

4-30-2010

**REVISION OF SECTIONS 105, 202, 401, 406 and 601  
HOT MIX ASPHALT 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 all projects having HMA pavement.

Use the following guideline to assign the pavement smoothness category for the project. Place the pavement smoothness category assignment in the General Notes if it is not HRI Category II.:

**HRI Category I** applies to the following asphalt pavement construction:

1. Urban Reconstruction with or without curb and gutter;
2. Construction of one layer over an intermediate treatment (Removal of Asphalt Mat (Planing), Cold Bituminous Pavement (Recycle), Heating and Remixing, Heating and Repaving, Full Depth Reclamation, leveling course with a thickness of 1.5 inches or less or other intermediate treatment);
3. May be used in overlays meeting #2, with curb and gutter when a shoulder separates driving lanes from the curb and gutter. A minimal amount of utility boxes, intersections and grade changes are allowed. A note needs to be placed in the plans stating that the new asphalt driving lanes will not have to match curb and gutter.
4. May be used in overlays meeting #2, with curb and gutter when pavement smoothness is very important. A minimal amount of utility boxes, intersections and grade changes are allowed. A note needs to be placed in the plans stating that the new asphalt driving lanes will not have to match curb and gutter.

**HRI Category II** applies to the following asphalt pavement construction:

1. New construction with or without curb and gutter;
2. Construction of more than one layer;
3. May be used in overlays meeting #2, with curb and gutter when a shoulder separates driving lanes from the curb and gutter. A minimal amount of utility boxes, intersections and grade changes are allowed. A note needs to be placed in the plans stating that the new asphalt driving lanes will not have to match curb and gutter grades.

4. May be used in overlays meeting #2, with curb and gutter when pavement smoothness is very important. A minimal amount of utility boxes, intersections and grade changes are allowed. A note needs to be placed in the plans stating that the new asphalt driving lanes will not have to match curb and gutter.

**HRI percent improvement urban construction** applies to the following asphalt pavement construction:

1. When smoothness is affected by matching existing curb and gutter and/or numerous intersections and/or utility boxes.

**HRI percent improvement rural construction** applies to the following asphalt pavement construction:

1. Only one layer of pavement is being placed without an intermediate treatment.
2. Only one layer of pavement is being placed over Heating and Scarifying
3. Heating and Repaving without an overlay
4. May be used in urban overlays meeting #1-4, with curb and gutter when a shoulder separates driving lanes from the curb and gutter. A minimal amount of utility boxes, intersections and grade changes are allowed. A note needs to be placed in the plans stating that the new asphalt driving lanes will not have to match curb and gutter grades.
5. May be used in urban overlays meeting #1-4, with curb and gutter when pavement smoothness is very important. A minimal amount of utility boxes, intersections and grade changes are allowed. A note needs to be placed in the plans stating that the new asphalt driving lanes will not have to match curb and gutter.

**No pavement smoothness category** is applied to the following asphalt pavement construction:

1. Cold Recycling without an overlay.
2. Thin overlays (< 1.5 inches) of HMA or SMA without an intermediate treatment.
3. Heating and Scarifying without an overlay.
4. Heating and Remixing without an overlay
5. Chip seals

Paving treatments 1-4 are tested according to 105.07 (e). A general note needs to be placed stating that they are not subject to incentive/disincentive and will be accepted according to 105.07 (e)

Chip seals are not tested at all for smoothness.

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

The Designer will assign the pavement smoothness category(s). At least 2 weeks prior to the F.O.R. meeting, send a copy of the plans to Staff Materials for review of the pavement smoothness category assignment.

The Designer will set up a planned force account for pavement smoothness based on the maximum incentive possible for the project. On Rural Percent Improvement, the smoothness category may be changed to HRI Category during construction and the available incentive doubles. Make sure the smoothness force account can cover the change of smoothness categories.

If the designer intends for shoulders to be future driving lanes, a note needs to be added in the General Notes stating whether or not these future driving lanes are subject to incentive/disincentive payments.

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.

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Sections 105, 202, 401, 406, 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. The pavement smoothness category shall be HRI Category II unless shown on the plans.

(a) *Smoothness Quality Control Testing.*

1. The Contractor shall perform Smoothness Quality Control (SQC) testing. The test results shall be submitted to the Engineer within 48 hours of completion. SQC test results shall show the Half Car Roughness Index (HRI) or Percent Improvement (%I) for each 0.10 mile or 0.05 mile section respectively. When the Contract specifies HRI, the test results shall show the results for localized roughness.

