

## PCC Pavement Rideability

SCDOT Designation: SC-M-502 (08/09)

---

### 1. SCOPE

- 1.1. The Resident Construction Engineer (RCE) will evaluate Portland cement concrete (PCC) pavement surfaces for a satisfactory ride. If conditions permit and unless otherwise specified in the special provisions, the Research and Materials Engineer will test the PCC pavement surface in accordance with **SC-T-124** or **SC-T-125** as appropriate. Unless otherwise stated, the Contractor will make all corrective action required by this Standard at no expense to the Department.

---

### 2. REFERENCED DOCUMENTS

- 2.1. SCDOT Standard Specifications Division 500
- 2.2. **SC-T-124**, Operation of the Cox Model C8200 Electronic Profilograph for Surface Measurement
- 2.3. **SC-T-125**, Measurement of Pavement Rideability using the Dynatest 5051 Mark III Road Profiler
- 2.4. **SC-M-503**, PCC Pavement Thickness Measurement and Tolerance

---

### 3. EQUIPMENT

- 3.1. *Diamond Grinding*
  - 3.1.1. Use only a self-propelled grinding and texturing machine with diamond blades mounted on a multi-blade arbor with a minimum cutting-head width of 36 inches. Equipment that causes strain or damage to the underlying surface of the pavement is not acceptable. Repair or replace any equipment that causes excessive ravels, aggregate fractures, spalls, or disturbance of the transverse or longitudinal joints.

---

### 4. REQUIREMENTS FOR TESTING

- 4.1. For **SC-T-124** to be used, the following conditions must be met:
  - 4.1.1. The segment of roadway is a minimum continuous length of 0.1 miles, not including bridges.
  - 4.1.2. The segment consists of mainline roadway, ramps at least 0.1 mile in continuous length, or shoulder pavement designated for eventual mainline use. Other shoulder pavement and ramps less than 0.1 mile in continuous length are not appropriate for testing by **SC-T-124**.

4.2. For **SC-T-125** to be used, the following conditions must be met:

- 4.2.1. The segment of roadway is a minimum continuous length of 0.5 miles, not including bridges.
- 4.2.2. The segment is posted for a speed limit of 45 mph or greater and has no stop signs or traffic signals that would impede the profiler.

---

## 5. REQUIREMENTS FOR NEW CONSTRUCTION.

### 5.1. *Pavement with a Tined or Broomed Final Surface*

#### 5.1.1. *Final Finishing*

5.1.1.1 After the surface has been prepared as described in Subsection 501.4.10 and the water sheen has practically disappeared, texture the pavement using a drag strip. Use a drag strip consisting of a seamless strip of damp burlap, cotton fabric, or artificial turf that produces a uniform surface of gritty texture after dragging it longitudinally with a slight back-and-forth motion along the full-width of the pavement.

5.1.1.2 Ensure that the drag is an integral part of the paving train or, in the case of stationary side forms, is mounted on a bridge that travels on the forms. The minimum acceptable length of the drag strip is 3 feet. Ensure that the bottom edge of the drag strip remains in full contact with the pavement surface for the full width of the pavement. Where burlap fabric is used, ensure that the drag strip consists of at least two layers with the bottom layer approximately 6 inches longer than the upper layer(s). Maintain the drag in a condition that produces a concrete surface of uniform appearance and reasonably free from grooves over 1/16 inch in depth. Ensure that the drag is maintained clean and free from encrusted matter. If a drag is unable to be cleaned, discard it and replace with a new drag.

#### 5.1.2. *Belting and Brooming*

5.1.2.1 In order to obtain the desired surface qualities or texture, the RCE may require the use of an approved belt or belting procedure or an approved brooming operation. A belting or brooming operation may be required separately, jointly, or along with the fabric or turf drag.

