,530	1.01	1.03	1.02
Fauntleroy-Southworth	180	550	730	230	530	760	1.28	0.96	1.04
Seattle-Bremerton	370	830	1,200	360	730	1,090	0.97	0.88	0.91
Seattle-Bainbridge	760	1,920	2,680	850	1,760	2,610	1.12	0.92	0.97
Edmonds-Kingston	1,120	1,560	2,680	970	1,650	2,620	0.87	1.06	0.98
Mukilteo-Clinton	790	1,460	2,250	750	1,480	2,230	0.95	1.01	0.99
Port Townsend-Keystone	310	340	650	320	340	660	1.03	1.00	1.02
Subtotal	**4,460**	**7,730**	**12,190**	**4,490**	**7,590**	**12,080**	**1.01**	**0.98**	**0.99**
Anacortes-San Juan Islands[1]									
All vessels to/from Anacortes	1,730	1,730	3,460	1,710	1,790	3,500	0.99	1.03	1.01
Inter-Island Vessel Only	180	180	360	140	210	350	0.78	1.17	0.97
Anacortes/San Juan Islands-Sidney, B.C.	110	110	220	110	90	200	1.00	0.82	0.91
Grand Total	**6,480**	**9,750**	**16,230**	**6,450**	**9,680**	**16,130**	**1.00**	**0.99**	**0.99**

[1]Reflects daily ridership for the San Jaun routes.
LEGENDS:
- EB stands for Eastbound direction.
- WB stands for Westbound direction.

Table 2.1b - Comparison Between 2006 Actual Counts and Estimated PM Peak (3:00-7:00) Weekday Total Walk-Board Ferry Ridership

	Actual Ridership			Estimated (Modeled) Ridership			Estimated/Actual		
Ferry Routes	EB	WB	Total	EB	WB	Total	EB	WB	Total
Point Defiance-Tahlequah	10	80	90	20	50	70	2.00	0.63	0.78
Vashon-Southworth	0	10	10	0	20	20	0.00	2.00	2.00
Fauntleroy-Vashon	270	270	540	270	280	550	1.00	1.04	1.02
Fauntleroy-Southworth	10	210	220	10	210	220	1.00	1.00	1.00
Seattle-Vashon/Vashon-Southworth P.O.	0	50	50	0	50	50	0.00	1.00	1.00
Seattle-Vashon Passenger Only	20	180	200	20	170	190	1.00	0.94	0.95
Seattle-Bremerton	170	1,170	1,340	150	1,110	1,260	0.88	0.95	0.94
Seattle-Bainbridge	160	2,570	2,730	190	2,580	2,770	1.19	1.00	1.01
Edmonds-Kingston	60	380	440	70	390	460	1.17	1.03	1.05
Mukilteo-Clinton	30	490	520	40	490	530	1.33	1.00	1.02
Port Townsend-Keystone	40	20	60	40	30	70	1.00	1.50	1.17
Subtotal	**770**	**5,430**	**6,200**	**810**	**5,380**	**6,190**	**1.05**	**0.99**	**1.00**
Anacortes-San Juan Islands[1]									
All vessels to/from Anacortes	320	320	640	350	280	630	1.09	0.88	0.98
Anacortes/San Juan Islands-Sidney, B.C.	50	50	100	40	50	90	0.80	1.00	0.90
Anacortes/San Juan Islands-Sidney, B.C.	10	10	20	10	10	20	1.00	1.00	1.00
Grand Total	**1,150**	**5,810**	**6,960**	**1,210**	**5,720**	**6,930**	**1.05**	**0.98**	**1.00**

[1]Reflects daily ridership for the San Jaun routes.
LEGENDS:
- EB stands for Eastbound direction.
- WB stands for Westbound direction.

2.2 Stage 1 Forecasting Analysis

The WSF model depends on PSRC model databases for the overall growth for the cross-sound travel demand. Growth estimates could have been derived either from PSRC model trip distribution results or directly based on forecasts for demographics. Given that PSRC model was being refined and going through additional validation for the cross-sound travel market, the WSF peer review team reached a consensus to derive travel growth from forecasts of total households and employment. Such an approach for development of travel growth has been also used in the Sound Transit incremental model and staged ridership forecasting analysis process. ST model procedures has gone through independent peer reviews, including review and acceptance from the Federal Transit Administration (FTA) in support of their Full Funding Grants Agreements with FTA for the Central and University light rail lines.

The Stage 1 forecasting analysis process involved:

- Calculation of growth in total households and employment between 2006 and a future year (e.g., 2020 or 2030) at 51 districts encompassing the 12-county WSF service areas (see Figure 2.2a). Total households and employment summaries (at a 28-district level) and implied growth in 2010, 2020, and 2030 relative to 2006 are included in Tables 2.2a and 2.2b, respectively. A map of 28-district boundaries is shown in Figure 2.2b. Note that household forecasts were not available for the outlying areas. Average household size for Kitsap County was used as a proxy in conjunction with forecast of population for these counties to estimate households.

- Base year PM peak trip ends were estimated according to projected growth in households and employment at 51-district level. Resulting future year trip ends in conjunction with a base year trip matrix (aggregated at 51-district level) were fed into the matrix-balancing module in EMME to produce a future year trip table (at 51-district level).

Subsequently, implied district-to-district growth in trips was calculated and applied to the base year trip table at the WSF zonal level. This process was repeated to produce a Stage 1 trip table in all forecast years. This process evolved based on feedback from the peer review team resulting from discussion of the Stage 1 forecasting procedure.

The system-wide Stage 1 ferry forecasts and implied growth are presented in Table 2.2c. Implied growth estimates shown in Table 2.2c indicate that 2010, 2020, and 2030 Stage 1 ferry ridership forecasts exhibit an annual growth of 1.06%, 1.35%, and 1.34%, respectively. District-level stage 1 forecasts by PM trip origins and destinations are shown in Tables 2.2d and 2.2e, respectively. District-level implied growth estimated for ferry trips at PM origins and destinations (shown in Tables 2.2d and 2.2e) are reasonably aligned with those exhibited in employment and household projections (shown in Tables 2.2b and 2.2a).

Figure 2.2a – 51 District Map

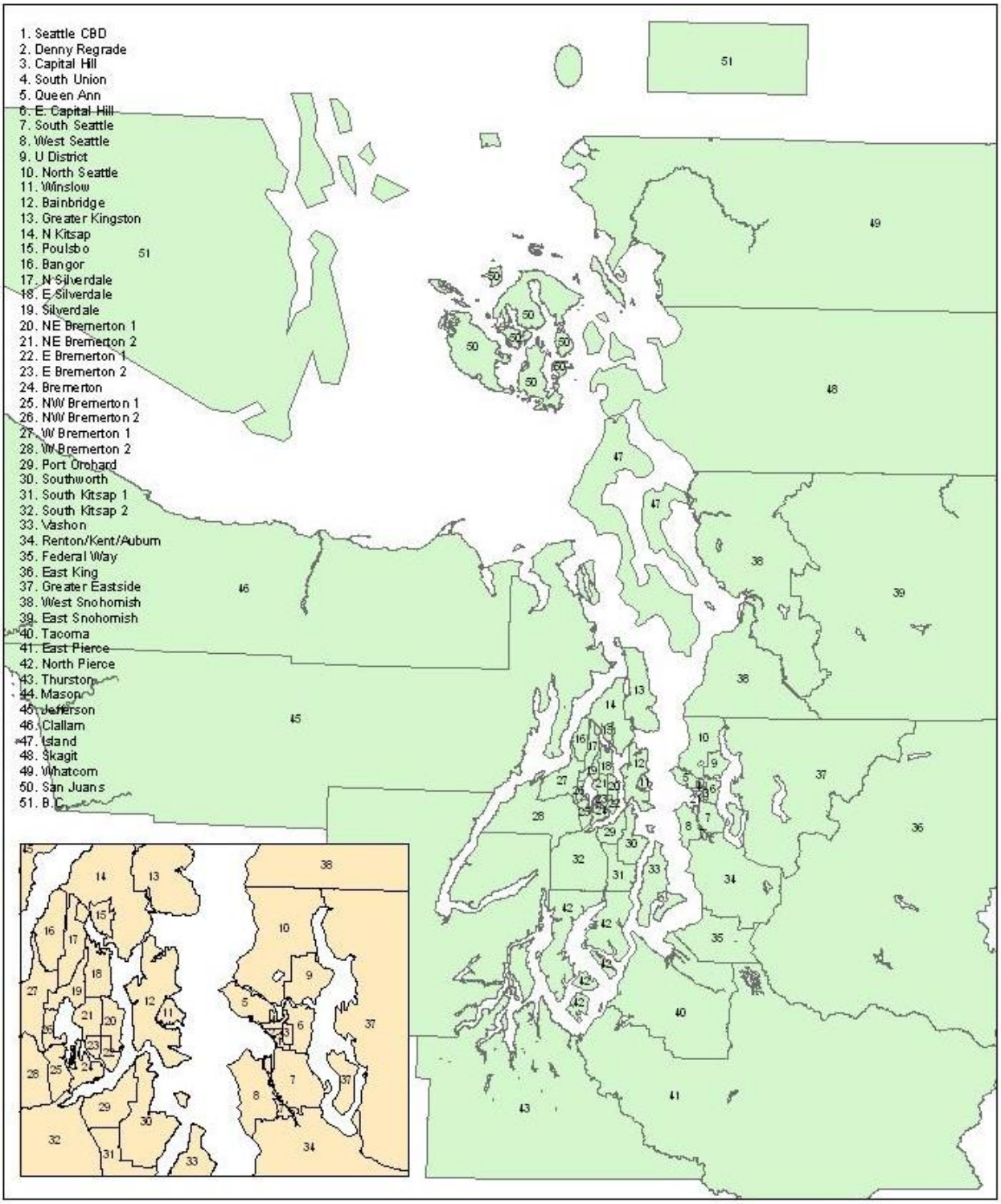


Figure 2.2b – 28 District Map

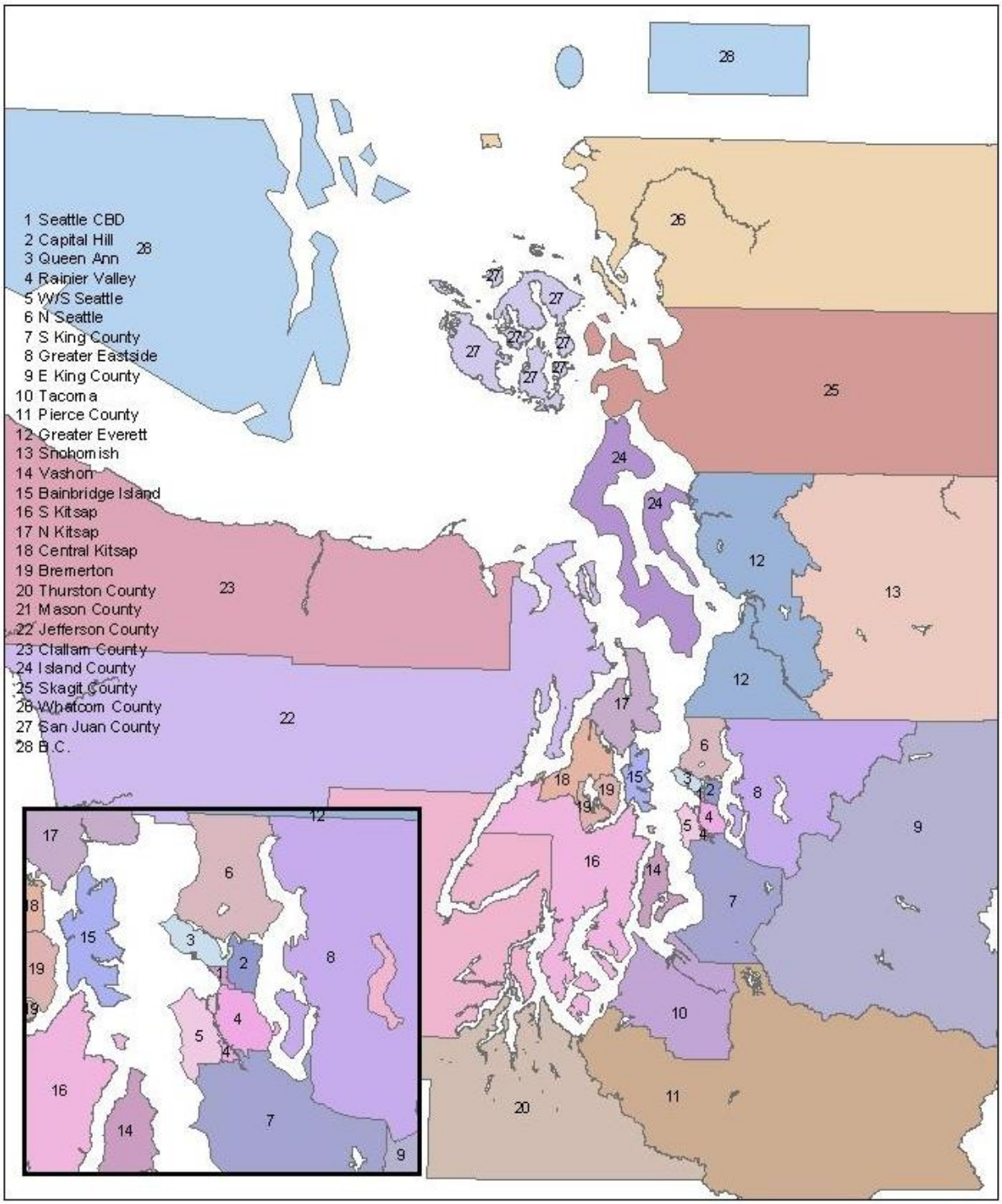


Table 2.2a – Household Forecasts by 28 Districts

District	Households				Growth Rate relative to 2006		
	2006	2010	2020	2030	2010	2020	2030
1 Seattle CBD	15,400	18,100	23,900	31,600	1.18	1.55	2.05
2 Capital Hill	44,200	45,000	49,800	53,100	1.02	1.13	1.20
3 Queen Ann	32,700	34,300	40,700	46,200	1.05	1.24	1.41
4 Rainier Valley	24,700	25,300	27,300	29,400	1.02	1.11	1.19
5 W/S Seattle	35,500	35,800	37,100	38,500	1.01	1.05	1.08
6 N Seattle	136,200	137,600	150,700	162,700	1.01	1.11	1.19
7 S King County	208,300	215,500	242,000	268,700	1.03	1.16	1.29
8 Greater Eastside	209,900	221,900	257,900	290,400	1.06	1.23	1.38
9 E King County	46,000	50,200	60,700	71,300	1.09	1.32	1.55
10 Tacoma	215,700	227,600	262,100	295,600	1.06	1.22	1.37
11 Pierce County	49,500	54,100	67,900	80,200	1.09	1.37	1.62
12 Greater Everett	238,800	258,400	314,300	364,700	1.08	1.32	1.53
13 Snohomish	17,400	18,700	22,700	26,900	1.07	1.30	1.55
14 Vashon	4,400	4,500	4,900	5,400	1.02	1.11	1.23
15 Bainbridge Island	8,700	9,200	11,100	13,000	1.06	1.28	1.49
16 S Kitsap	48,900	52,100	61,500	71,700	1.07	1.26	1.47
17 N Kitsap	14,700	15,800	19,900	24,500	1.07	1.35	1.67
18 Central Kitsap	14,200	15,200	18,200	21,200	1.07	1.28	1.49
19 Bremerton	30,000	30,700	34,300	39,500	1.02	1.14	1.32
20 Thurston County	91,100	102,000	129,600	156,700	1.12	1.42	1.72
21 Mason County	21,500	25,000	31,400	38,900	1.16	1.46	1.81
22 Jefferson County	11,300	11,700	14,000	16,500	1.04	1.24	1.46
23 Clallam County	26,000	29,400	33,700	39,000	1.13	1.30	1.50
24 Island County	30,200	33,800	41,100	49,600	1.12	1.36	1.64
25 Skagit County	45,200	47,500	57,100	88,000	1.05	1.26	1.95
26 Whatcom County	72,100	78,200	93,400	109,800	1.08	1.30	1.52
27 San Juan County	6,200	6,900	8,400	10,100	1.11	1.35	1.63
28 B.C.	1.00	1.27	1.53	1.70	1.27	1.53	1.70
Total	**1,698,800**	**1,804,500**	**2,115,700**	**2,443,200**	**1.06**	**1.25**	**1.44**

Sources: Note that for the outlying areas, household forecasts for the outlying areas were not available. They were estimated based on applying average household size, implied in the PSRC forecast of population for Kitsap to their respective population forecasts available from the following sources:

1. PSRC 2006 small area forecasts by FAZ (2000, 2010, 2020, 2030 & 2040)
2. Thurston Regional Planning Council (TRPC) demographic forecasts 2007
3. OFM average of low and medium projections
4. OFM average of medium and high projections.
5. OFM medium projection.
6. OFM medium projection.
7. OFM average of low and medium projections.
8. OFM high projection.
9. OFM average of medium and high projections.

Table 2.2b – Total Employment Forecasts by 28 Districts

District	Total Employment[1]				Growth Rate relative to 2006		
	2006	2010	2020	2030	2010	2020	2030
1 Seattle CBD	194,500	202,000	225,800	243,600	1.04	1.16	1.25
2 Capital Hill	65,900	66,900	70,900	71,900	1.02	1.08	1.09
3 Queen Ann	72,700	75,500	90,900	98,000	1.04	1.25	1.35
4 Rainier Valley	90,200	92,000	100,200	109,700	1.02	1.11	1.22
5 W/S Seattle	19,300	19,600	23,000	26,900	1.02	1.19	1.39
6 N Seattle	135,500	138,200	156,600	172,000	1.02	1.16	1.27
7 S King County	317,000	323,100	369,000	419,800	1.02	1.16	1.32
8 Greater Eastside	348,600	371,400	435,700	492,600	1.07	1.25	1.41
9 E King County	19,100	20,200	23,500	27,400	1.06	1.23	1.43
10 Tacoma	218,100	225,700	260,100	295,100	1.03	1.19	1.35
11 Pierce County	44,600	45,000	49,500	55,100	1.01	1.11	1.24
12 Greater Everett	233,000	245,500	294,900	344,600	1.05	1.27	1.48
13 Snohomish	3,600	3,700	4,400	5,400	1.03	1.22	1.50
14 Vashon	2,400	2,300	2,500	2,800	0.96	1.04	1.17
15 Bainbridge Island	5,500	5,600	6,400	7,400	1.02	1.16	1.35
16 S Kitsap	23,500	24,400	28,300	32,900	1.04	1.20	1.40
17 N Kitsap	9,700	10,200	12,100	14,100	1.05	1.25	1.45
18 Central Kitsap	18,800	19,400	21,700	24,100	1.03	1.15	1.28
19 Bremerton	43,100	44,100	49,100	54,300	1.02	1.14	1.26
20 Thurston County[2]	118,100	137,200	161,500	172,600	1.16	1.37	1.46
21 Mason County[3]	11,300	17,500	21,980	27,230	1.55	1.95	2.41
22 Jefferson County[3]	7,700	8,190	9,800	11,550	1.06	1.27	1.50
23 Clallam County[3]	20,400	20,580	23,590	27,300	1.01	1.16	1.34
24 Island County[3]	13,400	16,900	20,550	24,800	1.26	1.53	1.85
25 Skagit County[4]	43,700	46,600	54,642	64,120	1.07	1.25	1.47
26 Whatcom County[3]	77,900	78,200	93,400	109,800	1.00	1.20	1.41
27 San Juan County[3]	4,900	4,830	5,880	7,070	0.99	1.20	1.44
28 B.C.	1.00	1.27	1.53	1.70	1.27	1.53	1.70
Total	**2,162,500**	**2,264,800**	**2,615,942**	**2,942,170**	**1.05**	**1.21**	**1.36**

Sources:

1. PSRC 2006 small area forecasts by FAZ (2000, 2010, 2020, 2030 & 2040)
2. Thurston Regional Planning Council (TRPC) demographic forecasts 2007
3. Skagit County Employment based on Mirai Review of Comprehensive Plan 2007 using employment growth found in adopted 2003 plan
4. 2006 data were derived from Census Bureau's Quick Fact web site (http://quickfacts.census.gov/qfd/states/53/)
   2010, 2020 and 2030 projections were based on job to households ratios derived from census and ESD database (2005).

Table 2.2c – System-wide Stage 1 PM Peak Ferry Ridership Forecasts and Implied Growth Rates Comparison

Forecast Year	PM Peak Ferry Riders	Implied Growth
Base Year (2006)	23,200	
Year 2010	24,200	
Year 2020	28,000	
Year 2030	31,900	
Growth Rate:		
2006 to 2010		4.3%
2006 to 2020		20.7%
2006 to 2030		37.5%
2010 to 2020		15.7%
2020 to 2030		13.9%
% Annual Growth:		
2006 to 2010		1.06%
2006 to 2020		1.35%
2006 to 2030		1.34%
2010 to 2020		1.47%
2020 to 2030		1.31%

Table 2.2d – District-Level Stage 1 Ferry Ridership Forecasts Comparison - Trip Ends for PM Origins

District	Stage 1 PM Peak Riders by PM Origins				Ratio of Future Year Riders over Base Year (2006) Riders		
	2006	2010	2020	2030	2010	2020	2030
1 Seattle CBD	3,880	4,030	4,470	4,820	1.04	1.15	1.24
2 Capital Hill	1,070	1,090	1,170	1,190	1.02	1.09	1.11
3 Queen Ann	930	970	1,160	1,260	1.04	1.25	1.35
4 Rainier Valley	860	880	950	1,050	1.02	1.10	1.22
5 W/S Seattle	240	240	280	330	1.00	1.17	1.38
6 N Seattle	1,360	1,390	1,570	1,720	1.02	1.15	1.26
7 S King County	1,010	1,030	1,170	1,340	1.02	1.16	1.33
8 Greater Eastside	1,160	1,240	1,450	1,640	1.07	1.25	1.41
9 E King County	10	10	10	10	1.00	1.00	1.00
10 Tacoma	370	380	440	500	1.03	1.19	1.35
11 Pierce County	20	20	20	20	1.00	1.00	1.00
12 Greater Everett	2,080	2,200	2,640	3,080	1.06	1.27	1.48
13 Snohomish	30	30	40	40	1.00	1.33	1.33
14 Vashon	1,250	1,230	1,330	1,470	0.98	1.06	1.18
15 Bainbridge Island	670	680	800	940	1.01	1.19	1.40
16 S Kitsap	240	250	290	350	1.04	1.21	1.46
17 N Kitsap	570	600	750	910	1.05	1.32	1.60
18 Central Kitsap	320	340	390	440	1.06	1.22	1.38
19 Bremerton	590	610	680	750	1.03	1.15	1.27
20 Thurston County	50	50	60	70	1.00	1.20	1.40
21 Mason County	100	160	200	240	1.60	2.00	2.40
22 Jefferson County	490	530	630	740	1.08	1.29	1.51
23 Clallam County	420	430	490	580	1.02	1.17	1.38
24 Island County	1,020	1,290	1,560	1,890	1.26	1.53	1.85
25 Skagit County	1,320	1,410	1,650	1,930	1.07	1.25	1.46
26 Whatcom County	320	320	380	450	1.00	1.19	1.41
27 San Juan County	2,590	2,600	3,110	3,770	1.00	1.20	1.46
28 B.C.[1]	210	250	300	330	1.19	1.43	1.57
Total	**23,180**	**24,260**	**27,990**	**31,860**	**1.05**	**1.21**	**1.37**

[1]Both households and employment are not available, border crossing estimates was used as surrogate.

