NATIONAL CONCRETE CONSORTIUM

State DOT: Alabama

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

Alabama DOT does not conduct IRI testing.
We still/only use a Profile Index (PI) spec.

1. Who does the testing? If not the state, then how do you certify machine and operator?
2. When is the testing done (daily, once paving is complete, or after open to traffic)?
3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?
4. Do you see an influence on the type of pavement texture?
5. What equipment/laser setup are you using for concrete?
6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?
7. What bump threshold number do you use for concrete? Is it the same as asphalt?
8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?
9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?
10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?
11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?
12. Do you require Proval?
13. Are there any additional deductions for grinding to meet a minimum IRI?
14. If ground, can the section be re-profiled to attain a smoothness bonus?

NATIONAL CONCRETE CONSORTIUM

State DOT: California

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?
   Contractor does the testing. Machine and operator are to be certified at TTI until CA certification site is established.
2. When is the testing done (daily, once paving is complete, or after open to traffic)?
   It's up to the Contractor. Typically, when paving is complete.
3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?
   Do not know.
4. Do you see an influence on the type of pavement texture?
   As long as a line laser is used, we don't distinguish a difference.
5. What equipment/laser setup are you using for concrete?
   Inertial profiler with minimum 4 inch line laser.
6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?
   Concrete acceptance is less than 60 in/mile. We are not using incentive/disincentive. Asphalt thick lift (>0.2') project acceptance is less than 60 in/mile. Asphalt thin lift (<0.20') project acceptance is less than 75 in/mile.
7. What bump threshold number do you use for concrete? Is it the same as asphalt?
   Not specified.
8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?
   N/A
9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?
   Yes, localized roughness must be less than 120 in/mile
10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?
    Same as highways.
11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?
    No.
12. Do you require Proval?
    Yes.
13. Are there any additional deductions for grinding to meet a minimum IRI?
    N/A
14. If ground, can the section be re-profiled to attain a smoothness bonus?
    N/A

State DOT: Colorado

NATIONAL CONCRETE CONSORTIUM

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?
   CDOT does all acceptance testing for PCCP. The contractor does their QC testing.
   The contractor does all the acceptance and QC testing on HMA pavements. CDOT performs verification testing on 25% of the projects.

   CDOT uses a SURPRO to lay out a certification site yearly to certify CDOT's and the contractor's profilers. All operators must be certified by an in-state certification program.

2. When is the testing done (daily, once paving is complete, or after open to traffic)?

   Testing can be performed anytime the pavement is in its final configuration. It can be tested prior to or after traffic has been allowed on it. Acceptance testing is performed when all paving is complete, or when a major phase is complete.

3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?
   PCCP gets slightly smoother after traffic has been placed on it. ~0 to 5 in/mile. This is likely due to tined ridges being worn away, or saw cut slurry and other debris being removed

4. Do you see an influence on the type of pavement texture?
   Yes. Longitudinally tined concrete has an IRI increase of 5 to 30 in/mile when using single point lasers. When using a line laser (RoLine) the texture influence on IRI is removed.

5. What equipment/laser setup are you using for concrete?
   ICC high speed profiler using the 3k Selcom Roline lasers.

6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?

   HRI Category I for PCCP is for construction that will be affected by curb & gutter, numerous intersections, and utility boxes.

   HRI Category II for PCCP is for express ways, interstates and any other PCCP that is not affected by curb & gutter, numerous intersections, and utility boxes.

   HRI Cat I for HMA is for a milling & a single lift of pavement
   HRI Cat II for HMA is 2 or more lifts of pavement.
   Another category exists for a single lift of pavement placed on the existing pavement without any milling.

   Asphalt pavements use the same IRI limits, but have a reduced incentive/disincentive adjustment.

Table 105-10

PCCP PAVEMENT SMOOTHNESS (INCHES/MILE)

HALF-CAR ROUGHNESS INDEX

Pavement Smoothness Category	Incentive Adjustment ($/sq yd)	No Incentive or Disincentive	Disincentive Adjustment ($/sq yd)	Corrective Work Required
I	When HRI ≤ 40.0 I = $1.40	When HRI ≥ 63.0 and ≤ 72.0 I = $0.00	When HRI > 72.0 and < 90.0 I = 5.59 − 0.0776 HRI	When HRI > 90.0
	When HRI > 40.0 and < 63.0 I = 3.84 − 0.061 HRI		When HRI ≥ 90.0 I = − $ 1.40	
II	When HRI ≤ 35.0 I = $ 1.40	When HRI ≥ 58.0 and ≤ 67.0 I = $0.00	When HRI > 67.0 and < 85.0 I = 5.20 − 0.0776 HRI	When HRI > 85.0
	When HRI > 35.0 and < 58.0 I = 3.53 − 0.061 HRI		When HRI ≥ 85.0 I = − $ 1.40	

7. What bump threshold number do you use for concrete? Is it the same as asphalt?
   CDOT uses the localized roughness criteria based on a 25 ft interval.
   These limits are the same for asphalt pavements

HRI SMOOTHNESS CATEGORY	HRI In/mile
I	135.0
II	125.0

8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?
   $/sy
9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?
   Yes, see answer for question #7
10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?
    These are tested in the same manner as other highways. Same limits apply to all pavements, no matter the posted speed limit, urban or rural. Traffic control is setup to allow non-stop testing.
11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?
    We no longer use profilographs
12. Do you require Proval?
    Proval is only used for localized roughness determinations. The ICC software is used for everything else.
    Yes
13. Are there any additional deductions for grinding to meet a minimum IRI?
    No penalty for grinding. Why penalize the contractor for providing a smoother pavement? Diamond grinding is an equal, if not better, texture to tining or dragged textures.
14. If ground, can the section be re-profiled to attain a smoothness bonus?
    The contractor can remove disincentive by grinding, but currently cannot earn incentive.

NATIONAL CONCRETE CONSORTIUM

State DOT: ILLINOIS

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?

   The Contractor is responsible for testing. The Department will test a minimum of 10% of the project's total lane-miles for monitoring and comparison purposes.

   The Department conducts its Profile Equipment Verification (PEV) Program at a local airport, verifying the performance of approximately thirty profile devices each year. During the PEV, the Contractor's machine is required to profile two 0.1-mile test tracks (one "smooth", the other "rough"), which are initially profiled by the Department using a FACE Dipstick and analyzed using ProVAL to determine their respective Profile Index (PI).

   Only the profile device is verified, not the operator. First, each device must conduct applicable device calibrations (e.g., vertical test, horizontal test, bounce test, etc.). Then, each device must perform a minimum of five runs on each of the two test tracks. Each run shall be within 10 percent of the reference profile measurement, and the percent of average (Standard Deviation divided by Average) shall be no greater than 4.0%.

2. When is the testing done (daily, once paving is complete, or after open to traffic)?

   The Contractor's testing shall be conducted within three days of paving. All profile traces and reports shall then be provided to the Department within two working days of completing the testing.

3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?

   The Department has not conducted any studies to determine the difference in profile measurements immediately after paving as compared to some days after. During informal conversations with one Contractor during a lengthy overlay project, it was noted that lower Profile Index (PI) results seemed more likely after the pavement was opened to traffic for a couple of days.

4. Do you see an influence on the type of pavement texture?

   Most of what the Department has experience profiling has been coarse densely-graded or gap-graded (SMA) hot mix asphalt (HMA) overlays. Some PCC pavements have been tested, but not nearly as many as HMA pavements. In general, I do not believe significant differences have been observed amongst the different pavement textures those pavement types exhibit.

5. What equipment/laser setup are you using for concrete?

   Regardless of pavement type, any type of profile equipment can be used: California beam- or truss-type profilographs, or non-contact inertial profilers (so-called lightweight profilers such as Ames makes, or high-speed bumper-mounted profilers) with software capable of producing a California profilograph simulation.

   In talking with Contractor's who have purchased non-contact inertial profilers, they have indicated preferring the TriODS or RoLine lasers for PCC paving projects.

6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?

   Although the Department's smoothness criteria are based on Profile Index, we would eventually like to adopt IRI as our measure of smoothness.

   In terms of PI, the values for acceptance/incentives are the same regardless of pavement type. There is a distinction between high-speed mainline pavement and low-speed mainline pavement, but the criteria for either is the same regardless if the pavement is HMA or PCC. The assessment values are different for each pavement type, as shown below.

SMOOTHNESS ASSESSMENT SCHEDULE (Full-Depth HMA)		
High-Speed Mainline Pavt. Average Profile Index in./mile (mm/km)	Low-Speed Mainline Pavt. Average Profile Index in./mile (mm/km)	Assessment per sublot
6.0 (95) or less		+$800.00
>6.0 (95) to 11.0 (175)	15.0 (240) or less	+$550.00
>11.0 (175) to 17.0 (270)	>15.0 (240) to 25.0 (400)	+$350.00
>17.0 (270) to 30.0 (475)	>25.0 (400) to 45.0 (710)	+$0.00
>30.0 (475) to 40.0 (635)	>45.0 (710) to 65.0 (1025)	+$0.00
Greater than 40.0 (635)	Greater than 65.0 (1025)	-$500.00

SMOOTHNESS ASSESSMENT SCHEDULE (PCC)		
High-Speed Mainline Pavt. Average Profile Index in./mile (mm/km)	Low-Speed Mainline Pavt. Average Profile Index in./mile (mm/km)	Assessment per sublot
6.0 (95) or less		+$1,200.00
>6.0 (95) to 11.0 (175)	15.0 (240) or less	+$950.00
>11.0 (175) to 17.0 (270)	>15.0 (240) to 25.0 (400)	+$600.00
>17.0 (270) to 30.0 (475)	>25.0 (400) to 45.0 (710)	+$0.00
>30.0 (475) to 40.0 (635)	>45.0 (710) to 65.0 (1025)	+$0.00
Greater than 40.0 (635)	Greater than 65.0 (1025)	-$750.00

7. What bump threshold number do you use for concrete? Is it the same as asphalt?

   Bumps are indicated as high points in excess of 0.30 in. (8 mm). No different from HMA pavement.

8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?

   Set amount per 0.1-mile sublot of mainline pavement prior to any corrective work except remove and replace.

9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?

   N/A

10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?

