



## Chapter 4

# Maintaining and Repairing Roadways

---

This chapter of the Toolbox describes various road maintenance practices and provides a few easy tips for conducting the work in a way that helps protect the environment:

1. Cleaning streets
2. Repairing roadways
3. Surfacing and resurfacing
4. Marking pavement
5. Controlling snow and ice on roadways
6. Maintaining bridges
7. Installing utilities in roadways

A handy roadway maintenance checklist is provided on the next page.



# Roadway Maintenance Checklist

Use this checklist of clean water tips as a guide for conducting or water quality-friendly maintenance practices. Refer to the rest of this chapter for details regarding each clean water tip.

Practice	Done ✓	Clean Water Tip	Tip #
Street cleaning		Use more effective sweeper	1
		Eliminate street flushing	2
		Recycle sweeping debris	3
		Recycle leaf material as compost	4
		Support research	5
		Use covered storage containers	6
		Deal with illegal dumps	7
		Create recordkeeping system	8
Roadway repair		Schedule work in dry weather	9
		Protect storm drain inlets	10
		Protect roadside ditches	11
		Avoid using water to clean up	12
		Place stockpiles away from streams	13
		Contain water and wastes	14
		Recycle used asphalt & concrete	15
		Use drip pans for leaks	16
Surfacing & resurfacing		Avoid wet weather for paving	17
		Protect storm drain inlets	18
		Protect roadside ditches	19
		Avoid using water for clean up	20
		Place stockpiles away from streams	21
		Contain water and wastes	22
		Recycle used asphalt	23
		Use drip pans for leaks	24
Pavement marking		Develop paint handling procedures	25
		Protect storm drain inlets	26
		Avoid using water to clean up	27
		Contain water and wastes	28

Roadway Maintenance Checklist continued.

<b>Practice</b>	<b>Done ✓</b>	<b>Clean Water Tip</b>	<b>Tip #</b>
Snow & ice control		<i>Recycle sands and gravels</i>	29
		<i>Place stockpiles away from streams</i>	30
		<i>Do not use salts</i>	31
		<i>Use chemicals sparingly</i>	32
Bridge repair		<i>Follow water quality requirements</i>	33
		<i>Don't use heated water/detergents</i>	34
		<i>Do not use lead-based paints</i>	35
		<i>Contain sand blast grit</i>	36
		<i>Paint over graffiti</i>	37
		<i>Protect exposed soil</i>	38
		<i>Recycle scrap materials</i>	39
Installation of utilities in roads		<i>Protect storm drain inlets</i>	40
		<i>Avoid using water to clean up</i>	41
		<i>Do not discharge dewatering wastes directly</i>	42
		<i>Contain water &amp; wastes</i>	43
		<i>Place stockpiles away from streams</i>	44

---

## Street cleaning

### *Description:*

Traditionally, street cleaning has been performed to meet these goals:

- Remove street dirt, debris and other hazards for health, safety and appearance.
- Protect air quality through road dust removal.
- Remove street debris and sediments which tend to block flow and cause flooding.
- Protect public investment in transportation facilities from damage.

In recent years, many agencies have added another objective: to protect water quality by removing excess debris and pollutant-carrying sediments before they reach streams. Ideally, it's best to keep these materials out of the storm sewers in the first place.

Street cleaning generally involves one or more of the following activities: mechanical sweeping, vacuum/air sweeping, flushing, and leaf removal.

- **Mechanical and vacuum/air sweeping** occurs on regularly scheduled routes, typically very often (e.g., daily or weekly) in downtown business districts and only periodically along major arterials (e.g., weekly or monthly) and residential neighborhoods (e.g., monthly or quarterly). Frequencies vary depending on the expected average daily traffic, air quality regulations (dust control), or budget available. Typically signs are posted to inform residents of sweeping operations in congested areas. This reduces parking obstructions and increases effectiveness. Most agencies issue parking citations for those not obeying signs. To minimize non-productive travel or "standby time" of sweepers, many agencies have sweepers transfer loads to drop boxes placed along the route. The boxes are moved daily.

