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**Washington State
Department of Transportation**

Maintenance Manual

M 51-01.11

September 2020

Maintenance Operations

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Foreword

Washington State Maintenance Operations personnel work through many challenges in maintaining the state highway system, including; increasing growth in population and vehicles, and extreme weather patterns that can bring wind, rain, snow, and ice. Providing for safe movement on our highway system while performing a variety of maintenance activities in a safe manner is a priority for our Maintenance Operations family. Through the use of tools, technology, techniques and talent; you, the maintenance professional take on these challenges and deliver through it all.

Pasco Bakotich III, P.E.
Director of Maintenance Operations

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Introduction

Purpose of this Manual

The purpose of this manual is to provide maintenance personnel with guidance on how to conduct a wide variety of activities performed within the maintenance programs. The focus is on types of equipment, materials, techniques, and other information needed to properly carry out basic maintenance activities such as patching a pothole or removing snow from a roadway. Although this guidance does not establish absolute standards, it helps to promote uniform operating procedures and performance guidelines. Highway maintenance is carried out in a dynamic environment where varying factors can lead to different solutions to maintenance problems. Maintenance Operations personnel need flexibility to match the appropriate solutions to different conditions. This manual is one of many resources that are available for trained maintenance personnel to utilize in applying their professional judgment to their daily work.

Performance Measurement

The extent to which maintenance activities are conducted is primarily determined by the level of funding provided each biennium by the Washington State Legislature. By placing their trust, in the form of nearly five hundred twenty million dollar appropriation per biennium, both the legislature and the public are expecting the department's maintenance organizations to deliver their program in a timely and efficient manner. To better communicate the outcomes of the maintenance program, the Maintenance Accountability Program (MAP) has been developed and integrated into the Highway Maintenance Program. The MAP uses performance measures to communicate in easily understood terms the Level of Service (LOS) Maintenance delivers for various maintenance activities. A comprehensive MAP manual has been developed and is available for use by maintenance personnel. The MAP manual is available by visiting the Headquarters Maintenance organizations internet web site.

LOS is based on a letter-grade scale of "A" (highest level of funding) to "F" (lowest level of funding). The LOS for each activity is determined by conducting field condition assessments at highway locations randomly-selected throughout the state during the summer each year. The LOS targets, by MAP activity, are determined by statewide Maintenance staff utilizing both funding and Legislative guidance to provide the appropriate emphasis. The annual surveys can be a valuable management tool for Maintenance Managers in allocating funds amongst various maintenance activities as well as adjusting their work schedules to achieve LOS targets.

Maintenance and Design Coordination

Maintenance activities are key to the highway infrastructure. In order to maintain highway assets Maintenance and Design coordination. Maintainability upon delivery of a completed construction project is key to the lifecycle of all highway asset. Maintenance's role during the scope and design process needs to become routine in the process of project delivery.

Environmental Responsibilities

Just as we are entrusted with public monies to maintain the highway system, we are also entrusted with being good stewards of the public right of way associated with the highway system. As the population of Washington State continues to grow, the environmental value of the highway right of way and adjacent lands is also increasing. Whether the right of way or adjacent lands serve as habitat for burrowing owls, a conveyance for stormwater runoff into salmon-bearing streams, or as a haven for native plant species, it is reasonable to expect that the increasing environmental protection requirements will necessitate changes in how many maintenance activities are performed.

Many resources are available to assist maintenance personnel in conducting maintenance activities in compliance with environmental requirements. Several environmental guidance documents are available on the Headquarters Maintenance and Operations web site <http://wwwi.wsdot.wa.gov/operations/facilities/mecp.htm> Particularly applicable to specific maintenance activities is the ESA 4d Regional Road Maintenance Guidelines. This manual contains a number of best management practices that can be used for a variety of activities and/or conditions to ensure environmental compliance. General HPA permits are also available to cover common maintenance activities that occur in waters of the state. The Maintenance Environmental Compliance Assurance Procedure will be followed to ensure that environmental problems encountered during highway maintenance activities are appropriately responded to and that timely communication of these events is elevated to proper levels of management.

Personnel are available in both the Headquarters Maintenance and Operations Office as well as Regional Environmental offices to assist in providing guidance on environmental issues. Each region environmental office has a Region Maintenance Environmental Coordinator position dedicated to supporting the maintenance program to achieve environmental compliance. One of the most valued environmental resources that can be developed by maintenance personnel is a positive work relationship with local environmental regulators such as the Washington State Department of Fish and Wildlife's Area Habitat Biologists. Such a positive work relationship will help maintenance personnel to not only deliver their program in a timely manner but to do so in conformance with environmental best practice methods.

Fiscal Management

Sound fiscal management is a key ingredient in delivering the maintenance program in an effective and efficient manner. Once the biennial budget is distributed to region maintenance organizations it is essential that the expenditure for various activities be accurately documented. This is accomplished through the department's labor collection (DOTtime) and voucher processing systems which not only provide an expenditure record for each maintenance activity, but also the detailed components that make up the cost, i.e., regular time, overtime, vendor services, materials, and equipment. By tracking the expenditure of activities maintenance managers are not only aware of the costs of doing business relative to targets but are better positioned to adjust their schedules to meet evolving problems and/or deliver their programs.

Acronyms and Abbreviations

AAH	Adopt a Highway
BMP	Best Management Practices
BST	Bituminous Surface Treatment
DOE	Department of E-Ecology
HATS	Maintenance Management System
HMA	Hot Mix Asphalt
HPA	Hydraulic Project Approval
IVM	Integrated Vegetation Management
IRVM	Integrated Roadside Vegetation Management
LOS	Level of Service
MAP	Maintenance Accountability Process
MDT	Measuring Distributor Tank
MUTCD	Manual on Uniform Traffic Control Devices
PCC	Portland Cement Concrete
PDA	Preliminary Damage Assessment
PTO	Power Take Off
RPM	Raised Pavement Marker
RWIS	Roadway Weather Information System
TSMS	Traffic Sign Management System
VMS	Variable Message Signs
WDFW	Washington State Department of Fish and Wildlife
WSDA	Washington State Department of Agriculture
WSDOT	Washington State Department of Transportation
WSP	Washington State Patrol

1-1 **General Responsibilities**

This chapter provides guidance to reduce the vulnerability of the state transportation system from any emergencies by:

1. Establishing capabilities for protecting the transportation system and employees from the effects of emergencies or disasters,
2. Responding efficiently to emergencies and disasters,
3. Assist in recovering in the aftermath of any emergency or disaster.

RCW 38.52 directs the state to develop and implement a [State Comprehensive Emergency Management Plan \(CEMP\)](#). The CEMP designates WSDOT as the Primary Agency for Emergency Support Function (ESF) 1 – Transportation. ESF1 supports Washington State by assisting State agencies, local, and Tribal governments; and volunteer organizations relying on the state transportation infrastructure during an actual or potential incident. ESF #1 is designed to provide support during incident response. Activities within the scope of ESF #1 functions include:

- Performing damage assessments to state transportation infrastructure as a result of an incident;
- Coordinating alternate transportation routes;
- Coordinating the restoration and recovery of the state transportation infrastructure;
- Performing activities conducted under the direct authority of WSDOT; and
- Coordinating prevention, preparedness, mitigation among transportation infrastructure stakeholders at the federal, state, local, and tribal levels.

This chapter also incorporates some of the day-to-day operational procedures that are used in responding to incidents such as hazardous material spills, snow/ice removal, traffic incidents, disaster response and recovery efforts. The Washington State Department of Transportation (WSDOT) [Emergency Operations Plan M 54-11.01](#) and the [Funding Manual M 3014](#) defines the details of how the Department responds to these types of incidents.

An emergency is defined as a situation involving natural phenomena, disasters, casualties, national defense or security measures, etc. and includes response activities that must be taken to prevent the imminent loss of human life, property, and the environment.

WSDOT will perform the following functions in emergency situations:

- Determine usable portions of the state highway network. Coordinate and control emergency highway traffic regulations in conjunction with the Washington State Patrol (WSP).
- Comply with Hazardous Materials and Hazardous Waste requirements related to emergency response. This includes (but is not limited to) [29 CFR 1910.120](#) Hazardous Waste Operations and Emergency Response.
- Comply with environmental regulatory requirements related to emergency response. Each WSDOT region is required to develop notification procedures for contacting and informing regulatory agencies before and during an emergency response.
- Meet the conditions of the Washington Department of Fish and Wildlife (HPA) permit if applicable and possible.

1-2 Regional Emergency Response Procedures

Each region shall develop and maintain written day-to-day operational procedures to address routine spills, incidents, etc. Regions will also develop written procedures to address their response capabilities for incidents beyond the normal day-to-day operational capability. Each of these procedures shall clearly define employee roles and responsibilities.

1-3 WSDOT Emergency Operations Plan

1-3.1 *Concepts of Operations*

Governments have the responsibility to make every effort to protect life, property, and the environment during emergencies. When the emergency exceeds the capability of government to respond, assistance will be requested from the next higher level of government.

For example:

- Local government may request state assistance and if unable to fulfill the request, the state government may request federal assistance. However, this plan heavily emphasizes the responsibility and capability of local governments to respond to and accomplish short-term recovery of their infrastructure during emergencies/disasters.
- The WSDOT Emergency Operations Plan recognizes that emergency functions for groups and individuals should be similar to normal day-to-day functions. When this is not possible, managers should attempt to maintain organizational continuity and assign familiar tasks to employees.

1-4 Organization and Assignment of Responsibilities

Headquarters and regions have emergency responsibilities in addition to normal duties. To do this they have established procedures for:

- Operations during emergencies.
- Emergency personnel rosters.
- Compliance with WSDOT responsibilities and authorities.

1-5 Administration and Logistics

WSDOT acknowledges that during an emergency, some administrative procedures may be suspended, or relaxed.

Documentation is critical for reimbursement of funds or to support liability issues. WSDOT will document all response actions taken, especially changes to established procedures. This responsibility lies with maintenance lead technicians, maintenance supervisors, and superintendents.

Maintenance office staff are to be provided the documentation and then are tasked with filling out the proper records and forms to be forwarded to the regional maintenance administration.

1-6 Plan Development and Maintenance

The WSDOT Emergency Operations Plan is the principal source of documented department emergency management activities. Regional offices are responsible for developing a process that supports the tasks in the plan. This may require coordination with local, state, and federal agencies. Overall, the WSDOT Emergency Operations Plan development, maintenance, and coordination is the WSDOT Office of Emergency Management's (OEM) responsibility working with the regions.

1-7 Training and Exercises

WSDOT OEM will provide training and conduct exercises to test the WSDOT Emergency Operations Plan that reflect current WSDOT operational practices and readiness.

1-8 Emergency Operating Procedures (Hazardous Materials)

1-8.1 General

There are many situations when WSDOT staff may be exposed to situations requiring emergency action. The most common emergency situations maintenance crews may encounter are vehicle collisions and hazardous material spills.

In accordance with [RCW 70.136](#), Washington State Patrol (WSP) has the responsibility to act as Incident Command during any incident involving hazardous materials; WSP may also act in a Unified Command Structure consisting of response agencies, resources providing agencies, and responsible party. WSDOT staff at the scene of an incident will take emergency actions only as required to protect human life and property until WSP has control of the situation. WSP may request assistance from WSDOT for traffic control and to clear debris.

Hazardous materials are those substances which, when spilled, may make driving on the roadway unsafe, endanger human life, or contaminate the environment. Response Awareness training enables WSDOT Maintenance employees to recognize incidental/common vehicle fluids (e.g. gas, oil, diesel), but not to identify or respond to any other type of hazardous material.

Vehicle collisions, debris, or spillage may not always release hazardous materials, but may cause hazardous conditions, such as fine powders which create visibility problems or damaged roadway which can cause lane closure. Other substances may make the roadway surface slippery, impair visibility, or cause lane and road closures.

If hazardous materials are found or suspected to be present, WSP will lead the clean up by requesting the cleanup support from Department of Ecology and/or the owner of the cargo. Clean up is the responsibility of the owner or shipper of the cargo, if they can be identified. If the owner/generator is unknown, the Department of Ecology will consult with the WSP Incident Commander and WSDOT to determine responsibility of clean up, based on the type, material, and conditions of the hazard. WSDOT staff will not attempt to clean up any hazardous material spills or take possession of abandoned cargo containing hazardous materials; in most cases, WSDOT Maintenance employees do not have training and/or the proper resources to clean up hazardous materials.

1-8.2 *Maintenance Field Personnel*

Maintenance field personnel will take the following actions when encountering known or suspected hazardous materials:

- Advise the area maintenance supervisor or superintendent of the problem. Communicate the possible extent of the problem, and request aid from WSP.
- Take precautionary actions to protect themselves, maintenance crews, and the traveling public from any exposure.
- Provide traffic control, including closure of the highway if appropriate, to ensure that no one comes in contact with the hazardous material.
- If the spilled substance is identified as an incidental/common vehicle fluid and is spreading toward water courses, additional traffic lanes, or likely to come in contact with ground water, take appropriate action to absorb or confine the spill.
- Never take action on an unknown substance or on a known substance that is extremely hazardous to life and property. This means those products that can cause more harm than gas, oil and diesel. If WSDOT staff are not sure what the product is they are to stay clear of the area.
- Some incident scenes include human tissue and blood residues. Avoid contact with these materials. Fire response should wash this residue from the highway or highway feature surfaces. WSP as the Incident Commander should assure that the incident scene is ultimately safe.
- Stay on site to safeguard traffic until proper traffic control devices are installed and/or until relieved by your maintenance supervisor, lead technician, or a WSP trooper.
- Look for stranded travelers in isolated areas when traffic has been controlled and when applicable.

1-8.3 *Maintenance Superintendent or Supervisor:*

- Coordinate personnel and equipment to close a highway or restrain traffic from entering a hazardous area.
- Make a complete report of the closure to the regional maintenance engineer/manager and Traffic Management Center (TMC).
- Make the regional Public Information Office aware of the incident so that they can communicate the closure.

1-9 Abandoned Cargo

- All cargo abandoned on WSDOT property will be removed at the owner's expense if the owner can be identified. A determination that the cargo is a hazardous material will necessitate the procedures outlined earlier. State law (RCW 4.24.314) dictates that the responsible party has the responsibility for clean-up of hazardous materials.
- For known or suspected hazardous cargo, stay safely back from the cargo, establish traffic control, and call the WSP. WSP who will notify the Department of Ecology Spill Response Team. If the risk assessment determines that there are no life safety issues, and the container does not appear to have a leak or severe damage, it can be removed to the edge of the shoulder to allow traffic flow prior to Ecology's arrival on-scene. Do not take it back to the maintenance facility.
- If identified as non-hazardous and reusable, move the abandoned material to the maintenance facility. If not reclaimed within 30 days it becomes the property of the department and may be used for its intended purpose, if appropriate.

1-10 Clearing the Highway

1-10.1 Open Road Policy

- The WSP/WSDOT "Joint Operating Policy Statement" was developed to stress the importance of the Agencies' responsibility to do what is reasonable to reduce incident associated delays. This Policy's statement states that WSP and WSDOT will work together, to open the roadway as soon as safely possible.
- It is a goal of WSDOT to minimize traffic delays caused by roadway incidents. WSDOT Maintenance personnel assisting at incidents will make every reasonable effort to quickly and safely clear the roadway.
- **First Priority** – Safety. It is the departments' obligation and responsibility to provide a safe environment for its employees and the public.
- **Second Priority** – Minimizing Traffic Delay. Maintenance personnel responding to incidents which involve lane closures will consider every reasonable measure in coordination with WSP, to clear the lane as quickly as possible. At incident scenes involving spilled or damaged cargo, the goal is to minimize traffic delay. Salvage of the cargo is secondary and at the convenience and benefit of transportation movement. Criteria for making "Open Road" decisions include:
 - Crime Scene Investigation
 - Traffic Volume
 - Time of Day
- **Lowest Priority** – The potential salvage of the cargo is the last consideration in decisions related to minimizing traffic delay.

Note: Bridges and other transportation structures closed due to structural damage require approval from the Bridge Preservation Engineer before opening.

2-1 General

Effective traffic control is vital for the safety of workers and the state's multimodal traveling public. The WSDOT traffic control guidelines provide the public with clear and consistent guidance through work zones, and reduce maintenance workers exposure to traffic.

The Secretary of Transportation has adopted the [Manual on Uniform Traffic Control Devices](#) (MUTCD) with modifications as the legal standard by [Chapter 468-95 WAC](#). **It is mandatory that traffic control measures on maintenance projects comply with the MUTCD requirements.** The MUTCD outlines basic principles and prescribes standards for the design, application, installation, and maintenance of traffic control devices. The MUTCD details requirements for color, size, shape, location and need for traffic control devices.

The WSDOT [Work Zone Traffic Control Guidelines](#) M 54-44 is a subsidiary manual to the MUTCD and has Washington specific requirements that are more stringent. For further work zone information, refer to the [Traffic Manual](#) M 51-02, Chapter 5.

The maintenance employee in charge at a work zone is responsible to see all standards are followed. This includes ensuring that temporary signs, warning devices and flagging personnel are placed appropriately. **Traveling public and worker safety are of primary importance. Safety takes precedence over all efforts to maintain a highway or structure.**

Consult the Regional Traffic Engineer when standard layouts are not applicable.

3-1 General

The roadway is defined as the area between the outer limits of side slopes or otherwise improved portion of a public highway ordinarily used for vehicular travel. A roadway surface is normally classified as flexible (consisting of asphaltic materials) or rigid (consisting of Portland Cement Concrete) pavement.

It is desirable that the roadway surface provide a safe, smooth driving surface with good skid resistance for the people we serve. Roadway distress such as alligator cracks, pumping, pushing, wheel rutting, raveling, frost heaves, and pot holing are defects that need to be addressed.

Maintenance of the state's roadways is the primary way that unwanted pavement distresses are reduced or eliminated. Preferably, the maintenance of pavement should be accomplished with minimum expense and the least possible traffic disruption. Maintenance of pavements is a necessary investment performed to prevent costly renovation or reconstruction.

Preventive maintenance is the most cost effective way to extend pavement performance and minimize the need for future costly major repairs. Area maintenance staff are required to inspect each section of highway at least once a year to detect and schedule deficiency repairs prior to becoming a major problem.

The intent of this chapter is to communicate the benefits of pavement preservation in the life of a pavement and to identify pavement distress. It must be noted that proper documentation and communication is of greatest importance. This will be developed in greater detail as this chapter progresses.

3-2 Reference

[*Standard Specifications for Road, Bridge, and Municipal Construction*](#) M 41-10

Asphalt Institute

3-3 Resources

Headquarters Maintenance Office

Regional and Area Maintenance Offices/Crews

Regional Materials Office

[Construction Manual M 41-01](#)

[Design Manual M 22-01](#)

[WSDOT Pavement Policy](#)

Asphalt Institute Publications

MS-4	<i>The Asphalt Handbook</i>
MS-5	<i>Introduction to Asphalt</i>
MS-8	<i>Asphalt Paving Manual</i>
MS-14	<i>Asphalt cold-Mix Manual</i>
MS-15	<i>Drainage of Asphalt Pavement Structures</i>
MS-16	<i>Asphalt in Pavement Maintenance</i>
MS-17	<i>Asphalt Overlays for Highway and Street Rehabilitation</i>
MS-19	<i>Basic Asphalt Emulsion Manual</i>

3-4 Communication

The Washington State Legislature provides biennial appropriations conforming to a specific, (LOS) Level of Service for roadway maintenance and operations activities. The maintenance area's roadway surface program needs to be managed to meet the LOS commitments.

In doing so, it is essential that each Region Maintenance Area work in combination with its Program Management, Materials, Design and Construction offices to ensure that Maintenance projects are coordinated with the work that these offices are planning and/or constructing in the Capital Program.

It is advised that written recommendations for pavement repairs be submitted to the Regional Maintenance Engineer. The Regional Maintenance Engineer will then share the region wide roadway surface maintenance program with the Regional Materials and Regional Construction Engineer. This allows better coordination between the maintenance and construction programs. As a result of this coordination reoccurring areas of pavement failure can be eliminated.

3-5 Integrated Pavement Preservation

Washington State has adopted an integrated approach to pavement preservation. Integrated pavement preservation looks at the overall pavement life-cycle and is a planned approach to pavement preservation and pavement maintenance. Because the terminology of preservation and maintenance can vary based on context, the following is how the FHWA defines the two:

Preservation: Preservation consists of work that is planned and performed to improve or sustain the condition of the transportation facility in a state of good repair. Preservation activities generally do not add capacity or structural value, but do restore the overall condition of the transportation facility.

Maintenance: Maintenance describes work that is performed to maintain the condition of the transportation system or to respond to specific conditions or events that restore the highway system to a functional state of operation. Maintenance is a critical component of an agencies asset management plan that is comprised of both routine and preventive maintenance.

As well as structuring funds so they can be moved in a timely manner for planned maintenance, the success of this approach relies on decision making and timing of maintenance activities. Integrated Pavement Preservation consists of Preventive Preservation, to include Strategic and Emerging Preservation, and Reactive Preservation.

3-5.1 *Preventive Preservation*

Preventive Preservation is planned and coordinated maintenance that is typically performed early in a pavement life and is intended to extend pavement service life 1 to 6 years. Planning occurs between the Region Maintenance Engineer, the Region Materials Engineer, the HQ Pavement Office and Capital Program Development and Management (CPDM).

Preventive Preservation includes Strategic Preservation and Emerging Preservation.

The following is an example of a typical Strategic Preservation Maintenance (P1-M) schedule for a biennium.

Strategic Pavement Preservation Maintenance (P1-M) Schedule - 21-23 Biennium				
Start	End	Organization	Description of Work	Duration (Days)
6/1/2019	8/15/2019	Region Program Development	Region Materials Review	75
8/16/2019	9/30/2019	Region Program Development	Provides proposed changes to WSPMS from the notes of Region Pavement Review	45
10/1/2019	10/31/2019	Region Maintenance	Region 21-23 pavement maintenance needs, including P1 and M2	30
11/1/2019	7/31/2020	Region Program Development Region Materials Lab	Develop 10-year P1 (Preservation) Plan (expect schedules to adjust)	273
7/31/2020	7/31/2020	Region Program Development	Publish the 2-year P1 Preservation Project List to Region Materials and Region Maintenance	0
8/1/2020	8/31/2020	Region Program Development Region Materials Lab	Develops the Region Strategic Preservation Maintenance List (P1-M and M2)	30
9/1/2020	10/31/2020	Region Materials Lab Region Maintenance	Conduct field reviews of the Region P1-M list and provide recommendations to HA Mats Lab for approval	60
11/1/2020	11/30/2020	HQ Materials Lab - Pavement Office	Review the P1-M List and provide comments/concurrence	29
12/1/2020	12/31/2020	HQ Materials Lab - Pavement Office Region Program Development Region Materials Lab Region Maintenance	Finalize the 21-23 P1-M List	30
12/1/2020	4/30/2021	Region Maintenance	Begin environmental review/permitting process	150
1/1/2021	4/30/2021	Region Maintenance	Develop the P1-M cost estimates into HATS Feature Activities. HQ coordinates with HQ Mats Lab for WSPMS upload. Region Maintenance coordinates with Construction Traffic Control Office.	119
5/1/2021	5/31/2021	Region Program Delivery	Send WOA to CPDM	30
6/1/2021	6/30/2021	CPDM	Approves and setup the work order and groups	29
7/1/2021	6/30/2023	Region Maintenance	Executes the 21-23 P1-M List; begins reporting unit costs	729

It must be stated that there are limitations and parameters set for the funding of P1-M projects. These limitations can change and include, but are not limited to, average daily traffic (ADT), chip seals, ramps, and total dollars to be spent.

3-5.2 Strategic Preservation

This work is primarily completed early in the pavement life cycle to within 4 years before a planned (Capital Preservation) project. Strategic Preservation work may be completed under Contract or by Maintenance.

Examples of Strategic Preservation for flexible pavements would include crack seal, mastic seal, chip seals, wheel path chip sealing. For rigid pavements, strategic preservation might include spall repair, corner break and or partial depth repairs.

3-5.3 Emerging Preservation

This work is completed with M2 funding and performed by WSDOT Maintenance. The intent of this work should be to reduce the need for future Reactive Preservation and extend pavement life.

Emerging Preservation work focuses on areas of pavement that are predicted to fail within a year if maintenance is not performed.

Emerging Preservation work might include digouts, grader patching, and milling for flexible pavement as well as partial depth or full depth panel replacement for rigid pavement.

3-5.4 Reactive Preservation

This work is completed using M2 funding and performed by WSDOT Maintenance.

Reactive Preservation is unplanned, “emergent” and maintenance work that is done to correct immediate needs.

Since Reactive Preservation is emergent and needs to be quickly addressed, the most typical technique is pothole patching where cold patch or possibly a grader patch is used to hold the pavement distress until a more effective treatment can be placed.

The easiest way to summarize pavement preservation as it relates to maintenance activities is to say that this work mainly involves *Emerging and Reactive Preservation*.

3-6 HATS

In order to properly document areas of pavement repair need and prepare for work to be completed, a system of mapping pavement distress for planned activities has to be in place.

HATS is the program used to collect the needs of pavement maintenance and to estimate budgetary requirements. The data contained within HATS provides a complete record of planned activities which can be used to estimate the funding needed to complete identified maintenance program activities.

The other benefit of the HATS program is that it can be used to compare when and where a Capitol Preservation or P1 maintenance project is going to occur. By having clearly defined HATS information available, programming can occur as to whether or not emerging treatment will even be needed.

3-7 Pavement Distresses

Environment and traffic loading are the primary cause of pavement distress, but damage and deterioration of pavements can result from numerous other factors. For example, an overlay with poorly graded or inadequately fractured aggregate and low asphalt content may not have adequate particle interlock; thus cracking and oxidation may develop. Poor subgrade drainage, overweight loads, and accelerating or decelerating traffic are all potential sources of surface irregularities.

The WSDOT collects pavement condition data of the existing roadways using the Pavement Distress Identification Van. Distress measurement data is collected, processed, then analyzed and input within the Washington State Pavement Management System (WSPMS).

Pavement distress is measured according to the [Pavement Surface Condition Rating Manual](#) (pdf 3.32 mb), however; the following are brief descriptions and examples of various pavement distress. It is always best to consult with your respective Region Materials Engineer if you are not sure about the type or cause of distress or the proper repair needed.

3-7.1 Longitudinal Cracking

A longitudinal crack runs approximately parallel to the roadway centerline. These are typically a result of traffic loading or HMA with inadequate asphalt content.

Exhibit 3-1 Longitudinal Cracking



This type of crack is usually a non-working crack that can be treated with a crack sealing material. It is highly recommended that these cracks are filled before getting to a width greater than a $\frac{1}{2}$ inch to reduce sealant cost. Although this is the most cost-effective treatment option available, attempting to seal cracks that are greater than $\frac{3}{4}$ inch is not recommended.

3-7.2 Transverse Cracking

Transverse cracks run roughly perpendicular to the roadway centerline. They are usually caused by surface shrinkage caused by low temperatures, hardening of the asphalt, or cracks in underlying pavement layers such as PCC slabs. They may extend partially or fully across the roadway.

Exhibit 3-2 Transverse Cracking



Transverse cracks are most typically a working crack and sealing these cracks with a rubberized material is the most effective treatment option, although crack sealing is an alternative if a mastic material is used.

3-7.3 Alligator Cracking

The condition of alligator cracking is reached when irregular longitudinal cracks begin to interconnect to form a series of small blocks that resemble an alligator's skin. This distress is associated with traffic loading and is usually rooted in poor construction, poor drainage, subgrade failure, or the pavement may have just reached the end of its life. If neglected, full-depth distress can be observed when subgrade material is forced up through the surface leading to depressed pavement and an eventual pothole.

Exhibit 3-3 Alligator Cracking



If the alligator cracking isn't extensive, subgrade material isn't visible and signs of depressed pavement isn't present, a chip seal might be a possibility. The typical repair method, however; is to complete a partial-depth or full-depth patch. Full-depth cracking extends through the entire pavement structure, whereas partial-depth cracking goes through a portion of the pavement.

3-7.4 Potholes

Potholes are voids in the roadway surface where pieces of the pavement have become dislodged. Areas in which many potholes occur become suspect for fundamental problems such as inadequate drainage, pavement strength, or base/subgrade problems. Single or infrequent potholes may be the only pavement distress to occur in an area, and beyond the treatment of the individual pothole no other pavement repair work may be required. If potholes occur in a systematic or cyclic manner, these are typically a result of the construction process.

Exhibit 3-4 Potholes



Pothole repairs will generally be full-depth patches but care should be taken to confirm that they are full-depth. The repair area will always need to extend beyond the limit of the visible distress in order to get to sound material. If repairs only include the affected area, reoccurring distresses typically result.

3-7.5 Raveling and Pitting

Raveling and pitting distresses are characterized by the loss or dislodgment of surface aggregate particles. This usually results from HMA that is designed with too little asphalt or overheating of the mix during manufacture. It can also occur by oxidized asphalt binder initiated by poor compaction, letting the mix get cold when paving, dirty aggregate, or paving too late in the construction season. The most important consideration with this distress is to perform repairs before a more serious condition develops, and prior to the onset of inclement weather because this pavement distress is a good indicator of negatively permeable pavement. A pavement that is raveling must be sealed as soon as reasonably possible since unsealed pavements will continue to ravel, age and harden much faster than normal resulting in difficult maintenance problems.

Exhibit 3-5 Raveling and Pitting



The best treatment option for a pavement that is raveling or pitting is to perform a fog seal to ensure the pavement has been sealed and thereby reduce the rapid deterioration usually exhibited from this distress. If raveling becomes severe a chip seal is an alternative.

3-7.6 Flushing

Flushing (or bleeding) is free asphalt on the surface of the pavement indicated by a shiny, glass like surface. There are many causes such as too many fines in the mix, too few voids, too much asphalt in patches, underlying distress that is allowing moisture to strip the asphalt from the aggregate, or a chip seal that has lost its rock. It is inherent to unstable mixes and often results in other roadway surface distress, such as rutting, if not corrected.

Exhibit 3-6 Flushing



Removal and replacement of flushed or bleeding pavement areas is an expensive, but sometimes cost-effective method of repair. Another option is to perform a chip seal with minimal or no emulsion but this approach necessitates proper prior planning. If repairs are not possible prior to a seasonally wet period, contact the regional traffic engineer to evaluate friction and the need for posting "Slippery When Wet" signs.

3-7.7 **Rutting**

Rutting is a surface depression within the wheel path and is a result of permanent deformation of the pavement or subgrade. This condition is normally caused by heavy loads on roads lacking sufficient strength to support the loading but can also occur as a result of HMA with too much binder in addition to studded tire use. Wheel ruts, if not repaired, can trap water and contribute to hydroplaning.

Exhibit 3-7 Rutting



There are a few options available to address this type of roadway distress. Rut filling with HMA is the most widely used, however; a second rut filling option is to utilize chip seal materials. Grinding of rutting can also occur but care must be taken to ensure this option will remove ruts until preservation occurs.

3-7.8 Sags and Humps

Sags and humps are localized depressions or elevated areas of the pavement that result from settlement, pavement shoving, displacement due to subgrade swelling, or displacement due to tree roots. The deficiency usually occurs in isolated areas of the roadway surface.

Exhibit 3-8 Sags and Humps



This distress typically results in full-depth repairs although a partial-depth patch or a micro-grind may be used depending on the cause of the distress.

3-8 Preventive Maintenance Techniques

Preventive maintenance programs started early in the life of a pavement (1-3 years) provide the protection needed to greatly improve service life. For aged pavements, surface treatments can greatly delay the costs of major reconstruction.

In recent years research has shown that applying the proper maintenance treatment can help to extend pavement service life when applied at the right time. Additionally, placing the appropriate treatment can also provide cost benefits if done when pavement distresses have not progressed too far in the pavement life.

The following maintenance techniques are placed in the preferred order of a pavement life cycle which also corresponds to least costly to most costly. As an example, it is recommended that crack sealing take place earlier in the pavement service life, whereas HMA dig out patching should occur later, with an estimated cost that is nearly 12 times that of crack sealing. Of course, there may be instances when a more costly treatment is a better choice because of the amount of distress. For example, a chip seal may be more cost effective than crack sealing if the amount of cracking is high and if an HMA dig out is needed, it is the preferred method of repair.

3-9 Crack Sealing (or Pouring)

Crack sealing can extend the useful pavement life for several years. The purpose of crack sealing is to prevent water from entering the subgrade and causing damage and to keep the edges of the cracks from raveling where top down cracking is present. There are two widely used types of crack pouring material in highway maintenance, hot pour and cold pour. The two types use different techniques and equipment. The purpose of the two is the same, to minimize water entry and resulting damage.

Over-poured cracks can be a safety hazard to motorcycles. Overband (over-poured) crack pouring, especially on longitudinal cracks, can cause loss of control for motorcycles. The problem is compounded on curves or when the surface is wet. Cracks that are not over filled do not seem to cause a problem. Areas that have excessive crack pouring material from past practices should be addressed.

The supervisor needs to be aware of the nature, extent, and severity of the cracking problem and also of the next scheduled contract for resurfacing. Filling cracks in an area scheduled for immediate reconstruction or resurfacing by contract is not recommended unless it is a part of the overall project.

Generally, alligator cracking or more general cracking can be repaired using chip seals. Serious cracking and settlement of the pavement may indicate the need for excavation to repair the subgrade before patching can be successful.

3-9.1 Hot Pour Method

This method utilizes blocks of crack pour material heated in specialized crack pouring machines. The most common type in maintenance are trailer mounted, oil jacketed units. This method is often used by contractors and maintenance for crack sealing distressed areas that are not going to be removed and repaired prior to an overlay. It is a common method of sealing the joint between the edge of a PCC road surface and the asphalt shoulder. It works well for large volume work involving large cracks. Often the cracks are routed out first. If not, they should be cleaned and dried with compressed air prior to pouring. Filling cracks with this method requires a large crew and specialized equipment.

Safety is a big concern in a hot crack pour operation. This material is extremely hot and can cause severe burns when loading the machine or applying the material.

3-9.2 Cold Pour Method

This method utilizes cold applied liquid material and does not require specialized equipment. This type of material is available in 5- to 50-gallon containers. It can be sanded lightly after application and opened to traffic. One person can apply it using the spout on the 5-gallon bucket it comes in.

Experience has shown that for maintenance purposes cold pour seems to prevent water entry into the subgrade as well as hot pour material. It also resists build up on bumps better than the hot material does.

Cold pour is excellent as tack for small asphalt patches and pothole repairs. It greatly simplifies the problems of tack storage, transporting, and application. A sealed five gallon bucket can be carried easily by a pothole patching crew.

This material works well for hand pouring the cracks around an isolated bridge drain or catch basin if a piece of foam 'backer rod' is poked down into the crack before pouring to serve as a bottom for the material. It can also be poured against rubber expansion joints without melting the rubber joint.

3-10 Bituminous Surface Treatments

A bituminous surface treatment (BST) of flexible pavements utilize asphalt emulsions in the treatment process and are excellent methods for preventing the development of early pavement damage or distress. These treatments seal the pavement, retards the aging process and prevents the old pavement from further hardening.

3-10.1 Fog Seals

In instances of a pavement with very minor raveling, a fog seal may adequately seal the pavement and prevent further raveling. Fog Seals are very light applications of diluted, quick breaking asphalt emulsions. Some of the asphalt materials used for fog seals are: CSS-1 and STE-1 which are cationic (positively charged) emulsions, while HFE-100S-50% diluted is an Anionic (negatively charged) emulsion. These products may require cover material ($\frac{1}{4}$ - 0) depending on the surface and application rate. The decision whether to use a cationic or anionic formulation should be based on knowledge of the charge of the existing materials used as part of the pavement. Understand that like charged materials repel each other and opposites attract. We want the materials to attract each other and make a tight bond. The Region or the Headquarters Materials Lab should be consulted to assist in the determination.

Asphalt emulsions used for fog seals are usually diluted with water or other types of cut-backs as prescribed by the manufacturer. The Fog Seals are applied at the rate of 0.1 to 0.2 gallons (of diluted material) per square yard, depending on the texture and porosity of the old pavement. The application rate will be determined by the amount of emulsion the old pavement surface can absorb without becoming slippery. Traffic control may be required for up to two hours, depending on location and volume of traffic.

3-10.2 Sand Seal

Where more raveling has occurred, a sand seal may be needed to adequately seal the surface and provide a quality surface. A sand seal is an application of liquid or emulsified asphalt covered with fine aggregate. It is used to seal against air and water infiltration, or improve skid resistance. Applications are 0.1 to 0.2 gallons of CRS-2 or CMS-2 per square yard covered with ten pounds of $\frac{3}{8}$ minus aggregate. Some regions have found $\frac{1}{4}$ minus to be better suited for sand seals.

3-10.3 Aggregate (Chip) Seal

An aggregate seal is a single spray application, usually of a liquid or emulsified asphalt. Immediately following is a single layer of aggregate of as uniform a gradation (size) as practicable. This type of seal reduces the infiltration of air and water into the mat and may be used to improve skid resistance of slippery pavements.

Chip seals are useful and can be applied in many different ways: Full lane width, wheel path, partial lane width, short longitudinal sections or for long sections.

A typical chip seal uses application rates for CRS-2P at .35 to .60 gallons/per square yard (typically 0.45 gal./s.y.) with 20 to 45 pounds of Crushed Cover Stone per square yard (typically 30 lb./s.y.). Look in the *Standard Specifications* Sections 5-02.3, 9-02.1, and 9-03.4 for specific information on Bituminous Surface Treatment and materials.

3-11 HMA Repair Methods

All flexible pavements require patching at some time during their service life. Surface patching should be performed to a standard that is appropriate to the resources available with the objective of retaining a smooth ride for as long as possible.

There are two principal methods of repairing HMA pavements. The first includes remove and replace (grind and inlay) which can be categorized as partial-depth and full-depth repairs. The second method is an HMA overlay and this technique covers defective roadway sections in order to seal, stabilize and renew the defective area.

Since patching is one of the most expensive operations to perform, it is essential to develop work schedules that include desirable weather conditions, adequate staffing, and proper equipment.

3-11.1 Partial-Depth Grind and Inlay

Partial-Depth Grind and Inlay are used for making permanent repairs to the pavement. Defective pavement and unstable surfacing materials are removed to a depth of stable material that can typically be found only two-inches below the roadway surface. The milled area should extend into the good pavement surrounding the defective area by about 12 inches (1 foot). Cut the edges of the patch area vertically and in straight lines to provide a good line for compaction later.

After the defective pavement material is removed, clean the entire repair area to create a clean foundation for new HMA to be placed. Apply a tack coat of asphalt to the vertical

and horizontal surfaces of the hole to assure a good bond and seal between old and new HMA material. New HMA should be placed in depths at least equal to the thickness of the adjacent HMA compacted in lifts of 1 to 3 inches.

For best results in a patch of this nature, back fill the hole with HMA Class $\frac{3}{8}$ (preferred) or HMA Class $\frac{1}{2}$ Inch material. The asphalt should be compacted in lifts of no more than 3 inches thick to obtain optimum patch life. Small patch projects can be compacted with a vibrating plate compactor, while a roller works best on large patches. During hot weather it might be advantageous having some water on hand to help cool the mix between lifts. Standing water should not be allowed on the mix between lifts.

After the intermediate lifts of the patch have been compacted sufficiently, the surface lift can be completed. Take special care to ensure that it is compacted to slightly above flush with the surrounding surface since some compaction will occur by traffic as the mix is further kneaded into place. The patch should be cool enough before traffic is allowed on it, so it will not leave marks in the surface. Deeper patches will require more time to cool and must be planned for accordingly.

3-11.2 Full-Depth Dig Out

Full-Depth Dig Outs are used for making permanent repairs to the pavement. Defective pavement and unstable surfacing materials are removed to a depth of stable material. Alligator cracking that is depressed greater than $\frac{1}{2}$ inch is a good indication that pavement distress is full-depth and stable material might only be found at the subgrade. The excavated area should extend into the good pavement surrounding the defective area by about 12 inches (1 foot). Cut the edges of the patch area vertically and in straight lines to provide a good line for compaction later.

After defective pavement and/or base material is removed, level and compact the base material. This will make an adequate foundation for the new asphalt concrete material. Surfacing materials (gravel base, crushed surfacing) and pavement must always be replaced in depths at least equal to the original design or by additional depth of ACP compacted in lifts of 1 to 3 inches. Apply a tack coat of asphalt to the vertical sides of the hole to assure a good bond and seal between old and new pavements.

For best results in a patch of this nature, back fill the hole with a hot plant-mix material such as HMA Class $\frac{3}{8}$ (preferred) or HMA Class $\frac{1}{2}$ Inch. The asphalt should be compacted in lifts of no more than 3 inches thick to obtain optimum patch life. Small patch projects can be compacted with a vibrating plate compactor, while a roller works best on large patches. During hot weather it might be advantageous having some water on hand to help cool the mix between lifts. Standing water should not be allowed on the mix between lifts.