Table 2.2e - District-Level Stage 1 Ferry Ridership Forecasts Comparison - Trip Ends for PM Destinations

District	Stage 1 PM Peak Riders by PM Destinations				Ratio of Future Year Riders over Base Year (2006) Riders		
	2006	2010	2020	2030	2010	2020	2030
1 Seattle CBD	520	590	680	860	1.13	1.31	1.65
2 Capital Hill	380	370	400	420	0.97	1.05	1.11
3 Queen Ann	370	390	500	570	1.05	1.35	1.54
4 Rainier Valley	220	210	220	230	0.95	1.00	1.05
5 W/S Seattle	400	390	390	390	0.98	0.98	0.98
6 N Seattle	1,040	1,020	1,080	1,120	0.98	1.04	1.08
7 S King County	650	650	710	760	1.00	1.09	1.17
8 Greater Eastside	600	610	690	730	1.02	1.15	1.22
9 E King County	80	80	100	110	1.00	1.25	1.38
10 Tacoma	150	160	180	190	1.07	1.20	1.27
11 Pierce County	40	40	50	50	1.00	1.25	1.25
12 Greater Everett	1,080	1,140	1,340	1,460	1.06	1.24	1.35
13 Snohomish	50	60	70	70	1.20	1.40	1.40
14 Vashon	1,630	1,620	1,720	1,780	0.99	1.06	1.09
15 Bainbridge Island	2,950	3,020	3,500	3,880	1.02	1.19	1.32
16 S Kitsap	1,160	1,190	1,360	1,500	1.03	1.17	1.29
17 N Kitsap	2,030	2,110	2,560	2,990	1.04	1.26	1.47
18 Central Kitsap	670	690	810	890	1.03	1.21	1.33
19 Bremerton	1,500	1,480	1,600	1,740	0.99	1.07	1.16
20 Thurston County	70	70	90	100	1.00	1.29	1.43
21 Mason County	200	220	270	310	1.10	1.35	1.55
22 Jefferson County	660	660	760	850	1.00	1.15	1.29
23 Clallam County	370	400	450	490	1.08	1.22	1.32
24 Island County	2,280	2,480	2,910	3,310	1.09	1.28	1.45
25 Skagit County	920	940	1,090	1,580	1.02	1.18	1.72
26 Whatcom County	420	450	510	570	1.07	1.21	1.36
27 San Juan County	2,530	2,730	3,210	3,640	1.08	1.27	1.44
28 B.C.[1]	230	280	320	340	1.22	1.39	1.48
Total	**23,200**	**24,050**	**27,570**	**30,930**	**1.04**	**1.19**	**1.33**

[1]Both households and employment are not available, border crossing estimates was used as surrogate.

2.3 Stage 2 Forecasting Analysis (Route-Level Ferry Ridership Forecasts)

Stage 1 forecast representing total PM peak ferry travel patterns for a future year. This is input into the WSF model for production of route-level ridership forecasts. The WSF model includes:

- An incremental model for method of boarding between walk-ons and auto-boardings;
- A subchoice incremental model for walk-ons; and
- A subchoice incremental model for auto boardings.

Matrices representing level of service related variables used in the mathematical equations for the auto-board and walk-board mode of access and egress choices are generated from the procedures described in the *"Washington State Ferries Travel Forecasting Methodology Report,"* prepared by Parsons Brinckerhoff, Inc., Seattle, Washington, March 2005. WSF travel

forecasting model was used to produce route-level PM peak ridership forecasts for scenario of interest. Ridership forecasting analysis was performed for the Baseline Alternative.

Baseline Alternative Definition

The Baseline alternative assumes that ferry service remains similar to current service levels, with some modest capacity improvements on some routes resulting from replacing retiring vessels with ones slightly larger.

Levels of service (LOS) for the Baseline Alternative were defined by WSF and are shown in Table 2.3a. Underlying assumptions were documented in a memorandum, entitled *"WSF Base Year and Future Baseline – Key Assumptions," dated April 8, 2008* prepared by Parsons Brinckerhoff, Inc*.,* Seattle, Washington. This document includes fare assumptions used in the WSF planning model, highlighted below.

Fare Assumptions

The fares that went into effect on May 1, 2006 serve as the basis for creating blended passenger and vehicle/driver fares for input to the WSF Planning Model. Specifically, the Planning Model requires as input one fare for passengers and one fare for vehicles including drivers on each route, which are calculated as weighted averages of various posted fares. The weighting scheme considers the distribution of ridership across different fare categories as well as the blending of ridership between summer surcharge/peak season and non-peak season for applicable fare categories. The fare inputs for the San Juan Islands routes uses fares already blended to reflect early week (Sunday-Tuesday) and late week (Wednesday-Saturday) fares. Note that the fare inputs prepared for Planning Model use were intended for measuring changes in travel behavior reflected in relative fare differences by route and mode, and were not anticipated to be used for revenue calculations. For example, the model vehicle fares reflect a blend of regular and discounted auto fares, but excludes weighting factors and corresponding higher fares for oversize/commercial vehicles.

The WSF Planning Model is designed for general planning purposes and not for predicting the specific characteristics of each fare category, particularly those of commercial truck movements. For future Baseline years, fare assumptions were based on the WSF Revenue Forecast Scenario#2 ("Baseline Fare Increases"), which assumes 2.5% fare increases each October beginning in 2009 (FY 2010), rounded up to the nearest nickel. This was assumed for future years through October 2024 (FY 2025). Beyond 2025, fares were assumed to increase with projected inflation, using the November 2007 projection produced by the Washington State Office of Financial Management (OFM) for the Implicit Price Deflector for Personal Consumption. The November 2007 projection for this index yields an average annual inflation rate of approximately 2.0% per year.

Table 2.3a - Level-of-Service (LOS) Attributes Definition

Base Year (2006) & 2010/2020/2030 Baseline Alternative

Ferry Route	*Headway (minutes)*				*Crossing Time (minutes)*				*Sailings (PM Peak Period)*				*Average Vessel Capacity (vehicles)*				*One-Way PASSENGER FARE for Modeling in Each Direction [1] (Constant 2006 Dollars)*				*One-Way VEHICLE/DRIVER FARE for Modeling in Each Direction [1] (Constant 2006 Dollars)*			
	2006	*2010*	*2020*	*2030*	*2006*	*2010*	*2020*	*2030*	*2006*	*2010*	*2020*	*2030*	*2006*	*2010*	*2020*	*2030*	*2006*	*2010*	*2020*	*2030*	*2006*	*2010*	*2020*	*2030*
Pt. Defiance-Tahlequah	55	55	55	55	15	15	15	15	5	5	5	5	48	50	50	50	$1.69	$1.66	$1.81	$1.88	$6.29	$6.14	$6.63	$6.85
Southworth-Vashon	61	61	61	61	10	10	10	10	4	4	4	4	65	73	73	73	$1.70	$1.67	$1.82	$1.89	$6.41	$6.26	$6.76	$6.98
Fauntleroy-Vashon	34	34	34	34	15	15	15	15	8	8	8	8	82	94	94	94	$1.71	$1.68	$1.83	$1.90	$6.23	$6.09	$6.57	$6.79
Fauntleroy-Southworth	40	40	40	40	30	30	30	30	6	6	6	6	54	67	67	67	$2.07	$2.05	$2.24	$2.32	$8.35	$8.13	$8.76	$9.08
Seattle-Southworth Passenger-Only[2]	85	85	85	85	55	55	55	55	2	2	2	2	—	—	—	—	$3.63	$5.18	$5.42	$5.52	—	—	—	—
Seattle-Vashon Passenger-Only[3]	85	85	85	85	30	30	30	30	2	2	2	2	—	—	—	—	$3.63	$3.51	$3.60	$3.63	—	—	—	—
Seattle-Bremerton	75	75	75	75	55	55	55	55	4	4	4	4	132	144	144	144	$2.74	$2.69	$2.94	$3.05	$11.20	$10.92	$11.79	$12.18
Seattle-Bainbridge Island	52	52	52	52	30	30	30	30	6	6	6	6	202	202	202	202	$2.70	$2.65	$2.90	$3.00	$10.77	$10.50	$11.34	$11.71
Edmonds-Kingston	41	41	41	41	25	25	25	25	6	6	6	6	196	196	196	196	$2.68	$2.63	$2.88	$2.98	$11.22	$10.94	$11.82	$12.20
Mukilteo-Clinton	30	30	30	30	15	15	15	15	9	9	9	9	124	136	136	136	$1.57	$1.55	$1.69	$1.75	$6.23	$6.06	$6.57	$6.77
Pt. Townsend-Keystone	45	45	45	45	30	30	30	30	6	6	6	6	64	60	60	60	$2.13	$2.11	$2.30	$2.38	$9.55	$9.29	$10.02	$10.38
San Juan Islands Domestic Route																								
Anacortes-Lopez	126	126	126	126	40	40	45	45	8	8	8	8	41	50	50	50	$4.40	$4.30	$4.64	$4.80	$11.64	$11.33	$12.09	$12.44
Anacortes-Shaw	178	178	178	178	68	68	62	62	6	6	6	6	9	9	9	9	$4.23	$4.13	$4.46	$4.61	$13.34	$12.97	$13.84	$14.24
Anacortes-Orcas	174	174	174	174	65	65	52	52	6	6	6	6	97	99	99	99	$4.63	$4.52	$4.88	$5.05	$14.99	$14.59	$15.57	$16.02
Anacortes-Friday Harbor	142	142	142	142	79	79	62	62	7	7	7	7	81	102	102	102	$4.64	$4.53	$4.89	$5.06	$17.25	$16.79	$17.91	$18.43
Lopez-Shaw	142	142	142	142	22	22	25	25	6	6	6	6	7	7	7	7	—	—	—	—	$7.26	$7.07	$7.54	$7.76
Lopez-Orcas	131	131	131	131	29	29	28	28	6	6	6	6	27	35	35	35	—	—	—	—	$7.26	$7.07	$7.54	$7.76
Lopez-Friday Harbor	143	143	143	143	66	66	59	59	7	7	7	7	24	30	30	30	—	—	—	—	$7.26	$7.07	$7.54	$7.76
Shaw-Orcas	155	155	155	155	10	10	10	10	6	6	6	6	9	9	9	9	—	—	—	—	$7.26	$7.07	$7.54	$7.76
Shaw-Friday Harbor	172	172	172	172	61	61	68	68	6	6	6	6	6	6	6	6	—	—	—	—	$7.26	$7.07	$7.54	$7.76
Orcas-Friday Harbor	157	157	157	157	46	46	49	49	6	6	6	6	42	57	57	57	—	—	—	—	$7.26	$7.07	$7.54	$7.76
Sidney, B.C. International Route													*WB* / *EB*	*WB* / *EB*	*WB* / *EB*	*WB* / *EB*								
Anacortes-Sidney B.C.	Daily (180)	Daily (180)	Daily (180)	Daily (180)	183	183	183	183	1	1	1	1	72 / 72	62 / 62	62 / 62	62 / 62	$13.36	$13.04	$14.04	$14.50	$47.15	$45.88	$48.91	$50.33
Orcas-Sidney, B.C. (westbound only)	Daily (180)	Daily (180)	Daily (180)	Daily (180)	125	125	125	125	1	1	1	1	18 / —	16 / —	16 / —	16 / —	$9.47	$9.24	$9.95	$10.27	$33.39	$32.49	$34.63	$35.64
Friday Harbor-Sidney, B.C.	Daily (180)	Daily (180)	Daily (180)	Daily (180)	88	88	88	88	1	1	1	1	36 / 19	31 / 19	31 / 19	31 / 19	$9.47	$9.24	$9.95	$10.27	$33.39	$32.49	$34.63	$35.64

[1] Fares are one-way weighted averages reflecting each route's distribution of fare categories.

[2] Reflects a transfer connection on Vashon Island between the Seattle-Vashon Passenger-Only and Southworth-Vashon ferries in 2006 and 2010, with new King County passenger-only terminal at Southworth constructed in 2012. Fares in 2020 and 2030 are lower than those in 2010 because of direct passenger-only service between Seattle and Southworth starting in 2012.

[3] Assumes King County will take over Seattle - Vashon service in 2008. Fare escalation is assumed to be same as WSF.

Baseline Ridership Demand Estimates

Baseline PM peak ridership estimates for 2010, 2020, and 2030 are shown for the westbound and eastbound directions in Tables 2.3b and 2.3c, respectively. Implied growth in ridership relative to 2010 is also shown in Tables 2.3b and 2.3c. This reflects suggestion provided by the peer review team to compare change in Baseline ridership to 2010 rather than to 2006 for the purpose of consistency in the underlying processes.

Ridership estimates shown in Table 2.3b and 2.3c reflect a number of post-modeling steps subsequently applied to “raw” results from the WSF travel forecasting model:

- Implied growth relative to base year (2006) exhibited in “raw” model results were incrementally applied to “actual” ridership for each route. This was intended to establish a more streamlined Baseline demand estimates;
- Mode split estimates exhibited in ridership for the San Juan market did not seem realistic. This had primarily been caused by sparse survey data in the model database for the Inter-island market. The peer review team reached a consensus on post-processing of mode split for this market based on relying on implied growth in ridership in the WSF Revenue Model for this market. The post processing of daily vehicle-board and walk-board did not alter total ridership produced from the WSF travel forecasting.

Table 2.3b - Year 2010, 2020 & 2030 PM Peak (3:00-7:00) Weekday Ferry Ridership Estimates[1] by Boarding Method (Westbound)

- Baseline Alternative -

Ferry Route	2010 Total Veh.	2010 Total Riders	2010 Walk-On Pass.	2010 Walk-On Share	2020 Total Veh.	2020 Difference to 2010	2020 % Change to 2010	2020 Total Riders	2020 Difference to 2010	2020 % Change to 2010	2020 Walk-On Pass.	2020 Difference to 2010	2020 % Change to 2010	2020 Walk-On Share	2030 Total Veh.	2030 Difference to 2010	2030 % Change to 2010	2030 Total Riders	2030 Difference to 2010	2030 % Change to 2010	2030 Walk-On Pass.	2030 Difference to 2010	2030 % Change to 2010	2030 Walk-On Share
Point Defiance - Tahlequah	240	320	70	22%	260	20	8%	360	40	13%	80	10	14%	22%	260	20	8%	370	50	16%	100	30	43%	27%
Vashon - Southworth	50	70	10	14%	70	20	40%	100	30	43%	20	10	100%	20%	100	50	100%	150	80	114%	20	10	100%	13%
Fauntleroy - Vashon	670	1,120	200	18%	660	-10	-1%	1,150	30	3%	230	30	15%	20%	630	-40	-6%	1,060	-60	-5%	170	-30	-15%	16%
Fauntleroy - Southworth	460	960	260	27%	590	130	28%	1,250	290	30%	320	60	23%	26%	590	130	28%	1,370	410	43%	420	160	62%	31%
Subtotal	**1,420**	**2,470**	**540**	**22%**	**1,580**	160	11%	**2,860**	390	16%	**650**	110	20%	**23%**	**1,580**	160	11%	**2,950**	480	19%	**710**	170	31%	**24%**
Seattle - Southworth Passenger Only[2]	N/A	20	20	100%	N/A	N/A	N/A	30	10	50%	30	10	50%	100%	N/A	N/A	N/A	30	10	50%	30	10	50%	100%
Seattle - Vashon Passenger Only	N/A	90	90	100%	N/A	N/A	N/A	120	30	33%	120	30	33%	100%	N/A	N/A	N/A	220	130	144%	220	130	144%	100%
Subtotal		**110**	**110**	**100%**				**150**	40	36%	**150**	40	36%	**100%**				**250**	140	127%	**250**	140	127%	**100%**
Seattle - Bremerton	440	1,730	1,060	61%	470	30	7%	1,830	100	6%	1,090	30	3%	60%	570	130	30%	2,160	430	25%	1,270	210	20%	59%
Seattle - Bainbridge Island	1,060	4,290	2,660	62%	1,290	230	22%	5,210	920	21%	3,170	510	19%	61%	1,540	480	45%	5,970	1,680	39%	3,480	820	31%	58%
Edmonds - Kingston	1,340	2,450	390	16%	1,400	60	4%	2,650	200	8%	490	100	26%	18%	1,380	40	3%	2,780	330	13%	670	280	72%	24%
Subtotal	**2,840**	**8,470**	**4,110**	**49%**	**3,160**	320	11%	**9,690**	1,220	14%	**4,750**	640	16%	**49%**	**3,490**	650	23%	**10,910**	2,440	29%	**5,420**	1,310	32%	**50%**
Mukilteo - Clinton	1,050	2,110	510	24%	1,140	90	9%	2,430	320	15%	660	150	29%	27%	1,160	110	10%	2,720	610	29%	910	400	78%	33%
Port Townsend - Keystone	170	410	20	5%	210	40	24%	520	110	27%	30	10	50%	6%	280	110	65%	690	280	68%	50	30	150%	7%
Subtotal	**1,220**	**2,520**	**530**	**21%**	**1,350**	130	11%	**2,950**	430	17%	**690**	160	30%	**23%**	**1,440**	220	18%	**3,410**	890	35%	**960**	430	81%	**28%**
Total	**5,480**	**13,570**	**5,290**	**39%**	**6,090**	610	11%	**15,650**	2,080	15%	**6,240**	950	18%	**40%**	**6,510**	1,030	19%	**17,520**	3,950	29%	**7,340**	2,050	39%	**42%**
Anacortes-San Juan Islands																								
All Vessels To/From Anacortes[3]	1,060	2,140	230	11%	1,230	170	16%	2,470	330	15%	260	30	13%	11%	1,400	340	32%	2,920	780	36%	400	170	74%	14%
Inter-Island Vessel Only[2]	100	240	50	21%	140	40	40%	320	80	33%	70	20	40%	22%	160	60	60%	370	130	54%	80	30	60%	22%
Anacortes/San Juan islands-Sidney, B.C.[3]	40	140	20	14%	40	0	0%	160	20	14%	20	0	0%	13%	50	10	25%	170	30	21%	20	0	0%	12%
									0															
Total	**1,200**	**2,520**	**300**	**12%**	**1,410**	210	18%	**2,950**	430	17%	**350**	50	17%	**12%**	**1,610**	410	34%	**3,460**	940	37%	**500**	200	67%	**14%**
Grand Total	**6,680**	**16,090**	**5,590**	**35%**	**7,500**	820	12%	**18,600**	2,510	16%	**6,590**	**1,000**	18%	**35%**	**8,120**	1,440	22%	**20,980**	4,890	30%	**7,840**	**2,250**	40%	**37%**

[1]Ridership estimates were derived based on applying implied growth to actual base year (2006) ridership on each route. Mode split estimates for San Juan Islands routes required a post-processing step because of inadequate survey data for this market.
[2]This route reflects transfer connection on Vashon Island between Seattle-Vashon Passenger-Only and Southworth-Vashon routes.
[3]Represents daily ridership for the San Jaun routes.

Table 2.3c - Year 2010, 2020 & 2030 PM Peak (3:00-7:00) Weekday Ferry Ridership Estimates[1] by Boarding Method (Eastbound)

- Baseline Alternative -

Ferry Route	2010 Total Veh.	2010 Total Riders	2010 Walk-On Pass.	2010 Walk-On Share	2020 Total Veh.	2020 Difference to 2010	2020 % Change to 2010	2020 Total Riders	2020 Difference to 2010	2020 % Change to 2010	2020 Walk-On Pass.	2020 Difference to 2010	2020 % Change to 2010	2020 Walk-On Share	2030 Total Veh.	2030 Difference to 2010	2030 % Change to 2010	2030 Total Riders	2030 Difference to 2010	2030 % Change to 2010	2030 Walk-On Pass.	2030 Difference to 2010	2030 % Change to 2010	2030 Walk-On Share
Point Defiance - Tahlequah	60	90	10	11%	60	0	0%	100	10	11%	20	10	100%	20%	70	10	17%	110	20	22%	10	0	0%	9%
Vashon - Southworth	50	70	0	0%	70	20	40%	90	20	29%	0	0	N/A	0%	110	60	120%	130	60	86%	10	10	N/A	8%
Fauntleroy - Vashon	610	1,100	180	16%	640	30	5%	1,170	70	6%	180	0	0%	15%	700	90	15%	1,270	170	15%	180	0	0%	14%
Fauntleroy - Southworth	140	180	10	6%	160	20	14%	210	30	17%	10	0	0%	5%	150	10	7%	210	30	17%	10	0	0%	5%
Subtotal	**860**	**1,440**	**200**	**14%**	**930**	70	8%	**1,570**	130	9%	**210**	10	5%	**13%**	**1,030**	170	20%	**1,720**	280	19%	**210**	10	5%	**12%**
Seattle - Southworth Passenger Only[2]	N/A	0	0	N/A	N/A	N/A	N/A	0	0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	0	0	N/A	0	0	N/A	N/A
Seattle - Vashon Passenger Only	N/A	30	30	100%	N/A	N/A	N/A	30	0	0%	30	0	0%	100%	N/A	N/A	N/A	50	20	67%	50	20	67%	100%
Subtotal		**30**	**30**	**100%**				**30**	0	0%	**30**	0	0%	**100%**				**50**	20	67%	**50**	20	67%	**100%**
Seattle - Bremerton	330	600	180	30%	350	20	6%	640	40	7%	200	20	11%	31%	400	70	21%	730	130	22%	210	30	17%	29%
Seattle - Bainbridge Island	630	1,060	150	14%	660	30	5%	1,120	60	6%	170	20	13%	15%	770	140	22%	1,330	270	25%	200	50	33%	15%
Edmonds - Kingston	650	1,010	70	7%	850	200	31%	1,320	310	31%	80	10	14%	6%	880	230	35%	1,420	410	41%	100	30	43%	7%
Subtotal	**1,610**	**2,670**	**400**	**15%**	**1,860**	250	16%	**3,080**	410	15%	**450**	50	13%	**15%**	**2,050**	440	27%	**3,480**	810	30%	**510**	110	28%	**15%**
Mukilteo - Clinton	670	1,010	30	3%	780	110	16%	1,170	160	16%	40	10	33%	3%	880	210	31%	1,310	300	30%	40	10	33%	3%
Port Townsend - Keystone	190	410	40	10%	240	50	26%	520	110	27%	50	10	25%	10%	310	120	63%	700	290	71%	100	60	150%	14%
Subtotal	**860**	**1,420**	**70**	**5%**	**1,020**	160	19%	**1,690**	270	19%	**90**	20	29%	**5%**	**1,190**	330	38%	**2,010**	590	42%	**140**	70	100%	**7%**
Total	**3,330**	**5,560**	**700**	**13%**	**3,810**	480	14%	**6,370**	810	15%	**780**	80	11%	**12%**	**4,270**	940	28%	**7,260**	1,700	31%	**910**	210	30%	**13%**
Anacortes-San Juan Islands																								
All Vessels To/From Anacortes[3]	1,060	2,140	230	11%	1,230	170	16%	2,470	330	15%	260	30	13%	11%	1,400	340	32%	2,920	780	36%	400	170	74%	14%
Inter-Island Vessel Only[2]	100	240	50	21%	140	40	40%	320	80	33%	70	20	40%	22%	160	60	60%	370	130	54%	80	30	60%	22%
Anacortes/San Juan islands-Sidney, B.C.[3]	40	140	20	14%	40	0	0%	160	20	14%	20	0	0%	13%	50	10	25%	170	30	21%	20	0	0%	12%
									0															
Total	**1,200**	**2,520**	**300**	**12%**	**1,410**	210	18%	**2,950**	430	17%	**350**	50	17%	**12%**	**1,610**	410	34%	**3,460**	940	37%	**500**	200	67%	**14%**
Grand Total	**4,530**	**8,080**	**1,000**	**12%**	**5,220**	690	15%	**9,320**	1,240	15%	**1,130**	**130**	13%	**12%**	**5,880**	1,350	30%	**10,720**	2,640	33%	**1,410**	**410**	41%	**13%**

[1]Ridership estimates were derived based on applying implied growth to actual base year (2006) ridership on each route. Mode split estimates for San Juan Islands routes required a post-processing step because of inadequate survey data for this market.
[2]This route reflects transfer connection on Vashon Island between Seattle-Vashon Passenger-Only and Southworth-Vashon routes.
[3]Represents daily ridership for the San Jaun routes.