All traffic control costs associated with SQC testing will be paid for in accordance with Section 630.

When the Contract specifies HRI Category I, SQC results shall be in the form of HRI. SQC shall be performed on the first 2,000 tons for the final layer.

When the Contract specifies HRI Category II, SQC results shall be in the form of HRI. SQC shall be performed on the first 2,000 tons for both the final layer and the next lower pavement layer and at the completion of the next lower pavement layer.

When the Contract specifies HRI Percent Improvement, SQC results shall be in the form of HRI and HRI Percent Improvement. SQC shall be performed on the first 2,000 tons for the final layer.

SQC testing shall be performed using the Contractor's inertial profiler, pursuant to the methods described in subsection 105.07(b) and in accordance with the manufacturer's recommendations. The Contractor's Profiler shall be certified according to CP 78. A list of certified profilers is located at <http://www.dot.state.co.us/DesignSupport/>.

Production shall be suspended if SQC testing indicates that corrective work is required in accordance with subsection 105.07 (c). **If the SQC data becomes available after production has started for the day, work will be allowed to continue until the end of that production day.** 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 2,000 tons of HMA. The conditions above for suspension of work will apply.

2. The finished transverse and longitudinal surface elevation of the pavement shall be measured using a 10 foot straightedge. Areas to be measured will be directed by the Engineer. The Contractor shall furnish an approved 10 foot straightedge, depth gauge and operator to aid the Engineer in testing the pavement surface. 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) *Initial Smoothness Acceptance Testing.* The Contractor shall perform Smoothness Acceptance Testing (SA) which will be used for acceptance and calculation of incentive and disincentive payments.

All traffic control costs associated with SA testing will be paid for in accordance with Section 630.

1. Longitudinal Pavement Surface Smoothness Acceptance. Pavement surfaces shall be tested and accepted for longitudinal smoothness as described herein.

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- A. Testing Procedure (General). The longitudinal surface smoothness of the final pavement surface shall be tested by the Contractor in accordance with CP 74 and using the Contractor's high-speed profiler (HSP). The Contractor's Profiler shall be certified according to CP 78. A list of certified profilers is located at <http://www.dot.state.co.us/DesignSupport/>

The HSP instrumentation shall be verified in accordance with CP 74 prior to measurements. The Contractor shall lay out a distance calibration site. The distance calibration site shall be located no more than ten miles from the Project limits. 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 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 shall be profiled. Shoulders less than 12 foot in width and medians will not be profiled and will not be subject to incentive/disincentive adjustments. Shoulders with a width of 12 feet or greater, ramps, tapers, turn slots, acceleration lanes and deceleration lanes will be profiled, but will not be subject to incentive/disincentive adjustments. Shoulders with a width of 12 feet or more, ramps, tapers, turn slots, acceleration lanes and deceleration lanes will be evaluated for localized roughness corrective work. The profile of the entire length of a lane shall be taken at one time. However, the Engineer may break a project into sections to accommodate Project phasing.

A sufficient distance shall 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 shall be tested in accordance with subsection 105.07(a) 2.

Shoulders less than 12 foot in width and medians constructed as part of this project shall be measured in accordance with subsection 105.07(a) 2.

When the Contract Specifies HRI, the following applies:

- (1) The profile shall 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 profile shall start 5 feet outside the project paving limits. The profile of the section of pavement 5 feet outside the paving limits to 25 feet inside paving limits will not be subjected to incentive or disincentive payments, but will be evaluated for localized roughness.
- (2) The profile of the area 25 feet each side of every railroad crossing, cattle guard, bus pad, manhole, gutter pan and intersection (where there is a planned breakpoint in the profile grade line in the direction of testing) shall be deleted from the profile before the HRI is determined. Incentive/disincentive payments will not be made for these areas. Areas deleted from the profile shall be tested in accordance with subsection 105.07(a) 2.
- (3) When both new pavement and a new bridge or new bridge pavement are being constructed in a project, the profile of the area 25 feet each side of every bridge expansion device (joint) shall be deleted from the profile before the HRI is determined. Incentive/disincentive payments will not be made for this area. Areas deleted from the profile shall be tested in accordance with subsection 105.07(a) 2. **The bridge deck will not be subject to incentive/disincentive payments, but will be evaluated for localized roughness.** Corrective work required in these areas will not be measured and paid for separately, but shall be included in the work. For all other projects, the profile of the area 25 feet each side of every bridge expansion device (joint) shall be

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deleted from the profile before the HRI 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.

