



# **IGGA Guide Specification: Diamond Grinding for Pavement Preservation**

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## **SCOPE**

This standard specifies the procedures for operations of continuous diamond grinding Portland cement concrete or asphalt concrete pavement and roadway surfaces to provide desired surface characteristics such as ride, friction and drainage. This standard does not apply to corrective bump grinding. The standard also provides guidelines for levels of acceptance for the desired surface characteristics. The user of this standard shall be responsible to ensure that all local safety, health and environmental standards are made a part of the project specification.

Conventional diamond grinding is also utilized to reduce the noise created by the interaction of the tire with the pavement surface in areas of low to moderate noise concern. When grinding solely for noise reduction, it is important to completely remove the existing surface texture such as transverse tining. The profile requirements stated elsewhere in this specification may not apply to grinding solely for noise abatement. In areas of high tire/pavement noise concern and speed limits above 45 mph, the pavement should be ground in accordance with the specification for the Next Generation Concrete Surface (NGCS) grinding.

## **EQUIPMENT**

Grinding shall be performed using diamond blades mounted on a self-propelled machine designed for grinding and texturing pavement. The equipment shall be at a minimum 35,000 pounds (15,876 kilograms) including the grinding head, and of a size that will grind a strip at least 3 feet (.914 meters) wide. The effective wheel base of the machine shall be no less than 12 feet (3.66 meters).

The equipment shall have a positive means of vacuuming the grinding residue from the pavement surface, leaving the surface in a clean, near-dry condition.

Grinding equipment that causes raveling, aggregate fractures or disturbance to the joints shall not be permitted.

The equipment shall be maintained to ensure it is in proper working order, with attention paid to the "roundness" of the match and depth control wheels. Any wheels found to be out of round shall be immediately replaced.

## **CONSTRUCTION**

The construction operation shall be scheduled and proceed in a manner that produces a neat, uniform finished surface. Shoulder, auxiliary or ramp lane grinding shall transition from the edge of the mainline as required to provide drainage leaving no more than a 3/16-inch (4.67-



millimeter) ridge and an acceptable riding surface. Full- and partial-depth concrete repairs, slab stabilization and dowel bar retrofit shall be completed prior to any grinding. Joint sealing shall be completed subsequent to the diamond grinding operations.

Grinding shall be accomplished in a manner that eliminates joint or crack faults so there is no more than a 1/16-inch (1.59 millimeter) differential between the adjacent sides of the joints and cracks. Grinding shall also substantially remove pavement conditions such as warp and curl to provide an acceptable ride.

Lateral drainage shall be achieved by maintaining a constant cross slope between grinding extremities in each lane. The finished cross slope shall mirror the pregrind cross slope and shall have no depressions or misalignment of slope greater than 1/4-inch (6.35 millimeters) in 12 feet (3.66 meters) when measured with a 12-foot (3.66 meter) straightedge placed perpendicular to the centerline. Steps will be taken to ensure that wheel path rutting is substantially removed and that the grinding operation is simply not texturing the wheel path depressions. Areas of deviation shall be reground. Straightedge requirements will not apply across longitudinal joints or outside the ground area.

Grinding shall begin and end at lines normal to the pavement centerline at the project limits. Passes of the grinding head shall not overlap more than 1-inch (25.4 millimeters). No unground surface area between passes will be permitted.

**FINAL SURFACE FINISH**

The grinding process shall produce a pavement surface that is true in grade and uniform in appearance with longitudinal line-type texture. The line-type texture shall contain corrugations parallel to the outside pavement edge and present a narrow ridge corduroy type appearance. The peaks of the ridges shall be 1/8-inch (3.18 millimeters) +/- 1/16-inch (1.59 millimeters) higher than the bottom of the grooves with evenly spaced ridges having a width that measures within the ranges listed below:

	Limestone	Gravel
Land area between grooves	0.090 to 0.110 inch (2.29 to 2.79 millimeters)	0.080 to 0.095 inch (2.03 to 2.41 millimeters)