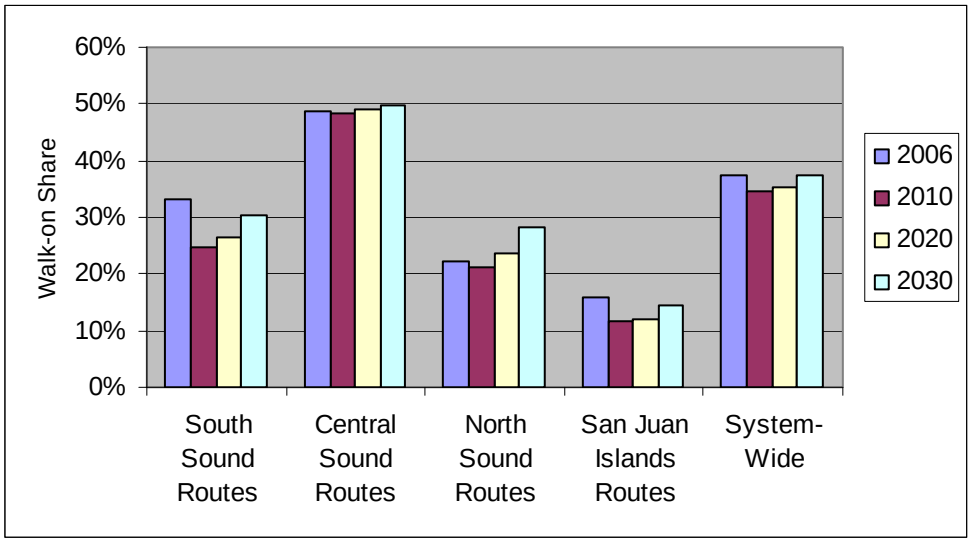
Table 2.3d highlights system-wide PM peak ridership demand and mode share estimates. Estimated system-wide walk-on share has slightly decreased in the intermediate 2010 and 2020 years and comes within 1% of base year 30% walk-on share in 2030.

Table 2.3d - System-Wide PM Peak Baseline Ridership Demand & Mode Share Estimates

					2006 - 2030		2010 - 2030	
	2006	2010	2020	2030	% Growth	% Annual Growth	% Growth	% Annual Growth
Walk-on	6,960	6,565	7,720	9,270	33%	1.20%	41%	1.74%
Auto-Board (Drivers+Passengers)	16,240	17,635	20,280	22,630	39%	1.39%	28%	1.25%
Total Riders	**23,200**	**24,200**	**28,000**	**31,900**	**38%**	**1.34%**	**32%**	**1.39%**
Walk-on Share	30%	27%	28%	29%				
Auto-Board Share	70%	73%	72%	71%				
Average Auto Occupancy (AVO)	**1.52**	**1.57**	**1.59**	**1.61**	**6%**	**0.24%**	**3%**	**0.13%**

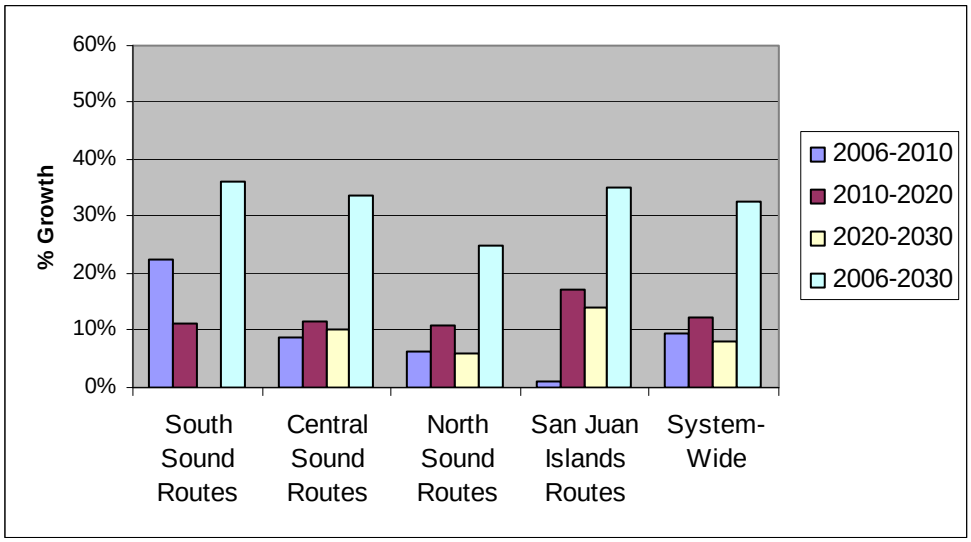
Westbound walk-on share estimates are highlighted in Figure 2.3a. Share of walk-on ridership is most pronounced for the Central Sound Routes (about 50%) and estimated to remain constant between 2006 and 2030. System-wide walk-on share in 2030 is estimated to be about 37%, similar to base year walk-on share as shown in Figure 2.3a.

Figure 2.3a - Baseline PM Peak Walk-on Share Estimates - Westbound



An estimate of growth profile in vehicle-board is shown in Figure 2.3b for the westbound direction. This figure indicated that the rate of growth in vehicle-board in peak direction is over 30% (or over 1% on the average annual basis) between 2006 and 2030 for each market, except for North Sound Routes, which is about 25% growth.

Figure 2.3b - Baseline PM Peak Growth Estimates in Vehicle-Board (Westbound)



Baseline ridership demand estimates presented above were thoroughly reviewed and evaluated by the peer review team members. Consensus was reached by the peer review team that they are reasonable to support the LRSP development process.

3.0 RIDERSHIP FORECASTING ANALYSIS - "RECONCILIATION" BETWEEN PLANNING & REVENUE MODELS

This section presents the methodology used to develop post-model factors for expanding weekday PM peak period baseline forecasts from the WSF Planning Model to monthly and annual ridership forecasts; in other words, a way to expand the results for peak period forecasts to a forecast of total ridership for all times and all routes. PM peak period-to-monthly expansion factors are provided, as well as total annual and average annual daily ridership forecasts by route. Finally, the annual ridership forecasts are compared with annual ridership forecasts derived from the WSF Revenue Model.

3.1 Expansion Factor Development and Application

Expansion factors were developed by calculating the ratios between Weekday PM Peak Period ridership from the 2006 Base Year model and historical monthly ridership for 2006, retrieved from WSF point-of-sale fare collection data. This was done for each month and for each route, by two broad fare categories (vehicle driver fares and walk-on / in-vehicle passenger fares), with both directions combined. An example of this calculation is shown below for the Seattle – Bainbridge Island route.

2006 "count" for typical weekday PM peak vehicles/drivers (westbound): 1,682

January 2006 actual vehicles/drivers: 162,002

Typical Weekday (to January) Expansion Factor for vehicles/drivers:

162,002 / 1,682 = 96.3

The expansion factors were then used to expand 2010, 2020, and 2030 Weekday PM Peak Period ridership forecasts to monthly forecasts, assuming that the expansion factors remain constant over time. An example of this calculation is shown below for the Seattle – Bainbridge Island route.

2020 forecast for typical weekday PM peak vehicles/drivers: 1,943

Estimated expanded forecast for January 2020 vehicles/drivers:

1,943 × 96.3 = 187,111 vehicle drivers

The resulting monthly ridership forecasts, summed for all fare categories, were then summed to estimate total annual ridership forecasts by route.

3.2 Results

Table 3.2a provides a comparison of the annual expanded ridership forecasts from the WSF Planning Model with annual ridership forecasts from the WSF Revenue Model, the latter from the June 2008 forecast. As shown in Table 3.2a, the total system-wide 2020 ridership forecasts produced by the two models are within 2% of each other.

It should be noted that while the two models compared in Table 3.2a reflect similar level of service attribute assumptions, the two models are intended to be used for different purposes. Key differences are illustrated in Table 3.2b, in which the two models are compared in the context of their relative resolution, forecast emphasis, horizon continuity, and update frequency.

The WSF Planning Model is designed to predict directional demand for travel for the PM peak period within a typical weekday, for two fare categories. Inputs to the forecast are limited to two or three horizon years. In contrast, the WSF Revenue Model is designed to forecast ridership and resulting revenue for monthly, quarterly and/or annual periods by six fare categories. It has more precision by fare category but its more aggregated time resolution does not identify any directional differences. The Revenue Model is designed to react to economic and demographic inputs that are updated quarterly, and the resolution of those inputs allows for projections for each month of the forecast horizon.

Table 3.2b - Model Comparison: WSF Planning Model vs. Revenue Model

	WSF Planning Model	Revenue Model
Ridership estimate period	Typical weekday PM Peak by route	Monthly, quarterly, and annual ridership by route
Fares	3 modes over 2 blended fare categories	6 fare categories
Forecast Horizon	Every 10 years (2010, 2020,2030)	Monthly, Quarterly, Yearly
Forecast Frequency	Typically every 1 to 3 years	Every quarter

Table 3.2a - Ridership Forecast Comparison: WSF Planning Model vs. WSF Revenue Model (June 2008 Forecast)

	Total Ridership				Vehicle / Driver Fare Ridership				Passenger Fare Ridership			
Ridership by Forecasting Model	***CY 2006****	***FY 2010***	***FY 2020***	***FY 2030***	***CY 2006***	***FY 2010***	***FY 2020***	***FY 2030***	***CY 2006****	***FY 2010***	***FY 2020***	***FY 2030***
Planning Model – PM Peak Total	22,910	24,000	27,720	31,410	10,690	11,200	12,690	13,960	12,220	12,800	15,020	17,440
Planning Model – Expanded Annual Totals	23,809,700	25,113,000	29,011,000	32,693,000	10,855,500	11,441,000	12,904,000	14,082,000	12,954,200	13,672,000	16,107,000	18,611,000
Revenue Model – Annual Totals	23,809,700	24,391,700	28,716,800	N/A	10,855,500	10,624,800	12,368,000	N/A	12,954,200	13,766,900	16,348,900	N/A
Revenue Model – Annual Totals (Unconstrained)	23,809,700	24,618,000	29,491,000	N/A	10,855,500	10,710,900	12,990,000	N/A	12,954,200	13,907,100	16,501,000	N/A

	Total Ridership				Vehicle / Driver Fare Ridership				Passenger Fare Ridership			
Percentage Growth from CY 2006 by Forecasting Model	***% Change Relative to CY 2006 >***	***CY 2006 – FY 2010***	***CY 2006 – FY 2020***	***CY 2006 – FY 2030***	***% Change Relative to CY 2006 >***	***CY 2006 – FY 2010***	***CY 2006 – FY 2020***	***CY 2006 – FY 2030***	***% Change Relative to CY 2006 >***	***CY 2006 – FY 2010***	***CY 2006 – FY 2020***	***CY 2006 – FY 2030***
Planning Model – PM Peak Total		4.8%	21.0%	37.1%		4.8%	18.7%	30.6%		4.7%	22.9%	42.7%
Planning Model – Expanded Annual Totals		5.5%	21.8%	37.3%		5.4%	18.9%	29.7%		5.5%	24.3%	43.7%
Revenue Model – Annual Totals		2.4%	20.6%	N/A		-2.1%	13.9%	N/A		6.3%	26.2%	N/A
Revenue Model – Annual Totals (Unconstrained)		3.4%	23.9%	N/A		-1.3%	19.7%	N/A		7.4%	27.4%	N/A

	Total Ridership				Vehicle / Driver Fare Ridership				Passenger Fare Ridership			
Planning Model Annual Differences from Revenue Model	***Difference re: Revenue Model >***	***FY 2010***	***FY 2020***	***FY 2030***	***Difference re: Revenue Model >***	***FY 2010***	***FY 2020***	***FY 2030***	***Difference re: Revenue Model >***	***FY 2010***	***FY 2020***	***FY 2030***
Planning vs. Revenue		721,300	294,200	N/A		816,200	536,000	N/A		(94,900)	(241,900)	N/A
% Planning vs. Revenue		3.0%	1.0%	N/A		7.7%	4.3%	N/A		(0.7%)	(1.5%)	N/A
Planning vs. Revenue (Unconstrained)		495,000	(480,000)	N/A		730,100	(86,000)	N/A		(235,100)	(394,000)	N/A
% Planning vs. Revenue (Unconstrained)		2.0%	(1.6%)	N/A		6.8%	(0.7%)	N/A		(1.7%)	(2.4%)	N/A

NOTES:
* Excludes Seattle-Vashon passenger-only service riders, including those transferrring to/from Southworth at Vashon, since this service will not be operated by WSF after FY 2008.
— The Revenue Model produces a capacity-constrained demand forecast whereby some vehicles are not served during times when demand exceeds capacity. Unconstrained demand is also presented for comparison.
— The sum of ridership by fare categories by forecast year may not match total ridership due to rounding.

4.0 RIDERSHIP FORECASTING ANALYSIS - SUMMER PEAK PERIODS & RECREATIONAL TRAVEL

This section presents the methodology used to develop post-model factors for converting weekday PM peak period baseline forecasts from the WSF Planning Model to ridership demand for other peak travel times. In addition, it also covers the development of procedures for assessing growth in recreational travel and adjusting Planning Model forecasts to reflect the unique growth trend in recreational trips. Per a recommendation from the WSF forecasting review team, the adjusted forecasts accounting for the unique recreational travel trends are intended to be used as a sensitivity test to provide some additional context in WSF system planning as to the range of possible outcomes.

4.1 Analysis Objectives

This analysis included two major objectives:

1. Develop post-model factors for converting weekday PM peak period model forecasts to ridership demand for other peak travel times

2. Develop procedures for assessing growth in recreational travel and adjusting the Planning Model baseline forecasts to reflect unique growth trend(s) of recreational travel

    a. Estimate recreational share of total travel

    b. Estimate growth trend for recreational travel

4.2 Background

Engrossed Substitute House Bill (ESHB) 2358 requires that survey data be collected by WSF biennially to help inform level of service, operational, pricing, and investment decisions. Among other items, the survey must collect information on recreational use:

> *"The Commission must, with the involvement of the WSDOT, conduct a survey of ferry users to inform level of service, operational, pricing, planning, and investment decisions. Information is to be gathered on recreational users, vehicle and walk-on customers, freight movement, and reactions to possible operational strategies and pricing policies."*
>
> *Final Bill Report, ESHB 2358*

A WSF working group discussed what may constitute "recreational use." Ferry travel can be broadly categorized into two types of trips: "maintenance trips", e.g., commuting, appointments, regular shopping; and "discretionary trips". For the purpose of this analysis, recreational users, including tourists, were defined as a subset of the discretionary trip category.

The WSF Planning Model produces PM peak period ridership forecasts for a typical weekday. Given an interest in how various peak time periods differ from a typical weekday, the working group agreed that post-model conversion factors would be developed to provide ridership demand estimates for two categories of peak travel. The two categories are:

- A peak summer season weekday during the highest volume 4-hour PM peak period in each travel direction; and
- A peak summer season weekend day during the highest volume 4-hour peak period experienced on either a Saturday or Sunday in each travel direction.

4.3 Data Assembly and Analysis

Summer Peak Travel Periods

To estimate summer peak period ridership demand, it is necessary to factor up from the typical weekday conditions. The WSF ridership database was mined to yield weekend and weekday ridership by route, direction and vessel sailing time. For summer weekdays, ticket sales data were assembled and summarized for all Tuesdays, Wednesdays, and Thursdays in the months of July and August 2006. For summer weekends, data were assembled and summarized for all Saturdays and Sundays for the same months.

Identification of Peak Periods

Based on the assembled ticket sales data, the highest four hours of ridership was identified for each route by direction for weekdays, Saturdays, and Sundays during the peak summer months of July and August 2006. Table 4.3a shows the 4-hour peak periods that were identified for each route for peak direction volumes.

Table 4.3a - Summer Weekday and Weekend 4-hour Peak Periods

Route	Dir	4-hr Peak Period*		
		Weekday	Saturday	Sunday
Point Defiance - Tahlequah	Westbound	2:40pm - 6:40pm	2:40pm - 6:40pm	
	Eastbound	n/a		n/a
Vashon - Southworth	Westbound	n/a		n/a
	Eastbound	6:05am - 10:05am	12:00pm - 4:00pm	
Fauntleroy - Vashon	Westbound	4:00pm - 8:00pm	10:10am - 2:10pm	
	Eastbound	n/a		n/a
Fauntleroy - Southworth	Westbound	3:35pm - 7:35pm	8:35am - 12:35pm	
	Eastbound	4:30am - 8:30am		1:10pm - 5:10pm
Seattle - Bremerton	Westbound	3:00pm - 7:00pm	3:00pm - 7:00pm	
	Eastbound	6:20am - 10:20am		3:00pm - 7:00pm
Seattle - Bainbridge Island	Westbound	3:00pm - 7:00pm	10:40am - 2:40pm	
	Eastbound	6:20am - 10:20am		6:30pm - 10:30pm
Edmonds - Kingston	Westbound	2:30pm - 6:30pm	10:45am - 2:45pm	
	Eastbound	2:15pm - 6:15pm		10:50am - 2:50pm
Mukilteo - Clinton	Westbound	3:00pm - 7:00pm	10:30am - 2:30pm	
	Eastbound	7:00am - 11:00am		3:30pm - 7:30pm
Port Townsend - Keystone	Westbound	11:15am - 3:15pm	11:15am - 3:15pm	
	Eastbound	1:30pm - 5:30pm		2:15pm - 6:15pm
San Juan Domestic Routes	Westbound	All Day	All Day	
	Eastbound	All Day		All Day
Anacortes/San Juans-Sidney, B.C.	Westbound	All Day	All Day	
	Eastbound	All Day		All Day

Note: "n/a" indicates that TCC ticket sales information was not available for this direction

* Peak period for San Juan Island routes is all day

Estimation of Missing Data

Vehicle/driver fares are generally collected in both directions except for Vashon Island and the San Juan Island destinations, where they are collected in the “to island” (generally westbound) direction for a round-trip. Passenger fares are typically collected in the westbound or to island direction for a round trip. As a result, there is no passenger, in some cases, no vehicle/driver ridership data collected for the eastbound / from island vessel sailings. For cases where such ridership data are not available, ridership demand must be estimated. These cases included:

- Eastbound / From Island Weekday Peak Periods: For the Vashon Island routes, from-island ridership data is not collected, so the from island peak period volumes were assumed to be equal to the to island peak period volumes. For other routes, vehicle/driver fare data is available, so eastbound peak period passenger volumes were assumed to have the same proportional relationship to peak vehicle/driver volumes as in the westbound peak period.

- Eastbound Sunday Peak: Similar to the weekday case, for Vashon Island routes, from-island data is not collected, so Sunday from island peak period volumes were assumed to be equal to Saturday to island peak period volumes. For other routes, vehicle/driver fare data is available, so Sunday eastbound peak passenger volumes were assumed to have the same proportional relationship to peak vehicle/driver volumes as in the Saturday westbound peak period.

- Anacortes - San Juan Island routes: From-island or eastbound ridership data are not generally collected. Sunday eastbound daily ridership was assumed to be 20% greater than Saturday westbound daily ridership. For these routes, the peak period was defined as the entire day.

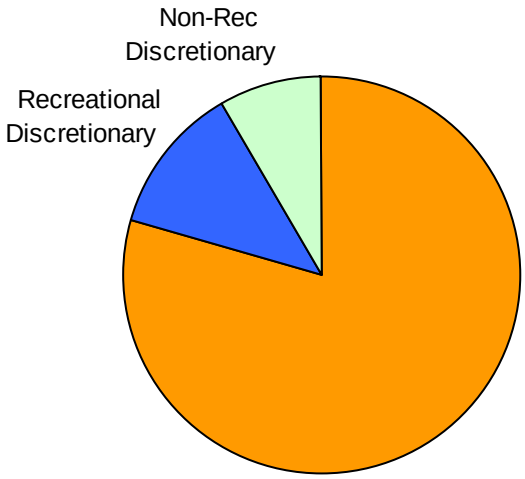
Recreational Travel Adjustment Sensitivity Test

The WSF Planning Model forecasts are driven from land use projections about where population growth, housing and employment will be located in the future. Arguably, recreational travel may not be as closely related to future land use as other discretionary and maintenance (or non-discretionary) trip purposes, defined in Table 4.3a. As such, an alternative method for extracting recreational trips, applying growth and recombining them with the Planning Model projections for other trip purposes was developed. Adjustments to reflect growth in recreational travel involved two major steps: 1) identification of the recreational share of total travel; and, 2) development of a growth rate to apply to that portion of ferry users.

Recreational Share of Total Travel

For the purpose of this analysis, recreational travel was assumed to be a subset of discretionary travel, which, along with maintenance trips, comprises total WSF ridership. Figure 4.3a illustrates the breakdown of WSF trip use types into maintenance and discretionary, and, further, the breakdown of discretionary travel into recreational and non-recreational.

Figure 4.3a - Illustration of Recreational Travel Relative to Total Travel



Data from the 2006 WSF travel survey were used to assess discretionary and the recreational subset shares of typical weekday PM peak period ridership as identified from existing 2006 ridership data. Table 4.3b shows how trip purpose categories from the 2006 travel survey instrument were defined for the purpose of this analysis.

Table 4.3a - Definition of Discretionary and Recreational

Survey Response	Trip Purpose Category		
	Maintenance	Discretionary (Recreational)	Discretionary (Non-Recreational)
I am going to/from my regular workplace	✓		
Business-related activity	✓		
School	✓		
Medical appointment	✓		
Sightseeing		✓	
Special Event		✓	
Shopping			✓
Social or recreational activity		✓*	✓*
Personal business/errand	✓		

Source: 2006 WSF Travel Survey

* Responses marked "social or recreational" were split evenly between Recreational and Non-Recreational

Note: if respondent indicated both a Maintenance and Discretionary trip purpose, then Maintenance was assumed

Due to limited sample sizes at the route level, data were grouped by routes into Vashon Island, South/Central Kitsap, Central/North Kitsap, North Sound, San Juans domestic, and International route groups. The weekday survey data was analyzed to determine a discretionary share and a recreational share for each route group.

The discretionary share of total trips and the recreational share of discretionary trips were ultimately used to arrive at recreational share of total trip. However, equivalent trip purpose data were not available for the summer peak periods of interest. Therefore, assumptions were made and procedures were developed to estimate the recreational travel shares for summer weekend peak periods and summer weekday peak periods.