- (4) The Contractor shall notify the Engineer in writing at least five working days in advance of his intention to perform SA testing. The Contractor shall profile the Project within 14 days after the completion of paving operations. The Engineer will witness the SA profiling and take immediate possession of the SA data.
- (5) The Contractor shall not perform any corrective work that will effect the pavement smoothness for ten working days after completion of the SA testing or as approved by the Engineer. This time is to allow for the Department to analyze the data and perform smoothness verification testing.

When the Contract specifies HRI Percent Improvement, the Contractor shall comply with the following:

- (1) The Contractor shall notify the Engineer in writing of his intention to perform SA testing on the existing pavement. This notification shall be at least five working days in advance of any work that will affect the smoothness of the lanes. This includes but is not limited to the following work; manhole adjustment, valve box adjustments, curb and gutter repair, milling, planing or patching.
  - (2) The Contractor shall perform the SA testing on the existing pavement prior to any work that will affect the smoothness of the lanes. The Engineer will witness the SA profiling and take immediate possession of the SA data.
  - (3) The Contractor shall not perform any work that will effect the initial smoothness of the lanes for ten working days after completion of the SA testing on the existing pavement or as approved by the Engineer. This time is to allow for the Department to analyze the data and perform smoothness verification testing.
  - (4) When the Contractor performs work on the existing pavement prior to the ~~initial~~ SA testing on the existing pavement, the affected sections will not be subject to incentive payments, but will be subject to disincentive payments and corrective work.
  - (5) The Contractor shall notify the Engineer in writing at least five working days in advance of his intention to perform SA testing. The Contractor shall profile the Project within 14 days after the completion of paving operations. Manholes and valve boxes shall be raised prior to SA testing. The Engineer will witness the SA profiling and take immediate possession of the SA data.
  - (6) The Contractor shall not perform any corrective work that will effect the final pavement smoothness for ten working days after completion of the SA testing or as approved by the Engineer. This time is to allow for the Department to analyze the data and perform smoothness verification testing.
  - (7) The profile shall include an additional 25 feet of pavement outside the project paving limits.
- B. Smoothness Testing Procedures. The Contractor shall mark the profiling limits and excluded areas. When the Contract specifies HRI Percent Improvement, the markings shall be located in a location that will not be disturbed, so that the section start and stop locations will be identical for the initial and final pavement surface. The Engineer will verify that the Contractor's marks are located properly. The Contractor shall use traffic cones with reflective tape or reflective tape on the pavement 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. These locations

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shall be marked with temporary paint so that the Department's profiler uses the same locations for smoothness verification testing.

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 at least five days in advance of SA testing. 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.

Each lane shall be profiled three times at a constant speed (+/- 5 mph) with a minimum speed of 15 mph and a maximum speed of 70 mph. Shoulders with a width of 12 feet or more, ramps, tapers, turn slots, acceleration lanes and deceleration lanes shall be profiled once. The profile shall be taken in the intended direction of travel. The left and right wheel paths shall be profiled simultaneously. The collected profiles shall be turned over immediately to the Engineer and will be analyzed using CP 74.

- (1) When the Contract specifies HRI, the Department will determine a HRI for each 0.1 mile section or fraction thereof of completed pavement. The HRI consists of the average of the left and right wheel path's profile passed through the International Roughness Index (IRI) filter.

The Contractor's SA test results will be available within ten working days of the completion of SA testing. The Engineer will give the Contractor a report that will include the lane profiled, the HRI in 0.10 mile increments and a summary of areas requiring corrective work. The Engineer may determine that it is necessary for the Contractor to re-profile a lane.

Areas requiring corrective work will be determined according to subsection 105.07(c) 1. The third run of each lane will be used for the determination of Localized Roughness.

Sections less than 0.01 miles in length shall not be subject to corrective work as specified by Table 105-6. Sections less than 0.01 miles in length shall be included in the Localized Roughness determination.

- (2) When the Contract specifies HRI Percent Improvement, the Department will determine an HRI for each 0.05 mile section or fraction thereof of pavement. The HRI consists of the average of the left and right wheel path's profile passed through the IRI filter.

The Contractor's SA test results will be available within ten working days of the completion of SA testing. The Engineer will give the Contractor a report that will include the lane profiled, the HRI in 0.05 mile increments, percent improvement in 0.05 mile increments and areas requiring corrective work. The Engineer may determine that it is necessary for the Contractor to re-profile a lane.

