

# Illinois Tollway

## Manual of Modified Test Procedures

Effective Date: 12/18/2023

### Revision History and Documentation Control since 03/03/2023

<b><i>Tollway Testing Procedure</i></b>	<b><i>Summary of Revision</i></b>
TTP 006	Removed with addition of TTP 016/TTF 013
<a href="#">TTP 014</a>	Revision to maturity meter installation procedure
<a href="#">TTP 016</a>	Added new Tollway Test Procedure for Volumetric Mobile Mixer Approval Procedures
<b><i>Tollway Testing Form</i></b>	<b><i>Summary of Revision</i></b>
<a href="#">TTF 002</a>	Various formatting changes
TTF 004	Removed with addition of TTP 016/TTF 013
<a href="#">TTF 013</a>	Added new Tollway Testing Form – Volumetric Mixer Calibration Form

*Tollway Modified Procedures are modifications to the Illinois Department of Transportation (IDOT) Manual of Test Procedures, AASHTO Test Procedures and/or ASTM Test Procedures as specified herein.*

*Tollway Testing Procedures are combinations of Tollway Modified Procedures, IDOT Modified Procedures, AASHTO and/or ASTM Test Procedures as specified herein.*

*Tollway Testing Forms can also be found on the Tollway website at a future date.*

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Illinois Tollway Modified Test Procedure  
Effective Date: 03/14/2019  
Revised Date: 12/1/2020

Standard Method of Test  
for

**Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)**

Reference ITP 324 (Revised 12/1/2020)

*Below are modifications to the Illinois Department of Transportation (IDOT) Manual of Test Procedures*

**Tollway Modified ITP 324**

AASHTO Section	Illinois Tollway Modification
1.2	Revise the last sentence as follows: Alternatively, field cores with a diameter of 150 mm (5.91 in.) may be tested.
6.2.6.2	Replace with the following: <i>Compacting SGC Cylindrical Specimens</i> – Four $62 \pm 2$ mm specimens shall be compacted using a SGC according to IL Modified AASHTO T 312. All samples shall be compacted to 3% above the Mix Design Target Air Voids $\pm 0.5\%$ Air Voids.
7.3	Replace Section 7.3 with the following: Determine the air void content of the specimens in accordance with T 269.
8.6.3	<i>Selecting the number of Wheel Passes</i> – Every test shall be run to 20,000 wheel passes to collect Stripping Inflection Data.
9.2 & 9.3	<i>Calculation</i> – The use of stripping inflection point using the Iowa Department of Transportation Hamburg Wheel Tracking Device Report, Version 2.00 (or greater), or similar, is allowed to calculate stripping inflection point. Sensors are selected according to ITP 324  Below is a link to the Iowa DOT Hamburg Software and description of the calculation:  <a href="http://www.iowadot.gov/Construction_Materials/hma/Hamburg_Software.xlsm">http://www.iowadot.gov/Construction_Materials/hma/Hamburg_Software.xlsm</a>  to determine SIP. The software is developed for machines manufactured by Precision Metal Works and Troxler, where deformation is measured at 11 locations along the track. Contact Tollway Materials when using other machines.  Measurement locations 3 through 9 will be used for analysis for samples. For each measurement location, the deformation curve is characterized by a 6 <sup>th</sup> degree polynomial determined through least-squares multiple regression. If the curve has an

$R^2$  greater than or equal to 90.0%, the creep and stripping slopes are calculated. If not, the sensor is considered invalid and is not used in the analysis.

The SIP, creep slope, and stripping slope are calculated for each valid sensor for each wheel. The final SIP and slopes are the average of both wheels provided both sides of the device contain the same mix. If the ratio between the average stripping slope and the average creep slope is less than 2.0, the SIP is invalid and the mix is considered passing.

*Details:*

*The creep slope represents the rate of rutting in the linear region of the deformation curve prior to the onset of tertiary flow. The stripping slope is the rate of the rutting in the linear region of the post tertiary deformation curve to the end of the test. The stripping inflection point (SIP) is the point of intersection of these two slopes.*

*Stripping Slope:*

*The stripping slope is calculated prior to creep slope. First, the maximum rutting slope (absolute value) nearest the end of the test is found. This is accomplished by using Solver to find the pass number nearest the end of the test (strip pass) as which the first derivative of the deformation curve is smallest (rutting is a negative value). The slope of the curve is then evaluated at this pass number to give the stripping slope. The stripping slope intercept is then found using point slope form. Note: the first derivative is synonymous with slope.*

*Creep Slope:*

*To calculate the creep slope, the pass as which the absolute value of the rutting slope is the smallest prior to the strip pass is first found. This is accomplished first using Solver to find the pass (creep pass) at which the second derivative is zero (prior to the strip pass). The first derivative of the deformation curve is then evaluated at the creep pass, resulting in the creep slope.*