Specifically, the percentage increase in ridership paying the full posted fare from average annual (typical) to summer (July/August) was used as a proxy for the summer increase in the discretionary travel share of total ridership. The assumption here is that any change in maintenance trips would be more likely than not to involve a discounted fare available to frequent users, especially during the summer when the peak season surcharge creates an extra incentive for relatively frequent users to avoid the full fare. A review of the limited summer survey data available from 1993 and 1999 supported and corroborated the use of the increase in full fare ticket sales as a proxy for the increase in discretionary trips. Furthermore, it was assumed that the summer growth in discretionary travel is composed predominantly of recreational trips, especially on weekends.

Table 4.3b shows the shares of total trips that are discretionary, Table 4.3c shows the shares of discretionary trips that are recreational, and Table 4.3d summarizes the resulting shares of total trips that represent recreational travel. Readily available data from the existing customer survey data could not provide appropriate information to facilitate identifying differences in discretionary and maintenance trips during all peak periods. This analysis, however, provided relevant feedback to collect such information with future (customer) surveys.

Table 4.3b - Percent Discretionary of Total Users

Route	% Discretionary of Total		
	Typical Weekday PM Peak	Summer Weekday Peak	Summer Weekend Peak
Point Defiance - Tahlequah	19%	28%	28%
Vashon - Southworth	19%	28%	28%
Fauntleroy - Vashon	19%	28%	28%
Fauntleroy - Southworth	7%	10%	10%
Seattle - Bremerton	7%	10%	10%
Seattle - Bainbridge Island	16%	22%	22%
Edmonds - Kingston	16%	22%	22%
Mukilteo - Clinton	28%	42%	42%
Port Townsend - Keystone	28%	42%	42%
San Juan Domestic Routes	34%	67%	67%
Anacortes/San Juans-Sidney, B.C.	54%	81%	81%

Source: 2006 WSF Travel Survey, 2006 WSF TSS ticket sales data

Table 4.3c - Percent Recreational of Discretionary Users

Route	% Recreational of Discretionary		
	Typical Weekday PM Peak	Summer Weekday Peak	Summer Weekend Peak
Point Defiance - Tahlequah	58%	64%	73%
Vashon - Southworth	58%	64%	73%
Fauntleroy - Vashon	58%	64%	73%
Fauntleroy - Southworth	73%	81%	92%
Seattle - Bremerton	73%	81%	92%
Seattle - Bainbridge Island	61%	67%	76%
Edmonds - Kingston	61%	67%	76%
Mukilteo - Clinton	52%	58%	65%
Port Townsend - Keystone	52%	58%	65%
San Juan Domestic Routes	62%	68%	78%
Anacortes/San Juans-Sidney, B.C.	74%	81%	92%

Source: 2006 WSF Travel Survey, 2006 WSF TSS ticket sales data

Table 4.3d - Percent Recreational of Total Users

Route	% Recreational of Total		
	Typical Weekday PM Peak	Summer Weekday Peak	Summer Weekend Peak
Point Defiance - Tahlequah	11%	18%	20%
Vashon - Southworth	11%	18%	20%
Fauntleroy - Vashon	11%	18%	20%
Fauntleroy - Southworth	5%	8%	9%
Seattle - Bremerton	5%	8%	9%
Seattle - Bainbridge Island	10%	15%	17%
Edmonds - Kingston	10%	15%	17%
Mukilteo - Clinton	14%	24%	27%
Port Townsend - Keystone	14%	24%	27%
San Juan Domestic Routes	21%	46%	52%
Anacortes/San Juans-Sidney, B.C.	40%	66%	75%

Source: 2006 WSF Travel Survey, 2006 WSF TSS ticket sales data

Recreational Travel Growth

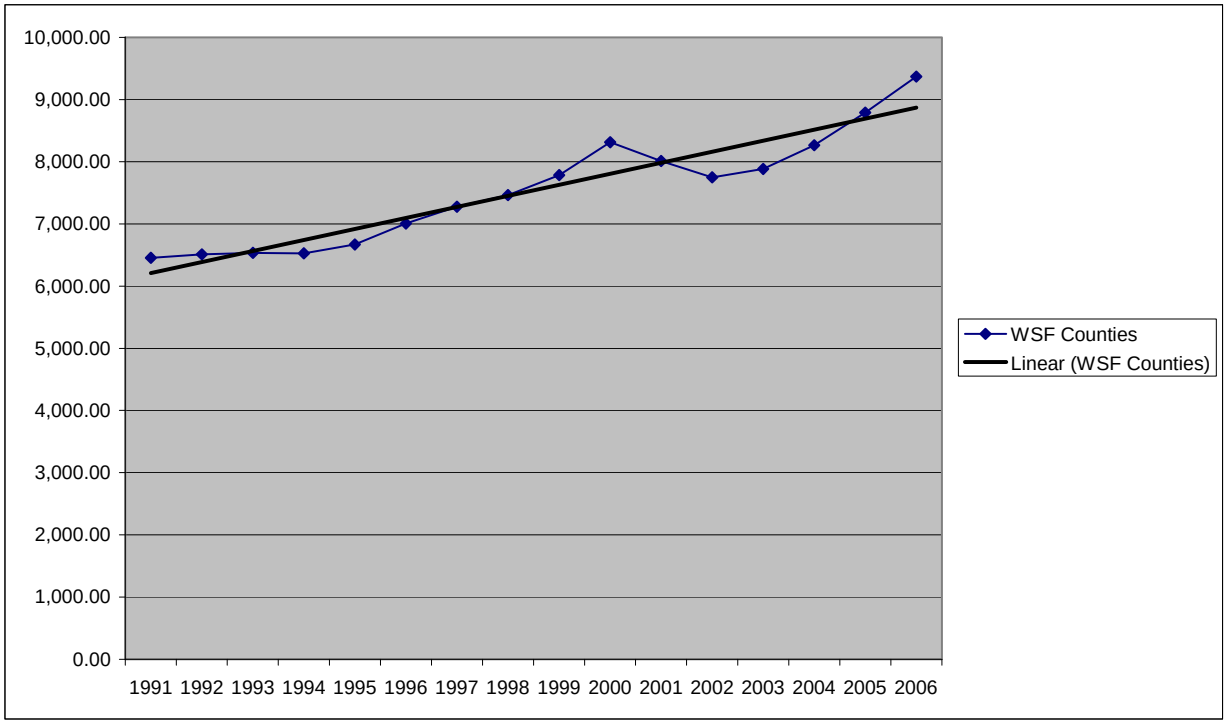
A recreational travel growth trend for ferry riders system-wide was estimated using data from the Washington State Tourism Office.[2] A growth trend for real expenditures in the tourism sector after accounting for inflation was identified from 1991-2006 for the eight counties served by WSF.[3] This was accomplished by calculating total travel spending for the eight counties for each year, converting the amounts to constant 2006 dollars to assess the real changes, and identifying the real growth trend. As described later in more detail, the resulting average annual growth rate for recreational travel of 2.41% per year was then applied to the recreational share of total ridership for each route.

Similar trend analyses were also conducted using travel spending data for just King County and the entire state of Washington. The resulting average annual growth rates of 2.37% and 2.31%, respectively, are similar to the growth rate calculated for the eight counties served by WSF, suggesting that data from King County, by far the largest of the eight counties, is not skewing the results.

[2] Washington State Travel Impacts & Visitor Volume (Dean Runyan Associates, December 2007)

[3] King, Snohomish, Pierce, Kitsap, Island, San Juan, Skagit, Jefferson

Figure 4.3b - Growth in Travel Spending in Counties Served by WSF 1991-2006 (millions of $)



Source: Washington State Travel Impacts & Visitor Volume (Dean Runyan Associates, December 2007)
Note: Spending amounts adjusted for inflation

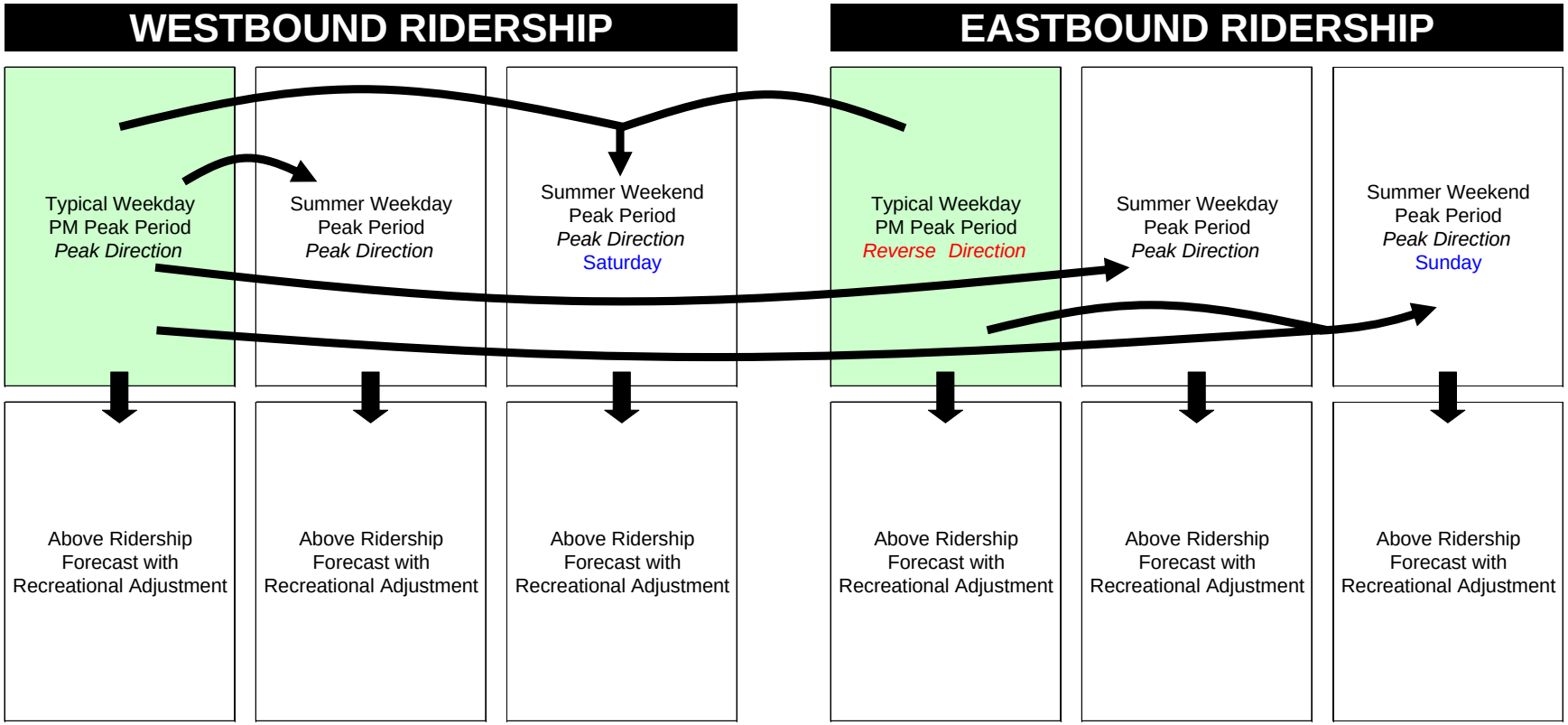
4.4 Forecast Processing For Summer Peak Periods and Recreational Travel

This section describes the methodology used to develop conversion factors for factoring from the typical weekday PM peak period (3-7pm) ridership forecasts — as produced by the WSF Planning Model — to Summer Weekday and Summer Weekend peak period ridership. The sensitivity test process to account for a unique growth rate in recreational travel is also documented in this section.

Figure 4.4a on the next page provides an illustration of the general approach taken in typical summer peak periods conversion process as well as for the recreational travel sensitivity test forecast adjustment.

As indicated by the arrows in Figure 4.4a, the conversion to summer peak periods was performed first in all cases, and the recreational travel adjustment is then applied to the periods of interest, as applicable.

Figure 4.4a - Ridership Conversion and Recreational Adjustment Analysis Flow Chart



The chart above shows the general approach taken in developing conversion factors for converting from the period modeled in the WSF Planning Model (Typical weekday PM peak period - shown in green boxes) to Summer Weekday and Summer Weekend peak periods. It also shows the approach in adjusting ridership forecasts to reflect growth in recreational travel. As illustrated in the chart, the westbound Typical weekday PM peak period volumes in the Planning Model are in the peak direction of travel, while eastbound PM peak period volumes are in the *reverse* direction of travel. However, the Summer Weekday and Summer Weekend volumes are all peak direction volumes. Therefore, conversion factors for Summer Weekday eastbound (peak direction) volumes were derived from Typical weekday westbound (peak direction) volumes, while conversion factors for Summer Weekend volumes in both directions were derived from an average of westbound and eastbound Typical weekday volumes.

Conversion to Summer Peak Periods

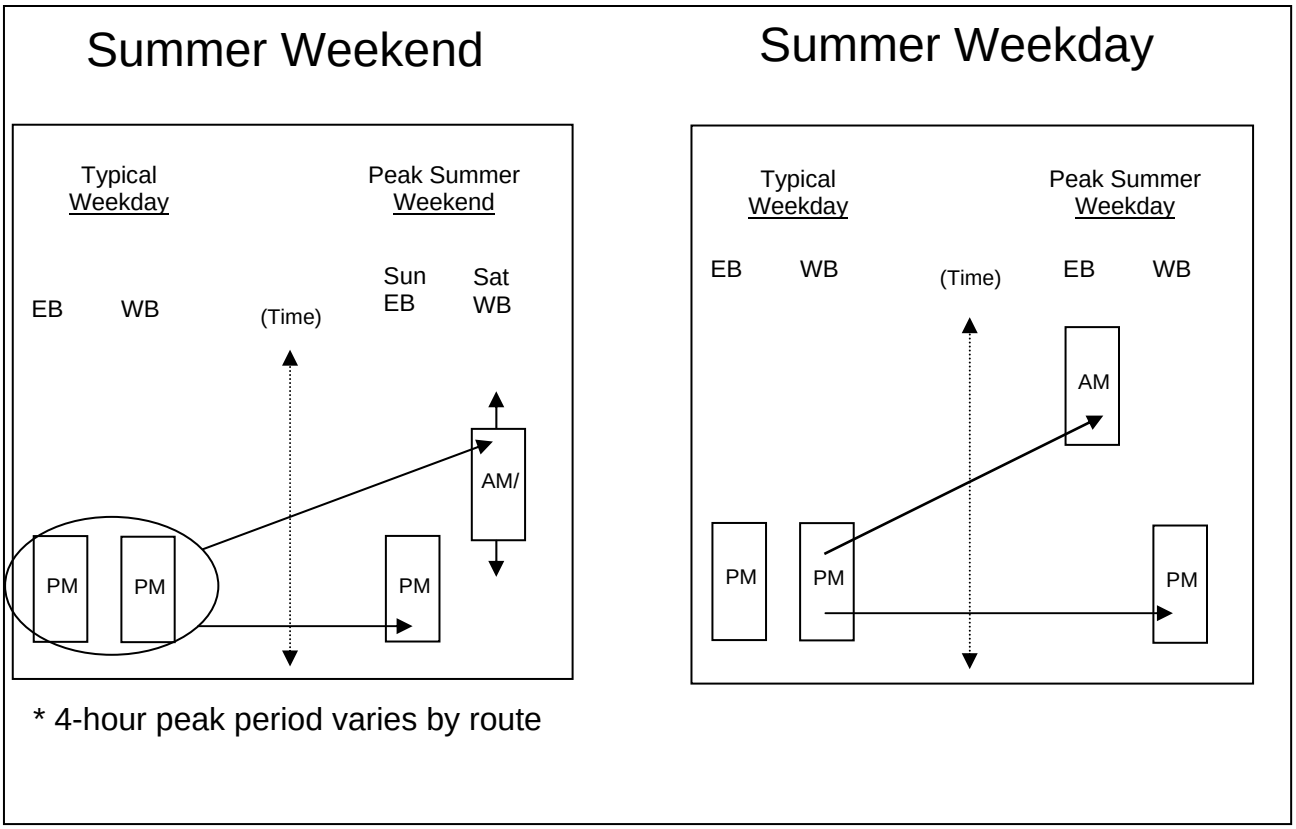
As stated previously, conversion factors were developed for each route, direction, and fare category. Figure 4.4b illustrates the general approach taken for development of conversion factors for peak direction volumes.

The average of eastbound and westbound forecasted ridership in the typical weekday PM peak period were used to derive conversion factors for summer weekend periods, as shown in the left-hand side of Figure 4.4b.

Westbound ridership for the typical weekday PM peak period (the peak travel direction during this time) were used to derive conversion factors for the summer weekday 4-hour peak periods in both directions, as illustrated in the right-hand side of Figure 4.4b.

In converting to the various summer peak periods, the time of day, and for weekends, the day of week were allowed to vary in identifying the 4 hour peak period in each travel direction (see Table 4.4b).

Figure 4.4b - Development of Conversion Factors for Summer Peak Period Demand



An example of the development and application of these conversion factors, using passenger fare ridership from the Edmonds - Kingston route, is provided below.

2006 Typical weekday PM peak westbound: 942

2006 Summer Weekday 4 hr peak westbound: 1,106

Typical Weekday-to-Summer Weekday Conversion Factor:

1,106 / 942 = 1.17

2030 Model Forecast for Typical Weekday PM Peak Westbound: 1,405

Estimated 2030 Summer Weekday Peak Westbound:

1,405 × 1.17 = 1,644 passengers

Table 4.4a and Table 4.4b provide the conversion factors used to estimate summer weekday and weekend peak period ridership demand, respectively, from the typical weekday PM peak period ridership forecasts.

Table 4.4a - Conversion Factors – Typical Weekday PM Peak Period to Summer Weekday 4-Hour Peak

	Westbound			Eastbound*		
Route	Vehicles/ Drivers	Passenger Fares	Total Riders	Vehicles/ Drivers	Passenger Fares	Total Riders
Point Defiance - Tahlequah	1.33	1.59	1.43	1.33	1.59	1.43
Vashon - Southworth	1.44	0.39	1.09	1.44	0.39	1.09
Fauntleroy - Vashon	1.28	1.51	1.39	1.28	1.51	1.39
Fauntleroy - Southworth	1.08	1.13	1.11	1.12	1.17	1.15
Seattle - Bremerton	1.03	1.19	1.15	1.00	1.14	1.11
Seattle - Bainbridge Island	1.07	1.17	1.15	0.98	1.07	1.04
Edmonds - Kingston	1.10	1.17	1.14	0.98	1.05	1.01
Mukilteo - Clinton	1.13	1.21	1.17	1.13	1.21	1.17
Port Townsend - Keystone	1.64	2.21	1.94	1.50	1.93	1.73
San Juan Domestic Routes	1.30	1.99	1.64	1.30	1.99	1.64
Anacortes/San Juans-Sidney, B.C.	3.95	4.19	4.11	3.65	3.86	3.79

* Based on comparison with 2006 Typical Weekday PM Peak Westbound ridership

Table 4.4b - Conversion Factors – Typical Weekday PM Peak Period to Summer Weekend 4-Hour Peak

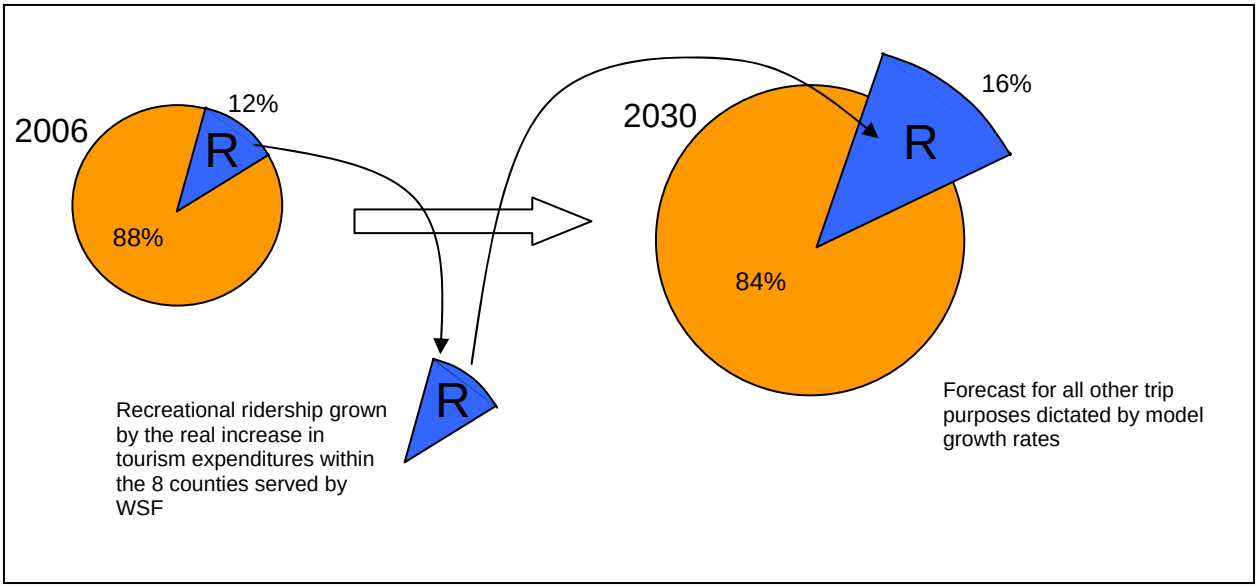
	Westbound			Eastbound		
Route	Vehicles/ Drivers	Passenger Fares	Total Riders	Vehicles/ Drivers	Passenger Fares	Total Riders
Point Defiance - Tahlequah	1.67	3.56	2.35	1.67	3.56	2.35
Vashon - Southworth	1.13	2.41	1.45	1.13	2.41	1.45
Fauntleroy - Vashon	1.01	1.46	1.22	1.01	1.46	1.22
Fauntleroy - Southworth	1.08	1.46	1.25	1.18	1.60	1.37
Seattle - Bremerton	0.88	1.62	1.39	1.50	2.75	2.35
Seattle - Bainbridge Island	1.37	1.35	1.36	1.29	1.27	1.27
Edmonds - Kingston	1.26	2.89	1.93	1.28	2.94	1.96
Mukilteo - Clinton	1.36	2.99	2.03	1.34	2.93	1.99
Port Townsend - Keystone	2.16	3.15	2.69	2.68	3.49	3.12
San Juan Domestic Routes	1.46	3.12	2.27	1.75	3.75	2.72
Anacortes/San Juans-Sidney, B.C.	5.32	5.56	5.48	6.12	6.28	6.23

* Based on comparison with average of 2006 Typical Weekday PM Peak Westbound and Eastbound ridership

Recreational Travel

The recreational growth factor developed in the analysis described previously was used to adjust the various peak period ridership forecasts for each route. Figure 4.4c illustrates the application of the recreational growth adjustment. As shown in the figure, the recreational growth rate was used as a replacement for model-predicted growth for recreational users only. This was done by removing the recreational trips from the total ferry ridership before forecasting (using the percentages shown previously in Table 4.3d), applying the unique recreational growth rate to that subset, and then combining them back with the ridership forecast for non-recreational trips. Growth for the remainder of the ferry travel (non-recreational trips) was dictated by the Planning Model growth rates.