Currently, there are 4 types of sweepers on the market:

- mechanical or "broom" (rotating brush/broom with water spray)

- 
- regenerative-air (dry blower and vacuum system)
  - vacuum-assisted (broom and vacuum combination - usually wet)
  - EV-series (combines a brush/broom with a high powered vacuum - dry)
- **Flushing** is done in two stages: (1) advance flushing to reduce dust and increase effectiveness of street sweeping operations that follow, and (2) back flushing to move residual material away from traffic lanes.
  - **Leaf removal** prevents flooding and traffic hazards through localized seasonal leaf pick up. Generally, flushers and sweepers work together (i.e., flushing follows sweeping) to reduce dust and pickup leaf debris. Roll-off trucks and drop boxes are placed along the route to temporarily store materials and reduce the unproductive travel time of sweepers.

### Clean Water Tips:

**1. Use a more effective street sweeper.** In general, street sweeping with mechanical sweepers has a poor reputation as a best management practice for protecting water quality. Mechanical sweepers are good at picking up litter and debris, but cannot pick up the fine sediments that generally contain the pollutants of concern for stormwater quality. Most sweeper experts agree that mechanical-broom sweeper efficiency can be improved by broom height/angle adjustment, but only marginally.

Vacuum sweepers have been shown to be more effective than mechanical sweepers at removing fine particles from street surfaces. However, keep in mind that vacuum sweepers are most effective on dry pavement and may not work well much of the year in very wet areas such as Northwest Oregon.

**2. Eliminate street flushing activities,** or temporarily protect storm drain inlets during flushing. Flushing street surfaces can add petroleum hydrocarbons or metals pollutants to the storm sewer systems. Cover inlets with plates or mats, or consider several filter inserts that are on the market, to filter out fine sediments, dust, gravel, and oil and grease. Use booms and vacuum or allow area to dry before uncovering storm drain inlets.

- 
3. **Recycle street sweeping debris.** A study is under way by ODOT and Multnomah County to consider recycling options for street cleaning debris. Consider recycling debris in your community as a way to protect the environment and save money on landfill disposal costs.
  4. **Recycle leaf material as compost** for use in city parks and facilities. Look for opportunities to sell the compost to local suppliers.
  5. **Support research.** Continue to support local and national research that promotes recycling and reuse of waste materials.
  6. **Use covered storage containers.** Use only covered roll-off trucks and drop boxes to temporarily store street cleaning debris and leaf material. This will prevent rainfall and street runoff from carrying the debris to the storm sewers.
  7. **Deal quickly with illegal dumps.** Establish an agency procedure for quickly dealing with illegally dumped materials discovered by street cleaning crews. Consider posting “do not dump” signs in areas where dumping tends to occur the most.
  8. **Create a recordkeeping system** that allows crews to track curb miles swept, amount of debris collected, and problems requiring follow-up. Set up a routing procedure for the forms to make sure incidents are followed up promptly.

## Roadway repair

### *Description:*

Five basic types of road repair activities are described here: base repair, shoulder repair, cold milling, profiling and concrete street repair.

- **Base repair** involves replacement and compaction of new base material, after the hard surface and base materials are removed. Base paving includes the placement of lifts of asphaltic concrete in localized areas. Base repair is done to correct, restore, or improve the load-bearing capacity and structural integrity of the underlying bed-

---

ding material. This helps extend the life of the overlying road surface.

- **Gravel shoulder maintenance** supports the edge of the roadway pavement and provides a way to drain both surface and subsurface moisture away from the roadbed.
- **Cold milling** is a method of preparing the roadway for resurfacing by grinding or cutting away the surface material and providing a structurally sound base.
- **Profiling** restores appropriate shape and grade to the road surface to relieve drainage or safety problems.
- **Concrete street repair** involves placement of forms, pouring concrete, and leveling and floating the surface smooth. A broom or other finish is applied and edges and joints are troweled as needed. The forms are then stripped and the curb face is finished if necessary.

