

## Section 440 Ride Quality

### 440.1 Description

- (1) This section describes profiling with a non-contact profiler, locating areas of localized roughness, and determining the International Roughness Index (IRI) for each wheel path.
- (2) Profile the final mainline riding surfaces greater than 1500 feet in continuous length. Include bridges, bridge approaches, and railroad crossings in the calculation of IRI. Exclude roundabouts and pavements within their entry and exit curves from the calculation of IRI.
- (3) Also profile final riding surfaces of pavement greater than 1500 feet in continuous length for the following:
  - Auxiliary lanes in Category I and II segments.
  - Mainline pavement on county, state, or U.S. highway crossroads reconstructed under the contract.
- (4) The engineer may direct straightedging under [415.3.10](#) or [450.3.2.9](#) for pavement excluded from localized roughness under [440.3.5.2\(1\)](#); for bridges; and for roundabouts and pavements within 150 feet of the points of curvature of roundabout intersections.

### 440.2 (Vacant)

### 440.3 Construction

#### 440.3.1 Quality Control Plan

- (1) Submit a written quality control plan to the engineer at or before the pre-pave meeting. Ensure that the plan provides the following elements:
  1. An organizational chart with names, telephone numbers, current certifications and/or titles, and roles and responsibilities of quality control personnel.
  2. The process used to disseminate quality control information and corrective action efforts to the appropriate persons. Include a list of recipients, the communication means used, and action time frames.
  3. The methods and timing used for monitoring and/or testing ride quality throughout the placement process. Also indicate the approximate timing of acceptance testing in relation to placement operations.
  4. The segment locations of each profile run used for acceptance testing.
  5. A traffic control plan.

#### 440.3.2 Personnel

- (1) Have an HTCP-certified profiler operator operate the equipment, collect the required data, and analyze the results using the methods taught in the HTCP profiling course. Ensure that an HTCP-certified profiler operator supervises data entry into the department's materials reporting system (MRS) software.

#### 440.3.3 Equipment

- (1) Furnish a profile-measuring device capable of measuring IRI from the list of department-approved profilers on the department's web site at:  
<https://wisconsindot.gov/Documents/doing-bus/eng-consultants/cnslt-rsrcs/tools/qmp/profilers.pdf>
- (2) Unless the engineer and contractor mutually agree otherwise, arrange to have a calibrated profiler available when paving the final riding surface.
- (3) Perform daily calibration verification of the profiler using test methods according to the manufacturer's recommendations. Notify the engineer before performing the calibration verification. If the engineer requests, arrange to have the engineer observe the calibration verification and operation. Maintain records of the calibration verification activities, and provide the records to the engineer upon request.

#### 440.3.4 Testing

##### 440.3.4.1 Run and Reduction Parameters

- (1) Enter the equipment-specific department-approved filter settings and parameters given in the approved profilers list on the department's web site at:  
<https://wisconsindot.gov/Documents/doing-bus/eng-consultants/cnslt-rsrcs/tools/qmp/profilers.pdf>

##### 440.3.4.2 Contractor Testing

- (1) Operate profilers within the manufacturer's recommended speed tolerances. Perform profile runs in the direction of travel. Measure the longitudinal profile of each wheel track of each lane. The wheel tracks are 6.0 feet apart and centered in the traveled way of the lane.
- (2) Coordinate with the engineer to schedule profile runs for acceptance. The department may require testing to accommodate staged construction or if corrective action may be required.

- (3) Measure the profiles of each standard or partial segment. Define primary segments starting at a project terminus and running contiguously along the mainline to the other project terminus. Field-locate the beginning and ending points for each profile run. When applicable, align segment limits with the subplot limits used for testing under [715](#). Define segments one wheel path wide and distinguished by length as follows:

- 1. Standard segments are 500 feet long.
- 2. Partial segments are less than 500 feet long.