Figure 4.4c - Illustration of Recreational Growth Adjustment Process



The impact of this procedure on total system-wide ridership growth between 2006 and 2030 was an increase from 37% without the recreational adjustment to 42% with the adjustment. Tables 4.4c, 4.4d, and 4.4e show the impact of the recreational growth adjustment for each route for the three categories of peak travel — typical weekday PM peak period, summer weekday peak periods, and summer weekend peak periods, respectively. The percentage changes shown in these tables reflect the recreational adjustments only, independent of the conversion to summer peak periods.

Table 4.4c - Percent Change with Recreational Adjustment — Typical Weekday PM Peak Period 2030

	Westbound			Eastbound		
Route	Vehicles/ Drivers	Passenger Fares	Total Riders	Vehicles/ Drivers	Passenger Fares	Total Riders
Point Defiance - Tahlequah	+ 5%	+ 11%	+ 7%	+ 11%	+ 4%	+ 8%
Vashon - Southworth	– 2%	– 2%	– 2%	– 0%	– 4%	– 1%
Fauntleroy - Vashon	+ 6%	+ 11%	+ 8%	+ 4%	+ 6%	+ 5%
Fauntleroy - Southworth	+ 0%	– 0%	– 0%	+ 5%	– 1%	+ 3%
Seattle - Bremerton	+ 3%	+ 3%	+ 3%	+ 2%	+ 1%	+ 2%
Seattle - Bainbridge Island	+ 3%	+ 3%	+ 3%	+ 3%	+ 1%	+ 2%
Edmonds - Kingston	+ 3%	+ 2%	+ 2%	+ 7%	+ 1%	+ 5%
Mukilteo - Clinton	+ 7%	+ 1%	+ 4%	+ 5%	– 5%	+ 1%
Port Townsend - Keystone	+ 1%	– 3%	– 1%	– 1%	– 2%	– 2%
All Vessels To/From Anacortes	+ 7%	+ 4%	+ 5%	+ 7%	+ 4%	+ 5%
Inter-Island Vessel Only	+ 3%	+ 1%	+ 1%	+ 3%	+ 1%	+ 1%
Anacortes/San Juans-Sidney, B.C.	+ 16%	+ 5%	+ 8%	+ 16%	+ 5%	+ 8%

Table 4.4d - Percent Change with Recreational Adjustment — Summer Weekday Peak Period 2030

	Westbound			Eastbound		
Route	Vehicles/ Drivers	Passenger Fares	Total Riders	Vehicles/ Drivers	Passenger Fares	Total Riders
Point Defiance - Tahlequah	+ 9%	+ 18%	+ 12%	+ 9%	+ 18%	+ 12%
Vashon - Southworth	– 3%	– 3%	– 3%	– 3%	– 3%	– 3%
Fauntleroy - Vashon	+ 9%	+ 17%	+ 13%	+ 9%	+ 17%	+ 13%
Fauntleroy - Southworth	+ 1%	– 1%	– 0%	+ 1%	– 1%	– 0%
Seattle - Bremerton	+ 4%	+ 5%	+ 5%	+ 4%	+ 5%	+ 5%
Seattle - Bainbridge Island	+ 4%	+ 5%	+ 5%	+ 4%	+ 5%	+ 5%
Edmonds - Kingston	+ 4%	+ 3%	+ 3%	+ 4%	+ 3%	+ 3%
Mukilteo - Clinton	+ 12%	+ 2%	+ 6%	+ 12%	+ 2%	+ 6%
Port Townsend - Keystone	+ 2%	– 5%	– 2%	+ 2%	– 5%	– 2%
All Vessels To/From Anacortes	+ 15%	+ 8%	+ 10%	+ 15%	+ 8%	+ 10%
Inter-Island Vessel Only	+ 6%	+ 1%	+ 3%	+ 6%	+ 1%	+ 3%
Anacortes/San Juans-Sidney, B.C.	+ 27%	+ 8%	+ 13%	+ 27%	+ 8%	+ 13%

Table 4.4e - Percent Change with Recreational Adjustment — Summer Weekend Peak Period 2030

	Westbound			Eastbound		
Route	Vehicles/ Drivers	Passenger Fares	Total Riders	Vehicles/ Drivers	Passenger Fares	Total Riders
Point Defiance - Tahlequah	+ 12%	+ 17%	+ 15%	+ 12%	+ 17%	+ 15%
Vashon - Southworth	– 2%	– 4%	– 3%	– 2%	– 4%	– 3%
Fauntleroy - Vashon	+ 9%	+ 14%	+ 12%	+ 9%	+ 14%	+ 12%
Fauntleroy - Southworth	+ 2%	– 1%	+ 0%	+ 2%	– 1%	+ 0%
Seattle - Bremerton	+ 4%	+ 5%	+ 5%	+ 4%	+ 5%	+ 5%
Seattle - Bainbridge Island	+ 5%	+ 5%	+ 5%	+ 5%	+ 5%	+ 5%
Edmonds - Kingston	+ 7%	+ 3%	+ 4%	+ 7%	+ 3%	+ 4%
Mukilteo - Clinton	+ 12%	– 0%	+ 4%	+ 12%	– 0%	+ 4%
Port Townsend - Keystone	+ 0%	– 5%	– 3%	+ 0%	– 5%	– 3%
All Vessels To/From Anacortes	+ 17%	+ 9%	+ 11%	+ 17%	+ 9%	+ 11%
Inter-Island Vessel Only	+ 6%	+ 1%	+ 3%	+ 6%	+ 1%	+ 3%
Anacortes/San Juans-Sidney, B.C.	+ 31%	+ 9%	+ 15%	+ 31%	+ 9%	+ 15%

4.5 Results

The tables on the following pages present the ridership forecast results for years 2006, 2020, and 2030, reflecting conversion to the summer peak periods as well as the sensitivity test adjustments for recreational growth. Tables 4.5a, 4.5b, and 4.5c reflect the conversion to summer peak periods only, while Tables 4.5d, 4.5e, 4.5f, and 4.5g show both conversion to summer peak periods and the adjustments for recreational growth.

Observations

Data Limitations

A key assumption in this analysis is the use of fare data to estimate the recreational share of total ferry travel during the summer peak periods. If there is continued interest in understanding if and how recreational travel growth differs from general land use driven trip generation, it is recommended that survey data collected during summer peak travel periods over time be used to provide a better understanding of the true recreational share of total travel by route.

Impact of Recreational Adjustment

System-wide, the recreational travel adjustment increases total 2030 model-predicted ridership by the following:

+ 3% (+1,050 on 31,406 riders) for Typical Weekday PM Peak

+ 6% (+3,103 on 50,252 riders) for Summer Weekday 4 hr Peak

+ 6% (+3,810 on 61,595 riders) for Summer Weekend 4 hr Peak

The recreational growth impact varies more widely on a route-level basis. In fact, while most routes show a positive increase in the ridership volume forecast, two routes (Vashon – Southworth and Port Townsend – Keystone) show a reduction in the ridership volume as a result of the recreational growth adjustment. This is because the model-predicted overall ridership growth rates for those routes are higher than the growth trends identified for recreational travel.

Table 4.5a - 2006 Base Year Ridership Volumes by Fare Category with Conversions to Summer Weekday and Weekend Peak Periods

WESTBOUND

Ferry Route	Typical (May) Weekday PM Peak Period / Peak Direction				Summer Weekday Peak Period / Peak Direction							Summer Weekend Peak / Peak Direction (Saturday)			
	4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders	4-hr Peak Period	Vehicle/ Driver Fares	% Change from Typical ←	Passenger Fares	% Change from Typical ←	Total Riders	% Change from Typical ←	4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders
Point Defiance - Tahlequah	3-7 pm	220	130	350	2:40pm - 6:40pm	290	32%	210	62%	500	43%	2:40pm - 6:40pm	250	290	540
Vashon - Southworth	3-7 pm	50	20	70	PM Peak[3]	70	40%	10	-50%	70	0%	Unknown[4]	60	40	100
Fauntleroy - Vashon	3-7 pm	540	470	1,010	4:00pm - 8:00pm	690	28%	710	51%	1,400	39%	10:10am - 2:10pm	540	700	1,240
Fauntleroy - Southworth	3-7 pm	360	400	760	3:35pm - 7:35pm	390	8%	450	13%	840	11%	8:35am - 12:35pm	280	310	590
South Sound Routes		**1,170**	**1,020**	**2,190**		**1,440**	**23%**	**1,380**	**35%**	**2,810**	**28%**		**1,130**	**1,340**	**2,470**
Seattle - Bremerton	3-7 pm	500	1,500	2,000	3:00pm - 7:00pm	510	2%	1,780	19%	2,290	15%	3:00pm - 7:00pm	360	1,400	1,760
Seattle - Bainbridge Island	3-7 pm	1,110	3,380	4,490	3:00pm - 7:00pm	1,190	7%	3,950	17%	5,140	14%	10:40am - 2:40pm	1,160	2,510	3,670
Edmonds - Kingston	3-7 pm	1,000	940	1,940	2:30pm - 6:30pm	1,100	10%	1,110	18%	2,210	14%	10:45am - 2:45pm	1,160	1,850	3,010
Central Sound Routes		**2,610**	**5,820**	**8,430**		**2,800**	**7%**	**6,840**	**18%**	**9,640**	**14%**		**2,680**	**5,760**	**8,440**
Mukilteo - Clinton	3-7 pm	970	970	1,940	3:00pm - 7:00pm	1,100	13%	1,170	21%	2,280	18%	10:30am - 2:30pm	1,120	1,680	2,800
Port Townsend - Keystone	3-7 pm	170	190	360	11:15am - 3:15pm	280	65%	420	121%	700	94%	11:15am - 3:15pm	360	600	960
North Sound Routes		**1,140**	**1,160**	**2,300**		**1,380**	**21%**	**1,590**	**37%**	**2,980**	**30%**		**1,480**	**2,280**	**3,760**
Subtotal for Peak Periods		**4,920**	**8,000**	**12,920**		**5,620**	**14%**	**9,810**	**23%**	**15,430**	**19%**		**5,290**	**9,380**	**14,670**
All Vessels To/From Anacortes[1]	Daily	1,050	1,000	2,050	Daily	1,370	30%	1,990	99%	3,360	64%	Daily	1,530	3,130	4,660
Inter-Island Vessel Only[1]	Daily	100	120	220	Daily	130	30%	240	100%	380	73%	Daily	150	380	530
Anacortes/San Juans-Sidney, B.C.[1]	Daily	40	80	120	Daily	150	275%	330	313%	480	300%	Daily	200	440	640
San Juan Island Routes Subtotal[1]		**1,190**	**1,200**	**2,390**		**1,650**	**39%**	**2,560**	**113%**	**4,220**	**77%**		**1,880**	**3,950**	**5,830**
Total Ridership[2]		**6,110**	**9,200**	**15,310**		**7,270**	**19%**	**12,370**	**34%**	**19,650**	**28%**		**7,170**	**13,330**	**20,500**

EASTBOUND

Ferry Route	Typical (May) Weekday PM Peak Period / Reverse Direction				Summer Weekday Peak Period / Peak Direction							Summer Weekend Peak / Peak Direction (Sunday)					
	4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders	4-hr Peak Period	Vehicle/ Driver Fares	% Change from WB ↑	Passenger Fares	% Change from WB ↑	Total Riders	% Change from WB ↑	4-hr Peak Period	Vehicle/ Driver Fares	% Change from WB ↑	Passenger Fares	% Change from WB ↑	Total Riders	% Change from WB ↑
Point Defiance - Tahlequah	3-7 pm	80	30	110	AM Peak[3]	290	0%	210	0%	500	0%	Unknown[4]	250	0%	290	0%	540	0%
Vashon - Southworth	3-7 pm	60	10	70	6:05am - 10:05am	70	0%	10	0%	70	0%	0	60	0%	40	0%	100	0%
Fauntleroy - Vashon	3-7 pm	550	490	1,030	AM Peak[3]	690	0%	710	0%	1,400	0%	Unknown[4]	540	0%	700	0%	1,240	0%
Fauntleroy - Southworth	3-7 pm	160	30	190	4:30am - 8:30am	410	5%	470	4%	870	4%	1:10pm - 5:10pm	310	11%	340	10%	650	10%
South Sound Routes		**850**	**560**	**1,400**		**1,460**	**1%**	**1,400**	**1%**	**2,840**	**1%**		**1,160**	**3%**	**1,370**	**2%**	**2,530**	**2%**
Seattle - Bremerton	3-7 pm	320	220	540	6:20am - 10:20am	490	-4%	1,710	-4%	2,210	-3%	3:00pm - 7:00pm	610	69%	2,370	69%	2,980	69%
Seattle - Bainbridge Island	3-7 pm	570	350	920	6:20am - 10:20am	1,080	-9%	3,600	-9%	4,680	-9%	6:30pm - 10:30pm	1,090	-6%	2,360	-6%	3,450	-6%
Edmonds - Kingston	3-7 pm	850	340	1,180	2:15pm - 6:15pm	980	-11%	990	-11%	1,970	-11%	10:50am - 2:50pm	1,180	2%	1,880	2%	3,060	2%
Central Sound Routes		**1,740**	**910**	**2,640**		**2,550**	**-9%**	**6,300**	**-8%**	**8,860**	**-8%**		**2,880**	**7%**	**6,610**	**15%**	**9,490**	**12%**
Mukilteo - Clinton	3-7 pm	660	150	820	7:00am - 11:00am	1,100	0%	1,170	0%	2,280	0%	3:30pm - 7:30pm	1,100	-2%	1,650	-2%	2,750	-2%
Port Townsend - Keystone	3-7 pm	160	190	350	1:30pm - 5:30pm	260	-7%	370	-12%	620	-11%	2:15pm - 6:15pm	440	22%	660	10%	1,110	16%
North Sound Routes		**820**	**340**	**1,170**		**1,360**	**-1%**	**1,540**	**-3%**	**2,900**	**-3%**		**1,540**	**4%**	**2,310**	**1%**	**3,860**	**3%**
Subtotal for Peak Periods		**3,410**	**1,810**	**5,210**		**5,370**	**-4%**	**9,240**	**-6%**	**14,600**	**-5%**		**5,580**	**5%**	**10,290**	**10%**	**15,880**	**8%**
All Vessels To/From Anacortes[1]	Daily	1,050	1,000	2,050	Daily	1,370	0%	1,990	0%	3,360	0%	Daily	1,840	20%	3,750	20%	5,590	20%
Inter-Island Vessel Only[1]	Daily	100	120	230	Daily	130	0%	240	0%	380	0%	Daily	180	20%	460	21%	640	21%
Anacortes/San Juans-Sidney, B.C.[1]	Daily	40	80	120	Daily	140	-7%	310	-6%	440	-8%	Daily	230	15%	500	14%	720	13%
San Juan Island Routes Subtotal[1]		**1,190**	**1,200**	**2,400**		**1,640**	**-1%**	**2,540**	**-1%**	**4,180**	**-1%**		**2,250**	**20%**	**4,710**	**19%**	**6,950**	**19%**
Total Ridership[2]		**4,600**	**3,010**	**7,610**		**7,010**	**-4%**	**11,780**	**-5%**	**18,780**	**-4%**		**7,830**	**9%**	**15,000**	**13%**	**22,830**	**11%**

Note: Typical Weekday volumes are produced from the WSF Planning Model; Summer Weekday and Weekend volumes represent a post-processing conversion

[1] Represents daily ridership forecasts.

[2] Represents combination of PM peak period and daily ridership volumes

[3] Assumption; actual period unknown due to lack of ticket sales data

[4] Actual period unknown due to lack of ticket sales data

Table 4.5b - 2020 Baseline Ridership Volumes by Fare Category with Conversions to Summer Weekday and Weekend Peak Periods

WESTBOUND

Ferry Route	Typical (May) Weekday PM Peak Period / Peak Direction				Summer Weekday Peak Period / Peak Direction							Summer Weekend Peak / Peak Direction (Saturday)			
	4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders	4-hr Peak Period	Vehicle/ Driver Fares	% Change from Typical ←	Passenger Fares	% Change from Typical ←	Total Riders	% Change from Typical ←	4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders
Point Defiance - Tahlequah	3-7 pm	260	100	360	2:40pm - 6:40pm	350	*35%*	150	*50%*	500	*39%*	2:40pm - 6:40pm	270	240	510
Vashon - Southworth	3-7 pm	70	30	100	PM Peak[3]	90	*29%*	10	*-67%*	110	*10%*	Unknown[4]	70	70	150
Fauntleroy - Vashon	3-7 pm	660	490	1,150	4:00pm - 8:00pm	850	*29%*	740	*51%*	1,580	*37%*	10:10am - 2:10pm	660	740	1,400
Fauntleroy - Southworth	3-7 pm	590	660	1,250	3:35pm - 7:35pm	640	*8%*	740	*12%*	1,380	*10%*	8:35am - 12:35pm	400	520	920
South Sound Routes		**1,580**	**1,280**	**2,860**		**1,930**	***22%***	**1,640**	***28%***	**3,570**	***25%***		**1,400**	**1,570**	**2,980**
Seattle - Bremerton	3-7 pm	470	1,350	1,830	3:00pm - 7:00pm	490	*4%*	1,610	*19%*	2,100	*15%*	3:00pm - 7:00pm	360	1,340	1,700
Seattle - Bainbridge Island	3-7 pm	1,290	3,930	5,210	3:00pm - 7:00pm	1,380	*7%*	4,600	*17%*	5,970	*15%*	10:40am - 2:40pm	1,330	2,960	4,290
Edmonds - Kingston	3-7 pm	1,400	1,250	2,650	2:30pm - 6:30pm	1,530	*9%*	1,470	*18%*	3,000	*13%*	10:45am - 2:45pm	1,410	2,490	3,910
Central Sound Routes		**3,160**	**6,530**	**9,690**		**3,400**	***8%***	**7,680**	***18%***	**11,070**	***14%***		**3,100**	**6,790**	**9,900**
Mukilteo - Clinton	3-7 pm	1,140	1,290	2,430	3:00pm - 7:00pm	1,290	*13%*	1,560	*21%*	2,840	*17%*	10:30am - 2:30pm	1,300	2,510	3,820
Port Townsend - Keystone	3-7 pm	210	300	520	11:15am - 3:15pm	350	*67%*	670	*123%*	1,020	*96%*	11:15am - 3:15pm	480	920	1,400
North Sound Routes		**1,350**	**1,590**	**2,950**		**1,640**	***21%***	**2,230**	***40%***	**3,860**	***31%***		**1,780**	**3,430**	**5,220**
Subtotal for Peak Periods		**6,090**	**9,400**	**15,500**		**6,970**	***14%***	**11,550**	***23%***	**18,500**	***19%***		**6,280**	**11,790**	**18,100**
All Vessels To/From Anacortes[1]	Daily	1,230	1,240	2,470	Daily	1,600	*30%*	2,470	*99%*	4,070	*65%*	Daily	1,790	3,880	5,670
Inter-Island Vessel Only[1]	Daily	140	180	320	Daily	180	*29%*	360	*100%*	540	*69%*	Daily	200	560	760
Anacortes/San Juans-Sidney, B.C.[1]	Daily	40	120	160	Daily	180	*350%*	480	*300%*	660	*313%*	Daily	240	640	880
San Juan Island Routes Subtotal[1]		**1,410**	**1,540**	**2,950**		**1,960**	***39%***	**3,310**	***115%***	**5,270**	***79%***		**2,230**	**5,080**	**7,310**
Total Ridership[2]		**7,500**	**10,940**	**18,450**		**8,930**	***19%***	**14,860**	***36%***	**23,770**	***29%***		**8,510**	**16,870**	**25,410**

EASTBOUND

Ferry Route	Typical (May) Weekday PM Peak Period / Reverse Direction				Summer Weekday Peak Period / Peak Direction							Summer Weekend Peak / Peak Direction (Sunday)					
	4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders	4-hr Peak Period	Vehicle/ Driver Fares	% Change from WB ↑	Passenger Fares	% Change from WB ↑	Total Riders	% Change from WB ↑	4-hr Peak Period	Vehicle/ Driver Fares	% Change from WB ↑	Passenger Fares	% Change from WB ↑	Total Riders	% Change from WB ↑
Point Defiance - Tahlequah	3-7 pm	60	40	100	AM Peak[3]	350	*0%*	150	*0%*	500	*0%*	Unknown[4]	270	*0%*	240	*0%*	510	*0%*
Vashon - Southworth	3-7 pm	70	30	90	6:05am - 10:05am	90	*0%*	10	*0%*	110	*0%*	0	70	*0%*	70	*0%*	150	*0%*
Fauntleroy - Vashon	3-7 pm	640	530	1,170	AM Peak[3]	850	*0%*	740	*0%*	1,580	*0%*	Unknown[4]	660	*0%*	740	*0%*	1,400	*0%*
Fauntleroy - Southworth	3-7 pm	160	50	210	4:30am - 8:30am	660	*3%*	770	*4%*	1,430	*4%*	1:10pm - 5:10pm	440	*10%*	570	*10%*	1,010	*10%*
South Sound Routes		**930**	**650**	**1,570**		**1,950**	***1%***	**1,670**	***2%***	**3,620**	***1%***		**1,440**	***3%***	**1,620**	***3%***	**3,070**	***3%***
Seattle - Bremerton	3-7 pm	350	300	640	6:20am - 10:20am	470	*-4%*	1,550	*-4%*	2,020	*-4%*	3:00pm - 7:00pm	610	*69%*	2,270	*69%*	2,890	*70%*
Seattle - Bainbridge Island	3-7 pm	660	460	1,120	6:20am - 10:20am	1,250	*-9%*	4,190	*-9%*	5,440	*-9%*	6:30pm - 10:30pm	1,250	*-6%*	2,780	*-6%*	4,030	*-6%*
Edmonds - Kingston	3-7 pm	850	480	1,320	2:15pm - 6:15pm	1,370	*-10%*	1,310	*-11%*	2,670	*-11%*	10:50am - 2:50pm	1,440	*2%*	2,540	*2%*	3,970	*2%*
Central Sound Routes		**1,860**	**1,240**	**3,080**		**3,090**	***-9%***	**7,050**	***-8%***	**10,130**	***-8%***		**3,300**	***6%***	**7,590**	***12%***	**10,890**	***10%***
Mukilteo - Clinton	3-7 pm	780	390	1,170	7:00am - 11:00am	1,290	*0%*	1,560	*0%*	2,840	*0%*	3:30pm - 7:30pm	1,280	*-2%*	2,470	*-2%*	3,750	*-2%*
Port Townsend - Keystone	3-7 pm	240	280	520	1:30pm - 5:30pm	320	*-9%*	580	*-13%*	900	*-12%*	2:15pm - 6:15pm	600	*25%*	1,020	*11%*	1,620	*16%*
North Sound Routes		**1,020**	**670**	**1,690**		**1,610**	***-2%***	**2,140**	***-4%***	**3,740**	***-3%***		**1,880**	***6%***	**3,490**	***2%***	**5,370**	***3%***
Subtotal for Peak Periods		**3,810**	**2,560**	**6,340**		**6,650**	***-5%***	**10,860**	***-6%***	**17,490**	***-5%***		**6,620**	***5%***	**12,700**	***8%***	**19,330**	***7%***
All Vessels To/From Anacortes[1]	Daily	1,230	1,240	2,470	Daily	1,600	*0%*	2,470	*0%*	4,070	*0%*	Daily	2,150	*20%*	4,660	*20%*	6,800	*20%*
Inter-Island Vessel Only[1]	Daily	140	180	320	Daily	180	*0%*	360	*0%*	540	*0%*	Daily	240	*20%*	680	*21%*	920	*21%*
Anacortes/San Juans-Sidney, B.C.[1]	Daily	40	120	160	Daily	160	*-11%*	450	*-6%*	610	*-8%*	Daily	270	*13%*	730	*14%*	1,000	*14%*
San Juan Island Routes Subtotal[1]		**1,410**	**1,540**	**2,950**		**1,940**	***-1%***	**3,280**	***-1%***	**5,220**	***-1%***		**2,660**	***19%***	**6,070**	***19%***	**8,720**	***19%***
Total Ridership[2]		**5,220**	**4,100**	**9,290**		**8,590**	***-4%***	**14,140**	***-5%***	**22,710**	***-4%***		**9,280**	***9%***	**18,770**	***11%***	**28,050**	***10%***

Note: Typical Weekday volumes are produced from the WSF Planning Model; Summer Weekday and Weekend volumes represent a post-processing conversion

[1] Represents daily ridership forecasts.