After the intermediate lifts of the patch have been compacted sufficiently, the surface lift can be completed. Take special care to ensure that it is compacted to be even and flush with the surrounding surface, so it provides a good riding surface. Some compaction will occur by traffic as the mix is further kneaded into place. The patch should be cool enough before traffic is allowed on it, so it will not leave marks in the surface. Deeper patches will require more time to cool and must be planned for accordingly.

3-11.3 Potholes

Potholes and localized failures should be repaired as soon as possible after they are reported. Asphalt pre-mix (cold mix) should be available throughout the year so any potholes that appear can be patched immediately. Fiber reinforced, and other specialized 'winter mix' have been found to be effective in many locations. Many times the use of a propane torch to dry the holes and heat the mix for good compaction is time well spent.

The use of an asphalt 'tack' is highly recommended. A higher success rate is normally achieved when the edges are squared up and tack is added to the edge of the pothole. If the lack of availability or storage of standard tack is a problem, try using one of the cold pour crack pouring materials. They are available in (5) gallon buckets with a pour spout. Many pothole patching crews use this as standard procedure.

Do not use sand, clay, or other temporary patching material to patch or "pad" potholes or frost boils. On today's roads these methods usually cost more in the long run and often leave unsafe conditions for the traveling public. Asphalt pre-mix is the preferred method, even if it has to be replaced when final repairs are made.

For permanent pothole patching proceed as follows:

- Remove the defective material down to a stable base.
- Square off the edge of the hole vertically.
- Dry the hole as much as possible (fiber reinforced mix often does well in wet holes).
- Tack the hole if possible.
- Place and compact the mix.

Compaction is very important in making the repair permanent (heat applied to the mix is very beneficial to good compaction). If traffic is picking the fresh mix out of the hole try dusting the finished patch with some roadside dirt. Spend a little more time patching and compacting the pothole the first time. This will often keep you from returning to patch the same hole repeatedly. Permanent repairs are normally made with hot mix if available.

3-11.4 HMA Overlay

Overlay patches are generally applied when an area is too large to be economically repaired by hand with a small crew. The overlay patch with HMA also has the advantage of setting quickly. It does, however, commit a considerable investment in labor, equipment, and materials.

Typically, overlay patches are applied in areas of pavement failure or wear problems rather than areas with a base or subgrade problem. Ruts, raveling, pitting, minor cracking, and oxidation are typical failures where overlay can be effective in quickly and permanently restoring the surface. When addressing pavement rutting, mix should be placed in lifts when patching rutted areas in order to get uniform compaction. This method of compaction will help prevent the rut from reflecting into the finished patch. To obtain proper compaction in the wheel ruts, a rubber tired roller should be used. Steel wheel rollers will bridge the rut and very little compaction will occur. After the ruts are filled

and if it is decided to overlay the entire lane, then a steel wheel roller would be used for compaction.

Application of any overlay patch requires a considerable degree of skill, coordination, and planning. All loose, broken asphalt should be removed and replaced. Any deep ruts, depressions, or humps should be repaired or pre-leveled in advance of the overlay so that the overlay may proceed efficiently. It is necessary to repair these areas prior to the overlay in order to provide an even platform for the new pavement. This is essential to proper compaction and consequently to pavement life. If, for instance, wheel path ruts are overlaid without pre leveling, the ruts will not get the same compaction from rolling that the thinner high spots will. Then traffic wheel loads will eventually compact the deeper new sections, causing ruts to reappear. All areas should be tacked before patching to ensure a good bond and minimize raveling in thin areas. The tack rate should be 0.4 to 1.4 gallon per square yard of applied tack (0.2 to 0.8 residual).

Be careful when repairing the roadway surface in an area of unpaved shoulders. Widening over thin gravel or dirt shoulders will usually lead to cracking and failure. This is because of the lack of sufficient top course material. If there is the need to widen the paved roadway, make sure the shoulder is prepared properly to support the anticipated loading.

3-11.5 **Spreader Box Patching**

On small paving jobs it is often convenient and economical to use a tow-behind paver, or spreader box. These pavers hook to the rear of the trucks that are hauling the mix. The asphalt is dumped directly in the hopper of the paver which places it on the roadway or base material.

As the towing vehicle moves ahead, the mix is struck off by an adjustable height blade (cutter bar or screed) and is surface-finished by the screed. Starting the paving at full depth requires setting the screed on blocks before filling the hopper. The hopper should be kept uniformly full during paving to ensure an even spread. An even towing speed is necessary to maintain a uniform spread thickness.

Spreader boxes vary greatly in size, operating controls, accessories, and capabilities. Working with them requires skill and experience. Manufacturers and construction equipment dealers can provide assistance in the operation and care of particular models.

Clean-up of equipment and tools after each day's operation is essential to good patches. This is especially true of the spreader box. It must be kept free from the accumulation of cold asphalt. An environmentally approved release agent should be used for cleaning tools and equipment.

Spreader box patching with HMA material has the advantage of providing a smooth finished surface, when the equipment is properly operated. Several people are required to operate a spreader box efficiently. Careful planning of the patching operation is very important to economical and cost-effective pavement maintenance. The spreader boxes can work well if surface irregularities are pre-leveled with equipment appropriate for the conditions. The entire surface should be tacked, both before pre leveling and before starting the spreader box patch.

Rolling of the hot plant-mix should begin immediately after placement of the mix. If the mix is allowed to cool below 185 degrees before rolling, adequate compaction will not be possible.

3-11.6 Grader Patching

Road graders are a useful pavement patching tool especially valuable for leveling to eliminate sharp depressions or sags in the pavement surface. These graders vary in size, model, and capabilities depending on their intended use.

One efficient way of blade patching is using two graders facing each other. This method is quicker than the single blade method, and can help in getting the patch laid before the mix gets cold. It helps keep coarse mix away from the ends of the patches, making smoother approaches, and helps keep a straighter edge.

HMA patching with graders is frequently accomplished when it is not practical or economical to use other means. Graders can be used to lay a leveling course of pavement prior to placing finish courses with asphalt spreader boxes and are excellent for placing a leveling course to restore the roadway grade and shape when it cannot be done with a paver or spreader box.

All of the area to be blade patched should be tacked. Road graders with a long wheel base and smooth-tread tires are often used for spreading hot plant-mix asphalt in leveling operations. The roller must follow the grader immediately after the mix is spread while it is still hot.

Graders are not efficient at carrying large quantities of material over long distances, so the dumping of asphalt should be carefully controlled for an efficient operation. A dump person should be utilized. Make as few passes as possible with the grader to reduce segregation of the material.

3-11.7 Compacting Hot Mix Patches

Compaction is among the most important phases of the operation. All asphalt concrete patches, small or large, must be compacted to consolidate the material. The properly compacted asphalt patch will be tough and dense and will stand up to the wear of traffic and weather much better than if compaction is inadequate. However you compact the mix, do it well; it is very important.

A 10 ton or larger steel-wheeled roller is valuable to an efficient asphalt patching operation. A lighter vibratory roller is a poor substitute, as it can slow the operation considerably. On larger paving projects, one roller may be used to do the breakdown rolling or initial compaction, with another used for the finish rolling.

The patching operation should match the speed of the roller train. If the patching crew outpaces the roller, it forces the rolling of mix that is too cold resulting in a poor quality patch. The maximum temperature of mix from the plant is 350 degrees and tarping trucks from the HMA plant is highly recommended to retain heat the longest. Do not compact HMA at a temperature below 175 degrees F. Rolling mix that is too cold can cause it to crack. If the operation needs to move faster and the roller can't keep up, add

more rollers to the compaction train. Compacting mix that is too hot can cause pushing. Avoid stopping rollers or reversing direction on the hot mat. Do not turn on the mat while moving. Improper operation of rolling equipment can affect the quality and ride of the patch.

Rolling for compaction should begin as soon as the paving material is laid. The initial rolling or “breakdown” gives the highest percentage of compaction of any rolling phase. Consequently, it also offers the most potential for material displacement at the edges. It is important to make the initial breakdown pass at least 4 inches away from the edges of the mat. A subsequent pass will level this edge.

Intermediate rolling further compacts and seals the surface. Finish rolling removes any roller marks and other blemishes left by prior rolling.

Various roller types are used in asphalt compaction. Steel-wheeled, vibratory, and pneumatic tired are the types most commonly available. Steel wheeled and vibratory rollers are used for all three phases of asphalt rolling. Vibratory rollers should not be operated on thin lifts and so are not generally used in maintenance patching operations. Rubber-tired rollers are not normally used in maintenance operations with the exception of rut filling activities and chip seal applications.

All rollers used in asphalt paving or patching operations should be:

- In good operating condition.
- Used according to the manufacturer’s recommendations.
- Capable of reversing direction without backlash.
- Able to operate at speeds low enough to avoid displacement of the hot asphalt.

Do not use rollers producing pickup, washboard, uneven compaction, or otherwise undesirable effects. Vibratory rollers under vibration should not exceed (3) mph. Steel-wheeled rollers should be limited to (4) mph and pneumatic tired rollers to (5) mph maximum. The drive wheel of the roller should always be pulling the roller to prevent displacement and pushing of the material. This is particularly important on steeper grades and in breakdown rolling passes.

3-11.8 *Effects of Traffic on a Patching Operation*

Timing is critical while doing hot asphalt mix patching. Flaggers for the operation must avoid delaying asphalt trucks and paving equipment while hot mix patching/paving as the mix temperature is critical to successfully completing the patch or paving operation.

Don’t let traffic drive on any uncompact mix. A finished patch should be cool enough to hold your hand on before traffic is allowed to drive on at normal speeds. A pilot car offers a big advantage for multiple patches over an extended section of roadway. The use of a third flagger or traffic cones to keep traffic off the unfinished mix and away from the equipment is desirable. Traffic striping that is blacked out or covered should be remarked the same day with temporary striping (tape or paint products).

3-12 HMA Materials Information

Sources for additional pavement maintenance information.

3-13 Classes of Hot Mix Asphalt (HMA)

Exhibit 3-9 Mix Type in Patches

Mix Class	Size	
Class 1/2"	1/2"-0"	Mix should be used when placing multiple layers
Class 3/8"	3/8"-0"	Mix should be used when placing one or more layers

Exhibit 3-10 Asphalt Concrete Paving Quantities (Tons/100 linear ft)

Width (ft)	Depth of Mix (Compacted)					
	1"	2"	3"	4"	5"	6"
2	1.2	2.4	3.6	4.8	6.0	7.6
4	2.5	5.0	7.5	10.0	15.0	15.2
6	3.8	7.6	11.4	15.2	19.0	22.8
8	5.0	10.1	15.0	20.0	25.0	30.4
10	6.3	12.6	18.9	25.2	31.5	38.0
11	7.0	14.0	21.0	28.0	35.0	42.0
12	7.6	15.2	22.8	30.4	38.0	45.6
16	10.1	20.2	30.4	40.6	50.7	60.8
18	11.4	22.8	34.2	45.6	57.0	68.4
20	12.4	25.2	37.2	49.6	62.0	76.0
22	14.0	28.0	41.8	56.0	70.0	83.7
24	15.2	30.4	45.7	60.8	76.0	91.3

The following can be used to convert tons volume to tons:

$$\text{Volume (cu.ft.)} = \text{Length (ft.)} \times \text{Width (ft.)} \times \text{Thickness (ft.)} = \text{cu.ft.}$$

$$\text{Pounds of HMA (lbs.)} = \text{Volume (cu.ft.)} \times 145 \text{ (lbs./cu.ft.)} = \text{lbs.}$$

$$\text{Tons of HMA} = \text{Pounds of HMA (lbs.)} \div 2,000 \text{ (lbs. per ton)} = \text{tons}$$

Example:

$$\text{Volume (cu.ft.)} = \text{Length (20 ft.)} \times \text{Width (12 ft.)} \times \text{Thickness (0.20 ft.)} = 48 \text{ cu.ft.}$$

$$\text{Pounds of HMA (lbs.)} = \text{Volume (48 cu.ft.)} \times 145 \text{ (lbs./cu.ft.)} = 6,960 \text{ lbs.}$$

$$\text{Tons of HMA} = \text{Pounds of HMA (6,960 lbs.)} \div 2,000 \text{ (lbs. per ton)} = 3.48 \text{ tons}$$

3-14 Successful Chip Seal Projects

Chip seals are one of the more commonly used pavement preservation techniques used in Washington State. In order to improve the likelihood of a successful project and ensure longevity, it is important to understand the basics. The following will cover aspects related to pavement conditions, material selection, construction overview, pre-construction, and calibration.

3-15 Pavement Conditions

Prior to sealing, thoroughly examine the roadway surface. Then decide what kind of repair is needed based on the overall pavement condition. A chip seal does not add to the structural integrity of pavement. Therefore, the existing pavement must be structurally sound in order to obtain a long performance life from a chip seal repair. Existing pavements may have to be repaired; patched, crack sealed and then allowed to cure before a chip seal can be applied. Always clean the existing roadway surface before starting the chip seal process.

Since chip seals follow the original profile of the pavement, they do not correct surface irregularities. Chip seals are not typically used on pavements with more than $\frac{3}{4}$ " of rutting because aggregates in the ruts cannot be fully compacted unless a pneumatic tired roller is used. Cleaning loose aggregate from the rut with a power broom will dislodge the aggregate from the non-rutted area. If the surface has light-to-moderate bleeding, the binder application rate should be reduced. Use of a chip seal on pavements with a high severity of bleeding should be avoided.

3-16 Chip Seal Material Selection

3-16.1 *Asphalts and Emulsions*

The two general types of asphalt for seal coating are liquid asphalt and emulsified asphalt. Emulsified asphalts are manufactured by suspending asphalt particles in water with the aid of an emulsifying agent. Asphalts for chip seals are listed in the [Standard Specification](#) Section 9-02.

3-16.2 *Common Types of Emulsions Used for Chip Seals*

CRS-2 (Cationic Rapid Set Emulsion) and CRS-2P (Polymer) are two of the most widely used emulsions. This emulsion will run into wheel ruts and down super elevated roadways if applied at rates above 0.4 gallons per square yard. CRS-2 provides a good seal on low volume highways.

CVRS-2P (Cationic Very Rapid Set Emulsion w/Polymer) is a rapid setting emulsion that binds the chips very fast and can be used on high volume roads. This material allows for sweeping of the roadway within an hour of application, thereby causing less windshield damage and increased safety for the travelling public.

HFRSP2/HFE-100S (High Float Rapid Set Polymer/High Float Emulsion) is used for chip seals. It is a rapid setting emulsion that binds the chips very fast and can be used on high volume roads. This product should not bleed under high pavement temperatures.

3-16.3 Aggregate

Aggregate for chip seals must conform to the requirements in the *Standard Specifications* Section 9-03.4 for grading and quality. However, aggregate availability may be a factor to consider if the chip seal is not intended to last a full cycle. The material must meet the requirements for grading and quality when placed in hauling vehicles for delivery to the roadway. During manufacture and placement into a temporary stockpile the exact point of acceptance will be determined by the Engineer or Area Superintendent. The finished product shall be clean, uniform in quality, and free from wood, bark, roots, and other contaminants. Crushed screenings must be substantially free from adherent coatings.

3-17 Chip Seal Construction Overview

3-17.1 Application of Emulsion

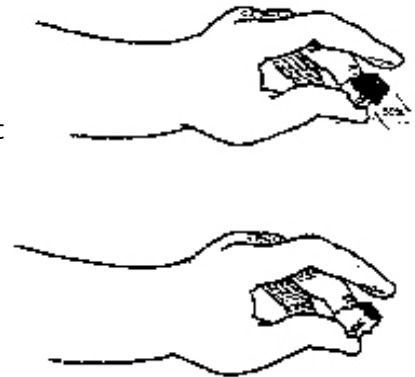
It is very important that the correct amount of emulsion be applied to the surface, as too much or too little asphalt will cause a slick roadway and flush the surface. If not enough asphalt is shot, the rock will ravel off leaving a surface rich in asphalt.

Many factors are used to determine the amount of asphalt to shoot, including the grade of asphalt, size of aggregate, condition of roadway surface, and traffic. After a rate of application is determined, a shot of asphalt should be put down, covered with aggregate, and rolled. A field check should be made by checking to see that the asphalt depth is approximately three-quarters of the way up on the firmly placed aggregate.

Any adjustment needed should be made in the asphalt application rate at this time. A field check should be performed periodically during the day to assure correct application rates are maintained throughout the entire project.

Rough and unsightly transverse joints can be avoided by starting and stopping the asphalt spread on building paper. The distributor, traveling at the correct speed for the desired application rate, starts spraying on the paper so that a full, uniform application of asphalt results when reaching the exposed surface. The use of smaller, more absorptive aggregate at the ends has been successfully used instead of paper.

A longitudinal joint is usually unavoidable because traffic lanes must be maintained. If possible, longitudinal joints should be made along the centerline or center of lane of the pavement and never in the wheel tracks. To prevent aggregate from building up on the longitudinal joint, the edge of the aggregate spread should coincide with the edge of the full thickness of applied asphalt. This allows a width where asphalt is present in partial thickness, due to outside nozzle spray, that can be overlapped when asphalt is applied in the adjacent lanes.



3-17.2 Spreading Aggregate

Chip spreaders kick the aggregate backward or drop the aggregate straight down to reduce aggregate rollover and reduce the degree to which the aggregate picks up on vehicle tires after the section has been opened to traffic. The spreader is a variable width machine and calibrated on pounds per square yard. Dump trucks work in combination with the chip spreader to achieve a uniform application of aggregate.

All aggregate required for the planned spread should be on hand before starting. It should be dampened if necessary, as described in the section on Material Selection. When the distributor moves forward to spray asphalt, the aggregate spreader should follow immediately behind it. The asphalt must be covered as soon as possible, otherwise the cooling of the asphalt will prevent good adhesion between asphalt and aggregate. It is important that the aggregate be spread uniformly and at the proper rate of one rock thickness. Marking the length that each truckload of aggregate should cover aids in controlling distribution.

3-17.3 Rolling

Rolling seats the aggregate in the asphalt and promotes the bond necessary to resist traffic stresses. Pneumatic tired rollers should be used on all seal coat jobs to give uniform ground pressure over the entire area to achieve proper embedment of the aggregate in the asphalt binder. Steel wheeled rollers tend to compact only high spots and can fracture soft aggregates.

Rolling should begin immediately after the aggregate has been distributed and should continue until the aggregate is properly seated in the binder. Rolling should begin at the outer edge of the treatment and proceed in a longitudinal direction, working toward the center of the road. Each trip should overlap the previous trip by about one-half the width of the front wheels. As soon as the asphalt has a definite set or hardening, rolling should be discontinued, to prevent the bond between the surface and aggregate from being broken by the roller.

Rollers should be operated at slow speeds (4 to 6 mph) to set the rock, not displace it. The number of rollers required for a seal coat project depends on the length of the operation. It takes two to four passes of the roller to set the rock. These rollers should have tire pressures of (45) psi or more.

Loose aggregate should be swept along the longitudinal joint and from the uncovered lane prior to application of asphalt. Brooming loose aggregate on a completed sealed surface should be done as soon as practicable, and during the cool part of the day, to minimize flying rock problems.

Relying on traffic to seat the aggregate has been successful, if speed is controlled, but using rollers gives better control and improves the chances for success.

3-17.4 *Spreading of Fines or Choking - Optional*

The need for applying fines will vary with the types of emulsions used and application rates. Those rates must be closely monitored. The most common material used for choking is $\frac{1}{4}$ " minus maintenance sand. In urban areas clean masonry sand can be used. Spreading these fines on a seal helps fill the voids, key the stone, reduces the chances of bleeding, and stops the squeezing and tracking of asphalt. The application of these fines prior to the roller, or after the roller depends on the types of emulsions used, and the location of the project. Fines application should not cover the coarse aggregate but merely fill the voids. The spreading of fines could be achieved by using a Hopper Sander with a mid-mount spinner. This vehicle may be placed before or after the rollers depending on the type of operation.

3-17.5 *Post-Seal Inspection*

The embedment of the aggregate into the asphalt should be checked a day or so after the construction of the seal coat. Remove several of the largest stones and determine if the 50 percent to 70 percent embedment has been obtained.

If an inadequate application of asphalt was applied, a fog seal can enrich and tie down the seal rock. A diluted CSS-1 (usually 50/50) is applied at the rate of 0.1 to 0.2 gallons per square yard of the dilution. (Application can vary depending on pavement texture, local conditions, and traffic). No cover aggregate is required; however, if a tighter seal is desired, a sand or $\frac{1}{4}$ "- 0 cover may follow. Traffic should be controlled until the CSS-1 has cured.

3-18 **Chip Seal Pre-Construction**

3-18.1 *Weather*

The best time of year construct a chip seal is between May 15th and August 15th when the weather is dry during, and for some weeks after, placement. Specifications require the air temperature in the shade to be at least 60°F and rising before work begins and the road surface temperature shall not be more than 130°F. No matter what the temperature of the asphalt when sprayed, it will cool to the temperature of the pavement surface in one minute.

Never start a chip seal when the surface is wet or when it is threatening to rain. If the freshly placed chip seal gets wet, the combination of water and traffic will result in loss of the cover aggregate and will potentially cause damage to vehicles.

3-18.2 *Traffic Control*

Traffic control is important and must be maintained throughout the work area. High speed traffic over a fresh seal coat displaces aggregate, causing bleeding of asphalt. Traffic should be allowed only in the lane not being sealed. When work is completed, traffic speed should be maintained at less than 35 mph, or the legal speed if under 35 mph, until the asphalt sets. Warning signs, flag persons, and pilot cars are essential for traffic control. Route trucks hauling aggregate to the aggregate spreader in a direction opposite of the seal coat operation. This prevents loaded trucks being turned on freshly placed seal coat.

Some emulsions such as High Floats may require up to 24 hours of traffic control or until the first sweeping occurs. This is in areas of high volume traffic or areas where vehicle weight exceeds the normal load range.

3-18.3 *Equipment*

Before any work begins, examine all equipment to ensure it is in good working condition. Check spreader boxes or aggregate spreaders to see they are in proper working order. The roller operator should make sure that each tire on the roller is equally inflated to correct pressure and that controls for steering, starting, and stopping operate smoothly. All tires should be the same size and the water spray and scraper system must be checked to ensure material does not bond to the tires.

3-18.4 *Distributor*

New distributors use a ground speed control sensor and computer to regulate material application rates. Set the computer to the desired rate and the application will be correct even if the vehicle speed varies.

Older distributors are equipped with hydrostatic drive systems. The hydrostatic drive consists of a variable output pump driven by the truck power take off (P.T.O.). This in turn drives the distributor asphalt pump with a hydrostatic motor. Once the correct ratio between ground speed and pump flow rate is established for a given transmission setting, the truck ground speed may be varied without affecting the application rate. The operator needs a dry run to establish correct ratio between pump flow rate and ground speed.

Determine the correct ground speed (F.P.M.) and pump flow rate (G.P.M.) for the desired spray bar length (FT.) and application rate (GAL/SQ.YD.). Follow the correct operation procedures set up in your distributor manual for calibration.

3-18.5 *Nozzle Size*

The spray bar and nozzles are an important part of the distributor. The proper quantity of asphalt must be spread uniformly on the road surface through the spray nozzles. To achieve good results, correctly sized nozzles must be selected for the job conditions. For example: if nozzles are too large for the desired application, pulsation of the spray may occur, resulting in uneven longitudinal spreading of the asphalt.

Each equipment manufacturer has specific recommendations for the size of spray nozzles to be used for different applications. Use the manufacturer's recommendation when choosing the correct nozzle size. All nozzles selected for use at any one time should have the same size opening.

3-18.6 *Proper Pressure*

The spray bar must have a constant, uniform pressure along its entire length for equal output from all nozzles. Be sure the spray bar and nozzles are CLEAN.

Although several methods are used to maintain pressure, distributors use gear-type pumps to deliver asphalt to the spray bar. Pressure is governed by variable pump speed on some distributors and by constant pump speed and a pressure relief valve on others. Each application should be checked, as recommended by the manufacturer.

The correct pump speed or pressure are critical to the proper application of the asphalt. Too low a pressure will result in a non-uniform discharge/streaking of material from the individual nozzles. Too high a pressure, in addition to atomizing the asphalt, will distort the spray fan.

When a metering system is used, the manufacturer supplies the distributor with charts for finding the proper pump speed for each application rate.

When a pressure relief valve is used, the pump runs at a constant speed and the pressure is automatically held in the spray bar. The manufacturer supplies charts for determining the discharge in gallons per minute for each size nozzle, the proper truck speeds for various application rates, and the corrections for temperature-viscosity variations. The following is general information related to how many gallons of emulsion (emulsified asphalt) might be required per 100 linear feet.

Exhibit 3-11 Gallons of Emulsified Asphalt Required Per 100 linear Feet: Various Widths and Rates

Gals. per Sq. Yd.	Width (feet)														
	1	2	6	7	8	9	10	11	12	14	16	18	20	24	24
0.10	1.1	2.2	6.7	7.8	8.9	10.0	11.1	12.2	13.3	15.6	17.8	20.0	22.2	24.4	26.7
0.15	1.7	3.3	10.0	11.7	13.3	15.0	16.7	18.3	20.0	23.3	26.7	30.0	33.3	36.7	40.0
0.20	2.2	4.4	13.3	15.6	17.8	20.0	22.2	24.4	26.7	31.1	35.6	40.0	44.4	48.9	53.3
0.25	2.8	5.6	16.7	19.4	22.2	25.0	27.8	30.6	33.3	38.9	44.4	50.0	55.6	61.1	66.7
0.30	3.3	6.7	20.0	23.3	26.7	30.0	33.3	36.7	40.0	46.7	53.3	60.0	66.7	73.3	80.0
0.35	3.9	7.8	23.3	27.2	31.1	35.0	38.9	42.8	46.7	54.4	62.2	70.0	77.8	85.5	93.3
0.40	4.4	8.9	26.7	31.1	35.6	40.0	44.4	48.9	53.3	62.2	71.1	80.0	88.9	97.8	107.
0.45	5.0	10.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0	70.0	80.0	90.0	100.	110.	120.
0.50	5.6	11.1	33.0	38.9	44.4	50.0	55.5	61.1	66.7	77.8	88.9	100.	111.	122.	133.
0.55	6.1	12.2	36.7	42.8	48.9	55.0	61.1	67.2	73.3	85.5	97.8	110.	122.	134.	147.
0.60	6.7	13.3	40.0	46.7	53.3	60.0	66.7	73.3	80.0	93.3	107.	120.	133.	147.	160.
0.65	7.2	14.4	43.3	50.6	57.8	65.0	72.2	79.4	86.7	101.	115.	130.	144.	159.	173.
0.70	7.8	15.6	46.7	54.4	62.2	70.0	77.8	85.5	93.3	109.	124.	140.	156.	171.	187.
0.75	8.3	16.7	50.0	58.3	66.7	75.0	83.3	91.7	100.	117.	133.	150.	167.	183.	200.
0.80	8.9	17.8	53.3	62.2	71.1	80.0	88.9	97.8	107.	124.	142.	160.	178.	196.	213.
0.85	9.4	18.9	56.7	66.1	75.5	85.0	94.4	104.	113.	132.	151.	170.	189.	208.	227.
0.90	10.0	20.0	60.0	70.0	80.0	90.0	100.	110.	120.	140.	160.	180.	200.	220.	240.
0.95	10.6	21.1	63.3	73.9	84.4	95.0	106.	116.	127.	148.	169.	190.	211.	232.	253.
1.00	11.1	22.2	66.7	77.8	88.9	100.	111.	122.	133.	156.	178.	200.	222.	244.	267.
1.10	12.2	24.4	73.3	85.5	97.8	110.	122.	134.	147.	171.	196.	220.	244.	269.	293.
1.20	13.3	26.7	80.0	93.3	107.	120.	133.	147.	160.	187.	213.	240.	267.	293.	320.
1.25	13.9	27.8	83.3	97.2	111.	125.	139.	153.	167.	198.	222.	250.	278.	306.	333.
1.30	14.4	28.9	86.7	101.	116.	130.	144.	159.	173.	202.	230.	260.	288.	318.	347.
1.40	15.6	31.1	93.3	109.	124.	140.	156.	171.	187.	218.	249.	280.	311.	342.	373.
1.50	16.7	33.3	100.	117.	133.	150.	164.	183.	200.	233.	267.	300.	333.	367.	400.
1.75	19.4	38.9	117.	136.	156.	175.	194.	214.	233.	272.	311.	350.	389.	427.	467.
2.00	22.2	44.4	133.	156.	178.	200.	222.	244.	267.	311.	356.	400.	444.	489.	533.
2.25	25.0	50.0	150.	175.	200.	225.	250.	275.	300.	350.	400.	450.	500.	550.	600.
2.50	27.8	55.6	167.	194.	222.	250.	278.	306.	333.	389.	444.	500.	556.	611.	667.
2.75	30.6	61.1	183.	214.	244.	275.	305.	336.	367.	428.	489.	550.	611.	672.	733.
3.00	33.3	66.7	200.	233.	267.	300.	333.	367.	400.	467.	533.	600.	667.	733.	800.

Note:

Formula used for calculation:

Where:

- Q = Quantity of asphalt required, in gallons per 100 ft (l/m)
 R = Rate of application in gallons per sq. yd. (l/m²)
 W = Width of application, in feet (m)

For metric conversion factors see pages 6-A and 6-B Metric formula for calculation: Q = LWR where L = length in metres.

3-18.7 Proper Nozzle Angle

Adjust nozzle opening angles so the spray fans will not interfere with each other. The nozzle angle will vary according to the make of the distributor. The angle recommended by the Asphalt Institute, measured from the spray bar axis, is 15 to 30 degrees.

Manufacturers furnish special wrenches for setting the angle of the nozzles. The use of these wrenches is recommended, as it is extremely difficult to obtain a uniform spread with visually set nozzles. All nozzles should be set at the same angle except for the cut-off nozzle (end nozzle). Manufacturers make a nozzle with $\frac{1}{2}$ spray pattern for this purpose.

At the time the angle of the nozzles is set, the edges of the nozzle openings should be inspected to see that they are not damaged. A nicked or otherwise damaged edge will produce a distorted fan of asphalt.

3-18.8 Spray Bar Height

The height of the spray bar above the pavement surface is probably the most important adjustment to assure uniformity of asphalt spread. Correct height must be maintained during the entire application. If the spray bar is too low or too high, streaking will result.

The preset height above the pavement surface should not vary more than $\frac{1}{2}$ inch. The bar will not stay within this tolerance, however, unless the manufacturer or the contractor takes steps to ensure that it does. As the asphalt leaves the spray bar, the load lightens and the springs raise the distributor. If there is an appreciable amount of deflection in the springs, the spray bar can rise as much as 4 inches, resulting in an uneven application.

Excess vertical movement of the spray bar can be corrected in several ways. After the bar height is adjusted with a full load in the tank, the frame of the distributor can be tied down to the axle during the spreading runs. If it is a truck-mounted distributor and has an adjustable type spray bar, mechanical controls can be supplied by the manufacturer to maintain the proper height, regardless of the deflection in the springs. On trailer-mounted distributors, bar height control is not necessary because of the small deflection of trailer springs. In any event, the height of the bar should be checked after each run and any necessary adjustment made at that time.

Triple Coverage – This is where any point on the roadway surface will receive overlapping spray from the two adjoining nozzles.

- **4-Inch Nozzle** – Best results with 4-inch nozzle spacing will come from an exact triple coverage of the spray fans. A simple test procedure assures the proper height setting of a spray bar with 4-inch nozzle spacing. One can determine by visual inspection whether or not an exact single coverage of asphalt is being applied. To begin, the second and third, fifth and sixth, eighth and ninth, etc., nozzles are closed, using the center section of the bar only. The distributor is then operated at the correct pump speed/pressure with the spray bar height changed not more than ½-inch at a time until the proper height is obtained. When an even single coverage of asphalt, heated to the proper spraying viscosity, is applied to the surface, it will give a uniform triple coverage with all nozzles operating.
- **6-inch Nozzle** – The height of bar necessary to give a triple coverage will frequently cause wind distortion of the spray fans, resulting in non-uniform application. A double coverage is therefore recommended for 6-inch nozzle spacing.

Double Coverage – This involves the same procedure as above except that every other nozzle is left open; the remaining ones are shut off. If the distributor has already been checked for double coverage, increasing the spray bar height by 50 percent will give triple coverage.

3-18.9 **Streaking Will Occur**

- If the asphalt is too cold.
- When the viscosity of the asphalt is too high.
- If the snivies are not at the same angle.
- When the bar is too high.
- When the bar is too low.
- When the bar pressure is too high it cuts furrows because the snivies are too small and/or there is too much pump pressure.
- When the bar varies in height from a full to an empty distributor, blocking or locking against the overload springs will reduce or eliminate this variance in height.
- When the bar is too long and/or the snivy openings are too large for the pump capacity, this results in narrow and fluttering fans. Smaller snivies and/or higher pump capacity will correct this.
- If the pump pressure is too low it will create narrower spray fans and fluttering.
- If the distributor tank is allowed to run completely empty, an irregular pattern of misses and fluttering will occur across the bar. For this reason, the shot should be terminated while approximately 100 gallons are left in the distributor.

3-18.10 *Cleaning*

Cleaning of the distributor should take place in an area determined by its characteristics that are protective of the environment. For example: areas near waterways or with high seasonal water tables would not be necessarily suitable. These cleaning areas may require all fluids to flow through an oil water separator and all tank and bar cleaning agents to be barreled and labeled for disposal. No discharging or blowing your distributor bars in the ditch line, upon the right of ways or on private property is allowed, this could result in a serious violation.

3-18.11 *Checking the Bitumeter*

A bitumeter consists of a rubber-tired wheel, mounted on a retractable frame, with a cable leading to a circular dial in the cab of the vehicle. The dial registers the rate of travel in feet per minute and the total distance of each trip in feet. At least one manufacturer furnishes a dial that registers the application rate in gallons per square yard in addition to travel in feet per minute.

Check the bitumeter regularly to ensure accurate registering of speed when the distributor is spraying asphalt. To verify the bitumeter, a distance of 500 feet to 1,000 feet is accurately marked off on a straight and level length of road. The distributor is driven at constant speed over this length and the trip is timed with a stopwatch. The speed in feet per minute is calculated and compared with the bitumeter dial reading recorded during the run. This procedure is repeated for a number of other speeds, bracketing the speed to be used for spraying.

Errors found at the various speeds are tabulated or plotted on a graph so they can be readily applied when using the distributor. The bitumeter, when used, must be kept clean to ensure accurate registering of the truck speed. A build-up of asphalt on the wheel will produce an error.

3-19 Calibration Procedures

3-19.1 Distributor Calibrations

Step 1 – Calculate how much material is in the holding tank. The following methods work to calibrate an older distributor and calculate the application rate.

- **Method 1** – Determine the number of gallons in the distributor. This can be done by several methods. The first and most accurate is to weigh the distributor before loading and after loading. Subtract the weights and divide by the pounds per gallon the emulsion weighs. This equals the total gallons.
- **Method 2** – Find a level spot (the distributor tank must be level). Use a dip stick to dip the tank. Measure the number of inches covered with asphalt. After you know the size of the tank, you can calculate the number of gallons in the tank.
- **Method 3** – Use the meter on the distributor tank. This is a good method for checking the above calculations but is **not recommended** for calibrating purposes.

Methods 1 and 2 are recommended for Measuring Distributor Tank (MDT) equipment prior to the start of the project.

Step 2 – Apply asphalt to a known distance (minimum 200 feet) and established width.

Step 3 – Determine the total square yards covered with emulsion. This can be done by doing the following calculation:

$$\frac{\text{Length Traveled (feet)} \times \text{Width Covered (feet)}}{9} = \text{Square Yards}$$

Step 4 – Determine the number of gallons remaining on the distributor. Again use Method 1 or Method 2 explained in Step 1.

Step 5 – Subtract the total gallons on the distributor originally from the total gallons left on after applying asphalt. This will give the gallons used.

Step 6 – Divide the total gallons used by the total square yards covered:

$$\frac{\text{Total Gallons}}{\text{Total Square Yard}} = \text{Gallons/Square Yard}$$

Step 7 – To check your application rate on the project, follow the same steps except use Method 3 outlined in Step 1 to determine the number of gallons on the distributor.

3-19.2 Chip Spreader Calibration

The following is a step-by-step procedure on how to calibrate your chip spreader and calculate the application rate.

1. Construct a one square yard shallow box or tarp, with shallow and narrow sides.
2. Place the box/tarp in the middle of the roadway a minimum of 50 feet in front of the chip spreader.
3. Get the chip spreader up to speed and apply chips over the top of the box/tarp.
4. Remove the box/tarp with the chips from the road.
5. Find an accurate materials scale. If in the field, the scale must be leveled and checked.
6. Place the chips from the box/tarp in a small bucket and weigh the bucket with the chips.
7. Empty the chips out and weigh the empty bucket.
8. Subtract the weight of the empty bucket from the weight of the bucket with the chips.
9. Since you had a one-square yard box/tarp, the weight from Step 8 is your pounds per square yard of chips.
10. Repeat the process at two to three gears and two to three RPM or speeds. You can then develop a chart.

Exhibit 3-12 Tons of Aggregate Required Per Mile for Various Widths and Rates

Spread Rate	Spread Width (In Feet)						
	8	9	10	12	16	18	20
lb/yd ²	Tons Per Mile	Tons Per Mile	Tons Per Mile	Tons Per Mile	Tons Per Mile	Tons Per Mile	Tons Per Mile
5	12	13	15	18	23	26	29
10	23	26	29	35	47	53	59
15	35	40	44	53	70	79	88
20	47	53	59	70	94	106	117
25	59	66	73	88	117	132	147
30	70	79	88	106	141	158	176
35	82	92	103	123	164	185	205
40	94	106	117	141	188	211	235
45	106	119	132	158	211	238	264
50	117	132	147	176	235	264	293
60	141	158	176	211	282	317	352
75	176	198	220	264	352	396	440
100	235	264	293	352	469	528	587
150	352	396	440	528	704	792	880
200	469	528	587	704	939	1056	1173
250	587	660	733	880	1173	1320	1467
300	704	792	880	1056	1408	1584	1760

Note: The aggregate weight may vary a couple of pounds if the chips are wet.

3-19.3 DOs and DO NOTs of Seal Coating

- **Do** turn spray nozzles so that fans are at proper angle to spray bar, so sprays do not touch or merge.
- **Do** check bar height at start of each shot to determine ground-to-nozzle distance over entire length of the spray bar.
- **Do** check spraying pressure so as to give constant uniform spray. Pressure too high will cause spray to fog and distort, pressure too low will cause spray to sag with heavy edges and pronounced longitudinal streaking.
- **Do** heat asphalt to upper part of spraying temperature range to eliminate heavy edge that is characteristic of all fan type sprays.
- **Do** keep spray bars in proper working order by regular cleaning and inspecting of strainers. Clean spray bars after each day's operation.
- **Do** keep aggregate stockpiles clean and free of contaminates.
- **Do** clean out tank thoroughly when changing asphalts from emulsified to cutback asphalts or from cationic to anionic emulsions.
- **Do** keep equipment on the same side of the roadway that the sealing operation is on, so traffic flow is not impeded.
- **Do** cover shot as soon as possible and roll immediately to ensure a good bond.
- **Do not** use worn nozzles or ones that have mechanical imperfections.
- **Do not** heat asphalt material above maximum temperature range, which would cause spray patterns of the fans to be uneven.
- **Do not** use asphalts that are too cold. Material will be too viscous and cause narrow spray fan, and materials will not flow together.
- **Do not** try to seal a wet or dirty road surface.
- **Do not** try to seal coat if air or road surface is too cold. Don't seal when windy.
- **Do not** make shots too long before applying aggregate.
- **Do not** turn equipment on a fresh patch.

3-20 Blade Mixed Asphalt Mix

Blade mixing of asphalt cold mixes is an economical and versatile method of producing material for construction or repair of highway pavement. High production rates are possible with a comparatively low expenditure, and entirely satisfactory pavements can be achieved with blade mixed cold asphalt. However, proper attention must be devoted to ensuring uniform quantities of aggregates, uniform aggregate gradation, and correct, uniformly applied quantities of asphalt are combined into the final mix design.

A wide variety of aggregates ranging from well graded crushed rock to silty sands can be mixed satisfactorily by cold blade methods. The optimum results will be obtained by using a uniformly graded manufactured aggregate with a maximum particle size of ½ inch or less and not more than 10 percent passing the No. 200 sieve.

Emulsified or cutback asphalts may be used in the production of cold mixes. Up to 3 percent surface moisture may be required on aggregates for successful mixing with emulsified asphalts and subsequent compacting of the mixture. The surface moisture of aggregates should be as low as possible if cutback asphalts are used.