    The Department's test section categories are as follows:

    1. **High-speed Mainline Pavement. High-speed mainline pavement shall consist of pavements, ramps, and loops with a posted speed greater than 45 mph. These sections shall be tested using a profile testing device (i.e., California profilograph or non-contact inertial profiler).**

2. **Low-speed Mainline Pavement. Low-speed mainline pavement shall consist of pavements, ramps, and loops with a posted speed of 45 mph or less. These sections shall be tested using a profile testing device (i.e., California profilograph or non-contact inertial profiler).**
3. **Miscellaneous Pavement. Miscellaneous pavement shall consist of:**
    a. **Pavement on horizontal curves with a centerline radius of curvature of less than or equal to 1000 ft (300 m) and pavement within the superelevation transition of such curves;**
    b. **Pavement on vertical curves having a length of less than or equal to 200 ft (60 m)in combination with an algebraic change in tangent grades greater than or equal to three percent, as may occur on urban ramps or other constricted-space facilities;**
    c. **The first or last 15 ft (4.5 m) of a pavement section where the Contractor is no responsible for the adjoining surface;**
    d. **Intersections;**
    e. **Variable width pavements;**
    f. **Side street returns;**
    g. **Crossovers;**
    h. **Connector pavement from mainline pavement expansion joint to the bridge approach pavement;**
    i. **Bridge approach pavement; and**
    j. **Other miscellaneous pavement surfaces (i.e., a turn lane) as determined by the Department.**

    Miscellaneous pavement shall be tested using a 16 ft (5 m) straightedge set to a 3/8 in. (10 mm) tolerance.

11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?

    N/A

12. Do you require Proval?

    No.

13. Are there any additional deductions for grinding to meet a minimum IRI?

    See values shown in tables provided in Question 6. Corrective work shall be at no cost to the Department.

14. If ground, can the section be re-profiled to attain a smoothness bonus?

    Upon completion of grinding, the section shall be re-profiled to see if additional corrective work is necessary; however, the assessment is based on the initial profile measurement. A bonus will only be applied if the corrective action taken is the section being removed and replaced, resulting in a new pavement section to be profiled and assessed.

NATIONAL CONCRETE CONSORTIUM

State DOT: Illinois State Toll Highway Authority

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?
   IRI testing is performed by Applied Research Associates, Inc. (ARA) annually through the whole network. The company has many years of experience; the equipment used to measure IRI is calibrated every week on the field to assure proper measurements. The operator of the equipment have also many years of experience with this type of measurements, they have different training sessions when they started and annually training is done to all the operators.

2. When is the testing done (daily, once paving is complete, or after open to traffic)?
   IRI testing is performed annually in the whole network. However the California Test Method 526, Operation of California Profilograph and Evaluation of Profiles are used as specification for pavement smoothness. The testing will be performed depending on each contractor; however it happens after the paving is complete for a long stretch of work. According to the Illinois Department of Transportation's Supplemental specification for Section 420. Portland Cement Concrete Pavement the finished surface of the pavement shall be tested for smoothness once the pavement has attained a flexural strength of 550 psi or a compressive strength of 3000 psi.

3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?
   For the California Profilograph the testing is performed before it is open to traffic, therefore the difference between after the day of paving and a week of paving is minimum that can be discarded. However IRI values are measured every year and a comparison is performed. IRI values increases with the use of the pavement.

4. Do you see an influence on the type of pavement texture?
   The pavement texture is not usually measured, however an influence can be seen in the values, however this is not analyzed or reported.

5. What equipment/laser setup are you using for concrete?
   ARA utilized a Digital Survey Vehicle (DSV) equipped with single point laser technology. The laser setup will have 3 or 5 lasers in the front of the vehicles, where one is in the middle of the vehicle, two are on the wheel paths and the other two are at the ends of the vehicle. This equipment also has two other laser to measure grade and slope of the road.

6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?
   There is not an IRI specification that is associated with acceptance or incentives from the Tollway. There is only one that relates to pavement smoothness using as testing equipment the California Profilograph. Theses specifications corresponds to the Illinois Department of Transportation Supplemental Specifications and Recurring Special Provisions adopted on January 1st, 2013. The following table corresponds to the acceptance and incentives for the average profile index according to the Supplemental Specification for Section 420. Portland Cement Concrete Pavement.

SMOOTHNESS ASSESSMENT SCHEDULE (PCC)		
High-Speed Mainline Pavt. Average Profile Index in./mile (mm/km)	Low-Speed Mainline Pavt. Average Profile Index in./mile (mm/km)	Assessment per sublot
6.0 (95) or less		+$1200.00
>6.0 (95) to 11.0 (175)	15.0 (240) or less	+$950.00
>11.0 (175) to 17.0 (270)	>15.0 (240) to 25.0 (400)	+$600.00
>17.0 (270) to 30.0 (475)	>25.0 (400) to 45.0 (710)	+$0.00
>30.0 (475) to 40.0 (635)	>45.0 (710) to 65.0 (1025)	+$0.00
Greater than 40.0 (635)	Greater than 65.0 (1025)	-$750.00"

For asphalt IDOT has Supplemental Specification for Section 407. Hot-Mix Asphalt Pavement (Full-Depth) and the following table corresponds to the acceptance and incentives for the average profile index.

SMOOTHNESS ASSESSMENT SCHEDULE (Full-Depth HMA)		
High-Speed Mainline Pavt. Average Profile Index in./mile (mm/km)	Low-Speed Mainline Pavt. Average Profile Index in./mile (mm/km)	Assessment per sublot
6.0 (95) or less		+$800.00
>6.0 (95) to 11.0 (175)	15.0 (240) or less	+$550.00
>11.0 (175) to 17.0 (270)	>15.0 (240) to 25.0 (400)	+$350.00
>17.0 (270) to 30.0 (475)	>25.0 (400) to 45.0 (710)	+$0.00
>30.0 (475) to 40.0 (635)	>45.0 (710) to 65.0 (1025)	+$0.00
Greater than 40.0 (635)	Greater than 65.0 (1025)	-$500.00

7. What bump threshold number do you use for concrete? Is it the same as asphalt?
   The bump threshold number set by IDOT's Supplemental Specification is 0.30 in (8 mm). This is the same as asphalt. However for High-Speed Mainline Pavement any sublot having a profile index (PI) with the range of or greater than 30.0 to 40.0 in/mile including bumps, shall be corrected or replaced at the contractor's option. For Low-Speed Mainline Pavements any sublot having a PI within the range of or greater than 45.0 to 65.0 in/mile including bumps shall be corrected or replaced at the contractor's option.

8. On what do you base your incentive payments (set amount per .1mile or % of a bid price)?
   The incentives are a set amount per 0.1 mile (sublot). A partial sublot greater than or equal to 250 ft resulting from an interruption in the pavement will be subject to the same evaluation as a whole sublot. This is according to IDOT's Suplemental Specifications.

9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?
   There is not an IRI specification in place.

10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?
    The Illinois Tollway do not have mid-speed urban areas. However IDOT's supplemental specification uses the California profilograph. The table was presented above in question 6.

11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?
    There is not an IRI specification in place. The PI specification is used in the whole network of the Illinois Tollway.

12. Do you require Proval?
    This software package is not required by the Illinois Tollway.

13. Are there any additional deductions for grinding to meet a minimum IRI?
    There is not an IRI specification in place. IDOT's supplemental specification uses PI and specifies a corrective work for concrete pavements when the PI is within the range of or greater than 30.0 to 40.0 in/mile. When the PI is greater than 40.0 in/mile there is a deduction of $750.00 dollars per sublot (0.1 mile segments).

14. If ground, can the section be re-profiled to attain a smoothness bonus?
    For sublots that are replaced, assessments will be based on the profile index determined after replacement.

NATIONAL CONCRETE CONSORTIUM

State DOT: IOWA

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

Note: Iowa only uses IRI for diamond grinding, not for slip form PCC paving.

1. Who does the testing? If not the state, then how do you certify machine and operator?
   The contractor does the testing using calibrated equipment. Verification testing (10% of project) is done by the Department to allow contractor test results to be used for acceptance.

2. When is the testing done (daily, once paving is complete, or after open to traffic)? Contractor testing is done daily. Verification testing is done randomly during the project.

3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic? N/A

4. Do you see an influence on the type of pavement texture?

5. What equipment/laser setup are you using for concrete?

6. What are the IRI numbers associated with acceptance/incentives? See below. Are they the same for asphalt? N/A

International Roughness Index for greater than 45 mph	International Roughness Index for 45 mph or less	Dollars per 0.1 mile (161 m) segment per lane
Inches per mile (m/km)	Inches per mile (m/km)	
0.00 – 30.00 (0.000-0.473)	-	400
30.01 - 50.00 (0.474-0.789)	- -	1000-(20 X IRI) [1000-(1267 X IRI)]
50.01 - 65.00 (0.790-1.026)	0.00 - 115.00 (0.000-1.815)	Contract Unit Price
>65.01 (1.027)*	>115.01 (1.816)*	Grind

7. What bump threshold number do you use for concrete? 0.5" Is it the same as asphalt? Yes

8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?

9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?

10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them? In table above.

11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations? Not for diamond grinding.

12. Do you require Proval? No

13. Are there any additional deductions for grinding to meet a minimum IRI? No

14. If ground, can the section be re-profiled to attain a smoothness bonus? No

State DOT: Kansas

NATIONAL CONCRETE CONSORTIUM

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

Kansas DOT does not have an IRI spec, we still require the California Type Profilograph.

1. Who does the testing? If not the state, then how do you certify machine and operator?
   Contractor. The profilographs are certified and calibrated annually by the bureau of Materials and Research and a prequalified list is manufactured for the year listing contractor and type of profilograph that is certified. The operator is required to have passed the Profilograph class that is part of KDOT's certified inspector training program.

2. When is the testing done (daily, once paving is complete, or after open to traffic)?
   The profilograms and evaluation are provided to the Engineer within 2 working days after placement of the pavement, so typically the contractor is performing this daily.

3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?

4. Do you see an influence on the type of pavement texture?

5. What equipment/laser setup are you using for concrete?

6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt? Below is the table, they are different for asphalt.

TABLE 503-2: PCCP SMOOTHNESS PRICE ADJUSTMENT		
Average Profile Index Inch per mile per 0.1 mile section (Greater than 45 mph)	Average Profile Index Inch per mile per 0.1 mile section (45 mph or less & ramps)	Contract Price Adjustment Per 0.1 mile section per lane
6.0 or less		+ $2000.00
6.0 to 10.0	15.0 or less	+ $1670.00
10.1 to 15.0		+ $1250.00
	15.1 to 25.0	+ $830.00
15.1 to 18.0		+ $620.00
18.1 to 30.0	25.1 to 45.0	0.00
30.1 to 40.0	45.1 to 65.0	0.00*
40.1 or more	65.1 or more	- $1250.00*

*Correct to 25.0 inch/mile (45.0 inch/mile for 45 mph or less & ramps)

7. What bump threshold number do you use for concrete? Is it the same as asphalt?

TABLE 503-1: PCCP SURFACE CORRECTIONS		
Pavement Surface Tolerances (in./mi.)		**Required Corrective Action**
Through Lanes Speed Limit Greater than 45 mph[1]	**Through Lanes Speed Limit 45 mph or Less[2]**	
Average Profile Index per Section of 30 or less	Average Profile Index per Section of 45 or less	Correct all bumps[3]
Profile Index per Section of between 30.1 and 65 for an individual trace		Correct the Profile Index of each individual trace to 25 or less per section[3]

	Profile Index per Section of between 45.1 and 65 for an individual trace	Correct the Profile Index of each individual trace to 45 or less per section[3]
Profile Index per Section of 65.1 or greater for an individual trace		Correct the Profile Index of each individual trace to 25 or less per section, or replace the section (Contractor's option)[3]
	Profile Index per Section of 65.1 or greater for an individual trace	Correct the Profile Index of each individual trace to 45 or less per section, or replace the section (Contractor's option)[3]
Daily Average Profile Index greater than 40	Daily Average Profile Index greater than 65	Suspend the paving operations until corrective actions are taken to improve the paving operations

[1]Excluding acceleration/deceleration lanes and ramps.
[2]Including all acceleration/deceleration lanes and ramps, regardless of the speed limit. Acceleration/Deceleration lanes include the taper. Acceleration lanes that become through lanes are limited to 500 feet from the nose of the ramp. Ramps are from the nose to the intersection of the adjoining road.
[3]Correct all areas within each section having high points (bumps) with deviations in excess of 0.3 inches in a length of 25 feet or less regardless of the profile index value.