Areas requiring corrective work will be determined in accordance with subsection 105.07(c) 2.

- C. When the Contract specifies HRI, 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 HRI 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.

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**Table 105-6  
HMA PAVEMENT SMOOTHNESS (INCHES/MILE)  
HALF-CAR ROUGHNESS INDEX**

Pavement Smoothness Category	Incentive Payment (\$/sqyd)	No Incentive or Disincentive	Disincentive Payment (\$/sqyd)	Corrective Work Required
I	When HRI ≤ 40.0 I = \$1.28	When HRI ≥ 63.0 and ≤ 72.0 I = \$0.00	When HRI > 72.0 and < 90.0 I = 5.12 – 0.07111 x HRI	When HRI > 90.0
	When HRI > 40.0 and < 63.0 I = 3.51 – 0.05565 x HRI		When HRI ≥ 90.0 I = – \$1.28	
II	When HRI ≤ 35.0 I = \$1.28	When HRI ≥ 58.0 and ≤ 67.0 I = \$0.00	When HRI > 67.0 and < 85.0 I = 4.76 – 0.07111 x HRI	When HRI > 85.0
	When HRI > 35.0 and < 58.0 I = 3.23 – 0.05565 x HRI		When HRI ≥ 85.0 I = – \$1.28	

- D. When the Contract specifies HRI Percent Improvement (%I), acceptance and incentive/disincentive payments for pavement smoothness will be made on a square yard basis in accordance with the following:

The Engineer will produce a report of the original surface that will include the lane profiled and the HRI in 0.05 mile increments.

Incentive and disincentive payments will be based on the %I of the HRI for each 0.05 mile section or fraction thereof on the final paved surface compared to the HRI for each 0.05 mile section or fraction thereof on the original surface. Sections less than 0.01 miles in length will not be subject to disincentive payments.

The %I will be calculated as follows:

$$\%I = \frac{\text{HRI OF ORIGINAL SURFACE} - \text{HRI OF FINAL SURFACE}}{\text{HRI OF ORIGINAL SURFACE}} \times 100$$

Incentive/disincentive payments for Pavement Smoothness will be made in accordance with Table 105-7 or 105-8.

When the Contract specifies Rural Construction Percent Improvement, the Contractor may request in writing to the Engineer that the pavement smoothness category is changed to HRI Category I. The request shall be made prior to the Smoothness Acceptance testing of final paving surface. If approved by the Engineer all requirements for HRI Category I shall apply and the smoothness category shall not be changed back to Rural Construction Percent Improvement.

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**Table 105-7  
HMA PAVEMENT SMOOTHNESS  
RURAL CONSTRUCTION  
PERCENT IMPROVEMENT (%I)  
HALF-CAR ROUGHNESS INDEX**

Incentive Payment (\$/sqyd)	No Incentive or Disincentive	Disincentive Payment (\$/sqyd) <sup>1</sup>	Corrective Work Required <sup>1</sup>
When %I > 60.0 I = \$0.32	When %I > 40.0 and < 45.0 I = \$0.00	When %I ≥ 25.0 and ≤ 40.0 I = (32 x %I - 1280)/1500	When %I < 20.0
When %I ≥ 45.0 and ≤ 60.0 I = (32 x %I - 1440)/1500		When %I < 25.0 I = -\$0.32	
1 Disincentives will not be assessed and corrective work will not be required for a 0.05 mile section if the HRI is equal to or less than 80.0 in/mi			

**Table 105-8  
HMA PAVEMENT SMOOTHNESS  
URBAN CONSTRUCTION  
PERCENT IMPROVEMENT (%I)  
HALF CAR ROUGHNESS INDEX**

Incentive Payment (\$/sqyd)	No Incentive or Disincentive	Disincentive Payment (\$/sqyd) <sup>1</sup>	Corrective Work Required <sup>1</sup>
When %I > 50.0 I = \$0.32	When %I > -5.0 and < 5.0 I = \$0.00	When %I ≥ -20.0 and ≤ -5.0 I = (32 x %I + 160)/1500	When %I < -25.0
When %I ≥ 5.0 and ≤ 50.0 I = (32 x %I - 160)/4500		When %I < -20.0 I = -\$0.32	
1 Disincentives will not be assessed and corrective work will not be required for a 0.05 mile section if the HRI is equal to or less than 80.0 in/mi			

(c) *Corrective Work.*

The Department will analyze the SA testing for acceptance and indicate areas requiring corrective work in accordance with subsection 105.07(b). Corrective work shall be proposed in writing by the Contractor. Corrective work shall not be performed until approved in writing by the Engineer. **The Contractor shall not perform any corrective work on the final layer until after the Engineer returns the results of the Initial Smoothness Acceptance testing and after the Department's Smoothness Verification testing, if performed.** The Contractor shall perform corrective work in the areas indicated by the SA testing.