#### 5.1.3. *Tining*

5.1.3.1 When all finishing is complete, unless the pavement is intended to receive a diamond ground surface as the final finish, texture the surface using mechanical equipment for grooving plastic concrete that uses rectangular-shaped steel tines. Ensure that the tines are evenly spaced at intervals of 0.5 inches on center and are sized such that they produce transverse grooves in the hardened surface of the concrete that are approximately 0.08 inch to 0.12 inch in width and 0.10 inch to 0.15 inch in depth. Irregular areas where the use of the automatic tining equipment is not practical may be textured using a manually-operated rake that will produce transverse grooves meeting the dimensional requirements given above.

5.1.4. *Initial Surface Check*

5.1.4.1 Ensure that the pavement is true to the specified cross slope and grade. As soon as the concrete has cured sufficiently to walk on, but not later than 9:00 AM the day following placement, the RCE or the RCE's designated representative will check the transverse and longitudinal surface contour of all mainline pavement and ramp pavement, as well as any shoulder pavement intended as a future lane, with a 10-foot straightedge or other device approved by the Materials and Research Engineer. All variations of 1/8 inch or more, exclusive of texturing, will be plainly marked on the surface. Straightedge tests are made at approximate 100-foot intervals, but may be taken more frequently at the RCE's sole discretion if uneven areas are encountered or suspected.

5.1.5. *Immediate Correction*

5.1.5.1 Immediately attempt to correct the marked areas by rubbing with a carborundum brick and water. However, in no case is it acceptable to rub the surface to the degree that contact with the coarse aggregate is made and the enveloping mortar is broken. If variations of 1/8 inch or more remain after rubbing, remove these areas with a power-driven grinding machine after the concrete has attained approximate full strength, but not less than 21 days after placement. Promptly replace any curing compound disturbed by the straightedge check or rubbing activities.

5.1.6. *Profilograph Measurement*

5.1.6.1 For pavement meeting the requirements of Subsection 4.1, a measured profile index greater than 12 with a 0.1-inch blanking band is not acceptable for any 0.25-mile lot in any wheelpath. Additionally, individual bumps greater than 0.2 inch above the blanking band are also unacceptable. Unless otherwise specified, the Department's Pavement Evaluation Unit will make profile measurements using **SC-T-124** to determine the profile index and bump size.

5.1.7. *Further Corrective Action*

5.1.7.1 The Contractor must correct unacceptable conditions either by removing and replacing the unacceptable pavement or by using a power-driven grinding machine after the pavement has achieved approximate full strength, but not less than 21 days after placement. If the total length of grinding exceeds 132 linear feet as measured parallel to the centerline of the roadway in any 0.25-mile segment, regardless of the transverse grinding width, grind 100% of the entire surface area of that segment for the full width of the individual lane being measured to achieve a uniform appearance. Conduct all grinding operations in accordance with Section 5.2.3 contained herein. Prior to any corrective work, the Contractor will provide the RCE with a written plan of corrective action and receive approval from the RCE before implementation.

5.2. *New Pavement with a Diamond Ground Final Surface:*

5.2.1. *Surface Finish*

5.2.1.1 Texturing by mechanical equipment for grooving plastic concrete using steel tines is not required when the final surface will be textured by diamond grinding. All other required finishing and texturing, including texturing using a drag strip is conducted according to the Standard Specifications and Subsection 5.1, above. Tining and/or diamond grinding is not required for shoulder pavement unless otherwise directed in the Plans or Contract. However, a brooming or belting process as given in Subsection 5.1 is required for shoulder pavement to provide a medium to heavy broom finish. All drags, brooming, and belting are included in the unit price for Portland Cement Concrete Pavement and are not measured or paid separately.

