

# Technical Bulletin

## Rotating Carbide-Tipped Grader Blades

**ROTATING CARBIDE-TIPPED GRADER BLADES – A grader blade system with replaceable and freely rotating carbide bits that offer numerous benefits when grading unpaved roads.**

### BENEFITS OF THE CARBIDE-TIPPED BLADE SYSTEM

**DURABILITY.** The individual carbide steel cutting bits rotate with the vibration and force applied during grading operations (see Photo 1). Carbide cutting bits can outlast traditional cutting edges by twenty to one.

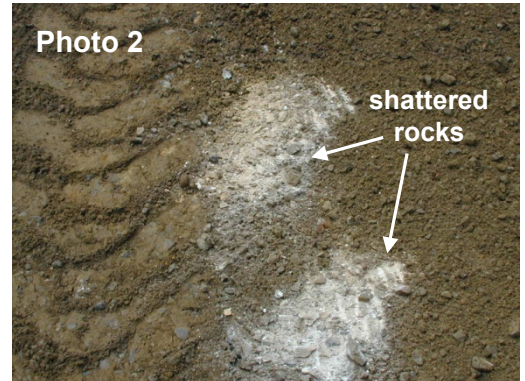


**CUTTING EFFECTIVENESS.** Compared to straight blades, carbide-tipped blade systems more effectively cut hard surfaces and will typically cut deeper with each pass. Carbide bits shatter rocks rather than pulling them out of the road (see Photo 2). The bits also grind off embedded rocks, allowing restoration of the road to the desired cross section and improving adhesion of gravel overlays.

**INCREASED PRODUCTIVITY.** Since carbide tipped blades typically cut deeper with each pass and shatter embedded rocks, rather than aggressively hooking them, it is possible to grade more aggressively and effectively at higher travel speeds. Final grooming of the graded road can be accomplished with the carbide-tipped blade system, eliminating the undesirable practice of raking, which segregates the newly blended aggregate in the road surface. When newly graded roads are raked, the dislodged stones quickly displace, which creates more dust.

**BINDING AND COMPACTION.** Two common problems with traditional grading equipment are the inability to cut deep enough to collect fines locked in the road and of the failure to significantly roughen the road to promote adhesion of the freshly graded road material (see Photo 3 and 4). The carbide-tipped blade system helps enormously with these issues. The deeper cutting action mixes road fines with reclaimed shoulder stones, and the grooves left in the aggregate surface eliminate shear planes, improve adhesion, and enhance compaction, especially when only a thin layer, or lift, of road material is placed or generated during the grading process.

**GRADING UNDER WET CONDITIONS.** The carbide-tipped grader blade allows for grading under wet conditions. In fact, it is desirable to grade when moisture is present in the road surface, after periods of wet weather or with the use of a water truck. Moisture is critical to proper compaction and the cohesiveness of water reduces both segregation and dust (see Photo 5). The cutting action of this blade system causes the graded material to dry rapidly. Grading crews should be prepared to roll the road immediately after the final grooming pass of the grader. This is especially important on sunny and windy days.



**Photos:** *Photo 4.* Note the high moisture content of the graded aggregate. The material is well mixed by the toothed blade and can be effectively compacted. *Photo 5.* Here maintenance grading was done after a few days of soaking rain.



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## Grading Sequence with a Rotating Carbide-Tipped Grader Blades

Carbide-tipped blade systems offer numerous benefits over traditional straight grader blades for maintenance grading operations. This is the preferred tool for maintaining a road surfaced with a quality aggregate, such as Driving Surface Aggregate (DSA). This document is prepared for operators not familiar with the rotating carbide-tipped blade. Minor adjustments to techniques used with traditional straight blades will allow the blade to perform at maximum potential. Presented here is the road surface grading sequence using a rotating carbide-tipped grader blade:

1. Scratch the Road Surface
2. Restore Proper Cross-Slope
3. Spread the Material
4. Groom the Road
5. Compact

The sequence outlined here depicts the process for grading a center-crown shaped road.

### 1. SCRATCH THE ROAD SURFACE

The first step in grading is to loosen and roughen the entire surface of the road. The shallow grooves created by a carbide-tipped blade eliminate shear planes and act as anchor points, greatly improving binding of the newly graded material.

Typically one pass in each direction is sufficient to loosen the material and prepare the center of the road to receive material. When scratching the surface, stay on one side of the crown and off the centerline (see Figure 1). Scratch/loosen the road material to the depth of the deepest point in the road cross-section. It is particularly important to cut the road (cross-sectional profile) to the bottom of any washboards or shallow holes. This may require additional passes.

Deeper holes should be cut below the bottom with a grader-mounted scarifier or other toothed digging equipment (backhoe or excavator). This is to destroy the shape of the hole, to drain the hole, and to reduce the potential for the hole to recur. Failure to scratch the center of the road when attempting to rebuild/repair crown is a recipe for future potholes and washboards (see Photo 1).



Figure 1.

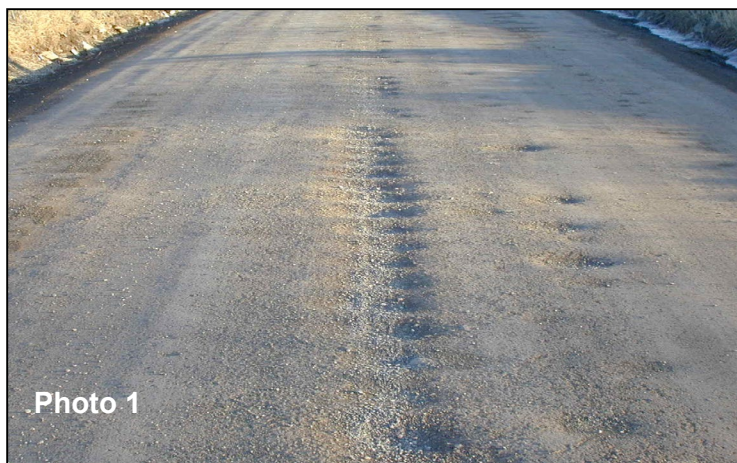


Photo 1



## 2. RESTORE PROPER CROSS-SLOPE

The accumulation of stone along the outside edge of the road is a material displaced by traffic. Pulling this material back into the middle of the roadway is an important step in re-establishing proper road shape and eliminating water from becoming trapped on the road. Evenly blending the retrieved stone with material dug from the travel way is critical. If the large segregated aggregate is brought back to the center of the road without mixing in fine material, the road will unravel very quickly, generating dust and potholes.

