

October 25, 2007

REVISION OF SECTIONS 105 & 601
PORTLAND CEMENT CONCRETE PAVEMENT ROADWAY
SMOOTHNESS (HIGH SPEED PROFILER)

NOTICE

This is a standard special provision that revises or modifies CDOT's *Standard Specifications for Road and Bridge Construction*. It has gone through a formal review and approval process and has been issued by CDOT's Project Development Branch with formal instructions for its use on CDOT construction projects. It is to be used as written without change. Do not use modified versions of this special provision on CDOT construction projects, and do not use this special provision on CDOT projects in a manner other than that specified in the instructions unless such use is first approved by CDOT's Standards and Specifications Unit. The instructions for use on CDOT construction projects appear below.

Other agencies which use the *Standard Specifications for Road and Bridge Construction* to administer construction projects may use this special provision as appropriate and at their own risk.

Instructions for use on CDOT construction projects:

Use on projects having portland cement concrete pavement.

The Design Engineer will determine pavement smoothness category and list the pavement smoothness category in the general notes.

Category I is for Rural Interstate & Highway construction with a speed limit greater than 45 mph

Category II is for Urban Interstate & Highway construction with a speed limit greater than 45 mph

Category III is for all other highways with a speed limit less than 45 mph.

The Designer will set up a planned force account for pavement smoothness based on the maximum incentive possible for the project.

The Designer will estimate the required number of Flagging Hours, Traffic Control Supervision, Traffic Control Devices and Uniformed Traffic Control necessary to implement the Department's Quality Assurance portion of this specification. The designer will include these quantities in the quantities table to be bid

Projects may be broken into different sections with different pavement smoothness categories instead of using the easier pavement smoothness category for the whole project.

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Sections 105 and 601 of the Standard Specifications are hereby revised for this project as follows:

Delete subsection 105.07 and replace with the following:

105.07 Conformity to Roadway Smoothness Criteria. Roadway smoothness testing and corrective work shall be performed as described below:

(a) *Contractor Quality Control Smoothness.*

1. The Contractor shall perform Quality Control Smoothness (QCS) testing. A profile shall be taken on the first mile of paving and again after completion of paving of each lane. The test results shall be submitted to the Engineer within 48 hours of completion. QCS test results shall show the Lane Profile Index (LPI) in inches per mile for each 0.10 mile section and the location of Bumps. The LPI consists of the average of the left wheel path's Profile Index and right wheel path's Profile Index.

Contractor quality control, corrective work and the associated traffic control as described below will not be measured and paid for separately, but shall be included in the work.

The Contractor shall not profile the concrete pavement until it has attained a strength of 1,000 psi if a profilograph or light weight profiler is used or 2,000 psi if a high speed profiler is used.

QCS testing shall be performed using the Contractor's California profilograph or profiling device capable of simulating a California profilograph with similar methods as the acceptance testing performed by the Department described in subsection 105.07 (c) and in accordance with the Manufacturer's instructions. The Contractor's California profilograph or profiling device shall be certified in accordance with CP 73 and have a certification sticker which includes the date of certification, the type of filters, and the filter setting used for certification.

Production shall be suspended if QCS testing indicates that corrective work is required in accordance with subsection 105.07 (b). Production will remain suspended until the problem is identified and corrected. Each time production is suspended, corrective actions shall be proposed in writing by the Contractor.

When production resumes, the Contractor shall profile the first mile of paving. The conditions above for suspension of work will apply.

Corrective work shall be proposed in writing by the Contractor. Corrective work shall not be performed until approved in writing by the Engineer. Corrective work shall be completed after Quality Assurance Smoothness (QAS) testing is complete. The Department will perform the QAS testing for acceptance and indicate areas requiring corrective work as determined in accordance with subsection 105.07 (c). Incentive/disincentive payments will be based on the Department's QAS testing. The Contractor shall perform all corrective work in the areas indicated by the QAS testing. The Contractor shall profile the roadway to verify that the required corrective work has been completed.

2. The finished transverse and longitudinal surface elevation of the pavement shall be measured using a 10 foot straightedge. The Contractor shall furnish an approved 10 foot straightedge and depth gauge and provide an operator to aid the Engineer in testing the finished pavement surface. Areas to be measured shall be as directed by the Engineer. Areas showing high spots of more than 3/16 inch in 10 feet shall be marked and diamond ground until the high spot does not exceed 3/16 inch in 10 feet.

(b) *Corrective Work.*

1. Lane Profile Index Corrective Work. The criteria for determining if a 0.1 mile section or fraction thereof requires corrective work is specified in Table 105-6. In addition to determining if a 0.1 mile section or fraction thereof requires corrective work, the profiles shall be analyzed for Bumps.