8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?
   Set amount per .1 mile

9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?

TABLE 503-4: GRINDING REQUIREMENTS	
Condition	**Action***
Greater than 25% (132 feet) of the 0.1 mi. section requires correction	Continuously grind the 0.1 mi. section.**
Greater than 25% (1320 feet) of 1.0 mi. segment require correction	Continuously grind the 1.0 mi. segment.
Greater than 25% of the project requires correction	Continuously grind the entire project.

* Continuously grinding requires a minimum of 98% of the pavement be ground.
**If the skip length between areas to be ground (either within a 0.1 mi. section or between 0.1 mi. sections) is less than either grind length, combine the grinds so the area between is also ground. This additional ground area (area between) will apply to the computation of the 25% of the 0.1 mi. section.

10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?

TABLE 503-3: PCCP SMOOTHNESS PRICE ADJUSTMENT (URBAN TYPE PROJECTS)		
Average Profile Index Inch per mile per 0.1 mile section (Greater than 45 mph)	Average Profile Index Inch per mile per 0.1 mile section (45 mph or less & ramps)	Contract Price Adjustment Per 0.1 mile section per lane
10.0 or less	15.0 or less	+ $2820.00
10.1 to 15.0		+ $2100.00
	15.1 to 25.0	+ $1400.00
15.1 to 18.0		+ $1050.00
18.1 to 30.0	25.1 to 45.0	0.00
30.1 to 45.0	45.1 to 65.0	0.00*
45.1 or more	65.1 or more	- $1770.00*

*Correct to 30.0 inch/mile (45.0 inch/mile for 45 mph & ramps)

11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?

12. Do you require Proval?
    No.
13. Are there any additional deductions for grinding to meet a minimum IRI?
    No.

14. If ground, can the section be re-profiled to attain a smoothness bonus?
    If the entire project is ground then the profile after grinding will determine incentive. Otherwise the profile prior to corrective action is used for incentive/disincentive.

State DOT: Louisiana

NATIONAL CONCRETE CONSORTIUM

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?
   Contractor. Contractor's machines are certified through our Materials Laboratory via TR 644 (attached) or reciprocity is allowed with Texas Transportation Institute Certification for Lightweight Profilers. 10 test runs are required and the standard deviation of the IRI results obtained must not exceed 3 inches per mile for each sensor. The mean IRI value shall be within ± 6 percent of the reference IRI as determined by the Department's Australian Road Research Board Walking Profiler. Recertification is required annually and whenever major component repairs, replacements, or modifications are made to the equipment.

2. When is the testing done (daily, once paving is complete, or after open to traffic)?
   Contractors are encouraged to test daily for QC. Fully completed lanes are tested for acceptance once the projected is completed end-to-end.

3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?
   Within ±6 Inches per mile up to 6 months after paving.

4. Do you see an influence on the type of pavement texture?
   No.

5. What equipment/laser setup are you using for concrete?
   Line lasers are strongly encouraged, but not required. The profiler must meet the requirements set forth in ASTM E950 Class I or Class II.

6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?
   The following table lays out the smoothness requirements for PCCP pavements.

Table 601-1[1]

Pavement Adjustment Schedule for Longitudinal Surface Tolerance, Maximum International Roughness Index, inches per mile (mm per km)

Percent of Contract Unit Price		102%[2]	100%	98%	50% or Remove and Replace[3]
Category I: Design Speed ≥ 60 mph	IRI in/mi (mm/km)	≤65 (1026)	≤75 (1200)	76-84 (1201-1340)	≥85 (1341)
Category II: Design Speed ≥ 45 mph and < 60 mph	IRI in/mi (mm/km)	≤75 (1184)	≤85 (1356)	86-94 (1357-1499)	≥95 (1500)
Category III: Design Speed < 45 mph	IRI in/mi (mm/km)	N/A	≤115 (1829)	116-129 (1830-2049)	≥130 (2050)

[1] Applies to each travel lane for the entire project's length

[2] Incentive Pay Requirements:

- Must equal or be less than the average IRI indicated for bonus payment
- Grinding is not allowed to achieve incentive payment but requirements for 601.03.11.3.2 must be met

[3]At the option of the Chief Engineer

They are not the same for Asphalt. Asphalt has much tighter smoothness requirements.

7. What bump threshold number do you use for concrete? Is it the same as asphalt?

Table 601-2[1]
Individual Wheel Path Deficient Area Boundries Requiring Corrective Action
Maximum International Roughness Index, inches per mile (mm per km) as measured to the nearest whole number.

Any 25-foot Sliding Baseline		PCCP: Longitudinal Direction
Category I	IRI in/mi (mm/km)	≤170 (2685)
Category II	IRI in/mi (mm/km)	≤190 (3000)
Category III	IRI in/mi (mm/km)	≤210 (3315)

[1] The contractor shall use a continuous 25-foot sliding base selected in the ProVal software to analyze and determine must grind areas of localized roughness as specified by this table. The limits for localized roughness, unless greater than that shown in the table above, must be identified and corrected, or accepted by the Project Engineer.

No, asphalt bump specifications are much tighter.

8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?
   Incentive payments are based on % of SQYD price for the whole length of the project per lane.

9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?
   See the answer to question #7.

10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?
    We still use the high speed profiler. In exclusion areas such as catch basins, bridges, intersections of a different grade, and ramps, the standard ¼ inch in 10 feet bump specification is the acceptance criteria.

11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?
    No.

12. Do you require Proval?
    Yes.

13. Are there any additional deductions for grinding to meet a minimum IRI?
    No, but a contractor cannot grind to incentive.

14. If ground, can the section be re-profiled to attain a smoothness bonus?
    No.

IRI SPECIFICATIONS

601.03.11 SURFACE TOLERANCE (IRI)

601.03.11.1 General:

This subsection outlines the measurement of surface roughness, quality control requirements, corrective actions, and acceptance criteria for PCCP. Use the International Roughness Index (IRI) to determine the amount of roughness in a measured longitudinal profile. In the direction of travel, measure the longitudinal surface profile in inches per mile (mm per km) and report as the IRI; all in accordance with DOTD TR 644.

601.03.11.2 Equipment:

In accordance with TR 644, furnish a DOTD certified inertial profiler for quality control and acceptance testing. The inertial profiler shall measure both wheel paths simultaneously with laser height sensing equipment at a constant speed within the certified range. Due to the surface texture of PCCP, lasers with a footprint greater than a single point are recommended for accurate readings. Profilers require a current DOTD decal indicating the date of certification and the profiler's system parameter settings.

Furnish a 10-foot (3.0 m) metal static straightedge for quality control and acceptance testing for transverse cross slope, grade, and individual longitudinal bumps in excess of ¼ inch (6 mm) in 10 feet (3 m). Additionally, bumps are not to exceed ¼ inch (6 mm) in 10 feet (3 m) for non-IRI pavements including but not limited to bike paths, detour roads, parking areas, sidewalks, turning lanes, turn outs, and shoulders.

601.03.11.3 Quality Control

601.03.11.3.1 Longitudinal Smoothness: Run the certified profiler and evaluate the raw IRI data using the ProVAL "25-foot sliding baseline" to identify areas of localized roughness as defined by Table 601-2 for each wheelpath. Correct deficiencies in accordance with Table 601-2 and modify construction operations to mitigate deficiencies.

Any individual bump which is more than 1/4 inch (6 mm) when tested with a 10 foot (3 m) metal static straightedge is a deficiency which requires correction.

Have quality control IRI results available for assessment by the engineer as requested.

601.03.11.3.2 Correction of Deficient Areas:

Correct areas to meet the requirements of Table 601-2 and the ¼ inch (6 mm) in 10 feet (3 m) straight edge bump requirement. Correct transverse, cross slope, or grade deficiencies to meet specifications. Corrections may be made by removing and replacing the PCCP full depth, or by diamond grinding and reestablishing surface texture and depth. Make corrections at no direct pay.

In cases involving minor dips and extreme vertical curves where grinding will not improve the surface profile, provide the engineer a justification plus a ProVAL screen shot for the area showing the 25 foot-sliding baseline and corresponding 25 foot profilograph along with a request to accept as constructed.

Although omitted from corrective action, these areas still contribute to the overall IRI results.

601.03.11.4 Acceptance:

601.03.11.4.1 Longitudinal Surface Tolerance Acceptance: Measure the mainline continuously from start to finish in the direction of travel for each lane for the project's entire length. Perform the measurement under the observation and in the presence of the certified DOTD inspector. For projects that qualify for 102 percent pay, in accordance with Table 601-1and allowable grinding as per Table 601-2, the Materials and Testing Section will verify the testing results. Measure the surface tolerance for acceptance at the completion of the project after all corrective actions.

Profiler system parameter settings shall be verified before and during each run by the DOTD inspector. The inspector will witness and document the daily setup procedure and pre-operation tests performed by the contractor in accordance with the manufacturer's procedures and DOTD TR 644. A copy of the manufacturer's setup, pre-operation, and general operating procedures for measuring surface tolerance, along with a copy of DOTD TR 644, shall be available at all times during measurement. Place a start and stop mark at the beginning and end of each travel lane so that measurements can be rerun by the Department.

The mainline longitudinal surface tolerance IRI specification requirements are in Table 601-1.

The Department will view the mainline PCCP's IRI raw data with the ProVAL 25-foot sliding base line to identify areas of localized roughness as defined by Table 601-2 for deficiencies. Submit to the engineer for approval the locations and screen shots for any allowed uncorrected deficiencies in accordance with 601.03.11.3.2. Although grinding for some areas may be deemed unnecessary by the engineer the measured roughness for such areas will still contribute to the total IRI for the project. In addition, the Department will check for ¼ in (6 mm) bumps at locations determined by the engineer. Correct deficiencies in accordance with 601.03.11.3.2.

