



IGGA Guide Specification: NGCS Construction on Existing Roadways

Introduction

This standard developed by the International Grooving and Grinding Association (IGGA) specifies the procedures for project level construction of the Next Generation Concrete Surface (NGCS) on existing roadways using diamond grinding and grooving techniques. This standard does not apply to any other diamond grinding or grooving processes and should not be used for construction of NGCS test sections. Also found within this standard are guidelines for levels of acceptance related to 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 specifications.

NGCS is a term used to describe a category of texture(s) that have or will evolve through current research. The term may apply to several textures that evolve for both new construction and rehabilitation of existing surfaces. When constructed properly, these textures will provide a very smooth profile coupled with good micro texture and excellent macro texture. This specification provides direction for construction of the technique.

The user of this standard accepts ALL responsibility for decisions made as a result of its use. The International Grooving and Grinding Association, its Officers, Board of Directors and staff are absolved of any responsibility for any decisions made as a result of your use. Use of this standard implies acceptance of the terms of use.



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Publication Date: February 15, 2011

SCOPE

This standard specifies the procedures for project level construction of the Next Generation Concrete Surface (NGCS) on existing roadways using diamond grinding and grooving techniques. This standard does not apply to any other diamond grinding or grooving processes and should not be used for construction of NGCS test sections. Also found within this standard are guidelines for levels of acceptance related to 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 specifications.

EQUIPMENT

Grinding shall be accomplished using diamond blades mounted on a self-propelled machine designed specifically for diamond grinding and texturing pavement. The equipment shall weigh a minimum of 35,000 pounds including the grinding head and be of a size that will grind a strip at least 4 feet wide in a single pass. Grinding equipment that causes raveling, aggregate fractures, spalls, or disturbance to the transverse or longitudinal joints shall not be permitted. 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.

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 replaced immediately.

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 0.1875 inch ridge and an acceptable riding surface. When conditions require a feather pass into the shoulder, auxiliary or ramp lanes, conventional diamond grinding shall be used. 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 and shall be installed in a recessed condition.

NGCS construction can be accomplished as a single-pass or two-pass operation as determined by the contractor. If the single pass operation is selected, smoothness levels stated within this standard must be attained and checked periodically by the contractor throughout the construction phase to ensure that corrective measures are not necessary as this could impact the quality of the NGCS texture.

The contractor shall construct a single lane NGCS test grind 500 feet in length to demonstrate that the equipment and procedures used are capable of attaining the desired surface texture and smoothness



requirements. The contractor will not be allowed to proceed any further until the test grind has been approved in writing by the Agency.

Grinding shall be accomplished in a manner that eliminates joint or crack faults so there is no more than a 0.0625 inch 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 0.125 inch in 12 feet when measured with a 12 foot straightedge placed perpendicular to the centerline. 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. No unground surface area between passes will be permitted.

Single-Pass NGCS Operation – The construction operation will provide a flush ground surface that contains longitudinal grooves and shall be constructed in one, single-pass operation. The diamond blade stack will consist of two types of diamond grinding blades arranged to provide a flush ground surface as well as those required to produce the longitudinal grooves. The diamond blade stack shall be mounted on a 4 foot grinding head, stacked with 0.125 inch wide blades separated by 0.035 +/- 0.005 inch wide spacers. The blades used to produce the flush ground surface shall be flat across their contact surface and in the same plane with other flush grind blades (excluding grooving blades) when mounted. The complete head, when stacked with all blades, shall be straight across its length without bowing when mounted on the diamond grinding machine. No unground surface area between passes will be permitted. The longitudinal grooving blades will be spaced among the flush grind blade stack on 0.5 inch to 0.625 inch centers and shall produce grooves 0.125 inch to 0.1875 inch in depth. The grooves shall be constructed parallel to the centerline. The contractor shall use a guide to ensure proper alignment of the grooves to centerline.

Two-Pass NGCS Operation – This construction operation will allow for two separate operations to construct the NGCS section. The first operation will create the flush ground surface. The flush grind blades shall be mounted on a 4 foot grinding head, stacked with 0.125 inch wide blades separated by 0.035 +/-0.005 inch wide spacers. The blades used to produce the flush ground surface shall be flat across their contact surface and in the same plane with other flush grind blades when mounted. The complete head, when stacked with all blades, shall be straight across its length without bowing when mounted on the diamond grinding machine. No unground surface area between passes will be permitted. The smoothness levels stated within this standard must be attained and measured to the satisfaction of the Contracting Agency prior to constructing the second operation. The second operation will provide the longitudinal grooves. The longitudinal grooves shall be 0.125 inch wide and will be 0.125 inch to 0.1875 inch in depth. The longitudinal grooves will be spaced on 0.5 inch to 0.625 inch centers. The grooves shall be constructed parallel to the centerline. The contractor shall use a guide to ensure proper alignment of the grooves to centerline.



FINAL SURFACE FINISH

The NGCS grinding process shall produce a pavement surface that is true to grade and uniform in appearance with a longitudinal grooved texture. The flush ground surface shall appear smooth and shall contain no ridges that exceed 0.03 inch. The longitudinal grooves shall be constructed parallel to the centerline. At a minimum, 98% of the pavement surface shall be textured utilizing the NGCS. Depressed pavement areas due to subsidence, edge slump or other localized causes will be excluded from this requirement when approved by the Contracting Agency.