### *Clean Water Tips:*

9. **Schedule repair during dry weather.** Wet weather patterns in some parts of Oregon mean that repair activities during rain events is unavoidable. However, try to schedule major repair jobs during the drier late summer months. In other drier parts of the state, avoid all repair work during wet weather.
10. **Protect storm drain inlets** and open manholes during repair activities. Cover with plates or mats, or consider using one of the several filter inserts on the market, to filter out fine sediments, dust and gravel. If runoff water contains oil and grease, consider using sandbags or absorbent booms to pool the water, and vacuum. If runoff water contains gravel, sands and other particulates, use gravel-filled burlap bags as berms around the inlet to filter the water before it enters the storm drain system. Biobags (mesh bags filled with wood chips) can also be used, but keep in mind that they do not stay in place as well as gravel-filled bags and they can be destroyed if vehicles and equipment drive over them.
11. **Protect roadside ditches.** During wet weather on uncurbed roadways, use temporary berms or dikes at the edge of the road to prevent sediment, debris and waste materials from washing into roadside ditches. Keep in mind that certain types of protection (e.g., sandbags, fences) hold the water back, while

---

others (e.g., gravel-filled burlap bags and hay bales) slowly filter the water as it drains through. Choose the method that will work best in the given situation. Sediment builds up behind all of these devices and should be inspected during and after rain events and cleaned as needed.

- 12. Avoid using water to clean up.** Sweep or vacuum dust and debris generated during repair activities. DO NOT wash residue into the storm sewers.
- 13. Place stockpiles away from drainage courses** and storm drain inlets to prevent materials from being washed into streams. Cover stockpiles or contain within berms.
- 14. Contain water and wastes** generated during cleaning and flushing of spray equipment and hauling trucks, and field servicing of equipment. The first choice for disposal of this rinsate is to the sanitary sewer system. If this is not allowed, wait to clean equipment until it is returned to the yard. Finally, if this option is not feasible, and DEQ allows, land apply the water or treat it and discharge to the storm sewer. This may require a washwater permit.
- 15. Recycle used asphalt materials,** such as concrete and fill material when possible. Store these materials properly.
- 16. Use drip pans to contain leaks** from parked vehicles and equipment parked at the site overnight.

## Surfacing and resurfacing

### *Description:*

Resurfacing is generally part of an overall pavement management system designed to minimize the costs of maintaining and replacing entire roadways. The activities described here protect roadways by restoring road surfaces and controlling moisture damage to sub-grades. They protect the base, prevent erosion, provide a smooth and safe surface for traffic, slow deterioration of surfaces and improve appearance. Basic activities of surfacing and resurfacing include:

- **Paving** is the application of a layer of asphaltic concrete over base material to seal and protect the road.

- 
- **Hot Patch** repairs surface defects in asphalt and oil-gravel streets using hot mix asphalt concrete. Damaged surfaces such as potholes, depressions and pavement cuts are broken out and replaced.
  - **Slurry seal** is a mix of asphaltic emulsion and aggregate used to seal structurally sound surfaces. This method provides a practical alternative to asphaltic concrete overlays.
  - **Crack filling** seals cracks and small holes in hard-surface pavement with a rubberized asphalt material. Cracks are cleaned with compressed air, and then sealant is applied with a pressurized system.

### *Clean Water Tips:*

17. **Avoid paving in wet weather** in dry parts of the state. In other wetter parts of the state where some work during rain events is unavoidable, try to schedule major paving jobs during the drier late summer months.
18. **Protect storm drain inlets** and open manholes during road repair work, to prevent slurry mixes, dust, and debris from entering the storm sewers. (See notes above under Roadway Repair for ways to protect inlets).
19. **Protect roadside ditches.** During wet weather on uncurbed roadways, use temporary berms or dikes at the edge of the road to prevent sediment, debris and waste materials from washing into roadside ditches. (See notes above under Roadway Repair regarding temporary dikes along the roadway edge).
20. **Avoid using water to clean up.** Mechanically sweep and/or vacuum dust and debris following all activities. DO NOT wash residue into the storm drain system.
21. **Place stockpiles away from drainage courses** and storm drain inlets to prevent materials from being washed into streams. Cover stockpiles or contain within berms.
22. **Contain water and wastes** generated during cleaning and flushing of spray equipment and field servicing of equipment. Use booms and inlet protection, and vacuum or allow area to dry before uncovering storm drain inlets. Also, refer back to Tip #1 in this chapter.

- 
- 23. Recycle used materials such as asphalt.** Store these materials properly.
- 24. Use drip pans to contain leaks** from vehicles and equipment parked at the site overnight.