A DOTD inspector will be present for the acceptance testing and will immediately receive a copy of the raw data, the "*.erd "file and any files with information about the project, the operator, the equipment, the settings, daily pre-operation results, and a copy of the IRI results via USB flash drive. In addition to the data transferred by USB storage device, provide the engineer a paper copy of the IRI report. Acceptance for the project will be in accordance with Tables 601-1 and 601-2. The Department may elect to perform and utilize independent ride quality test results for acceptance at any time.

601.03.11.4.2 Exclusions:

Take the IRI acceptance measurement in its entirety, without exclusions. The Department will then review the profile report obtained for each lane. In special cases or extenuating circumstances, the engineer may isolate or exclude sections of the profile. These include the following:

- Bridges, including the approach slabs
- Curb and gutter sections, just the affected wheel path, and adjacent areas
- Manholes, catch basins, valve and junction boxes
- Intersections of a different grade
- Structures located in the roadway which cause abrupt deviations in the profile
- Ramps less than 1500 feet (460 m)
- Sections where the project engineer determines that attaining smoothness is beyond the contractor's reasonable control.

The roughness in excluded areas will not be included in the total IRI used for payment purposes, but shall meet the requirements of 601.03.11.3.2 and Table 601-2. The quantity represented by the roadway length excluded will not receive any bonus pay adjustment for surface tolerance.

Table 601-1[1]

Pavement Adjustment Schedule for Longitudinal Surface Tolerance, Maximum International Roughness Index, inches per mile (mm per km)

Percent of Contract Unit Price		102%[2]	100%	98%	50% or Remove and Replace[3]
Category I: Design Speed ≥ 60 mph	IRI in/mi (mm/km)	≤65 (1026)	≤75 (1200)	76-84 (1201-1340)	≥85 (1341)
Category II: Design Speed ≥ 45 mph and < 60 mph	IRI in/mi (mm/km)	≤75 (1184)	≤85 (1356)	86-94 (1357-1499)	≥95 (1500)
Category III: Design Speed < 45 mph	IRI in/mi (mm/km)	N/A	≤115 (1829)	116-129 (1830-2049)	≥130 (2050)

[1] Applies to each travel lane for the entire project's length

[2] Incentive Pay Requirements:

- Must equal or be less than the average IRI indicated for bonus payment
- Grinding is not allowed to achieve incentive payment but requirements for 601.03.11.3.2 must be met

[3]At the option of the Chief Engineer

Table 601-2[1]

Individual Wheel Path Deficient Area Boundries Requiring Corrective Action

Maximum International Roughness Index, inches per mile (mm per km) as measured to the nearest whole number.

Any 25-foot Sliding Baseline		PCCP: Longitudinal Direction
Category I	IRI in/mi (mm/km)	≤170 (2685)
Category II	IRI in/mi (mm/km)	≤190 (3000)
Category III	IRI in/mi (mm/km)	≤210 (3315)

[1] The contractor shall use a continuous 25-foot sliding base selected in the ProVal software to analyze and determine must grind areas of localized roughness as specified by this table. The limits for localized roughness, unless greater than that shown in the table above, must be identified and corrected, or accepted by the Project Engineer.

State DOT: Michigan

NATIONAL CONCRETE CONSORTIUM

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?

   Project Engineers have two options. Option 1) MDOT performs acceptance testing with its own equipment and operator. Option 2) MDOT provides a certified operator (MDOT employee or contracted consultant construction tech.) and uses contractor-provided profiler that has been certified. Operators are certified for the equipment brand they will be using. Operator certification is good for 3 years. Equipment is certified annually (or after repairs) on a MDOT provided certification site. In addition, validation sites are provided throughout the state with published ride numbers and profiles. These are used to check equipment operation prior to any acceptance testing.

2. When is the testing done (daily, once paving is complete, or after open to traffic)?

   Acceptance testing is done once paving is complete on a project or phase of a project if there are substantial phases that will require traffic to be placed on parts of the pavement before the entire project is completed.

3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?

   Ride measurements on concrete pavements will vary based on time of day, weather conditions (sunlight, humidity, etc.), cleanliness of the pavement, condition of the joints (fully cut, cut and sealed, slurry completely removed, etc.), and unavoidable wander of the profiler. We have not noted any overall ride deterioration that can be attributed solely to pavement degradation due to aging between time of paving and time opened to traffic. In addition, we feel that it is more appropriate to measure ride close to the time that the pavement is open to traffic since that is what the motoring public will experience.

4. Do you see an influence on the type of pavement texture?

   Longitudinal tining seems to have the most influence.

5. What equipment/laser setup are you using for concrete?

   MDOT uses an SSI RoLine line laser equipped profiler for acceptance testing of concrete pavement. Most concrete paving contractors have also invested in either SSI or Ames profilers with Roline line lasers.

6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?

   For design speeds greater than 50 MPH we have the following acceptance thresholds: Large corridor projects: 70 inches per mile for pavements and 130 inches per mile for bridge decks; General reconstructs: 75 inches per mile for pavement; Diamond Grinding: 40 percent improvement or down to 75 inches per mile; Single course HMA overlays also have percent improvement requirements. For design speeds of 30 to 50 mph, the reconstruct threshold is 100 inches per mile. We are currently not using incentives, but may consider them for large corridor projects in the future. Thresholds are the same for concrete and HMA for new pavement.

7. What bump threshold number do you use for concrete? Is it the same as asphalt?

   Bumps subject to correction for both types of pavement are 0.3 inches in 25 feet for design speeds above 50 mph and 0.5 inches in 25 feet for design speeds 30 to 50 mph. MDOT will also consider proposals to base corrective action on the ProVal localized smoothness criteria instead of a mathematically generated profilograph trace.

8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?

   Not currently using incentives. Past incentive payments were per 0.1 mile segment.

9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?

   Our standard specification uses a California Profilorgraph plot to determine bumps. However the specification allows the contractor to propose using an alternate using ProVal's definition of localized roughness. To date, we have not had any projects accepted using localized roughness.

10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?

    We use the same specification but have a separate table listing acceptance criteria for design speeds of 30 to 50 mph. Thresholds were listed in the answer to # 6 above. Urban projects are evaluated during design to determine if using the ride quality specification is appropriate.

11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?

    No, although a mathematical representation of a California profilograph is still utilized as a bump locating tool.

12. Do you require ProVal?

    Not mandated but ProVal is commonly used by most paving contractors.

13. Are there any additional deductions for grinding to meet a minimum IRI?

    No. For certain preventive maintenance treatments, the project engineer has the choice of assessing a monetary penalty instead of requiring grinding.

14. If ground, can the section be re-profiled to attain a smoothness bonus?

    We currently don't pay incentives. In the past we did allow diamond ground areas to receive a bonus but received so many complaints from field offices about this practice, that if incentives are re-implemented, we will not allow any 0.1 mile segments with diamond grinding to be candidate for incentive.

NATIONAL CONCRETE CONSORTIUM

State DOT: Minnesota DOT

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?
   - Contractor
   - Yearly certification of machine at MnROAD, equipment is certified for both concrete and asphalt testing
   - Operator certification is online and recertification is every 3 years

2. When is the testing done (daily, once paving is complete, or after open to traffic)?
   - Concrete testing is completed dependent on the Contractor, they generally test daily right away and then every few days after that, they are required to submit the raw data on a memory stick each day they test as well as a summary print out of the IRI and ALR
   - They are required to submit a paper Proval report within 5 days after completion of concrete pavement placement

3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?
   - In general no, but we did have a project where it was tested before the joints had all cracked and once it was opened to traffic, the ride was significantly different (bumpier) than when it was measured.

4. Do you see an influence on the type of pavement texture?
   - In general not between astroturf and broom drag, although we are doing some testing to determine what IRI is added due to the texturing of the pavement.

5. What equipment/laser setup are you using for concrete?
   - They are required to use a Triod or Roline laser

6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?
   - Different equations for concrete and asphalt, except Alternate Bid uses equation HMA-B for both

Table 2399-5 Smoothness Pay Adjustments and Corrective Work for Concrete Pavements		
Equation	**Smoothness in/mi [m/km]**	**Pay Adjustment $/0.1 mi [0.16 km]**
PCC-A	< 50.0 [0.79]	890.00
	50.0 – 90.0 [0.79 – 1.42]	2940.00 – 41.000 × Smoothness [2940.00 – 2597.800 × Smoothness]
	> 90.0 [1.42]	Corrective Work to ≤ 71.7 in/mi [1.13 m/km]

Table 2399-4 Smoothness Pay Adjustments and Corrective Work for Bituminous Pavements		
Equation	**Smoothness in/mi [m/km]**	**Pay Adjustment $/0.1 mi [0.16 km]**
HMA-A	< 30.0 [0.47]	400.00

Table 2399-4 Smoothness Pay Adjustments and Corrective Work for Bituminous Pavements		
Equation	**Smoothness in/mi [m/km]**	**Pay Adjustment $/0.1 mi [0.16 km]**
	30.0 – 75.0 [0.47 – 1.18]	850.00 – 15.000 × Smoothness [850.00 – 957.450 × Smoothness]
	> 75.0 [1.18]	Corrective Work to ≤ 56.7 in/mi [0.89 m/km]
HMA-B	< 33.0 [0.52]	270.00
	33.0 – 85.0 [0.52 – 1.34]	600.00 – 10.000 × Smoothness [600.00 – 638.950 × Smoothness]
	> 85.0 [1.34]	Corrective Work to ≤ 60.0 in/mi [0.94 m/km]
HMA-C	< 36.0 [0.57]	180.00
	36.0 – 95.0 [0.57 – 1.50]	414.00 – 6.500 x Smoothness [414.00 – 410.500 x Smoothness]
	> 95.0 [1.50]	Corrective Work to ≤ 63.7 in/mi [1.01 m/km]

7. What bump threshold number do you use for concrete? Is it the same as asphalt?
    - We do not use bumps and dips, we use Areas of Localized Roughness (ALR). The values are the same but the Concrete pavements have to fix the work ALR and the asphalt pavements can take a larger monetary adjustment

Table 2399-7 ALR Monetary Deductions and Corrective Work Requirements		
Equation	**25 ft [7.62 m] Continuous MRI, in/mi [m/km]**	**Corrective Work or Monetary Deduction, per linear 1.0 ft [0.30 m]**
HMA-A or HMA-B, and a posted vehicle speed > 45 mph [73 km/hr]	< 125.0 [1.97]	Acceptable
	≥ 125.0 [1.97] to < 175.0 [2.76]	Corrective Work or $10.00, as directed by the Engineer
	≥ 175.0 [2.76] to < 250.0 [3.94]	Corrective Work or $25.00, as directed by the Engineer
	≥ 250.0 [3.94]	Corrective Work or $100.00, as directed by the Engineer
PCC-A and a posted vehicle speed > 45 mph [73 km/hr]	< 125.0 [1.97]	Acceptable
	≥ 125.0 [1.97] to < 175.0 [2.76]	Corrective Work or $10.00, as directed by the Engineer
	≥ 175.0 [2.76] to < 250.0 [3.94]	Corrective Work or $25.00, as directed by the Engineer
	≥ 250.0 [3.94]	Corrective Work as directed by Engineer
HMA-C, PI, ramps. loops, concrete intersections constructed under traffic, or any paving with a posted vehicle speed ≤ 45 mph [73 km/hr]	< 175.0 [2.76]	Acceptable
	≥ 175.0 [2.76] to < 250.0 [3.94]	$10.00
	≥ 250.0 [3.94]	$25.00