*SIP:*

*The intersection of the creep slope and the stripping slope is found mathematically setting the equations for both lines equal and solving for the pass number.*

Illinois Tollway Modified Test Procedure  
Effective Date: 03/14/2019  
Revised Date:

Standard Method of Test  
for

**Fracture Energy of Asphalt Mixtures Using the Disk-Shaped Compact Tension Geometry**

Reference ASTM D7313-07

*Below are modifications to the ASTM D7313*

**Tollway Modified D7313**

ASTM Section	Illinois Tollway Modification
4.1	Replace the second sentence with the following: The test method is valid for specimens that are tested at $-12^{\circ}\text{C} \pm 1^{\circ}\text{C}$ .
4.1	Replace with the third sentence with the following: The specimen geometry is readily adapted to 150-mm diameter specimens, such as fabricated from Superpave gyratory compactors (Test Method D 6925), that are used for the asphalt concrete design and production process.
4.1	New paragraph: Four specimens are required for a valid test. Average all four test specimens. Discard the specimen that produces the furthest fracture energy result from the average. Average the remaining three specimens to produce the final Fracture Energy result.
6.1	Replace with the following: Test specimens shall be produced or procured according to the following requirements. <u>Cores:</u> <ol style="list-style-type: none"><li>1. Cores shall be sampled from the pavement at the same offset. The edge of the core must be 12" minimum from edge of pavement. Sample two cores for DCT.</li><li>2. <i>Investigative Cores:</i> Sample two additional cores. Two cores shall be tested for Gmb and used in the DCT. And the two additional cores shall be tested for Gmm to determine the in-place air voids, using ASTM D2726.</li><li>3. <i>Production Cores:</i> Use the Gmm from the Design, the day's production, or the five day running average.</li><li>4. If a core is greater than 50mm, cut excess thickness from the top and bottom of the core. If there is only enough room to cut from one edge, cut from the top of the core.</li></ol>

	<p>5. For cores that are less than 50mm, use the correction factor to determine the <math>J/m^2</math> based on the actual thickness. Do not use a core that is less than 50mm thick.</p> <p><u>Production or Design Material:</u></p> <ol style="list-style-type: none"> <li>1. All samples shall be compacted using a gyratory compactor to 3% above the Mix Design Target Air Voids <math>\pm</math> 0.5% Air Voids.</li> <li>2. Two DCT samples shall be cut from the same gyratory specimen.</li> </ol>
6.2	<p>Add the following:</p> <p>Test specimens shall be fabricated in accordance with the dimensions shown in Fig. 3.</p>
7.1	<p>Replace with the following:</p> <p><i>Conditioning</i> – The specimens shall be placed in a standard freezer for a minimum of 8 hours and a maximum of 12 hours at a temperature within <math>-12^{\circ}\text{C} \pm 5^{\circ}\text{C}</math>. After the initial conditioning, the specimen shall be placed into the DCT chamber for 1.5 hours <math>\pm</math> 0.5 hours at the standard testing temperature of <math>-12^{\circ}\text{C}</math>.</p>



Illinois Tollway Modified Test Procedure  
 Effective Date: 03/14/2019  
 Revised Date:

Standard Method of Test  
 for

**Automated Extraction of Asphalt Binder**

Reference ASTM D8159-18

*Below are modifications to the ASTM D8159*

**Tollway Modified D8159**

ASTM Section	Illinois Tollway Modification
3.1	Replace the first sentence with the following: The asphalt paving mixture is extracted using the automated extraction equipment, using only trichloroethylene (TCE).
6.2.1	Remove section allowing the use of Tetrachloroethylene
6.2.3	Remove the section allowing the use of Methylene Chloride
5.2	Replace the second sentence with the following: The cylindrical wall is made of mesh having an aperture of 0.075mm.
8.7	Add the following paragraphs:  The number of wash cycles will be determined by extracting a calibration sample. Document the number of wash cycles until the solution is straw colored and no visible AC left on the aggregates.  The number of dry cycles will be determined by testing a calibration sample. Document the number of dry cycles until the sample is at a constant weight (no further drying will cause less than 0.1% mass loss).
8.9.2	Add the following sentence after the first sentence: Brush any remaining aggregate from the washing chamber into the filler cup.
9.1	Add the following paragraph: The Tollway will allow a 0.5% increase in total P200 to stay consistent with the IDOT District 1 policy.
9.3	Add the following: Record and calculate M1-M9 values to the nearest 0.1g. Calculate the percent asphalt content to the nearest 0.1%.