## Pavement marking

### *Description:*

Several types of pavement marking activities can pollute stormwater runoff:

- **Street line painting/stripping/stenciling** applies specialized paint (sometimes containing reflective beads) to mark traffic lanes and parking areas. This can be permanent or temporary.
- **Hot plastic pavement marking** involves placing hot molten thermoplastic material to mark special traffic control features such as stop lines, cross walks and turn bays. Deteriorated markings are swept, ground or pressure washed before new markings are installed.
- **Cold plastic markings** lays out and places pre-cut plastic markings using primers or adhesives. For very specialized pavement markings, bituminous adhesive may be used for bonding.

### *Clean Water Tips:*

- 25. Develop paint-handling procedures** for proper use, storage and disposal of paints to keep the materials contained. Educate staff about the procedures.
- 26. Protect storm drain inlets,** open manholes and roadside ditches during grinding and pressure washing activities. (See notes above under Roadway Repair for ways to protect inlets and ditches).
- 27. Avoid using water to clean up.** Mechanically sweep and/or vacuum grindings and dust following all activities. **DO NOT** wash residue into the storm drain system.

---

**28. Contain water and wastes** generated during cleaning and flushing of equipment and field servicing of equipment. Use booms and inlet protection, and vacuum or allow area to dry before uncovering storm drain inlets. Also refer back to Tip #14 in this chapter.

## Snow and ice control

### *Description:*

There are several maintenance activities designed to protect public safety during snow and ice storms:

- **Sanding** involves applying abrasive material to surfaces covered with snow, ice or slush for traction.
- **Deicing** involves applying chemicals to iced surfaces to promote melting for traction.
- **Plowing** or blading snow moves accumulated snow or slush to the edge of traffic lanes or off the edges of uncurbed streets.

### *Clean Water Tips:*

- 29. Recycle sands and gravels.** Sweep up sands and gravels as soon as possible after winter storms so that they are not washed into storm sewers. Screen and wash sands for reuse. Many larger agencies in Oregon already use this practice to keep unwanted sediments out of drainage courses.
- 30. Place sand stockpiles away from drainage courses** and storm drain inlets to prevent materials from being washed into streams. Cover stockpiles or contain with berms. This practice applies to new and used sands.
- 31. Do not use salts for anti-icing.** Salts can seriously harm aquatic life in streams and are prohibited for use on roadways in Oregon. Consider safer biodegradable chemicals.
- 32. Use biodegradable chemical de-icers sparingly.** Limit use of chemicals to fire access routes, bridges, steep arterial streets, and airport runways, where sanding and plowing are not possible or

---

quick de-icing is required. Do not use these chemicals near sensitive waterways and small streams. Keep informed about research on “safer alternatives” that biodegrade quickly and change practices if possible. Train staff about proper chemical application rates and methods, or use licensed applicators.

## Bridge repair and maintenance

### *Description:*

Bridge repair and maintenance involves the restoration, cleaning and maintenance of bridges and bridge parts for public safety. The following are some typical activities:

- **Bridge repair** reconditions damaged or deteriorated concrete, steel or timber bridge parts to restore structural integrity and extend service life. This may also involve reconstruction of bridge footings or use of rocks, riprap or similar materials to reinforce and protect exposed soil areas around footings.
- **Bridge washing** is generally conducted using low pressure water during high flow conditions. Heated water and detergents should not be used.
- **Expansion joint cleaning and repair** involves flushing dirt, gravel and other debris from joint to protect the structure or removing and replacing damaged or deteriorated joints. This activity helps protect bridges from water and freeze damage.
- **Painting** occurs periodically, according to an established schedule and available funding. This may involve pressure washing or sand blasting to remove built-up grit and flaking paint before painting.
- **Graffiti removal** is generally accomplished using spray cleaners, pressure washing with a chemical or baking soda solution, or painting over the graffiti.

