

Technical Bulletin

Surface Maintenance

For unpaved roads



PennState

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Center for Dirt and Gravel Road Studies

PURPOSE OF SURFACE MAINTENANCE FOR UNPAVED ROADS – To establish effective drainage, to smooth the road for vehicular travel, to reduce long-term maintenance costs and pollution impacts.

WHAT IS SURFACE MAINTENANCE?

Road surface maintenance is the periodic re-shaping of the road surface to ensure proper drainage and smooth traffic passage. The process may involve re-graveling, or the replenishment of surface material, and includes:

- Re-establishing crown and proper cross-slope (see Crown & Cross-Slope Informational Bulletin).
- Incorporating segregated stones back into the road surface (see Grading Sequence Technical Bulletin).
- Eliminating imperfections such as potholes, ruts, and washboards.

Timely maintenance using up-to-date surface maintenance techniques can improve road performance, lengthen maintenance cycles, reduce maintenance costs, and reduce pollution impacts.

WHY IS SURFACE MAINTENANCE NECESSARY?

The surface stones on an unpaved road are not bound with asphalt or concrete, as on a paved road, and are constantly moving due to traffic and weather. Vehicles differentially compact, displace, and segregate the mix. Freeze-thaw swells and breaks apart the road. Water trapped on the surface softens the road. Over time, the coarse stones, which provide support for traffic, are displaced and accumulate along the edge of the road. This resultant windrow traps water on the traveled surface. Water that cannot freely leave the road has more time to saturate the road surface and road base, breaking down the road's support structure. Additionally, water that accumulates on the road becomes increasingly erosive as it gains volume and velocity on steeper slopes, or forms potholes at low points on the road. The process starts slowly but if surface maintenance is not completed on a timely basis, the damage to the road can be severe.

BENEFITS OF SURFACE MAINTENANCE

- Limits water from flowing on, or laying on, the road.
- Creates a tightly packed road surface;
- Reduces dust generation caused by the grinding action of loose stones under traffic; and
- Minimizes loss of road material caused by traffic and erosion, to save money and reduce sediment and dust pollution.

INDICATORS THAT SURFACE MAINTENANCE IS NEEDED

- Excessive dust;
- Loose stone on the road surface or along the road edge (particularly in windrows – see Photo 1);
- Water flowing parallel with the road in the wheel tracks (see Photo 2);
- Holes or potholes (see Photo 3);
- Ruts or Wash-boarding;
- Loss of crown, even if other indicators are not yet present.



ADVANTAGES OF A QUALITY AGGREGATE ROAD SURFACE:

A good road surface aggregate consists of a mixture of crushed hard stone designed specifically as a surface-wearing course. The mixture will have minimal amount of deleterious material such as clay, silt and organics. The gradation, or distribution of specific rock sizes, will create a dense and durable travel surface when compacted at optimum moisture. Driving Surface Aggregate, or DSA, is a good example of a quality surface aggregate. DSA information and specification can be found in the separate DSA Technical Bulletin.

HOW IS SURFACE MAINTENANCE OF QUALITY AGGREGATE DIFFERENT?

Grading Equipment: A road surface made up of quality aggregate should always be graded and never bladed. The tight knit surface should not be disrupted with the use of a rake or drag. When grading, the equipment should cut deep enough (3"-4" +) to mix fines embedded in the road back in with larger stone retrieved from the road edge. A carbide toothed grader blade is ideal for this purpose.

Moisture: Moisture is critical to achieving maximum compaction (road density). Grading quality aggregate should be done when adequate moisture is present in the road to minimize segregation of stone sizes and maximize compaction density. Grade after extended wet weather periods, or add moisture to the road surface (see Photo 5). Compact the road following grading, before the road dries.

Compaction: Post grading compaction greatly extends the functional life of a re-graded road. This procedure minimizes the differential compaction and aggregate displacement caused by traffic and allows the road to maintain effective crown longer. The loss of fines, typically flushed from the road surface by the first rain storm on a freshly graded road, is reduced considerably. This reduces the loss of purchased road material and sediment pollution of nearby surface waters. A 10 ton vibratory roller is ideal for this application. However, smaller vibratory rollers and even static drum rollers will add to the durability of the road surface and the longevity of the grading job.

Re-graveling (surface replenishment): Whether doing a full overlay or a skim coat, it is best to reapply quality aggregate, so as not to contaminate or compromise the original aggregate mixture.



OTHER MAINTENANCE OPERATIONS

- Shoulder maintenance and ditch cleaning are often combined with surface grading as one operation. Material retrieved from the road shoulder is often displaced surface aggregate useful in reconditioning the road. Ditch material, often rich in organic debris, is not desirable road material. Combining ditch cleaning and shoulder maintenance with grading typically leads to some ditch material mixing into the road aggregate. This has the serious drawback of contaminating the quality surface aggregate and nullifying its desirable attributes.
- Potholes must be scarified at least 1" below the base, or bottom, of the hole. If a pothole is too deep to scratch to this depth with a carbide toothed grader blade, the hole should be scratched with a trenching bucket on a backhoe or excavator prior to the grading operation. Where numerous deep potholes exist, each road lane should be graded in two directions (with traffic and against traffic) prior to the final grooming pass and subsequent compaction.

MAINTENANCE STRATEGIES

- Avoid doing road surface maintenance and road ditch maintenance on a schedule and together. Grade a road and clean ditches only when needed (see page 1 for grading indicators).
- If both surface grading and ditch cleaning are necessary, and separating the procedures is impractical, cut the road shoulder and blend that material back into the road before cleaning the ditch. Clean the ditch, remove the ditch material from the road, and dispose of the spoils appropriately.