During this phase the blade carrier should be vertical with the carbide teeth pointed forward about 25 degrees (see Figure 2). Having the moldboard rolled forward causes the material to ride up the blade and fall onto itself, helping to mix the large material back into the fines.

On roads with significant potholes, ruts, or washboards, or where major rebuilding of the crown is required, it may be necessary to cut the road several times in each direction in order to:

- Accumulate sufficient material to rebuild the crown.
- Cut the holes or washboards deeply enough to delay their return.
- Recover fine aggregate particles to replace the fine particles lost to erosion, dust, and traffic action.

On roads where centerline crown is desired, the end of the grader blade at road center is kept at or slightly above the final elevation desired. This technique allows the grader to compact deposited aggregate with each pass and reduces the amount of aggregate to be spread in the next step.

## 3. SPREAD THE MATERIAL

Aggregate accumulated in the center of the road is to be spread. Straddle the windrow of material with the blade straight and pitched forward slightly. Spread the material leaving the center of the road 1" or 2" higher than the elevation desired at completion (see Figure 3). After this pass the road will have a slightly elevated flat center with a notch on both sides.



**Figure 2.** Large aggregate that has accumulated on the shoulder is pulled to the center of the road and mixed with fine aggregate particles as it rides up the blade. Excess aggregate is deposited in a windrow in the center of the road. Note the high moisture content of the graded material.



**Figure 3.** The material is knocked down (above) leaving the road with a high flat center (far left).

#### 4. GROOM THE ROAD

With this blade system, the final passes to groom the road are the most critical. Properly done, these two passes have the same effect as raking the road without separating the aggregate. On these passes, turn the grader blade the opposite direction from earlier scratching and cutting segments (as if plowing snow).

The grader stays in the travel lane and off the centerline. Pitch the blade forward sufficiently to see the material feeding out between the teeth. The road center end of the blade should be kept at the final elevation of the centerline and the road edge end of the blade kept at an elevation such that little if any material runs off the edge of the blade (see inset above right). A flat “A” shaped crown is desired. During these passes, the grader will not be carrying much material (see Figure 4). Any large rocks, roots, or chunks of vegetation should ride down the blade to the edge of the road. Pull material across the full lane width and avoid spreading the material too thin along the outside edge of the road.

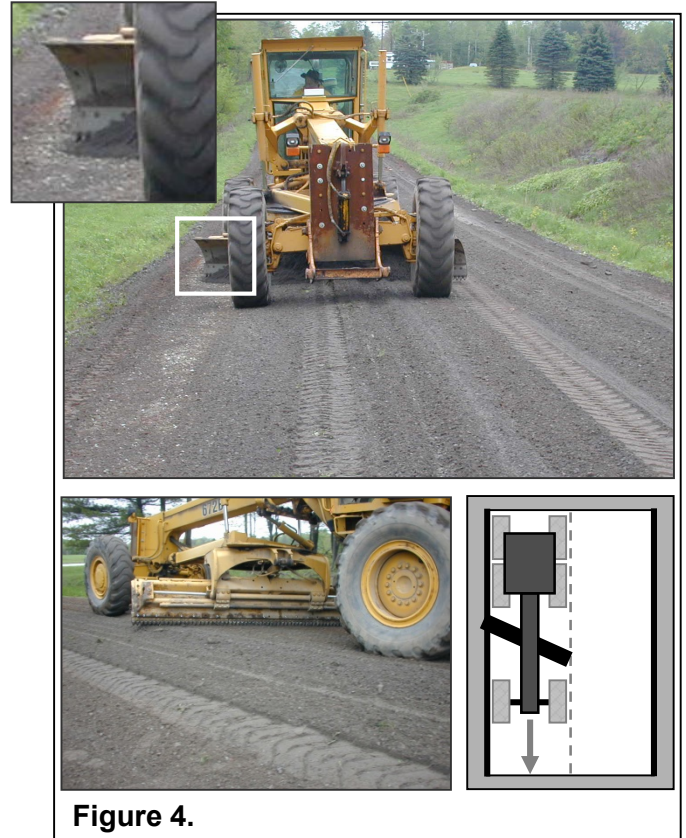


Figure 4.

#### 5. COMPACT

The final stage of maintenance grading is compaction, which should begin immediately after the final grooming pass. Roll from the road edge and work toward the centerline. The center of the road should be rolled, but care should be taken to avoid straddling the crown with the roller. A 10 ton vibratory roller is ideal for this purpose. However, it is more valuable to roll the road with the equipment available than to avoid rolling for lack of ideal equipment (see Figure 5).

Carbide-toothed blades perform best under moist conditions that would be too wet for grading with a traditional blade. In order to achieve the maximum benefit from a carbide-blade system it is important to grade when there is moisture in the graded layer of the road. Avoid grading during periods of dry weather. Otherwise, the use of a water truck to add moisture is recommended.



Figure 5. Here the grader was used to partially compact the groomed road. Slightly offsetting the wheels on an articulating grader allows the operator to compact twice as much area with each pass.