5.2.2. *Diamond Grinding*

- 5.2.2.1 Conduct diamond grinding operations using equipment as specified in Section 3 and in accordance with the requirements provided herein. Perform no diamond grinding until the pavement has attained sufficient strength to be opened to all types of traffic, and no sooner than 21 days after placement unless otherwise directed by the RCE. Complete all diamond grinding on any section prior to opening that section to other than construction traffic unless otherwise instructed by the RCE.
- 5.2.2.2 Perform grinding and texturing on the entire surface area of the lanes specified in the Plans or as directed by the RCE. Ensure that the surface on each side of transverse joints is uniformly ground and textured until the surface on both sides of the joints and all cracks are in the same plane and meet the surface requirements contained herein. This may require additional passes of the equipment to texture both sides of a faulted joint.
- 5.2.2.3 Ensure that the finished surface has a corduroy-type texture consisting of grooves that are between 0.090 and 0.150 inch wide. Ensure that the land area between the grooves is between 0.060 and 0.125 inch wide and the peaks of the ridges are 1/16 inch higher than the bottom of the grooves.
- 5.2.2.4 Ensure that all grooves and adjacent passes are parallel to each other and the roadway, with no variation. Completely lap adjacent passes, allowing no unground surface between them. However, do not allow adjacent passes to overlap more than 1.5 inches. When measured with a 3-foot straightedge, ensure that adjacent passes are within 1/8 inch of the same height. Texture not less than 98 percent of the specified surface, with 100 percent of the specified area as a target. Allow no ridges between lanes after grinding. Feather out any remaining ridges on the outside edge into the shoulder in a separate operation to the satisfaction of the RCE. When grinding the shoulder is necessary to remove ridges, this operation is not counted in the area for payment and is conducted at no expense to the Department.
- 5.2.2.5 At no expense to the Department, correct any deficiencies in the final surface due to improper operations and/or equipment. This includes, but is not limited to, a)

corrugation due to "out-of-round" wheels or improper cutting operations, b) depressions created due to improper starting or stopping operations, or c) unground ridges due to defective blades. Make all corrections parallel to and matching existing operations.

5.2.2.6 Remove residue from the grinding and texturing operation from the roadway. Do not permit residue to flow across shoulders or lanes occupied by traffic. Also, do not allow residue to flow into gutters or other drainage structures. Remove solid residue from the pavement surface before such material is blown by the action of traffic or wind. Perform a final sweeping using power equipment before opening the pavement to traffic.

5.2.3. *Joint Sealing*

5.2.3.1 Complete all joint sealing operations after diamond grinding operations are conducted, including diamond grinding on adjacent lanes. Before and during grinding, place and maintain an appropriately sized temporary backer rod in the initial saw cut at a depth sufficient to prevent contact with the grinding operation in order to prevent slurry and other contaminants from entering the saw cut. Remove and discard the temporary backer road shortly in advance of joint sealing activities.

5.3. *Rideability Requirements*

5.3.1. After overall grinding operations are completed, the Department's Pavement Evaluation Unit will measure the rideability of the pavement using SC-T-125 and based on nominal 0.1-mile lots and report the International Roughness Index (IRI) in inches per mile. Based on the results of these measurements, an adjusted pay factor for Portland Cement Concrete Pavement for each lot is applied based on Table 1 shown below.

<b>Table 1. Schedule For Adjusted Payment – New Construction</b>	
<b>IRI (inches/mile)</b>	<b>Adjusted Unit Price</b>
Less than or equal to 60	105%
61 – 65	103%
66 – 70	101%
71 – 80	100%
81 – 85	95%
86 – 90	90%
91 – 95	80%
96 and above	See Note 1

**Note 1:** For each additional increment of 5 inches per mile of IRI above 95 inches per mile, make an additional 10% reduction based on the contract unit price of the Portland Cement Concrete Pavement.

5.3.2. When the IRI exceeds 80 and the RCE determines that the pavement does not have an acceptably smooth ride, correct such deficient sections without additional compensation. The RCE may withhold payment for the pavement until the deficiencies have been corrected, and the surface is re-tested and provides an acceptably smooth ride. Obtain

written approval of the RCE for the method of correcting the surface deficiencies. The RCE will deduct as a lump sum the total amount of any reduction in payment from monies due.