8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?
    - Based on 0.1 mile segments

9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?
    - Yes, See #7

10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?
    - We use ALR for roadways with speed limits between 30 and 45 mph and everything in Table 2399-2 below

Table 2399-2 Areas Excluded from Smoothness Evaluation
For All Pavements
Paving in areas with a posted vehicle speed less than or equal to 45 mph [73 km/hr]
Ramps and loops
Acceleration and deceleration lanes less than or equal to 1,000 ft [304.80 m] in length
Projects less than 1,000 ft [304.80 m] in length
Bridge decks and approach – the occurrence of bridges shall not interrupt the continuity determination
For Bituminous Pavements
Single lift overlays over concrete
For Concrete Pavements

Intersections constructed under traffic – begin and end exclusion 100 ft [30.48 m] from the intersection radius

- Roadways less than 30 mph and those in Table 2399-3 below use 10 ft straightedge

Table 2399-3 Areas Excluded from Smoothness and ALR Evaluation
For All Pavements
Paving in areas with a posted vehicle speed less than 30 mph [48 km/hr]
Turn lanes, crossovers
10 ft [3.05 m] on either side of obstructions in lane that obstruction is located
Side streets, side connections
150 ft [45.72 m] before intersections that end at a stop sign or yield signs at a roundabout
For Bituminous Pavements
Paved shoulders
Intersections where mainline profiles are merged or blended into the cross street profile – begin and end exclusion 100 ft [30.48 m] from the intersection radius
For Concrete Pavements
Undoweled shoulders less than or equal to 10 ft [3.05 m] in width
Headers adjacent to colored concrete

11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?
    - No, we use 100% Inertial Profilers (usually Lightweight)

12. Do you require Proval?
    - Yes

13. Are there any additional deductions for grinding to meet a minimum IRI?
    - We pay incentive if the Contractor grinds out of disincentive and into incentive, however we pre-approve the corrective work (ie. Grinding) plan

14. If ground, can the section be re-profiled to attain a smoothness bonus?
    - If grinding is performed, the Contractor has to re-profile to verify they ground out of Unacceptable

(2399) PAVEMENT SURFACE SMOOTHNESS

2399.1 DESCRIPTION

This work consists of measuring the smoothness of the final concrete or bituminous surface.

A Definitions

The Department defines "Smoothness" as the Mean Roughness Index (MRI) value per 0.1 mi [0.16 km] segment. The Department defines "Areas of Localized Roughness" (ALR) as areas greater than or equal to the limiting criteria for a continuous MRI calculation with a 25 ft [7.62 m] interval, as calculated using the FHWA's Profile Viewing and Analysis (ProVAL) software.

2399.2 MATERIAL REQUIREMENTS

A Inertial Profiler (IP)

Provide a Department certified, calibrated, and documented IP meeting the requirements of ASTM E 950, Class 1 and procedures maintained by the MnDOT Pavement Engineering Section. Refer to the procedures maintained by the MnDOT Pavement Engineering Section or to the MnDOT Smoothness website for the required settings for individual certified profilers.

Provide an IP capable of producing a profilogram and exporting raw profile data in an unfiltered electronic Engineering Research Division (ERD) file format. Produce ERD filenames in the YYMMDD-T-N-D-L-B-E.ERD standardized format in accordance with Table 2399-1:

Table 2399-1
Standardized Naming Convention for ERD Files

Abbreviation	Definition
YY	Two-digit year
MM	Month (include leading zeros)
DD	Day of month (include leading zeros)
T	Route type (I, MN, US, CSAH, etc.)
N	Route number (no leading zeros) and auxiliary ID (if applicable, for example E, W, etc.)
D	Primary route direction (I or D)
L	Lane number (1 for driving lane, increasing by one for each lane to the left)
B	Beginning station
E	End station

B Profile Analysis Software

Use ProVAL software to conduct a profile analysis to determine Smoothness and ALR. Report IRI values in units of in per mi to one digit right of the decimal [m per km to two digits right of the decimal] in accordance with conventional rounding procedures.

C Operator Certification

Provide an operator, trained in the operation of the particular IP in accordance with 2399.2.A, "Inertial Profiler," and knowledgeable in the use of the required profile analysis software in accordance with 2399.2.B, "Profile Analysis Software." Ensure profiler operators pass a proficiency test and possess a current certification issued by the Department. The Contractor may access a list of certified operators on the MnDOT Smoothness website. Provide documentation of operator certification to the Engineer.

D Submittals

D.1 Before Profiling

Provide the Engineer with current, valid documentation, issued by the Department, indicating both IP and the operator certification.

D.2 Day of Profiling

Submit a printout containing the IP's settings, each segment's left and right International Roughness Index (IRI) values, and the signature of the operator to the Engineer on the same day of the profiling.

Submit electronic files in ERD format representing the raw data from each pass on the same day of the profiling.

If the Contractor fails to submit actual data to the Engineer on the day of profiling, the Department will require the Contractor to reprofile the measured segments.

D.3 Upon Completion of Pavement Placement

Within 5 calendar days after all pavement placement and before beginning corrective work, submit a paper ProVAL summary report for each lane, indicating the results of the "Smoothness Assurance" analyses. Use the ERD filenames in accordance with 2399.2.A, "Inertial Profiler" to create ProVAL summary reports.

If the summary reports indicate no ALR, submit a final spreadsheet summary in accordance with 2399.2.D.5, "After Corrective Work."

D.4 Before Corrective Work

If the summary reports indicate any ALR, submit a written corrective work plan to the Engineer in accordance with 2399.3.E, "Corrective Work." Include the beginning and ending points of locations planned for correction in the corrective work plan. Do not begin corrective work before the Engineer approves the plan.

If the Engineer elects to assess a monetary deduction for ALR in accordance with Table 2399-7 instead of requiring corrective work, submit a final spreadsheet summary in accordance with 2399.2.D.5, "After Corrective Work."

D.5 After Corrective Work

After reprofiling, submit a paper summary ProVAL report for each lane, indicating the results of updated "Smoothness Assurance" analyses to the Engineer. Submit a spreadsheet summary in tabular form, with each 0.1 mi [0.16 km] segment occupying a row to the Engineer. The Contractor may access an acceptable spreadsheet summary template in electronic form on the MnDOT Smoothness website.

2399.3 CONSTRUCTION REQUIREMENTS

Using an IP, measure the final pavement surface for MRI unless otherwise excluded in Table 2399-3.

Unless otherwise approved by the Engineer, perform all profiling in the presence of the Engineer. Schedule profiling with the Engineer. Reprofile any pavement profiled in the absence of the Engineer as directed by the Engineer at no additional cost to the Department.

The Engineer will use a 10 ft [3.05 m] straightedge to evaluate areas excluded from surface testing with the IP in accordance with Table 2399-3.

A Pavement Surface Testing

Remove objects and foreign material from the pavement surface before performing the pavement surface evaluation. Provide traffic control required for testing and performing corrective work on the final pavement surface.

Run the IP in the direction of traffic. Measure profiles in the left and right wheel paths of each lane.

Test and evaluate each lane separately. The Engineer will determine the length in miles [kilometers] of each mainline traffic lane. Operate the IP at the optimum speed as recommended by the manufacturer.

Separate each lane into segments 0.1 mi [0.16 km] in length. Evaluate the remainder segment less than 0.1 mi [0.16 km] in each lane as an independent segment. The Engineer will prorate pay adjustments for length.

Make each pass continuously, regardless of length, and end passes before exclusions in accordance with Table 2399-3, "Areas Excluded from Smoothness and ALR Evaluation." Begin each subsequent pass 50 ft [15.24 m] before, and including, construction headers and end-of-day work joints. In concrete pavements, evaluate terminal headers tying into existing portland cement concrete pavement.

For percent improvement projects, measure Smoothness before the beginning of construction and after the completion of construction. Use the same stationing for the final profiling as the stationing used for the initial profiling to allow for a direct comparison of Smoothness when calculating the percent improvement. Measure the Smoothness Before Paving and the Smoothness After Paving values with the same IP.

The Engineer will use a 10 ft [3.05 m] straightedge to measure for surface deviations greater than ¼ in [6.35 mm] in 10 ft [3.05 m]. The Engineer will evaluate transverse joints by centering the straightedge longitudinally across the transverse joint.

B Exclusions

Table 2399-2 indicates areas that are excluded from Smoothness evaluation, but still require measurement with an IP, and are subject to evaluation for ALR and the 10 ft [3.05 m] straightedge. Table 2399-3 indicates areas that are excluded from surface testing with the IP, but are subject to evaluation with the 10 ft [3.05 m] straightedge

Table 2399-2
Areas Excluded from Smoothness Evaluation

For All Pavements
Paving in areas with a posted vehicle speed less than or equal to 45 mph [73 km/hr]
Ramps and loops
Acceleration and deceleration lanes less than or equal to 1,000 ft [304.80 m] in length
Projects less than 1,000 ft [304.80 m] in length
Bridge decks and approach – the occurrence of bridges shall not interrupt the continuity determination
For Bituminous Pavements
Single lift overlays over concrete
For Concrete Pavements
Intersections constructed under traffic – begin and end exclusion 100 ft [30.48 m] from the intersection radius

Table 2399-3
Areas Excluded from Smoothness and ALR Evaluation

For All Pavements
Paving in areas with a posted vehicle speed less than 30 mph [48 km/hr]
Turn lanes, crossovers
10 ft [3.05 m] on either side of obstructions in lane that obstruction is located
Side streets, side connections
150 ft [45.72 m] before intersections that end at a stop sign or yield signs at a roundabout
For Bituminous Pavements
Paved shoulders
Intersections where mainline profiles are merged or blended into the cross street profile – begin and end exclusion 100 ft [30.48 m] from the intersection radius
For Concrete Pavements
Undoweled shoulders less than or equal to 10 ft [3.05 m] in width
Headers adjacent to colored concrete

C Calculations

C.1 Smoothness

Obtain the Smoothness values in an individual lane using the ProVAL "Smoothness Assurance" analysis with the 250 mm filter.

For percent improvement projects, use the Smoothness Before Paving and Smoothness After Paving values to calculate the percent ride improvement.