It shall be the contractor’s responsibility to select the number of blades per foot to be used to provide the proper surface finish for the aggregate type present on the project. The engineer may require removal of unbroken fins at the contractor’s expense. The project conditions may dictate that the contractor has to make multiple passes with the equipment to meet the specifications. It is the contractor’s responsibility to determine the proper sequence of operations to meet the specification. If multiple passes of the grinding equipment are required, the area will only be considered for payment once. A minimum of 95 percent of any 100-foot (30.48 meter) section of pavement surface shall be textured. Depressed pavement areas due to subsidence or other localized causes will be exempted from texture and smoothness requirements.



### **SLURRY HANDLING AND REMOVAL**

The contractor shall remove and dispose of all residues from the pavement surface in a manner and at a location that satisfies environmental regulations. The diamond grinding machine shall be equipped with a well-maintained vacuum system that is capable of removing all standing slurry, leaving the roadway in a damp condition after the grinder passes. Residue shall not be permitted to encroach into open lanes or enter into closed drainage systems. Slurry handling requirements should be defined in the contract documents. (The International Grinding and Grooving Association has published a Best Management Practices for slurry handling that should be used in defining the proper operation for each project). The three basic handling procedures are outlined below:

### **SLURRY SPREADING DISPOSAL**

In rural areas that have vegetated slopes, the slurry can be deposited on the slopes as the grinding operation progresses down the road. As part of the contract documents, the engineer shall identify wetlands and other environmentally sensitive areas where slurry discharge operations are not permitted. The engineer and contractor shall make a site inspection prior to the start of grinding to define and mark the sensitive areas. The spreading of slurry should not take place through these sensitive areas. The slurry spreading start and stop points shall be clearly marked on the shoulder of the road. The slurry generated in nonspread areas shall be picked up and hauled for disposal to nonsensitive areas of the project. The vacuumed material shall be spread uniformly on the adjacent slopes by dragging a flexible hose or other approved device along the slope. Spreading should begin a minimum of 1-foot (.305 meters) from the shoulder with each pass of the grinder moving the spreading operation farther down the slope to ensure no build-up of grinding residue. The slurry shall not be spread within 100 feet (30.48 meters) of any natural stream or lake or within 3 feet (.914 meters) of a water filled ditch. Efforts should be taken to restrict the spreading operation to above the high-water line of the ditch.

### **SLURRY COLLECTION AND POND DECANTING**

In urban and other areas with closed drainage systems, the slurry shall be collected in water-tight haul units and transported to settlement ponds constructed by the contractor. These ponds may be constructed within or outside of the right-of-way. All locations shall be approved by the engineer. These ponds shall be constructed to allow for the settlement of the solids and decanting of the water for reuse in the grinding operation. At the completion of the grinding operation, the remaining water will be allowed to evaporate or may be used in a commercially useful manner (i.e. dust control). After drying, the remaining solids may be used as fill material or other commercially useful applications. The pond area shall be reclaimed to its original condition and vegetated to protect against erosion.

### **SLURRY COLLECTION AND PLANT PROCESSING**

The slurry shall be collected and hauled as with the pond processing. There are various plant designs such as centrifuge and belt press. The plant site shall be prepared to control any storm water runoff in accordance with local regulations. The site should be restored and



vegetated at the completion of operations. The processed water and solids are to be handled in the same fashion as the settlement ponds. The site may be within or outside the right-of-way. Site location is to be approved by the engineer.

### **SMOOTHNESS REQUIREMENTS**

An initial profile index of representative portions of the project may be available through the project contact person upon written request. When available, this information represents the conditions that existed at the time the survey was made. The contractor is cautioned to note the date the survey was made since the conditions may have changed over time. This profile is for informational purposes only, to give the contractor an idea of the conditions that existed at the time of the survey. The contractor assumes the risk of error if the information is used for any purpose other than as stated. Contractors are responsible for visiting the project site to make their own condition determination prior to bidding.