- (4) Treat partial segments as independent segments. The department will categorize segments as follows:

Segments with a posted speed limit of 55 mph or greater:

HMA I Asphalt pavement with multiple opportunities to achieve a smooth ride. The following operations performed under this contract are considered as opportunities: a layer of HMA, a leveling or wedging layer of HMA, and diamond grinding or partial depth milling of the underlying pavement surface.

HMA II Asphalt pavement with a single opportunity to achieve a smooth ride.

HMA III Asphalt pavement segments containing any portion of a bridge, bridge approach, railroad crossing, or intersection. An intersection is the area within the points of curvature of the intersection radii.

PCC II Concrete pavement.

PCC III Concrete pavement segments containing any portion of a bridge, bridge approach, railroad crossing, intersection, or gap. An intersection is the area within the points of curvature of the intersection radii.

RCDG V Rural concrete pavement surfaces the contract designates for continuous diamond grinding.

Segments with any portion having a posted speed limit less than 55 mph:

HMA IV Asphalt pavement including intersections, bridges, approaches, and railroad crossings.

PCC IV Concrete pavement including gaps, intersections, bridges, approaches, and railroad crossings.

UCDG V Urban concrete pavement surfaces the contract designates for continuous diamond grinding.

#### 440.3.4.3 Verification Testing

- (1) The department may conduct QV testing to validate the quality of the product. An HTCP-certified profiler operator will perform the QV testing. The department will provide the contractor with a listing of the names and telephone numbers of verification personnel for the project.
- (2) The department will notify the contractor before testing so the contractor can observe the QV testing. Verification testing is performed independent of the contractor's QC work using separate equipment from the contractor's QC tests. The department will provide test results to the contractor within 1 business day after the department completes the testing.
- (3) The engineer and contractor will jointly investigate any testing discrepancies. The investigation may include additional testing as well as review and observation of both the department's and contractor's testing procedures and equipment. Both parties will document investigative work.
- (4) If the contractor does not respond to an engineer request to resolve a testing discrepancy, the engineer may suspend production until action is taken. Resolve disputes as specified in [440.3.6](#).

#### 440.3.4.4 Documenting Profile Runs

- (1) Compute the segment IRI for each segment and analyze areas of localized roughness using the ProVAL software available for download at:

<http://www.roadprofile.com>

- (2) Prepare the ProVAL ride quality module reports showing the segment IRI for each segment and areas of localized roughness exceeding 200 in/mile. Develop ride quality module reports using the following:

	FIXED INTERVAL(segment IRI)	CONTINUOUS (localized roughness)
BASE-LENGTH	500 feet	25 feet
THRESHOLD	140 in/mile	200 in/mile

- (3) As part of the profiler software outputs and ProVAL reports, document the areas of localized roughness. Field-locate the areas of localized roughness before the engineer's assessment for corrective actions. Document the reasons for areas excluded.
- (4) Within 5 business days after completing profiling, unless the engineer and contractor mutually agree to a different timeline, upload the electronic ProVAL project file containing the .ppf files for each profiler acceptance run and ride quality module reports, in pdf format using the MRS software available at:

<http://www.atwoodsystems.com/>

- (5) Notify the engineer when the profiler acceptance run data and the ride quality module report have been uploaded to the MRS software.

#### **440.3.5 Corrective Actions**

##### **440.3.5.1 General**

- (1) Analyze ProVAL reports and recommend corrective action to the engineer. Include areas of localized roughness not continuously diamond-ground.
- (2) Before directing corrective action, the engineer will assess whether a repair will help or hurt the long-term performance. Correct the ride as the engineer directs in writing.

##### **440.3.5.2 Corrective Actions for Localized Roughness**

- (1) The engineer will assess each wheel path for areas of localized roughness within 5 business days of being notified that ProVAL reports are uploaded. The engineer will document each area that exceeds 200 in/mile and do one of the following:

1. Direct the contractor to correct the area to minimize the effect on the ride.
2. Leave the area of localized roughness in place with no pay reduction.
3. Assess a pay reduction for each area in each wheel path as follows:

Length  $\leq$ 25 feet: (localized roughness in/mile - 200) dollars/foot or \$250 whichever is least

Length >25 feet: (localized roughness in/mile - 200) dollars/foot or 10 dollars/foot whichever is least

The department will not reduce pay for localized roughness within HMA IV and PCC IV segments or within 25 feet of bridges, bridge approaches, or railroad crossings not constructed under the contract.