[2] Represents combination of PM peak period and daily ridership volumes

[3] Assumption; actual period unknown due to lack of ticket sales data

[4] Actual period unknown due to lack of ticket sales data

Table 4.5c - 2030 Baseline Ridership Volumes by Fare Category with Conversions to Summer Weekday and Weekend Peak Periods

WESTBOUND

Ferry Route	Typical (May) Weekday PM Peak Period / Peak Direction				Summer Weekday Peak Period / Peak Direction							Summer Weekend Peak / Peak Direction (Saturday)			
	4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders	4-hr Peak Period	Vehicle/ Driver Fares	% Change from Typical ←	Passenger Fares	% Change from Typical ←	Total Riders	% Change from Typical ←	4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders
Point Defiance - Tahlequah	3-7 pm	260	120	370	2:40pm - 6:40pm	350	*35%*	180	*50%*	530	*43%*	2:40pm - 6:40pm	280	280	550
Vashon - Southworth	3-7 pm	100	50	150	PM Peak[3]	140	*40%*	20	*-60%*	160	*7%*	Unknown[4]	120	90	210
Fauntleroy - Vashon	3-7 pm	630	430	1,060	4:00pm - 8:00pm	810	*29%*	640	*49%*	1,450	*37%*	10:10am - 2:10pm	670	730	1,400
Fauntleroy - Southworth	3-7 pm	590	770	1,370	3:35pm - 7:35pm	640	*8%*	870	*13%*	1,510	*10%*	8:35am - 12:35pm	400	610	1,010
South Sound Routes		**1,580**	**1,370**	**2,950**		**1,940**	***23%***	**1,710**	***25%***	**3,650**	***24%***		**1,470**	**1,710**	**3,170**
Seattle - Bremerton	3-7 pm	570	1,600	2,160	3:00pm - 7:00pm	590	*4%*	1,890	*18%*	2,480	*15%*	3:00pm - 7:00pm	430	1,560	1,990
Seattle - Bainbridge Island	3-7 pm	1,540	4,430	5,970	3:00pm - 7:00pm	1,650	*7%*	5,180	*17%*	6,830	*14%*	10:40am - 2:40pm	1,590	3,360	4,950
Edmonds - Kingston	3-7 pm	1,380	1,410	2,780	2:30pm - 6:30pm	1,510	*9%*	1,650	*17%*	3,160	*14%*	10:45am - 2:45pm	1,420	2,800	4,220
Central Sound Routes		**3,490**	**7,440**	**10,910**		**3,750**	***7%***	**8,720**	***17%***	**12,470**	***14%***		**3,440**	**7,720**	**11,160**
Mukilteo - Clinton	3-7 pm	1,160	1,570	2,720	3:00pm - 7:00pm	1,310	*13%*	1,890	*20%*	3,200	*18%*	10:30am - 2:30pm	1,390	3,000	4,380
Port Townsend - Keystone	3-7 pm	280	420	690	11:15am - 3:15pm	450	*61%*	920	*119%*	1,370	*99%*	11:15am - 3:15pm	630	1,270	1,900
North Sound Routes		**1,440**	**1,990**	**3,410**		**1,760**	***22%***	**2,810**	***41%***	**4,570**	***34%***		**2,020**	**4,270**	**6,280**
Subtotal for Peak Periods		**6,510**	**10,800**	**17,270**		**7,450**	***14%***	**13,240**	***23%***	**20,690**	***20%***		**6,930**	**13,700**	**20,610**
All Vessels To/From Anacortes[1]	Daily	1,400	1,520	2,920	Daily	1,820	*30%*	3,020	*99%*	4,850	*66%*	Daily	2,040	4,750	6,780
Inter-Island Vessel Only[1]	Daily	160	210	370	Daily	210	*31%*	420	*100%*	630	*70%*	Daily	240	660	900
Anacortes/San Juans-Sidney, B.C.[1]	Daily	50	120	170	Daily	180	*260%*	520	*333%*	710	*318%*	Daily	250	690	940
San Juan Island Routes Subtotal[1]		**1,610**	**1,850**	**3,460**		**2,210**	***37%***	**3,960**	***114%***	**6,190**	***79%***		**2,530**	**6,100**	**8,620**
Total Ridership[2]		**8,120**	**12,650**	**20,730**		**9,660**	***19%***	**17,200**	***36%***	**26,880**	***30%***		**9,460**	**19,800**	**29,230**

EASTBOUND

Ferry Route	Typical (May) Weekday PM Peak Period / Reverse Direction				Summer Weekday Peak Period / Peak Direction							Summer Weekend Peak / Peak Direction (Sunday)					
	4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders	4-hr Peak Period	Vehicle/ Driver Fares	% Change from WB ↑	Passenger Fares	% Change from WB ↑	Total Riders	% Change from WB ↑	4-hr Peak Period	Vehicle/ Driver Fares	% Change from WB ↑	Passenger Fares	% Change from WB ↑	Total Riders	% Change from WB ↑
Point Defiance - Tahlequah	3-7 pm	70	40	110	AM Peak[3]	350	*0%*	180	*0%*	530	*0%*	Unknown[4]	280	*0%*	280	*0%*	550	*0%*
Vashon - Southworth	3-7 pm	110	30	130	6:05am - 10:05am	140	*0%*	20	*0%*	160	*0%*	0	120	*0%*	90	*0%*	210	*0%*
Fauntleroy - Vashon	3-7 pm	700	570	1,270	AM Peak[3]	810	*0%*	640	*0%*	1,450	*0%*	Unknown[4]	670	*0%*	730	*0%*	1,400	*0%*
Fauntleroy - Southworth	3-7 pm	150	60	210	4:30am - 8:30am	660	*3%*	900	*3%*	1,570	*4%*	1:10pm - 5:10pm	440	*10%*	670	*10%*	1,100	*9%*
South Sound Routes		**1,030**	**700**	**1,720**		**1,960**	***1%***	**1,740**	***2%***	**3,710**	***2%***		**1,510**	***3%***	**1,770**	***4%***	**3,260**	***3%***
Seattle - Bremerton	3-7 pm	400	330	730	6:20am - 10:20am	560	*-5%*	1,820	*-4%*	2,390	*-4%*	3:00pm - 7:00pm	730	*70%*	2,650	*70%*	3,370	*69%*
Seattle - Bainbridge Island	3-7 pm	770	560	1,330	6:20am - 10:20am	1,500	*-9%*	4,720	*-9%*	6,220	*-9%*	6:30pm - 10:30pm	1,490	*-6%*	3,160	*-6%*	4,650	*-6%*
Edmonds - Kingston	3-7 pm	880	530	1,420	2:15pm - 6:15pm	1,350	*-11%*	1,470	*-11%*	2,820	*-11%*	10:50am - 2:50pm	1,450	*2%*	2,850	*2%*	4,300	*2%*
Central Sound Routes		**2,050**	**1,420**	**3,480**		**3,410**	***-9%***	**8,010**	***-8%***	**11,430**	***-8%***		**3,670**	***7%***	**8,660**	***12%***	**12,320**	***10%***
Mukilteo - Clinton	3-7 pm	880	440	1,310	7:00am - 11:00am	1,310	*0%*	1,890	*0%*	3,200	*0%*	3:30pm - 7:30pm	1,360	*-2%*	2,940	*-2%*	4,300	*-2%*
Port Townsend - Keystone	3-7 pm	310	400	700	1:30pm - 5:30pm	410	*-9%*	800	*-13%*	1,210	*-12%*	2:15pm - 6:15pm	780	*24%*	1,420	*12%*	2,190	*15%*
North Sound Routes		**1,190**	**840**	**2,010**		**1,720**	***-2%***	**2,690**	***-4%***	**4,410**	***-4%***		**2,140**	***6%***	**4,360**	***2%***	**6,490**	***3%***
Subtotal for Peak Periods		**4,270**	**2,960**	**7,210**		**7,090**	***-5%***	**12,440**	***-6%***	**19,550**	***-6%***		**7,320**	***6%***	**14,790**	***8%***	**22,070**	***7%***
All Vessels To/From Anacortes[1]	Daily	1,400	1,520	2,920	Daily	1,820	*0%*	3,020	*0%*	4,850	*0%*	Daily	2,450	*20%*	5,690	*20%*	8,140	*20%*
Inter-Island Vessel Only[1]	Daily	160	210	370	Daily	210	*0%*	420	*0%*	630	*0%*	Daily	280	*17%*	800	*21%*	1,080	*20%*
Anacortes/San Juans-Sidney, B.C.[1]	Daily	50	120	170	Daily	170	*-6%*	480	*-8%*	650	*-8%*	Daily	280	*12%*	780	*13%*	1,070	*14%*
San Juan Island Routes Subtotal[1]		**1,610**	**1,850**	**3,460**		**2,200**	***0%***	**3,920**	***-1%***	**6,130**	***-1%***		**3,010**	***19%***	**7,270**	***19%***	**10,290**	***19%***
Total Ridership[2]		**5,880**	**4,810**	**10,670**		**9,290**	***-4%***	**16,360**	***-5%***	**25,680**	***-4%***		**10,330**	***9%***	**22,060**	***11%***	**32,360**	***11%***

Note: Typical Weekday volumes are produced from the WSF Planning Model; Summer Weekday and Weekend volumes represent a post-processing conversion

[1] Represents daily ridership forecasts.

[2] Represents combination of PM peak period and daily ridership volumes

[3] Assumption; actual period unknown due to lack of ticket sales data

[4] Actual period unknown due to lack of ticket sales data

Table 4.5d - 2020 Baseline Ridership Forecasts by Fare Category with Conversions to Summer Peak Periods and Adjustments for Recreational Travel - WESTBOUND

Baseline Ridership Forecast

Ferry Route	Typical (May) Weekday PM Peak Period / Peak Direction: 4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders	Summer Weekday Peak Period / Peak Direction: 4-hr Peak Period	Vehicle/ Driver Fares	% Change from Typical ←	Passenger Fares	% Change from Typical ←	Total Riders	% Change from Typical ←	Summer Weekend Peak / Peak Direction (Saturday): 4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders
Point Defiance - Tahlequah	3-7 pm	260	100	360	2:40pm - 6:40pm	350	35%	150	50%	500	39%	2:40pm - 6:40pm	270	240	510
Vashon - Southworth	3-7 pm	70	30	100	PM Peak[3]	90	29%	10	-67%	110	10%	Unknown[4]	70	70	150
Fauntleroy - Vashon	3-7 pm	660	490	1,150	4:00pm - 8:00pm	850	29%	740	51%	1,580	37%	10:10am - 2:10pm	660	740	1,400
Fauntleroy - Southworth	3-7 pm	590	660	1,250	3:35pm - 7:35pm	640	8%	740	12%	1,380	10%	8:35am - 12:35pm	400	520	920
South Sound Routes		**1,580**	**1,280**	**2,860**		**1,930**	**22%**	**1,640**	**28%**	**3,570**	**25%**		**1,400**	**1,570**	**2,980**
Seattle - Bremerton	3-7 pm	470	1,350	1,830	3:00pm - 7:00pm	490	4%	1,610	19%	2,100	15%	3:00pm - 7:00pm	360	1,340	1,700
Seattle - Bainbridge Island	3-7 pm	1,290	3,930	5,210	3:00pm - 7:00pm	1,380	7%	4,600	17%	5,970	15%	10:40am - 2:40pm	1,330	2,960	4,290
Edmonds - Kingston	3-7 pm	1,400	1,250	2,650	2:30pm - 6:30pm	1,530	9%	1,470	18%	3,000	13%	10:45am - 2:45pm	1,410	2,490	3,910
Central Sound Routes		**3,160**	**6,530**	**9,690**		**3,400**	**8%**	**7,680**	**18%**	**11,070**	**14%**		**3,100**	**6,790**	**9,900**
Mukilteo - Clinton	3-7 pm	1,140	1,290	2,430	3:00pm - 7:00pm	1,290	13%	1,560	21%	2,840	17%	10:30am - 2:30pm	1,300	2,510	3,820
Port Townsend - Keystone	3-7 pm	210	300	520	11:15am - 3:15pm	350	67%	670	123%	1,020	96%	11:15am - 3:15pm	480	920	1,400
North Sound Routes		**1,350**	**1,590**	**2,950**		**1,640**	**21%**	**2,230**	**40%**	**3,860**	**31%**		**1,780**	**3,430**	**5,220**
Subtotal for Peak Periods		**6,090**	**9,400**	**15,500**		**6,970**	**14%**	**11,550**	**23%**	**18,500**	**19%**		**6,280**	**11,790**	**18,100**
All Vessels To/From Anacortes[1]	Daily	1,230	1,240	2,470	Daily	1,600	30%	2,470	99%	4,070	65%	Daily	1,790	3,880	5,670
Inter-Island Vessel Only[1]	Daily	140	180	320	Daily	180	29%	360	100%	540	69%	Daily	200	560	760
Anacortes/San Juans-Sidney, B.C.[1]	Daily	40	120	160	Daily	180	350%	480	300%	660	313%	Daily	240	640	880
San Juan Island Routes Subtotal[1]		**1,410**	**1,540**	**2,950**		**1,960**	**39%**	**3,310**	**115%**	**5,270**	**79%**		**2,230**	**5,080**	**7,310**
Total Ridership[2]		**7,500**	**10,940**	**18,450**		**8,930**	**19%**	**14,860**	**36%**	**23,770**	**29%**		**8,510**	**16,870**	**25,410**

Baseline Ridership Forecast - Adjusted for Recreational Travel

Ferry Route	Typical (May) Weekday PM Peak Period / Peak Direction: 4-hr Peak Period	Vehicle/ Driver Fares	% Change from Base ↑	Passenger Fares	% Change from Base ↑	Total Riders	% Change from Base ↑	Summer Weekday Peak Period / Peak Direction: 4-hr Peak Period	Vehicle/ Driver Fares	% Change from Typical ←	% Change from Base ↑	Passenger Fares	% Change from Typical ←	% Change from Base ↑	Total Riders	% Change from Typical ←	% Change from Base ↑	Summer Weekend Peak / Peak Direction (Saturday): 4-hr Peak Period	Vehicle/ Driver Fares	% Change from Base ↑	Passenger Fares	% Change from Base ↑	Total Riders	% Change from Base ↑
Point Defiance - Tahlequah	3-7 pm	260	0%	110	10%	370	3%	2:40pm - 6:40pm	360	38%	3%	180	64%	20%	530	43%	6%	2:40pm - 6:40pm	280	4%	280	17%	560	10%
Vashon - Southworth	3-7 pm	70	0%	30	0%	100	0%	PM Peak[3]	90	29%	0%	10	-67%	0%	110	10%	0%	Unknown[4]	80	14%	70	0%	150	0%
Fauntleroy - Vashon	3-7 pm	670	2%	500	2%	1,180	3%	4:00pm - 8:00pm	870	30%	2%	780	56%	5%	1,650	40%	4%	10:10am - 2:10pm	680	3%	790	7%	1,470	5%
Fauntleroy - Southworth	3-7 pm	590	0%	650	-2%	1,240	-1%	3:35pm - 7:35pm	630	7%	-2%	730	12%	-1%	1,370	10%	-1%	8:35am - 12:35pm	400	0%	510	-2%	910	-1%
South Sound Routes		**1,590**	**1%**	**1,290**	**1%**	**2,890**	**1%**		**1,950**	**23%**	**1%**	**1,700**	**32%**	**4%**	**3,660**	**27%**	**3%**		**1,440**	**3%**	**1,650**	**5%**	**3,090**	**4%**
Seattle - Bremerton	3-7 pm	480	2%	1,390	3%	1,880	3%	3:00pm - 7:00pm	510	6%	4%	1,670	20%	4%	2,180	16%	4%	3:00pm - 7:00pm	370	3%	1,390	4%	1,770	4%
Seattle - Bainbridge Island	3-7 pm	1,310	2%	4,000	2%	5,310	2%	3:00pm - 7:00pm	1,420	8%	3%	4,730	18%	3%	6,150	16%	3%	10:40am - 2:40pm	1,380	4%	3,050	3%	4,430	3%
Edmonds - Kingston	3-7 pm	1,400	0%	1,260	1%	2,650	0%	2:30pm - 6:30pm	1,530	9%	0%	1,480	17%	1%	3,010	14%	0%	10:45am - 2:45pm	1,450	3%	2,510	1%	3,950	1%
Central Sound Routes		**3,190**	**1%**	**6,650**	**2%**	**9,840**	**2%**		**3,460**	**8%**	**2%**	**7,880**	**18%**	**3%**	**11,340**	**15%**	**2%**		**3,200**	**3%**	**6,950**	**2%**	**10,150**	**3%**
Mukilteo - Clinton	3-7 pm	1,170	3%	1,300	1%	2,470	2%	3:00pm - 7:00pm	1,350	15%	5%	1,580	22%	1%	2,920	18%	3%	10:30am - 2:30pm	1,370	5%	2,470	-2%	3,840	1%
Port Townsend - Keystone	3-7 pm	220	5%	300	0%	510	-2%	11:15am - 3:15pm	360	64%	3%	650	117%	-3%	1,010	98%	-1%	11:15am - 3:15pm	490	2%	890	-3%	1,380	-1%
North Sound Routes		**1,390**	**3%**	**1,600**	**1%**	**2,980**	**1%**		**1,710**	**23%**	**4%**	**2,230**	**39%**	**0%**	**3,930**	**32%**	**2%**		**1,860**	**4%**	**3,360**	**-2%**	**5,220**	**0%**
Subtotal for Peak Periods		**6,170**	**1%**	**9,540**	**1%**	**15,710**	**1%**		**7,120**	**15%**	**2%**	**11,810**	**24%**	**2%**	**18,930**	**20%**	**2%**		**6,500**	**4%**	**11,960**	**1%**	**18,460**	**2%**
All Vessels To/From Anacortes[1]	Daily	1,280	4%	1,280	3%	2,550	3%	Daily	1,740	36%	9%	2,610	104%	6%	4,350	71%	7%	Daily	1,970	10%	4,130	6%	6,100	8%
Inter-Island Vessel Only[1]	Daily	140	0%	180	0%	320	0%	Daily	180	29%	0%	350	94%	-3%	530	66%	-2%	Daily	200	0%	550	-2%	750	-1%
Anacortes/San Juans-Sidney, B.C.[1]	Daily	50	25%	110	-8%	160	0%	Daily	190	280%	6%	470	327%	-2%	660	313%	0%	Daily	270	13%	620	-3%	890	1%
San Juan Island Routes Subtotal[1]		**1,470**	**4%**	**1,570**	**2%**	**3,030**	**3%**		**2,110**	**44%**	**8%**	**3,430**	**118%**	**4%**	**5,540**	**83%**	**5%**		**2,440**	**9%**	**5,300**	**4%**	**7,740**	**6%**
Total Ridership[2]		**7,640**	**2%**	**11,110**	**2%**	**18,740**	**2%**		**9,230**	**21%**	**3%**	**15,240**	**37%**	**3%**	**24,470**	**31%**	**3%**		**8,940**	**5%**	**17,260**	**2%**	**26,200**	**3%**

Note: Typical Weekday volumes are produced from the WSF Planning Model; Summer Weekday and Weekend volumes represent a post-processing conversion

[1] Represents daily ridership forecasts.

