1. SCOPE.

1.1 Measure and report the ride quality of a finished surface using a calibrated inertial profiler.
1.2 Report test results to the engineer as an average International Roughness Index (IRI) and localized roughness percentage out of spec of each Pavement Ride Quality (PRQ) lot.

2. REFERENCES.

   AASHTO R 56
   AASHTO R 57
   AASHTO M 328

3. TERMINOLOGY.

   International Roughness Index (IRI). An index computed from a longitudinal profile measurement reported in inches/mile (in/mi).

   Pavement Ride Quality (PRQ) Lot. A PRQ lot is a continuous 528 ft (1/10th mile) section of pavement one lane wide, in areas shown in the contract documents as requiring pavement ride quality testing.

   Lane Lot. A continuous test section made up of multiple PRQ Lots.

   ProVAL. Computer application used for pavement ride quality analysis.

   Lane Lot Percentage. The average of the “percent out of spec” for the right and left wheel path of a lane lot. The lane lot percentage is used for determining localized roughness.

   Lane Percentage. The average of the three (3) lane lot percentages in a lane.

4. PREPARATION.

4.1 Advanced Preparation

   A. Equipment. Refer to AASHTO M 328 Inertial Profiler General Equipment Requirements section for Inertial Profiler requirements. All Inertial Profilers will be required to have GPS by January of 2021.

   B. Certification. Refer to NYSDOT Certification Method 653 Pavement Ride Quality Testing Certification section for Inertial Profiler Certification requirements. All inertial profilers must be certified within the calendar year.
4.2 Daily Preparation

A. Tire pressure of testing vehicles must be maintained in accordance to the vehicle manufacturer’s recommendations.

B. Maintain a Calibration Verification Log in accordance with **AASHTO R 56 6.1.1 Calibration Verification Log** to maintain records of calibration history.

C. Vertical calibration verification
   
   a) **Block.** Check sensors for accurate elevation readings. This check is performed after the operating system has reached operational stability per the manufacturer. During the test, do not lean on the profiler or cause it to move in any way. This test requires the use of calibrated measuring blocks of 0.25, 0.5 and 1.0 inches.
      
      1) Place a smooth base plate under the height sensors. Allow the system to measure this height. Zero out the sensors.
      
      2) Center a 0.25 inch block under the height sensors on top of the base plate and record height measurement.
      
      3) Replace the 0.25 inch block with the 0.50 inch block. Record height measurement.
      
      4) Replace 0.50 inch block with the 1.00 inch block. Record height measurement.
      
      5) Each inertial profiler must be furnished with their own base plate and gauge blocks which are labeled by thickness. Each gauge block reading should be recorded in the calibration log. Calculate the difference between each measurement on a gauge block and the base plate to get the thickness of the gauge block as measured by the height sensor. Repeat this calculation for each gauge block. The difference for any given gauge block should be less than or equal to 0.01 inch.

   b) **Bounce.** This test is performed with the host vehicle on a flat level surface. It is performed after the operating system has reached operational stability per the manufacturer. Follow the manufacturer’s recommendation for performance procedure of the bounce test. The static portion of the test should result in an IRI of less 3 in/mi. The bouncing portion of the test should result in an IRI of less than 8 in/mi.

D. Longitudinal control testing

   Daily calibration verification is required for QA testing on all NYS DOT contracts. Daily Control Testing (DCT) is performed to ensure that the inertial profiler is providing consistent results from day to day. DCT is performed on a control section that is, when possible, maintained for the project’s duration. The test results are to be processed by ProVAL. The EIC must be informed when and where daily control testing takes place before it begins.
Control sections should be located on a driving lane of pavement that test vehicles can access each day without obstructing traffic.

a) Establish a control section
   1) Select an area on or near the project site that can facilitate testing as described in this section.
   2) Submit the selected location to the Engineer for approval prior to the start of ride quality testing.
   3) Establish a reference line 528 ft long, with a lead-in section of at least 150 ft and safe acceleration and deceleration areas, per AASHTO R 56
   4) Clearly mark the reference line or use pavement lane markings to designate the reference line.

b) Daily control testing procedure
   1) Perform daily control testing each day after performing vertical calibration procedures and prior to performing any quality control testing
   2) Make all measurements in the same direction.
   3) On the first day of DCT for each profiler, perform 5 longitudinal profile measurements of the control section.
      i. These measurements should be made on the first day of QC testing.
      ii. The control section should have an IRI of 120 in/mi or less when possible.
      iii. There must be at least 92% repeatability between the 5 measurements.
      iv. Of the 5 longitudinal profiles performed, determine the median run. This will be the control profile.
   4) On all following days of testing perform 1 longitudinal profile measurement of the control section
      i. Using the certification module in ProVAL, compare the daily results to the control profile.
      ii. The results must pass 90% repeatability.

c) Documentation
   1) Submit electronic files to the Engineer-in-Charge with project results.