**Revise 440.3.5.2(2) to require authorization from the Bureau of Structures before corrective action on bridge decks. This change was implemented in ASP 6 effective with the September 2016 letting.**

- (2) The engineer will not direct corrective action or assess a pay reduction for an area of localized roughness without physically riding that work. **The engineer will not direct corrective action on bridges without authorization from the department's bureau of structures.**
- (3) Re-profile corrected areas to verify that the localized roughness is less than 140 in/mile. Upload a revised ProVAL ride quality module report for corrected areas into the MRS software.

##### **440.3.5.3 Corrective Actions for Excessive Segment IRI**

- (1) If an individual segment IRI exceeds 140 in/mile for HMA I, HMA II, and PCC II pavements after correction for localized roughness, the engineer may require the contractor to correct that segment. Correct the segment final surface as follows:

HMA I: Correct to an IRI of 60 in/mile using whichever of the following methods the engineer approves:

- Mill and replace the full lane width of the riding surface excluding the paved shoulder.
- Diamond grinding, conforming to [420.3.2](#) through [420.3.4](#) except space grooves 0.06 - 0.09 inches apart, or fine-tooth milling of the full lane width of the riding surface including adjustment of the paved shoulders.

HMA II: Correct to an IRI of 85 in/mile using whichever of the following methods the engineer approves:

- Mill and replace the full lane width of the riding surface excluding the paved shoulder.
- Diamond grinding, conforming to [420.3.2](#) through [420.3.4](#) except space grooves 0.06 - 0.09 inches apart, or fine-tooth milling of the full lane width of the riding surface including adjustment of the paved shoulders.

PCC II: Correct to an IRI of 85 in/mile using whichever of the following methods the engineer approves:

- Diamond grinding, conforming to [420.3.1](#) through [420.3.4](#), of the full lane width of the riding surface including adjustment of the paved shoulders.
- Remove and replace the full lane width of the riding surface.

- (2) Re-profile corrected segments to verify that the final segment IRI meets the above correction limits and there are no areas of localized roughness. Upload a revised ProVAL ride quality module report for the corrected areas into the MRS software. Segments failing these criteria after correction are nonconforming work under [105.3](#).

##### **440.3.5.4 Corrective Grinding for Continuous Diamond Ground Work**

- (1) Do not apply localized roughness criteria to surfaces designated for continuous diamond grinding under [420](#) or the transitions to existing work not ground under the contract. Instead ensure that the finished ground surface does not include longitudinal surface deviations exceeding 0.3-inch in 25 feet as determined using ProVal's straightedge simulation analysis.

- (2) Exclude low areas due to subsidence or other localized causes from the smoothness requirements. The engineer will review each low area and may direct the contractor to perform corrective grinding to reduce the final segment IRI for that segment.
- (3) If an individual segment IRI exceeds 65 in/mile for RCDG V or 115 in/mile for UCDG V, perform corrective grinding on that segment. Re-profile corrected segments to verify the final segment IRI. Ensure that each segment has a segment IRI after corrective grinding as follows:
  - For segments with a before-grinding IRI less than or equal to 200 in/mile, provide a final segment IRI that does not exceed 65 in/mile for RCDG V or 115 in/mile for UCDG V.
  - For segments with a before-grinding IRI greater than 200 in/mile, provide a final segment IRI that does not exceed 65 in/mile for RCDG V, 115 in/mile for UCDG V, or 35 percent of the before-grinding IRI whichever is greater.
- (4) Submit a revised ProVAL smoothness assurance report after corrective grinding for corrected segments to validate the final segment IRI.
- (5) If after performing corrective grinding, a segment contains a bump exceeding 0.3 inch in 25 feet or has a final segment IRI greater than specified, that segment is nonconforming work under [105.3](#).