Illinois Tollway Modified Test Procedure  
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Standard Method of Test  
 for

**Non-Nuclear Pavement Density**

Reference ASTM D7113-10

*Below are modifications to the ASTM D7113*

**Tollway Modified D7113**

ASTM Section	Illinois Tollway Modification
6.4	<p>Replace Section 6.4 with the following:            Follow the IL Department of Transportation’s <i>Procedure for Correlating Gauge Density with Core Densities</i>.</p> <p>NOTE: Replace all “Nuclear” references to “Nuclear or Non-Nuclear.”</p>
6.4.1 – 6.4.6	Remove sections 6.4.1 through 6.4.6
7.3	<p>Replace Section 7.3 with the following:            Select a test location, using the IL Dept of Trans "Hot-Mix Asphalt QC/QA Procedure for Determining Random Density Locations". Each random density test site location shall consist of five equally spaced density offsets across the mat. These density offsets shall be positioned to provide a diagonal configuration across the mat. The outer density offsets shall be located at a distance equal to the lift thickness or a minimum of 2 in. (50 mm), from the edge of the mat, whichever is greater.</p> <ul style="list-style-type: none"> <li>• If the edge is unconfined, an “individual test result” shall represent the average of three “density readings” spaced 10 feet apart longitudinally along the unconfined edge.</li> <li>• If the edge is confined, the density reading will be averaged with the remaining offset “density readings” to provide an “individual test result” representing everything except unconfined edges.</li> </ul> <p><b>Density Test Location:</b> The random station location used for density testing.  <b>Density Reading:</b> A single density reading.</p>

**Individual Test Result:** An individual test result is the average of three to five density readings obtained at each random density test location.

One to three “individual test results” will be required per “density test location” depending on the following conditions:

- If two confined edges are present, one “individual test” result representing all five density readings across the mat shall be reported. (Confined edge density readings are included in the average.) Any edge over LJS will be considered a confined edge.
- If one confined and one unconfined edge is present, two “individual test results” shall be reported for each density test location.
  - One “individual test result” representing the average of four density readings across the mat, including the one confined edge and excluding the unconfined edge density readings.
  - One “individual test result” representing the average of three density readings on the unconfined edge.
- If two unconfined edges are present, three “individual test” results shall be reported for each density test location.
  - One “individual test result” representing the average of three density readings across the mat, excluding the unconfined edge density readings.
  - One “individual test result” representing the average of three density readings on the unconfined edge.
  - One “individual test result” representing the average of three density readings on the opposite unconfined edge.

Illinois Tollway Testing Procedure

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Standard Method of Test  
for

**Recovered Asphalt Binders**

Reference Tollway Modified ASTM D8159

Reference ASTM D5404

Reference AASHTO M-320

Reference AASTHO D7643

*Below are modifications to the above-mentioned test procedures*

**Illinois Tollway Test Procedure (TTP) 001 – Recovered Asphalt Binders**

Section:	Illinois Tollway Modification
ASTM D8159-18	Standard Test Method for Automated Extraction of Asphalt Binder from Asphalt Mixtures
	Follow the Tollway Modified D8159 procedure
	Extract enough HMA material to produce 650 grams of condensed (binder and TCE solution) liquid
ASTM D5404-12	Standard Practice for Recovery of Asphalt from Solution Using the Rotary Evaporator
8.1	Replace with the following: The sample shall be extracted in accordance with Test Method D8159-18. Recovery shall be conducted immediately after the extraction process is completed. Total time from beginning of extraction to end of recovery shall not exceed 8 hours.
9.4	Add the following sentence in between the first and second sentence: Increase oil bath temperature to 155°C and hold for 10 ± 1 minute to allow for temperature to increase.
9.5	Replace the third sentence with the following: Invert the flask and place in an oven at 165 ± 5°C for 10 to 15 min to cause the asphalt to flow into the container.
AASHTO M320-10	Performance-Graded Asphalt Binder
7.	Add the following sentences: Test at both pass and fail temperatures to allow for continuous grading.

	<p>Recovered asphalt material shall be treated as RTFO-conditioned asphalt binder at the end of the recovery process. Do not run RTFO on binder used for PG determination.</p> <p>Exclude all testing on Original Binder.</p> <p>Determine if excess residual solvent is present in recovered binder by conducting Mass Change (T 240) on recovered binder (no lab aging). Binder used in Mass Loss determination shall be discarded after test and not used for PG determination. Mass change of recovered binder shall not exceed 1.0%. If Mass Change exceeds 1.0%, discard sample and restart extraction process.</p> <p>RTFO DSR procedure shall be run on recovered binder (no lab aging) to determine High Temperature PG. The High Temperature PG will be based solely on RTFO DSR result.</p> <p>PAV aged material shall be prepared per AASHTO R28 except recovered binder shall be used in place of RTFO-aged binder.</p> <p>Exclude Direct Tension (T 314).</p>
AASHTO D7643	Standard Practice for Determining the Continuous Grading Temperatures and Continuous Grades for PG Graded Asphalt Binders
	Use this procedure to report the binder grade of the recovered binder sample.
Calculation	Delta Tc
	Material used for Delta Tc testing shall be PAV-conditioned (20 hr) per AASHTO R28.
	Ensure the Bending Beam Rheometer (BBR) testing was conducted (per AASHTO T313 & M320) at a passing <u>and</u> failing temperature per AASHTO R29.
	Ensure the continuous PG grade was determined (per ASTM D7643) for the Stiffness and m-value components of the BBR individually.
	Delta Tc is the calculated difference of the Stiffness continuous grade (Stiffness Tc) and the m-value continuous grade (m-value Tc) as follows.
	Delta Tc= (Stiffness Tc) – (m-value Tc)
Reporting	
	<p>Continuous PG</p> <p>Delta Tc</p> <p>AASHTO T240 Mass Change (per modified method described above)</p>

