4.2-b STREET SWEEPING

DESCRIPTION

Street sweepers are used to remove pollutants, debris, and sediment from roads and parking lots. When routine street sweeping practices are employed, a portion of pollutants that accumulate on roads and parking lots may be removed before they are entrained in stormwater runoff and potentially transported to receiving waters.

BMP DESIGN APPROACH
■ **Pollutant Source Control**
☐ Hydrologic Source Control
☐ Stormwater Treatment
SCALE OF APPLICATION
☐ All SFR and MFR < 1 acre
■ **MFR 1-5 Acre and CICU < 5 acres**
■ **MFR and CICU > 5 acres and all WQIPs**
BMP TYPE
☐ Temporary
■ **Permanent**

APPLICABILITY

- Applicable to all Lake Tahoe Region roads and parking lots, but most applicable for roads and parking lots where road abrasives are applied.
- Not applicable when snow or ice is present on a road.

Advantages

- Can reduce the total mass of pollutants on roads and parking lots.
- Can reduce maintenance requirements for downstream stormwater treatment BMPs and infiltration systems.
- Certain types of street sweepers can reduce pollutants of concern for lake clarity from roads and parking lots.

Disadvantages

- Significant costs associated with procurement of sweeping equipment, as well as operation and maintenance of sweeping equipment.
- Ineffective when roads are wet or muddy.
- Ineffective when snow and ice are present on roads.

DESIGN AND OPERATION CONSIDERATIONS

Three types of street sweepers are defined in this Handbook:

A. Mechanical Broom Sweeper: uses brooms typically spanning the width of the sweeper that contact the pavement surface and sweep debris onto a conveyer which deposits the debris into a hopper. Mechanical broom sweepers commonly spray water on the pavement surface to reduce the generation of fugitive dust, which can reduce the efficiency of material recovery.

- Mechanical broom sweepers are not considered an effective type of sweeper for recovery of pollutants of concern for lake clarity (in particular fine sediment particles).
- Relative to the other sweeper types discussed, mechanical broom sweepers may be the most practical and effective sweeper to operate on roads with significant material accumulation, pack-down material, or significant amounts of debris such as pine needles.
- Mechanical broom sweepers may also be applicable for construction sites where large debris collection is needed.

B. Regenerative Air Sweeper: uses a recirculating air supply to blast the pavement surface with air to dislodge and entrain sediment and debris in the air. A vacuum system is positioned to pull the blasted air, and the material it has entrained, back into the sweeper hopper.

- Regenerative air sweepers are considered an effective type of sweeper for recovery of pollutants of concern for lake clarity (in particular fine sediment particles).
- Relative to mechanical brush sweepers, regenerative air sweepers may be less expensive to maintain because they operate with less moving parts, including less moving parts that touch the pavement.

The TYMCO DST-6, a popular regenerative air sweeper used by the local jurisdictions.

C. High Efficiency Street Sweeper: the term "high efficiency" implies that a sweeper is designed with an advanced air filtration system for dust containment in combination with the use of both main and gutter brooms[2].

- High efficiency street sweepers are considered the most effective type of sweeper for recovery of pollutants of concern for lake clarity (in particular fine sediment particles).
- High efficiency street sweepers can only operate when roads are free of ice and snow.

OPERATION CONSIDERATIONS

- For roads with significant amounts of debris, if may be impractical to operate a regenerative air or high-efficiency street sweeper because the heavy debris load may overwhelm the sweeper and create an impractical maintenance burden. For this situation, consider using a mechanical broom sweeper first, followed by

[2] Sutherland, R.C., and Jelen, S.L., 1997, *Advances in Modeling the Management of Stormwater Impacts*, Volume 5, (Edited by William James) CHI. Guelph, Ontario, Canada: 179-190, Contrary to Conventional Wisdom: Street Sweeping Can be an Effective BMP.

sweeping with a regenerative air or high-efficiency sweeper to reduce the maintenance burden on the more technologically advanced sweeper while recovering pollutants of concern for lake clarity.

- Maintenance departments that have used high efficiency street sweepers in the Lake Tahoe Region have reported significant recovery of fine grained material in the air filtration system. However, the maintenance departments also noted that the high efficiency street sweeper was the most resource intensive piece of equipment to maintain among the equipment they operate.
- To maximize recovery of pollutant loads when applying limited resources for street sweeping, consider the following approach:
  - Prioritize sweeping on roads that receive frequent road abrasive applications that are also directly connected to a drainage system and/or receiving waters.
  - Prioritize sweeping on road shoulders above sweeping on travel lanes. Research has identified material accumulations to be most significant along the road shoulder[3].
- Sweep roads that receive road abrasives after every abrasive application (as road conditions allow).
- All roads should be swept a minimum of twice per year. Preferably in the spring and fall.

INSPECTION AND MAINTENANCE

Inspection and maintenance activities for street sweepers will vary dependent upon the type of sweeper used, the frequency of sweeping, and the condition of the roads being swept. In general, manufacturer's guidelines should be followed to determine maintenance needs and maintenance frequencies. Below are general maintenance considerations for a street sweeper after each use:

- Clean the sweeper to remove sediment and debris.
- Dispose of sediment and debris at a TRPA approved location.
- Check for clogged/damaged pathways and parts and repair as needed.

EFFECTIVENESS CONSIDERATIONS

A significant number of street sweeper effectiveness studies have been conducted for a range of street sweeper types, models, and sweeping frequencies[4,5,6,7]. However, the majority of existing sweeper effectiveness research does not directly address the primary pollutant of concern for lake clarity: fine sediment particles. While a Lake Tahoe Region study that compares the type of street sweeper to efficiencies for fine sediment particle recovery has not been conducted, the existing

[3] 2NDNATURE, 2010, *Road Rapid Assessment Methodology (RAM), Technical Document* prepared for California Tahoe Conservancy and Nevada Division of Environmental Protection
[4] Center for Watershed Protection (CWP), 2008, *Deriving Reliable Pollutant Removal Rates for Municipal Street Sweeping and Storm Drain Cleanout Programs in the Chesapeake Bay Basin*
[5] Selbig, W.R. and Bannerman, R.T., 2007, *Evaluation of Street Sweeping as a Stormwater-Quality-Management Tool* for the U.S. Geological Survey in Water Resource Investigations Report 2007-5156.,
[6] Shoemaker, L., Lahlou, M., Doll, A., and Cazenas,P., 2002, *Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring* for the U.S. Department of Transportation Federal Highway Administration
[7] Sutherland, R.C., and Jelen, S.L., 1997, *Contrary to Conventional Wisdom: Street Sweeping Can be an Effective BMP* in Advances in Modeling the Management of Stormwater Impacts, Volume 5, (Edited by William James) CHI. Guelph, Ontario, Canada: 179-190,.

sweeper effectiveness studies mentioned above agree that mechanical broom sweepers are not effective for recovery of fine sediment particles.

The newest and most technologically advanced sweepers that apply vacuum-assisted air filtration systems are currently considered the most effective type of sweeper for fine sediment particle recovery. However, the magnitude of pollutant load reductions that can be achieved by these types of sweepers on an annual basis is not well understood because of constraints associated with: 1) limited maintenance resources to operate the sweepers at a high frequency and maintain the sweepers; 2) inconclusive of conflicting performance monitoring studies; and 3) operational impairment during the winter season (i.e. sweepers are generally ineffective when snow, ice, and water is present on the roads).