**440.3.6 Dispute Resolution**

- (1) The engineer and contractor should make every effort to avoid conflict. If a dispute between some aspect of the contractor's and the engineer's testing program does occur, seek a solution mutually agreeable to the project personnel. The department and contractor may review the data, examine data reduction and analysis methods, evaluate testing procedures, and perform additional testing.
- (2) If project personnel cannot resolve a dispute that affects payment or could result in incorporating nonconforming work, the department will resolve the dispute using third-party testing by the department's quality assurance unit or a mutually agreed on independent testing company. The engineer and contractor will abide by third-party test results. The party in error will pay independent testing company costs. The department may use third-party tests to evaluate the quality of questionable work and determine appropriate payment.

**440.4 Measurement**

- (1) The department will measure Incentive IRI Ride by the dollar, calculated as specified in [440.5.2](#).

**440.5 Payment**

**440.5.1 Payment for Profiling**

- (1) Costs for furnishing and operating the profiler, documenting profile results, and correcting the final surface are incidental to the contract. The department will pay separately for engineer-directed corrective action performed within areas excluded under item 3 of [440.3.5.2\(1\)](#) as extra work.

**440.5.2 Pay Adjustment**

- (1) The department will pay incentive for ride under the following bid item:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
440.4410	Incentive IRI Ride	DOL

- (2) Incentive payment may be more or less than the amount the schedule of items shows.
- (3) The department will administer disincentives for ride under the Disincentive IRI Ride administrative item.
- (4) The department will not assess disincentive on HMA III or PCC III segments. Incentive pay for HMA III and PCC III segments will be based on the category of the adjoining segments.
- (5) For work placed under the contract, the department will adjust pay based on the initial segment IRI for that segment. If corrective action is required, the department will base disincentives on the segment IRI after correction as follows:

All Pavement: The corrective work is performed in a contiguous, full lane width section 500 feet long, or a length as agreed with the engineer.

HMA Pavements: The corrective work is a mill and inlay or full depth replacement and the inlay or replacement layer thickness conforms to [460.3.2](#).

Concrete Pavements: The corrective work is a full depth replacement and conforms to [415](#).

For continuous diamond grinding of existing concrete, the department will adjust pay based on the final segment IRI as specified in [420.3.5](#).

- (6) The department will adjust pay for 500-foot long standard segments nominally one wheel path wide using equation "ride 2.01" as follows:

For HMA I Pavement:	Initial IRI (in/mile)	Pay Adjustment (dollars/500 feet)
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	< 30	250
	≥ 30 to <35	1750 - (50 x IRI)
	≥ 35 to < 60	0
	≥ 60 to < 75	1000 - (50/3 x IRI) <sup>[1]</sup>
	≥ 75	-250 <sup>[1]</sup>
For HMA II and PCC II Pavement:	Initial IRI (in/mile)	Pay Adjustment (dollars/500 feet)
	< 50	250
	≥ 50 to < 55	2750 - (50 x IRI)
	≥ 55 to < 85	0
	≥ 85 to < 100	(4250/3) - (50/3 x IRI) <sup>[1]</sup>
	≥ 100	-250 <sup>[1]</sup>

<sup>[1]</sup> The department will not assess a ride disincentive for HMA pavement placed in cold weather because of a department-caused delay as specified in [450.5\(5\)](#).

For HMA IV and PCC IV Pavement:	Initial IRI (in/mile)	Pay Adjustment (dollars/500 feet)
	< 35	250
	≥ 35 to < 45	1125 - (25xIRI)
	≥ 45	0
For RCDG V Pavement:	Final IRI (in/mile)	Pay Adjustment (dollars/500 feet)
	< 45	125
	≥ 45 to < 55	687.5 - (12.5 x IRI)
	≥ 55	0
For UCDG V Pavement:	Final IRI (in/mile)	Pay Adjustment (dollars/500 feet)
	< 50	125
	≥ 50 to < 75	375 - (5 x IRI)
	≥ 75	0

(7) The department will prorate the pay adjustment for non-standard segments based on their length.