C.2 Areas of Localized Roughness

Identify ALR using the ProVAL "Smoothness Assurance" analysis, calculating MRI with a continuous short interval of 25 ft [7.62 m] with the 250 mm filter.

D Pay Adjustments

D.1 Smoothness

Evaluate Smoothness requirements using the equations and criteria in accordance with the following tables:

(1) Table 2399-4 for bituminous pavements,
(2) Table 2399-5 for concrete pavements, and
(3) Table 2399-6 for percent improvement projects.

The Engineer will base pay adjustments on the segment Smoothness value (or percent improvement value, for percent improvement projects) measured at the completion of surface pavement, unless corrective work is required by the summary report results. If a segment is less than 100 ft [30.48 m] in length and Table 2399-4, Table 2399-5, or Table 2399-6 requires corrective work, the Engineer will waive the corrective work requirement for the segment and instead assess a prorated disincentive. The Department will still subject the segment to ALR analysis in accordance with Table 2399-7

For segments requiring corrective work, reprofile the entire 0.1 mi [0.16 km] segment after performing corrective work as directed by the Engineer and enter the reprofiled Smoothness values into the final spreadsheet summary.

D.1.a Bituminous Pavements

Table 2399-4 contains pay adjustments for bituminous pavements. See Section 2360, "Plant Mixed Asphalt Pavement" of the Special Provisions for the ride equation requirement.

Table 2399-4
Smoothness Pay Adjustments and Corrective Work for Bituminous Pavements

Equation	Smoothness in/mi [m/km]	Pay Adjustment $/0.1 mi [0.16 km]
HMA-A	< 30.0 [0.47]	400.00
	30.0 – 75.0 [0.47 – 1.18]	850.00 – 15.000 × Smoothness [850.00 – 957.450 × Smoothness]
	> 75.0 [1.18]	Corrective Work to ≤ 56.7 in/mi [0.89 m/km]
HMA-B	< 33.0 [0.52]	270.00
	33.0 – 85.0 [0.52 – 1.34]	600.00 – 10.000 × Smoothness [600.00 – 638.950 × Smoothness]
	> 85.0 [1.34]	Corrective Work to ≤ 60.0 in/mi [0.94 m/km]
HMA-C	< 36.0 [0.57]	180.00
	36.0 – 95.0 [0.57 – 1.50]	414.00 – 6.500 x Smoothness [414.00 – 410.500 x Smoothness]

Table 2399-4 Smoothness Pay Adjustments and Corrective Work for Bituminous Pavements		
Equation	**Smoothness in/mi [m/km]**	**Pay Adjustment $/0.1 mi [0.16 km]**
	> 95.0 [1.50]	Corrective Work to ≤ 63.7 in/mi [1.01 m/km]

For bituminous projects, the Engineer will not pay any positive Total Pay Adjustments if greater than 25 percent of all mainline density lots for the project fail to meet the minimum density requirements in accordance with 2360, "Plant Mixed Asphalt Pavement."

D.1.b Concrete Pavements

For concrete pavements, the Engineer will use equation PCC-A.

Table 2399-5 Smoothness Pay Adjustments and Corrective Work for Concrete Pavements		
Equation	**Smoothness in/mi [m/km]**	**Pay Adjustment $/0.1 mi [0.16 km]**
PCC-A	< 50.0 [0.79]	890.00
	50.0 – 90.0 [0.79 – 1.42]	2940.00 – 41.000 × Smoothness [2940.00 – 2597.800 × Smoothness]
	> 90.0 [1.42]	Corrective Work to ≤ 71.7 in/mi [1.13 m/km]

D.1.c Percent Improvement Projects

The Engineer will base pay adjustments on the segment percent improvement values. The Engineer will not require corrective work and will not assess a negative pay adjustment if the Smoothness Before Paving value is less than 60.0 in per mi [0.95 m per km] and the percent improvement is greater than zero. The Engineer will calculate the percent improvement in accordance with the following equation:

$$\%I = \frac{SmoothnessBeforePaving - SmoothnessAfterPaving}{SmoothnessBeforePaving} \times 100$$

Determine the Smoothness Before Paving value before patching or other repair. Determine the Smoothness After Paving value after the completion of paving and any corrective work.

Table 2399-6 Smoothness Pay Adjustments and Corrective Work for Percent Improvement Projects		
Equation	**Percent Improvement (%I)**	**Pay Adjustment, per $/0.1 mi [$/0.1609 km] segment**
PI	> 64.0	180.00
	33.0 to 64.0	−295.00 + 7.420 × (%I)
	< 33.0	Corrective work to %I of at least 39.8

For bituminous percent improvement projects, the Engineer will not pay any positive Total Pay Adjustments if greater than 25.0 percent of all mainline density lots for the project fail to meet minimum density requirements in accordance with 2360, "Plant Mixed Asphalt Pavement."

Correct segments with a percentage improvement of less than 33.0 percent at no additional cost to the Department as required by the Engineer.

D.2 Areas of Localized Roughness

The Engineer will evaluate ALR in accordance with Table 2399-7, "ALR Monetary Deductions and Corrective Work Requirements."

Table 2399-7
ALR Monetary Deductions and Corrective Work Requirements

Equation	25 ft [7.62 m] Continuous MRI, in/mi [m/km]	Corrective Work or Monetary Deduction, per linear 1.0 ft [0.30 m]
HMA-A or HMA-B, and a posted vehicle speed > 45 mph [73 km/hr]	< 125.0 [1.97]	Acceptable
	≥ 125.0 [1.97] to < 175.0 [2.76]	Corrective Work or $10.00, as directed by the Engineer
	≥ 175.0 [2.76] to < 250.0 [3.94]	Corrective Work or $25.00, as directed by the Engineer
	≥ 250.0 [3.94]	Corrective Work or $100.00, as directed by the Engineer
PCC-A and a posted vehicle speed > 45 mph [73 km/hr]	< 125.0 [1.97]	Acceptable
	≥ 125.0 [1.97] to < 175.0 [2.76]	Corrective Work or $10.00, as directed by the Engineer
	≥ 175.0 [2.76] to < 250.0 [3.94]	Corrective Work or $25.00, as directed by the Engineer
	≥ 250.0 [3.94]	Corrective Work as directed by Engineer
HMA-C, PI, ramps, loops, concrete intersections constructed under traffic, or any paving with a posted vehicle speed ≤ 45 mph [73 km/hr]	< 175.0 [2.76]	Acceptable
	≥ 175.0 [2.76] to < 250.0 [3.94]	$10.00
	≥ 250.0 [3.94]	$25.00

The Engineer will consider ALR acceptable if the retested segment contains no ALR. The Department will reduce payment for ALR remaining after retesting as determined by the Engineer and in accordance with Table 2399-7, "ALR Monetary Deductions and Corrective Work Requirements."

D.3 Straightedge Evaluation

The Engineer will allow variations less than or equal to ¼ in [6.35 mm] within the span of the straightedge in the longitudinal or transverse direction to remain in place without correction or penalty.

The Engineer will require corrective work on surface deviations greater than ¼ in [6.35 mm] within the span of the straightedge in any direction. For corrected variations, the Engineer will accept deviations less than or equal to ¼ in [6.35 mm] within the span of a 10 ft [3.05 m] straightedge in any direction.

E Corrective Work

Notify the Engineer at least 24 hr before beginning corrective work. Do not begin corrective work before the Engineer approves the methods and procedures in writing.

Perform corrective work using a surface diamond grinding device consisting of multiple diamond blades, unless otherwise approved by the Engineer. Fog-seal diamond ground bituminous surfaces as required by the Engineer and at no additional cost to the Department. Repair and replace joint sealant damaged by diamond grinding on concrete pavement as directed by the Engineer and at no additional cost to the Department.

The Contractor may correct bituminous pavements by overlaying the area or replacing the area by milling and inlaying as approved by the Engineer. If milling and inlaying or overlaying, perform work in accordance with 2399, "Pavement Surface Smoothness," over the entire length of the correction. If milling and inlaying or overlaying, use a transverse saw cut to begin and end the surface correction.

Perform corrective work across the entire lane width. Maintain the pavement cross slope through corrective areas.

Perform coring to determine if diamond grinding corrective work results in thin pavements, as directed by the Engineer. Provide additional coring for thickness verification at no additional cost to the Department. The Department may reduce the payment for thin pavement sections after diamond grinding. Handle residue and excess water resulting from diamond grinding in accordance with 1717, "Air, Land, and Water Pollution."

Perform surface corrections before placing permanent pavement markings. Replace permanent pavement marking damaged or destroyed by corrective work at no additional cost to the Department.

Reprofile segments containing corrected areas with the same certified IP in accordance with 2399.2.A, "Inertial Profiler" within 5 calendar days after the completion of corrective work required by the Engineer.

F Retesting

Perform retesting as directed by the Engineer and within 30 days of the original profiling.

If the retested Smoothness values differ from the original Smoothness values by greater than 10 percent, the Engineer will use the retested values as the basis for acceptance and pay adjustments. If the retested values differ from the original values by greater than 10 percent, the Department will not pay for the cost of retesting.

If the retested Smoothness values differ by less than or equal to 10 percent of the original Smoothness values, the Engineer will use the original values. If the Engineer verifies the accuracy of the original results, the Department will pay for retesting as directed by the Engineer, except for retesting required after corrective work, at $100.00 per lane mi [$62.14 per lane km] retested or $500.00, whichever provides the greater amount.

2399.4 METHOD OF MEASUREMENT — (BLANK)

2399.5 BASIS OF PAYMENT

The Department will include the cost of the IP, testing, and traffic control in the relevant contract unit price for wearing course mixture for bituminous pavements, concrete pavement for concrete pavements, or for concrete grinding.

NATIONAL CONCRETE CONSORTIUM

State DOT: Missouri

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?

The contractor performs QC testing and provides the data to the department. MoDOT performs QA testing on 10% of the lane miles. Inertial profilers are certified annually at MoDOT's certification site in accordance with MoDOT Test Method TM-59. Operators of inertial profilers are certified through MoDOT's technician certification program.

2. When is the testing done (daily, once paving is complete, or after open to traffic)?

   In most cases, testing is done the day after paving. Sometimes testing is done after paving is completed.

3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?

   n/a

4. Do you see an influence on the type of pavement texture?

   We have not seen much of a difference when a row line laser is used.

5. What equipment/laser setup are you using for concrete?

   The same equipment is used for concrete and asphalt pavements. The equipment is required to comply with AASHTO M328.

6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?

   Concrete and asphalt pavements require the same IRI values. Required IRI values are shown below:

Table 1 (Posted Speed >45 m.p.h.)	
IRI, Inches per mile	**% of Contract Price**
40.0 or less	105
40.1 – 54.0	103
54.1 – 80.0	100
80.1 or greater	100[a]

[a]After correction to 80.0 inches per mile or less.