Corrective work on lower layers shall be at the Contractor's discretion.

The Contractor shall profile the roadway to verify that the required corrective work has been completed.

**If the Contractor elects to perform corrective work prior to the completion of initial SA testing, the entire 0.05 or 0.10 mile section or fraction thereof will not be eligible for incentive payment but will be eligible for disincentive. The Engineer will not modify the limits of the 0.05 or 0.10 mile sections to group corrective work areas in an effort to reduce the number of sections impacted by this decision.**

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The Contractor may elect to perform additional corrective work to reduce or eliminate the disincentive payment for each 0.1 mile section or fraction thereof after the initial SA testing and the Department's verification testing.

1. Half-Car Roughness Index Corrective Work:

- A. 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 areas of Localized Roughness.
- B. Localized Roughness. The profiles shall be analyzed to determine where areas of localized roughness occur. The profile shall be summarized using the continuous HRI reporting system using an averaging length of 25 feet. The FHWA's ProVal (Version 2.7 or later) software will be used to generate the continuous HRI report. ProVal can be downloaded at <http://www.roadprofile.com>.

Areas shall be considered deficient, and require corrective work where the continuous HRI report exceed the values in Table 105-9. Areas of localized roughness less than 25 feet in distance that contain a valve box shall be tested in accordance with subsection 105.07 (a) 2. for corrective work.

**Table 105-9  
CONTINUOUS HRI USING 25 FOOT AVERAGING FOR LOCALIZED  
ROUGHNESS CORRECTIVE WORK ON HMA PAVEMENTS**

HRI SMOOTHNESS CATEGORY	HRI In/mile
I	135.0
II	125.0

2. Half Car Roughness Index Percent Improvement Corrective Work. The criteria for determining if corrective work is required for a 0.05 mile section or fraction thereof is specified in Table 105-7 or 105-8.

When the corrective work is complete, the Contractor shall re-profile the corrective work area and determine a HRI Percent Improvement for each 0.05 mile section or fraction thereof. Additional corrective work in accordance with this specification will be required if the HRI Percent Improvement for a 0.05 mile section or fraction thereof doesn't meet the specified range shown in Table 105-7 or 105-8.

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.

3. Corrective Methods. Corrective work shall consist of diamond grinding, an approved overlay, or removal and replacement.

Corrective work shall conform to of one of the following conditions:

- (1) Removal and Replacement. The pavement requiring corrective work shall be removed, full width of the lane and the full thickness of the layer in accordance with subsection 202.09.

The removal area shall begin and end with a transverse butt joint, which shall be constructed with a transverse saw cut perpendicular to centerline. Replacement material shall be placed in sufficient

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quantity so the finished surface conforms to grade and smoothness requirements. Sections removed and replaced shall be at least 0.20 miles in length.

- (2) **Overlay.** The overlay shall cover the full width of the pavement including shoulders. The area overlaid shall begin and end with a transverse butt joint, which shall be constructed with a transverse saw cut and asphalt removal. All material shall be approved hot bituminous mixtures that meet all contract requirements. The overlay shall be placed so that the finished surface conforms to grade and smoothness requirements. The overlay area shall be compacted to the specified density. The overlay thickness shall be equivalent to that of the final layer in accordance with the Contract. Sections overlaid shall be at least 0.20 miles in length.
- (3) **Diamond Grinding.** Grinding shall not reduce planned pavement thickness by more than 0.3 inches. The entire ground area of the final pavement surface shall be covered with a Tack Coat conforming to Section 407 (CSS-1h at 0.1 gallons per square yard of diluted emulsion; the emulsion shall be diluted with water at the rate of 50 percent water and 50 percent emulsion) when grinding is complete. Cores shall be taken to verify that minimum pavement thicknesses have been maintained. **A minimum of one core shall be taken every 100 cumulative feet or fraction thereof per lane of diamond grinding, as directed by the Engineer.** Coring shall be at the Contractor's expense.
- (d) **Final Smoothness Acceptance Testing.** After the Contractor has completed the required corrective work and any additional corrective work, the Contractor will retest the pavement in accordance with subsection 105.07(b). **If the Contractor requests to do additional corrective work to reduce disincentive after Final SA Testing, the Department will perform an additional Final SA Testing for the project. A charge of \$500 will be assessed to the Contractor for each additional trip to the project required to perform additional Final SA Testing. Time count will be charged pursuant to contract requirements during the time period required for all Final SA Testing. Delays associated with additional Final SA Testing will be considered non-excusable and non-compensable.**