---

 **Clean Water Tips:**

- 33. Follow special water quality requirements** for bridges over sensitive waterways and in environmental protection zones. Check with the regional offices of the Oregon Department of Environmental Quality for applicable requirements and technical assistance.
- 34. Do not use heated water or detergents** in bridge washing operations.
- 35. Do not use lead-based paints** and apply chemicals and solvents sparingly with spray cans or rags in small areas.
- 36. Contain sand blast grit** and other residues. Enclose sand blasting, pressure washing, grinding and welding activities to protect streams and rivers. Capture and dispose of wastes properly.
- 37. Paint over existing material** or graffiti whenever possible, to avoid generating waste residue.
- 38. Protect exposed soil** in areas around footings and under decking so that sediments do not erode and move downstream. This might include vegetation, riprap, rock, or some other technique, depending on agency preference and type of erosion.
- 39. Recycle scrap metal**, concrete and wood whenever possible. Integrate bridge maintenance with overall agency waste reduction/recycling program.

---

## Installation of utilities in roadways

### Description:

Utilities such as sewer and water lines are generally installed in the roadway by the public agency or its contractors, except in new developments, where they may be installed by a developer and later deeded over to the agency. Public utility companies also hire contractors to install electrical, gas and telecommunication lines and structures in the public right-of-way. Utility work involves sawcutting and breaking pavement, trenching, laying the lines in gravel or slurry fill, backfilling, and road repair. For sewer and water utilities, the work may include constructing and repairing drain inlets, laterals and manholes.

### Clean Water Tips:

- 40. Protect storm drain inlets**, open manholes and roadside ditches during utility activities. (See notes above under Roadway Repair for ways to protect inlets and ditches).
- 41. Avoid using water to clean up.** Mechanically sweep and/or vacuum dirt and debris following all activities. DO NOT wash materials into the storm sewers.
- 42. Do not discharge dewatering wastes directly** to the storm sewer or receiving stream without some form of treatment. First consider land applying or reusing the water. If this is not possible, temporarily store the water to allow sediments to settle out before discharge. This activity may require a permit from Oregon DEQ.
- 43. Contain water and wastes** generated during sawcutting activities as well as during cleaning and flushing of equipment. Use booms and inlet protection, and vacuum or allow area to dry before uncovering storm drain inlets. Also refer back to Tip #14 in this chapter.
- 44. Place stockpiles away from drainage courses** and storm drain inlets to prevent materials from being washed into streams. Cover stockpiles or contain within berms.

---

## Research Notes -



## Alameda County Demonstrates High Efficiency Street Sweeper

The Alameda County Public Works Agency is conducting a multi-year test of a new street sweeper technology. This new technology combines vacuum pickup of dry material (no water is sprayed on the street surface) with air filtration of the street dirt not deposited in the sweeper's hopper. The primary objective of the project is to demonstrate that reductions in street surface debris can have a direct impact on storm water quality.

In order to demonstrate this relationship, the project is measuring:

- 1.** The initial and residual pollutant loadings before and after cleaning. To do this, street surface particulate samples are divided into various particle sizes and chemically analyzed. The constituents of concern for this study are metals (e.g., lead, copper, zinc, and nickel).
- 2.** Stormwater quantity and quality on the street surface during the study are also being monitored.

The El Nino effect in FY 97/98 caused an insufficient number of actual sweeper tests to be conducted. However, a large amount of information is being developed from the street surface sampling that was conducted and the large number of storms monitored at multiple sites.

Contact: Gary Shawley,  
Alameda County Public Works Agency,  
(510) 670-5582.

---

## Research Notes -



### What's Been Learned About Street Sweeping Since the 1980's?

The 1980's Nationwide Urban Runoff Program studies appeared to support the belief that sediment buildup occurred only during dry weather and washing off occurred just during wet weather. Street sweeping was shown as ineffective at removing the fine particulates that tend to carry pollutants to streams. Things have changed. More recent studies have shown:

- Substantial sediment accumulation occurs during the rainy season between storms as well as during extended dry periods.
- Pollutant washoff from paved surfaces appears to be a year-round process.
- Newer street sweepers appear much more effective than the mechanical broom sweepers cited in the 1980's studies.
- Using a tandem sweeper (mechanical sweeping followed by vacuum) can improve pollutant removal efficiency.
- To have maximum effect, sweeping should be conducted six times a year.

These findings show that it is important to maintain a consistent street sweeping program year round. When purchasing new equipment, it would also be worthwhile to consider the newer vacuum or air-type sweepers. The added cost could be justified by improved performance and water quality benefits.

Contact: Roger Sutherland,  
Kurahashi & Associates, Portland, Oregon,  
(503) 968-1605.