Well graded mixes are made using an asphalt with a fairly slow rate of curing such as MC, SC, SS, or CSS. Open graded mixes are made with a faster curing asphalt such as MC or CMS, or RC if it is to be spread and compacted immediately. Asphalt cold mixes which are to be made and placed into stockpile for future use are made with an MC or SC asphalt of 250 or 800 grade.

Prior to beginning the mixing operation, a permanent base pad must be prepared at the site upon which the cold mix will be made. The pad should be reasonably level, 3 to 4 feet wider than the distributor spray bar, and must be surfaced with compacted hot or cold asphalt mix. The length of the pad can vary depending upon conditions but should be approximately 400 feet if possible.

The cold mix is made in batches, the size of which will depend upon the capacity of the distributor and the desired asphalt content. For a uniform manufactured aggregate of ½ inch to 0 inch gradation, with a desired asphalt content of 5 percent and using a 1,000 gallon distributor, the batch size will be approximately 60 cubic yards.

Using a truck and tail gate or chip spreader, a layer of aggregate the width of the distributor spray bar is uniformly placed upon the length of the base pad at a rate of approximately 50 pounds per square yard. Heated asphalt is then shot over the layer of aggregate at a rate calibrated to yield the desired asphalt content. The amount of asphalt required will depend on the gradation of the aggregate and will normally range from 4 to 7 percent by weight of the completed mix. Successive layers of aggregate and shots of asphalt are placed one on top of the other until the batch is completed.

Mixing is accomplished by turning and blending the mixture with a grader. If several batches are being produced for stockpiling and production is a factor, the mixing is more efficiently accomplished by using two blades working in opposite directions. Well graded mixes will require a relatively greater mixing effort to coat all of the particles evenly than will be required for open graded mixes. Mixing should continue until a thoroughly uniform mixture is produced. The completed mix is then windrowed and picked up by a front-end loader and placed into stockpile.

Stockpiled mixes made with MC or SC cutback asphalts should be allowed to cure out for a period of time before the mix is used. Cure time varies depending on weather conditions but will normally be approximately two weeks.

3-21 Handling Emulsified Asphalts

The Asphalt Institute Fourth Edition of MS-19 titled *Basic Asphalt Emulsion Manual* is a great source of for best handling practices. Please refer to this manual for additional information.

3-22 Maintenance of Rigid Pavements

Rigid pavements are generally referred to as Portland Cement Concrete Pavement (PCCP) or Concrete Pavement. PCCP should be patched with Portland Cement Concrete. Prepare and apply patching materials according to the manufacturer instructions. If recommended by the patching material manufacturer, use a bonding agent.

The PCCP surface to be repaired should have all loose material removed down to solid material. A jackhammer or similar equipment may be necessary to remove some of the material in the area to be patched. The area to be repaired needs to be squared by concrete sawing, then sand blasted, cleaned and dried. Any operation that creates concrete dust that becomes airborne is a safety concern. Ensure appropriate PPE and methods are in place and can be found within Chapter 8 of the [Safety Procedures and Guidelines Manual M 75-01.42](#).

Delamination occurs when a thin layer of surface concrete has lost bond with the underlying concrete. The area around the patch should be checked for delamination. Tapping on the surface with a hammer and listening for a hollow sound is one way to find the delaminated areas. Jack hammer operation can cause or exacerbate delamination. It is important for the operator to take care to avoid contacting the steel reinforcing with the jack hammer operation.

If reinforcing steel is encountered, remove or neutralize all rust. Coat exposed reinforcing steel with a WSDOT approved product to prevent rust from reoccurring. Then proceed with patching the area.

Traffic should be kept off the new patch as specified by the manufacturer, until it gains sufficient strength to support traffic.

3-23 Portland Cement Concrete Pavement Crack Pouring

Joints in Portland Cement Concrete Pavements (PCCP) compensate for thermal movements of the pavement. Properly sealed joints and cracks in concrete pavements prevent water from entering into and weakening the underlying base and subgrade materials. Properly sealed joints also prevent incompressible materials such as dirt and gravel from penetrating into joints, which then restricts thermal joint movements. Materials that restrict the natural expansion of the pavement joints can cause diagonal slab cracking, slab blowups, or tipping and spalling.

PCCP joints and cracks should be checked before the wet season to make sure they are sealed to prevent entry of damaging water.

Even fine cracks in steel reinforced slabs can be serious. They can allow water or chlorides to reach the steel causing corrosion and serious damage.

PCCP crack pouring is most effective when the pavement is cold and has contracted and opened the cracks. Don't pour cracks when the pavement temperature is below 45 degrees. Always use WSDOT approved crack sealant material.

Cracks must be cleaned out before pouring. A typical method is to clean and dry with compressed air prior to pouring. Foam backer rod can be used in larger cracks to keep the sealant in the top 1 inch of the crack reducing unnecessary use of sealing product.

Safety is a big concern in any hot pour operation. This material is extremely hot and can cause severe burns when loading the machine or applying the material.

3-24 Portland Cement Concrete Panel Replacement

Panel replacement and spall repairs are the concrete panel repair methods most often used by WSDOT. The intent of panel replacement is to remove and replace concrete panels that have deteriorated to a point where they have already failed or will fail prior to the preservation project.

3-24.1 Full or Partial Panel Replacement

Sometimes it is more economical to remove only the distressed portion of the panel. Reducing panel size decreases the cross sectional area of the panel available to resist loads which can result in premature cracking. To ensure good performance, the following criteria should be used when determining whether to use full or partial panel replacement (also see [Standard Specification](#) Section 5-01.3(4)):

- All full panel and partial panel replacements need to extend the full width of the existing panel.
- The remaining portion of the panel should be free of distress with the exception of minor spalling.
- The minimum length of a partial panel replacement is 6 feet.
- The minimum length of the portion of the panel to remain is 6 feet.
- Replace the entire panel if the above criteria cannot be met.

3-24.2 Adjacent Panels

When there are multiple panel replacements the intermediate dowel bars can be installed using dowel bar baskets. This is less time consuming than drilling into existing panels to install dowel bars. When a single cracked panel falls between two panels that are being replaced in the same lane, it should be considered for replacement.

3-24.3 Non-Working Joints

All concrete pavement cracks due to shrinkage as new concrete cures or due to loading during the concrete's life. Occasionally a crack does not form at a sawcut location leading to a non-working joint. A key to identifying a non-working joint is that there is no movement between the two sides of the joint. The joint will be uniform in width, cannot open and close due to temperature change and will not have any elevation difference between the two sides of the joint. If unsure if a joint is working or non-working, treat it as a working joint.

3-24.4 Skewed Joints

When replacing panels with skewed joints, the new joints can either be constructed with the same skew or they can be constructed perpendicular to the direction of travel (same as our current practice). If the joints are constructed perpendicular, they need to intersect the adjacent panel or panels at the existing transverse joint. Note that this situation will only occur when two or more adjacent panels are replaced in the same lane.

3-24.5 Random Panel Spacing and Panels Longer than 17 feet

For panels with random spacing the minimum size for partial panel replacement requires full panel replacement of the shorter panels. The longer panels are more susceptible to shrinkage cracking when being replaced and need to be broken up into two equal length panels. Dowel bars will be needed for the transverse joints in order to reduce the likelihood of transverse shrinkage cracking. Occasionally unusually long panels are encountered within sections of standard PCCP. These should also be reduced into smaller panels using the criteria above if they are replaced.

3-24.6 Sympathy Cracks

Sympathy cracks form when joints intersect to form a T. If a T intersection is necessary, the panels should be isolated from each other by installing form core board, roofing paper or other material between the panels. The isolation material should extend a minimum of 2 feet each side of the joint.

4-1 General

Managing water on the right of way requires a drainage system that effectively responds to the immediate environment. A typical highway drainage system includes conveyances of all types: gutters, drains, ditches, culverts, storm sewers, and other miscellaneous drainage structures.

The system is designed and constructed to collect, treat, and remove storm water from the highway right of way. It must be properly maintained to:

- Permit the maximum use of the roadway.
- Prevent damage to the highway structure.
- Protect natural resources.
- Protect abutting property from physical damage.
- Comply with applicable storm water management permits.

Drainage facilities should be maintained as nearly as possible to the condition and at the capacity for which they were originally designed and constructed. The entire drainage system should be generally inspected at least twice a year or otherwise based on specific environmental permit requirements, past experience, and professional judgement. Deficiencies should be corrected when they are discovered. Additional inspections may be required during heavy storms and periods of high runoff in order to determine the effectiveness of the system. High water marks should be observed and recorded as well as conditions that threaten damage to the drainage facility or the highway. Maintenance personnel must be continually alert to assure that all natural water course channels crossing the right of way remain open. WSDOT policy regarding accommodation of Storm water Runoff onto Right of Way is outlined in Policy Statement Number P 2032 dated February 10, 2012. This policy clarifies the departments responsibility for establishing and maintaining storm water management systems for its highways and other facilities that adequately manage the volumes and quality of storm water according to standards contained within the *Highway Runoff Manual M 31-16*.

4-2 Drainage From Abutting Properties

Storm water is the only effluent allowed to be discharged upon the highway right of way. [RCW 47.44](#) allows persons and entities who have been issued utility franchises or permits to encroach on or cross highway right of way to install and maintain the item for which the permit was granted.

Population growth, urban sprawl, and numerous new regulations restrict how maintenance crews can maintain surface and subsurface drainage systems. Regulations that may affect drainage maintenance include:

- Endangered Species Act
- Federal Clean Water Act – National Pollutant Discharge Elimination System (NPDES)
- Storm Water Management
- Wetlands Preservation
- WDFW Hydraulic Rules
- Growth Management Act
- Shoreline Management Act
- Irrigation Limitations

It is important that the Washington State Department of Transportation (WSDOT) not allow abutting property owners to discharge water onto the highway right of way without obtaining a permit. Property owners may obtain permits by applying at the WSDOT area or region office. Drainage design engineers and maintenance staff review potential drainage impacts from the abutting property to the highway right of way. The property owner may be required to mitigate water quality and/or quantity impacts to obtain a permit.

Maintenance personnel who routinely patrol a roadway section must be trained in the basic knowledge of what types of direct drainage and sheet flow from abutting property may require a permit. These include new:

- Commercial developments such as shopping centers
- Subdivisions
- Industrial development
- Automobile wrecking yards
- Dairy and other intensive farming activities.

Maintenance personnel should report land use changes they observe to their supervisor. The supervisor will forward this information to the appropriate reviewer.

4-3 Ditches and Gutters

Open ditches should be routinely checked and maintained as close as possible to the line, grade, depth, and cross section to which they were constructed. Vegetation in ditches often helps prevent erosion and treats storm water. Remove vegetation only when flow is blocked or excess sediments have accumulated. Remove vegetation using “best management practices” that minimize erosion and sediment escape to water bodies.

Excessive erosion of drainage ditches must be controlled or repaired. Ditch linings of loose or grouted rock and concrete or other energy dissipation methods can control erosion. However, these linings need be checked frequently and repaired as necessary.

Keep ditches and gutters free of litter and debris. Repair cracks and breaks as necessary.

Be especially careful when chemicals are used for brush and grass control in open ditches. Herbicides must be carefully controlled so as not to contaminate water or to transfer and concentrate chemicals in adjacent areas where environmental damage may result. Always follow product application instructions.

Be alert for diversion ditches on top of cut slopes that prevent slope erosion by intercepting surface drainage. Diversion ditches must be maintained to retain their diversion shape and capability.

Surplus material that results from ditch cleaning can often be used for widening. Material placed into the adjacent portions of the highway or disposal areas must not obstruct or impair other roadside drainage areas. Do not relocate material that may cause sedimentation problems into water bodies. Take care to avoid causing erosion problems or loose unstable fills. Do not use non-porous materials such as clay. They can become unstable when wet and trap water in the existing fill. If there is doubt about using such surplus material, contact the Region Soils Engineer for assistance and consult with your Region Maintenance Environmental Coordinator.

Do not blade ditch cleanings across roadway surfaces. Dirt and debris remaining on the pavement after ditch cleaning operations must be swept from the pavement.

Avoid undercutting the roadway back slope or in slope. Undercutting weakens the slope and will cause damaging slip-outs and other forms of slope erosion.

4-4 Rockfall Ditches and Slope Benches

Keep rock fall ditches and slope benches clean. Large amounts of slough or rock fall and other slide material that effectively block the ditch or bench should be removed as soon as possible.

4-5 Dry Wells

Dry wells accommodate the drainage flow in certain areas where:

- Natural outfalls for a drainage system were not available.
- Their use reduces the need for or size of downstream facilities.

These dry wells should be inspected periodically. Replace the drain rock if storm water no longer percolates into the soil. Within NPDES permit coverage areas, dry wells must be inspected annually and maintained to the applicable standards found in the [Highway Runoff Manual](#) M 31-16. Inspection frequencies may be revised in accordance with NPDES permit provisions. Inspection and maintenance work completed on dry wells within NPDES permit coverage areas must be documented in the Highway Activity Tracking System (HATS) to meet annual reporting requirements.

4-6 Culverts

A culvert is a closed conduit under a roadway or embankment used to maintain flow from a natural channel or drainage ditch. A culvert should convey flow without causing damaging backwater, excessive flow constriction, or excessive outlet velocities.

WSDOT's highway culvert inventory is managed in HATS. WSDOT is responsible for maintaining culverts that cross under state owned highways and culverts under county road approaches. Culverts under approaches to city streets that are designated as part of the highway system are the responsibility of the city under RCW 47.24.020 and as clarified under the current City State Guidelines. Culverts under privately owned roads are the responsibility of the private property owner per the provision of access connection permits referenced within WAC 468-51-080 (3).

As a general guideline, culverts should be inspected twice a year, once before the fall/winter storms and once after the rainy season has ended to ensure they are clean and in good operating condition. Culverts may be inspected more or less than this frequency based on the past history of the particular culvert.

A routine culvert inspection form is found in HATS and shall be used to document certain deficiencies that necessitate culvert cleaning and repair. A level 1 inspection form is found in HATS and shall be used to rate the condition of the culvert feature as well as document certain deficiencies identified during the inspection that require further action including cleaning, repair, and notification to region hydraulic program to perform a level 2 inspection. A level 1 inspection is expected to be performed at least once every 5 years or as resources allow. If conditions change significantly then Level 1 inspections may occur more frequently.

Changes in the upstream watershed due to logging, land development activities, farming practices, forest fires, etc., may increase water runoff, sedimentation, and debris. With these conditions more frequent inspections, particularly after periods of high runoff, are necessary to enable maintenance personnel to take corrective measures if damage has occurred. During storms and floods, critical areas need to be inspected and the culvert inlets kept clear. For these inspections that are in response to storms and floods the routine inspection form may be used.

Badly worn or broken culverts should be repaired, replaced, or rehabilitated to minimize the possibility of damage to the roadbed by water saturating the fill material. Depending on the scope of this work, it may be completed by state workforces in the Maintenance Program or by contractors under the funding and management of the Preservation Program. All culvert repair work conducted within the Maintenance Program shall be documented in HATS.

Culverts with 50 percent or more constriction should be flushed or otherwise cleaned to restore the culvert's original capacity. (Follow any applicable permit provisions and use BMPs to minimize adverse impacts to water quality or fish when doing this work). Some of the larger culverts in flowing streams are designed for construction below the stream bed, to accommodate fish life. In these cases, the culvert should also be cleared of obstructions that may be detrimental to the passage of fish. All culvert cleaning work conducted shall be documented in HATS.

Culverts should be checked for scour around the inlet and outlet. Scoured areas should be repaired with rip-rap or some other protection if necessary. In some cases, standing water is desirable at the inlet end of the culvert to settle out sediment. Vegetation at culvert ends can be controlled by residual herbicides or mechanical means.

Controlled burning of vegetation at culvert ends is a feasible alternative at some locations. Whatever method of vegetation control utilized needs to be accompanied by erosion and sediment control features/practices.

Pavement markings that show the location of culverts should be renewed annually. These markings are critical for quickly locating culverts for both emergency and routine maintenance. Pavement markings of more permanent materials, such as thermoplastics, are encouraged.

4-7 Automatic Pumps

Automatic pumps, sumps, and pipes at underpass structures or draining depressed sections of highway must be kept in good operating condition at all times. Each installation must be inspected on a routine basis, at least once per week. Inspections should include the electrical, ventilation, greasing and drainage systems.

4-8 Under Drains

Under drains are often constructed in the subgrade to intercept subsurface water from springs and seepage water from the surface or percolating from below. Control of this water is essential to ensure the stability of the subgrade upon which the highway is constructed.

Inspect under drains on the same schedule as culverts. Keep their outlets open and clean. Choked under drains can be cleaned by high pressure flushing with water or flexible sewer rods. In cases where roots effectively block the drainage, the use of herbicides may be needed. Whatever method of cleaning is used, consideration for erosion and sediment control is needed.

4-9 Horizontal Drains

Horizontal drains (HDs) are effective devices in some locations for draining water from hillsides to help maintain slope stability. They are generally plastic pipes that have been engineered and constructed into hillsides. When drilling into the hillside during initial installation, a steel casing is used but once the plastic drainpipe is placed in the hillside, the steel casing is pulled out, leaving the final HD in place. The HD is typically 37 mm (1.5 inches) in diameter and can reach several hundred feet or more back into the hillside. Inspection and maintenance for HDs is recommended at an annual frequency, and is optimally completed with guidance from a person experienced with the installation or maintenance of such drains. Over time, HDs can become clogged by silt, minerals, and biological matter or sheared off due to ground movement. This would result in reduced flows and unfavorable increases in the groundwater level and, therefore, would increase the risk of renewed slide activity. The following guidance should be used for the inspection and cleaning of horizontal drains. Documenting the maintenance operation and results achieved at the time of cleaning will provide accurate and usable records for engineering evaluation and long-term asset management.

4-9.1 *Horizontal Drain Outlet*

The HD should protrude from the finished slope. The discharge end of the HD pipe is open to allow water to flow out. However, in the event a collection piping system or manifold is installed, a cap is attached to the end of the HD pipe to access the pipe for cleanout. The collection pipes should be attached in a manner that does not conflict with future maintenance operations. Ideally, the HD should be photographed and its location, length of each pipe, and other details of the HD should be documented in an as-built as part of the construction documentation. This information should be provided by the Construction Office to the Area Maintenance Office who will be maintaining the HDs. The Chief Engineering Geologist in the Geotechnical Office may be helpful in acquiring an as-built for the HD. If a detailed as-built is not completed during construction, the location of the HD outlet should be documented with GPS coordinates when it is initially maintained. A sketch map may be helpful for ongoing inspection and maintenance activities. Access and maintenance needs should be communicated to HD designers in the Geotechnical Office and/or in the Region Design Office during the design process so these issues can be given full consideration during project development.

4-9.2 *Location Marking*

Since the HD outlets can become obscured over time with vegetation or other hillside debris, their location should be marked in the field so they can be easily found for routine inspection and maintenance. A short, green stripe should be painted perpendicular to the travel lane at the edge of pavement to mark the location of the HD outlet. If the painted mark becomes worn over time, it should be re-painted as part of the routine HD inspection. A short piece of surveyor's tape or ribbon can also be tied around the HD outlet to make it more visible on the hillside. A carsonite marker may also be placed at the HD outlet for this purpose.

4-9.3 *Inspection and Cleaning*

Inspection should preferably be done by a person familiar with the design, installation, or maintenance of HDs. Flows from each HD should be measured prior to cleaning. This can be done by timing the volume discharged into a five gallon bucket and reported as gallons per minute (gpm). A numbering system or some type of identification scheme for the drains should be established and recorded in HATS so inspection and cleaning operation can be documented against each specific drain. The cleaning procedure should be done only after initial flows are measured and recorded for all HDs. Adjacent drain flows can be affected during the flushing operation. Inspections and cleaning of HDs should be documented in HATS. The feature activity type in HATS that should be selected for this is "Horizontal Drains". During the inspection, any field marking that has worn away or is missing should be noted for refreshing or replacement. Items such as any blockage or damage to the HD outlet, if the HD outlet is becoming obscured from view should be documented. The amount of water draining from the HD should also be identified in the HATS record. Once the cleaning is complete and a sufficient amount of time has lapsed to ensure that all cleaning or surging waters have drained from the HD, flows should be measured again and recorded. Some removal of vegetation may be required to allow for completion of an HD inspection.

4-9.4 *Cleaning Equipment*

Vactor trucks or trailer-mounted vactor units are commonly used to provide an adequate water supply and pressure for HD cleaning. Vactor units may need to be modified for HD cleaning. These units usually come with hoses on a hydraulically-controlled feed spool system. This hose may need to be replaced with smaller diameter hose to clean the smaller diameter HD pipe that is typically 37-mm (1.5-in) diameter. The hose will need to be several hundred feet in length and be equipped with proper swivel connections to allow for maximum rotation. Pressure washer pumps can also be configured and used for HD cleaning if vactor units are not available.

4-9.5 *Nozzle and Hose*

Nozzles have been developed for pipeline cleaning which are self-feeding. Nozzles are designed with four main components: (1) size of hose attachment, (2) gallons per minute (gpm) delivered, (3) maximum pressure rating (psi), and (4) physical design (shape) of the nozzle. Hoses are limited to certain gpm and psi ratings. A high strength, very lightweight, thermal plastic hose is usually used.

A hose for cleaning long horizontal drain pipes should allow for at least 12 gpm of flow. Head loss is greater in a smaller diameter hose, therefore making it much less effective at advancing into the pipe at greater depths. The hose should be rated for at least 5,000 psi working pressure. Nozzle designs vary greatly. Markings may be made on the hose at 25-foot intervals to assist in the HD cleaning procedure described below. Such markings would have to be refreshed periodically as they become worn from repeated HD cleanings. Having two or three nozzle types to adapt to actual field conditions is recommended. At least two nozzles should be available for use that have one central front jet and six rear radial jets which are angled back at about 15 degrees. The radial jets help

to feed the hose into the drain pipe, as well as provide flushing of the drain slots in the horizontal drain pipe. The nozzle outside diameter should not be more than 27 mm (1.1 in). The design of the nozzle should be matched to the hose to gain maximum pull by the self-advancing nozzle. The selection of nozzles should be done by a nozzle supplier who can match the pump and delivery system with the hose selected for optimal design. The length of the nozzle is not critical, but a compact overall design is recommended.

4-9.6 *Cleaning Sequence*

Pressure should be limited to 2,000 psi at the nozzle. The flow should be maximized to speed up the cleaning process. A minimum of 12 gpm should be used. Cal-Trans prepared a report "Effectiveness of Horizontal Drains" (Report No. FHWA/CA/TL-80/16) which states that "best performance can be expected when pressures are maintained between 1,600 and 2,000 psi and when the water volume is 30 gpm or more." The general sequence for cleaning drains is very simple unless obstructions are encountered. After any protective caps have been removed, advance the nozzle with enough pressure to maintain a slow, steady feed rate. Drains should be cleaned in a slow, steady manner so that permanent damage to the drains may be avoided. The hose should never be advanced at a very fast speed directly to the end of the drain. The nozzle and hose should be inserted about 8 m (25 ft) and then removed at a slow, steady rate of about 0.3 to 1.0 m/sec (1 to 3 ft/sec). After the first 8 m (25 ft) and slow removal, the nozzle should be advanced to 15 m (50 ft) and then removed at the recommended rate. This process should be continued by adding about 8 m (25 ft) each time and noting the amount of debris and sediment each time. Once the full depth of the drain has been reached, the pressure should be turned up to 1,800 to 2,000 psi and the hose slowly removed at a rate of 0.3 to 0.7 m/sec (1 to 2 ft/sec). This higher pressure cleaning is the major cleaning of the drain. If obstructions are encountered, the depth of the obstruction should be measured and recorded.

The rear jets that advance the hose act as cleaning jets when removed in a slow, steady manner.

During the entire operation of cleaning, the nozzle should not be allowed to sit at one location at high pressure as this may damage the drain pipe and scour material from outside the drain pipe. At no time should air pressure be used in the drain pipe. Also, the drain outlet must always be open during flushing to prevent the buildup of pipe pressure which could ultimately damage the HD. If a significant amount of material is removed, it is recommended to repeat this higher pressure cleaning. It is not necessary to do this more than twice. It is important that the operator knows the drain depth and makes sure to stop the nozzle 4 to 7 m (15 to 25 ft) short of the end of the drain, so that the end cap of the drain pipe may not be damaged. If the use of such high pressures results in HD damage, test with lower pressures (possibly 600 psi) to determine the highest allowable pressure which consistently does not cause damage.

4-9.7 Surging

Surging is the process of flooding or filling the HD with water, then letting it drain out in an effort to stimulate water flow in the HD. During the cleaning process, the pressurized water being sprayed through nozzles inside the drain can push through slots in the HD and compress soil particles in an outward direction from the HD. If this appears to have decreased the flow of water from the HD, a surging procedure can be used to help re-establish flow in the horizontal drains. Surging operations are performed after the jet-cleaning operation. The pump should provide about 50-gpm and 1,500 psi pressure during the surging operation. The hose diameter could be 20 to 25 mm (0.75 to 1 in). The operation is performed in several 60 second cycles. Any protective caps should be replaced after all cleaning and surging operations are completed.

4-10 Storm Sewers and Catch Basins

In many areas underground pipe systems are necessary to carry storm runoff normally handled by ditches. Storm sewers are often used in long, depressed highways or along curbed sections on city streets. Water carried by the system is generally collected through inlets, catch basins, or manholes and carried by pipe to an out fall on a natural waterway.

Clogged pipes can often be cleaned with high-pressure water jets. But, if tree roots or broken pipes are causing the clogging, more service will be required. Flexible rotary cutters will remove roots intruding into a pipe.

Broken pipes may be repaired by jacking an insert liner into the failed location. Otherwise, the failed pipe may have to be excavated and relayed to repair it. Whatever method of cleaning is selected, consideration for erosion and sediment control is needed. In no case can debris or sediment be allowed to enter a water body.

Manholes are generally used where there is a change in profile or alignment and also at strategic points in long, straight sections in order to provide access for cleaning the pipe.

Inspect and clean inlets, catch basins, and manholes using a vacuum truck or manual cleaning methods. Frequency of inspections shall follow the regional area's requirements, with exception of NPDES and TMDL coverage areas. Conduct inspections during storms to ensure that the inlet grates are not becoming clogged with water-born debris. Schedule sweeping operations to help prevent the accumulation of leaves, paper, or other clogging debris.

Within NPDES permit coverage areas, catch basins must be inspected annually and maintained to the applicable standards found in the [Highway Runoff Manual M 31-16](#). Inspection frequencies may be revised in accordance with NPDES permit provisions. Inspection and maintenance work completed on catch basins within NPDES permit coverage areas must be documented in HATS to meet annual reporting requirements.

When pavement is overlaid by contract or maintenance work crews be sure that the manhole covers are flush with the finished pavement elevations.

4-11 Bank Protection

Maintenance personnel must be continually alert to conditions that may cause scour, undermining, or washout of highway embankments or structures by storms, floods, or wave action.

Highways adjacent to water courses, drainage ways, and embankments throughout the state are protected in a variety of ways against damage due to high water. These include barbs, stone rip-rap, grouted rip-rap, pile revetments, retaining walls and cribs, rock and wire mesh (gabions), and vegetation.

These features must be inspected during storms or periods of high water, as well as at least once each spring or after major high water periods, and repairs made where required. Make repairs with materials similar to those in place. If possible, take corrective measures to eliminate the direct cause of the damage.

Hydraulic Project Approval permits (Washington State Department of Fish and Wildlife) and other regulatory permits may apply to this type of work. Permits are commonly conditioned to protect fish life and habitat.

When the need for significant additional bank protection around structures or embankments is indicated, the area superintendent is to be notified immediately and a determination made as to whether or not the protection materials will be placed by maintenance or construction forces. New bank protection projects should be reviewed by hydraulic engineers to ensure that proper design and risk/safety factors are addressed.

4-12 Detention Ponds, Tanks, and other Storm water Treatment Facilities

Designers are increasingly specifying the use of detention ponds and tanks that store water runoff and release it slowly through a controlled outfall or outlet. In this way the size of downstream pipes and culverts can be reduced, erosion is mitigated, and solids that settle out can be removed. Other storm water treatment facilities, commonly referred to as Best Management Practices, or BMPs, are also increasingly being used to comply with storm water management requirements.

To function correctly the controlled outfall or outlet pipe must be free of debris. Accumulated settled materials must be removed on a schedule based on experience at each site. If oil separators are combined with these facilities, timely removal and proper disposal of oils is essential.

Within NPDES permit coverage areas, detention ponds, tanks, and other types of BMPs must be inspected annually and maintained to the applicable standards found in the [Highway Runoff Manual](#) M 31-16. Inspection frequencies may be revised in accordance with NPDES permit provisions. Inspection and maintenance work completed on detention ponds, tanks, and other BMPs within NPDES permit coverage areas must be documented in the Highway Activity Tracking System (HATS) to meet annual reporting requirements.

If inspection or cleaning necessitates working inside an underground detention tank, confined space procedures must be followed.

5-1 General

The proper care of structures is vital to the preservation of the highway network and to the safety of the traveling public. This chapter discusses those items in which area maintenance personnel assist in this maintenance effort. Other more comprehensive references are available to the Maintenance Engineer.

For general responsibilities refer to the *Transportation Structures Preservation Manual* M 23-11. For specific responsibilities for movable bridges, refer to the specific *Operation, Inspection, and Maintenance Manual* (OIM).

5-2 Major Structures

For maintenance purposes, major structures are identified as those bridges included in the [Bridge List](#) M 23-09. The State Bridge and Structures Engineer is the responsible authority for these structures and must be contacted prior to any major maintenance or modifications to them. The designated contact in Olympia is the Bridge Preservation Engineer.

Bridges and other transportation structures closed due to structural damage, require approval from the Bridge Preservation Engineer before opening.

5-3 Minor Structures

For maintenance purposes, minor structures are identified as those drainage structures (culverts, etc.), retaining walls, acoustical barriers, cribbing, etc., that are not listed in the Bridge List. The Region Maintenance Engineer is the responsible authority for minor structures.

Any defects or damage to minor structures should be referred to the Area Maintenance Superintendent, who will coordinate the required action.

The structural components of sign bridges, bridge-mounted sign brackets, and high-mast luminaries are inspected and inventoried by the bridge preservation office. Major maintenance or modifications to these structures is to be coordinated through the Bridge Preservation Office. The designated contact in Olympia is the Bridge Preservation Engineer.

5-4 Inspection

Federal regulations require that all major highway structures be inspected by a crew under the supervision of a professional engineer, at intervals not exceeding two years. This requirement is met by the WSDOT Headquarters' Bridge Preservation Engineer and staff. Certain bridges, such as steel bridges, untreated timber bridges, bridges having a posted load limit, movable bridges, floating structures and bridges with pending repairs are inspected annually.

A bridge's condition can change in much less than two years. The Bridge Preservation Office relies on Region maintenance personnel to be alert for settlement, washout, collision damage, and other problems, and to notify their superintendent as appropriate.

Area maintenance crews are also expected to maintain or repair minor approach settlements, approach guardrail damage, plugged bridge drains, sweeping of bridge decks, asphalt overlays and other items that are considered part of normal maintenance operations.

Additionally, removal of dirt and debris accumulation on timber caps, timber stringers, steel expansion devices (bearings), lower chords of steel bridges and sign bridge bases are considered routine maintenance activity. However, at times these can become critical to a structure and will be added to the repair list.

Modifications to bridges need to be detailed in drawings and submitted to the Bridge Preservation Engineer for as-built documentation and future reference. All bridge structural as-built information is maintained at the Bridge Preservation Office.

All minor structures, related to bridges, should be inspected at least annually by the designated region maintenance supervisors or crews. Inspect more often if warranted by weather conditions or past experience.

The Bridge Preservation Office distributes a list of scour critical bridges to each region Bridge Maintenance office. These bridges are to be closely monitored during high water events. Scour critical bridges require close monitoring due to a high susceptibility to foundation damage caused by high water events. Area Maintenance Superintendents are responsible for monitoring weather conditions in anticipating high water events for scour critical bridges in planning for advance deployment of crews to monitor each bridge's condition. Scour is the number one cause of bridge failures in Washington.

Region bridge maintenance personnel are responsible to inspect all bridges and designated minor structures annually. Record all deficiencies. Keep the records on file until the deficiencies are corrected.

Review bridge inspection report notes, repairs, and photos to identify items to focus on during inspections.

During inspection, the following items should be checked. Deficiencies should be immediately repaired or scheduled for future work.

- **Approach Fills** – Note any deficiency. Pay particular attention to the pavement seats of the structure. Look for sagging, pot holing, scaling, or spalling.
- **Asphalt Wearing Surface** – Note potholes, scaling, wheel rutting, and general pavement condition.
- **Concrete Deck** – Note scaling, spalling, cracks, and any exposed reinforcing steel.
- **Grid Decks** – Look for and note broken welds or clips, loss of a section due to rust and any bent members.
- **Curbs and Railings** – Note any deterioration, cracking, spalling, or damage.
- **Paint** – Note the general condition of the paint. Look for cracking, peeling, fading, and presence of rust or algae.
- **Stringers, Caps, and Floor Beams** – Note any crushing at bearing points, and any warping, cracking or debris buildup.
- **Steel Truss Members** – Note bent or damaged steel, deflection, cracking, vibration, debris buildup on chord members, and deterioration due to rust. Pay particular attention to pinned joints at hinges, excessive rust, vibration, missing nuts, or loose plates. Immediately inform the designated bridge maintenance representative of any known or suspected problems.
- **Wood Truss Members** – Look for and note damaged or broken members, crushing, cracking, warping, vibration, and deterioration due to rot or boring insects.
- **Expansion Joints** – Note loose, banging, and jammed expansion joints. Also, note the presence and condition of the joint material.
- **Abutments, Bulkheads, Piers, and Intermediate Bents** – Note any type of tilting, bulging, and deterioration. Pay particular attention to the buildup of drift debris and any scouring or undermining due to high water and erosion.
- **Bridge Drains** – Note plugged bridge drains. Check pipe outfall areas to see if soil erosion is occurring. Plugged drains may result in saturation of the bridge approach fills and may explain any unusual erosion or undermining of abutments or bulkheads.
- **Waterways** – Note scour and conditions that could cause log jams or ice jams during high water stages. Look for any logs or other debris jammed against piers, bulkheads, or piling. In the winter check all bridges with piers or bulkheads in the water with a floating debris problem during and after each flooding condition.
- **General Conditions** – Look for accumulation of dirt, excessive bird droppings or debris on the roadway at bearing points and on the caps or lower chords. Pay particular attention to the presence of materials that might pose a fire hazard or restrict access for maintenance activities. Note any unauthorized attachments such as private fences. Have electrical fences removed from bridge access areas or clearly mark them with warning signs.

- **Walls and Cribbing** – Inspection can be of a cursory nature according to guidelines designated by the Area Maintenance Superintendent. Check walls for tipping, bulging, cracking, spalling, and water runoff over or through wall. Check all weep holes to assure that they are open. If the structure is wooden, check for rot and the presence of fire hazards.
- **Tunnels** – Condition of walls, ceiling, or liner. Look for cracking, spalling or loose overhead hazards. Note increased water seepage, and the condition of wire retention fabrics. Check for tears or failures that may indicate potential structural hazards and impact on portals or overhead members.

5-5 Bridge Repair Guidelines

Any major or structural repairs need to be coordinated through and approved by the WSDOT Headquarters Bridge Preservation Engineer. If there is any doubt about the structural significance of a damaged or deteriorated bridge component, notify the WSDOT Headquarters Bridge Preservation Engineer. Generally, bridge repairs are identified on the bridge repair list.

There are six priority definitions in the repair lists. “Emergency” or “Urgent” priorities are intended to recognize the various levels of work accomplished by Bridge Maintenance. As maintained previously, these six repair priorities represent a priority level hierarchy; therefore, repairs that are not completed in a timely manner may be moved to a higher priority. Only four priorities will be published on the repair list since “Emergency” and “Urgent” repair lifecycles will be anticipated to be much shorter than the repair list publication cycle. They will be tracked in the Bridge Preservation Office repair database.

The use of “Emergency” and “Urgent” priorities will be authorized by the Bridge Preservation Engineer. These types of repairs will be reported directly to each region.

The priority definitions are as follows:

- **Emergency** – Repair work requiring immediate action when structures are partially or completely closed.
- **Urgent** – Repair work requiring prompt action that must be completed when structural details and bridge crews become available.
- **Priority 1** – Repair work required when damage to primary structural elements directly affects safety, reliability of transportation system, protecting public investment, and maintaining legal mandates. Secondary and minor items will qualify for this priority if they pose a hazard to traffic.
- **Priority 2** – Work should be accomplished within regular work schedule or programmed in the biennial work schedule.
- **Priority 3** – Generally a minor nonstructural or ‘housekeeping’ type of repair, which may evolve into a higher priority if not corrected.
- **Priority 4** – A condition that requires the structure to be monitored primarily by the bridge inspection teams, and may evolve into a higher priority.

The WSDOT Headquarters Movable Bridge Engineer prepares and updates individual maintenance manuals for all movable bridges. Consult these manuals for both routine and specialized maintenance tasks. Direct any questions to the Movable Bridge Engineer in the Bridge and Structures Office in Olympia.

Minor repairs to railings, curbs, concrete decks, expansion joints, etc., can be performed without the individual approval of the WSDOT Headquarters Bridge and Structures Office. Similarly, drift may be removed, clearance lights changed, etc.

5-6 Bridge Information

Bridge information is available to all DOT staff through the Bridge Engineering Information System (BEIST). Go to the [Bridge and Structures](#) website for a link to BEIST.

BEIST contains inventory data, bridge plans, inspection reports, the repair list, and related files. Additionally, BEIST contains the Sign Bridge Repair List and Standard Plans.

5-7 Environmental Aspects

WSDOT environmental staff will provide Maintenance Engineers, Area Superintendents and Maintenance Supervisors with training and education on which regulations apply to specific maintenance activities and what is the appropriate response to the regulatory process.

In addition to federal regulations, state environmental agencies, tribes and city or county health ordinances may have environmental restrictions on work done on or near bridges.

Before initiating bridge repair activities, the Maintenance Engineer, Superintendent, or Supervisor will confirm if environmental permits are required. They will also review the proposed repair method with the environmental staff to determine whether it is both appropriate and/or environmentally sound. The following list provides some of the environmental concern factors that impact bridge maintenance in some localities. This list is not comprehensive or current because the list of environmental factors to be considered continues to change. However, it does provide some insight into the degree to which maintenance is being held to an increasing level of environmental accountability.

- State or federal list of threatened or endangered species.
- Species of high interest to state or federal agencies.
- Migratory waterfowl habitat.
- Anadromous fish habitat.
- Trout and other cold water fish habitat.
- Habitat for birds of prey (Must have Bridge and Structures approval to attach platform, boxes or any other structure to any part of a bridge).
- Wetlands and wetland habitat.
- Riparian habitat.
- Migratory corridors.
- Wintering areas and other critical feeding areas of wildlife.

- Important wildlife reproductive habitat.
- Public water supplies, including important aquifers.
- Islands and other coastal barriers.
- Hazardous waste.
- Regulatory flood ways and other flood plain areas.
- Commercial fish and shellfish production areas.
- Important sport fishing areas.
- Highly erosional soils.
- Listed or proposed wild and scenic rivers.
- Navigable waterways.
- Significant historic resources.
- Natural resource agency holdings or interests (refuges, parks, habitat areas, etc.).

The Bridge and Structures Office is concerned with the placement of temporary or permanent wildlife habitat structures (peregrine falcon platforms, bat boxes, etc.) on state bridges due to their potential negative impact to inspections of all bridges in accordance with the federally-mandated National Bridge Inspection Standards and the potential negative affects to maintain the bridge structure itself. The Bridge and Structures Office discourages the practice of placing these habitat structures on state bridges.

Therefore, all plans to place temporary or permanent wildlife habitat structures on state bridges are to be reviewed by the Bridge Preservation Engineer. This is consistent with the review process for all other attachments to bridges.

Maintenance agreements established with any regulatory agency that includes bridges must have approval from the Bridge and Structures Office. Agreements that define or limit access to a bridge due to the Endangered Species Act, affect inspections and repairs.

5-8 Utility Installations

Bridge Maintenance Superintendents need to work directly with region utility engineers to coordinate utility installations to ensure construction inspectors are aware of the utility installation and inspect the construction for proper installation per the franchise agreement and structural details approved by the Bridge and Structures Office. Scaffolding attached to or setting on any portion of the bridge is to be included in the review by the bridge office.

Construction inspectors are to ensure that the utility contractor is following DOT-prescribed construction practice in accordance with [Standard Specifications](#).

Chapter 6 *Roadside Management*

6-1 General

This chapter addresses roadside maintenance issues primarily as they relate to vegetation management and roadside land use assets. It also covers maintenance activities and work planning with relation to litter control, and touches on issues with regard to auxiliary features such as Safety Rest Areas, viewpoints, and historical markers. Roadside management as it pertains to Maintenance responsibility for drainage, stormwater management, shoulder pavement, and maintenance of barriers and structures are covered in other chapters. Project permitted Environmental Mitigation Sites are also considered an important component of the agency's Roadside Land Use assets, but until these sites are fully established (10 to 12 years after construction) they are monitored and maintained through the HQ/Regional Environmental Services Offices.