- 5.3.3. The RCE will review sections of roadway for which the IRI roughness measurement is 96 inches per mile or above on an individual basis. If the RCE determines that the section is unacceptable, remove the pavement and replace or perform additional diamond grinding subject to the approval of the RCE. Should the RCE determine that the material may remain in place and does not require other corrective action, a price adjustment will be assessed based on the Schedule for Adjusted Payment shown in Table 1.
- 5.3.4. **SC-T-125** is modified such that the IRI measured for each wheelpath is averaged and the average value is reported for the section. The section will be tested with the profiler five times and the best three of five IRI values are averaged to determine the overall IRI for the section. If the three lowest IRI values have a standard deviation of greater than 6 inches per mile, the section will be tested five additional times and the lowest three out of the second group of five runs will be averaged to determine section IRI. If the standard deviation of the lowest three out of five runs of the second group has a standard deviation of greater than 6 inches per mile, the section will be tested an additional five times and the lowest three out of five IRI averages for the third set of runs will be averaged to determine section IRI. If the standard deviation of the lowest three runs on the third attempt exceeds 6 inches per mile, the lowest three out of all 15 runs will be averaged to determine the section IRI for payment.

#### 5.4. *Pavement Thickness*

- 5.4.1. When diamond grinding and texturing is required on new pavement as part of the original construction, requirements for pavement thickness tolerance as given in Supplemental Technical Specification **SC-M-503** or contract special provisions apply after all grinding operations are complete and accepted. It is the Contractor's responsibility to consider potential loss of pavement thickness from the grinding operation and adjust initial pavement thickness accordingly to ensure that the finished product has the required thickness.

### 6. REQUIREMENTS FOR REHABILITATION PROJECTS

#### 6.1. *Diamond Grinding*

- 6.1.1. Perform diamond grinding operations in accordance with the requirements of Section 5.2.3. of SC-M-502(06/07).

#### 6.2. *Testing*

- 6.2.1. When existing Portland Cement Concrete Pavement is diamond ground as a means to improve the rideability and surface characteristics, the pavement is tested according to **SC-T-125, Measurement of Pavement Rideability using the Dynatest 5051 Mark III Road Profiler** by the Department's Pavement Evaluation Unit after all grinding

operations are complete if the pavement meets the requirements of Subsection 4.2 of SC-M-502(06/07) with the modifications given below. The International Roughness Index (IRI) is reported in inches per mile in 0.1-mile nominal lots.

6.2.2. **SC-T-125** is modified as given in Section 5.3.4 above.

6.3. *Rideability*

6.3.1. The pavement is considered acceptable if the IRI roughness is 99 inches per mile or less after grinding operations are complete unless otherwise specified in the Special Provisions. Based on the measured roughness, the contract unit price for Grinding and Texturing Existing Concrete Pavement is adjusted according to Table 2, shown below.

<b>Table 2. Schedule For Adjusted Payment – Existing Pavement</b>	
<b>IRI Roughness (inches/mile)</b>	<b>Adjusted Unit Price</b>
Less than or equal to 60	125%
61 – 74	110%
75 – 90	100%
91 – 99	90%
Greater than 99	Corrective Action Required

6.4. *Further Corrective Action*

6.4.1. In the event that the initial IRI of the ground surface is greater than 99 inches per mile, perform further work on the pavement such that the IRI is reduced to 99 inches per mile or less at no expense to the Department. Additional remedial work may also be optionally conducted at lower initial IRI roughness levels. Prior to any corrective action, submit a written remediation plan to the RCE for approval. Conduct no corrective work until the RCE has approved the written plan. If the initial IRI roughness is less than 91 inches per mile, the Department reserves the right to reject any additional corrective work if, in the Department's opinion, additional work will be detrimental to the pavement or reduce the pavement thickness excessively. The final adjusted unit price for Grinding and Texturing Existing Concrete Pavement is determined based on Table 2 and the IRI measured after corrective action is applied.