Table 2 (Posted Speed <=45 m.p.h.)	
IRI, Inches per mile	**% of Contract Price**
70.0 or less	103
70.1 – 125.0	100
125.1 or greater	100[b]

[b]After correction to 125.0 inches per mile or less.

7. What bump threshold number do you use for concrete? Is it the same as asphalt?

   Asphalt and concrete pavements have the same bump threshold requirements. MoDOT utilizes localized roughness. Bump requirements are shown below:

   Final posted speed greater than 45 m.p.h.
   A continuous 25-foot average IRI if 125.0 inches per mile or greater

   Final posted speed of 45 m.p.h. or less
   A continuous 25-foot average IRI if 175.0 inches per mile or greater

8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?

   Incentive payments are based on percent of contract price.

9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?

   MoDOT does utilize localized roughness.

   Final posted speed greater than 45 m.p.h.
   A continuous 25-foot average IRI if 125.0 inches per mile or greater

   Final posted speed of 45 m.p.h. or less
   A continuous 25-foot average IRI if 175.0 inches per mile or greater

10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?

    MoDOT only looks at two categories for speed, above 45 m.p.h. and 45 m.p.h. or less.

11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?

    MoDOT no longer utilizes PI specifications to evaluate smoothness.

12. Do you require Proval?

    Yes, Proval is required to compute the IRI smoothness and to determine the areas of localized roughness.

13. Are there any additional deductions for grinding to meet a minimum IRI?

    When less than a segment (0.1 mile) is ground, the area ground is considered a marred surface and a 20% deduction is applied.

14. If ground, can the section be re-profiled to attain a smoothness bonus?

    If a segment (*0.1 mile*) is ground, it is not eligible for incentive pay but the deduction for marred surface is waived. If a section (*a day's paving*) is ground, it is eligible for incentive pay and the deduction for marred surface is waived.

State DOT: Nebraska

NATIONAL CONCRETE CONSORTIUM

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?
   The contractor does the testing. NDOR verifies 10% of the project. Contractor must have their machine certified each year through NDOR. Also, operator must be certified and the certification is good for 5 years.

2. When is the testing done (daily, once paving is complete, or after open to traffic)?
   The Contractor may begin testing as soon they have achieved required strength and before opening to traffic.

3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?
   NA

4. Do you see an influence on the type of pavement texture?
   NA

5. What equipment/laser setup are you using for concrete?
   Lightweight non-contact profiler with the 3K-RoLine laser.

6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?
   CONCRETE: Acceptance is 124 in/mi. or lower. 100% pay is 93 in/mi. or lower. Incentive is 68 in/mi. or lower.
   ASPHALT: Acceptance is 96 in/mi or lower. 100% is 68 in/mi. or lower. Incentive is 56 in/mi or lower.

   What bump threshold number do you use for concrete? Is it the same as asphalt?
   CONCRETE: 0.3 inch and ASPHALT: 0.4 inch with vertical deviations above or below a base line span of 25 feet.

7. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?
   0.1 mile

8. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?
   No

9. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?
   45 MPH and lower do not have an IRI specification, but they are still checked for bumps and dips.
   50 MPH and higher are under the IRI specification

10. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?
    NDOR stills have the California profilograph for bridges. The Department runs the IRI and the California profilograph using software to simulate the California Profilograph. Contractor is still responsible for bumps and dips that exceed the 0.3 inches for concrete and 0.4 inches for asphalt.

11. Do you require Proval?
    No

12. Are there any additional deductions for grinding to meet a minimum IRI?
    No

13. If ground, can the section be re-profiled to attain a smoothness bonus?
    No, but can attain 100% pay.

State DOT: NCDOT

NATIONAL CONCRETE CONSORTIUM

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?
   Contractor / Rep – hire Consultant. Documentation on calibration and documented experience of Operator from Manufacturer training course and projects.

2. When is the testing done (daily, once paving is complete, or after open to traffic)? Completion of paving.

3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic? Depends. Could be one week to one month or more.

4. Do you see an influence on the type of pavement texture? Single point lasers do not work well on concrete pavements which is why we required line lasers for IRI testing on both asphalt and concrete.

5. What equipment/laser setup are you using for concrete? NCDOT Specs require line lasers.

6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt? YES.

TABLE Error! Use the Home tab to apply Section Number Char to the text that you want to appear here.**-1**

MRI PRICE ADJUSTMENT PER 0.10-MILE SECTION

MRI after Completion (Inches Per Mile)	**Price Adjustment Per Lane (0.10-Mile Section)**
45.0 and Under	$200.00
45.1-55.0	PA = 600 – (10 * MRI)
55.1-70.0	Acceptable (No Pay Adjustment)
70.1-90.0	PA = 650 – (10 * MRI)
Over 90.1	Corrective Action Required

7. What bump threshold number do you use for concrete? Is it the same as asphalt?

8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)? 0.10-Mile Section

9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?
   IRI = 125 in/mile for 25-ft. Same for concrete.

10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them? IRI spec applies to any facility.

11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations? Rainhart profilograph for irregular areas and bridges.

12. Do you require Proval? YES.

13. Are there any additional deductions for grinding to meet a minimum IRI? NO, grinding is required as corrective action but penalty is already assessed from initial IRI numbers.

14. If ground, can the section be re-profiled to attain a smoothness bonus? NO.

State DOT: North Dakota

NATIONAL CONCRETE CONSORTIUM

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?
   Testing is done by NDDOT with equipment that is certified at MnRoads.

2. When is the testing done (daily, once paving is complete, or after open to traffic)?
   Initial testing can be partially done when over half the project is complete and continuous. The remaining portion is done when project is complete.

3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?
   No.

4. Do you see an influence on the type of pavement texture?
   No.

5. What equipment/laser setup are you using for concrete?
   Roline lasers.

6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?

   For reconstruction:

Range	Incentive / Disincentive
≤ 36.0	$1,600.00
36.1 to 41.0	$1,200.00
41.1 to 46.0	$800.00
46.1 to 50.0	$400.00
50.1 to 54.0	$0.00
54.1 to 59.0	($800.00)
59.1 to 64.0	($1,200.00)
64.1 to 68.0	($1,600.00)
≥ 68.1	Corrective Action

   IRI is based on an average per lot which is 528 feet long and 12 feet wide.

   For asphalt the ranges and dollar amounts are different.

7. What bump threshold number do you use for concrete? Is it the same as asphalt?
   Concrete: Speed limit 40 mph or greater is 1/8 inch in 10 feet. For speed limits less than 40 mph is ¼ inch in 10 feet.
   Asphalt: 3/8 inch in 16 feet.

8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?
   Set amount per tenth of mile.

9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?
   Yes.
   Parameters for localized roughness:

Localized roughness is defined as locations of the roadway with an MRI threshold value of 80 in/mi or greater in a 25 foot continuous segment. The profile will be evaluated using the Smoothness Assurance Module (SAM) within the current version of ProVal. The SAM module settings will be as follows:

- *Ride Quality Index set to MRI.*
- *Ride Quality Threshold set to 80 in/mile.*
- *The base length for the short continuous, long continuous, and fixed interval will be 25 feet, 528 feet, and 528 feet, respectively.*
- *The 250 mm filter will be applied to the file being analyzed.*

10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?
    We use rural and the speed is defined as anything 40 mph and above. We are just in the process of developing an urban ride spec.

11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?
    No.

12. Do you require Proval?
    Yes.

13. Are there any additional deductions for grinding to meet a minimum IRI?
    No.

14. If ground, can the section be re-profiled to attain a smoothness bonus?
    No.

Additional comment:

Attached are the special provisions used for IRI ride specifications on reconstruction, concrete pavement repair and grinding, and asphalt rehabilitation projects.

State DOT: Ohio Department of Transportation

NATIONAL CONCRETE CONSORTIUM

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?
   Contractor. OH DOT certifies equipment and operator according to Supplement 1058.
2. When is the testing done (daily, once paving is complete, or after open to traffic)?
   Up to contractor. Generally they test as they go for QC purposes. Acceptance runs are generally made when they have a good stretch of a project completed.
3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?
   Depends. If it is not clean and saw cut slurry not removed, that's a detriment. Obviously, once it's open to traffic, the joints are working and slab curl/warp could be an issue.
4. Do you see an influence on the type of pavement texture?
   No, not if you use the Roline height sensors.
5. What equipment/laser setup are you using for concrete?
   Line scan height laser (Roline).
6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?
   Positive pay adjustments with mean IRI below 60 "/mile to max adjustment at 45 "/mile. Negative pay adjustments above 70 "/mile up to 95 "/mile. Mandatory corrective action is required above 95 "/mile. Same criteria for AC.
7. What bump threshold number do you use for concrete? Is it the same as asphalt?
   It doesn't matter if it is a bump or a dip or a series of either that causes localized roughness. Localized roughness must be corrected anywhere the IRI exceeds 160"/mile using a continuous sliding 25 foot baselength to calculate the IRI per wheelpath. Same criteria for AC.
8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?
   Set amount per 0.1 mile lots.
9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?
   Yes, localized roughness must be corrected anywhere the IRI exceeds 160"/mile using a continuous sliding 25 foot baselength to calculate the IRI per wheelpath.
10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?
    There is a 10 foot straightedge spec for both material types. We have designer notes that suggest IRI specs should not be used on low speed/urban settings. 40-50 mph would not be considered low speed.
11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?
    The CA PI was phased completely out by either 2008 or 2009.
12. Do you require Proval?
    Yes.
13. Are there any additional deductions for grinding to meet a minimum IRI?
    Our specs are set up such that if you have any lot with either localized roughness area that requires correction or the entire lot requires corrective action, that lot is not eligible for positive pay adjustment. Likewise, if a lot is in the negative pay adjustment range, it is not eligible for positive pay adjustment after correction. The contractor may correct out of a negative pay adjustment but can never correct into a positive pay adjustment.
14. If ground, can the section be re-profiled to attain a smoothness bonus?
    Not if it was originally in a negative pay adjustment category or mandatory correction catergory.

State DOT: Pennsylvania

NATIONAL CONCRETE CONSORTIUM

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?
   IRI is determined by the contractor. PennDOT does QA verification testing within 90 days of the data being entered into the system. PennDOT certifies both operator (every three years) and their equipment (yearly) at a designated state-owned facility.

2. When is the testing done (daily, once paving is complete, or after open to traffic)?
   Contractor conducts IRI testing when the project has been completed. PennDOT conducts QA testing within 90 days of the projected being entered into the system.

3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?

4. Do you see an influence on the type of pavement texture?

5. What equipment/laser setup are you using for concrete?
   We currently allow light weight profilers with single point, wide spot, Triod, and Roline lasers on all pavement types.