This chapter has been written to integrate with information relating to roadside management topics presented in all other departmental documents. In particular it is tied to the contents of the [Roadside Manual M 25-30](#), the [Roadside Policy Manual M 3110](#), the [Design Manual M 22-01](#) and the annually updated [Region/Area Integrated Roadside Vegetation Management Plans](#).

6-2 Definitions

Roadside – The roadside is the area of highway right of way outside the traveled roadway. This applies to all lands owned and maintained by the Washington State Department of Transportation (WSDOT) and may extend to elements outside the right of way boundaries. It includes unpaved median strips and auxiliary facilities such as rest areas, roadside parks, viewpoints, heritage markers, pedestrian and bicycle facilities, wetlands and their associated buffer areas, stormwater treatment facilities, park and ride lots, and quarries and pit sites within the right of way.

Roadside Management – encompasses the planning, design, construction, and maintenance of the non-paved highway right of way. The bulk of this work involves soils and vegetation systems, but also includes visual issues like litter control and graffiti removal. Management of specific detailed functions within the area of roadside right of way, such as Drainage, Stormwater Filtration, and Roadside Hardware are covered in other sections.

Roadside management goals include:

- Provide for all highway operational objectives
- Restore, protect, and preserve native ecosystems
- Mitigate highway impacts on the environment
- Create and/or maintain desirable visual quality

These goals can be achieved with the lowest life cycle costs by:

- Design and construct roadside plantings that are well established by the time they are turned over to Maintenance responsibility.
- Applying consistent, long-term IVM strategies throughout the management process.
- Using a GIS-based data management system to plan activities, track accomplishments, and monitor the results of IVM treatments.

Roadside Land Use – The major types of landscapes managed by WSDOT, each with a unique set of design and management objectives. WSDOT distinguishes between five types of land use:

- **Operational Right of Way** – The first 15 to 30 foot band of land adjacent to the roadway pavement edges throughout the state. This area is managed in response safe highway operation and drainage.
- **Non-Operational Right of Way** – The land that WSDOT owns and maintains beyond the operational right of way, primarily along major freeway corridors and interchanges. This area is managed as a buffer between the highway and surrounding natural and built environment.
- **Formal Landscape** – Areas of roadside along freeways and interchanges through major cities throughout the state that have been designed to be maintained in a set condition and require routine annual mowing/trimming, weed control, and irrigation in many cases.
- **Resource Conservation Areas** – Naturalized areas of mature native plant communities purchased with Federal dollars, during initial development of the Interstate Highway System for preservation in perpetuity. WSDOT is responsible for ensuring that land remains as undisturbed as possible.
- **Environmental Mitigation Sites** – Sites designed and constructed based on environmental permit conditions. These sites are maintained by the Environmental Services Division until they are fully established (up to 12 years). Once sites have been adequately established to satisfy permit conditions, responsibility shifts to the Maintenance Division and areas area added to the area of non-operational right of way.

Integrated Vegetation Management (IVM) – Integrated Vegetation Management (IVM) is defined as a coordinated decision making process that uses the most appropriate vegetation management strategy on a site-specific basis. It utilizes a monitoring and evaluation system to ensure achievement of roadside maintenance program goals and objectives. IVM practices are environmentally responsible and economically sound. WSDOT uses IVM to design and construct roadsides which will grow and evolve with the natural ecosystem. The type of site specific vegetation chosen is designed to require the least possible attention from maintenance over the long term.

Integrated Roadside Vegetation Management (IRVM) Plans – Integrated Roadside Vegetation Management Plans are updated and published annually for all regions and areas of the state. These plans explain the priorities, procedures, and locations for planned IVM treatment for throughout the state.

Environmental Mitigation Sites – These sites are the result of project permits for environmental mitigation, and fish passage restoration. Because these sites are monitored for permit compliance until fully established, management is funded and carried out through the Environmental Services division. Once fully established and permits are signed off, these sites become the responsibility of the Maintenance Division.

Illegal Camping – The term used to describe the unpermitted use of roadside areas and bridge abutments for temporary housing of transient population.

Pesticides – Federal and State labeled chemical compounds used to control unwanted living organisms. The only pesticides used by WSDOT are herbicides, which are specifically designed to target plant material.

Herbicides – Federal and State labeled chemical compounds used to control and/or eliminate unwanted plant material. Herbicides are approved for use on state highway in Washington based on specific scientific analysis of risk from roadside applications throughout the state. Products are restricted from use in any situations where there is a health risk to the public or the environment.

Best Management Practices (BMPs) – They are physical, structural, and/or managerial practices that, when used singly or in combination, reduce the downstream quality and quantity impacts of stormwater.¹ These assets have vegetation management requirements in many cases. Typical BMPs include biofiltration swales, wet ponds vegetated filter strips, and wet vault/tanks. BMP details can be found in the [Highway Runoff Manual](#) Chapter 8.

6-3 Reference

[Roadside Manual](#) M 25-30

[Roadside Policy Manual](#) M 3110

[Region/Area Integrated Roadside Vegetation Management Plans](#) (updated annually)

[WSDOT Maintenance Manual for Water Quality and Habitat Protection Guidance](#), WSDOT, IL 4020.00, July 1, 1999

[Highway Runoff Manual](#) Chapter 8

[Design Manual](#) M 22-01

[Maintenance Accountability Process Handbook](#)

¹ [Highway Runoff Manual](#) M 31-16. WSDOT

6-4 Resources

- Headquarters Maintenance Office
- Regional and Area Maintenance Offices/Crews
- Region Landscape Architects
- Headquarters Roadside and Site Development Office
- Statewide and Regional Mitigation/Restoration Crews
- Washington State Parks Arborist Crews
- Department of Ecology Youth Corps Crews
- Department of Corrections Work Release Crews
- Volunteer and Sponsored Adopt-a-Highway Participants

6-5 Sustainable Roadside Design and Management

The roadside is designed and managed to support the highway's purpose in four functional categories: **operational, environmental, visual, and auxiliary**. By fulfilling highway needs in these four categories, the roadside contributes to WSDOT's delivery of transportation services. Exhibit 6-1 explains the functions and gives examples.

The [Roadside Policy Manual M 3110](#) provides the basis for solutions to site specific questions on how to develop and manage the roadside. This document provides guidance for resolving the roadside functional needs with variations in site conditions, vegetative patterns, and geographic surroundings. The [Region/Area Integrated Roadside Vegetation Management Plans](#) contain the details of how the majority of the agency's roadside vegetation is maintained, mile-by-mile along all highways in the state, to achieve ongoing compliance with all safety and operation, social, visual, and environmental objectives.

The process for coordination and consultation between Design and Maintenance during the design and construction process varies from region to region, but agency policy dictates (Section 1.1 of the [Roadside Policy Manual](#)) that design coordinate with local maintenance managers on roadside planting design. Once roadsides have been redesigned and constructed following highway improvement projects, the plans for ongoing management are added to the locally adapted Region/Area IRVM plans.

In general terms roadside plantings are designed to function in zones extending outward from the edge of the pavement. Roadside planting design is dictated by highway transportation management objectives in relation to safety and legally required weed control. Roadsides are designed, planted and maintained in bands of land area extending from the edge of pavement. There are also locations throughout the highway system where roadsides are designed and maintained to support local conditions such as Resource Conservation Areas, and Formal Landscapes around urban freeways and interchanges.

Roadside functions and design objectives are further explained Exhibit 6-1.

Exhibit 6-1

Function	Definition
Operational	<p>Those functions that provide safe and multi-use roadsides. Operational functions include:</p> <ul style="list-style-type: none"> • Right of Way Access control • Provide for a free-draining pavement edge • Maintaining a low-growing vegetative ground cover where operational function dictates • Maintain sight distances for intersections, corners, and sign visibility • Controlling trees in vehicle recovery areas • Removing mature hazardous trees • Providing for snow removal storage and snow drift control where needed <p>The Design Manual M 22-01 provides the primary guidance for operational roadside vegetation design guidance. The Area/Region IRVM Plans contain an inventory of all planned work required to provide for operational and safety functions.</p>
Environmental	<p>Those functions that protect, buffer, and/or enhance our natural and built surroundings. Environmental functions mitigate the roadway's impact on its surrounding ecosystem. Major environmental functions include:</p> <ul style="list-style-type: none"> • Water quality (preservation, protection, and improvement) • Storm water detention and retention • Wetland and sensitive area protection • Noxious weed control • Pollinator forage and habitat • Noise control • Habitat protection and connectivity • Air quality improvement and Carbon Sequestration • Erosion control <p>Many roadside environmental functions are regulated by federal, state, and local regulations and as a result, all permit related vegetation management and/or litter control is managed and conducted by the Environmental Services Offices in Headquarters and the Regions.</p>
Visual	<p>Those functions that are designed and experienced primarily from a visual perspective. Visual functions promote a positive quality of life and are integral to operational, environmental, and auxiliary functions. They include:</p> <ul style="list-style-type: none"> • Enhancing roadway delineation, guidance, and navigation • Litter control and cleanliness • Partnering with local communities for enhancement of interchanges and state highway corridors through cities • Screening undesirable views/distractions and maintaining scenic views at viewpoints • Creating visual corridor continuity <p>In addition many activities such as noxious weed control, litter control and illegal camping, wetland and sensitive area preservation, and habitat preservation/connectivity are readily perceived and evaluated through sight.</p>
Auxiliary	<p>Those functions that provide additional operational, environmental, and visual functions to support or supplement the transportation system in local situations. Examples of auxiliary facilities are:</p> <ul style="list-style-type: none"> • Safety rest areas • Stockpile sites • Community enhancement areas • Roadside parks/viewpoints/heritage markers • Bicycle and pedestrian facilities • Park and ride lots

6-6 Roadside Management Zones

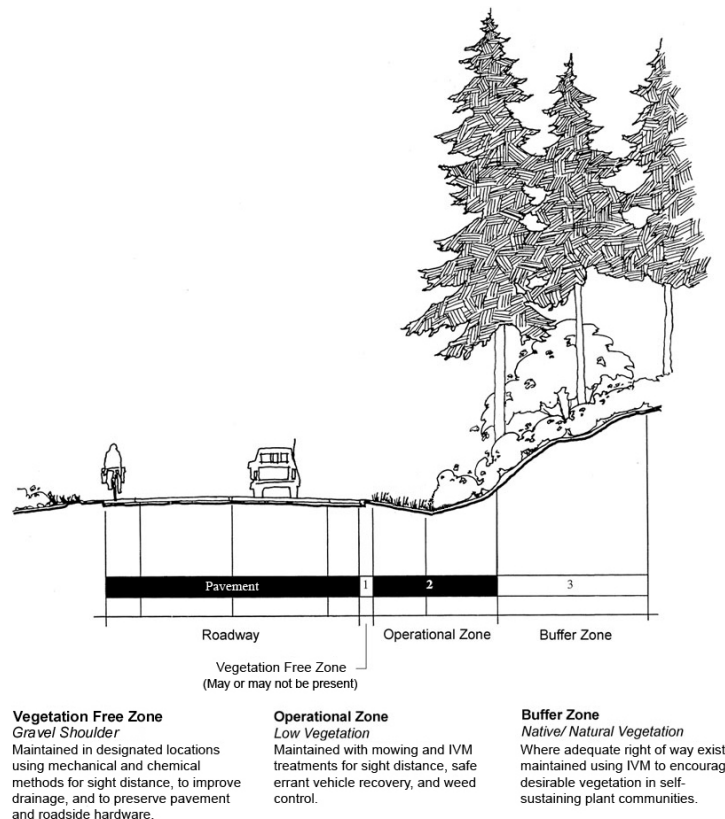
To address the highway's functional needs (as describe above), the roadside is designed and maintained in three major bands of area referred to as Zone 1 – Vegetation Free, Zone 2 – Operational, and Zone 3 – Transition/Buffer. Roadside maintenance priorities within these zones are established beginning with activities relating to the safe traffic operations, maintenance and preservation of the built highway infrastructure, legally required noxious weed control, and environmental mitigation, restoration, protection, and preservation wherever possible.

[Exhibit 6-2](#) shows a cross-section of a typical divided highway, illustrating typical relationships of the Roadside Management Zones within the highway right of way and giving examples of the functional objectives as they apply to the three zones.

6-6.1 Operational Zones

The Operational Zones include a vegetation-free gravel shoulder in most cases, adjacent to band of routinely trimmed low-growing vegetation. These areas require routine roadside maintenance activities occur in **Zones 1 and 2**. These areas are designed and maintained to facilitate operational roadway functions, such as surface and subsurface drainage, traffic operations visibility and site distance. Zones 1 and 2 also allow unobstructed vehicle recovery where traffic may accidentally leave the roadway (referred to as the **Design Clear Zone**). The [Design Manual M 22-01](#) provides guidance on the required extent of the roadside “clear zone” (Zone 2) for varying highway configurations. In some cases the actual requirements for the clear zone may extend beyond the right of way lines.

Exhibit 6-2 Roadside Management Zones and Objectives



6-6.2 Non-Operational Zones

Along freeway corridors and areas with wide rights of way where there is area available outside the Operational Zones the roadside can function as a buffer to surrounding land use, and provide an opportunity to create pollinator forage and other ecosystem benefits. Zone 3 is managed to address some safety functions such as prevention and removal of hazard trees and trees shading the roadway. There are other operational functions which may be addressed within the area of **Zone 3**, such as drainage, noise and visual attenuation, and stormwater management needs. However, Zone 3 is primarily developed and maintained to address the visual, auxiliary, and non-regulated environmental functional needs of the highway. Zone 3 offers the greatest opportunity to create and maintain self-sustaining, low maintenance plant communities.

Non-operational roadside areas also include:

- **Formal Landscape** – Areas that have been planted with ornamental landscapes in urban settings are measured, planned, and tracked as a separate set of activities. Plantings in formal landscapes are maintained in a set condition and in many cases include permanent irrigation systems. These roadsides are designed and routinely maintained in accordance with all legal and highway operational requirements. Some formal landscape areas are maintained by local government's forces using WSDOT funds.
- **Resource Conservation Areas** – Areas of significant ecosystem preservation value were purchased throughout the state during the expansion of the Interstate Highway System in the 60s and 70s. These areas were purchased with Federal Interstate Completion dollars, with the understanding that they would be preserved in perpetuity. The areas typically consist of mature vegetation that provide screening from junkyards and other developed areas.

Where either of these conditions exist, the roadside area is considered part of Zone 3 and maintenance actions are defined in [Region/Area Integrated Roadside Vegetation Management Plans](#).

6-6.3 Functional Zone Objectives

The Area/Region IRVM Plans contain an inventory of all the planned treatments necessary to achieve the necessary functional objectives for highway operation and maintenance. Treatments are designed to accomplish objectives listed in Exhibit 6-3 in Operational and Non-operational zones throughout the state.

Exhibit 6-3 Functional Zone Objectives

Zone 1 – Vegetation Free	Zone 2 – Operational	Zone 3 – Transition/Buffer
<p>(2 to 5 feet from pavement, maintained where necessary along the majority of road shoulders)</p> <ul style="list-style-type: none"> • Provide for surface drainage • Reduce fire potential • Provide for visibility and maintenance of roadside hardware • Prevent pavement breakup by invasive plants • Provide sight distance for passing, stopping, and at intersections • Prevent the buildup of wind blown debris and winter sand at the pavement edge 	<p>(From Zone 1 or pavement edge to meet operational and maintenance needs)</p> <ul style="list-style-type: none"> • Maintain design width for vehicle recovery • Provide sight distance for passing, stopping, at interchanges and at intersections • Maintain hydraulic capacity of ditches • Eliminate vegetative obstructions (trees with a trunk diameter of 4" or more) • Control weeds • Prevent erosion • Provide wildlife habitat where compatible with roadway traffic • Accommodate underground utilities • Enhance visual quality 	<p>(From Zone 2 to Right of Way line)</p> <ul style="list-style-type: none"> • Promote self-sustaining plant communities that support all ecosystem services mentioned in Exhibit 6-1. • Blend and/or screen adjacent surroundings to meet the goals and objectives of the Roadside Policy Manual M 3110 • Eliminate hazard trees and branches causing excessive shade (ice and frost potential) on the highway pavement • Control noxious weeds • Prevent erosion • Promote pollinator forage • Maintain and enhance visual quality • Preserve wetlands and wildlife habitat • Accommodate utilities • Preserve and conserve native plants and wildflowers

6-7 The Practice of Integrated Vegetation Management

Integrated Vegetation Management (IVM) is a coordinated decision-making process that determines and implements the most appropriate vegetation management methods and strategy, along with a monitoring and evaluation system, to achieve roadside maintenance goals and objectives in the most environmentally and economically sound manner.

The IVM process relies on Highway Activity Tracking System (HATS) and the IRVM Plans, in combination with annual crew training to deliver the most practical and long-term sustainable solutions to roadside vegetation management challenges throughout the state.

The majority of roadside management work is focused on the control of undesirable vegetation – That is, controlling vegetative growth that is in conflict with the objectives listed in Exhibit 6-3. This goes hand in hand with providing care for desirable vegetation – the practice of IVM is intended to encourage roadside plant communities that compliment and support surrounding native ecosystems. WSDOT's IVM program emulates the principles of Integrated Pest Management (IPM) and complies with state law as cited in [RCW 17.15](#), which requires that all state land management agencies to utilize IPM principles when controlling invasive species and other unwanted organisms.

6-7.1 *Components of Integrated Vegetation Management for Roadsides*

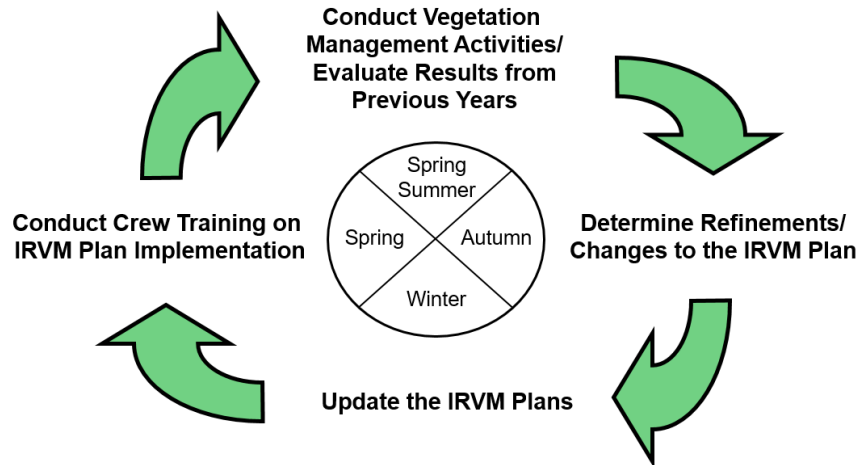
Managing vegetation in relation to designed and constructed roadside zones is a continually adaptive process, as roadside ecosystems never stop growing and evolving in response to maintenance inputs and controls. Planning for this work requires annual consideration of the previous year's accomplishments and the observed response of the plant material to maintenance treatments. In order to accomplish this throughout WSDOT's 100,000 acres of roadsides throughout the state, the agency has developed HATS which includes a geographically oriented inventory of the vegetation maintenance workload, and an accompanying record-keeping system. The annual planning and performance data collected by HATS provides the basis for WSDOT accountability in maintenance and stewardship of the states roadside land use assets.

Roadside vegetation management and the practice of IVM requires specialized knowledge, skills, and certification on the part of the maintenance crews engaged in the work. Crew members responsible for leading vegetation management projects are required to obtain a Pesticide Applicator's License from WSDA and accumulate continuing education credits in IVM practice to maintain the license. Crew training and engagement in IVM planning is a central component of WSDOT's IVM program.

The annual cycle illustrated in Exhibit 6-4 shows the process followed by all WSDOT crews, for all roadside vegetation maintenance on state highways.

This process is supported with planning documents, a geographic inventory of planned treatments, field-based mobile technology that allows geographic recording of all accomplished work, annual statewide crew training and area work planning sessions, and an IVM reference library that can be accessed as needed in the field using mobile devices.

Exhibit 6-4



6-7.2 Roadside Management and the Highway Activity Tracking System

Maintenance activities are mapped and recorded in HATS as shown in Exhibit 6-5.

Exhibit 6-5 Roadside Records and Features in HATS

Group 3 Activities	Work Op/HATS Records	Mapped Reference Features	Unit Reporting
3A1 – Litter	Litter Bag Pickup	N/A	Cubic Yards removed
	Encampment Cleanup	Points representing existing and previous encampments	Cubic Yards removed
3A2 – Noxious Weed Control	Noxious Weed Control – Spray	Points representing locally prioritized infestation sites	Acres treated
	Noxious Weed Control – Manual/ Mechanical		Acres treated
3A3 – Nuisance Vegetation Management	Nuisance Veg. Control – Spray	Polygons representing areas where Nuisance Veg. Management may be required	Acres treated
	Nuisance Veg. Control – Manual/ Mechanical		Acres treated
3A4 – Control of Vegetation Obstructions	Zone 1 Spray	Lines representing locations where routine herbicide treatments are planned	Acres treated
	Zone 2 Mow	Lines representing locations where routine mowing treatments are planned	Acres mowed
	Tree & Brush Control – Spray	N/A – Annually prioritized locations are described in IRVM Plans	Acres treated
	Tree & Brush Control – Mechanical	N/A – Annually prioritized locations are described in IRVM Plans	Acres trimmed
	Tree & Brush Control – Manual	N/A – Annually prioritized locations are described in IRVM Plans	Acres trimmed
	Hazard Tree Removal	N/A	Trees removed
3A5 – Landscape Maintenance	Landscape Maintenance	Polygons representing areas where formally landscaped areas are maintained	Acres maintained

6-8 Vegetation Management Methods and Procedures

Administration of the roadside vegetation management program involves a number of specialized agency processes and functions. It is essential to the function and integrity of the agency that these issues be addressed consistently throughout the state in accordance with the following topics and information.

6-8.1 Chemical Control Methods

Chemical control measures are an essential component of the IRVM program. The use of chemical controls is a highly regulated process and requires that WSDOT maintenance technicians obtain and maintain a Pesticide Application License from the Washington State Department of Agriculture.

When applied in accordance product labels, and used in combination with other vegetation management methods, herbicides are one of the safest, most effective and economical tools available to the roadside vegetation managers.

To further ensure the safety of applicators, the public and all environmental endpoints, WSDOT has invested in additional research into the assessment of environmental and human health risks from use of herbicides. Based on this research, the agency has developed guidelines for agency specific restrictions and application guidelines for [Herbicide Applications on State Right of Way](#).

The largest portion of WSDOT herbicide use is for control of vegetation at the edge of pavement (Zone 1). For other tasks considered in the IVM decision-making process, herbicides are used to achieve initial control of weed infestations, and/or prevent seed production. Once the infestation has been reduced or eliminated through herbicide applications, other methods can be employed for long-term vegetation management. Therefore, in a successful IVM program, overall herbicide use should decrease and applications become increasingly selective over time as beneficial competitors are allowed to become more established on the roadside.

Applicator Licensing and Legal Requirements

All pesticides applied on state highway right of way must be applied by WSDOT employees or contractors licensed through the Washington State Department of Agriculture (WSDA). Licenses are obtained by passing uniform tests administered by WSDA. In order to maintain a pesticide license, applicators must attend and receive credit for continuing education certified through WSDA. Forty recertification credits are required every four years and no more than 15 credits can be counted for any one year.

Maintenance technicians are personally liable for following all state and federal regulations and product label requirements. Legal requirements for pesticide application are defined in [RCW 17.15](#).

Premium Pay for Pesticide Applicators

Due to the technical requirements and personal legal liability inherent in the application of chemical controls, maintenance technicians receive additional pay when preparing for and carrying out the application of herbicides. The details of how this pay is administered and who receives it for which tasks is part of the negotiated agreement is documented in the biennially updated Collective Bargaining Agreement between the State and the Washington Federation of State Employees, Council 28 AFSCME.

6-8.2 *Herbicide Risk Assessment and Product Screening*

WSDOT has developed a detailed and agency-specific risk analysis of potential human health and environmental impacts from the use of herbicides to manage roadside vegetation. This research was used to create a conservative agency policy for application of herbicides and minimize potential risks. The table [Herbicides Approved for Use on WSDOT Rights of Way](#) includes a list of approved herbicide compounds alongside associated products available on the state contract. This table also include herbicide compound specific recommendations, restrictions and additional cautions applied by crews statewide.

Any and all new herbicide compounds with potential application for roadside vegetation management will be formally evaluated for environmental and human health impacts prior to addition to the statewide contract and use on highway right of ways. The State Roadside Asset Manager will be responsible for determining when new products should be evaluated and for administering the contract for toxicological analysis. Once compounds have been analyzed, the state manager is responsible for approving use and determining any necessary restrictions or application buffers.

Pesticide Record Keeping

[RCW 17.21](#) requires that all pesticide applications be documented with a WSDA approved record-form and retained for 7 years. All WSDOT pesticide applications made by agency employees are required to be recorded in HATS on the day the applications are made. HATS Pesticide Application Records are recorded on iPads throughout the day as applications are prepared and carried out. WSDA approved record forms are generated when iPads are synced with HATS Web. Records are stored in the HATS online database for seven calendar years as required by law.

Managing Product Material Inventory

All materials used for making herbicide applications must be accounted for on a daily basis when applications are being made. Daily use of chemical herbicides and additive products recorded in HATS Pesticide Application Records is also tracked through WSDOT's inventory management system. To transfer data between HATS and the agency-wide tracking system, area maintenance offices record amounts on an 8420 form and information is manually input by area office personnel into WSDOT's DataMart system.

Posting Requirements

For all other applications made on the right of way with power equipment, posting is required in the form of placards on the spray apparatus. Requirements for posting right of way applications can be found in [RCW 17.21.400](#). For application of pesticides in areas that are intended for public access, such as Safety Rest Areas and bicycle/pedestrian paths it is required that notification flags be placed throughout the site. [RCW 17.21.410](#) lists legal requirements for posting public access.

Aquatic Pesticide Applications

Pesticide applications made in or over open water or within delineated wetlands are subject to additional regulation and come under the jurisdiction of the Washington State Department of Ecology (WSDOE). Operators making such applications must have aquatic certification on their pesticide applicator's license and a special permit must be obtained through WSDOE. The permit includes limitations on the products available for use and provisions for public posting and notification. The Headquarters Maintenance Office is responsible for negotiating and maintaining statewide coverage for aquatic pesticide applications.

Pesticide Sensitive Individuals

State law requires that pesticide applicators, prior to making an application, will notify individuals who have been medically certified as "pesticide sensitive" and live within one-half mile of the highway application site. The WSDA maintains and annually updates a list of individuals who have received this certification and their addresses. The HQ Maintenance Office is responsible for supplying information on pesticide sensitive individuals to the maintenance areas where notification is required. [RCW 17.21.420](#) explains the process and requirements for establishing the list through WSDA. [RCW 17.21.430](#) explains the requirements for notification of individuals on the list.

Container Disposal

The Washington Administrative Code ([WAC](#) 16-228-185(2)) states in part: "No person shall transport, handle, store, load, apply, or dispose of any pesticide, pesticide container or apparatus in such a manner as to pollute water supplies or waterways, or cause damage or injury to land, including humans, desirable plants and animals, or wildlife:...."

To comply with the law, all pesticide containers shall be triple rinsed (three times) each time, using a volume of an appropriate solvent (water, diesel, oil, etc.) equal to approximately 10 percent of the container's capacity. Rinsing of containers shall be accomplished as soon as possible after emptying. The rinse solution shall be added to the spray tank and considered as part of the pesticide carrier. Proper triple rinsing removes the "hazardous" stigma from the containers. However, the rinsed container must still be disposed of in the proper manner, as listed on the pesticide label.

The need for rinsing and disposal of containers can be eliminated if products are available in refillable bulk containers. Utilizing bulk and “mini-bulk” containers and metered pumps to transfer products from the container to the spray equipment reduces the chance of human contact. Where this system is used in conjunction with injection type spray equipment, unused product may be returned to the bulk container at the end of the day.

Returnable, Reusable, Closed-System Containers

Whenever practical, herbicide products are ordered and delivered in sealed containers with pre-blended mixtures in water, and/or straight concentrate. Use of this type of delivery system is encouraged whenever possible because it decreases the risk of employee exposure to synthetic chemicals and eliminates a portion of the waste from use of traditional, non-recyclable containers.

Hazard Trees

Dead, leaning, or structurally unsound trees within the right of way can pose a threat to the traveling public. They can also damage the pavement, structures, or other parts of the highway. Remove all danger trees as soon as possible after they have been identified.

When practical, debris and wastes may be left on site within the boundaries of Zone 3. The Regional Maintenance Engineer will direct off-site disposal or reuse of the wood. Danger trees outside the highway right of way (or permit boundaries such as in National Forests) may also be removed by WSDOT maintenance. If possible, consult with the property owner where the danger tree was grown prior to removal. If an emergency exists due to a danger tree outside the right of way, remove the tree immediately and notify the property owner at the earliest opportunity. When necessary to access neighboring property for hazard tree removal, there is a Right of Entry and Hold Harmless Agreement in the HATS File Library that protects the legal liability of WSDOT and its agents in this case.

In areas where logging activities occur, adjacent clear-cuts may create a fringe of unstable trees on the highway right of way if not removed or thinned at the time of the adjacent logging. Whenever possible dangerous trees should be removed prior to or in conjunction with the adjacent logging operation. The process for removal and disposal (or sale) of timber from state property is outlined in [RCW 47.12.140](#).

Clear cuts adjacent to the highway may create undesirable views from the road. Especially on corridors designated as scenic and recreational highways, care should be taken to preserve and protect as much of the smaller trees and native vegetation on the right of way as possible to maintain the desirable visual character of the corridor.

Disposal of Logs Dumped on Right of Way

Logs dumped on any state roadway, in any state highway drainage ditch, or within 30 feet of the edge of pavement, are to be removed immediately. Logs that remain within the state right of way for a period of 30 days should be confiscated and removed or disposed of as directed by the Maintenance Superintendent.

The log transporting firm is required to immediately remove any logs dumped on the roadway or drainage ditch. If it becomes necessary for the WSDOT to remove such logs in order to comply with the law, the transporting firm will be billed for the operation including any damage to the highway.

If any logs are left on state right of way for a period of 30 days, the region will notify the transporting firm, by letter, that the logs have been confiscated by the state.

The method of disposing of such logs is at the discretion of the Regional Administrator, taking into account the merchantable value.

Removal of Dangerous Objects and Structures

WSDOT has the authority to remove any structure, device, or natural or artificial object located sufficiently close to a state highway to constitute a hazard or obstruction.

Maintenance personnel should not arbitrarily remove any object from the roadside unless the object represents a definite danger to the highway itself or to highway users. The matter should be brought to the attention of the region office for an initial decision unless immediate local action is required. In some cases “Memorandums of Understanding” are in place with agencies like the Forest Service and National Park Service in order to handle these issues in the areas where they have jurisdiction.

Illegal Tree Removal

[RCW 47.40](#) states that removal or damage to any desirable plant on the right of way by an unauthorized individual is a misdemeanor and punishable by law. [RCW 64.12.030](#) and [040](#) discuss how courts assess damages for injury or removal of desirable plants. In cases where actions are witnessed or where it is obvious who the perpetrator is, the State Patrol and the Attorney General’s Office should be called in for assistance.

Unauthorized removal of materials often occur when adjoining parties feel that the trees are blocking visibility across the highway right of way. A desire to have better visibility for their establishment, their product advertising, or simply wanting a better view of the surrounding area may lead these parties to remove vegetation without proper permission.

While it is difficult to continually monitor the entire right of way for this type of illegal activity, certain locations are more prone to neighbor’s visibility issues than others and should be watched.

6-8.3 *Trespass and Encroachment*

All WSDOT maintenance employees are required to obtain permission from property owners before entering private property, except in cases of an immediate emergency.

Encroachment – General

Maintenance field personnel are not expected to be familiar with all the laws and policies pertaining to the use of public right of way for non-state highway purposes; however, they should at least be aware of the following basic facts:

- No work of any kind shall be permitted on state right of way except that authorized by law. The department has adopted policies, rules, and regulations governing legal encroachments, and permission to occupy the right of way is always covered by a written permit, franchise, or agreement.
- On some highways the access rights of abutting property owners have been purchased by the state. This means that no approach roads to the highway can be constructed except those authorized in the access control plan as a result of right of way agreements.

Encroachment – Maintenance Crew Responsibilities

Maintenance Supervisors assigned to sections are charged with the responsibility of reporting to their superintendent any evidence of intended or actual encroachment on the right of way by individuals, firms, or agencies for non-state highway purposes.

Most violators are not aware of the law or have encroached inadvertently because of poor communication and/or unclear delineation of the right of way line.

Good public relations require that the local Lead Technician politely inform violators of the legal requirements as soon as an impending encroachment is observed, rather than to permit unauthorized work to proceed without such warning while the matter is being referred to someone else for handling. Major work is quite often contracted, and a contractor's crew may not have knowledge of a permit or franchise even if one has been granted. By a radio inquiry to his area office, the maintenance technician can usually determine if authority has been requested or granted.

Generally it can be assumed that permission has not been granted for anyone to install or erect signs, sub-standard or otherwise, on the right of way. Contact the local Maintenance and/or Region Traffic Office if there are questions about the legality of any sign.

Maintenance crews should be familiar with the right of way widths on their sections in order to detect possible encroachments.

Franchises and Permits

Franchises and permits are issued on standard forms that contain applicable legal requirements. Each encroachment document will include its exact location, any applicable special provisions required in the project, and how the installation is to be constructed.

A single application form, in which the applicant describes, with the aid of sketches and/or maps, what he wants to do, is used for both permits and franchises. An area or region employee makes a field investigation to determine whether or not the proposed work is permissible by law, what its effect will be on existing highway conditions, and what construction designs must be adopted to protect the interests and legal requirements of the state. If all is in order, the field investigator submits a recommendation that the application be accepted and approved and what, if any, conditions or restrictions should be included.

Maintenance should check to ensure adequate provisions are included for revegetation of any and all disturbed soil.

Franchises are issued for all utility encroachments that extend along the highway for a distance of more than 300 feet. Approval can only be granted by action of the department after the applicant has furnished proof that he has complied with all the legal requirements of posting and advertising.

Permits are issued for encroachments less than 300 feet in length. Permit forms are shorter than franchise forms and there are no posting and advertising requirements.

All permits on restricted access highways, and permits for any gas or petroleum products crossings, except local gas service line on any highway, regardless of access restrictions, must be approved by the department.

The department has extended authority to the Regional Administrator to approve all other encroachment permits, including those for local gas service crossings and for the cultivation and/or growing of agricultural crops.

See the [Utilities Manual](#) M 22-87 for further information on WSDOT policy on franchises and permits.

Burning Debris

Burning of brush, slash, tumbleweeds or any other waste shall be accomplished in a manner and time that conforms to the rules and regulations of the regulatory agency for that area. Contact local air pollution authorities and fire departments regarding burning requirements.

6-9 Litter Control

6-9.1 *Removal of Large Debris Rubbish and Animal Carcasses*

Debris and rubbish deposited on or along the highway is picked up and disposed periodically as necessary. Debris such as fallen branches and articles that have fallen from vehicles, rocks, or earth slides onto the traveled portion of the roadway or onto shoulders or ditches should be removed immediately.

The remains of animals killed by motor vehicles should be removed promptly and buried at convenient locations. If license tags are present on domestic pets, notification of appropriate city or county is encouraged. A HATS record must be completed for this activity. This record of killed wildlife aids in the placement of signing and other preventive measures.

Occasionally, items of value are cleared from the right of way. If possible, the owners of the property should be notified. Otherwise, the property is retained for 30 days and the area office is notified. Generally, owners of such property will contact the department. If the property is not returned to the owners, the region either places the item in inventory or declares it surplus.

6-9.2 *Removal and Cleanup of Illegal Campsites*

WSDOT is reactive to this issue. Public complaint or need of access will trigger necessary efforts to remove and clean an illegal campsite. Illegal encampment cleanup requires the cooperation of agencies that are able to provide social service outreach and law enforcement resources.

6-9.3 *Litter Control and Partnerships for Roadside Enhancement*

Litter is highly visible. A clean or littered roadside creates a perceived indication of the overall maintenance service level. Litter control and local community roadside enhancement are not high maintenance priorities. Roadside partnerships allow WSDOT to accomplish roadside clean up and enhancement at minimal cost.

Responsibility for litter control on state highways is shared between WSDOT and Ecology.

The majority of litter pick up initiated by WSDOT takes place through the administration of the Adopt-a-Highway (AAH) program. WSDOT maintenance employees typically pick litter in advance of mowing operations to prevent shredding and spread of litter by mowing equipment, or where large debris such as discarded furniture items and tire shreds are present and pose a hazard to traffic.

Ecology administers a fund generated through a state tax imposed by [RCW 82.19.010](#) on the sale of all containerized goods, and is charged with leading education and prevention programs. Ecology also utilizes a portion of the fund to pay for litter pick up programs such as the Ecology Youth Corps, which employs seasonal crews to assist with cleaning litter on state highways.

It is necessary for Ecology to notify local WSDOT maintenance of when and where they plan to conduct litter collection activities. This communication insures that EYC activities do not interfere with WSDOT maintenance work and WSDOT maintenance crews are aware of the presence of filled litterbags for collection and disposal.

The largest maintenance expenditure for litter control results from the pick-up and disposal of bags filled by AAH volunteers, Corrections Crews and WSDOE sponsored programs.

6-10 Adopt-a-Highway

The Adopt-A-Highway Program (AAH) allows citizens and businesses an opportunity to contribute to a cleaner environment and an enhanced roadside appearance through partnership with the WSDOT. The program is authorized and governed by state law as defined in [RCW 47.40.100](#).

The program is intended for use in those situations where a volunteer group or business entity wishes to help WSDOT in the performance of litter control or other activities that will enhance the appearance of the roadside. Any activity undertaken as part of this program must be in the primary interest of the traveling public and must contribute to an improved visual and/or environmental condition. The outcome of any activity must be compatible with the surrounding roadside conditions and the department's overall policy and program goals.

6-10.1 Program Rules

It is important to maintain a level of consistency in administration of the program throughout the state, but the individual area maintenance offices must be somewhat flexible in their interaction with participating groups. Management of the program will therefore vary to some degree throughout the state; these rules and procedures are intended to provide consistency on statewide programmatic and legal issues.

6-10.2 Participant Eligibility

Any organization, individual, family, business, corporation, or combination thereof may participate in the Adopt-a-Highway Program by either voluntary efforts or by financially sponsoring roadside enhancement activities. The terms for each assignment shall be specified on the Adopt-a-Highway Agreement and subject to the following rules:

The name displayed on the AAH recognition sign shall be the official name of the organization, individuals, or business. Only the name may be displayed on the sign, no other information may be included. In the case of privately sponsored adoptions, where logo panels are provided by the sponsoring organization, additional information may be included if it is part of the organization's official logo.

Organizations shall not be eligible if their name:

1. Endorses or opposes a particular candidate for public office.
2. Advocates a position on a specific political issue, initiative, referendum, or piece of legislation.
3. Includes a reference to a political party.
4. Includes any words or reference to anything that may be considered or construed to be obscene to the general public.

Organizations whose agreements are terminated for failure to comply with terms shall be ineligible for participation until five years from the date of the termination.

6-10.3 *Assignment of Sections*

Sections shall be assigned on a first come, first served basis. Consider the type of location and anticipated volume of litter in relation to the type of group or privately sponsored adoption. Assignment of groups, locations, management of waiting lists, and special limitations or restrictions are determined by the regions and area management. Limit volunteer adoptions due to safety concerns in locations with high traffic volumes, high litter volume, or difficult access. Sponsored adoptions may occur anywhere except construction zones. Standard litter control sections range from a minimum of two centerline miles to ten centerline miles or more in length. Single organizations may adopt as many sections as desired, but sign placement for each section adopted by that organization on a given route must be managed in cooperation with region traffic offices. Wherever possible assign new adoptions next to existing adoptions.

Sometimes the AAH Program is used to initiate a roadside enhancement in addition to or other than litter control. The activities may include planting projects or graffiti removal.

In these situations assignments may be made for specific locations less than two miles in length, such as at interchanges or bridge crossings.

For type and placement of AAH participant recognition signs, see [Traffic Manual](#) Section 2-20.1 and Appendix, 2-26 and 2-27, signs I6-904, I6-905A, I6-906, I6-906A, and I6-906B.

Standard AAH agreements last for a minimum period of four years. The termination or renewal date for all agreements is four years from the beginning date, unless otherwise canceled by either party. Agreements can be terminated by either party upon 30 days notice. For routine four year renewals, organizations with previously assigned sections have first right of refusal for their sections upon renewal.

