

## ABRASIVES AS ANTI-SKID MATERIAL

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Municipal officials are faced with many choices to consider when dealing with snow and/or ice-covered highways and winter maintenance.

Do we have the equipment and operators to provide for efficient winter maintenance or will we need to contract some responsibilities to the private sector? Do we apply anti-icing chemicals prior to the storm to prevent snow from bonding to the roadway? Which materials should we use for traction and deicing? How many inches of snow should accumulate before we start plowing?

This technical information sheet is intended to provide information to assist municipalities in deciding which abrasive material (if any) that they will spread on municipal streets or highways for traction during their winter operations.

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**Abrasives do little to improve driving conditions on roads with high-traffic volume. Displacement by traffic or incorporation into forming snowpack quickly diminishes the benefit of abrasives.**

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### Advantages and Disadvantages of Abrasives

Abrasives have several advantages and disadvantages when used for treating urbanized city or subdivision streets or rural gravel roads. The choice of which abrasive material to use with deicers will depend on what type of road you are responsible for. Another concern when deciding if and what type of abrasives to use is potentially polluting stormwater and making sure you are following the requirements of the Environmental Protection Agency (EPA), commonly referred to as municipal separate storm sewer systems (MS4).

If you decide to use abrasives, you have to determine which abrasive to choose based upon various PennDOT specifications. Remember your PennDOT Municipal Service Representative will be able to help ensure you are properly spending your municipal Liquid Fuels Funds on abrasives for winter maintenance.

The decision to use or not use abrasives should be based upon consideration of all of the advantages and disadvantages. The following have been found to be **advantages of spreading abrasives:**

- Low initial cost
- Appropriate for use on unpaved roads
- Immediate friction improvement
- Suitable for low-temperature use
- Visibility to drivers

The following are **disadvantages of applying abrasives:**

- No melting effect for deicing
- Only temporary friction benefit due to traffic displacement
- Skidding hazard on bare pavement
- More costly than salt when considering cleanup costs
- Vehicle windshield and paint damage
- Environmental concerns, such as air quality, smothering roadside vegetation, and water quality, including siltation in drainage systems and waterways

Regardless of the advantages or disadvantages of using abrasives, sometimes winter storm conditions (such as ice storms or snowstorms when the temperature is below 10 degrees) will dictate that abrasives be mixed with sodium chloride (road salt) to provide initial traction on paved road surfaces. Whatever type of abrasive that you decide to spread, you may find it necessary to mix road salt with abrasives to keep stockpiles from freezing and to prevent chunks from forming in the truck spreaders.

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## Studies have shown that snow melts faster when 100 percent sodium chloride is spread in narrow strips on the road surface (near the centerline of a crowned street or on the high side of a superelevated curve).

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### EPA & MS4 Regulations

Based upon previous census figures, some municipalities fall under the definition and description of urbanized areas. These urbanized areas are based upon boundaries around dense areas of settlement and identified areas of concentrated development within the Stormwater Phase II Final Rule.

- Phase I regulations, issued in 1990, require medium and large cities or certain counties with populations of 100,000 or more to obtain NPDES permit coverage for their stormwater discharges. There are approximately 750 Phase I MS4s throughout the United States.
- Phase II regulations, issued in 1999, require regulated small MS4s in urbanized areas (go to <http://water.epa.gov/polwaste/npdes/stormwater/Urbanized-Area-Maps-for-NPDES-MS4-Phase-II-Stormwater-Permits.cfm> for maps of urbanized areas subject to federal MS4 regulations) as well as small MS4s outside the urbanized areas that are designated by the permitting authority to obtain NPDES permit coverage for their stormwater discharges. There are approximately 6,700 Phase II MS4s in the United States.

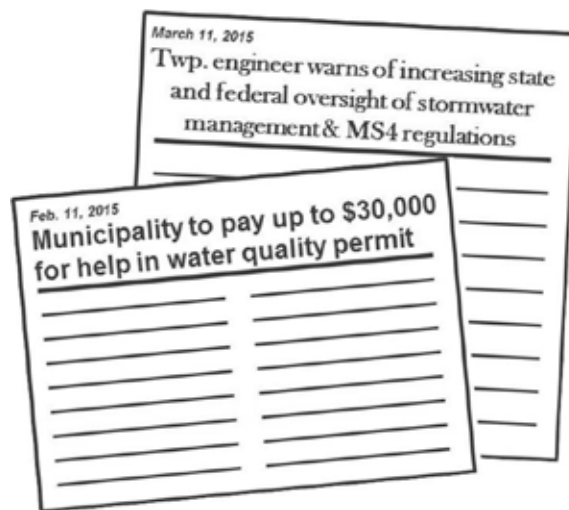
Due to the EPA regulations, several municipalities within Phase I and II areas have already made the decision to spread 100 percent sodium chloride (road salt) for winter deicing operations due to its lower cost and proven effectiveness.