The final surface will look similar to the photo in Appendix A.

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 Grooving and Grinding 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 Contracting Agency shall identify wetlands and other environmentally sensitive areas where slurry discharge operations are not permitted. The Contracting Agency 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 non-spread areas shall be picked up and hauled for disposal to non-sensitive 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 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 of any natural stream or lake or within 3 feet 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 watertight 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 Contracting Agency. 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 (e.g. dust control). After drying, the remaining solids may be used



for 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 Contracting Agency.

SMOOTHNESS REQUIREMENTS

Each segment of the finished NGCS shall have a final profile with a Mean International Roughness Index (MRI) of 50 inches/mile or less. Surfaces constructed using the single pass method will be measured for smoothness acceptance on the completed surface. Surfaces constructed using the two pass method will be measured for smoothness acceptance following the flush grinding operation and prior to the longitudinal grooving operation.

The smoothness profile shall be generated 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 Agency.

The contractor shall run the profile in both wheel paths and average the resulting IRI results to determine acceptance (MRI). The profiles shall be run 3 feet from each lane line. A guide shall be used to ensure proper alignment of the profile. The Contracting Agency shall have a representative with the lightweight profiler during all testing periods. This representative shall sign the resulting profile form. The Contracting Agency 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 Contracting Agency 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 Contracting Agency may choose to withhold payment for segments that do not meet these criteria until the problem is resolved. The Contracting Agency may choose to run verification profiles on the entire project if the comparison profiles are constantly outside the allowable tolerance. The Contracting Agency will charge \$700 / lane-mile for the additional testing if the contractor's operation is found to be in error. Segments found not meeting the smoothness requirements will require regrounding at no additional cost to the Agency.

The finished ground surface shall not include any bumps exceeding 0.3 inch in 25 feet.



METHOD OF MEASUREMENT

NGCS construction will be measured by the square yard. 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, auxiliary or ramp lanes, conventional diamond grinding shall be used. Payment will be by the square yard based on a width of 2 feet times the length of the required feather pass. The minimum length of feather pass will be 100 feet.

BASIS OF PAYMENT

NGCS construction will be paid for at the contract price per square yard. 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:

<u>MRI in/mi</u>	<u>Incentive \$ per 0.1 lane mile section</u>
0 - 35	\$704.00
35.1 - 45	\$ -69.703(IRI) + 3143.6
45.1 - 50	\$0.00
> 50	Corrective Action

APPENDIX A – Photos of NGCS Textures



Figure 1: Overall View of NGCS Texture

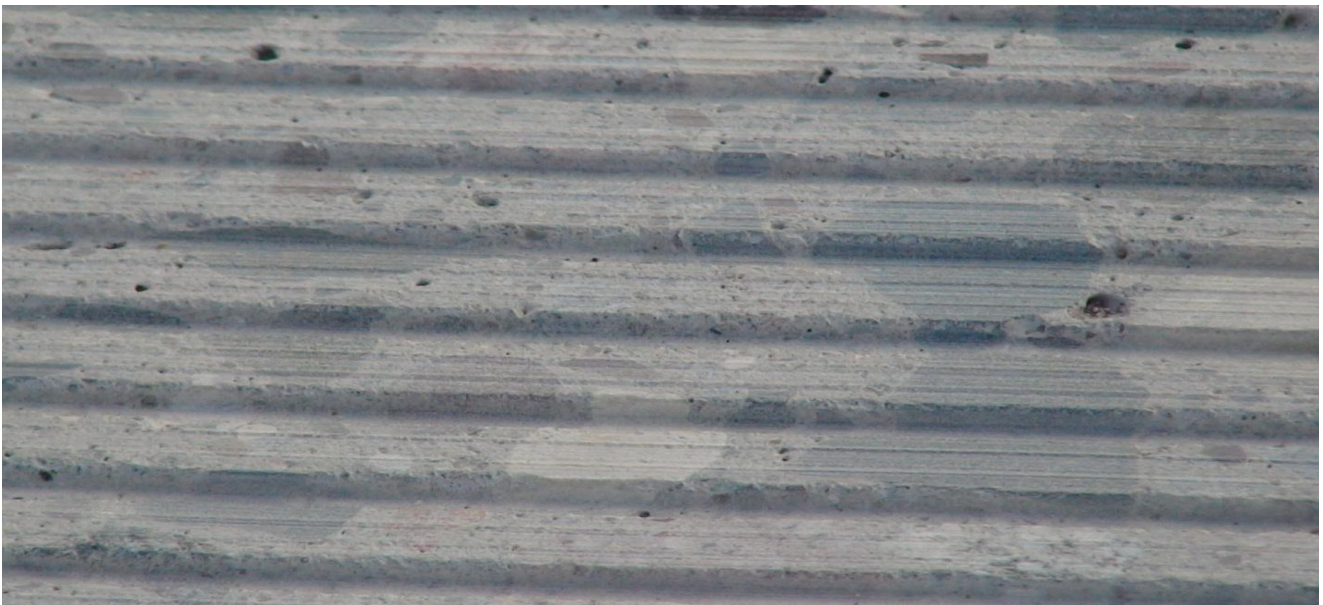


Figure 2: Close Up Photo of Completed NGCS Texture



Figure 3: Photo of Flush Grind Immediately After First Pass of Two Pass NGCS Operation



Figure 4: Photo of Grooving Operation of a Two Pass NGCS Operation