Prior to performing any grinding work, the contractor shall provide a profile using lightweight profiler equipment with a laser that simulates the tire footprint. Single point lasers shall not be used. Line laser equipment such as RoLine or an approved equal shall be used. All equipment shall have current certification and be approved by the contracting authority. This control profile will be used to identify the required smoothness for the project if a percent improvement is the controlling factor. Each .1 lane mile (kilometer) segment (528 feet -160.93 meters) of the finished surface shall have a final IRI of:

- For speeds greater than 45 mph (72.4 km/hr): 65 in/mile (103 cm/km).
- For speeds 45 mph or less: 115 in/mile (181 cm/km).
- For extremely rough conditions: the greater of 35 percent of the pregrind profile or the aforementioned requirement shall be the required smoothness.
- Depressed pavement areas due to subsidence or other localized causes will be excluded from the smoothness requirements. These areas shall be reviewed and approved by the engineer.

The contractor shall run the profile in both wheel paths and average the resulting IRI results to determine acceptance. The profiles shall be run 3 feet (.914 meters) from each lane line. A guide shall be used to ensure proper alignment of the profile. The engineer shall have a representative with the lightweight profiler during all testing periods. This representative shall sign the resulting profile form. The engineer shall run comparison profiles on no less than 10 percent of the segments using the same type of certified equipment as the contractor. It is of great importance that a proper guide is used to ensure that all testing is completed over the same track. The contractor testing and agency testing should be completed during the same time of day and under similar climatic conditions. The results of these verification profiles shall not vary more than 10 percent from the contractor profiles. The engineer may choose to accept isolated sections if the variance between the two profiles is less than 15 percent. When the difference exceeds 15 percent on an isolated basis or 10 percent on a consistent basis, referee testing will be required to determine which device is providing an accurate evaluation of the pavement surface. The party found to have the inaccurate equipment will pay for the



referee testing. The engineer may choose to withhold payment for segments that do not meet these criteria until the problem is resolved. The engineer may choose to run verification profiles on the entire project if the comparison profiles are constantly outside the allowable tolerance. The engineer will charge \$700 (\$435)/ lane-mile (kilometer) for the additional testing if the contractor's operation is found to be in error. Segments found not meeting the smoothness requirements will require regrinding at no additional cost to the department.

The finished ground surface shall not include any bumps exceeding 0.3-inch (7.62 millimeters) in 25 feet (7.62 meters).

The conditions of smaller municipal projects may not be suited for the above type of smoothness requirements. In these cases, the only smoothness requirement may be 1/8-inch (3.18 millimeter) variance in a 10-foot (3.05 meter) straightedge test.

**METHOD OF MEASUREMENT**

Grinding of pavement will be measured by the square yard (square meter). The measurement will be the final textured surface area regardless of the number of passes required to achieve acceptable results. Minor areas of unground pavement within the designated areas to be ground will be included in the measurement. When conditions require a feather pass into the shoulder or auxiliary or ramp lanes, payment will be by the square yard (square meter) based on a width of 2 feet (.61 meters) times the length of the required feather pass. The minimum length of feather pass will be 100 feet (30.48 meters).

**BASIS OF PAYMENT**

Grinding will be paid for at the contract price per square yard (square meter). Payment shall be full compensation for all labor, equipment, material and incidentals to complete this work, including hauling and disposal of grinding residue.

**RECOMMENDED SMOOTHNESS INCENTIVE FOR HIGHWAY APPLICATIONS:**

<b><u>IRI in/mile</u></b>	<b><u>Incentive \$ per 0.1 lane mile section</u></b>
0.00 - 45.00	\$450.00
45.01 - 55.00	\$ -45(IRI) + 2475
55.01 - 65.00	\$0.00
>65.01	Corrective Action
<b><u>IRI cm/km</u></b>	<b><u>Incentive \$ per 0.1 lane kilometer section</u></b>
0.00 - 71.00	\$280.00
71.01 - 87.00	\$ -17.5(IRI) + 1522.5
87.01 - 103.00	\$0.00
>103.01	Corrective Action