Municipalities within Phase II are required to implement a minimum of six Best Management Practices (BMPs). One of those BMPs involves pollution prevention and good housekeeping to address stormwater runoff from their facilities and activities. The term stormwater covers stormwater runoff, snowmelt runoff, and surface and drainage runoff. Streets, roads, highways, and other large municipal-owned paved surfaces, such as parking lots, are significant sources of pollutants in stormwater discharges, including trash, sediment, organic matter, and oil and grease. Abrasives used in winter maintenance to provide for temporary traction and safer driving fall into the category of pollutants and are required to be removed by street sweeping and cleaning.

### MS4 Audits

Some municipalities have already been audited by the EPA and have had their MS4 programs evaluated, resulting in substantial fines. The practice of using abrasives during winter maintenance has a great impact on receiving waters of discharges from municipal storm sewer systems. The EPA auditors' guide for MS4 program evaluation prepares the evaluator on what documentation to review or obtain during the audit to determine if the municipality is in compliance and performance of the municipality's MS4 program.

Auditors will request documentation on collecting abrasives from winter operations by street sweeping or catch basin cleaning to help in writing the evaluation report or documenting a permit violation. A comprehensive program evaluation will be tailored to the issues associated with each municipality and could include more specific questions regarding the municipality's MS4 program if abrasives are applied during winter operations.



To avoid substantial fines when their MS4 programs are evaluated by the EPA, municipalities must take care to be in compliance with standards regulating their use of abrasives during winter operations.

For example, MS4 auditors may request the following street sweeping operations information:

- Does the permittee regularly sweep streets or municipal-owned parking lots?
- What is the sweeping schedule?
- Are areas scheduled for sweeping based on aesthetics only, or is consideration given for reducing impacts on the stormwater and surface waters?
- What types of sweepers are used?
- How is street sweeping debris disposed? If the debris is dewatered, how is it done? How is the decanted water disposed?

- Are records kept of the amount of debris collected and amount of debris properly disposed of?
- How does the municipality use the data to further its program or evaluate program effectiveness? Are the data used to help prioritize cleaning frequency?

MS4 auditors may request the following catch basin cleaning operations information:

- Does the municipality have a schedule for routine maintenance or cleaning of basins?
- How many are cleaned and how often?
- Has the municipality targeted certain areas for more frequent maintenance? Does this targeting help minimize stormwater pollution?
- Are goals set for how many basins are inspected and cleaned each year?
- How are basin cleaning and maintenance needs tracked and recorded?
- What information is documented? Does the municipality track how much material is removed from each basin?
- What are the procedures for disposal of waste removed from basins or drains?
- Does flushing occur that could potentially discharge to surface water?
- If the material is removed by wet vacuum, how is the material dewatered? How is the decanted water disposed?
- Does the municipality have a schedule for routine maintenance or inspection of stormwater pipes?
- What are the maintenance procedures for cleaning clogged stormwater pipes?

MS4 auditors may request the following winter maintenance operations information:

- What type of winter anti-icing, deicing, and traction materials are used?
- How are the materials stored? Is the material covered and/or graded with a berm to prevent runoff?
- Does the municipality track the location and volumes of agents applied?
- Is the material picked up after the winter event? Is there a schedule for cleaning up after an event?

Keep in mind that the evaluator will question both managers and field staff regarding procedures used. The evaluator

will ascertain the level of understanding at the field level as well as what procedures are deemed appropriate and feasible for your specific winter operations and MS4 maintenance activities.

## PennDOT Regulations on Abrasives

Under the current PennDOT publications, abrasives (anti-skid materials) fall into two categories:

- 1) Aggregates, and
- 2) Cinders, coke, crushed coal boiler bottom ash, or burned anthracite coal mine refuse.

