Menu of BMPs Home

BMP Background

Public Education & Outreach on Stormwater Impacts

Public Involvement/ Participation

Illicit Discharge Detection & Elimination

Construction Site Stormwater Runoff Control

Post-Construction Stormwater Management in New Development & Redevelopment

Pollution Prevention/Good Housekeeping for Municipal Operations

Measurable Goals

Stormwater Home

Roadway and Bridge Maintenance

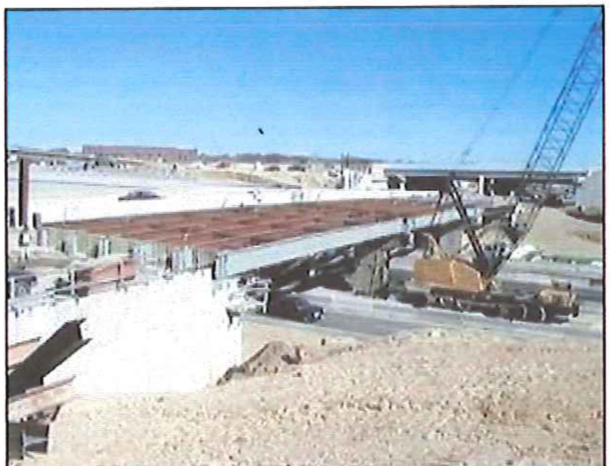
Click here to comment on this fact sheet

Minimum Measure: Pollution Prevention/Good Housekeeping for Municipal Operations

Subcategory: Municipal Activities

Description

This practice uses pollution prevention techniques to reduce or eliminate pollutant loadings from existing road surfaces as part of an operation and maintenance program. Daily roadway and bridge use, along with scheduled repairs, generate substantial amounts of sediment and pollutants. These pollutants contain heavy metals, hydrocarbons, and debris, which can threaten local water quality. Table 1 lists some of the constituents found in highway runoff and their primary sources.



Pollutants generated from road and bridge maintenance can be minimized with good housekeeping practices (Source: VDOT, 2000)

Table 1 also demonstrates, numerous pollutants deposited on roadways and bridges affect the water quality of stormwater runoff. Routine maintenance activities such as sweeping, vegetation maintenance, and cleaning of runoff control structures can help alleviate the effects of these pollutants. Modifying roadway resurfacing practices, along with how salt and other deicers are applied, also help reduce pollutant loads to stormwater runoff, protecting the quality of receiving waters.

Applicability

Roadway systems comprise a large part of the urban infrastructure across the country. Because of traffic use and climatic conditions, they require regular repairs and maintenance. The amount of pollutants found on roads and bridges vary, and can be affected by a number of factors other than traffic volume and climate. These other factors include surrounding land use, the bridge or roadway's design, the presence of roadside vegetation, insecticide use, and the frequency of hazardous chemical-inducing vehicle accidents and spills. In colder climates, deicer applied to roadways can also influence pollutant levels in road runoff, and thereby affect local water quality.

Table 1. Highway runoff constituents and their primary sources (Source: USEPA, 1993)

Constituent	Primary Sources
Particulates	Pavement wear, vehicles, atmosphere
Nitrogen, Phosphorus	Atmosphere, roadside fertilizer application
Lead	Tire wear, auto exhaust
Zinc	Tire wear, motor oil, grease
Iron	Auto body rust, steel highway structures, moving engine parts
Copper	Metal plating, brake lining wear, moving engine parts, bearing and bushing wear, fungicides and insecticides
Cadmium	Tire Wear, insecticides
Chromium	Metal plating, moving engine parts, brake lining wear
Nickel	Diesel fuel and gasoline, lubricating oil, metal plating, brake lining wear, asphalt paving
Manganese	Moving engine parts
Cyanide	Anticake compound used to keep deicing salt granular
Sodium, Calcium, Chloride	Deicing salts
Sulphate	Roadway beds, fuel, deicing salts
Petroleum	Spills, leaks or blow-by of motor lubricants, antifreeze and hydraulic fluids, asphalt surface leachate