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2. Bumps. A bump is defined as a deviation in the profile greater than 0.40 inches in 25 feet.
3. Corrective Procedures. If corrective work is required, the Contractor shall submit a written corrective work proposal to the Engineer, which shall include the methods and procedures that will be used. The Contractor shall not commence corrective work until the methods and procedures have been approved in writing by the Engineer.

The Engineer's approval shall not relieve the Contractor of the responsibility of producing work in conformity with the Contract.

Corrective work on concrete pavements shall consist of diamond grinding.

When longitudinal tining is required on concrete pavement, the pavement shall be grooved to restore the longitudinal texture as shown in the plans and specifications.

When any grinding on concrete pavement occurs where a core for determining pavement thickness has been previously taken, another core shall be taken after the grinding has been completed and shall replace the original core in the calculation of pavement thickness incentive and disincentive. Joint sealant that has been damaged by grinding on concrete pavement shall be repaired or replaced at the Contractor's expense in accordance with Standard Plan M-412-1 and subsection 412.18.

- (c) *Department Quality Assurance.* The Department's smoothness testing results will be used for acceptance and calculation of incentive and disincentive payments. All traffic control costs associated with Department quality assurance will be paid for by the Department in accordance with Section 630.

1. Longitudinal Pavement Surface Smoothness Acceptance. Pavement surfaces shall be tested and accepted for longitudinal smoothness as described herein.
 - A. Testing Procedure (General). The longitudinal surface smoothness of the final pavement surface will be tested and evaluated by the Department in accordance with CP 72 and using the Department's high-speed profiler (HSP).

The HSP instrumentation will be verified in accordance with CP 72 prior to measurements. The Contractor shall lay out a distance calibration site. The distance calibration site shall be 1056 feet long and shall be on a relatively flat, straight section of pavement as approved by the Engineer. The site shall have a speed limit equal to the Project's highest speed limit that allows for the HSP to operate uninterrupted. The limits of the site shall be clearly marked and the distance shall be measured to an accuracy of +/- 3 inches. The Contractor shall provide in writing the site location to the Engineer. The cost of the distance calibration site will not be measured and paid for separately, but shall be included in the work.

The Contractor shall notify the Engineer in writing at least 14 days in advance to schedule pavement smoothness Quality Assurance testing. The Engineer will not schedule pavement smoothness testing if the Contractor has not submitted QCS results.

The Contractor shall notify the Department at least 48 hours prior to the scheduled QAS testing date when the smoothness testing needs to be cancelled for any reason. The Contractor shall be charged \$500 for failure to meet this requirement and rescheduling is required. The Engineer may waive the \$500 charge if re-scheduling is a result of weather or at the convenience of the Department.

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The entire length of each through lane, climbing lane and passing lane including bridge approaches, bridge decks and intersections from the beginning to the end of the project will be profiled. Shoulders, ramps, tapers, turn slots, acceleration lanes, deceleration lanes, and medians will not be profiled and will not be subject to incentive/disincentive adjustments. The profile of the entire length of a lane will be taken at one time. However, the Department may break a project into sections to accommodate varying conditions.

A sufficient distance will be deleted from the profile to allow the profiler to obtain the testing speed plus a 300 foot distance to stop and start when required. Incentive/disincentive payments will not be made for this area. The final surface of these areas will be tested in accordance with subsection 105.07 (a) 2.

The profile will include transverse joints when pavement is placed by the project on both sides of the joint. When pavement is placed on only one side of the joint, the area 5 feet from the joint will be deleted from the profile before the LPI is determined. Incentive/disincentive payments will not be made for this area. Pavement within the area 5 feet on the newly constructed side of the joint will be tested in accordance with subsection 105.07(a) 2.

The profile of the area 5 feet each side of every railroad crossing, cattle guard, bus pad, manhole, valve box, gutter pan and intersection (where there is a planned breakpoint in the profile grade line in the direction of testing) will be deleted from the profile before the LPI is determined. Incentive/disincentive payments will not be made for these areas. Areas deleted from the profile will be tested in accordance with subsection 105.07 (a) 2.

When both new pavement and a new bridge or new bridge pavement are being constructed in a project, the profile of the area 5 feet each side of every bridge expansion device (joint) shall be deleted from the profile before the LPI is determined. Incentive/disincentive payments will not be made for this area. Areas deleted from the profile will be tested in accordance with subsection 105.07(a)2. Diamond grinding will not be measured and paid for separately, but shall be included in the work. For all other projects, the profile of the area 5 feet each side of every bridge expansion device (joint) shall be deleted from the profile before the LPI is determined. Incentive/disincentive payments will not be made for this area. If the Engineer determines that corrective work is required in this area, payment will be made in accordance with subsection 109.04.