   2) Responding to out-of-tolerance measurements

      If daily control testing does not pass 92% repeatability:
i. Have the operator repeat the process as a second attempt. All 5 out-of-tolerance test runs must be replaced by new test runs.

ii. If the repeat measurements pass the daily control testing requirements, ride quality testing may proceed.

iii. If the repeat measurements are out-of-tolerance, the Engineer will notify the Contractor, Regional Materials Engineer and Materials Bureau.

iv. RQ testing can not continue with the equipment until the discrepancy in daily control testing is fixed.

5. SECTIONS TO BE TESTED

Test and report the IRI of all specified roadways except for:

- Sections less than 1320 ft in length.
- Sections within 200 ft of any traffic control device or intersection.
- Tapered section less than a full lane-width.
- Ramps with posted advisory speed less than 45 mph.

6. TESTING PROCEDURE

6.1 Driving lanes that are to be tested should be clear of debris.

6.2 All testing will be completed in the wheel path and in the direction of traffic.

6.3 Test each lane 3 times in accordance with AASHTO R 57 Operating Inertial Profiling Systems.

7. REPORTING

See appendix A for guidance.

7.1 Layout PRQ lots.

7.1.1 Each run should be separated into 528 ft PRQ lots during data processing.

7.1.2 Sections within PRQ lots that contain castings, grates, frames, or other similar objects embedded within the travel lane are to be omitted. Remove data that is obtained 25 ft before and 25 ft after the obstruction. Section leave-outs may be done using the editor tool in ProVAL. Create a section over the area to be removed from the file and change the sections Type to “leave-out”. When the data is processed, ProVAL will exclude the highlighted section from processing.

7.1.3 Leave pavement sections less than 528 ft, located between a PRQ lot and an area not designated for ride quality testing or the end of the contract as an independent PRQ lot.

7.1.4 Sections that are less than 100 ft will only be analyzed for localized roughness.

7.2 Reporting IRI Testing. The Report shall consist of a header and results table. The report shall be given to the engineer as a printout and as a computer file, in spreadsheet form.

7.3 Header shall include:
NYSDOT Materials Bureau Test Method: NY 653-01

- Contract D-number
- Date

7.4 Results Table. Provide a table consisting of columns labeled as shown below and one row for each PRQ lot tested. Report all results in units of in/mi calculated to the nearest 1.0 in/mi.

<table>
<thead>
<tr>
<th>Lane/ Ramp</th>
<th>Direction</th>
<th>PRQ lot #</th>
<th>Begin Station</th>
<th>End Station</th>
<th>Measurement 1</th>
<th>Measurement 2</th>
<th>Measurement 3</th>
<th>Average of Measurements</th>
<th>IRI Quality Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LWP</td>
<td>RWP</td>
<td>LWP</td>
<td>RWP</td>
<td></td>
</tr>
</tbody>
</table>

7.5 Localized Roughness Summary Report. Analyze measurements using the Smoothness Assurance Module within ProVAL. Use the “short continuous” method with the threshold set to 135 in/mi and a 25 ft segment length. Determine the “percent out of spec” using the short continuous histogram for each wheel path. Average the “percent out of spec” for the left and right wheel paths of all three tests; which will be defined as the lane percentage. The lane percentage will be used to calculate the Quality units for localized roughness in each lane.

If testing on a project is done in stages, use a weighted average to determine the lane percentage.

7.6 Results Table. Provide a table consisting of columns labeled as shown below. Provide a row for each lane of test data.

<table>
<thead>
<tr>
<th>Lane</th>
<th>Direction</th>
<th>PRQ lot #’s</th>
<th>Begin Station</th>
<th>End Station</th>
<th>Measurement 1</th>
<th>Measurement 2</th>
<th>Measurement 3</th>
<th>Average Measurement</th>
<th>Localized Quality Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LWP</td>
<td>RWP</td>
<td>LWP</td>
<td>RWP</td>
<td></td>
</tr>
</tbody>
</table>

8. Profile Data. Provide an unfiltered copy of each profile in the electronic format. Name each file using the following format:

“XXXXXX_YYY_Z.ERD”

XXXXXX – Reserve the first six characters for the numerical portion of the contract number.

YYY – Separated from the first six characters by an underscore. Reserve the next three characters for the first lot number represented by the file.

Z – Separated from the previous three characters by an underscore. Reserve the last character for the number of the test (1, 2, or 3) represented by the file.