Siting and Design Considerations

Proper planning for road and bridge resurfacing operations is a simple but effective pollution control method. Many techniques can be used to control the side-effects of road maintenance procedures. First, to prevent runoff contamination, paving operations should be performed only in dry weather, using concrete, asphalt or other sealers. Second, proper staging techniques should be used to reduce the spillage of paving materials during the repair of potholes and worn pavement. These techniques can include covering storm drain inlets and manholes during paving operations, using erosion and sediment controls to decrease runoff from repair sites, and using drip pans, absorbent materials and other pollution prevention materials to limit leaks of paving materials and fluids from paving machines. Lastly, resurfacing operations can use porous asphalt for potholes and shoulder repair to reduce the amount of stormwater runoff from road systems. For more information on permeable road surface materials, see the Porous Pavement fact sheet.

Good cleaning practices can help diminish the effects of stormwater runoff. Sweeping and vacuuming of heavily traveled roadways to remove sediment and debris can reduce the amount of pollutants in runoff. Street sweeping as a pollution source control is discussed more extensively in the Parking Lot and Street Cleaning fact sheet. Regular cleaning of runoff control structures, such as catch basins, can help reduce sediment loads in runoff that will end up in local waterways (see Catch Basin Inserts fact sheet).

Proper application of road salt or other deicers also reduces stormwater pollution. By routinely calibrating spreaders, a program manager can prevent the over-application of deicing materials. Besides reducing the effects of these materials on the aquatic environment, cost savings may be realized due to reductions in the purchase of deicing materials. Training for transportation employees in proper deicer application techniques, the timing of deicer applications, and what type of deicer to apply will also determine the impacts on water quality and aquatic habitat. See the Road Salt Application and Storage fact sheet for more information.

Maintenance practices for roadside vegetation also help determine the stormwater quality of road runoff. Restrictions on the use of herbicides and pesticides on roadside vegetation, and training to ensure that employees understand the proper handling and application of pesticides and other chemicals, can help prevent contamination of runoff. Selection of roadside vegetation with higher salt tolerances will also help to maintain runoff-filtering vegetated swales and biofilters. For more information on vegetated stormwater practices, see the Vegetated Filter Strip fact sheet.

Controlling bridge runoff may require additional maintenance measures to eliminate stormwater runoff. Besides the roadway practices listed above, improved bridge siting and design can help reduce water quality effects. Avoiding scupper drains in new bridges and routine cleaning of existing ones to prevent sediment and debris buildup can help. Scupper drains can cause direct discharges of stormwater containing relatively high pollutant concentrations to surface waters (CDM, 1993). Program managers should consider advocating retrofits of scupper drains with catch basins or otherwise redirecting water from these drains to vegetated areas to provide treatment. Other techniques to help reduce discharges to receiving waters include using suspended tarps, booms and vacuums to capture paint, solvents, rust, paint chips and other pollutants generated by bridge maintenance. Additionally, unlike common road salt, deicers like glycol, urea, or calcium magnesium acetate (CMA) reduce the corrosion of metal bridge supports.

Limitations

Generally, pollution prevention practices for road and bridge maintenance is limited by the cost for additional equipment and training. But since all communities already require maintenance of roadways and bridges, staffing is usually in place, and alterations of current practices should not require additional staffing or administrative labor.

A new bridge's location may be a limitation. The cost and availability of land, along with other economic and political factors, may dictate the location of a new bridge. If placed near sensitive waters, improved designs may be needed to control runoff. Controlling the size of paved areas to limit impervious surface may be restricted by community requirements for roadway and shoulder widths.

Effectiveness

Limited data are available on the actual effectiveness of road and bridge maintenance practices at removing pollutants from stormwater runoff. Table 2 examines the effectiveness and cost of some of the operation and maintenance practices recommended for stormwater pollution control.