The Contractor shall notify the Engineer pursuant to 105.07(b) to schedule the final SA testing.

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

Incentive payments will be based on the HRI for each 0.1 mile section or fraction thereof from the Contractor's initial SA testing. Those sections which earned incentives or full payment based on the initial SA testing will not be re-evaluated for incentive after final SA testing.

The disincentive payment will be based on the HRI or percent improvement for each 0.05 or 0.1 mile section or fraction thereof from the Contractor's Initial SA testing or the Contractor's Final SA testing, whichever is less. Those sections which had disincentive levels indicated by the initial SA, will be re-evaluated for disincentive. The Contractor may eliminate all disincentives on those 0.05 or 0.1 mile sections, however, no incentives may be earned in these areas, regardless of the final smoothness.

- (e) **Department Smoothness Verification Testing (SV).** The Department may elect to perform smoothness verification (SV) testing using the Department's inertial profiler, with the methods described in subsection 105.07(b). The Engineer will notify the Contractor of the Department's intention to perform SV testing. All traffic control costs associated with Department SV testing will be paid for by the Department in accordance with Section 630.

The Contractor's SA test results will be compared to the Department's SV test results. The Contractor's SA test results will be considered acceptable and will be used for incentive/disincentive payment if the following criteria are met:

- (1) The difference in HRI for a 1/10 or 1/20 mile section is less than 6.1 inches/mile for a minimum of 90 percent of the 1/10 or 1/20 mile sections for each lane.
- (2) The difference in average HRI for each lane is less than 6.1 inches/mile.

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- (3) The difference in the length of each lane is less than 0.2 percent

When the Contractor's SA test results are not considered acceptable, the Department's SV test results will be used for incentive/disincentive payment and the Contractor's profiler certification shall be evaluated pursuant to CP 78. The Department will have 30 days to complete this evaluation.

The Contractor will be assessed a charge of \$1,000 for SV testing when the Contractor's SA test results are not considered acceptable.

- (f) *HMA Recycling Treatments and Thin Lift Smoothness Criteria.* When HMA recycling treatments or when only one layer less than 1.5 inches of HMA Pavement is placed without an intermediate treatment are constructed as the final riding surface, the following shall be used for acceptance:

An HRI for each 0.1 mile section shall be determined on the original pavement surface prior to beginning the work.

An HRI for each 0.1 mile section shall be determined on the pavement surface after the work is complete.

When a 0.1 mile section has a final HRI greater than 80.0 in/mile and the final HRI is greater than the HRI prior to performing the work, that 0.1 mile section shall be corrected by a method approved in writing by the Engineer. Corrective work shall be such that the resulting final HRI is equal to or less than the initial HRI or 80.0 in/mile, whichever is greater. All costs associated with corrective work shall be at the Contractor's expense, including but not limited to traffic control, additional hot mix asphalt, grinding and milling.

The pavement smoothness for HMA Recycling Treatments and Thin Lifts that will be overlaid with a final riding surface will not be evaluated by the Department for acceptance.

In subsection 202.09 delete the last paragraph

Delete subsection 401.20 and replace with the following:

**401.20 Surface Smoothness.** The roadway surface smoothness shall be tested in accordance with subsection 105.07.

Delete Subsection 406.11 and replace with the following:

**406.11 Smoothness.** The longitudinal surface smoothness of the roadway prior to and after cold recycling shall be tested in accordance with subsection 105.07 by the Contractor.

Delete subsection 601.15 (f) 2. and Table 601-2.

Subsection 3.2.1 of CP 78 has been changed to state the following:

3.2.1 The High Speed Profiler (HSP) shall meet the specifications of AASHTO MP 11-03 except that profilers used to measure the smoothness on concrete pavement shall have approved line lasers with at least a three inch wide foot print.