.ERD – Denotes the proper file format for evaluation.
APPENDIX A
Example of Data reporting

**Example situation**: Data collection has been completed. The result is three .ERD files for a 3,986’ section of pavement that is 1 lane wide. The test section is stationed from 00+00 to 39+86. There is a 150’ bridge (joint to joint) located at station 13+32. The finishing surface is HMA on a limited access highway.

**Step 1: Enter files into ProVAL**

![ProVAL screenshot](image)

**Step 2: Go to the editor window and select the correct .ERD file**
Step 3: using the “Add” tool, add a section. For this example, begin the section at 1307’ and end the section at 1507’. Change the section to “leave-out”. This section accounts for the bridge plus the 25’ at the beginning and end of the bridge as required per this materials method.

Step 4: Go to Smoothness Assurance Module
Step 5: select the file and analyze it

Step 6: Use the Navigate tab to go to the fixed interval table. Use this table to report the IRI’s in each wheel path per PRQ lot. Repeat steps 1 thru 6 for all 3 data sets per PRQ lot.
Step 7: Go to the short continuous Histogram to find the percent out of spec for each wheel path of the file. Repeat this step for all 3 data sets.
Step 8: Complete the reporting tables for both IRI and Localized roughness. Adjust the maximum quality units for PRQ lots less than 528’ in length based on the 425 standard specification. Calculate the total quality units based on 425 standard specifications.

Ride Quality Data Sheets

Date: ____________________________

Dri.: ____________________________

Testing Agency: ____________________________

Operator: ____________________________

Test Vehicle VIN #: ____________________________

<table>
<thead>
<tr>
<th>Lane</th>
<th>Direction</th>
<th>PRQ Lot #</th>
<th>Begin Station</th>
<th>End Station</th>
<th>Length (ft)</th>
<th>Measurement 1</th>
<th>Measurement 2</th>
<th>Measurement 3</th>
<th>Average Measurement</th>
<th>IRI Quality</th>
<th>weighted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Lane</td>
<td>North Bound</td>
<td>1</td>
<td>0</td>
<td>5+28</td>
<td>528</td>
<td>59</td>
<td>59</td>
<td>59</td>
<td>59</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Right Lane</td>
<td>North Bound</td>
<td>2</td>
<td>5+28</td>
<td>10+56</td>
<td>528</td>
<td>69</td>
<td>72</td>
<td>72</td>
<td>70</td>
<td>71</td>
<td>-1</td>
</tr>
<tr>
<td>Right Lane</td>
<td>North Bound</td>
<td>3</td>
<td>10+56</td>
<td>13+07</td>
<td>251</td>
<td>49</td>
<td>46</td>
<td>46</td>
<td>46</td>
<td>52</td>
<td>45</td>
</tr>
<tr>
<td>Right Lane</td>
<td>North Bound</td>
<td>4</td>
<td>13+07</td>
<td>20+35</td>
<td>528</td>
<td>63</td>
<td>57</td>
<td>57</td>
<td>63</td>
<td>60</td>
<td>55</td>
</tr>
<tr>
<td>Right Lane</td>
<td>North Bound</td>
<td>5</td>
<td>20+35</td>
<td>25+63</td>
<td>528</td>
<td>57</td>
<td>64</td>
<td>55</td>
<td>63</td>
<td>60</td>
<td>34</td>
</tr>
<tr>
<td>Right Lane</td>
<td>North Bound</td>
<td>6</td>
<td>25+63</td>
<td>30+91</td>
<td>528</td>
<td>61</td>
<td>59</td>
<td>59</td>
<td>61</td>
<td>58</td>
<td>61</td>
</tr>
<tr>
<td>Right Lane</td>
<td>North Bound</td>
<td>7</td>
<td>30+91</td>
<td>36+19</td>
<td>528</td>
<td>58</td>
<td>44</td>
<td>40</td>
<td>42</td>
<td>61</td>
<td>43</td>
</tr>
<tr>
<td>Right Lane</td>
<td>North Bound</td>
<td>8</td>
<td>36+19</td>
<td>39+86</td>
<td>367</td>
<td>42</td>
<td>50</td>
<td>51</td>
<td>43</td>
<td>53</td>
<td>47</td>
</tr>
</tbody>
</table>

Total = 37

<table>
<thead>
<tr>
<th>Lane</th>
<th>Direction</th>
<th>PRQ Lot #</th>
<th>Begin Station</th>
<th>End Station</th>
<th>Measurement 1</th>
<th>Measurement 2</th>
<th>Measurement 3</th>
<th>Average Measurement</th>
<th>Localized Quality Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Lane</td>
<td>North Bound</td>
<td>1 to 8</td>
<td>0+39+86</td>
<td>1.98%</td>
<td>2.25%</td>
<td>1.75%</td>
<td>2.25%</td>
<td>2.02%</td>
<td>2.35%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Quality Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRI</td>
</tr>
<tr>
<td>Localized</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>