6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?
   RIGID- (Inches /mile/lot) Depends on Type (I or II) 70 and below for incentive (Type I) 90 and below for incentive (type II)
   Flexible- (Inches/mile/lot) Depends on schedule (A or B) 60 and below for incentive, 70 for acceptance (schedule A) 70 and below for incentive, 90 for acceptance (schedule B)

7. What bump threshold number do you use for concrete? Is it the same as asphalt?
   ¼" when tested with 10' straight edge

8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?
   Set per .1 mile lot

9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?
   I don't believe the IRI specification accounts for localized roughness unless corrective action is required for grinding.

10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?
    Other than the necessary traffic control, we do not require changes to data collecting procedures or analysis in urban areas. We do not have alternative smoothness checks in place to account for Urban IRI.

11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?
    No PI spec

12. Do you require Proval?
    Yes, we use ProVAL to determine cross correlation when certifying profilers. We also conduct random on projects each year. For this we require the contractors submit raw data in ProVAL compatible format for IRI QA verification.

13. Are there any additional deductions for grinding to meet a minimum IRI?
    No

14. If ground, can the section be re-profiled to attain a smoothness bonus?
    Yes

NATIONAL CONCRETE CONSORTIUM

State DOT: South Dakota

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?
   State – but we are still in data gathering phase with no specification for PCCP. State for Asphalt.
2. When is the testing done (daily, once paving is complete, or after open to traffic)?
   We are leaning toward once paving is complete for our PCCP specification. Asphalt is once paving is complete.
3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?
   Unsure, one project indicated minor differences for PCCP.
4. Do you see an influence on the type of pavement texture?
   Concrete – not enough data/analysis but I don't think so with the Roline laser system. Asphalt – No.
5. What equipment/laser setup are you using for concrete?
   Ames Engineering Gators & High Speed / all are using the Roline laser system.
6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?
   In development – hope to have the same as one or two lift asphalt.
7. What bump threshold number do you use for concrete? Is it the same as asphalt?
   In development – currently 0.3 bump with PI band PCCP and 0.4 bump in 25' for asphalt.
8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?
   Currently with IRI asphalt is $/0.1 mile and PCCP is % of bid price using PI scale.
9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?
   NO
10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?
    Currently 0.2 band California PI or 10 foot straightedge.
11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?
    NA
12. Do you require Proval?
    No for asphalt acceptance.
13. Are there any additional deductions for grinding to meet a minimum IRI?
    No.
14. If ground, can the section be re-profiled to attain a smoothness bonus?

Asphalt – No ; No in PCCP with California PI specification.

13. Are there any additional deductions for grinding to meet a minimum IRI?
    No

14. If ground, can the section be re-profiled to attain a smoothness bonus?
    Yes

State DOT: Texas

NATIONAL CONCRETE CONSORTIUM

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?

The QA testing is done by the contractor. The agency can do verification testing if needed and if the difference in results between District and contractor is > 6in/mile referee testing is done. The profilers are certified at Texas A&M Transportation Institute on a yearly basis. The operators are also certified every 3 years.

2. When is the testing done (daily, once paving is complete, or after open to traffic)?

Testing is done when once paving is complete or after a major milestone.

3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?

   N/A

4. Do you see an influence on the type of pavement texture?

Based on research done in Texas longitudinally tined concrete affects the IRI measurements, we do not see a problem on other types of surfaces.

5. What equipment/laser setup are you using for concrete?

We use the single point laser some light weight units use the 19 mm. Our only requirement is the unit to be certified we do not specify the type of laser.

6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?

60 in/mile and it is the same for asphalt. We have three pay schedules in our spec 1, 2, 3 Pay schedule 1 is typically used for new asphalt pavements and 2 is typically used for concrete pavements. The incentive for both pay schedules start at 60 in/mile but the incentives are different also the penalty start at 65 in/mile for pay schedule 1 and at 75 in/mile for pay schedule 2.

7. What bump threshold number do you use for concrete? Is it the same as asphalt?

If the deviation between the measured profile and a 25 ft moving average profile > 0.15 in. Yes it is the same for asphalt. We do not use continuous IRI.

8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?

Set amount per 0.1 mile

9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?

Yes we use localized roughness in the ride specification. The parameter for PCCP is the same like Asphalt > 0.15" see answer for question 6.

10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?

In some cases when we cannot have continuous paving, we evaluate the ride quality using a straight edge.

11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?

No we do not use a PI spec. We use a straight edge in some locations.

12. Do you require Proval?

No, we have our own Ride Quality software.

13. Are there any additional deductions for grinding to meet a minimum IRI?

No

14. If ground, can the section be re-profiled to attain a smoothness bonus?

No just to correct deficient sections.

State DOT: UTAH

NATIONAL CONCRETE CONSORTIUM

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?
   Machine and operator certification is done through a state consultant contract.

2. When is the testing done (daily, once paving is complete, or after open to traffic)?
   Testing for acceptance is done once paving is complete prior to opening to traffic

3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?
   Time varies.

4. Do you see an influence on the type of pavement texture?
   Utah uses PI. .2 blanking band is used to eliminate texture effects.

5. What equipment/laser setup are you using for concrete?
   Not using IRI. We use inertial profilers however a conversion to PI is required.

6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?

DEFINITIONS

A. Category 1
   1. Pavement surfaces having two or more opportunities for improving the ride
   2. Portland Cement Concrete Paving

B. Category 2
   1. All other pavements incorporating single lift overlays

Table 1

Profile Deviation		
Category	*Section PI*	*Profile Deviation*
	inch/mile	*inch/25 ft*
1	*5*	*0.3*
2	*7*	*0.3*

1.8 INCENTIVE/DISINCENTIVE

A. Apply Incentive/Disincentive to Category 1 and 2 pavements longer than 1,000 ft in length, including:
   1. All traffic lanes
   2. Ramps
   3. Medians 8 ft and wider
   4. Turn lanes
   5. Bridges and approach slabs with final riding surfaces placed as part of the contract

C. *The Department calculates the Incentive/Disincentive for HMA, OGSC, BWC and SMA (final riding surface) according to Table 2. Amounts are prorated for partial pavement sections based on length.*

D. *The Department calculates the Incentive for PCCP according to Table 3. Disincentive does not apply to PCCP. The disincentive for PCCP is grinding and finish work needed to meet the minimum requirements.*

Table 2

HMA, OGSC, BWC, and SMA Incentive/Disincentive	
Category	***Incentive/Disincentive per Pavement Section***
1	*$150 x [(Required in/mi) - (PI)]*
2	*$100 x [(Required in/mi) - (PI)]*

Table 3

PCCP Incentive	
Category	***Incentive per Pavement Section***
1	*$200 x [(Required in/mi) - (PI)]*

7. What bump threshold number do you use for concrete? Is it the same as asphalt?

8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?
   .1 mile
9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?
   No
10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?

11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?
    We have a PI spec. moving to IRI.
12. Do you require Proval?
    PI spec. Receiving Proval training.
13. Are there any additional deductions for grinding to meet a minimum IRI?
    We allow and require grinding
14. If ground, can the section be re-profiled to attain a smoothness bonus?
    Yes.

State DOT: Washington State

NATIONAL CONCRETE CONSORTIUM

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator? ***The contractor does the testing. WSDOT uses the profilograph so no profiler certification is necessary. Calibration of the profilograph is required.***

2. When is the testing done (daily, once paving is complete, or after open to traffic)? ***Within 48 hours following placement.***

3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic? ***NA***

4. Do you see an influence on the type of pavement texture? ***No***

5. What equipment/laser setup are you using for concrete? ***Profilograph***

6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt? ***WSDOT requires a minimum PrI of 7 inches / mile for concrete. WSDOT uses IRI on HMA pavement with a minimum of 60 inches per mile for an incentive payment and 65 inches per mile maximum before a disincentive is assessed on new pavement.***

7. What bump threshold number do you use for concrete? Is it the same as asphalt? ***Bumps greater than 0.3 inches in 25 feet must be corrected. Correction is required for HMA if the IRI exceeds 95 inches per mile in 0.1 miles.***

8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)? ***An incentive of 1% of the bid price is paid if the PrI is 4.0 inches per mile or less and an addition 1% for each inch per mile below that for a maximum incentive of 4% of the bid price. A disincentive of 2% of the bid price is taken if the PrI exceeds 7.0 inches per mile and the profile must be corrected to 7.0 inches per mile or less.***

9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP? ***Not for PCCP. For HMA, sections greater than 95 inches per mile in 0.1 mile must be corrected.***

10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them? ***Requirements for concrete are the same regardless of speed. For HMA IRI smoothness is only specified for roadways with a speed limit of 45 mph and greater.***

11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations? ***Profilograph is used for all locations except irregular areas, tight curves, etc.***

12. Do you require Proval? ***No***

13. Are there any additional deductions for grinding to meet a minimum IRI? ***No***

14. If ground, can the section be re-profiled to attain a smoothness bonus? ***Sections can only be tested for smoothness once. Grinding is required to reduce the PrI to 7.0 inches per mile or less but the 2% penalty still applies.***

NATIONAL CONCRETE CONSORTIUM

State DOT: WISCONSIN

IRI Ride Spec Questions - State Reports - Spring 2013 Meeting

1. Who does the testing? If not the state, then how do you certify machine and operator?
   The contractor does the QC testing. WisDOT conducts a Roadeo in the spring to certify all profilers, and checks the operation of each against our QV profiler during the construction season.
2. When is the testing done (daily, once paving is complete, or after open to traffic)?
   For concrete, testing is either done daily or at the end of paving for a project stage before a traffic switch.
3. If not tested the day after paving, do you know how much difference there is by the time it is open to traffic?
   No
4. Do you see an influence on the type of pavement texture?
   No – filtered out by averaging effect of roline laser
5. What equipment/laser setup are you using for concrete?
   All contractors and WisDOT are currently using Ames Engineering lightweights with Selcom Roline lasers.
6. What are the IRI numbers associated with acceptance/incentives? Are they the same for asphalt?
   IRI < 50 inches/mile = full incentive
   IRI between 50 and 55 inches /mile – partial incentive
   Not the same as for asphalt
7. What bump threshold number do you use for concrete? Is it the same as asphalt?
   Localized roughness > 200 inches per mile
   Same as for asphalt
8. On what do you base your incentive payments (set amount per .1 mile or % of a bid price)?
   Set amount for single lane 500 feet segment ($250 max)
9. Do you use localized roughness in the IRI specification? If so, what are the parameters for PCCP?
   Yes – See #7 above
10. What smoothness checks do you use for mid-speed urban areas (40-50 mph), and how do you accomplish them?
    We have a separate segment category and pay specification (more lenient) for lower speed urban segments.
11. If you have an IRI spec, do you still use a PI spec (California profilograph) in any locations?
    IRI only
12. Do you require Proval?
    Yes
13. Are there any additional deductions for grinding to meet a minimum IRI?
    No
14. If ground, can the section be re-profiled to attain a smoothness bonus?
    No