Interruption of agreements may occur due to highway construction or improvement projects. WSDOT will notify all affected participants in the event of interruptions. During this period the area will be reserved for the original participants. Upon completion of construction the original participants have the option of renewing or terminating the agreement.

In some cases, it may be desirable to establish agreements for special clean up or enhancement activities through a General Permit with Special Provisions for Roadside Maintenance. A temporary agreement can be set up within the Adopt-a-Highway Tracking System database to serve this purpose. The procedures are the same as a standard four year agreement and all applicable forms must be completed.

6-10.4 *Volunteer Adoptions*

Volunteer adoptions are established through the form titled Application for Adopt-a-Highway Volunteer Group ([DOT Form 520-032](#)).

Each volunteer organization participating in the program shall have a designated leader or coordinator.

All participants shall be at least 15 years of age.

All participants will submit a signed Adopt-a-Highway Participant Registration Form ([DOT Form 520-031](#)) to WSDOT. This includes the requirement for signed parental consent to be submitted for all minors (participants under the age of 18), prior to their participation in any roadside activities.

During roadside clean up or enhancement activities, there shall be at least one adult supervisor present for every eight minors.

Upon completion of any and all AAH events, volunteers shall complete and submit to the department within seven days an Adopt-a-Highway Volunteer Participant Activity Report ([DOT Form 520-030](#)).

6-10.5 *Sponsored Adoptions*

Sponsored adoptions are established through the form titled Adopt-a-Highway Agreement for Privately Sponsored Work ([DOT Form 520-028](#)). This is a three party agreement between WSDOT, the sponsoring organization, and the organization providing the clean up or enhancement. WSDOT is not responsible for agreements or contracts made between a sponsoring organization and the organization providing the clean up or enhancement. Sponsored adoptions may be initiated by either a sponsor or a potential contractor wishing to solicit a sponsor. Agreements are granted on a first come, first served basis and will only be granted when a sponsor or contractor presents a copy of a signed contract to conduct the required work.

The cost of privately sponsored adoptions and the work involved is intended to be covered by the sponsor. The agreement between the sponsor and the sponsor's contractor must include provisions for all the equipment, materials, labor, and insurance necessary to accomplish the work specified in the agreement. Sponsors are required to pay a fee to the department covering the cost of sign fabrication, installation, and maintenance. The fee is based on the size and total number of signs required to satisfy the agreement, times the average cost per square foot for fabrication, and installation of the signs. The per-sign cost also includes a nominal administration fee to help defer the cost of establishing the agreement and coordinating with the sponsor and the sponsor's contractor over time.

Each sponsoring organization shall have a designated contact person. Each organization providing clean up or enhancement work shall have a designated crew leader for each adopted section and a designated central contact for the organization.

If, during the agreement period, the sponsoring organization fails to meet its financial obligation for the activities specified, WSDOT will allow the organization providing the clean up or enhancement to continue work under the agreement for up to 30 days, at their own expense. If the organization providing the enhancement work fails to obtain a new sponsor within 30 days, the agreement automatically terminates and all agreed upon conditions for default shall apply.

If, during the agreement period, the organization providing the cleanup fails to meet its obligation or otherwise dissolves its agreement with the sponsoring organization and discontinues work, the sponsoring organization has 30 days to find a new organization to provide the cleanup. If the sponsoring organization fails to contract with a new organization to provide the clean up within 30 days, the agreement automatically terminates and all agreed upon conditions for default shall apply.

Upon completion of AAH events, the organization providing the cleanup completes and submits a monthly report to the department.

6-10.6 *General Permits for Roadside Enhancement*

In some cases a General Permit with Special Provisions for Vegetation Management may serve as the most appropriate means to accomplish proposed roadside enhancement or special clean-up work. Use this as an option over an AAH agreement if:

- The permit Grantee is not interested in recognition through the AAH program.
- The proposed work overlaps with existing AAH litter control assignments.
- The proposed work is a situation where an abutting neighbor maintains, such as a “No Spray” agreement.
- The proposed work consists of a limited number of events.

Fill out all General Permits for roadside enhancement work using the AAH database program. This allows information to be recorded and accessed in relation to any questions regarding statewide roadside partnerships.

6-10.7 *AAH Administrative Roles and Responsibilities*

Each region, and each maintenance area has unique personnel resources and responsibilities. They must assign responsibilities for the AAH Program to fit their maintenance and operations management structure.

6-10.8 Maintenance and Operations Responsibilities

The State Maintenance Engineer will designate the AAH Program Manager. This position will be responsible for:

1. Establishing and maintaining standard procedures to provide uniform implementation of the statewide AAH Program.
2. Providing, maintaining, and updating a statewide network database containing all participant information and standard forms, agreements, correspondence letters, and recognition certificates for the AAH Program.
3. Developing, producing, updating, and distributing to the regions all public information on the AAH Program. This includes the administration of the Adopt-a-Highway Tracking System (AAHTS), brochures, safety literature, safety videos, internal SharePoint site and the WSDOT public Web site.
4. Maintaining records on all participating sponsored contractors including proof of insurance, and monthly reports.
5. Assisting the regions in coordination of AAH partnerships throughout the state including litter control and enhancement efforts.
6. Overseeing and commenting on all procedures and issues relating to the AAH Program, including review of all proposed agreements which include enhancement activities other than litter control prior to signature.
7. Pay premiums or assessments required under the [RCW 51.12.035](#) to secure medical aid benefits under [Chapter 51.36 RCW](#) for all volunteers participating in the Program.
8. Oversee the recording of all agreement information and participant activity on the statewide AAH Database and updates.

6-11 Region Responsibilities

The Regional Administrator may delegate responsibilities for regional management and operation of the AAH Program to best serve the Program in that region. Day-to-day interaction with AAH participants will occur at the maintenance area level, but the area offices will receive varying levels of assistance from the regional offices throughout the state. The regions shall delegate responsibility for the following:

1. Assignment of participating groups or sponsors to appropriate sections of highway.
2. Work with potential partners to develop proposals for roadside enhancement other than litter control.
3. Determine appropriate specifications for all agreements, including frequency of litter pick up, special provisions, and plans for special enhancement projects.
4. Inform and discuss, if requested, with the Washington Federation of State Employees; regional Chief Shop Steward, any projects other than volunteer litter control prior to approval of the agreement.

5. Erect and maintain AAH Recognition Signs in accordance with signing guidelines contained in the *Traffic Manual* Section 2.7.J.
6. Furnish volunteer groups with trash bags, required sign(s) and stand(s), a warning light, hats and vests for all volunteer participants, and all or a portion of the materials and provide assistance required for implementation of enhancement projects other than litter control.
7. Distribute safety information, training aids, and provide consultation to volunteer groups and sponsored contractors.
8. Pick up and dispose of litterbags collected by volunteer participants.
9. Collect and distribute funds paid for privately sponsored agreements to cover costs of sign fabrication, installation and maintenance, and processing agreement.

6-11.1 *Guidelines for Litter Crew Traffic Control*

- Review traffic control plans prior to going out to pick up litter as published in the online version of the M 54-44.
- Drive through assigned section and determine what safety concerns you will be facing.
- No stopping, parking, or buffering in the travel lane.
- Choose a safe place to let crew members out of the vehicles.
- Passengers should get out of the vehicle on the side away from traffic.
- Litter crew members should not walk on the paved shoulder.
- Walk facing traffic whenever possible.
- All litter crew members are required to wear an approved class 2 reflective safety vest.

6-11.2 *Two-Lane/Two-Way Roadway*

1. Work areas should be limited to 2-mile increments.
2. Pick litter up only one side of the road at a time.
3. Use pullouts and driveways to get safely off the road.
4. Vehicles must stay off the paved, traveled portion of the highway and should use pullouts and driveways for buffering, loading and unloading.

6-11.3 *High Speed Roadway*

1. Work areas should be limited to 2-mile increments.
2. Pick litter up on one side of the road at a time.
3. Vehicles must stay off the paved, traveled portion of the highway.
4. Find a safe place to set up signs and unload crew members.
5. When parking on shoulder, a minimum of 2 feet from the travel lane is recommended.

6-11.4 Median

1. Work areas are 2-mile increments.
2. Find a safe place to set up signs and unload crew members.
3. Vehicles must stay off the paved, traveled portion of highway.
4. When parking on a shoulder, a minimum of 2 feet from the travel lane is required.

6-12 Auxiliary Facilities

6-12.1 Safety Rest Areas

Safety rest areas have been developed throughout the state adjacent to the highway and within the right of way. These facilities provide places where motorists can get off the highway for short periods to nap, stretch, snack, and/or use the rest room. They also provide a safe place to pull over and telephone for help in the event of vehicle break down. Rest areas contribute to highway safety by allowing drivers to become refreshed and more alert when they resume their journey.

Regular maintenance of rest areas is important. A clean functioning rest area gives visitors and taxpayers a good impression of the state and of WSDOT. Frequency of maintenance depends largely on the use of the individual areas. Clean and service rest rooms at least twice per day or at four-hour intervals during periods of high use. Empty all trash cans. Pick up ground litter and have it removed on schedule. Wash and clean picnic tables and benches at least once a week or as often as necessary to maintain a neat appearance.

A poorly maintained safety rest area will tend to collect added trash. Users will have little respect or desire to put his trash in a litter barrel when large amounts of trash are already scattered about. Similarly, graffiti and other vandalism must be quickly repaired or additional abuse is likely. Some areas with toilets that are maintained by the department must receive extra attention and be maintained to a high -degree of sanitation. Sewage disposal facilities need scheduled maintenance of septic tanks, drain fields, pumps, filters, and back-flow prevention devices. In some rest areas chemical toilets are provided and maintained under private contract. Check them to assure that they are properly maintained. If they need attention or if there is indication of vandalism, report it immediately.

Pet waste stations should be provided at rest areas that fall within the boundaries of an approved bacteria Total Maximum Daily Load (TMDL) and WSDOT's NPDES Municipal Stormwater Permit coverage area. Pet waste stations consist of signage, pet waste pick-up bags and a garbage can. Maintenance of the stations occur as needed and is to include replacement of the pick-up bags. Periodic checks of the pick-up bags should occur to ensure the stations are properly stocked. Pet waste stations provided at rest areas outside the identified boundaries are subject to the same guidance.

Some areas are provided with drinking water from springs or wells. Check these regularly for repair and sanitation. Take test samples of water to ensure a clean water supply. Turn off or divert contaminated water supplies until the source of contamination is found and corrected.

6-12.2 *Park and Ride Lots*

It is the policy of WSDOT to plan, coordinate, develop, and implement effective partnerships for park and ride facilities. Clean, well maintained facilities help to instill a sense of confidence and safety for the users. Maintenance is critical for customer and vehicular safety, accessibility, utilization, protection of the infrastructure investments, and reduction of potential liabilities for the department and/or transit agency.

Whenever possible, maintenance of park and ride facilities is arranged through agreement with the local transit agency. In cases where WSDOT maintenance is responsible for care of a facility, the *Park and Ride Facilities Manual M 3010* provide guidance on activities and procedures.

6-12.3 *Historical Markers*

Historical markers and other interpretive signing within the right of way are maintained jointly with the Washington State Parks and Recreation Commission. Historical or interpretive signs and associated structures are maintained by Parks. WSDOT maintains road approaches, parking areas, litter barrels, and advance advisory signing.

6-12.4 *Viewpoints*

Viewpoints have been provided at many scenic locations. Like safety rest areas they are a definite asset and safety factor to the motorist. They generally consist of a parking area with litter receptacles. Maintenance requirements are not as intense as for rest areas. But, viewpoints do require regular checks to keep litter barrels emptied and trash picked up. Maintain parking areas and keep fences and guardrail in good repair. Assure all warning signs are in place and clearly legible. Remove all undesirable brush that would reduce sight distance and obstruct the view. Dispose the debris away from the viewpoint.

7-1 **General**

Removal or prevention of snow and ice accumulation on the roadway is a top priority and will generally take precedence over other non-emergency maintenance functions.

Washington State Department of Transportation (WSDOT) policy is to remove or prevent snow and ice accumulation starting with higher priority highways such as Interstates and other high ADT routes. After priority highways are cleared, snow removal occurs on lower priority highways according to the Roadway Treatment Goals as established in the [Statewide Snow and Ice Plan](#).

Some mountain pass highways are closed each year once winter snows arrive. Pass closures occur where light traffic does not justify the hazard and expense of attempting to keep roads open in the presence of heavy snowfall and avalanche occurrences.

When snowstorms occur, plowing starts soon after the storm begins. It takes time to complete the operation so during heavy snowfalls there will be periods of time when the roads will not be free of snow and ice and the travelers may need to install chains or other traction devices. Snow removal operations are intended to provide the traveling public with a reasonably safe driving surface. Snow and ice removal continues until roads are returned to a drivable condition even if it involves working extra hours at night, on weekends, and on legal holidays.

Freezing rain, freezing fog, and frost events can occur quickly and sometimes without warning. Deicing operations will begin after notice is made of such events and crews have time to react and treat such conditions appropriately. When conditions are appropriate, snow and ice material pre-treatments will be made to prevent the bonding of snow and ice to the roadway surface.

7-2 **Preparation for Winter Operations**

Winter operational planning begins well ahead of winter so that equipment, materials, and labor forces can be prepared for early events. All items in the [Statewide Snow and Ice Plan](#), Chapter 3, Annual Review of Snow and Ice Procedures, are reviewed and documented. Equipment is adapted to snow and ice response and new personnel are signed off on equipment operation by a qualified person. Material supplies are topped off, and other tools and supplies readied as needed. Night and weekend schedules and contingency schedules are updated and implemented to provide coverage for snow and ice response. Instructions on winter time chain of command, communication procedures, priority routes, and treatment specifications are provided to all maintenance personnel. Public agency, transit, school district, and other affected parties are notified of winter operations plans where appropriate.

7-3 Treatment Levels and Goals

There are five treatment levels assigned to highways in Washington State. They range from Level 1 highways, which include all of the Interstates, down to Level 5 roads which comprise those sections of highway which are closed in the winter. These levels are assigned primarily based on ADT. A color-coded treatment level map of all state highways is available for review in the [Statewide Snow and Ice Plan](#), Chapter 1.

In addition to the treatment levels assigned to all state highways, there are a series of special criteria which must be considered when assigning priority response to segments of state highway. These include:

- Importance to commerce.
- Commuter routes.
- School bus routes.
- Proximity to population centers.
- Curvature and grade of highway alignment.

These criteria are mostly location specific so it is important that priorities are assigned and understood by the area maintenance personnel where such segments deviate from the larger treatment level assignments.

The Treatment Level Goals assigned to the various levels are also available in the [Statewide Snow and Ice Plan](#), Chapter 1. Level 1 highways receive the highest degree of response followed in descending order by the other four levels. In areas where Level 1 highways do not exist, the corresponding treatment level goals may be applied to highways of lower priority. The language in the [Statewide Snow and Ice Plan](#) allows for Level 2 highways to be treated the same as Level 1 highways to the extent that resources allow. However, Level 1 highways where they do exist will take precedence over all other roads and resources may be shifted accordingly.

7-4 Other Facilities

The primary function and mission of the snow and ice program is response to roadway conditions in order to keep travelers moving and to provide for the accustomed level of service. WSDOT recognizes that there are other facilities besides state highways that may rely upon state forces for winter response in order to keep those facilities functional. These can include WSDOT ferries parking lots, park and ride lots, WSDOT regional and area facility lots and some sidewalks that were constructed using federal funds.

In all cases, response to roadway conditions will take precedence over any such activities, and these facilities will be handled on a “as conditions allow” basis. This may mean that such facilities will remain unmaintained until such time that all roadways in any given region are clear, level of service goals are met, and normal movement of goods and services is restored.

7-5 Area of Responsibility

Snow and ice control operations on state highways are restricted to the highway right of way. This includes those portions of intersecting public roads that are within the state highway right of way. Snow control operations consist of removing accumulated snow from the traveled way, shoulders, widened areas, and public highway approaches within highway right of way.

Snow and ice control on private approaches, including that portion that may be located within the state highway right of way, is the responsibility of the abutting property owner. Snow and ice control activities may inadvertently result in the deposit or the windrowing of snow, ice or sleet onto private approaches. The department does not assume responsibility for the removal or clearance of such material, even if caused by normal winter maintenance operations. However, all employees involved in snow control operations are expected to be sensitive, considerate, and courteous when carrying out these policies.

Snow and ice control operations on roads and other facilities under the jurisdiction of other governmental agencies are secondary to work on state highways. Work is completed in accordance with the provisions of an agreement with the other governmental agency. Agreements are processed by the Regional Administrator or his/her authorized representative.

7-6 Abandoned or Illegally Parked Vehicles

[Revised Code of Washington 46.55.085](#) allows the Washington State Patrol (WSP) to impound abandoned or illegally parked vehicles after documented attempts to notify the owner. This process can require several days. However, if the vehicle is determined to be a hazard, WSP can arrange for immediate removal. WSP has requested that WSDOT record any department requests for such removal in order to support WSP's actions should a conflict arise with the owner of the vehicle.

7-7 City Streets on the State Highway System

[RCW 47.24.020](#) defines the jurisdiction of the state and the cities for those city streets that serve as a part of the state highway system within the corporate limits of a city.

In respect to snow and ice control, the law provides that a city or town shall remove all snow at its own expense. Cities are also required to clean the streets, including catch basins, except WSDOT is responsible to plow snow on the roadway when necessary*.

Cities generally plow city streets and are expected to plow the state highways in the city as well. State crews are expected to assist by plowing on the way through town. However, plowing on city streets is a secondary priority to be completed after highways outside city jurisdiction have been cleared.

The general exception is routes within cities that are designated as limited access highways. In those instances, the state exercises full responsibility for the entire facility and all maintenance operations.

*See [2013 City Streets As Part of State Highways Conformed Agreement](#) for a definition of "when necessary"

7-8 Operational Considerations

The following guidelines are of a general nature as more specific guidelines are available in the [Statewide Snow and Ice Plan](#) and in regional and area plans and operator handbooks. These guidelines are also meant to address issues of statewide significance which have arisen in the recent past.

7-8.1 Road Closures and Restrictions

These may occur occasionally when conditions overwhelm the ability of maintenance forces to effectively respond. Deep snow drifts, spin-out accidents, avalanche control missions, and white-out conditions are among the causes of such measures. The safety of our employees and the traveling public is paramount, and when conditions prevent safe travel or response to conditions roads will be closed to safeguard employees and the public. The following actions are taken when a road must be closed for more than an hour:

- The Regional Administrator or designee notifies WSP and other pertinent organizations.
- Immediately erect appropriate traffic control devices and/or electronic message signs advising motorists of the closure and possible detours.
- Take all necessary measures to prevent motorists from entering and becoming stranded in the closed section.
- Keep the Regional Public Information Officer apprised of road conditions so that the news media can be informed of closures.
- Emergency closures require that the Area Superintendent, Regional Maintenance Engineer, Regional Administrator and the Regional Public Information Officer be notified as soon as possible.
- Keep the State Maintenance Engineer informed of all closures that are expected to last for four hours or more and of all actions taken to reopen the roads.

7-8.2 Emergency Assistance

Limited to actions that safeguard life and property. Time spent dealing with minor problems could result in deteriorating road conditions that will affect many more motorists. Employees may render emergency assistance to motorists at the motorist's request, provided:

- The stranded vehicle is drivable.
- The motorist makes his/her own chain or cable hook-up to their vehicle.
- A tow truck is not immediately available.
- Snow and ice conditions are under reasonable control.

Never tow any vehicle that may be unable to proceed because of lack of power or traction, except when the vehicle blocks the traveled way. In this instance, the stalled vehicle may be towed a sufficient distance to clear the normally traveled portion of the roadway to allow the safe passage of other vehicles.

WSDOT employees may not accept compensation of any kind for this or any other type of assistance.

It may be necessary occasionally for an employee to exercise judgment as to whether a motorist is capable of driving his/her vehicle. If the motorist appears impaired or otherwise unsuited to drive notify law enforcement agencies by radio or other available means as soon as possible.

Employees are required to notify the State Patrol about any crashes/collisions that occur on the highway.

WSDOT desires to avoid situations that can cause the department or its employees to be harmed or sued. This has resulted in a general policy that non-employees do not ride in state-owned vehicles. However, employees may provide transportation in state-owned vehicles to stranded travelers under emergency conditions, exercising very careful judgment when doing so, and keeping the TMC or a supervisor informed of such actions as they occur.

7-8.3 *Plowing*

Must be done at speeds appropriate to conditions to avoid damage to roadside hardware, highway signs, utility lines, mail boxes, parked cars, and other private property. Special care must be taken to avoid blocking sidewalks and bike lanes in areas where pedestrians may be present. Moderate speeds must be maintained when plowing wet snow and slush as they tend to be cast much further and faster than dry snow. Dry snow can also cause problems when plowed too fast by creating snow clouds which obscure visibility.

Care must be taken when plowing on the centerline or against median barriers to avoid casting snow into the oncoming lanes. Be especially careful when passing or being overtaken by other traffic to avoid casting snow onto windshields and obstructing the vision of other drivers.

Take care while removing snow in the vicinity of cars parked adjacent to the highway. Even though the cars may be illegally parked on the traveled way, take reasonable care consistent with the necessity of accomplishing the work.

Extreme care should be taken when plowing near or around railroad crossings, raised curbs, raised pavement markings, and other obstructions. When possible, such obstructions should be marked and/or maintenance personnel should be made aware of the locations of such obstructions.

When accumulated, snow becomes compact and removal is not possible with available equipment, the accumulation is treated as an ice control operation. Ice and compact snow are best removed under thawing conditions. If possible, schedule ice and compact snow removal operations during the temperature rise that often occurs between 11:00 a.m. and 3:00 p.m. Use this time to clear surfaces of melting snow and ice, and to remove as much slush as possible.

Tandem plowing can be used for snow removal on multilane highways. Where reversible plows are available, it is often advantageous to operate one plow toward the left plowing to the median strip. In areas where drifting snow is a frequent problem, caution should be exercised in placing snow on the median. A narrow median filled with snow can cause drifting in adjacent lanes. Also, melting snow in the median can cause icy roadways during colder nights. Take care to assure that plowed snow is not thrown into the path of oncoming vehicles or onto a roadway below the highway being plowed.

Interchange ramps are considered as separate roadways independent of the highway they serve. Priorities are determined by traffic volume. Ramp road ways are normally treated after one or more lanes are open on the main roadway.

Never leave a windrow of snow on a railroad grade crossing. Drivers are to raise or otherwise adjust the blade before reaching the crossing to prevent damage to the crossing and/or equipment. Be aware of and avoid any conflicts between snow removal operations and approaching railway traffic.

Widening for snow storage, established turnouts, mailboxes, etc., may be accomplished when available manpower and equipment permit. Shoulders are plowed in conjunction with plowing of the traveled way, or immediately after the storm is over. Clearing shoulders provides storage space for additional snow, makes the highway safer for traveling public helps prevent drifting, damage to the road bed from moisture infiltration, and excessive runoff onto the pavement. Perform shoulder plowing in the direction of travel. Always establish proper traffic control before plowing against traffic on the median shoulder of divided highways.

After the priority lanes are cleared, attention is needed to make sure the bike lanes and sidewalks are travelable.

Clear all drainage ways from the roadway surface prior to thawing conditions. Utilize a road grader or wing plow if possible.

Clear snow-covered highway signs after normal snow and ice control operations have been accomplished. Give first attention to regulatory and warning signs.

7-8.4 *Material Applications*

Must be done according to “sensible salting” strategies, that is, using the least amount of material necessary for the desired outcome. Outcomes are driven by service level goals for any given state route, and should not exceed the [Statewide Snow and Ice Plan](#) defined desired outcome through the excessive use of salt or deicers. Operators must be familiar with local application guidelines specific to the materials in use for that area. They should also be familiar with the characteristics and limitations of those materials.

WSDOT has a chemical priority policy for snow and ice response, but does not preclude the appropriate use of sand or abrasives to apply a traction component when needed. Sand can be an effective stand-alone treatment for certain conditions such as extreme cold or heavy compact snow which would require extremely heavy salt and deicer treatments to remove. The combination of salt and sand in some ratio can be an efficient and cost effective treatment.

Material application equipment must be calibrated pre-season and as needed during the season. The use of precision material controllers in combination with closed loop hydraulic systems is the preferred means of material delivery. Equipping all trucks with such technology is a WSDOT priority and should result in cost savings through more efficient applications of snow and ice material.

Care must be taken to avoid the inadvertent blasting of oncoming traffic with sand or salt. Spinner speed should be adjusted down or spinners turned off when meeting oncoming traffic.

Accurate record keeping of material applications is necessary to demonstrate efforts made to respond to winter conditions for purposes of performance rating, and for response to tort actions. Such record keeping is also useful in determining the “normal” or average material use for a given area over history, and as a budgeting tool. For equipment not yet provided with AVL/GPS technology, records should be kept via PDA or in paper form for later data entry on a PC.

7-8.5 **Material Storage**

Must abide by National Pollutant Discharge Elimination System (NPDES) standards where applicable, and by general good housekeeping and spill prevention procedures everywhere. The guidelines below apply to the storage of all winter chemicals for storm water compliance within the NPDES permit area. However, they outline good standards of practice for all areas and should be followed to the extent possible.

Prior to the reissuance of the current (2009) NPDES Permit, WSDOT will evaluate all winter chemical storage areas within the permit area to identify necessary capital structural control BMPs. These capital improvements will be ranked and constructed on a priority basis as funding becomes available. Funding may be needed by the state legislature prior to these BMPs being constructed. Additional capital BMPs may be added to this list as their need is identified.

Winter Operations – Winter maintenance chemicals are non-hazardous. However, large quantity spills and small spills that occur over a long period of time may contaminate groundwater drinking water sources and potentially surface water.

Winter Chemical (Solid)

- Manage only the chemical needed for the season.
- Products will be stored in designated areas.
- Designated areas should be located away from storm drains and water bodies.
- Ideally solid chemical will be stored in a covered shed that protects it from precipitation.
- If a covered shed is not available solid chemical will be covered with plastic sheeting (polyethylene, polypropylene, hypalon, or equivalent).
- For facilities that do not have a covered shed, product remaining at the end of the season should be transferred to a yard that does as soon as possible.

- Spilled solid chemical should be swept up and placed back under cover as soon as possible. During a winter storm event, spilled material should be cleaned up as soon as the storm event is over.
- Solid chemical should be stored on an impervious surface that is sloped so that stormwater does not come into contact with the solid chemical.

Winter Chemical (Mixing and Loading Solids)

- If possible solid chemical should be dumped directly into the storage shed.
- If it is not possible to directly dump into the storage shed, the following procedure should be followed:
 - Try to obtain solid chemical on a day when precipitation is not expected.
 - Sweep the impervious pad immediately in front of the storage shed prior to delivery of new product.
 - Have the delivery truck dump the solid chemical as close to the storage shed as possible. Immediately push the chemical into the storage shed with a loader.
 - Sweep the impervious pad to pick up any residual chemical and place it into the storage shed.

Conditioned Sand – Sand Mixed With Solid Chemical

- Only condition the amount of sand expected to be used during the upcoming winter storm event.
- Conditioned sand will be stored in designated areas.
- Designated areas should be located away from storm drains, drainage systems, and water bodies.
- Segregate conditioned sand from unconditioned sand.
- Conditioned sand should be placed in a covered shed if available or should be covered with plastic sheeting (polyethylene, polypropylene, hypalon, or equivalent).
- Spilled conditioned sand should be swept up and placed back in the conditioned sand pile.

Winter Chemical (Liquid)

- Protect tanks from vehicle impact.
- Install and maintain hose connections so that the flange couplings are protected and leaks are reduced.
- Valves should remain closed when not in use.
- Label tanks with product information.
- Inspect tanks and pipes monthly for leaks, spills, and deterioration.
- Permanent tanks must be located in impervious secondary containment surrounded by dikes or UL approved double-walled. The dike must be of sufficient height to provide a containment volume of either 10 percent of the total enclosed tank volume or 110 percent of the volume contained in the largest tank, whichever is greater, or if a single tank, 110 percent of the volume of that tank.

- All hoses and connections should be contained within the secondary containment enclosure.
- Shut-off valves for secondary containment should remain closed at all times, unless draining rainwater.
- Liquid deicer mixed with rainwater needs to be disposed of properly.
 - Pumped back into tanks.
 - Discharged to sanitary sewer.
 - Used on roads as dust suppressant.
- Leave product remaining at the end of the season in the tank.
- If a bucket is used to collect deicer spills during loading or unloading it should be placed within the containment unit and covered to prevent the introduction of rainwater.

7-9 Service Level Quality Measurement

The Headquarters Maintenance Office has developed quality performance measurements for snow and ice control operations. These performance measurements have been established to assess how well field maintenance responds to winter road conditions. These measures are focused on providing targeted levels of service for snow and ice control based on the [Statewide Snow and Ice Plan](#), Chapter 1, Roadway Treatment Goals.

8-1 **General**

Traffic services are maintenance functions necessary for the safe and efficient movement of traffic. These include maintaining highway signs, delineators, pavement markings, traffic islands, curbs, impact attenuators, barriers, guardrail, traffic signals, and highway illumination. Each serves a definite function in the control and guidance of traffic. Functions that utilize electricity, including traffic signals, ramp meters, data accumulator systems, changeable message sign systems, and highway illumination systems are discussed in [Chapter 10](#).

The application, installation, and maintenance of all traffic service functions must conform to the accepted practice and standards set forth in the FHWA [Manual on Uniform Traffic Control Devices](#) (MUTCD), the WSDOT [Design Manual](#) M 22-01, and the WSDOT [Standard Plans](#) M 21-01.

8-2 **Reconstruction Principles**

The following are samples of items that are subject to reconstruction to meet current design standards. The list is not all-inclusive, but serves to illustrate the updating that can be accomplished.

- Breakaway bases on all sign supports and luminaire poles.
- Guardrail terminals and transitions.
- Guardrail post spacing.

Use the “K Job Estimating Application” in the HATS to estimate the cost of repairing damaged highway hardware in kind. When upgrading damaged hardware to current standards, attach a sheet to the Repair Cost Estimate to document why the original installation does not conform. This sheet will also show estimated additional materials, labor, and costs to bring the installation up to present design standards. Where possible, take photographs before and after repair and updating, and include in the job file.

Repair and updating is accomplished by state forces or by contract. On state force work, include the work order number to be charged against on employee time sheets. A standby contract will be used to provide early contractor mobilization to assure fast repair of critical highway hardware damage.

In a region level contract, the Regional Administrator awards a contract in accordance with the delegated authority for contracts. Guidance for administering region level contracts can be found in WSDOT [Advertisement and Award Manual](#) M 27-02. The amount of State Force Work participation in contracts is governed by the monetary limits shown in [Revised Code of Washington 47.28.030](#).

8-3 Signing

Highway signs are erected to convey specific messages to the traveling public. They provide regulatory, warning, and guidance information.

8-4 Signing Responsibility

The Regional Traffic Engineer has the authority for the design, location, height, and other features associated with the installation of new signs, and for any revisions that may become necessary.

Region maintenance personnel are responsible for maintaining signs once they are in place, in consultation with the Regional Traffic Engineer.

8-5 Sign Installation

Most signs are mounted at approximately right angles to approaching traffic. Parking signs may be installed at an angle 30 degrees or 45 degrees or even parallel to approaching traffic in order to provide visibility to vehicles adjacent to the sign.

Orientation. Normally, signs should be vertically-mounted at right angles to the direction of, and facing, the traffic that they are intended to serve. Where mirror reflection from the sign face is encountered to such a degree as to reduce legibility, the sign should be turned slightly away from the road. Signs that are placed 30 feet or more from the pavement edge should be turned toward the road. On curved alignments, the angle of placement should be determined by the direction of approaching traffic rather than by the roadway edge at the point where the sign is located.

8-5.1 Sign Clearance

Erect signs and their supports with maximum practical lateral and vertical clearance in accordance with the [MUTCD](#) or [Design Manual](#) M 22-01. This will provide the most safety for motorists who may accidentally leave the roadway.

The near edge of signs is normally located more than six feet outside the edge of shoulder or twelve feet from the edge of the traveled lane. Where curb exists, locate the near edge of the sign no less than two feet from the face of the curb.

Take care when installing signs and their supports behind roadside barriers. Many barriers are designed to deflect upon impact. An inappropriately located sign or support within that area could prevent proper functioning of the barrier and may result in a potentially hazardous situation. Do not locate signs or supports within the deflection areas listed in 1610.03(3).

Barrier Type	System Type	Deflection
High-tension cable barrier	Flexible	6 ft to 10 ft typical [1] (face of barrier to object)
Beam guardrail, Type 1, 1a, and 10	Semi-rigid	3 ft [4] (face of barrier to object)
Beam guardrail, two-sided Types 3 and 4	Semi-rigid	4 ft (nearest face of barrier to object)
Beam guardrail Type 31 (including two-sided and omitted post)	Semi-rigid	5 ft (face of barrier to object)
Permanent precast concrete barrier, unanchored	Rigid Unrestrained	6 ft [2] (back of barrier to object)
Temporary precast concrete barrier, unanchored [5]	Rigid Unrestrained	3 ft [3] (back of barrier to object)
Permanent precast concrete barrier anchored	Rigid Anchored	2 ft (back of barrier to object)
Temporary precast concrete barrier, anchored [5]	Rigid Anchored	1 ft [3] [6] (back of barrier to object)
Cast in place or precast concrete barrier, embedded	Rigid Embedded	No deflection [7]

Use two checks when determining the height of post-mounted signs.

1. Assure the vertical clearance from the bottom of the sign to the roadway surface meets MUTCD specifications. This ensures good visibility.
2. Install signs as shown in the standard plans. This ensures that the safety mechanism (i.e., breakaway, slip base, load concentrating coupling, etc.) of the support system will function properly.

8-6 Maintenance

Keep all signs in proper position, clean, and legible. Conduct periodic day and night inspections for position, damage, legibility, and general condition. In addition, check sign structures and sign-to-structure connections for structural integrity.

8-6.1 Inspection

In snowy areas, signs may be damaged by plows or by thrown snow or ice. Inspections are most effective after the winter weather has ended. Another inspection is recommended in the fall to ensure readiness for winter driving. In areas where weather is less severe, inspections may be correlated with other maintenance work.

Periodically check sign bridge and cantilever structure end post and metal sign post base connections. In addition, inspect sign mounting bolts and beam clips for proper tightness. Replace or secure missing or loose hand hole covers on overhead sign structure supports. Give special attention to steel sign post base and fuse plate connections. To properly function as a breakaway support while resisting wind loading, the bolt torque specified in the standard plans must be maintained.

8-6.2 *Field Repair*

Good judgment and sound economics dictate when to perform field repairs. Field repair minor sign damage whenever possible. More extensive damage normally requires sign replacement. Signs such as STOP and YIELD, whose absence can be life threatening, must receive priority replacement.

Signs that are repeatedly knocked down by vehicles may be reinstalled farther away from the roadway or at a different location along the roadway. Care must be taken to ensure that the new location meets MUTCD requirements.

Sign supports within the “clear zone” described in [Chapter 2](#) must meet functional requirements of current safety standards. Sign support design elements are shown in the standard plans.

Never weld the steel sign post web to prevent wind blow-down. Proper fuse plate bolts and bolt torque will prevent blow-down.

Along with proper bolt torque, the area around the sign post base must be clear of obstructions that may prevent the post from slipping free of the base. Ensure that the base stub-post does not project more than 4 inches above the ground. Projections above that height may snag the under-carriage of a vehicle.

8-7 **Sign Visibility**

Promptly remove obstructions that prevent adequate sign visibility. Vegetation trimming is sometimes necessary to ensure adequate sign visibility. Maintenance crews must be particularly careful to avoid parking equipment in front of traffic signs.

At times, highway sign faces are obscured as a result of roadway snow removal. Clear all signs as soon as possible. Regulatory and warning signs have first priority.

8-8 **Sign Storage and Transportation**

Store signs indoors whenever possible to prevent sign sheeting failure. The signs may be packaged if dry. If packaged signs become wet, immediately unpack and separate them to allow drying.

At times, it is necessary to store signs outside. In this situation, remove the packing materials so that nothing is against the sign face. Never lay signs flat. Water accumulating between signs laying flat will cause sign sheeting failure.

Store signs upright on edge on blocks or other material to keep the signs off the ground. Install spacers along the sign edges to allow air circulation and normal moisture evaporation from the sign face. Avoid sign sheeting contact with treated wood. Avoid storage where dirt or water may splash on the sign face.

Transport signs on edge, face to face or back to back, to prevent sign face damage.

8-9 Delineation

Delineation is defined as one, or a combination of devices, (excluding signing), that warn or provide guidance to the roadway user. These devices include pavement markings, guideposts, guardrail delineators, and barrier delineators. Delineation of environmentally sensitive areas are identified with specifically marked green guideposts.

8-10 Pavement Markings

Pavement markings are divided into two categories – long line and transverse and symbol. Long line markings are the markings that are applied parallel to the roadway. Typically long line markings are renewed with a spray application of new material applied from a striping truck. Transverse and symbol markings are typically renewed by hand, by spray, or extruded application of new material.

Long line markings include the following – center line, no-pass line, double center line, double lane line, wide lane line, double wide lane line, lane line, edge line, solid lane line, dotted extension line, wide dotted lane line, wide broken lane line, drop lane line, barrier center line, two way left turn center line, and reversible lane line.

Transverse markings include the following – Crosswalk line, stop line and wide line. Symbol markings include the following:

- Traffic arrows
- Traffic letters
- Access parking space symbol
- High occupancy vehicle (HOV) lane symbols
- Railroad crossing symbols
- Bicycle lane symbols
- Drainage markings
- Aerial surveillance markers

Raised pavement markers (RPMs) are installed either as positioning guides along with longitudinal markings or they are installed as a complete substitute for long line markings. Surface mounted RPMs are installed on roadways where snow removal operations use rubber blades. Recessed RPM applications consist of the installation of an RPM in a groove that has been cut into the pavement. Recessed RPM applications are allowed in areas where snow removal operations use steel blades. Various markings are identified by color code as follows:

RPM Type	Color
Type 1W	White Non-Reflective
Type 1Y	Yellow Non-Reflective
Type 2W	White One Side Only
Type 2WR	White and Red
Type 2Y	Yellow One Side Only
Type 2YY	Yellow Both Sides
Type 2YR	Yellow and Red

Descriptions and dimensions of markings are shown in the [Standard Plans](#), Section M, Pavement Markings. Application requirements for various markings are shown on the standard plans, noted by type as follows:

Marking Application	Standard Plan
Longitudinal Marking Patterns	M-20.10
Profiled and Embossed Plastic Lines	M-20.20
Longitudinal Marking Supplemented with RPMs	M-20.30
Longitudinal Marking Supplement with RPM's ~ Turn Lanes	M-20.40
Longitudinal Marking Substitution with RPMs	M-20.50
Left Turn Channelization	M-3.10, M-3.20, M-3.30, and M-3.50
Two-Way Left-Turn and Median Channelization	M-3.40
Off-Ramp Gore Area Marking	M-2.20
Ramp Channelization Single Lane	M-1.20
Ramp Channelization Two Lane	M-1.40
Ramp Channelization Collector – Distributor Road	M-1.60
Symbol Markings ~ Traffic Arrows for Low Speed Roadways	M-24.20 and M-24.40
Bicycle Lane Symbol Layout	M-9.50
Crosswalk Layout	M-15.10
High Occupancy Vehicle (HOV) Lane Symbol Layout	M-7.50
Symbol Markings Miscellaneous	M-24.60
Aerial Surveillance Marking	M-24.60
Railroad Crossing Layout	M-11.10
Roundabout Traffic Arrows	M-24.40

RPMs installed as positioning guides along with longitudinal markings are shown on [Standard Plans](#) M-20.30 and M-20.40. RPMs installed as substitute applications for longitudinal markings are shown on [Standard Plans](#) M-20.50.

8-11 Materials

Pavement markings are renewed with a material that is compatible with the original application material. Painted markings are renewed at a thickness of 0.015 inches or 15 mils. The glass beads are applied at a minimum rate of seven pounds per gallon of paint. Thermoplastic markings are renewed at a thickness of 45 mils for long line markings and 90 mils for transverse markings. Methylmethacrylate markings are renewed at a thickness of 45 mils for long line markings and 90 mils for transverse markings. RPMs are replaced in kind.

8-12 Application

All materials shall be applied when the pavement is clean and dry since pavement moisture is the major cause of most marking failures. The Striping Supervisor is advised to contact the area Maintenance Supervisor in advance of any long line marking applications to coordinate maintenance activities and arrange for sweeping of the roadways.

Pavement marking materials are to be applied in accordance with the material manufacturer's recommendation. Apply paint and thermoplastic materials when the pavement temperature is 50 degrees and rising. Methylmethacrylate material can be applied when the pavement temperature is 40 degrees and rising, provided the pavement is dry.