Aggregates used for traction are found within PennDOT Publication 408, Section 703.4, Anti-Skid Material. If you decide to use cinders, coke, ash, or mine refuse, you will find those specifications within PennDOT Publication 447, Section MS-0450-0001, Anti-Skid Material for Municipal Use. Both products are approved for municipal use although there are differences in availability and use throughout the state.



At the Windsor Township, York County, material storage facility, sodium chloride is placed on the right, and Type AS2 anti-skid is located to the left. Material storage like this allows the municipality to spread straight salt or, depending upon the type of winter weather, a mixture of salt and anti-skid. Photo credit: ISMF LLC.

We will begin with the material within **Publication 408**. Generally, this material is used on ice- or snow-covered pavement surfaces and is produced by producers listed within PennDOT Publication 34, Bulletin 14, Aggregate Producers.

There are four different gradations of anti-skid for use: Types AS1, AS2, AS3, and AS4. The gradation (size of aggregate within each type) varies between each anti-skid type as shown in the following table:

Anti-Skid Type	Maximum Percent Passing Sieve								
	31.5 mm (1 1/4")	19.0 mm (3/4")	12.5 mm (1/2")	9.5 mm (3/8")	4.75 mm (No. 4)	2.36 mm (No. 8)	300 µm (No. 50)	150 µm (No. 100)	75 µm (No. 200)*
Type AS1				100	60-100	0-80		0-8	0-5
Type AS2				100	35-80	0-45		0-6	0-3**
Type AS3			100	90-100		0-30		0-8	
Type AS4				100	35-80	0-45		0-6	0-3**

\* Determined by PTM No. 100.

\*\* If the total percent passing the 2.36 mm (No.8) sieve is less than 25%, then the total percent passing the 75 µm (No. 200) sieve is allowed to be 0-5.

**Type AS1** is composed of natural sand, manufactured sand, or a combination of the two.

**Types AS2 and AS3** are composed of crushed stone, gravel, or slag.

**Type AS4** is composed of crushed stone or gravel only.

Each type of anti-skid is further defined within the publication referring to specifics on unit weight, amount of crushed fragments, abrasion loss, and how much metallic iron is allowed within the material. Acceptance of this material requires the producers to provide a Certificate of Compliance (CS-4171) to the municipality for each load.



This anti-skid material is approved within Publication 408 as Type AS2. Material provided by York Building Products, Inc. Material production site is located on Roosevelt Aveune in York, Pa. Photo credit: ISMF LLC.

Material within **Publication 447** is only intended to be used by municipalities on ice- and snow-covered pavement surfaces and is produced by suppliers listed within the current publication, Section MS-0450-0001. Material may not contain metal, glass, or substances that may be harmful to automotive equipment or vehicles.

There are three different gradations of anti-skid for municipal use: Types 1, 1A, and 4. The gradation varies between each anti-skid type as shown in the following table:

**Gradation Table**

Type	1 1/4"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 50	No. 100	No. 200
Type 1	100					70	18		
Type 1A		100	90-100			55	18		
Type 4			100	95-100		30		8	

**Types 1 and 1A** are composed of cinders, coke, crushed coal boiler bottom ash, or a combination of these. Bottom ash is residue of molten ash obtained from coal-burning boilers.

**Type 4** is composed of burned anthracite coal mine refuse.

Each type of anti-skid is further defined within the publication referring to specifics on unit weight, allowable amount of crushed brick, stone, blast furnace slag, steel slag, or gravel, and amount of unburned or partially burned coal or coke.



This anti-skid material is approved within Publication 447 as Type 1. Material provided by Ash Resources, Schuylkill Haven, Pa. Material production site is located in Montour County, Washingtonville, Pa. Photo credit: ISMF LLC.



This anti-skid material is approved within Publication 447 as Type 1A. If you compare the photo of Type 1 to Type 1A, you will notice that the Type 1A material is smaller in size, which agrees with the gradation table below. Material provided by Ash Resources, Schuylkill Haven, Pa.. Materail production site is located in Montour County, Washingtonville, Pa. Photo credit: ISMF LLC.

Acceptance of this anti-skid for municipal use requires the producers to provide a Certificate of Compliance (CS-4171) or (MS-447A) for each load.

**PennDOT Resources**

- Publication 408, Highway Construction Specifications
- Publication 447, Approved Products For Lower Volume Local Roads
- Publication 34, Bulletin 14, Approved Aggregate Producers