[2] Represents combination of PM peak period and daily ridership volumes

[3] Assumption; actual period unknown due to lack of ticket sales data

[4] Actual period unknown due to lack of ticket sales data

Table 4.5e - 2020 Baseline Ridership Forecasts by Fare Category with Conversions to Summer Peak Periods and Adjustments for Recreational Travel - EASTBOUND

Baseline Ridership Forecast

Ferry Route	Typical (May) Weekday PM Peak Period / Reverse Direction: 4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders	Summer Weekday Peak Period / Peak Direction: 4-hr Peak Period	Vehicle/ Driver Fares	% Change from Typical ←	Passenger Fares	% Change from Typical ←	Total Riders	% Change from Typical ←	Summer Weekend Peak / Peak Direction (Sunday): 4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders
Point Defiance - Tahlequah	3-7 pm	60	40	100	AM Peak[3]	350	483%	150	275%	500	400%	Unknown[4]	270	240	510
Vashon - Southworth	3-7 pm	70	30	90	6:05am - 10:05am	90	29%	10	-67%	110	22%	0	70	70	150
Fauntleroy - Vashon	3-7 pm	640	530	1,170	AM Peak[3]	850	33%	740	40%	1,580	35%	Unknown[4]	660	740	1,400
Fauntleroy - Southworth	3-7 pm	160	50	210	4:30am - 8:30am	660	313%	770	1440%	1,430	581%	1:10pm - 5:10pm	440	570	1,010
South Sound Routes		**930**	**650**	**1,570**		**1,950**	**110%**	**1,670**	**157%**	**3,620**	**131%**		**1,440**	**1,620**	**3,070**
Seattle - Bremerton	3-7 pm	350	300	640	6:20am - 10:20am	470	34%	1,550	417%	2,020	216%	3:00pm - 7:00pm	610	2,270	2,890
Seattle - Bainbridge Island	3-7 pm	660	460	1,120	6:20am - 10:20am	1,250	89%	4,190	811%	5,440	386%	6:30pm - 10:30pm	1,250	2,780	4,030
Edmonds - Kingston	3-7 pm	850	480	1,320	2:15pm - 6:15pm	1,370	61%	1,310	173%	2,670	102%	10:50am - 2:50pm	1,440	2,540	3,970
Central Sound Routes		**1,860**	**1,240**	**3,080**		**3,090**	**66%**	**7,050**	**469%**	**10,130**	**229%**		**3,300**	**7,590**	**10,890**
Mukilteo - Clinton	3-7 pm	780	390	1,170	7:00am - 11:00am	1,290	65%	1,560	300%	2,840	143%	3:30pm - 7:30pm	1,280	2,470	3,750
Port Townsend - Keystone	3-7 pm	240	280	520	1:30pm - 5:30pm	320	33%	580	107%	900	73%	2:15pm - 6:15pm	600	1,020	1,620
North Sound Routes		**1,020**	**670**	**1,690**		**1,610**	**58%**	**2,140**	**219%**	**3,740**	**121%**		**1,880**	**3,490**	**5,370**
Subtotal for Peak Periods		**3,810**	**2,560**	**6,340**		**6,650**	**75%**	**10,860**	**324%**	**17,490**	**176%**		**6,620**	**12,700**	**19,330**
All Vessels To/From Anacortes[1]	Daily	1,230	1,240	2,470	Daily	1,600	30%	2,470	99%	4,070	65%	Daily	2,150	4,660	6,800
Inter-Island Vessel Only[1]	Daily	140	180	320	Daily	180	29%	360	100%	540	69%	Daily	240	680	920
Anacortes/San Juans-Sidney, B.C.[1]	Daily	40	120	160	Daily	160	300%	450	275%	610	281%	Daily	270	730	1,000
San Juan Island Routes Subtotal[1]		**1,410**	**1,540**	**2,950**		**1,940**	**38%**	**3,280**	**113%**	**5,220**	**77%**		**2,660**	**6,070**	**8,720**
Total Ridership[2]		**5,220**	**4,100**	**9,290**		**8,590**	**65%**	**14,140**	**245%**	**22,710**	**144%**		**9,280**	**18,770**	**28,050**

Baseline Ridership Forecast - Adjusted for Recreational Travel

Ferry Route	Typical (May) Weekday PM Peak Period / Reverse Direction: 4-hr Peak Period	Vehicle/ Driver Fares	% Change from Base ↑	Passenger Fares	% Change from Base ↑	Total Riders	% Change from Base ↑	Summer Weekday Peak Period / Peak Direction: 4-hr Peak Period	Vehicle/ Driver Fares	% Change from Typical ←	% Change from Base ↑	Passenger Fares	% Change from Typical ←	% Change from Base ↑	Total Riders	% Change from Typical ←	% Change from Base ↑	Summer Weekend Peak / Peak Direction (Sunday): 4-hr Peak Period	Vehicle/ Driver Fares	% Change from Base ↑	Passenger Fares	% Change from Base ↑	Total Riders	% Change from Base ↑
Point Defiance - Tahlequah	3-7 pm	70	17%	40	0%	110	10%	AM Peak[3]	360	414%	3%	180	350%	20%	530	382%	6%	Unknown[4]	280	4%	280	17%	560	10%
Vashon - Southworth	3-7 pm	70	0%	20	-33%	90	0%	6:05am - 10:05am	90	29%	0%	10	-50%	0%	110	22%	0%	0	80	14%	70	0%	150	0%
Fauntleroy - Vashon	3-7 pm	660	3%	540	2%	1,200	3%	AM Peak[3]	870	32%	2%	780	44%	5%	1,650	38%	4%	Unknown[4]	680	3%	790	7%	1,470	5%
Fauntleroy - Southworth	3-7 pm	160	0%	50	0%	210	0%	4:30am - 8:30am	660	313%	0%	760	1420%	-1%	1,420	576%	-1%	1:10pm - 5:10pm	440	0%	560	-2%	1,000	-1%
South Sound Routes		**960**	**3%**	**650**	**0%**	**1,610**	**3%**		**1,980**	**106%**	**2%**	**1,730**	**166%**	**4%**	**3,710**	**130%**	**2%**		**1,480**	**3%**	**1,700**	**5%**	**3,180**	**4%**
Seattle - Bremerton	3-7 pm	350	0%	300	0%	650	2%	6:20am - 10:20am	490	40%	4%	1,610	437%	4%	2,100	223%	4%	3:00pm - 7:00pm	630	3%	2,360	4%	3,000	4%
Seattle - Bainbridge Island	3-7 pm	670	2%	460	0%	1,130	1%	6:20am - 10:20am	1,290	93%	3%	4,310	837%	3%	5,600	396%	3%	6:30pm - 10:30pm	1,300	4%	2,870	3%	4,160	3%
Edmonds - Kingston	3-7 pm	880	4%	480	0%	1,350	2%	2:15pm - 6:15pm	1,370	56%	0%	1,320	175%	1%	2,680	99%	0%	10:50am - 2:50pm	1,470	2%	2,550	0%	4,020	1%
Central Sound Routes		**1,900**	**2%**	**1,240**	**0%**	**3,130**	**2%**		**3,150**	**66%**	**2%**	**7,240**	**484%**	**3%**	**10,380**	**232%**	**2%**		**3,400**	**3%**	**7,780**	**3%**	**11,180**	**3%**
Mukilteo - Clinton	3-7 pm	800	3%	360	-8%	1,160	-1%	7:00am - 11:00am	1,350	69%	5%	1,580	339%	1%	2,920	152%	3%	3:30pm - 7:30pm	1,350	5%	2,420	-2%	3,770	1%
Port Townsend - Keystone	3-7 pm	230	-4%	280	0%	510	-2%	1:30pm - 5:30pm	330	43%	3%	570	104%	-2%	890	75%	-1%	2:15pm - 6:15pm	610	2%	990	-3%	1,600	-1%
North Sound Routes		**1,030**	**1%**	**640**	**-4%**	**1,670**	**-1%**		**1,680**	**63%**	**4%**	**2,150**	**236%**	**0%**	**3,810**	**128%**	**2%**		**1,960**	**4%**	**3,410**	**-2%**	**5,370**	**0%**
Subtotal for Peak Periods		**3,890**	**2%**	**2,530**	**-1%**	**6,410**	**1%**		**6,810**	**75%**	**2%**	**11,120**	**340%**	**2%**	**17,900**	**179%**	**2%**		**6,840**	**3%**	**12,890**	**1%**	**19,730**	**2%**
All Vessels To/From Anacortes[1]	Daily	1,280	4%	1,280	3%	2,550	3%	Daily	1,740	36%	9%	2,610	104%	6%	4,350	71%	7%	Daily	2,360	10%	4,950	6%	7,320	8%
Inter-Island Vessel Only[1]	Daily	140	0%	180	0%	320	0%	Daily	180	29%	0%	350	94%	-3%	530	66%	-2%	Daily	250	4%	660	-3%	900	-2%
Anacortes/San Juans-Sidney, B.C.[1]	Daily	50	25%	110	-8%	160	0%	Daily	180	260%	13%	430	291%	-4%	610	281%	0%	Daily	300	11%	700	-4%	1,010	1%
San Juan Island Routes Subtotal[1]		**1,470**	**4%**	**1,570**	**2%**	**3,030**	**3%**		**2,100**	**43%**	**8%**	**3,390**	**116%**	**3%**	**5,490**	**81%**	**5%**		**2,910**	**9%**	**6,310**	**4%**	**9,230**	**6%**
Total Ridership[2]		**5,360**	**3%**	**4,100**	**0%**	**9,440**	**2%**		**8,910**	**66%**	**4%**	**14,510**	**254%**	**3%**	**23,390**	**148%**	**3%**		**9,750**	**5%**	**19,200**	**2%**	**28,960**	**3%**

Note: Typical Weekday volumes are produced from the WSF Planning Model; Summer Weekday and Weekend volumes represent a post-processing conversion

[1] Represents daily ridership forecasts.

[2] Represents combination of PM peak period and daily ridership volumes

[3] Assumption; actual period unknown due to lack of ticket sales data

[4] Actual period unknown due to lack of ticket sales data

Table 4.5f - 2030 Baseline Ridership Forecasts by Fare Category with Conversions to Summer Peak Periods and Adjustments for Recreational Travel - WESTBOUND

Baseline Ridership Forecast

Ferry Route	Typical (May) Weekday PM Peak Period / Peak Direction: 4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders	Summer Weekday Peak Period / Peak Direction: 4-hr Peak Period	Vehicle/ Driver Fares	% Change from Typical ←	Passenger Fares	% Change from Typical ←	Total Riders	% Change from Typical ←	Summer Weekend Peak / Peak Direction (Saturday): 4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders
Point Defiance - Tahlequah	3-7 pm	260	120	370	2:40pm - 6:40pm	350	35%	180	50%	530	43%	2:40pm - 6:40pm	280	280	550
Vashon - Southworth	3-7 pm	100	50	150	PM Peak[3]	140	40%	20	-60%	160	7%	Unknown[4]	120	90	210
Fauntleroy - Vashon	3-7 pm	630	430	1,060	4:00pm - 8:00pm	810	29%	640	49%	1,450	37%	10:10am - 2:10pm	670	730	1,400
Fauntleroy - Southworth	3-7 pm	590	770	1,370	3:35pm - 7:35pm	640	8%	870	13%	1,510	10%	8:35am - 12:35pm	400	610	1,010
South Sound Routes		**1,580**	**1,370**	**2,950**		**1,940**	**23%**	**1,710**	**25%**	**3,650**	**24%**		**1,470**	**1,710**	**3,170**
Seattle - Bremerton	3-7 pm	570	1,600	2,160	3:00pm - 7:00pm	590	4%	1,890	18%	2,480	15%	3:00pm - 7:00pm	430	1,560	1,990
Seattle - Bainbridge Island	3-7 pm	1,540	4,430	5,970	3:00pm - 7:00pm	1,650	7%	5,180	17%	6,830	14%	10:40am - 2:40pm	1,590	3,360	4,950
Edmonds - Kingston	3-7 pm	1,380	1,410	2,780	2:30pm - 6:30pm	1,510	9%	1,650	17%	3,160	14%	10:45am - 2:45pm	1,420	2,800	4,220
Central Sound Routes		**3,490**	**7,440**	**10,910**		**3,750**	**7%**	**8,720**	**17%**	**12,470**	**14%**		**3,440**	**7,720**	**11,160**
Mukilteo - Clinton	3-7 pm	1,160	1,570	2,720	3:00pm - 7:00pm	1,310	13%	1,890	20%	3,200	18%	10:30am - 2:30pm	1,390	3,000	4,380
Port Townsend - Keystone	3-7 pm	280	420	690	11:15am - 3:15pm	450	61%	920	119%	1,370	99%	11:15am - 3:15pm	630	1,270	1,900
North Sound Routes		**1,440**	**1,990**	**3,410**		**1,760**	**22%**	**2,810**	**41%**	**4,570**	**34%**		**2,020**	**4,270**	**6,280**
Subtotal for Peak Periods		**6,510**	**10,800**	**17,270**		**7,450**	**14%**	**13,240**	**23%**	**20,690**	**20%**		**6,930**	**13,700**	**20,610**
All Vessels To/From Anacortes[1]	Daily	1,400	1,520	2,920	Daily	1,820	30%	3,020	99%	4,850	66%	Daily	2,040	4,750	6,780
Inter-Island Vessel Only[1]	Daily	160	210	370	Daily	210	31%	420	100%	630	70%	Daily	240	660	900
Anacortes/San Juans-Sidney, B.C.[1]	Daily	50	120	170	Daily	180	260%	520	333%	710	318%	Daily	250	690	940
San Juan Island Routes Subtotal[1]		**1,610**	**1,850**	**3,460**		**2,210**	**37%**	**3,960**	**114%**	**6,190**	**79%**		**2,530**	**6,100**	**8,620**
Total Ridership[2]		**8,120**	**12,650**	**20,730**		**9,660**	**19%**	**17,200**	**36%**	**26,880**	**30%**		**9,460**	**19,800**	**29,230**

Baseline Ridership Forecast - Adjusted for Recreational Travel

Ferry Route	Typical (May) Weekday PM Peak Period / Peak Direction: 4-hr Peak Period	Vehicle/ Driver Fares	% Change from Base ↑	Passenger Fares	% Change from Base ↑	Total Riders	% Change from Base ↑	Summer Weekday Peak Period / Peak Direction: 4-hr Peak Period	Vehicle/ Driver Fares	% Change from Typical ←	% Change from Base ↑	Passenger Fares	% Change from Typical ←	% Change from Base ↑	Total Riders	% Change from Typical ←	% Change from Base ↑	Summer Weekend Peak / Peak Direction (Saturday): 4-hr Peak Period	Vehicle/ Driver Fares	% Change from Base ↑	Passenger Fares	% Change from Base ↑	Total Riders	% Change from Base ↑
Point Defiance - Tahlequah	3-7 pm	270	4%	130	8%	400	8%	2:40pm - 6:40pm	370	37%	6%	220	69%	22%	590	48%	11%	2:40pm - 6:40pm	310	11%	330	18%	630	15%
Vashon - Southworth	3-7 pm	100	0%	50	0%	140	-7%	PM Peak[3]	140	40%	0%	20	-60%	0%	150	7%	-6%	Unknown[4]	110	-8%	90	0%	200	-5%
Fauntleroy - Vashon	3-7 pm	670	6%	470	9%	1,140	8%	4:00pm - 8:00pm	880	31%	9%	750	60%	17%	1,640	44%	13%	10:10am - 2:10pm	730	9%	830	14%	1,560	11%
Fauntleroy - Southworth	3-7 pm	590	0%	770	0%	1,360	-1%	3:35pm - 7:35pm	640	8%	0%	870	13%	0%	1,510	11%	0%	8:35am - 12:35pm	410	3%	600	-2%	1,010	0%
South Sound Routes		**1,630**	**3%**	**1,420**	**4%**	**3,040**	**3%**		**2,030**	**25%**	**5%**	**1,860**	**31%**	**9%**	**3,890**	**28%**	**7%**		**1,560**	**6%**	**1,850**	**8%**	**3,400**	**7%**
Seattle - Bremerton	3-7 pm	580	2%	1,650	3%	2,230	3%	3:00pm - 7:00pm	610	5%	3%	1,990	21%	5%	2,600	17%	5%	3:00pm - 7:00pm	450	5%	1,640	5%	2,090	5%
Seattle - Bainbridge Island	3-7 pm	1,580	3%	4,580	3%	6,150	3%	3:00pm - 7:00pm	1,710	8%	4%	5,450	19%	5%	7,160	16%	5%	10:40am - 2:40pm	1,660	4%	3,540	5%	5,210	5%
Edmonds - Kingston	3-7 pm	1,420	3%	1,430	1%	2,850	3%	2:30pm - 6:30pm	1,580	11%	5%	1,690	18%	2%	3,270	15%	3%	10:45am - 2:45pm	1,530	8%	2,880	3%	4,410	5%
Central Sound Routes		**3,580**	**3%**	**7,660**	**3%**	**11,230**	**3%**		**3,900**	**9%**	**4%**	**9,130**	**19%**	**5%**	**13,030**	**16%**	**4%**		**3,640**	**6%**	**8,060**	**4%**	**11,710**	**5%**
Mukilteo - Clinton	3-7 pm	1,240	7%	1,590	1%	2,830	4%	3:00pm - 7:00pm	1,460	18%	11%	1,940	22%	3%	3,400	20%	6%	10:30am - 2:30pm	1,550	12%	2,990	0%	4,540	4%
Port Townsend - Keystone	3-7 pm	280	0%	400	-5%	680	-1%	11:15am - 3:15pm	460	64%	2%	870	118%	-5%	1,330	96%	-3%	11:15am - 3:15pm	630	0%	1,220	-4%	1,840	-3%
North Sound Routes		**1,520**	**6%**	**1,990**	**0%**	**3,510**	**3%**		**1,920**	**26%**	**9%**	**2,810**	**41%**	**0%**	**4,730**	**35%**	**4%**		**2,180**	**8%**	**4,210**	**-1%**	**6,380**	**2%**
Subtotal for Peak Periods		**6,730**	**3%**	**11,070**	**3%**	**17,780**	**3%**		**7,850**	**17%**	**5%**	**13,800**	**25%**	**4%**	**21,650**	**22%**	**5%**		**7,380**	**6%**	**14,120**	**3%**	**21,490**	**4%**
All Vessels To/From Anacortes[1]	Daily	1,500	7%	1,570	3%	3,070	5%	Daily	2,090	39%	15%	3,250	107%	8%	5,350	74%	10%	Daily	2,390	17%	5,150	8%	7,540	11%
Inter-Island Vessel Only[1]	Daily	170	6%	210	0%	380	3%	Daily	220	29%	5%	430	105%	2%	650	71%	3%	Daily	250	4%	670	2%	920	2%
Anacortes/San Juans-Sidney, B.C.[1]	Daily	50	0%	130	8%	180	6%	Daily	230	360%	28%	560	331%	8%	800	344%	13%	Daily	320	28%	760	10%	1,080	15%
San Juan Island Routes Subtotal[1]		**1,720**	**7%**	**1,910**	**3%**	**3,630**	**5%**		**2,540**	**48%**	**15%**	**4,240**	**122%**	**7%**	**6,800**	**87%**	**10%**		**2,960**	**17%**	**6,580**	**8%**	**9,540**	**11%**
Total Ridership[2]		**8,450**	**4%**	**12,980**	**3%**	**21,410**	**3%**		**10,390**	**23%**	**8%**	**18,040**	**39%**	**5%**	**28,450**	**33%**	**6%**		**10,340**	**9%**	**20,700**	**5%**	**31,030**	**6%**

Note: Typical Weekday volumes are produced from the WSF Planning Model; Summer Weekday and Weekend volumes represent a post-processing conversion

[1] Represents daily ridership forecasts.

[2] Represents combination of PM peak period and daily ridership volumes

[3] Assumption; actual period unknown due to lack of ticket sales data

[4] Actual period unknown due to lack of ticket sales data

Table 4.5g - 2030 Baseline Ridership Forecasts by Fare Category with Conversions to Summer Peak Periods and Adjustments for Recreational Travel - EASTBOUND

Baseline Ridership Forecast

Ferry Route	Typical (May) Weekday PM Peak Period / Reverse Direction: 4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders	Summer Weekday Peak Period / Peak Direction: 4-hr Peak Period	Vehicle/ Driver Fares	% Change from Typical ←	Passenger Fares	% Change from Typical ←	Total Riders	% Change from Typical ←	Summer Weekend Peak / Peak Direction (Sunday): 4-hr Peak Period	Vehicle/ Driver Fares	Passenger Fares	Total Riders
Point Defiance - Tahlequah	3-7 pm	70	40	110	AM Peak[3]	350	400%	180	350%	530	382%	Unknown[4]	280	280	550
Vashon - Southworth	3-7 pm	110	30	130	6:05am - 10:05am	140	27%	20	-33%	160	23%	Unknown[4]	120	90	210
Fauntleroy - Vashon	3-7 pm	700	570	1,270	AM Peak[3]	810	16%	640	12%	1,450	14%	Unknown[4]	670	730	1,400
Fauntleroy - Southworth	3-7 pm	150	60	210	4:30am - 8:30am	660	340%	900	1400%	1,570	648%	1:10pm - 5:10pm	440	670	1,100
South Sound Routes		**1,030**	**700**	**1,720**		**1,960**	**90%**	**1,740**	**149%**	**3,710**	**116%**		**1,510**	**1,770**	**3,260**
Seattle - Bremerton	3-7 pm	400	330	730	6:20am - 10:20am	560	40%	1,820	452%	2,390	227%	3:00pm - 7:00pm	730	2,650	3,370
Seattle - Bainbridge Island	3-7 pm	770	560	1,330	6:20am - 10:20am	1,500	95%	4,720	743%	6,220	368%	6:30pm - 10:30pm	1,490	3,160	4,650
Edmonds - Kingston	3-7 pm	880	530	1,420	2:15pm - 6:15pm	1,350	53%	1,470	177%	2,820	99%	10:50am - 2:50pm	1,450	2,850	4,300
Central Sound Routes		**2,050**	**1,420**	**3,480**		**3,410**	**66%**	**8,010**	**464%**	**11,430**	**228%**		**3,670**	**8,660**	**12,320**
Mukilteo - Clinton	3-7 pm	880	440	1,310	7:00am - 11:00am	1,310	49%	1,890	330%	3,200	144%	3:30pm - 7:30pm	1,360	2,940	4,300
Port Townsend - Keystone	3-7 pm	310	400	700	1:30pm - 5:30pm	410	32%	800	100%	1,210	73%	2:15pm - 6:15pm	780	1,420	2,190
North Sound Routes		**1,190**	**840**	**2,010**		**1,720**	**45%**	**2,690**	**220%**	**4,410**	**119%**		**2,140**	**4,360**	**6,490**
Subtotal for Peak Periods		**4,270**	**2,960**	**7,210**		**7,090**	**66%**	**12,440**	**320%**	**19,550**	**171%**		**7,320**	**14,790**	**22,070**
All Vessels To/From Anacortes[1]	Daily	1,400	1,520	2,920	Daily	1,820	30%	3,020	99%	4,850	66%	Daily	2,450	5,690	8,140
Inter-Island Vessel Only[1]	Daily	160	210	370	Daily	210	31%	420	100%	630	70%	Daily	280	800	1,080
Anacortes/San Juans-Sidney, B.C.[1]	Daily	50	120	170	Daily	170	240%	480	300%	650	282%	Daily	280	780	1,070
San Juan Island Routes Subtotal[1]		**1,610**	**1,850**	**3,460**		**2,200**	**37%**	**3,920**	**112%**	**6,130**	**77%**		**3,010**	**7,270**	**10,290**
Total Ridership[2]		**5,880**	**4,810**	**10,670**		**9,290**	**58%**	**16,360**	**240%**	**25,680**	**141%**		**10,330**	**22,060**	**32,360**

Baseline Ridership Forecast - Adjusted for Recreational Travel

Ferry Route	Typical (May) Weekday PM Peak Period / Reverse Direction: 4-hr Peak Period	Vehicle/ Driver Fares	% Change from Base ↑	Passenger Fares	% Change from Base ↑	Total Riders	% Change from Base ↑	Summer Weekday Peak Period / Peak Direction: 4-hr Peak Period	Vehicle/ Driver Fares	% Change from Typical ←	% Change from Base ↑	Passenger Fares	% Change from Typical ←	% Change from Base ↑	Total Riders	% Change from Typical ←	% Change from Base ↑	Summer Weekend Peak / Peak Direction (Sunday): 4-hr Peak Period	Vehicle/ Driver Fares	% Change from Base ↑	Passenger Fares	% Change from Base ↑	Total Riders	% Change from Base ↑
Point Defiance - Tahlequah	3-7 pm	80	14%	40	0%	120	9%	AM Peak[3]	370	363%	6%	220	450%	22%	590	392%	11%	Unknown[4]	310	11%	330	18%	630	15%
Vashon - Southworth	3-7 pm	110	0%	30	0%	130	0%	6:05am - 10:05am	140	27%	0%	20	-33%	0%	150	15%	-6%	Unknown[4]	110	-8%	90	0%	200	-5%
Fauntleroy - Vashon	3-7 pm	730	4%	600	5%	1,330	5%	AM Peak[3]	880	21%	9%	750	25%	17%	1,640	23%	13%	Unknown[4]	730	9%	830	14%	1,560	11%
Fauntleroy - Southworth	3-7 pm	150	0%	60	0%	220	5%	4:30am - 8:30am	670	347%	2%	900	1400%	0%	1,570	614%	0%	1:10pm - 5:10pm	450	2%	660	-1%	1,110	1%
South Sound Routes		**1,070**	**4%**	**730**	**4%**	**1,800**	**5%**		**2,060**	**93%**	**5%**	**1,890**	**159%**	**9%**	**3,950**	**119%**	**6%**		**1,600**	**6%**	**1,910**	**8%**	**3,500**	**7%**
Seattle - Bremerton	3-7 pm	410	3%	330	0%	740	1%	6:20am - 10:20am	590	44%	5%	1,920	482%	5%	2,500	238%	5%	3:00pm - 7:00pm	760	4%	2,780	5%	3,540	5%
Seattle - Bainbridge Island	3-7 pm	800	4%	560	0%	1,360	2%	6:20am - 10:20am	1,560	95%	4%	4,960	786%	5%	6,520	379%	5%	6:30pm - 10:30pm	1,560	5%	3,330	5%	4,890	5%
Edmonds - Kingston	3-7 pm	940	7%	540	2%	1,480	4%	2:15pm - 6:15pm	1,410	50%	4%	1,510	180%	3%	2,920	97%	4%	10:50am - 2:50pm	1,550	7%	2,930	3%	4,480	4%
Central Sound Routes		**2,150**	**5%**	**1,430**	**1%**	**3,580**	**3%**		**3,560**	**66%**	**4%**	**8,390**	**487%**	**5%**	**11,940**	**234%**	**4%**		**3,870**	**5%**	**9,040**	**4%**	**12,910**	**5%**
Mukilteo - Clinton	3-7 pm	920	5%	410	-7%	1,330	2%	7:00am - 11:00am	1,460	59%	11%	1,940	373%	3%	3,400	156%	6%	3:30pm - 7:30pm	1,520	12%	2,940	0%	4,460	4%
Port Townsend - Keystone	3-7 pm	300	-3%	390	-3%	690	-1%	1:30pm - 5:30pm	420	40%	2%	760	95%	-5%	1,190	72%	-2%	2:15pm - 6:15pm	780	0%	1,350	-5%	2,130	-3%
North Sound Routes		**1,220**	**3%**	**800**	**-5%**	**2,020**	**0%**		**1,880**	**54%**	**9%**	**2,700**	**238%**	**0%**	**4,590**	**127%**	**4%**		**2,300**	**7%**	**4,290**	**-2%**	**6,590**	**2%**
Subtotal for Peak Periods		**4,440**	**4%**	**2,960**	**0%**	**7,400**	**3%**		**7,500**	**69%**	**6%**	**12,980**	**339%**	**4%**	**20,480**	**177%**	**5%**		**7,770**	**6%**	**15,240**	**3%**	**23,000**	**4%**
All Vessels To/From Anacortes[1]	Daily	1,500	7%	1,570	3%	3,070	5%	Daily	2,090	39%	15%	3,250	107%	8%	5,350	74%	10%	Daily	2,870	17%	6,180	9%	9,050	11%
Inter-Island Vessel Only[1]	Daily	170	6%	210	0%	380	3%	Daily	220	29%	5%	430	105%	2%	650	71%	3%	Daily	300	7%	810	1%	1,110	3%
Anacortes/San Juans-Sidney, B.C.[1]	Daily	50	0%	130	8%	180	6%	Daily	220	340%	29%	520	300%	8%	730	306%	12%	Daily	370	32%	850	9%	1,230	15%
San Juan Island Routes Subtotal[1]		**1,720**	**7%**	**1,910**	**3%**	**3,630**	**5%**		**2,530**	**47%**	**15%**	**4,200**	**120%**	**7%**	**6,730**	**85%**	**10%**		**3,540**	**18%**	**7,840**	**8%**	**11,390**	**11%**
Total Ridership[2]		**6,160**	**5%**	**4,870**	**1%**	**11,030**	**3%**		**10,030**	**63%**	**8%**	**17,180**	**253%**	**5%**	**27,210**	**147%**	**6%**		**11,310**	**9%**	**23,080**	**5%**	**34,390**	**6%**

Note: Typical Weekday volumes are produced from the WSF Planning Model; Summer Weekday and Weekend volumes represent a post-processing conversion

[1] Represents daily ridership forecasts.