Paint and methylmethacrylate material is purchased by the liquid gallon. Thermoplastic material is purchased by the pound, then heated and applied as liquid. Material requirements for pavement marking materials for a continuous four inch line are as follows:

Millage	Gallons/Mile (Liquid)	Pounds/Mile (Dry)
15	16.4	–
45	49.2	1100
90	98.3	2200

8-13 Surface Moisture Test

The presence of moisture on the pavement should be checked whenever conditions are questionable. Presence of pavement surface moisture can be determined as follows:

- Asphalt or Concrete Surfaces** – Place a 12 × 12 inch square piece of plastic wrap on the pavement surface using duct tape to affix the edges. Let stand approximately 15 minutes and check for moisture bubbles on the inside surface of the plastic. If moisture bubbles on the plastic are larger than a pencil eraser, then the pavement contains too much excess water. Notify the contractor of this condition and postpone all marking operation until the pavement is dry enough to prevent the large moisture bubbles from forming on the plastic.
- Thermoplastic Applications on Asphalt Only** – Using roofing felt paper, place a 12 × 12 inch square of felt on the asphalt and install the thermoplastic material directly onto the felt paper. Let it cool for approximately 10 seconds, then lift the paper to check for moisture on the back side. If moisture bubbles larger than a pencil eraser are present on the back side of the roofing paper, then the pavement contains too much excess water. Notify the contractor of this condition and postpone all marking operations until the pavement is dry enough to prevent the large moisture bubbles from forming on the back of the felt paper.

8-14 Marking Renewal or Replacement Frequency

Pavement markings are renewed when they no longer provide guidance during daytime and nighttime conditions. Markings that may appear adequate in the daytime may have no reflectivity at night. Typically markings fail by loss of reflectivity long before they fail by daytime appearance.

On the majority of our highways, the longitudinal paint stripes will have to be restriped every year to maintain adequate line presence and retroreflectivity.

On low volume highways with minimal snow plowing activity, paint striping may last more than one year. A stripe evaluation should be done that evaluates both the amount of paint remaining on the roadway surface (durability) and the retroreflectivity of the stripe. The study should determine if the stripe will remain adequate until the next striping maintenance cycle.

The frequency renewal rates can vary depending on a number of factors to include traffic, weather and plow damage to name a few. In general, renew applications typically occur on the following schedule:

Marking Type	Frequency
Long line painted markings	At least once a year or less determined by evaluation
Heavy wear long line painted markings	At least once a year or less determined by evaluation
Thermoplastic transverse applications	At least once every two years
Methylmethacrylate transverse applications	Every five years
Reflective RPMs (except yellow)	By group every two years
Reflective yellow RPMs supplementing the yellow edge lines on divided highways	Every four years
Non reflective RPMs	Replaced as needed when the associated reflective RPMs are replaced

8-15 Removal of Markings

Removed pavement markings can sometimes reappear and confuse motorists. All removed pavement markings must be unidentifiable as pavement markings under day or night, wet or dry conditions.

Do not over-paint markings with black paint or bituminous solutions. This treatment has proven unsatisfactory because the original lines eventually reappear as the overlying material wears away. In addition, lines covered in this manner may still be visible under wet conditions or low angle illumination (headlights) conditions.

8-16 Guideposts

Guideposts are classified as guide markings rather than required warning devices. Guidepost type designations and mounting details are noted on Standard Plan M-40.10. Guidepost placement guidelines are noted in Standard Plan M-40.20 through M-40.60.

Studies have shown that wildlife warning reflector systems are ineffective at reducing the accident potential for motor vehicle/wildlife collisions. WSDOT policy is to no longer design, place, or maintain wildlife reflectors.

Barrier delineation is used in areas with guardrail or concrete barrier where guideposts are required by other roadway conditions. The spacing of barrier delineators for these applications is the same as the spacing noted for guideposts. Promptly replace damaged or missing guideposts and barrier delineators.

8-17 Roadside Safety Hardware

Roadside safety hardware (referred to as simply “hardware” in this section) includes impact attenuators, roadside barriers (beam guardrail, cable barrier, and concrete barrier), guardrail terminals and transitions. This hardware is used to reduce the severity of vehicle crashes in situations where issues identified in the Design Clear Zone (as defined in [Chapter 2](#)) cannot be mitigated by removal, relocation, or redesign. Among the roadside issues to consider for mitigation are steep slopes, water bodies, and non-breakaway fixed objects. Roadside barrier components include the barrier standard run, terminals or anchors provided at the barrier ends, and transitions that connect barriers with differing stiffness characteristics. Impact attenuators are standalone devices used to shield non-breakaway features.

Install MASH compliant roadside safety hardware in all new construction and full maintenance replacements, except where otherwise noted below or in the HATS file library.

8-18 Maintenance

Barriers must be properly maintained to ensure that they will perform as intended when struck by a vehicles. Keep the area under and around barriers clean and free of debris. Do not attach objects to hardware where it is not supported or specified by the designer or manufacturer. The area under and around barriers may or may not need to be kept free of vegetation. This is a site-specific decision based on types of vegetation and the hardware’s design and function.

8-19 Inspection – General

Inspect barriers periodically, either by visual drive-by or by physical inspections.

Inspect for:

- The overall condition of the barrier (including posts).
- Proper interconnection of units.
- Proper installation of anchor cables and connecting pins.
- Tightness of blocks and fasteners.
- Proper overlapping of beam guardrail.
- Secure attachment of beam guardrail.

8-20 Inspection and Preventive Maintenance – Cable Barrier

All cable barrier should be inspected and re-tensioned annually, as recommended by cable barrier system manufacturers. The inspection shall consist of a maintenance technician walking along the run of barrier, visually observing barrier components to determine any deficiencies and the overall condition of the barrier. The inspection should also include measuring the tension and re-setting the tension to the recommended requirements. All inspection and preventive maintenance work shall be documented in HATS.

8-21 Repair

Repair damaged roadside safety hardware within two weeks of when the damage is documented, unless higher documented priorities preempt action. If possible, determine whether damaged hardware will be repaired, replaced, or removed. Document all repair work in HATS.

Removal of hardware may be the best solution, but this requires an evaluation of the original requirement for the installation. Contact the Region Traffic Engineer in order to engage region engineering staff when there is a need to design new barrier, to design significant modifications to an existing barrier, or to evaluate the need for an existing barrier.

In some instances, the need for the hardware can be eliminated (by flattening slopes or removal of a fixed object for example). Contact the Region Traffic Engineer for guidance on evaluating the requirement for a barrier. Evaluate whether to remove, replace, or upgrade damaged hardware using the following guidance.

8-22 Standard Run of Barrier

The standard run of barrier is the majority of the barrier run. It includes all of the barrier except the terminals and transition sections. Because barrier designs evolve over time, consider upgrading the entire run using to the most recent standard barrier when a significant portion has been damaged. For minor repairs, upgrade the damaged portion of barrier to current standards (post spacing, block outs, etc.), unless it's determined not to be practical.

Document decisions in HATS to not upgrade hardware during a repair.

8-23 Terminals and Anchors

A guardrail anchor is required at the ends of a standard run of guardrail to develop its tensile strength throughout its length. In addition, when the end of any barrier is subject to head-on impacts, a crash worthy terminal is required. Guardrail anchorage may be provided as part of the terminal, as a connection to a rigid structure, or by an anchor whose only purpose is to strengthen the run.

Many different terminal designs have been used on Washington State highways, the most recent having been tested to MASH standards. Replace damaged terminals that cannot be repaired replaced MASH standard designs. Refer to the [Repair and Replacement of Guardrail Terminal](#) in the HATS File Library and search.

Common features of non-crash worthy designs are as follows:

- No cable anchor.
- A cable anchored into concrete in front of the first post.
- Second post not breakaway (CRT).
- Design A end section (Design C end sections are acceptable to be left in place).
- Beam guardrail on both sides of the posts (two sided).

A common terminal that was used on Washington State highways is the Breakaway Cable Terminal (BCT). These terminals included a Type 1 anchor and a parabolic flare that offset the end four feet from the tangent run of guardrail. Replace BCTs that have sustained damage, requiring replacement of one post or one rail section to a MASH compliant terminal.

When replacing a terminal consider the feasibility of extending the run to a cut slope where a buried terminal may be installed instead.

8-24 Transitions

Transitions are used to stiffen a system, such as w-beam guardrail before a more rigid barrier such as a bridge rail. Stiffening is accomplished by nesting the rail elements, using bigger posts and reducing the post spacing. The transitions that are currently used are shown in the [Standard Plans](#) beginning at C-25.20 and vary depending on the transition section type.

8-25 Impact Attenuators

Impact attenuators can be used as an end treatment for barriers or to prevent vehicles from impacting non-breakaway fixed objects. When installing or repairing an attenuator, document (in HATS) the brand, layout showing parts order numbers, module locations and weights, and provide photographs of the device.

Install MASH compliant attenuators in all new construction and full maintenance replacements of attenuators, except as indicated below. Manufacturers may limit site conditions, such as cross slope and curb height, in which their devices are allowed to be installed. Existing NCHRP 350 compliant attenuators may remain in place and repaired.

New NCHRP 350 attenuators are allowed where installation of a MASH compliant device is not feasible. Document the decision to use an NCHRP 350 device. Use the impact attenuator selection template in the HATS file library when selecting attenuators.

8-26 Maintenance

Replace and repair impact attenuators in accordance with the manufacturer's recommendations. Check for proper restraining cable tightness, anchor bolt tightness, diaphragm and hardware in good condition, and fender panels securely in place.

Sand barrel designs may be proprietary or generic.

Inspect proprietary designs according to manufacturer's guidance and/or specifications.

Inspect generic sand barrels as follows:

- Lids are firmly in place and not dented.
- No visible damage or cracks in the outer shell.

Each barrel is filled with the correct amount of dry sand or dry pea gravel. (See original specifications)

No visible moisture inside the barrels. If the sand is found to contain moisture, mix salt with the sand at a rate of 10 percent to 20 percent (by volume) to prevent freezing. Some sand may need to be discarded before adding the salt to prevent overfilling the barrel.

For water filled designs, replace damaged water cell units. A damaged cell may be left in place temporarily as long as it's not leakage.

8-27 Islands

Islands must be properly maintained to provide protection of motorists and pedestrians. Keep island passageways clear of debris. Repaint outlines of islands as directed by the Regional Traffic Engineer. Replace missing or damaged raised pavement markers when more than three consecutive markers are missing.

Displaced or missing raised curb must be repositioned or replaced. Paint raised curb as directed by the Regional Traffic Engineer.

8-28 Transit Vehicle Stop Zones

8-28.1 Maintenance

Transit stops along state highways outside cities are maintained by the state. These locations should be kept free of debris, potholes and other obstacles that could cause tripping. The responsibility for maintaining transit stops on state highways inside cities is covered in the agreement discussed in the Traffic Manual's transit vehicle stop zone guidelines. An inventory of transit stops is available at the Regional Traffic Office.

9-1 General

All electrical systems require regularly scheduled maintenance in addition to non-scheduled maintenance caused by unpredictable events such as storms, accidents, and equipment failure. The intent of periodic maintenance is to keep the system operating correctly and effectively for the longest possible service lifetime. All maintenance activities shall be documented in the Signal Maintenance Management System (SIMMS) for all equipment tracked in SIMMS.

Certain maintenance activities are common to all systems, regardless of type. These activities should always be performed on the cycle applicable for the system. These activities are defined as follows:

9-2 Wiring and Connection Maintenance

- Clean conductors, terminals, and connectors of all corrosion.
- Tighten terminals and connectors including breaker, transformer, and contactor connectors.
- Check the equipment grounding system, including conduit end bushing connections, bonds, equipment grounding conductors, enclosure grounding connections, and pole grounding connections.
- Check the grounding electrode, grounding electrode conductor, and associated connections.
- Check conductor insulation for damage, and repair if necessary.
- Replace deteriorated or missing conductor and terminal identification markings.
- Reference [Standard Specification](#) 8-20.3(5), 8-20.3(8), 8-20.3(9), and Standard Plan J-60.05.

9-3 Enclosure Maintenance

- Clean enclosure inside and out.
- Repair corroded surfaces, fasteners, and anchor bolts.
- Lubricate lock, latch assembly, and hinges.
- Check door gaskets and base seals.
- Clean vent filter and replace if necessary.
- Clean drain hole.

9-4 Documentation

- Note all checks and repairs that are performed.
- Note major repairs that are required.

9-5 Dynamic (Variable) Message Sign Systems

- Observe operation.
- Lubricate hinges and check springs.
- Clean sign face.
- Relamp bulb matrix signs.
- Spot-paint sign lamp visors, sunscreen, and background, where necessary.
- Clean legend on disk signs.
- Verify network connectivity and remote operation.

9-6 Drain Pump Systems

- Check pump pit for water.
- Check water pipes for corrosion.
- Clean sump.
- Check high water alarm.
- Test pump and lubricate.
- Check heater and thermostat.

9-7 Gate and Barrier Systems

9-7.1 *Minor*

- Check relays, test switch, and limit switches.
- Operate per instructions and check all moving parts.

9-7.2 *Major*

- Check relays, test switch, and limit switches.
- Operate per instructions and check all moving parts.
- Clean gate surface.
- Tighten all mechanical connections.
- Lubricate shear pins, bull gear, and shaft.
- Check transmission level.
- Check collars.
- Check brake.
- Check heater.
- Remove flash guards and inspect.

9-8 Flashing Beacon Systems (Includes Intersection Control Beacons)

- Check flasher assembly.
- Spot-paint deteriorated areas of visor, head, and mount.
- Check signal mounting.
- Check signal supports.
- Check vertical clearance (16' - 6" minimum for overhead locations).

LED displays:

- Clean lens.
- Replace LED optical unit every 15 years.

Incandescent displays:

- Relamp or replace with LED optical unit.
- Clean lens and reflector.

9-9 Illumination Systems

9-9.1 Roadway Illumination Systems

- Check fusing in pole base (*Standard Specification* Section 9-29.10).
- Check bolt torque on slip bases.
- Check slip bases clear of debris.
- Document any slip bases without required grading (see Standard Plan J-28.22)
- Check if conductors are secured on breakaway base installations at adjacent junction boxes (Standard Plan J-28.70).
- Replace damaged or missing pole identification markings.
- Check junction boxes, adjust if necessary.

LED luminaires:

- Clean LED array/lens cover.
- Check shields when present.
- Replace luminaire every 15 years.

HID luminaires:

- Relamp every 4 years or replace with LED luminaire.
- Clean reflector and refractor.

9-9.2 Sign Lighting Systems

Contact HQ Traffic Office before planning work on Sign Lighting Systems.

- Relamp.
- Clean reflector and refractor.
- Check support mountings.
- Check fusing.

9-10 Services

- Check photocell.
- Check timers.
- Check contactors.
- Replace deteriorated or missing arc flash hazard warning label.
- Replace deteriorated or missing service, circuit, and wiring identification markings.
- Check control transformer on 480 volt services.
- Check test switch.
- Check heater and thermostat.

9-11 Signal Systems

(Includes traffic signal systems, reversible lane signals, emergency vehicle signals, data accumulator stations, and ramp meter signals.)

9-11.1 Vehicle Detection Systems

- Check detector operation by observing traffic and display panel indicators.
- Check loops and repair if required (See Standard Plans J-50.05 through J-50.30).
- Megger test loop circuits and record.
- Clean and verify proper operation of emergency vehicle preemption (EVP) detectors.

9-11.2 Vehicle Display Systems

- Spot-paint steel mounting brackets. Aluminum or bronze mountings will not require painting.
- Check mountings for wear and tightness.
- Check tether cable assemblies.
- Check seals on aerial junction boxes.
- Check vertical clearance (16' - 6" minimum for overhead displays).
- Check signal supports, messenger cable connections, and back guys.
- Replace missing cable ties on span wire systems.
- Adjust junction boxes, replace missing or damaged lids.

LED displays:

- Clean lens.
- Replace LED optical unit every 15 years.

Incandescent displays:

- Relamp or replace with LED optical unit.
- Clean lens and reflector.

9-11.3 *Pedestrian Detection and Display System*

- Check all buttons for operation. Verify Accessible Pedestrian Signal (APS) speech messages.
- Replace damaged buttons and/or signs (Standard Plan J-20.26).
- Remove neon grid displays and replace with LED displays.
- Spot-paint housings and mounting brackets as required.

LED displays:

- Clean lens.
- Verify proper countdown timer operation.
- Replace LED optical unit every 15 years.

Incandescent displays:

- Clean lens and reflector.
- Relamp

9-11.4 *Signal Control Systems*

- Observe controller timing functions.
- Check load switches.
- Check display panel, replace burned out indicator lights.
- Check coordination and communication equipment.
- Verify network connectivity and remote operation/access.
- Check cabinet seal, locks, hinges, ventilation, lighting, etc.
- Replace filter(s).

Major:

- Check all cabinet wiring, terminals, and associated markings/labels.
- Test conflict monitor/replace conflict monitor programming card/key.

9-12 Sprinkler Systems

- Cycle controller on 5 minute cycle.
- Check solenoids.
- Adjust junction boxes.

9-13 Camera (CCTV) Systems

- Lubricate mounting assembly.
- Check operation.
- Remove camera and shop-test.
- Verify network connectivity and remote operation.

10-1 Right of Way Fences

Fencing is provided to discourage encroachment onto highway rights of way. Fencing on a controlled access highway is usually owned and maintained by the state while fencing on non-controlled access highways is normally owned and maintained by the abutting property owner. Questions regarding maintenance responsibilities of a given section of fence should be resolved by the Area Superintendent.

10-2 Road Approaches – General

10-2.1 *Access Management – General*

There are two types of state highways when it comes to Access Management. **Limited Access Highways** and **Managed Access Highways**. Any highway that is not a Limited Access Highway is a Managed Access Highway. WSDOT controls access on all limited access state highways, and only controls access on Managed Access state highways that are outside the incorporated limits of a City or Town. Cities and Towns are the access permitting authority on Managed Access state highways within their incorporated City or Town limits.

Limited Access Highways - are highways in which the rights of access have been purchased by WSDOT from the adjacent property owner. There are three types of limited access control – full, partial, and modified. Full control is usually found on a freeway and allows no access except at interchanges, or in some cases at-grade intersections. Partial control allows no commercial accesses, but does allow residential, logging, and farm accesses. Farm accesses may not be used for retail uses, such as having a farm produce stand. Modified control allows whatever the local zoning allows, such as commercial uses. Access Connection Permits are not issued on limited access highways. General Permits may be issued to allow for the construction or modification of an access on a limited access highway if the access right already exists, such as in a Warranty Deed for the property. For more information on Limited Access Highways see Chapter 530, Limited Access Control in the WSDOT *Design Manual* M 22-01.

Managed Access Highways - are highways in which access is regulated. There are five classes of Managed Access Highways. Class 1 is the most restrictive down to Class 5 the least restrictive. WSDOT is the access permitting authority for Managed Access state highways outside of an incorporated city or town. All new access connections must be permitted by a regional or area office. Grandfathered access connections are access connections to the state highway which were in existence *and in active use* with the type of connection on July 1, 1990 do not require the issuance of a permit and may continue to provide access to the highway system. The access connection permit stipulates the conditions of the access footprint, such as width, turn radii, culvert sizing and type of surface (HMA or gravel) along with the specific location of the access to ensure adequate sight distance. The permit holder is responsible for maintenance of the access between the edge of pavement and the property line, including any culverts. If new or existing

access construction activities are noticed, the Area Superintendent should be notified to ensure the access is permitted. The fee charged by WSDOT to cover the administrative cost of an access connection permit is listed on DOT form 224-694 by category of connection to the adjacent highway. The involvement of the regional area personnel will vary with the type of access. For more information on Managed Access Highways see Chapter 540, Managed Access Control in the WSDOT *Design Manual M 22-01*.

A good source for more information on Access Management is your Region's Development Services Office.

10-3 Typical Maintenance Responsibilities in Cities

Maintenance on city streets may become complicated, depending on the type of installation. In accordance with [RCW 47.24](#) and [WAC 468-18-050](#), cities with a population greater than 27,500 have different requirements for some types of maintenance than do cities with a population less than 27,500. In general, the city or town is responsible for any portion of the facility beyond the curbs. If no curb is installed, the city or town's responsibility begins at the shoulder edge.

The guidelines in Appendix 1 are designed to clearly identify typical maintenance responsibilities, as determined by statute, agreement, or policy, on city streets that are certified as part of a non-controlled access state highway route. They are general in nature and do not preclude WSDOT and individual cities from entering into agreements to address particular circumstances.

The state has full maintenance responsibility for bridges conveying a State Route or Interstate traffic in a limited access corridor (unless otherwise covered under a separate agreement).

10-4 Maintenance Yards

All maintenance yards are to be kept in a neat, clean, and orderly condition. All buildings are to be kept in good repair, inside and out, and are to be repaired when necessary. Repairs to Maintenance facilities should be coordinated with Facilities for needed repairs for funding and environmental purposes. All buildings and yards are to be kept locked when not occupied by responsible personnel .

Truck sheds are to be kept clean of debris and free from fire hazards. Gasoline and other highly flammable materials should not be stored in buildings where trucks or equipment are stored. Oily rags should be kept in metal containers. If more than 25 gallons of flammable or combustible liquids are used, then the approved containers should be stored in a flammable liquids storage cabinet.

Materials and supplies are to be stored in an orderly manner and an inventory is to be kept of all materials and supplies on hand.

Hazardous wastes i.e. (solvent contaminated rags, methyl methacrylate wastes, and paint residues) are to be placed in proper containers, closed except when adding or removing waste, labeled with a yellow "Hazardous Waste" label and the nature of the hazard (toxic, corrosive, flammable, etc) and disposed of properly within (90) days. Free, printable labels

are available from <https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Dangerous-waste-guidance/Dangerous-waste-basics/Label-dangerous-waste/Print-free-labels>.

10-5 Stockpile Sites

Stockpile sites are to be cleared of all vegetation, trees, brush, rocks, or other debris, and a uniform ground surface is prepared prior to depositing stockpile material. The site chosen should attempt to minimize visual impact, especially in urban areas. Stockpiles are to be constructed in a neat and regular shape, that can occupy as small an area as practical while still being, accessible for loading material onto trucks without obstructing the highway. Stockpiles are built up in layers. Plank runways are required for operating trucks on stockpiles where there is danger of tracking dirt or other foreign matter onto the material.

Signs that identify the material as state property should be placed at each stockpile.

Sites where materials are stockpiled year-round or for a considerable period of time should be fenced with signs placed along the fence line identifying the site as state property and the gates kept locked.

Stockpiles should periodically be inspected for vegetation growth, which should be removed, and be on the alert against any removal of materials by unauthorized persons. The inspection should also note potential storm water impacts off-site and corrections should be made as appropriate.

Material used by state forces is to be promptly charged out and reported to the area office. Excessive amounts of materials should not be allowed to accumulate in stockpile sites. If use of stockpiled materials is not anticipated, the area office should be notified so the material can be declared surplus.

10-6 Materials From State Quarries or Pits

Materials produced or manufactured in state-owned or leased pits or quarries may not be sold, or otherwise disposed of, to private individuals or concerns.

Counties and cities or other governmental agencies may participate by having their requirements included in the state's crushing contract, with proper financial arrangements. It is the state's policy to assist other governmental agencies in need of small quantities of crushed rock by selling them material from existing stockpiles at current inventory prices if the material can be spared.

When quarry or pit sites are obtained from the Department of Natural Resources, the material is to be used for state highway construction or maintenance, or by other approved public agencies. Notify the area office when material from such pits and quarries is used.

Ecology storm water permits are required at pits and quarries where aggregate is being mined or crushing operations are taking place. Contact the regional Environmental Office for information.

10-7 Procurement of Materials

Materials necessary for highway maintenance are generally available from the inventory of materials in stores. Stores should be checked well in advance of need, if possible, to help ensure that materials will be available when required. Materials not available must be purchased by personnel in the area or region office. This purchasing process can take weeks or even months for certain materials. Therefore, it is imperative to plan ahead whenever possible.

10-8 Material Specifications – General

It is WSDOT policy that all materials used by state forces to repair or reconstruct highway facilities and buildings conform to the specifications adopted for like material in new construction whenever possible.

Specifications are necessary to ensure that the department receives the quality of material required for the intended use, and to permit vendors to quote prices on an equal basis. It is difficult to dispute the quality of any material received if the original order did not explicitly define what was expected. There is a reason for a particular design, mix, formula, type, or dimension being specified. Good workmanship will not counteract the effects of the use of inferior material, material intended for another purpose, or material that would be adequate only under different conditions. Therefore, it is imperative that maintenance personnel recognize the importance of specifications.

10-9 Disposal of Surplus Items

10-9.1 *Equipment*

If a crew determines that a piece of equipment is no longer needed or is no longer functional they should advise the superintendent or supervisor, providing information on needed repairs, problems, and future needs. This should be done to facilitate the decision on whether to transfer the equipment or dispose of it. A crew is charged for equipment even if it is not being used; therefore, it is important to be sure the equipment is necessary and operable.

For Dump Trucks, AVL modems that were once owned by Maintenance, would follow the Transfer procedure. These modems are now a part of the TEF in-service package and captured in the rental rate for the category of equipment they are placed in. Moving forward, in the case of dump trucks, WSDOT would follow the “PUTTING A NEW UNIT INTO SERVICE THAT IS EQUIPPED WITH AN AVL MODEM” and after its life cycle end, the “DISPOSAL OF AN AVL MODEM” Processes.

For Incident Response, AVL modems are non-TEF. Moving forward, for the foreseeable future, they will continue to follow the “TRANSFERRING AN AVL MODEM (from one vehicle to another)” Process.

10-9.2 *Inventoried Items*

If it is determined to dispose of an article that is carried on an inventory, the region office should be provided with a description of the article, its inventory number, and a statement of its condition. Generally, requests for replacements, with any necessary justification, should accompany the recommendations for disposal.

10-9.3 *Non-Inventoried Items*

Non-inventoried items with potential trade-in or resale value may be declared surplus and turned in to the area office. Disposal of all items will be in accordance with the *Disposal of Personal Property Manual M 72-91*.

10-10 Instructions for Radio Operation

Radio operation techniques primarily comes from on the job training working with supervisors, WSP, Traffic Management Center (TMC), and Incident Response Team (IRT). WSDOT is working to update the Statewide guidelines for IRT Standard Operating Guidelines (SOG) and protocols on radio systems and radio procedures.

10-11 Work Scheduling and Reporting

The previous sections of this manual were directed at specific maintenance activities. This section briefly discusses the overarching budget, plan, and reporting of all the activities. Since procedures change and various district policies vary, details for these processes are not included. The basic principles, however, will remain the same.

10-12 Budget

Maintenance Operations is an operating program where the budget and work accomplishments are on a biennial cycle (2 years). The biennium begins on July 1 of every odd-numbered year. Prior to the beginning of the biennium, the legislature allocates a specific amount of funding (appropriation) directly for maintenance. HQ allocates these funds by region and subprogram, while the region determines the area and activity breakout. The department also determines the statewide level of service (LOS) that can be provided for each of the thirty six activities identified in the Maintenance Accountability Process (MAP) given the funding level allocated. Due to the somewhat unpredictable nature of the work and all the factors that may affect our ability to deliver the work, planning for these funds can be difficult. However, a budget is required in order to responsibly manage our \$520 million program and tell the maintenance story. It is important to remember the budget plan is “anticipated” work and that actual work will not exactly match the plan. Given this, the basis for the budget is calculated by the number of employees, equipment, and materials needed to accomplish the work.

By state law, units within the department may not overspend their budgets. Supervisors should be notified if budget problems begin to arise.

10-13 Scheduling

Throughout the biennium, supervisory personnel must have one eye on the work to be done and one eye on the budget. To ensure that the most important work is accomplished within the budget limits, the biennial budget plan must be refined into a work plan for each month's activities. This enables coordination of materials and equipment availability with the work having the greatest priority for a given month. Consistent with that monthly plan, Supervisors prepare a daily plan of specific work assignments for the upcoming week. The daily plan should recognize the priority items addressed in the monthly plan, but also be adapted to fit current weather conditions, unexpected events, employee absences, equipment breakdowns, etc. This is the backbone of good management and alerts all employees of the following day's activity so they can make proper preparation and wear proper clothing.

10-14 Reporting

The requirement to report what was accomplished in a day, by whom, and with what equipment and materials can easily be viewed in the field as relatively unimportant. However, this is the basis for obtaining additional funding and telling the maintenance story. Without accurate data on what work is actually being done, it is impossible to properly discuss and identify the growing needs of the department and the true costs to deliver. Supervisory personnel should always encourage accurate reporting and review data for compliance

10-15 Environmental Sensitivity

Maintenance is WSDOT's most visible activity with respect to environmental consequences. Painting, sanding, anti-icing, herbicide application, mowing and brush control, landscaping, and maintaining drainage are activities that can raise environmental objections. All material handling can have environmental safety implications for our employees and the general public. Environmental, health and safety issues are being addressed through an education and training program provided by Headquarters.

11-1 General/Introduction

Maintenance operations staff are major stakeholders as they utilize, maintain and operate the facilities/assets that are designed and constructed throughout the lifecycle of the assets. They also have a personal connection and vested interest as they live in the communities they serve.

Given the nature and cost of maintaining assets throughout their lifecycle, as well as the inherent exposure to staff during maintenance and operational activities, it is important for designers to consider maintenance and operations staff as major stakeholders in every project.

11-2 Maintenance and Preservation Roles

Maintenance considerations should be included early in the design process, capitalizing on the intimate knowledge the crews have from being the “boots on the ground” experts that maintain and care for the highway infrastructure throughout its lifecycle.

- Maintenance describes work that is performed to maintain the condition of the transportation system or to respond to specific conditions or events that restore the highway system to a functional state of operation. Maintenance is a critical component of an agencies asset management plan that is comprised of both routine and preventive maintenance. Preventive maintenance is a pro-active cost-effective means of extending service life.
- Preservation consists of work that is planned and performed to improve or sustain the condition of the transportation facility in a state of good repair. Preservation activities generally do not add capacity or structural value, but do restore the overall condition of the transportation facility.

Organizational roles are key when communicating within the department. As it is with Engineering, Maintenance has multiple specialty groups, each with focused expertise and specific needs that are relevant to different highway assets and projects. When Regional Area offices are involved with reviewing a project, Maintenance should extend the communication past the superintendents and supervisors. All crews should be contacted as knowledge of regional area highways is spread across all groups:

- Traffic Operations
- Bridge Crews
- Signal Crews
- Striping Crews

11-3 Communication and Coordination

Maintenance has knowledge that is key to the fundamental components of plan development. The historical, systematic, and problematic areas and assets that exist on WSDOT routes are maintained by regional area crews. They have the knowledge of the day to day tasks necessary to sustain our highway infrastructure.

The following questions are covered in *Design Manual Chapter 301* (DM 301), which is a critical chapter to Maintenance that cannot be overlooked:

- Who are you communicating with?
- What methods of communication are being used?
- What is being communicated?
- How are you responding to communication?
- Where is the communication taking place?
- When does the communication need to occur to maximize effectiveness?
- Is the roadway experiencing any reoccurring maintenance issues?
- Are there drainage concerns?
- What other problems are present that may not be known?

All these are questions that the Regional Area and Maintenance Operations crews have intimate knowledge of, and live every day while at work.

The earlier Maintenance is heard the better for the designer to work in concerns and issues important to maintaining the highway infrastructure. Engage design staff early in the project design phase (prior to 30% design) to communicate maintenance issues potentially impacted or addressed by the project, and to establish expectations with respect to maintenance staff involvement through the entire design process. Review the project management plan (where available), and provide input on how region maintenance staff intend to get involved during the design phase. Contact region program management regularly to identify projects that will be scoped soon, and work with project scoping staff to determine how best to engage projects of interest.

11-4 Practical Solutions for Practical Decision Making

Practical Decision Making is an approach that considers each situation, aligns with a financially constrained budget environment, and encourages incremental, flexible, and sustainable investments by focusing on identified performance needs and engaging stakeholders at the right time.

In the case of Design and Maintenance coordination, Practical Decision Making aligns with the department's intention to deliver a scalable approach to the design delivery process that integrates across all divisions, including Operations and Maintenance, Environmental, Planning, and Engineering. It also assumes an approach to program investments that incorporates asset management and lifecycle costs that inform identification of performance measures and goals on a project level, as well as department wide.

Practical decision making occurs every day in the life of Maintenance personnel, from the amount of salt applied to the roadway, bridge deck patching, pavement repair, materials and equipment used; basically all actions in a given day.

11-5 Asset Management

Asset management is a strategic, risk-based approach to cost-effectively and efficiently manage the assets of Washington's transportation system. WSDOT uses transportation investment strategies to preserve and maintain the system on an ongoing systematic basis. Preserving the state's transportation assets saves money while maximizing performance across the transportation network. WSDOT considers asset management a key component of Practical Solutions, as a way to cost-effectively manage the assets of the transportation system.

Maintenance operations staff will need to maintain the assets placed or retained within a project location. It is important to make design aware of the various asset management systems:

- Maintenance Management System (HATS)
- Signal Maintenance Management System (SIMMS)
- Maintenance Productivity Enhancement Tool (MPET)
- Traffic Sign Management System (TSMS)

The asset management system reviews are necessary to confirm:

- Asset management and life cycle costs
 - How maintenance costs drive life cycle costs
 - If construction does not account for maintenance costs then life cycle costs are driven up

Asset Information should be compiled into an owner's manual for maintenance to reference (see DM 301.03(2)(e).

11-6 Design and Build for Maintainability

When reviewing a scoping or design project, maintenance needs to provide designers an understanding of the full life cycle costs for maintaining different assets/features.

Maintenance needs to communicate with design the following issues:

- The frequency of maintaining the asset
- Labor costs
- Material costs
- Traffic control costs
- Utility costs
- Accessibility
- Equipment Considerations:
 - cost to repair if equipment owned, rental costs
 - purchase cost of new equipment needed specifically for specialty designs
 - Cost of procuring replacement parts for the asset

Maintenance needs to attend or participate with program management and design meetings from the planning stage and scoping, all the way through to the pre-contract review or 90% of PS&E development. The expectation should be documented in the project management plan.

Document and record all concerns and recommendations Maintenance has with projects. Examples of checklists and input can be found in [DM 301](#) - Exhibits 301-1 through 301-3.

Maintenance needs to be part of the solution, engagement with boots on the ground, even if all things Maintenance would like to see done cannot be completed.

Design deliverables expectation matrix covers the level of coordination needed between design, maintenance, and construction. The matrix exhibits maintenance at different phases of construction, with maintenance activities like snow and ice, veg. management, etc.

**Deliverables Expectations Matrix on the Project management website provide the link – www.wsdot.wa.gov/construction-planning/project-management/online-guide/home

11-7 Examples of Maintenance Challenges

- Construction of a high mast lighting on SR 405 and Maintenance not having the man lifts to complete PM's or repairs, 100' mast height installed instead of 75'.
- Operational Right of Way
 - Reducing shoulders- reduction of a 6-8 foot shoulder to 4 foot- goes from being able to pull over and maintain assets vs. full traffic control to complete maintenance work
 - Maintaining accessibility to assets- being able to get to storm water pond, electrical service, cable barrier, etc.

See Below- Picture of the round about what should be used to implement solutions to reduce asset life cycle costs.



Roundabout with Landscape –increases lifecycle/maintenance costs.

Solutions are often available to reduce asset life cycle costs. For example, in the case of this roundabout, the most practical landscaping solution was to have the center areas hardscaped, rather than planted with non-native species which usually require ongoing and labor intensive maintenance. However, hardscapes can also attract weedy species that may not be desirable to the local community, and degrade the visual quality, resulting in the need for regular and long term application of herbicides. In that case, there are other options that can mitigate long term maintenance. In urban locations for example, project offices may negotiate a Maintenance Agreement with the local jurisdiction establishing their commitment to planned maintenance tasks and timing. In the case of rural locations where WSDOT is expected to maintain the area, planting low-maintenance vegetation may be another option.



Roundabout with hardscape- reduces life cycle/maintenance costs.

**CONFORMED AGREEMENT
INCORPORATED REVISIONS PER AMENDMENT
DATED:
APRIL 2, 2013
FOR REFERENCE**

**CITY STREETS
AS PART OF
STATE HIGHWAYS
GUIDELINES REACHED
BY THE
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
AND THE
ASSOCIATION OF WASHINGTON CITIES
ON THE INTERPRETATION OF SELECTED TOPICS
OF RCW 47.24 AND FIGURES OF WAC 468-18-050 FOR THE
CONSTRUCTION, OPERATIONS AND MAINTENANCE RESPONSIBILITIES OF
WSDOT AND CITIES FOR SUCH STREETS
April 30, 1997**

These guidelines are primarily intended for city streets designated as state highways and provide an outline for development of agreements within limited access. The jurisdiction, control, and duty of the state and city or town for city streets that are a part of state highways is specified in RCW 47.24.020; however, the implementing WAC'S, directives and manuals have been subject to interpretation. This report documents agreed upon guidelines that have been reached by the Washington State Department of Transportation (State) and the Association of Washington Cities (AWC) on the interpretation of construction, operations and maintenance responsibilities of the state and cities for such city streets.

These agreed upon Guidelines are derived from:

- The draft Task Force Report on City Streets as Part of State Highway.
- Additional discussions by the State, AWC and several cities on the interpretation of state versus local agency maintenance responsibilities that are illustrated in figures contained in WAC 468-18-050 and on other maintenance responsibilities for city streets that are part of state highways.

These Guidelines are designed to facilitate the allocation of maintenance responsibilities between the State and Washington Cities pursuant to RCW 47.24. The Guidelines of this report are general in nature and are not intended to reflect past practices but to apply to future practices.

While these guidelines do not expressly cover project development and/or capital improvement projects it was duly noted that there are areas which carry the potential to influence project development activities within the guideline. The Task Force actively encourages and recommends early communications between city and state officials where city streets are included as part of a state highway improvement project.

These agreed upon Guidelines will be incorporated in state manuals and related guidance for maintenance, operations, and construction activities. AWC will distribute copies of this report to their members.

These guidelines do not supersede existing agreements entered into by any individual city and the state.

AGREED UPON GUIDELINES

The agreed upon Guidelines of state and city responsibilities for city streets that are part of state highways are contained in the following tables:

- Table 1, City/State Maintenance Responsibilities for City Streets as Part of the State Highway System.
- Table 2, City/State Maintenance Responsibilities for Structures on City Streets as Part of the State Highway System (This table provides an interpretation of the figures of WAC 468-18-050).
- Table 3, State Owned Bridges That Convey City Traffic Over State Highways (This table provides an interpretation of the figures of WAC 468-18-050).

The following is an explanation of selected items of the above tables that are related to specific sections of RCW 47.24 and to WAC 468-18-050:

A) Guardrail (Barriers) Maintenance

Background: RCW 47.24.020(2) states that "The city or town shall exercise full responsibility for and control over any such street beyond the curbs and if no curb is installed, beyond that portion of the highway used for highway purposes (edge of paved shoulder)." The statement "...used for highway purposes ..." has led to differing interpretations of state and local agency responsibilities for the maintenance of guardrail.

Agreed Upon Guideline: Traffic barriers installed on state highways in areas without curb shall be maintained by the state. Traffic barriers installed beyond the curb shall be maintained by the cities. Curb in the context of RCW 47.24.020(2) refers to a standard curb and gutter and not to extruded curb such as those placed on fill sections for erosion control. Guardrail, concrete barriers, impact attenuators and similar devices are all considered to be traffic barriers.

B) Parallel Ditches and Cross Culverts

Background: The issue is clarification of what is meant by the RCW 47.24.020(2) statement "...for highway purposes ..." for use in interpreting responsibilities of the state and local agencies for maintenance of parallel ditches and cross culverts. Also at issue is responsibility for grass lined swale construction for water treatment purposes as compared to a ditch solely for drainage purpose. In addition a distinction needs to be made between cross culverts related to streams and maintaining natural flows as opposed to those constructed for storm drainage.

Agreed Upon Guideline: Within all cities, regardless of population, the state shall solely maintain the structural integrity of box culverts, multiplates and individual culverts greater than 60 inches in width that are within rights of way and are not part of an enclosed drainage system. These are the size appropriate to identify natural stream flows. These structures that are 60 inches or less in width will be maintained by

the cities. Cities shall maintain all other parallel roadside ditches and road approach culverts. Grass-lined swales constructed by the state solely for state highway runoff will be maintained by the state.

C) Betterments - Pavement Markings

Background: RCW 47.24.020(13) provides that cities and towns having a population greater than 25,000 are responsible to install, maintain, operate and control all traffic control devices. This has been interpreted to mean that the city or town must replace pavement markings and similar devices when a street is resurfaced (e.g., these markings are not included in the project costs). The issue is that a state project may destroy very recently installed pavement markings that, especially if they are durable markings (e.g., thermoplastic, raised pavement markers, etc.), involve expense to the city. The cities recommend that in-kind replacement of these markings be a part of the project costs.