Shoulders, ramps, tapers, turn slots, acceleration lanes, deceleration lanes, and medians constructed as part of this project will be measured in accordance with subsection 105.07(a)2.

- B. Smoothness Testing Procedures. The Contractor shall mark the project limits, climbing lane limits and passing lane limits. The Contractor shall mark 5 feet from each bridge approach slab, railroad crossing, cattle guard, bus pad, manhole, valve box, gutter pan and intersection (where there is a planned breakpoint in the profile grade line in the direction of testing). The Engineer will verify that the Contractor's marks are located properly. The Department will setup traffic cones with reflective tape at the beginning and end of each lane for triggering the start and stop locations on the profiler and at any other location, where portions of the profile are being deleted. If project or traffic conditions do not allow the use of traffic cones, the Department will place reflective tape on the pavement. The Contractor shall provide sufficient traffic control for the Department to safely place the traffic cones or reflective tape.

The Contractor shall clear the lanes to be tested of all debris before profiling.

The Contractor shall submit a Method for Handling Traffic (MHT) to the Engineer for approval. The MHT shall detail the methods for traffic control that will allow for continuous non-stop profiling of each lane to be profiled at a minimum speed of 15 mph. The Contractor shall provide the traffic control in accordance with the approved MHT.

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Each lane will be profiled three times at a constant speed with a minimum speed of 15 mph and a maximum speed of 70 mph. The profile will be taken in the intended direction of travel. The left and right wheel paths will be profiled simultaneously. The collected profiles will be analyzed using CP 72.

The Department will determine a LPI for each 0.1 mile section or fraction thereof of completed pavement. The LPI consists of the average of the left wheel path's Profile Index and right wheel path's Profile Index.

Areas requiring corrective work will be determined in accordance with subsection 105.07(b) 1. The third run of each lane will be used for the determination of Bumps.

Sections less than 0.01 miles in length will not be subject to corrective work as specified by Table 105-6. Sections less than 0.01 miles in length will be included in determining the existence of Bumps.

The Department's QAS test results will be available within five working days of the completion of testing. The Engineer will give the Contractor a report that will include profile data, the lane profiled, Profile Index for the left and right wheel paths, the LPI in 0.10 mile increments and a summary of Bumps. The Engineer may at his discretion, determine that it is necessary to reprofile a lane.

- C. Final acceptance and incentive/disincentive payments for pavement smoothness will be made on a square yard basis in accordance with the following:

Incentive and Disincentive payments will be based on the LPI for each 0.1 mile section or fraction thereof.

Incentive/Disincentive payments for Pavement Smoothness will be made in accordance with Table 105-6. Sections less than 0.01 miles in length will not be subject to disincentive payments.

**Table 105-6
 CONCRETE PAVEMENT SMOOTHNESS (INCHES/MILE)
 LANE PROFILE INDEX, 0.10 INCH BLANKING BAND (LPI)**

Pavement Smoothness Category ¹	Incentive Payment (\$/sqyd)	No Incentive or Disincentive	Disincentive Payment (\$/sqyd)	Corrective Work Required
I	When LPI < 8.0 I = \$1.40	When LPI > 14.0 and < 16.0 I = \$0.00	When LPI ≥ 16.0 and ≤ 22.0 I = (224 - 14 x LPI)/60	When LPI > 24.0
	When LPI ≥ 8.0 and ≤ 14.0 I = (196 - 14 x LPI)/60		When LPI > 22.0 I = -\$1.40	
II	When LPI < 8.0 I = \$1.40	When LPI > 16.0 and < 18.0 I = \$0.00	When LPI ≥ 18.0 and ≤ 25.5 I = (252 - 14 x LPI)/75	When LPI > 28.0
	When LPI ≥ 8.0 and ≤ 16.0 I = (224 - 14 x LPI)/80		When LPI > 25.5 I = -\$1.40	
III	When LPI < 8.0 I = \$1.40	When LPI > 18.0 and < 20.0 I = \$0.00	When LPI ≥ 20.0 and ≤ 29.0 I = (280 - 14 x LPI)/90	When LPI > 34.0
	When LPI ≥ 8.0 and ≤ 18.0 I = (252 - 14 x LPI)/100		When LPI > 29.0 I = -\$1.40	

¹ The pavement smoothness category will be shown on the plans.