[2] Represents combination of PM peak period and daily ridership volumes

[3] Assumption; actual period unknown due to lack of ticket sales data

[4] Actual period unknown due to lack of ticket sales data

5.0 TIME-OF-DAY/FARE ELASTICITY ESTIMATION

5.1 Summary

This section describes the work that was undertaken using recently-collected survey data to estimate the likely response of ferry customer volumes to changes in fare amounts and time-of-day pricing policies. The work was based on survey data that was collected in July 2008 by Opinion Research Northwest ("ORC-NW", Boise, Idaho). The survey included a set of questions that asked current peak drive-on ferry customers to choose among five options under different service conditions:

1. Drive-on the sailing chosen for the most recent trip
2. Drive-on an earlier sailing
3. Drive-on a later sailing,
4. Walk-on the sailing chosen for the most recent trip or
5. Make the trip some other way or not at all

The responses to those questions were used to statistically estimate the likelihood of an individual choosing each of these options under different fare policies and service conditions.

ORC-NW prepared a dataset that included all of the relevant data in a form suitable for analysis and conducted some initial statistical and simulation modeling. The work described here refined and extended that initial modeling. First, the survey data were reviewed and found to represent reasonable ranges of travel behavior. The survey data provides a rich description of customers' current travel and of their responses to a wide range of different service conditions.

As a second task, the choice models developed by the ORC-NW team were refined in two specific ways: 1) standard econometric methods were used to test different model forms and 2) the models were adapted to be consistent with standard travel mode choice modeling practices. The sensitivity of traffic volumes to fare in the resulting models is very close to that in the current Washington State Ferries forecasting model and also to the observed historical changes in actual customer volumes in response to past fare changes.

Finally, the travel choice models were imported into an Excel spreadsheet to allow direct analysis by Washington State Ferries staff and consultants of the numerous fare and service scenarios that will be analyzed as part of the current planning effort. The models are implemented in a form that is consistent with standard practice in travel mode choice modeling and in particular in a probabilistic form – estimating the probabilities of individuals choosing different options with different fare structures and service conditions. The spreadsheet is used to calculate elasticities by route group, fare class and time period. Several scenarios were evaluated and the results indicate, as did the initial work by the ORC-NW team, that fare changes can significantly affect both overall demand and, even more so, the time-of-day distribution of demand.

5.2 Introduction

This section describes the statistical and simulation modeling work that was undertaken to estimate the elasticity of ferry customer volumes to changes in fare amounts and time-of-day pricing policies. The work was based on survey data that were collected in July 2008 by ORC-NW. Details of the survey design and administration are available from ORC-NW but the element of direct relevance to this work is the survey's choice-based conjoint exercise. A conjoint survey is one in which respondents are given a choice between several alternatives, each described by a different set of features.

The structure of the choice-based conjoint exercise was developed collaboratively among ORC-NW, the Transportation Commission, Washington State Ferries and other consultants working for those entities. It was designed to follow the general approach commonly used for transportation choice modeling, also known as a stated preference (SP) survey. In this approach, respondents are asked to describe their most recent trip using the mode of interest. They are then presented with realistic alternatives for making that trip and asked to select the one that they would most likely choose under those circumstances. The use of a specific past trip as a point of reference is important in these surveys because travel decisions are commonly quite context specific – travelers have specific needs and constraints that vary considerably from day-to-day and from trip to trip and an average or typical trip does not reflect those real needs and constraints.[4]

The choice-based conjoint experiments for the Washington State Ferries survey were administered to drive-on customers who were asked to choose among five alternatives:

1. Drive-on the sailing chosen for the most recent trip
2. Drive-on an earlier sailing
3. Drive-on a later sailing,
4. Walk-on the sailing chosen for the most recent trip or
5. Make the trip some other way or not at all

Each of the alternatives was described by a fare, a waiting time and an actual sailing departure time. The fares, waiting times and departure times for the earlier and later sailings were varied across the experiments. An example screen from ORC-NW's online questionnaire is shown below in Figure 5.2a.

[4] The use of a specific past trip as a point of reference is important in these surveys because travel decisions are commonly quite context specific travelers have specific needs and constraints that vary considerably from day-to-day and from trip to trip and an average or typical trip does not reflect those real needs and constraints. By sampling across all trips made by respondents, a representative mix of these needs and constraints will be represented in the sample.

Figure 5.2a – Example Screen from Online Questionnaire

A total of eight such screens were shown to each respondent, with the values of the variables changing according to an experimental design that was aimed at extracting the best possible set of useful observations. The data from the 838 respondents who completed the choice-based conjoint exercises provide sufficient information to allow estimation of system-wide elasticities for current drive-on customers, and in particular to determine how those customers would likely change their use of the system in response to changes in fare levels and policies.

The remainder of this discussion describes the general approach that was used to estimate these elasticities and the values that were estimated for alternative policies to be evaluated in the current Washington State Ferries Long Range Plan.

5.3 Project Approach

Washington State Ferries currently uses a travel mode/route choice forecasting model that was developed using data from a 1999 on-board origin-destination and stated preference survey effort.[5] That model used a joint estimation approach with both actual travel data as well as stated preference survey data. This is generally regarded among practicing travel choice

[5] TECHNICAL MEMORANDUM: Results of WSF Mode Choice and Route Choice Model Estimation, prepared by Mark Bradley Research Consulting with consultation from Parsons Brinckerhoff Quade Douglas, Inc., 2001.

modelers as the most preferable approach for choice model estimation but it is possible only when there is sufficient variation in the variables of interest among the available mode and route alternatives. For example, the 1999 survey provides no information about possible changes in rider behavior because of peak vs. off-peak fares, because fares didn't vary between peak and off-peak periods. In order to analyze this issue as well as others, we used the more recent data gathered by ORC-NW that did address this variable.

The work described here was designed specifically to complement the existing WSF model, by providing estimates of the elasticity of drive-on volumes to changes in fares across departure times. The model structure and general approach to statistical estimation of the model coefficients were selected to be consistent with the existing WSFmodel where appropriate. In particular, segment-level multinomial logit models were estimated using classical econometric methods and the model scales were set to be consistent with those models. A multinomial logit model is typically used when there is a variety of choices or outcomes, and its output is an estimate of how the odds of a particular choice or outcome vary with changes in the inputs (the independent variables), in this case fares, minutes of wait time, fare differences between vehicles and walk-ons, and so forth. Individual respondent-level models were also developed to allow random heterogeneity across the sample. In other words, the model attempts to capture both individual preferences and the distribution of preferences across respondents. The resulting models were normalized so that the scale of the coefficient estimates was consistent with that estimated for the segment-level multinomial logit models, which also is very close to the scale of the existing WSF mode/route choice models.

The resulting individual-level ferry mode/time-of-day choice models were incorporated into a spreadsheet-based simulator that was designed to calculate elasticities at the route group level under different fare policies. The simulator calculates the likelihood of each individual in the survey sample choosing each of the available travel alternatives under different fare conditions. These likelihoods are then totaled to produce estimates of the alternatives' market shares under these fares. Finally, the changes in market shares from base conditions are used to calculate fare elasticities.

5.4 Model Specification and Estimation Results

Data for the model estimation work was provided by ORC-NW. The choice-based conjoint data was merged with demographic and trip data from the associated respondents. Together, these two sets of data allowed estimation of models that incorporated both systematic and random heterogeneity.[6] The models were specified to include all the variables that were varied among the choice-based conjoint experiments, in addition to selected demographic and trip characteristics. Fare and waiting/departure time differences (for the earlier and later sailings) were specified as nominal variables in dollars and minutes respectively and were treated as continuous rather than categorical variables.[7] In addition, the models were specified to include

[6] It has been shown that some differences in preferences are systematic effects of demographic variables such as income and it is important to incorporate those effects in the model structure before modeling random differences in preferences. See, for example, Bhat, C., V. Warburg and T. Adler, "Modeling Demographic and Unobserved Heterogeneity in Air Passengers Sensitivity to Service Attributes in Itinerary Choice," *Transportation Research Record 1951*, Transportation Research Board, Washington D. C., 2006.

[7] Initial work conducted previously by others treated fare and time shift as categorical variables with seven and four levels, respectively. However, the resulting individual-level models displayed significant non-monotonicity well over three-quarters of the individuals in the sample had estimated values that suggested that higher prices were preferred to lower prices. This was simply a result of stretching the data to estimate more fare and time shift coefficients than it could reasonably support.

only the number of terms that could be supported by the experimental design and that followed econometric identification rules.[8]

In addition to reviewing the data for outliers, several specification tests were conducted to determine the type of travel behavior represented by the data. In general, these tests indicated that the travelers who completed the survey responded carefully to the choice experiments; in other words, the responses given by a single traveler were not inconsistent with each other.

The general form of the specifications has the four conjoint variables: fare, time between the sailing used and an earlier sailing time, time between the sailing used and a later sailing time, and waiting time. In addition, constants were added for the walk-on and drive-on alternatives to represent additional factors that might affect choice between these alternatives and the no-trip option. Separate constants were not specified for the earlier and later sailing options because those constants were not significantly different from the one for the sailing time that was actually selected, the time shift variable adequately represents those differences. As a result, only two constants were specified for the five alternatives.[9]

As noted above, fare and the time variables were treated as continuous variables and a number of linear and nonlinear functions were tested to determine the relationship between these variables and the utility[10] of the ferry alternatives. These tests indicated that the effects on utility are not significantly different from linear within the range of fare values tested and similar tests indicated linearity in the effects of time shifts to earlier or later sailings. As a result, general linear specifications were used for these variables in all of the subsequent work.[11]

Also as noted above, systematic effects of demographic and other variables were also explored through specification tests. The most consistent effect was found to be an income effect on price sensitivity. This effect has been noted in many other travel choice models and was incorporated here.[12] This effect reflects the fact that higher income individuals are generally less sensitive to fares.

As expected, systematic differences were found in the responses between discretionary and non-discretionary trips. The sample was also segmented along three other dimensions to identify any other systematic variations in preference. The dimensions tested included:

1. **Payment type** – Multi-ride discounted fare or full fare
2. **Actual sailing time** – Peak period or off-peak

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[8] Some models developed previously were significantly over-specified meaning that more coefficients were included in the models than could be independently estimated given the structure of the data. When too many variables are included in a model for the size of the data set, the results are not meaningful. Previous models had approximately 60 individual terms (coefficients) that were estimated for each of the 838 respondents in the sample.

[9] Note that only n-1 constants can be independently identified for n alternatives because choices depend only on the difference in utilities between alternatives. If they have read this far, they already know this.

[10] Utility is the economic term to describe the general attractiveness of an alternative. In market research, the terms worth and part worth (for the contribution of a particular attribute) are more commonly used to describe this same quantity.

[11] Note that the overall effect of utility in the multinomial logit model used for this work is nonlinear even with a linear representation within the utility function.

[12] An additional exponent representing the elasticity of price sensitivity to income was estimated using a nonlinear search method. This is as opposed to a simple multiplicative interaction form commonly used in these models. See, for example, Axhausen, K.W., Hess, S., Knig, A., Abay, G., Bates, J.J. Bierlaire, M., "State of the art estimates of the Swiss value of travel time savings," *Transport Policy*, forthcoming, 2008.

3. **Route group** – North, Central, South or Island

Although some differences in price sensitivity were found between multi-ride and full fare passengers, the most significant differences were found among the route groups (North, South, Central and Island). While the sample sizes for the individual line groups were not sufficient to support detailed model estimation at that level, this segmentation structure was carried into the simulation modeling described in the next section.

The final estimated models and associated statistics are given in Table 5.4a and Table 5.4b below.

Table 5.4a - Logit Model Coefficients for Discretionary Trips

	Coefficient	T-Stat
Fare ($)	-0.136	-25.4
Shift earlier (min.)	-0.0101	-19.9
Shift later (min.)	-0.00962	-19.0
Wait time (min.)	-0.0205	-14.5
Drive-on constant	3.04	33.5
Walk-on constant	0.679	11.5
Fare-income elast.	-0.166	-5.0

Observations:	4170
Initial log likelihood:	-6711
Final log likelihood:	-5954

Table 5.4b - Logit Model Coefficients for Non-Discretionary Trips

	Coefficient	T-Stat
Fare ($)	-0.126	-18.7
Shift earlier (min.)	-0.0139	-19.6
Shift later (min.)	-0.0136	-19.5
Wait time (min.)	-0.0184	-12.0
Drive-on constant	2.9	25.8
Walk-on constant	0.87	13.1
Fare-income elast.	-0.0918	-1.8

Observations:	2526
Initial log likelihood:	-4065
Final log likelihood:	-3606

These coefficients can be used to calculate the change in odds that a traveler would choose a different sailing time or walk vs. drive given a change in fares and/or a change in the time variables. The large constant term for drive-on means that if a traveler chooses to drive on, given the fare structure and sailing times, a large change in those variables is necessary to shift his or her travel choice away from drive-on. This is shown by the size of the drive-on constant

relative to the other coefficients. The constant term serves to capture all the other variables that might go into a choice to drive on. Those other variables are at least partially captured in the survey done by ORC-NW. For example, the survey respondents indicated that availability of transit service on either side of the trip affected their travel choice, as well as total travel time and lack of flexibility.

All of the coefficient values are intuitively reasonable when compared to other travel choice models. The fare and time coefficients are all negative, meaning that utility values decline with increasing fares and wait time and all are highly statistically significant. The fare-income elasticities are negative, meaning that price sensitivity declines with higher incomes, as would be expected. Also as would be expected, these models indicate that travelers on non-discretionary trips are less willing to shift to earlier or later sailings and are less cost-sensitive than those making discretionary trips.

These results were compared with the model that is currently being used in the WSF forecasting system. The coefficient of fare is common between that model and the ones described in the tables above (travel time was not varied in this conjoint survey and so there is not a comparable value estimated here).[13] Also, the fare coefficients estimated here are remarkably similar to those developed in 1999 for the current Ferries model; -0.129 in that model vs. -0.136 for discretionary and -0.126 for non-discretionary trips.

These models describe the systematic differences that are most important in affecting choice among the ferry options but there are also random differences among individuals that may be important. There are several ways to represent these random differences, the most common of which are use of mixed logit and hierarchical Bayes (HB) estimation. These methods use a combination of data from the aggregate sample and from a given individual to estimate the sensitivities of that individual to changes in service conditions. To maintain consistency with the previous work that was conducted with these data, HB estimation was conducted using the model specifications described above. This process results in model coefficients for each of the individuals in the sample, representing their unique preferences. The results across the sample were similar to those shown in Tables 5.4a and 5.4b above but with a different scale to the coefficient values. Because the scale of the resulting HB coefficients is dependent on the type of normalization used and other controls on the estimation process, the average scale was post-normalized to the aggregate multinomial logit coefficient scales.

5.5 Elasticity Estimates

The price elasticity of demand is defined in economics as the ratio of the percent change in demand to the percent change in price. It is a measure of the relative responsiveness of demand to changes in price. Price elasticities are generally negative meaning that as price for a service increases, demand for that service decreases. Services with price elasticities with an absolute value greater than one are termed “elastic” and any increases in price for those services will result in decreases in both demand and gross revenue. Services with price elasticities with an absolute value less than one are called “inelastic” and increases in price for these services will result in reduced demand but higher gross revenue. The elasticities that

[13] The Ferries model uses a non-normalized nested logit structure and has a specification in which fare is divided by vehicle occupancy. The value of -0.126 was derived from the original coefficient by multiplying it by the nest theta and adjusting for an average occupancy as estimated in the ORC-NW 2008 Washington State Ferries Customer Survey report of September 10, 2008.

result from the mutinomial logit model used here[14] are not constant but, rather, increase in absolute value with increasing prices. This means that at some price, a service with inelastic demand will switch to elastic demand at some point, implying that there exists a maximum gross revenue price point.

The elasticity of ferry demand can be calculated by simulating the mode choice behavior of the population (as represented by the survey sample) with different fare structures. The individual-level HB models as described above were used in a spreadsheet simulation model to calculate elasticities under different fare policies. The individuals were weighted to be representative of the overall ferry population using weights calculated and supplied by ORC-NW. Two pricing tests were conducted:

1. Ferry drive-on fares were increased by 10% and

2. The drive-on fares for the later and earlier sailings were decreased by 20%

The arc price elasticities[15] were calculated for the drive-on ferry population as whole and separately for each of the ferry route groups. The resulting arc elasticities are shown in Tables 5.5a and 5.5b below.

Table 5.5a - Calculated Elasticities for Discretionary Trips

	Elasticity of Drive-on Volume to Drive-on Fares (10% fare increase)	**Elasticity of Peak Drive-on Volume to Off-peak Fares (20% off-peak fare decrease)**
North Routes	-0.40	0.74
Central Routes	-0.31	0.65
South Routes	-0.26	0.49
Island Routes	-0.20	0.91
Overall	**-0.30**	**0.64**

Note: The samples for the South and particularly the Island routes are too small to support reliable estimates of elasticities for those groups. For that reason, the results shown here for those routes should not be relied upon for any route-level fare policy decisions.

[14] Note that previous work with these conjoint data by others used a simpler model assuming that individuals always choose the alternative with highest utility. This is different from the multinomial logit model which is widely used for travel mode choice applications and which assumes that higher utility implies only a higher choice probability rather than a certain choice.

[15] Arc price elasticities in effect average the elasticities at the two points on the demand curve represented by the two price points.

Table 5.5b - Calculated Elasticities for Non-Discretionary Trips

	Elasticity of Drive-on Volume to Drive-on Fares (10% fare increase)	Elasticity of Peak Drive-on Volume to Off-peak Fares (20% off-peak fare decrease)
North Routes	-0.43	0.59
Central Routes	-0.37	0.52
South Routes	-0.22	0.34
Island Routes	-0.39	0.97
Overall	**-0.34**	**0.51**

Note: The samples for the South and particularly the Island routes are too small to support reliable estimates of elasticities for those groups. For that reason, the results shown here for those routes should not be relied upon for any route-level fare policy decisions.

Based on these calculations, drive-on ferry demand is inelastic at current fare levels (first numerical column in Tables 5.5a and 5.5b). This means that drive-on fares could be increased by at least small amounts and while the resulting demand would decrease somewhat, gross revenues would continue to increase. Elasticities of non-discretionary trips are generally higher, and in particular they are more likely to shift to walk-on in response to drive-on higher prices.

The elasticities of peak drive-on sailings to reductions in off-peak fares[16] (second numerical column in Tables 5.5a and 5.5b) are somewhat greater in absolute value, though still reflecting overall inelastic conditions.[17] Here, as expected, the elasticity of non-discretionary trips is somewhat lower than for discretionary trips, likely because there is less time-of-day flexibility in these trips.

In general, these results suggest the demand for drive-on boardings is somewhat sensitive to general increases in drive-on fares – a 10% increase would result in a more than 3% decline in drive-on boardings. However, the demand for peak drive-on sailings is even more sensitive to changes in fares for off-peak drive-in fares – a 10% decrease in off-peak sailing fares would result in a decline in peak sailing drive-ons of between 5% and 6%. This suggests in particular that a differential time-of-day fare policy could result in significant reductions in peak drive-on demand levels. These results reflect the relatively low sensitivity to shifting times as indicated by the logit model coefficients. Model Applications

A spreadsheet-based simulation model was developed to allow testing of a full range of pricing scenarios. The spreadsheet model allows fares to be specified by mode, traveler segment, by time-of-day and by route groups. It also is set up to facilitate comparisons among alternative scenarios in either current or future years. The spreadsheet model was used to calculate elasticities for a wide range of possible pricing scenarios to support the development of the Long Range Plan. The resulting elasticities were intuitively reasonable and provided a reasonable empirical basis for evaluation of those scenarios.

[16] These are cross-elasticities – the change in demand for one service as a result of a change in price of another service – which is why the signs are positive.

[17] These elasticities were compared to the results reported in Parametric Marketing's "Washington State Ferries Price Sensitivity Study: Conjoint Analysis Overview" WAS004 15-Aug-2008. For the off-peak fare reduction scenario reported there, the elasticity in that study was calculated to be 0.79, compared to 0.54 in the models used to construct Table 4 above, with the assumed sailing headways adjusted to be comparable.