Agreed Upon Guideline: As a part of State reconstruction/resurfacing projects the State will replace in-kind at no cost to the local agency only pavement markings that are damaged or removed as a result of the reconstruction or resurfacing project. This does not apply to durable pavement markings that have exceeded their useful life. The incremental additional cost for installation of higher quality pavement markings will be at the expense of the city.

Early communication and plan reviews between the state and the city is essential to enable local agencies to avoid installation of pavement markings, especially the more durable markings, shortly before the construction activity takes place.

D) Snow and Ice Removal

Background: At issue is the meaning of the phrase in RCW 47.24.020(6) that states "...except that the state shall when necessary plow the snow on the roadway." This statute states that the city or town, at its expense, is responsible for snow removal. The meaning of "when necessary" and responsibility of snow plowing versus snow removal needed clarification.

Agreed Upon Guideline: RCW 47.24.020(6) provides that the cities have responsibility for snow removal within their jurisdiction and that the State shall, when necessary, plow the snow on the roadway. The meaning of "when necessary" is that the State will plow snow, with city concurrence, on the traveled lane of the state highway on the way through the cities not having adequate snow plowing equipment. Cities must contact the state before using chemicals on structures.

E) Interchanges

Background: WAC 468-18-050(2). The construction of partially and fully controlled limited access freeways or similarly designed state highways through cities and towns is becoming more frequent. The construction of cloverleaf and other types of interchanges makes it difficult to determine exactly which features of the interchange constitute the "street intersection" for which responsibility is established by law.

Agreed Upon Guideline: For maintenance responsibilities at interchanges the state and the city are to develop an agreement as required by WAC 468-18-050(3) "After the access plan for any partial, or fully controlled limited access highway has been approved by a city or town, the state and city authorities shall negotiate an agreement establishing responsibility for construction and maintenance of the various

features of each interchange. To illustrate the basic principles of these responsibilities and to serve as a guide in such negotiations, the attached sketches of typical intersections and interchanges are hereby made a part of this policy. The scope of this policy does not include the roadside areas enclosed in the loops or ramps of an interchange or the slopes of cuts and fills, responsibility for which is more clearly defined by statute".

F) General Statements

Background: At issue is that cities often prefer roadside and traffic Control Devices that would be the result of a state standard installation to be more esthetically pleasing. This adds additional cost to the item rather than using state standards.

Agreed Upon Guideline: The state is responsible for the basic cost including replacement. The cities are responsible for any incremental costs over the state basic costs. Such as, the city is responsible for any incremental cost for any finish on signal poles and all other poles that is above the state standard galvanized finish.

Background: Due to the unique nature and circumstances surrounding state system highway improvements with respect to cities and local jurisdictions, the intent of this Memorandum of Understanding (MOU) is to serve as a guideline in identifying maintenance responsibilities not addressed elsewhere in the RCWs or WACs.

Agreed Upon Guideline: Nothing in these guidelines precludes a city or local jurisdiction from entering into an agreement with the state on issues specific in nature that may not fit within these guidelines. Early and continuous communications throughout the project development process will help to assure both parties jointly develop clear understanding and expectations with respect to future maintenance responsibilities.

**Table 1
City/State Maintenance Responsibilities For City Streets As Part Of The State Highway System**

Maintenance Item	Cities Over 25,000	Cities Under 25,000
Roadway Surface: The durable surface material laid down on an area intended to sustain vehicular or foot traffic.	State	State
Roadway Shoulders: The Reserved areas by the verge of a road, generally kept clear of all traffic.	State	State
Sidewalks:	City See Note [11]	City See Note [11]
Crosswalks: Is a designated point on a road at which some means are employed to assist pedestrians wishing to cross.	City See Guideline [C]	State See Guideline [C]
Channelization: The separation or regulation of conflicting traffic movements into definite paths by means of pavement markings to facilitate the safe and orderly movement of both vehicles and pedestrians.	City See Guideline [C]	State See Guideline [C]
Striping: Road surface striping is used on paved roadways to provide guidance and information to drivers and pedestrians.	City See Guideline [C]	State See Guideline [C]
ADA Features: Curb Ramps, Landings and Truncated Domes.	City See Note [6]	City See Note [6]
Concrete Curb and Gutter.	State	State
Extruded Curb, Hot Mix Asphalt (HMA): Placed at the base of fill sections for erosion control.	See Note [8]	See Note [8]
Curb for Traffic Control (C-Curb): Considered as Channelization.	City	State
Curb Cast Integral to Sidewalk.	City	City
Roundabout Channelization: Pavement Markings and Striping.	City	State
Curbing within roundabouts: Anything used for channelization i.e. Splitter Islands.	State	State
Raised Medians: The portions of a divided street separating vehicular traffic traveling in opposite directions.	See Note [4]	See Note [4]
Bike Lanes: Dedicated lanes for the use of bicyclists.	City See Note [5]	State See Note [5]
Stability of Cut & Fill Slopes: Slope stability may be defined as the resistance of inclined surface to failure by sliding or collapsing.	City	State

Maintenance Item	Cities Over 25,000	Cities Under 25,000
Retaining Walls Behind Sidewalks: Used for slope stability.	See Note [10]	See Note [10]
Noise Walls.	See Note [13]	See Note [13]
Parallel Roadside Ditches: Ditches or drains running parallel with the roadway.	See Guideline [B]	See Guideline [B]
Road Approach Culverts: Culverts under approaches matching the ditch grade.	City	City
Cross Culverts: Devices used to channel water to allow water to pass underneath a roadway.	See Guideline [B]	See Guideline [B]
Permeable Pavement: Allows stormwater through the pavement structure into the underlying soil, mimicking the natural process of infiltration.	See Note [8]	See Note [8]
Directional Signs/Route Markers: Provide a system of information and directions needed to guide motorists and pedestrians, safely and efficiently.	See Note [9]	See Note [9]
Regulatory and Warning Signs: Inform road users of selected traffic laws or regulations and indicate the applicability of the legal requirements.	City	State
Stop Signs (at Intersecting Streets): When a sign is used to indicate that traffic is always required to stop.	City	State See Note [3]
Signals: Power-operated traffic control devices by which traffic is warned or directed to take some specific action.	City See Note [12]	State
Illumination: Street lighting.	See Note [2]	See Note [2]
Utility Franchises: Agreements between an agency and utility providers which allow the utilities to make use of agency streets and rights-of-way for the purposes of construction, operation and maintenance of their utility systems.	City	City
Underground Facilities: Per RCW 47.24.020	City	City
Street Cleaning: Regular removal of dirt and debris from curbed streets within the city limits.	City	City
Street Sweeping: Regular street cleaning using mechanical vehicles to reduce pollutants in stormwater runoff from street surfaces.	City	City
Snow and Ice Removal: For removing snow and sometimes ice from roadways.	City See Guideline [D]	City See Guideline [D]

Maintenance Item	Cities Over 25,000	Cities Under 25,000
Vegetation: Plants in general or the mass of plants growing in a particular place.	City	City
Noxious Weeds: Plants that are injurious to agricultural and/or horticultural crops, natural habitats and/or ecosystems, and/or humans or livestock.	City See Note [1]	City See Note [1]
R/W Encroachments: Obstructions which intrudes upon the land of another. The encroachment could be a fence, a driveway, or a building.	City	City
R/W Cleanup: Removal of debris, natural or manmade beyond the curbs and, if no curb is installed, beyond that portion of the highway used for highway purposes.	City	City
Public Art: An enhancement to a functional element, feature, or place within a transportation facility to provide visual interest.	City	City
Stamped or Decorative Concrete Pavement: A design placed in the top of the concrete to make it more esthetically pleasing.	City	City
Stamped or Decorative Asphalt Pavement: A design placed in the top of the asphalt to make it more esthetically pleasing.	City	City
Guardrail, Concrete Barrier, Impact Attenuators, Etc.: To protect vehicles from roadside hazards.	See Guideline [A]	See Guideline [A]

[1] RCW 47.24.020(2) states the city or town shall exercise full responsibility for and control over any such street beyond the curbs and, if no curb is installed, beyond that portion of the highway used for highway purposes (edge of paved shoulder) and, thus, are responsible for noxious weed control.

[2] The agency paying the power bills or per agreement has responsibility for maintenance. Per RCW 47.24.020(6) "The city or town at its own expense shall provide street illumination".

[3] The state, with city concurrence, may install stop signs and posts to the city's standards or may contract with the city to have them perform these installations.

[4] Landscaping, irrigation systems and any decorative items are the cities' responsibility. However curbs and any hard surface (not landscaped) are the responsibility of cities with a population over 25,000 and

state’s responsibility for cities with population under 25,000. State is responsible for the roadway from street curb to median curb and median curb to street curb, not street curb to street curb if there is a landscaped median. The cross sections note this.

[5] Pavement is the state’s responsibility. Striping and pavement markings are dependent on the population of the city. Populations fewer than 25,000 are the state’s responsibility and populations over 25,000 are the cities’ responsibility.

[6] City responsibility except when the state has a construction project in process.

[7] Will follow approach from existing guidance. Pavement and truck apron are traveled surface and will be considered pavement, state responsibility. All elements beyond the curb such as landscaping or decorative features are the city responsibility.

[8] This needs to be a negotiated agreement on a case by case basis.

[9] Directional signs for directing traffic to state routes and route markers are the responsibility of the state. Directional signs directing traffic to businesses, parking, no parking...are the responsibility of the cities.

[10] Retaining walls in cities with a population of more than 25,000 will be the responsibility of the city and the state’s responsibility in cities with a population of less than 25,000 if the wall is substitute for a slope.

[11] Maintenance by cities may be in accordance with applicable city codes and ordinances regarding sidewalk and right of way maintenance.

[12] Except in limited access where the state has responsibility.

[13] Maintenance will be by agreement on a case by case basis.

Table 2
City/State Maintenance Responsibilities For Structures On City Streets As Part Of The State Highway System

(This table provides an interpretation of the figures of WAC 468-18-050)

Maintenance Item	Cities Over 25,000	Cities Under 25,000
Structural Related Bridge Maintenance: Preservation of the structural and operational characteristics of all bridge structures to the originally constructed or subsequently modified conditions.	State	State
Bridge Condition Inspections: The condition inspection and evaluation of in-service bridges.	State	State
Concrete Patching and Concrete Resurfacing on concrete bridge decks.	State	State

Maintenance Item	Cities Over 25,000	Cities Under 25,000
Asphalt Patching and Asphalt Resurfacing on asphalt bridge decks.	State	State
Bridge Approach: Provides a transition between roadway pavement and the bridge.	State	State
Bridge Deck Joints: Allow thermal movement or control cracking.	State	State
Bridge Railing: A fence-like construction built at the outermost edge of the roadway or the sidewalk portion of a bridge to protect pedestrians and vehicles.	State	State
Bridge Drains/Drainage: Used to remove stormwater from the bridge deck.	City	State
Striping: Used on paved roadways to provide guidance and information to drivers and pedestrians.	City	State
Illumination: Bridge lighting.	City See Note [1]	City See Note [1]
Deck Sweeping: Keeping the deck free from debris and weeds.	City	City
Snow and Ice Removal: For removing snow and sometimes ice from roadways.	See Guideline [D]	See Guideline [D]
Guard Rail: A barrier designed to redirect errant vehicles from roadside hazards.	See Guideline [A]	See Guideline [A]
Graffiti on all Structures: Images or lettering scratched, scrawled, painted or marked in any manner on property.	City	City

[1] The State has responsibility for maintenance of illumination systems within fully access controlled areas. In addition, the State may, with city concurrence, maintain and operate luminaires at locations where the electrical service powers electrical equipment under both State and City responsibility.

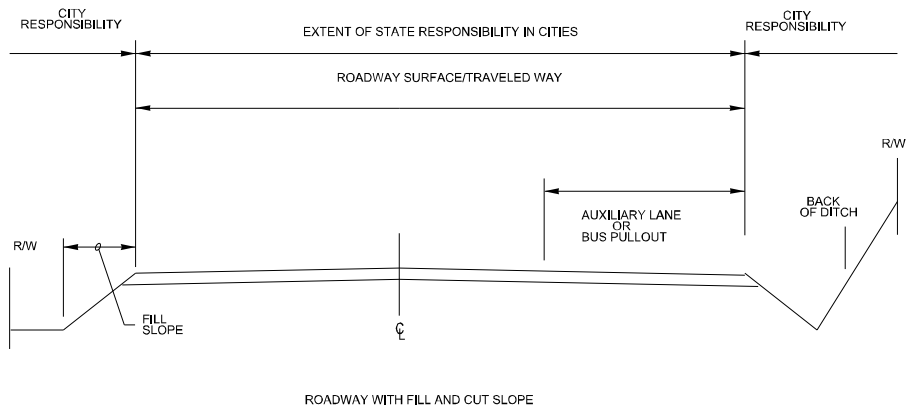
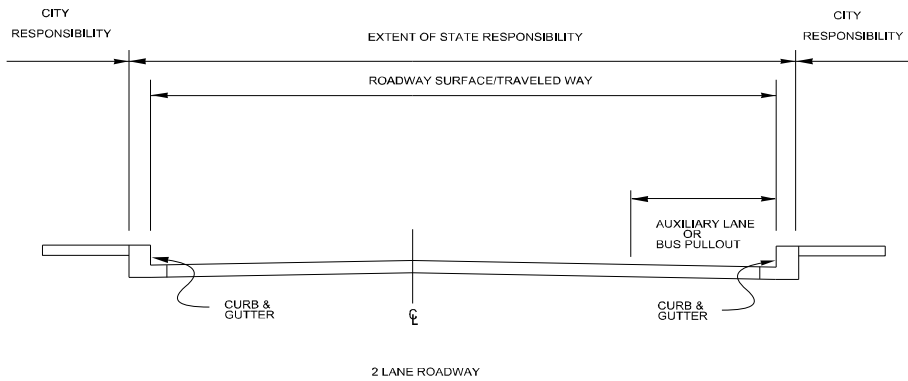
Table 3
State Owned Bridges That Convey City Traffic Over State Highways
 (This table provides an interpretation of the figures of WAC 468-18-050)

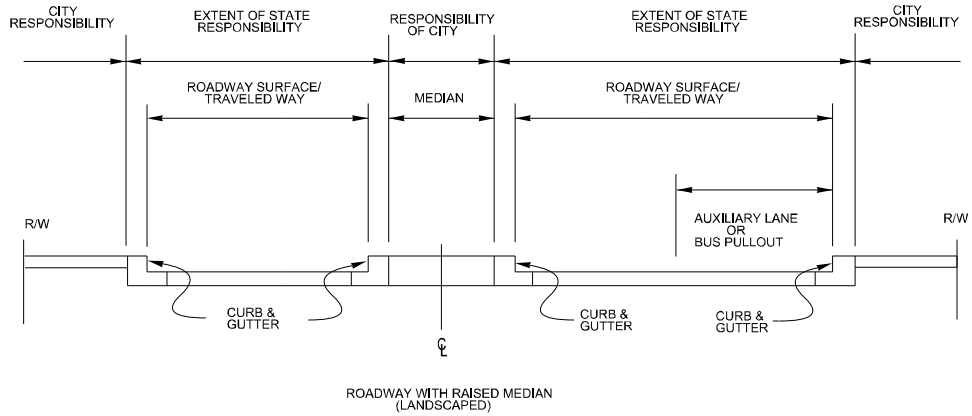
Maintenance Item	City/State
Structural Related Bridge Maintenance: Preservation of the structural and operational characteristics of all bridge structures to the originally constructed or subsequently modified conditions.	State
Bridge Condition Inspections: The condition inspection and evaluation of in-service bridges.	State

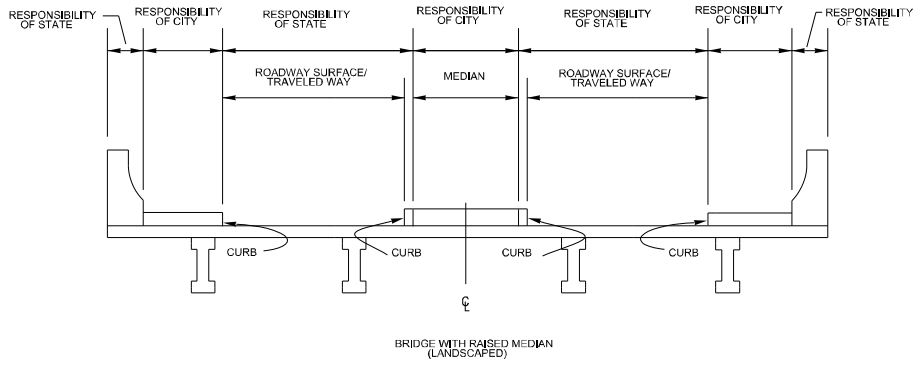
Maintenance Item	City/State
Concrete Patching and Concrete Resurfacing on concrete bridge decks.	State
Asphalt Patching and Asphalt Resurfacing on asphalt bridge decks.	City See Note [2]
Approach Slab: Provides a transition between roadway pavement and the bridge.	City See Note [1]
Bridge Deck Joints: Allow thermal movement or control cracking.	State
Bridge Railing: A fence-like construction built at the outermost edge of the roadway or the sidewalk portion of a bridge to protect pedestrians and vehicles.	State
Bridge Drains/Drainage: Used to remove stormwater from the bridge deck.	City
Striping: Used on paved roadways to provide guidance and information to drivers and pedestrians.	City
Illumination: Bridge lighting.	City
Deck Sweeping: Keeping the deck free from debris and weeds.	City
Snow and Ice Removal: For removing snow and sometimes ice from roadways.	City
Graffiti on all Structures Including Backside of Noise Walls: Images or lettering scratched, scrawled, painted or marked in any manner on property.	State
Guard Rail: A barrier designed to redirect errant vehicles from roadside hazards.	See Guideline [A]

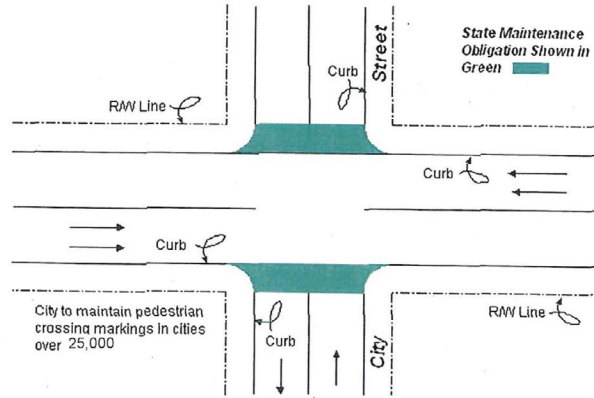
[1] Asphalt approach or concrete approach slab maintenance is the primary responsibility of the city. This includes approach repairs at the back of pavement seat joint. In the case where the State performs a concrete overlay on the bridge deck, the State may extend the overlay onto the concrete approach slab to smooth traffic flow.

[2] Cities must obtain a Bridge Deck Condition Report from the state and get concurrence in the final project design from the State prior to performing asphalt deck overlays on state owned bridges. Cost of the membranes is the responsibility of the State.

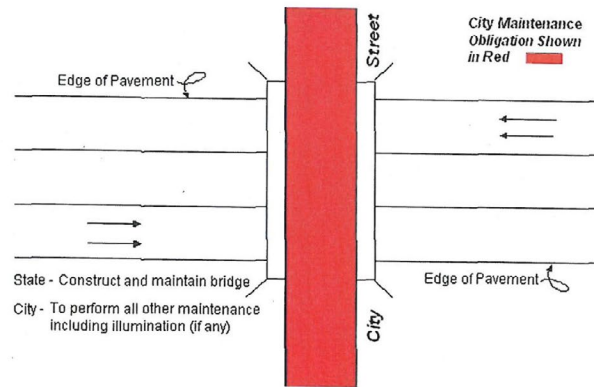




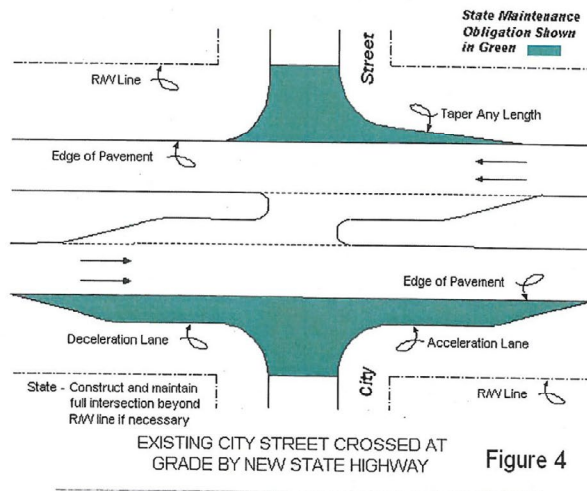
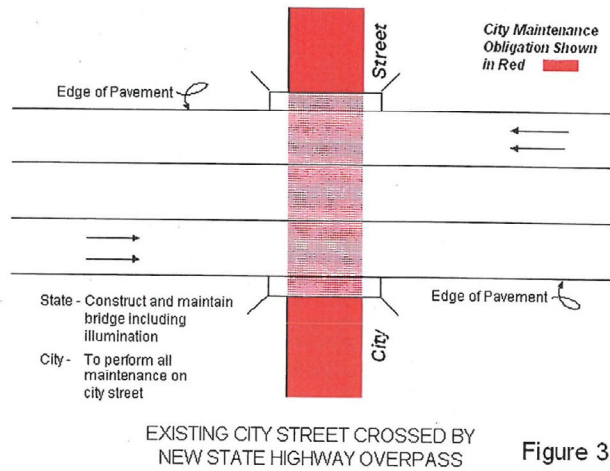




NORMAL INTERSECTION EXISTING STATE HIGHWAY **Figure 1**



EXISTING CITY STREET CROSSED BY NEW STATE HIGHWAY UNDERPASS **Figure 2**



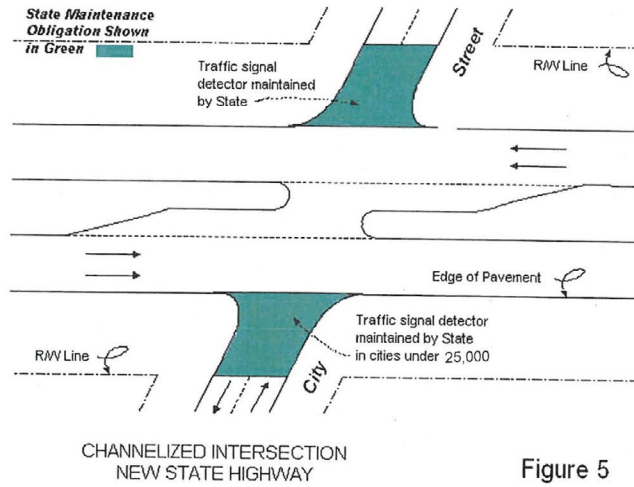


Figure 5

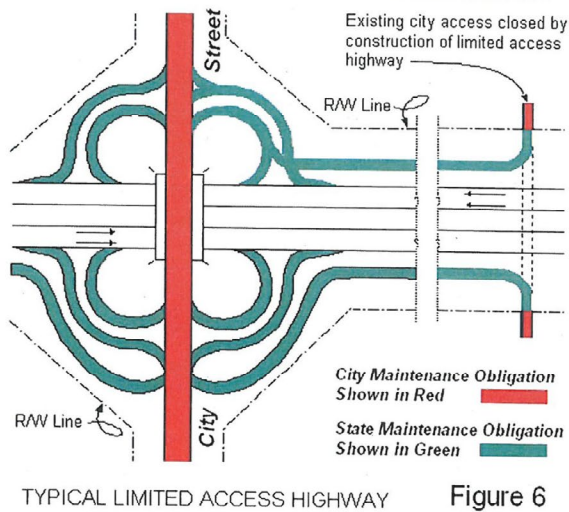
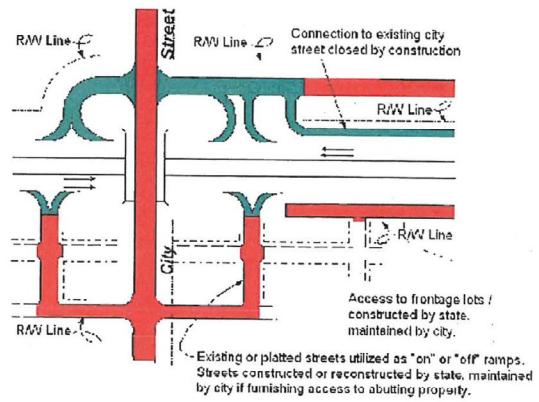
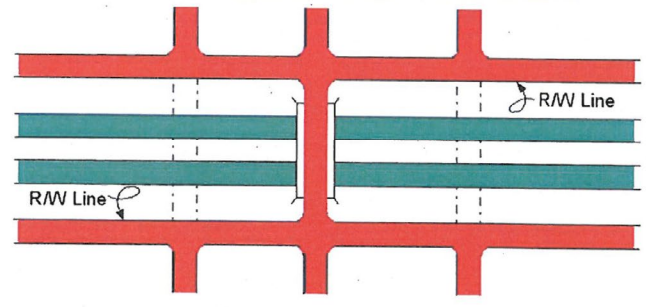


Figure 6



TYPICAL LIMITED ACCESS HIGHWAY UTILIZING CITY STREETS AS "ON" AND "OFF" RAMPS
 City Maintenance Obligation Shown In Red
 State Maintenance Obligation Shown In Green **Figure 7**



State - Construct and maintain bridge (structure only)
 City - Perform all other maintenance

DEPRESSED LIMITED ACCESS HIGHWAY LOCATED BETWEEN CITY STREETS

City Maintenance Obligation Shown in Red
 State Maintenance Obligation Shown in Green **Figure 8**

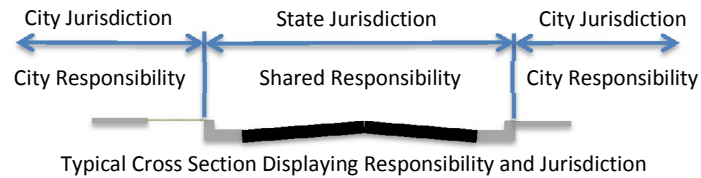
City Streets as State Highways Maintenance Guidelines – Briefing Summary

March 21, 2013

Background

Within the State of Washington there are over 500 centerline miles of City Streets that also function as State Highways. Cities that own these roadways and the State have shared responsibility for maintenance and operational activities as described in RCW 47.24.020. In 1997 the Association of Washington Cities (AWC) and WSDOT developed a set of agreed to guidelines outlining Construction, Operations and Maintenance responsibilities for these roadways.

In 2011 an effort was kicked off to update the guidelines to include additional features and resolve inconsistencies. The updated agreement will also reduce the number of individual maintenance agreements that are negotiated to cover elements not addressed in the previous agreement.



Approach to Update

A team was formed including representatives from WSDOT, AWC and Member Cities. All cities and additional WSDOT staff were provided an opportunity for input to identify needed updates and to review the updated draft agreement. Team members also presented draft agreements and solicited input at conferences.

Summary of Agreed to Changes

There were several changes to the document to clarify responsibilities, highlights are as follows;

- Plan to revisit the guidance on a three year cycle and update or amend as necessary.
- Additional general statements were added to address major items (snow and ice, major culverts, interchanges)
- Curb Ramps to meet ADA – City responsibility.
- Decorative Features and Finishes – City responsibility
- Raised Medians.
 - Landscaping and Irrigation systems – City responsibility.
 - Curbs and any hard surface (not landscaped) – WSDOT responsibility.
- Bike lanes will follow the same approach as all other travels lanes.
 - Pavement – WSDOT responsibility.
 - Striping and Pavement Markings – Dependent on population of city, under 25,000 –WSDOT, over 25,000 – City responsibility.
- Round-a-bouts will follow approach from existing guidance.
 - Pavement and truck apron are traveled surface and will be considered pavement – WSDOT responsibility.
 - All elements beyond curb such as landscaping or decorative features are city responsibility.
- Bridge Structures
 - Tables were simplified and clarified
- Additional cross sections were added to clarify limits of responsibility

Future Needs

In development of this update there were a number of elements which are contentious or need significant effort to resolve and define. These items are as follows;

- Storm water treatment and management within cities
- Evaluate responsibilities on city streets that cross limited access facilities

Team Members

Dave Catterson AWC	Ken Nelson City of Kennewick	Dick McKinley City of Tacoma
Steve Pratt City of Seattle	Steve Wall City of Ridgefield	Erin Leonhart City of Bothell
Monty Mills Maintenance	Kyle McKeon Project Development	Greg Selstead Maintenance
Aaron Butters H&LP	Chris Christopher Maintenance	Jay Alexander CPDM
John Nisbet Traffic Operations	Mike Dornfeld Traffic Operations	

Executive Sponsors

Jerry Lenzi – Chief Engineer
Kathleen Davis – Director Highways and Local Programs

Amendment to:

**CITY STREETS
AS PART OF
STATE HIGHWAYS
GUIDELINES Reached
BY THE
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
AND THE
ASSOCIATION OF WASHINGTON CITIES
ON THE INTERPRETATION OF SELECTED TOPICS
OF RCW 47.24 AND FIGURES OF WAC 468-18-050 FOR THE
CONSTRUCTION, OPERATION AND MAINTENANCE RESPONSIBILITIES OF
WSDOT AND CITIES FOR SUCH STREETS
April 30, 1997**

AGREED UPON GUIDELINES

The description of Table 2 has been deleted and replaced with the following:

- Table 2, City/State Maintenance Responsibilities for Structures on City Streets as Part of the State Highway System (This table provides an interpretation of the figures of WAC 468-18-050).

The description of Table 3 has been deleted and replaced with the following:

- Table 3, State Owned Bridges That Convey City Traffic Over State Highways (This table provides an interpretation of the figures of WAC 468-18-050).

Item 1 has been deleted and replaced with the following:

A) Guardrail (Barriers) Maintenance

Background: RCW 47.24.020(2) states that "The city or town shall exercise full responsibility for and control over any such street beyond the curbs and if no curb is installed, beyond that portion of the highway used for highway purposes (edge of paved shoulder)." The statement "...used for highway purposes ..." has led to differing interpretations of state and local agency responsibilities for the maintenance of guardrail.

B) Parallel Ditches and Cross Culverts

This item has been deleted and replaced with the following:

Agreed Upon Guideline: Within all cities, regardless of population, the state shall solely maintain the structural integrity of box culverts, multiplates and individual culverts greater than 60 inches in width that are within rights of way and are not part of an enclosed drainage system. These are the size appropriate to identify natural stream flows. These structures that are 60 inches or less in width will be maintained by the cities. Cities shall maintain all other parallel roadside ditches and road approach culverts. Grass-lined swales constructed by the state solely for state highway runoff will be maintained by the state.

C) Betterments - Pavement Markings

This item has been deleted and replaced with the following:

Page | 3

Background: RCW 47.24.020(13) provides that cities and towns having a population greater than 25,000 are responsible to install, maintain, operate and control all traffic control devices. This has been interpreted to mean that the city or town must replace pavement markings and similar devices when a street is resurfaced (e.g., these markings are not included in the project costs). The issue is that a state project may destroy very recently installed pavement markings that, especially if they are durable markings (e.g., thermoplastic, raised pavement markers, etc.), involve expense to the city. The cities recommend that in-kind replacement of these markings be a part of the project costs.

This item has been deleted and replaced with the following:

Agreed Upon Guideline: As a part of State reconstruction/resurfacing projects the State will replace in-kind at no cost to the local agency only pavement markings that are damaged or removed as a result of the reconstruction or resurfacing project. This does not apply to durable pavement markings that have exceeded their useful life. The incremental additional cost for installation of higher quality pavement markings will be at the expense of the city.

D) Snow and Ice Removal

This item has been deleted and replaced with the following:

Agreed Upon Guideline: RCW 47.24.020(6) provides that the cities have responsibility for snow removal within their jurisdiction and that the State shall, when necessary, plow the snow on the roadway. The meaning of "when necessary" is that the State will plow snow, with city concurrence, on the traveled lane of the state highway on the way through the cities not having adequate snow plowing equipment. Cities must contact the state before using chemicals on structures.

The following is a new item:

E) Interchanges

Background: WAC 468-18-050(2). The construction of partially and fully controlled limited access freeways or similarly designed state highways through cities and towns is becoming more frequent. The construction of cloverleaf and other types of interchanges makes it difficult to determine exactly which features of the interchange constitute the "street intersection" for which responsibility is established by law.

Agreed Upon Guideline: For maintenance responsibilities at interchanges the state and the city are to develop an agreement as required by WAC 468-18-050(3) "After the access plan for any partial, or fully controlled limited access highway has been approved by a city or town, the state and city authorities shall negotiate an agreement establishing responsibility for construction and maintenance of the various features of each interchange. To illustrate the basic principles of these responsibilities and to serve as a guide in such negotiations, the attached sketches of typical intersections and interchanges are hereby made a part of this policy. The scope of this policy does not include the roadside areas enclosed in the loops or ramps of an interchange or the slopes of cuts and fills, responsibility for which is more clearly defined by statute".

The following is a new item:

F) General Statements

Background: At issue is that cities often prefer roadside and traffic Control Devices that would be the result of a state standard installation to be more esthetically pleasing. This adds additional cost to the item rather than using state standards.

Agreed Upon Guideline: The state is responsible for the basic cost including replacement. The cities are responsible for any incremental costs over the state basic costs. Such as, the city is responsible for any incremental cost for any finish on signal poles and all other poles that is above the state standard galvanized finish.

The following is a new item:

Background: Due to the unique nature and circumstances surrounding state system highway improvements with respect to cities and local jurisdictions, the intent of this Memorandum of Understanding (MOU) is to serve as a guideline in identifying maintenance responsibilities not addressed elsewhere in the RCWs or WACs.

Agreed Upon Guideline: Nothing in these guidelines precludes a city or local jurisdiction from entering into an agreement with the state on issues specific in nature that may not fit within these guidelines. Early and continuous communications throughout the project development process will help to assure both parties jointly develop clear understanding and expectations with respect to future maintenance responsibilities.

Table 1 has been deleted and replaced with the following:

**Table 1
City/State Maintenance Responsibilities For City Streets As Part Of The State Highway System**

Maintenance Item	Cities Over 25,000	Cities Under 25,000
Roadway Surface: The durable surface material laid down on an area intended to sustain vehicular or foot traffic.	State	State
Roadway Shoulders: The Reserved areas by the verge of a road, generally kept clear of all traffic.	State	State
Sidewalks.	City See Note [11]	City See Note [11]
Crosswalks: Is a designated point on a road at which some means are employed to assist pedestrians wishing to cross.	City See Guideline [C]	State See Guideline [C]
Channelization: The separation or regulation of conflicting traffic movements into definite paths by means of pavement markings to facilitate the safe and orderly movement of both vehicles and pedestrians.	City See Guideline [C]	State See Guideline [C]
Striping: Road surface striping is used on paved roadways to provide guidance and information to drivers and pedestrians.	City See Guideline [C]	State See Guideline [C]
ADA Features: Curb Ramps, Landings and Truncated Domes.	City See Note [6]	City See Note [6]
Concrete Curb and Gutter.	State	State
Extruded Curb, Hot Mix Asphalt (HMA): Placed at the base of fill sections for erosion control.	See Note [8]	See Note [8]
Curb for Traffic Control (C-Curb): Considered as Channelization.	City	State
Curb Cast Integral to Sidewalk.	City	City
Roundabout Channelization: Pavement Markings and Striping.	City	State
Curbing within roundabouts: Anything used for channelization i.e. Splitter Islands.	State	State
Raised Medians: The portions of a divided street separating vehicular traffic traveling in opposite directions.	See Note [4]	See Note [4]

Maintenance Item	Cities Over 25,000	Cities Under 25,000
Bike Lanes: Dedicated lanes for the use of bicyclists.	City See Note [5]	State See Note [5]
Stability of Cut & Fill Slopes: Slope stability may be defined as the resistance of inclined surface to failure by sliding or collapsing.	City	State
Retaining Walls Behind Sidewalks: Used for slope stability.	See Note [10]	See Note [10]
Noise Walls.	See Note [13]	See Note [13]
Parallel Roadside Ditches: Ditches or drains running parallel with the roadway.	See Guideline [B]	See Guideline [B]
Road Approach Culverts: Culverts under approaches matching the ditch grade.	City	City
Cross Culverts: Devices used to channel water to allow water to pass underneath a roadway.	See Guideline [B]	See Guideline [B]
Permeable Pavement: Allows storm water through the pavement structure into the underlying soil, mimicking the natural process of infiltration.	See Note [8]	See Note [8]
Directional Signs/Route Markers: Provide a system of information and directions needed to guide motorists and pedestrians, safely and efficiently.	See Note [9]	See Note [9]
Regulatory and Warning Signs: Inform road users of selected traffic laws or regulations and indicate the applicability of the legal requirements.	City	State
Stop Signs (at Intersecting Streets): When a sign is used to indicate that traffic is always required to stop.	City	State See Note [3]
Signals: Power-operated traffic control devices by which traffic is warned or directed to take some specific action.	City See Note [12]	State
Illumination: Street lighting.	See Note [2]	See Note [2]
Utility Franchises: Agreements between an agency and utility providers which allow the utilities to make use of agency streets and rights-of-way for the purposes of construction, operation and maintenance of their utility systems.	City	City
Underground Facilities: As found in RCW 47.24.020	City	City
Street Cleaning: Regular removal of dirt and debris from curbed streets within the city limits.	City	City
Street Sweeping: Regular street cleaning using mechanical vehicles to reduce pollutants in stormwater runoff from street surfaces.	City	City
Snow and Ice Removal: For removing snow and sometimes ice from roadways.	City See Guideline [D]	City See Guideline [D]

Maintenance Item	Cities Over 25,000	Cities Under 25,000
Vegetation: Plants in general or the mass of plants growing in a particular place.	City	City
Noxious Weeds: Plants that are injurious to agricultural and/or horticultural crops, natural habitats and/or ecosystems, and/or humans or livestock.	City See Note [1]	City See Note [1]
R/W Encroachments: Obstructions which intrudes upon the land of another. The encroachment could be a fence, a driveway, or a building.	City	City
R/W Cleanup: Removal of debris, natural or manmade beyond the curbs and, if no curb is installed, beyond that portion of the highway used for highway purposes.	City	City
Public Art: An enhancement to a functional element, feature, or place within a transportation facility to provide visual interest.	City	City
Stamped or Decorative Concrete Pavement: A design placed in the top of the concrete to make it more esthetically pleasing.	City	City
Stamped or Decorative Asphalt Pavement: A design placed in the top of the asphalt to make it more esthetically pleasing.	City	City
Guardrail, Concrete Barrier, Impact Attenuators, Etc.: To protect vehicles from roadside hazards.	See Guideline [A]	See Guideline [A]

Notes for table 1 have been deleted and replaced with the following:

[1] RCW 47.24.020(2) states the city or town shall exercise full responsibility for and control over any such street beyond the curbs and, if no curb is installed, beyond that portion of the highway used for highway purposes (edge of paved shoulder) and, thus, are responsible for noxious weed control.

[2] The agency paying the power bills or per agreement has responsibility for maintenance. Per RCW 47.24.020(6) "The city or town at its own expense shall provide street illumination".

[3] The state, with city concurrence, may install stop signs and posts to the city's standards or may contract with the city to have them perform these installations.

[4] Landscaping, irrigation systems and any decorative items are the cities' responsibility. However curbs and any hard surface (not landscaped) are the responsibility of cities with a population over 25,000 and state's responsibility for cities with population under 25,000. State is responsible for the roadway from street curb to median curb and median curb to street curb, not street curb to street curb if there is a landscaped median. The cross sections note this.

[5] Pavement is the state's responsibility. Striping and pavement markings are dependent on the population of the city. Populations fewer than 25,000 are the state's responsibility and populations over 25,000 are the cities' responsibility.

[6] City responsibility except when the state has a construction project in process.

[7] Will follow approach from existing guidance. Pavement and truck apron are traveled surface and will be considered pavement, state responsibility. All elements beyond the curb such as landscaping or decorative features are the city responsibility.

[8] This needs to be a negotiated agreement on a case by case basis.

[9] Directional signs for directing traffic to state routes and route markers are the responsibility of the state. Directional signs directing traffic to businesses, parking, no parking...are the responsibility of the cities.

[10] Retaining walls in cities with a population of more than 25,000 will be the responsibility of the city and the state's responsibility in cities with a population of less than 25,000 if the wall is substitute for a slope.

[11] Maintenance by cities may be in accordance with applicable city codes and ordinances regarding sidewalk and right of way maintenance.

[12] Except in limited access where the state has responsibility.

[13] Maintenance will be by agreement on a case by case basis.