Table 2. Road and bridge maintenance management practices: cost and effectiveness (Source: USEPA, 1993)

	Effectiveness (% Removal)[a]		Cost
Maintaining Roadside Vegetation	Sediment Control: 90% average P and N: 40% average COD, Lead, and Zinc: 50% average TSS: 60% average		Natural succession allowed to occur Average: $100/acre/year Range: $50-$200/acre/year
Street Sweeping	Smooth Street Frequent Cleaning: TSS: 20% COD: 5% Lead: 25%	Smooth Street Infrequent Cleaning: TSS: N/A COD: N/A Lead: 5%	Average: $20/curb mile Range: $10-$30/curb mile
Litter Control	N/A		All are accepted as economical practices to control or prevent stormwater impacts.
General Maintenance	N/A		
Minimizing Deicer Application	N/A		

[a]P=phosphorus; N=nitrogen; TSS=total suspended solids; COD=chemical oxygen demand

Preventative maintenance and strategic planning are time-proven and cost-effective methods to limit stormwater runoff contamination, despite the limited data on cost and effectiveness. By working to reduce pollutant loads, it can be assumed that the management practices recommended will have a positive effect on both the stormwater quality and quantity. Protecting and restoring roadside vegetation, removing debris and sediment from roads and bridges, and directing runoff to vegetated areas all effectively treat stormwater runoff. Other practices, like minimizing deicer application, controlling litter, properly handling fertilizers, pesticides and other toxic materials, work to control some stormwater pollution pathways. Employing good road and bridge maintenance practices is an efficient, low-cost way to eliminate some of the effects of stream an waterway-impairing pollutants generated by road systems.

Cost Considerations

Most community public works or transportation departments already consider the maintenance of local roads and bridges. Therefore, the costs of pollutant reducing management practices will involve the training and equipment required to apply these new practices. Table 2 includes cost data for some recommended new practices.

Costs may vary greatly in the type of deicer selected for application. Table 3 includes a comparison of four different deicers and the cost of application. It should be noted that CMA costs more than the other deicers, but that reductions in corrosion to infrastructure, damage to roadside vegetation, and amount of material used may offset the higher cost.

Table 1. Deicing Alternatives (Keating, 2004)

Substance	Cost	Characteristics
		• Melts ice at

Calcium Chloride ($CaCl_2$)	Flake $290/ton, pellet $340/ton	temperatures of -25 ° F • If used as recommended, will not harm vegetation
Magnesium Chloride ($MgCl_2$)	Flake $260/ton, pellet $300/ton	• Lowest practical temperature: 5 ° F • If used as recommended, will not harm vegetation; however, $MgCl_2$, on a percentage basis, contains 17-56% more chloride ion than other salt-type deicers
Potassium Chloride (KCl)	$240/ton	• Lowest practical temperature: 12 ° F • Will not harm vegetation
Urea	$280/ton	• Lowest practical temperature: 15 ° F • Will not harm vegetation
Calcium Magnesium Acetate (CMA)	$2,000/ton	• Will work below 0 ° F • Low toxicity and biodegradable

References

Bay Area Stormwater Management Agencies Association (BASMAA). 1995. *Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction-Related Sites.* Bay Area Stormwater Management Agencies Association, Oakland, CA.

Camp Dresser & McKee et al. 1993. *California Stormwater Municipal Best Management Practice Handbook.* Stormwater Quality Task Force, Sacramento, CA.

Keating, Janis. 2004. Stormwater. *Deicing Salt: Still on the Table* [www.forester.net/sw_0106_deicing.html EXIT Disclaimer]. Accessed October 17, 2005.

Ohrel, R. 1995. Rating Deicing Agents-Road Salt Stands Firm. *Watershed Protection Techniques* Vol 1, No 4. pp. 217-220.

Ohrel, R. 1995. Choosing Appropriate Vegetation for Salt-Impacted Roadways. *Watershed Protection Techniques* Vol 1, No 4. pp. 221-223.

Virginia Department of Transportation. 2000. *Springfield Interchange Current Construction.* [http://www.springfieldinterchange.com EXIT Disclaimer]. Accessed September 15, 2005.

USEPA. 1993. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.* U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Click here to comment on this fact sheet