Table 2 has been deleted and replaced with the following:

**Table 2
City/State Maintenance Responsibilities For Structures
On City Streets As Part Of The State Highway System**

(This table provides an interpretation of the figures of WAC 468-18-050)

Maintenance Item	Cities Over 25,000	Cities Under 25,000
Structural Related Bridge Maintenance: Preservation of the structural and operational characteristics of all bridge structures to the originally constructed or subsequently modified conditions.	State	State
Bridge Condition Inspections: The condition inspection and evaluation of in-service bridges.	State	State
Concrete Patching and Concrete Resurfacing on concrete bridge decks.	State	State
Asphalt Patching and Asphalt Resurfacing on asphalt bridge decks.	State	State
Bridge Approach: Provides a transition between roadway pavement and the bridge.	State	State
Bridge Deck Joints: Allow thermal movement or control cracking.	State	State
Bridge Railing: A fence-like construction built at the outermost edge of the roadway or the sidewalk portion of a bridge to protect pedestrians and vehicles.	State	State
Bridge Drains/Drainage: Used to remove stormwater from the bridge deck.	City	State

Maintenance Item	Cities Over 25,000	Cities Under 25,000
Striping: Used on paved roadways to provide guidance and information to drivers and pedestrians.	City	State
Illumination: Bridge lighting.	City See Note [1]	City See Note [1]
Deck Sweeping: Keeping the deck free from debris and weeds.	City	City
Snow and Ice Removal: For removing snow and sometimes ice from roadways.	See Guideline [D]	See Guideline [D]
Guard Rail: A barrier designed to redirect errant vehicles from roadside hazards.	See Guideline [A]	See Guideline [A]
Graffiti on all Structures: Images or lettering scratched, scrawled, painted or marked in any manner on property.	City	City

Notes for table 2 have been deleted and replaced with the following:

[1] The State has responsibility for maintenance of illumination systems within fully access controlled areas. In addition, the State may, with city concurrence, maintain and operate luminaires at locations where the electrical service powers electrical equipment under both State and City responsibility.

Table 3 has been deleted and replaced with the following:

Table 3
State Owned Bridges That Convey City Traffic Over State Highways
 (This table provides an interpretation of the figures of WAC 468-18-050)

Maintenance Item	City/State
Structural Related Bridge Maintenance: Preservation of the structural and operational characteristics of all bridge structures to the originally constructed or subsequently modified conditions.	State
Bridge Condition Inspections: The condition inspection and evaluation of in-service bridges.	State
Concrete Patching and Concrete Resurfacing on concrete bridge decks.	State
Asphalt Patching and Asphalt Resurfacing on asphalt bridge decks.	City See Note [2]
Approach Slab: Provides a transition between roadway pavement and the bridge.	City See Note [1]
Bridge Deck Joints: Allow thermal movement or control cracking.	State
Bridge Railing: A fence-like construction built at the outermost edge of the roadway or the sidewalk portion of a bridge to protect pedestrians and vehicles.	State
Bridge Drains/Drainage: Used to remove stormwater from the bridge deck.	City

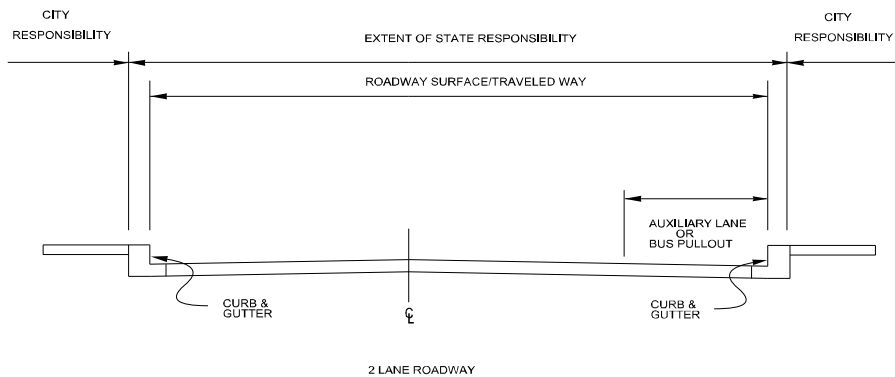
Maintenance Item	City/State
Striping: Used on paved roadways to provide guidance and information to drivers and pedestrians.	City
Illumination: Bridge lighting.	City
Deck Sweeping: Keeping the deck free from debris and weeds.	City
Snow and Ice Removal: For removing snow and sometimes ice from roadways.	City
Graffiti on all Structures Including Backside of Noise Walls: Images or lettering scratched, scrawled, painted or marked in any manner on property.	State
Guard Rail: A barrier designed to redirect errant vehicles from roadside hazards.	See Guideline [A]

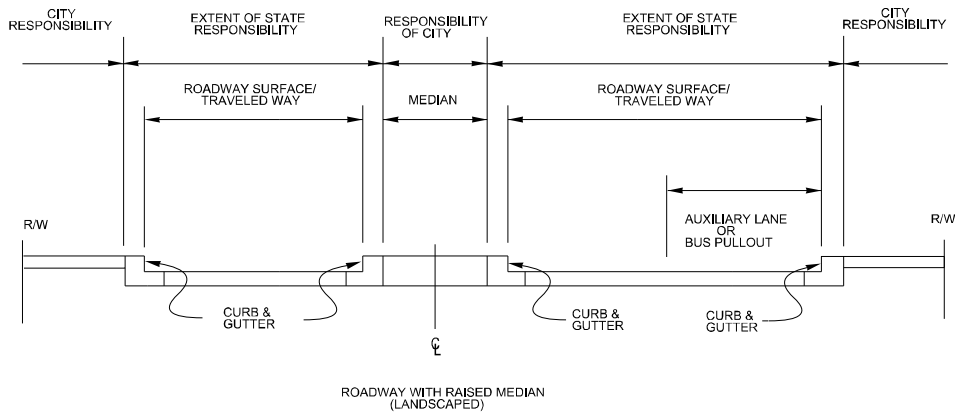
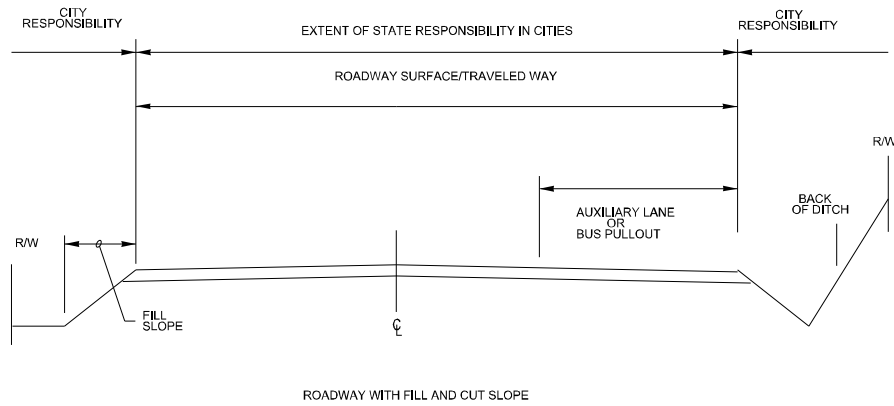
Notes for table 3 have been deleted and replaced with the following:

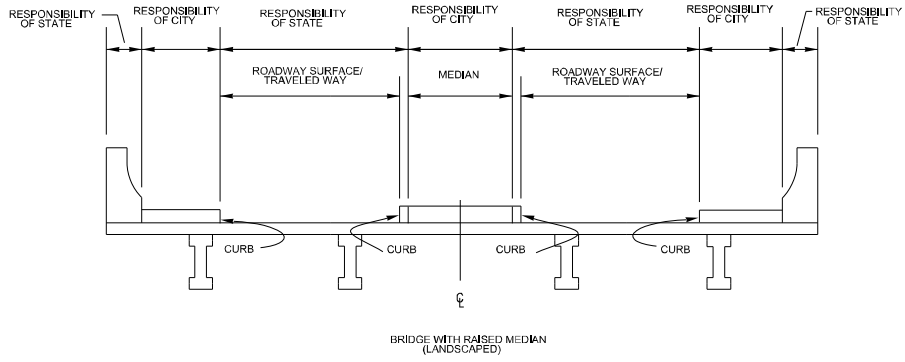
[1] Asphalt approach or concrete approach slab maintenance is the primary responsibility of the city. This includes approach repairs at the back of pavement seat joint. In the case where the State performs a concrete overlay on the bridge deck, the State may extend the overlay onto the concrete approach slab to smooth traffic flow.

[2] Cities must obtain a Bridge Deck Condition Report from the state and get concurrence in the final project design from the State prior to performing asphalt deck overlays on state owned bridges. Cost of the membranes is the responsibility of the State.

The roadway section has been deleted and replaced with the following:








CONCURRENCES: With the concurrence of WSDOT Executive Management, this amendment to the City Streets as State Highways Guidelines Dated April 30, 1997 was transmitted to the WSDOT Chief Engineer and to the Association of Washington Cities for implementation of the agreed upon guidelines. Final Report - April 2, 2013 respectfully submitted for acceptance,

RECOMMENDATIONS ACCEPTED:

 Date 4/2/2013
Mike McCarty
Chief Executive Officer Assoc. of Washington Cities

 Date 4/2/13
Jerry Lenzi
Chief Engineer Department of Transportation

Original 1997 Agreement
Pages A-35 - A-44

Original 1997 Agreement

Guidelines reached by the Washington State Department of Transportation and the Association of Washington Cities on the interpretation of selected topics of [RCW 47.24](#) and figures of [WAC 486-18-050](#) for the construction, operations and maintenance responsibilities of WSDOT and cities for such streets

April 30, 1997

The jurisdiction, control, and duty of the state and city or town for city streets that are a part of state highways is specified in [RCW 47.24.020](#); however, the implementing WAC's, directives and manuals have been subject to interpretation. This report documents agreed upon guidelines that have been reached by the Washington State Department of Transportation (WSDOT) and the Association of Washington Cities (AWC) on the interpretation of construction, operations and maintenance responsibilities of WSDOT and cities for such city streets.

These agreed upon guidelines are derived from:

- The draft Task Force Report on City Streets as Part of State Highway.
- Response to the legislative change that increased the 15,000 city population threshold to a 25,000 population threshold for state versus city responsibilities for certain maintenance responsibilities contained in [RCW 47.24](#).
- Additional discussions by the department, AWC, and several cities on the interpretation of state versus local agency maintenance responsibilities that are illustrated in figures contained in [WAC 468-18-050](#) and on other maintenance responsibilities for city streets that are part of state highways.

These guidelines are designed to facilitate the allocation of maintenance responsibilities between the WSDOT and Washington Cities pursuant to [RCW 47.24](#). The guidelines of this report are not intended to reflect past practices but to apply to future practices. They are general in nature and do not preclude the WSDOT and individual cities from entering into agreements to address particular circumstances.

These agreed upon guidelines will be incorporated in WSDOT manuals and related guidance for maintenance, operations, and construction activities. AWC will distribute copies of this report to their members.

Agreed Upon Guidelines

The agreed upon guidelines of State and city responsibilities for city streets that are part of state highways are contained in the following tables:

- Table 1 – City/State Maintenance Responsibilities for City Streets as Part of the State Highway System
- Table 2 – City/State Maintenance Responsibilities of Bridges That Convey Non-Limited Access State Highways That Are Also City Streets (Unless Otherwise Covered Under A Separate Agreement)
- Table 3 – State Owned Bridges That Convey City or County Traffic Over a Limited Access or Non-Limited Access Highway Corridor (Does Not Apply to City or County Owned Bridges)

The following is an explanation of selected items of the above tables that are related to specific sections of [RCW 47.24](#) and to [WAC 468-18-050](#):

1. **Guardrail (Barriers) Maintenance**

Background – [RCW 47.24.020\(2\)](#) states that “The city or town shall exercise full responsibility for and control over any such street beyond the curbs and if no curb is installed, beyond that portion of the highway used for highway purposes.” The statement “...used for highway purposes...” has led to differing interpretations of WSDOT and local agency responsibilities for the maintenance of guardrail.

Agreed Upon Guideline – Traffic barriers installed on state highways in areas without curbs shall be maintained by the WSDOT. Traffic barriers installed beyond the curb shall be maintained by the cities. Curb in the context of [RCW 47.24.020\(2\)](#) refers to a standard curb and gutter and not to extruded curb such as those placed on fill sections for erosion control. Guardrail, concrete barriers, impact attenuators and similar devices are all considered to be traffic barriers.

2. **Parallel Ditches and Cross Culverts**

Background – The issue is clarification of what is meant by the [RCW 47.24.020\(2\)](#) statement “...for highway purposes...” for use in interpreting responsibilities of WSDOT and local agencies for maintenance of parallel ditches and cross culverts. Also at issue is responsibility for grass lined swale construction for water treatment purposes as compared to a ditch solely for drainage purpose. In addition a distinction needs to be made between cross culverts related to streams and maintaining natural flows as opposed to those constructed for storm drainage.

Agreed Upon Guideline – Within all cities, regardless of population, the state shall solely maintain the structural integrity of box culverts, multiplates and individual culverts greater than 60 inches in width that are within rights of way and are not part of an enclosed drainage system. These are the size appropriate to identify natural stream flows. These structures that are less than 60 inches in width will be maintained by the cities. Cities shall maintain all other parallel roadside ditches and road approach culverts. Grass-lined swales constructed by the state solely for state highway runoff will be maintained by the WSDOT.

3. **Betterments - Pavement Markings**

Background – [RCW 47.24.020\(13\)](#) provides that cities and towns having a population greater than 25,000 are responsible to install, maintain, operate and control all traffic control devices. This has been interpreted to mean that the city or town must replace pavement markings and similar devices when a street is resurfaced (i.e., these markings are not included in the project costs). The issue is that a WSDOT project may destroy very recently installed pavement markings that, especially if they are durable markings (e.g., thermoplastic, raised pavement markers, etc.), involve expense to the city. The cities recommend that in-kind replacement of these markings be a part of the project costs.

Agreed Upon Guideline – As a part of State reconstruction/resurfacing projects the State will replace in-kind at no cost to the local agency only pavement markings that are damaged or removed as a result of the reconstruction or resurfacing project. This does not apply to durable pavement markings that have exceeded their useful life. Installation of higher quality pavement markings will be at the expense of the city.

Early communication and plan reviews between WSDOT and the city is essential to enable local agencies to avoid installation of pavement markings, especially the more durable markings, shortly before the construction activity takes place.

4. **Snow Plowing**

Background – At issue is the meaning of the phrase in [RCW 47.24.020\(6\)](#) that states “...except that the state shall when necessary plow the snow on the roadway.” This statute states that the city or town, at its expense, is responsible for snow removal. The meaning of “when necessary” and responsibility of snow plowing versus snow removal needed clarification.

Agreed Upon Guideline – [RCW 47.24.020\(6\)](#) provides that the cities have responsibility for snow removal within their jurisdiction and that the State shall, when necessary, plow the snow on the roadway. The meaning of “when necessary” is that the State will plow snow, with city concurrence, on the traveled lane of the state highway on the way through the cities not having adequate snow plowing equipment.

Maintenance Item	Cities Over 22,500	Cities Under 22,500
Roadway Surface	State	State
Roadway Shoulders	State	State
Stability of Cut & Fill Slopes	City	State
Sidewalks	City	City
Curbs	State	State
Parallel Roadside Ditches	City	City
Road Approach Culverts	City	City
Cross Culverts	City (3)	City (3)
Snow Plowing	See Note (4)	See Note (4)
Sanding & De-icing	City	City
Snow Removal	City	City
Sand Removal	City	City
Channelization	City (1)	State
Crosswalks	City (1)	State
Striping	City (1)	State
Directional Signs/Route Markers	State	State
Parking Signs	City	City
Regulatory Signs	City	State
Stop Signs (Intersecting Signs)	City	State (7)
Signals	City	State
Guardrail, Concrete Barrier, Impact Attenuators, etc.	State/City (2)	State/City (2)
Illumination	City (6)	City (6)
Street Cleaning	City	City
Street Sweeping	City	City
Vegetation	City	City
Noxious Weeds	City (5)	City (5)
R/W Encroachments	City	City
R/W Cleanup	City	City
Utility Franchises	City	City
Underground Facilities	City	City

Notes

- As a part of State reconstruction/resurfacing projects the State will replace in-kind at no cost to the local agency only pavement markings that are damaged or removed as a result of the reconstruction or resurfacing project. This does not apply to durable markings that have exceeded their useful life. Installation of higher quality pavement markings will be at the expense of the city. Early communication and plan reviews between WSDOT and the city is essential to enable local agencies to avoid installation of pavement markings, especially the more durable markings, shortly before the construction activity takes place.
- Traffic barriers installed on state highways in areas without curbs shall be maintained by the WSDOT. Traffic barriers installed beyond the curb shall be maintained by the cities. Curb in the context of [RCW 47.24.020\(2\)](#) refers to a standard curb and gutter and not to extruded curb such as those placed on fill sections for erosion control. Guardrail, concrete barriers, impact attenuators and similar devices are all considered to be traffic barriers.
- Within all cities, regardless of population, the state shall solely maintain the structural integrity of box culverts, multiplates and individual culverts greater than 60 inches in width that are within rights of way and are not part of an enclosed drainage system. These are the size appropriate to identify natural stream flows. These structures that are less than 60 inches in width will be maintained by the cities. Cities shall maintain all other parallel roadside ditches and road approach culverts. Grass-lined swales constructed by the state solely for state highway runoff will be maintained by the WSDOT.
- [RCW 47.24.020\(6\)](#) provides that the cities have responsibility for snow removal within their jurisdiction and that the State shall, when necessary, plow the snow on the roadway. The meaning of "when necessary" is that the State will plow snow, with city concurrence, on the traveled lane of the state highway on the way through the cities not having adequate snow plowing equipment.
- [RCW 47.24.020\(2\)](#) states the city or town shall exercise full responsibility for and control over any such street beyond the curbs and, if no curb is installed, beyond that portion of the highway used for highway purposes and, thus, are responsible for noxious weed control.
- The state has responsibility for maintenance of illumination systems within fully access controlled areas. In addition, the State may, with city concurrence, maintain and operate luminaries at locations where the electrical service powers electrical equipment under both State and City responsibility.
- WSDOT, with city concurrence, may install stop signs and posts to the city's standards or may contract with the city to have them perform these installations.

City/State Maintenance Responsibilities

for City Streets as Part of the State Highway System
Table 1

Maintenance Item	Cities Over 22,500	Cities Under 22,500
Structural Related Bridge Maintenance	State	State
Bridge Condition Inspections	State	State
L/C Overlays on Structures	State	State
Bridge Deck Membranes	State	State
Structural Asphalt Overlay on Bridge	State	State
Approach Slab	State	State
Bridge Deck Joints	State	State
Bridge Railing	State	State
Graffiti	City	City
Deck Sweeping	City	City
Bridge Drains/Drainage	City	State
Striping	City	State
Illumination	City (2)	City (2)
Snow Plowing	See Note (1)	See Note (1)
Snow Removal	City	City

Notes

1. [RCW 47.24.020\(6\)](#) provides that the cities have responsibility for snow removal within their jurisdiction and that the State shall, when necessary, plow the snow on the roadway. The meaning of “when necessary” is that the State will plow snow, with city concurrence, on the traveled lane of the state highway on the way through the cities not having adequate snow plowing equipment.
2. The state has responsibility for maintenance of illumination systems within fully access controlled areas. In addition, the State may, with city concurrence, maintain and operate luminaires at locations where the electrical service powers electrical equipment under both State and City responsibility.

**City/State Maintenance Responsibilities of Bridges That Convey
 Non-Limited Access State Highways That Are Also City Streets
 (Unless Otherwise Covered Under a Separate Agreement)**
 (This table provides an interpretation of the figures of [WAC 468-18-050](#))
 Table 2

Maintenance Item	City/State	County/State
Structural Related Bridge Maintenance	State	State
Bridge Condition Inspections	State	State
L/C Overlays on Structures	State	State
Bridge Deck Membranes	State	State
Structural Asphalt Overlay on Bridge	State	State
Non-Structural Asphalt Overlay on Bridge	City (1)	County (1)
Approach Slab	City (2)	County (2)
Bridge Deck Joints	See Note (3)	See Note (3)
Bridge Railing	State	State
Graffiti	City	County
Deck Sweeping	City	County
Bridge Drains/Drainage	City	County
Striping	City	County
Illumination	City	County
Snow Plowing	City	County
Snow Removal	City	County

Notes

1. Cities/counties should obtain the states concurrence prior to performing non-structural asphalt deck overlays on state owned structures.
2. Approach slab maintenance is the primary responsibility of the city/county. In the case where the state performs a structural overlay on the bridge deck, the state may extend the overlay onto the approach slab to smooth traffic flow.
3. Joints located on the bridge deck are the responsibility of the state. Back of pavement seat joint repairs are the responsibility of the city/county unless they affect the structural integrity of the bridge.

**State Owned Bridges That Convey City or County Traffic
Over a Limited Access or Non-Limited Access Highway Corridor
(Does Not Apply to City or County Owned Bridges)
(This table provides an interpretation of the figures of [WAC 468-18-050](#))
Table 3**

The State has full maintenance responsibility for bridges conveying a State Route or Interstate traffic in a limited access corridor (unless otherwise covered under a separate agreement).

Attachments - Intersection Diagrams from [WAC 468-18-050](#)

Concurrences

With the concurrence of WSDOT Executive Management, this report will be transmitted to WSDOT Assistant Secretaries and Regional Administrators and to the Association of Washington Cities for implementation of the agreed upon guidelines.

Respectfully submitted for acceptance,

Maintenance Engineer

Assistant Secretary
TransAid Service Center

Transportation Coordinator
Association of Washington Cities

Concurrences With Recommendations for Acceptance

Assistant Secretary
Field Operations Support Service Center

Environmental and Engineering Service Center

Recommendations Accepted

Executive Director
Association of Washington Cities

Deputy Secretary for Operations
Department of Transportation

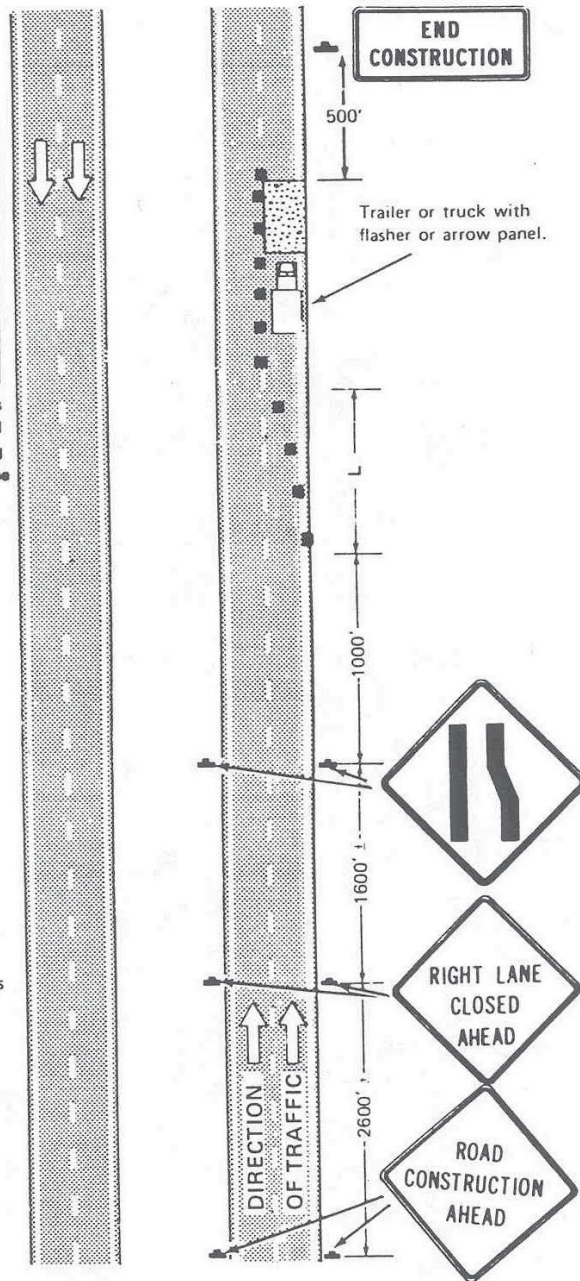
GENERAL NOTES

		MINIMUM TAPER LENGTH (L) IN FEET						
		Posted Speed (mph)						
Lane Width (feet)	10	105	150	205	270	450	500	550
	11	115	165	225	295	495	550	605
	12	125	180	245	320	540	600	660

The maximum spacing between channelizing devices in a taper should be nearly equal in feet to the speed limit; the maximum spacing between channelizing devices used to separate traffic should be 2 times the speed limit.

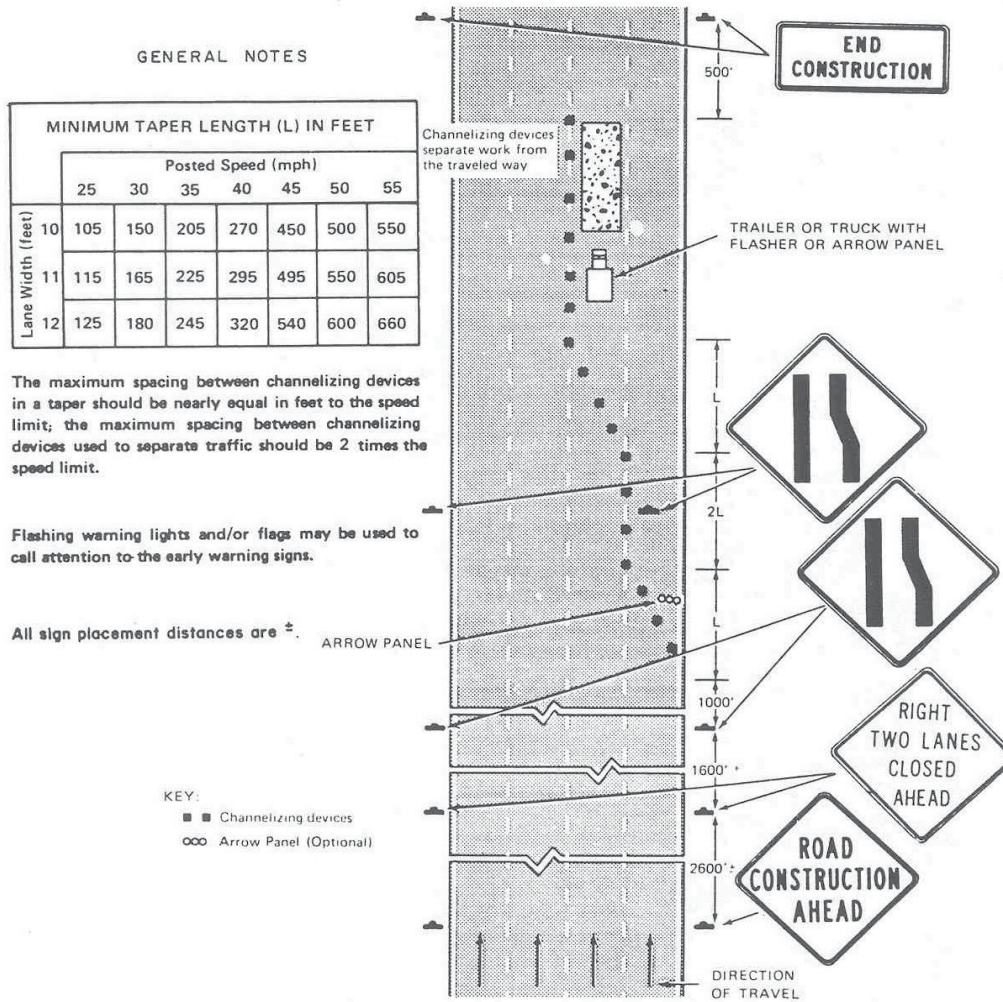
All sign placement distances are ±.

KEY:
 ■ ■ Channelizing devices



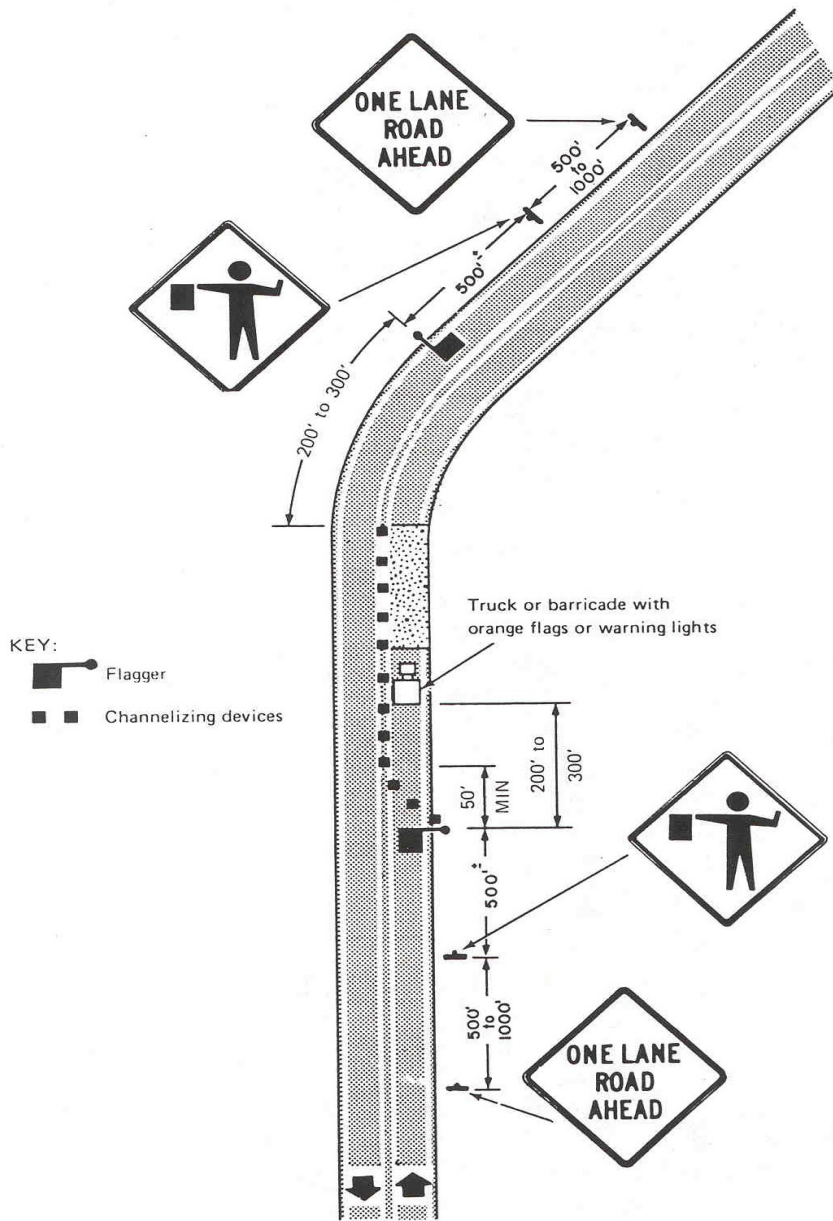
Typical application—daytime maintenance operations of short duration on a 4-lane divided roadway where half of roadway is closed.

Figure A1



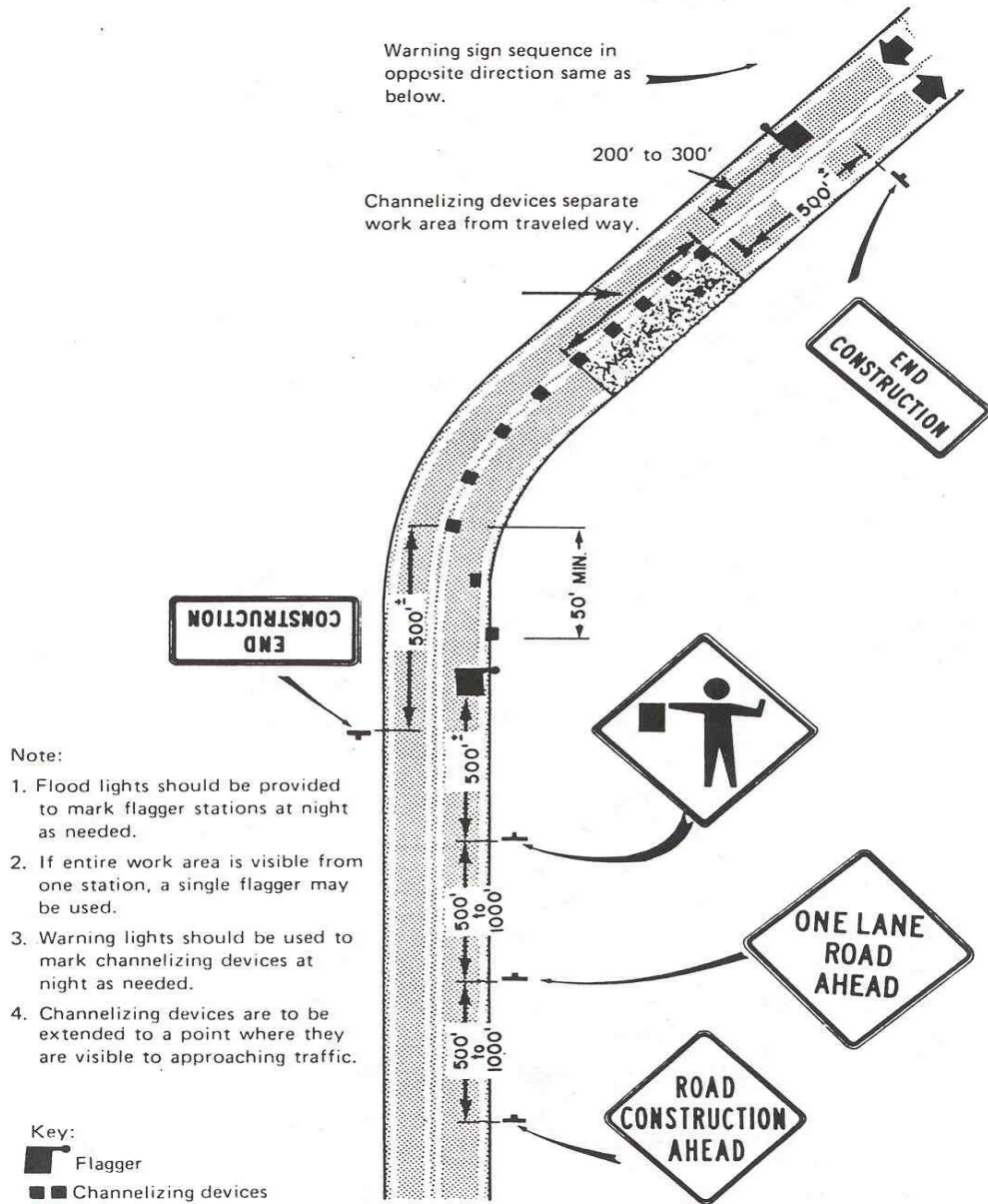
Typical application—closing multiple lanes of a multilane highway

Figure A2



Typical application—daytime maintenance operations of short duration on a 2-lane roadway and flagging is provided.

Figure A-3



Typical applications of traffic control devices on 2-lane highway where one lane is closed and flagging is provided.

Figure A-4

Appendix B Emergency Restrictions for Roads

[RCW 47.48](#), [RCW 46.44.080](#), and [WAC 468-38-080](#) authorize the Washington State Department of Transportation (WSDOT) to impose emergency road restrictions when conditions exist that could cause normal traffic to damage the roadway.

B-1 General

WSDOT may impose load and speed restrictions when freeze-thaw or other conditions may subject the roadway to damage from normal traffic. There are two types of load restrictions that may be imposed depending upon the highway and weather conditions:

- **Emergency Load Restrictions** – This restriction may be applied to any road when the untreated pavement layers (base course and sub-grade) are supersaturated and unstable. Evidence of surface deflection under traffic loading or free water in the base materials under less than six inches of treated materials supporting the roadway may be cause to apply these restrictions.
- **Severe Emergency Load Restrictions** – This restriction may be applied only to a roadway whose surfacing depth is insufficient to resist subgrade swell pressure or is surfaced with a thin bituminous treatment. This restriction may also be used for other roadway types displaying signs of severe distress during a freeze-thaw cycle or unusual weather conditions.

Notify the public, other WSDOT offices, and law enforcement agencies to ensure compliance with pending and current restrictions, and to minimize inconvenience to the public. Provide courtesy notices on highways leading to restricted roads to the extent possible under the circumstances, and in consideration of the expense to be incurred by WSDOT.

Special permits to operate on restricted roads may be issued to school buses and trucks hauling perishable commodities or commodities necessary for the health and welfare of local residents.

School buses may be given a general exemption from weight restrictions by letter, subject to speed restrictions. In no event may an exemption be granted to a vehicle with a gross load weight on each tire exceeding 550 pounds per inch of tire width.

B-2 Actions

As part of your annual snow and ice planning, alert road user groups, freight associations, and the media that emergency road restrictions may be imposed when and where necessary. Provide a list of roads that could be affected.

When weather forecasts indicate that restrictions will likely be imposed, notify Commercial Vehicle Services (CVSpermits@wsdot.wa.gov, 360-704-6340), and alert road user groups, freight associations, and the media that road restrictions will occur if conditions develop as predicted.

Determine the condition of roads subject to freeze-thaw or other weather conditions using the experience of local WSDOT maintenance crews, historical roadway performance, or the expertise of WSDOT materials engineers.

When restrictions must be imposed:

1. Post the road with appropriate signs.
2. Notify regional managers, the Region Administrator, and the traffic management center.
3. Notify Commercial Vehicle Services.
4. Notify local law enforcement agencies and the WSP detachment.
5. Provide courtesy notices to principal road users as circumstances allow.

After restrictions are imposed:

1. Continually monitor restricted roads and remove or change restrictions as conditions change or improve.
2. Establish permit speed and weight restrictions. Issue permits or provide exemptions for school buses and trucks hauling necessary commodities.
3. Notify the public, other WSDOT offices, and law enforcement agencies when restrictions are lifted or modified.
4. Continue to assess road conditions to determine if further restrictions are necessary.

B-3 Signing Instructions

Restrictions are legal only when “Emergency Restriction” signs are posted at each end of a restricted roadway. “Emergency Restriction” signs must also be posted at each crossroad intersection on the right-hand side of the restricted road. Intersection signs should be located within 50 feet of the intersection, preferably at 25 feet, so that motorists intending a right or left turn should see them prior to making the turn. The signs should not prohibit motorists from crossing the restricted road. When signing closely spaced intersections, determine the number and location of signs needed to provide reasonable notice to motorists.

The appropriate sign, “Emergency Load Restrictions” or “Severe Emergency Load Restrictions”, must be attached to “Emergency Restriction” signs when load restrictions apply.

Standard speed limit signs displaying the speed restriction must be posted 500 feet ahead of “Emergency Restriction” signs at each end of the posted road, and 500 feet after signs posted at crossroads. When signing closely spaced intersections, determine the number and location of signs needed to provide reasonable notice to motorists.

“Speed Zone Ahead” signs shall be posted ahead of the speed limit signs as specified in the MUTCD. If the restricted area immediately follows a zone having a lower posted speed, “Speed Zone Ahead” signs are not required.

Existing speed limit signs within the restricted area will be covered, turned away from traffic, or covered with the appropriate restricted speed limit sign.

Courtesy signs should be placed in advance of a restricted roadway to inform motorists and minimize backtracking. Courtesy signs are not necessary if only speed restrictions are imposed. The appropriate sign for either “Emergency Load Restriction” or “Severe Emergency Load Restriction” may accompany road restrictions signs.

The posting distance preceding the restricted area will depend upon site specific conditions, consult with Region Traffic Office for a preferred sign location. One approach is not exceed ten signs posted at locations most likely to be seen by motorists that could be affected by the restrictions.

B-4 Emergency Load Restrictions

Sign examples and size requirements:

Conventional Tires		Tubeless or Special With .5 Marking	
Tire Size	Gross Load Each Tire	Tire Size	Gross Load Each Tire
7.00	1800 lbs.	8-22.5	2250 lbs.
7.50	2250 lbs.	9-22.5	2800 lbs.
8.25	2800 lbs.	10-22.5	3400 lbs.
9.00	3400 lbs.	11-22.5	4000 lbs.
10.00	4000 lbs.	11-24.5	4000 lbs.
11.00	4500 lbs.	12-22.5	4500 lbs.
12.00 or over	4500 lbs.	12-24.5 or over	4500 lbs.

Sign size: 24" wide by 18" high. Black lettering on white background.
Attach to space provided on "Emergency Restrictions in Force" sign.

B-5 Severe Emergency Load Restrictions

Sign examples and size requirements:

Conventional Tires		Tubeless or Special With .5 Marking	
Tire Size	Gross Load Each Tire	Tire Size	Gross Load Each Tire
7.00	1800 lbs.	8-22.5	1800 lbs.
7.50	1800 lbs.	9-22.5	1900 lbs.
8.25	1900 lbs.	10-22.5	2250 lbs.
9.00	2250 lbs.	11-22.5	2750 lbs.
10.00	2750 lbs.	11-24.5	2750 lbs.
11.00 or over	3000 lbs.	12-22.5 or over	3000 lbs.

Sign size: 24" wide by 18" high. Red lettering on white background.
Attach to space provided on "Emergency Restrictions in Force" sign.