Illinois Tollway Testing Procedure  
Effective Date: 03/14/2019  
Revised Date:

Standard Method of Test  
for

**Fine Aggregate Angularity of Fractionated Reclaimed Asphalt Pavement (FRAP)  
(Uncompacted Void Content of Fine Aggregate)**

Reference Tollway Modified ASTM D8159  
Reference ITP 164

*Below are modifications to the above-mentioned test procedures*

**Illinois Tollway Test Procedure (TTP) 002**

Procedure	Illinois Tollway Modification
ASTM D8159	Standard Test Method for Automated Extraction of Asphalt Binder from Asphalt Mixtures
	Follow the Tollway Modified D8159 procedure
	Extract enough HMA material to produce the proportioned aggregate for the Uncompacted Void Content – Method B procedure below
AASTHO T 304-17	Standard Method of Test for Uncompacted Void Content of Fine Aggregate
1.2.1	Require Method A and all references to it
1.2.2	Remove (Method B) section, and all references to it
1.2.3	Remove (Method C) section, and all references to it

Illinois Tollway Testing Procedure  
 Effective Date: 03/14/2019  
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Standard Method of Test  
 for

**Porous Granular Embankment (PGE)**

Illinois Test Procedure 2 – Sampling of Aggregate  
 Illinois Test Procedure 11 – Materials Finer Than 75-µm  
 Illinois Test Procedure 27 – Sieve Analysis of Fine and Coarse Aggregate

*Below are modifications to the above-mentioned test procedures*

**Illinois Tollway Test Procedure (TTP) 003**

Procedure	Illinois Tollway Modification
Illinois Test Procedure 2	Sampling of Aggregates
5.1	Remove section (use of a Template)
5.2	Remove section (use of a sampling device to cut the flow of stream)
5.3	Replace with the following: <i>Shovel:</i> The shovel shall be pointed, greater than 5” wide and have a 1.5” side and back wall.
6.3	Replace with the following: <i>Sampling Procedure:</i> Sampling shall be accomplished by Mini-Pile. The QC technician shall have a 3 or 5 day Aggregate Technician certification. The certified technician shall collect all samples; preferably QC.
6.3.1-6.33	Replace with the following: <i>Mini-Pile:</i> <ul style="list-style-type: none"> <li>• Minimum of 3 representative buckets from an end loader or comparable amount of material using an excavator</li> <li>• Mix pile to the satisfaction of the Material Coordinator</li> <li>• Collect all aggregate from at least 3 different locations horizontally and vertically from test pile</li> <li>• QC and QA (and IA if start-up or investigatory sample) will take one (1) five (5) gallon bucket from each location to ensure that both parties receive a representative and comparable sample from the mini stockpile</li> </ul>
6.41	Replace with the following: <i>Sample Size:</i> <ul style="list-style-type: none"> <li>• 110 lbs minimum</li> </ul>

	<ul style="list-style-type: none"> <li>• Three (3), five-gallon buckets</li> <li>• For safety; do not overload buckets</li> <li>• Distribute collection area evenly to ensure a representative sample is collected</li> </ul>
7-9.1	Remove sections
Illinois Test Procedure 11	Materials Finer Than 75- $\mu$ m (No.200) Sieve In Mineral Aggregates By Washing
3.1	Add the following: The top half (retained on 3/8" sieve) does not have to be washed.
6.2	Add the following: A minimum dry sample mass of 1500.0 grams passing the 3/8" sieve is required.
9.1	Add the following: Document the amount of RAP and other deleterious material if the material is produced using a stationary crushing plant.
Illinois Test Procedure 27	Sieve Analysis of Fine and Coarse Aggregate
6.2	Add the following to <i>Sieves</i> : The testing lab must have a 5" sieve Remove the first line of the second paragraph
6.3	Add the following to <i>Mechanical Shaker</i> : The testing lab must have a Gilson (or approved equivalent) Shaker capable of testing up to 5" material
7.2	Add the following: The 3/8" sieve is the separation between the coarse and the fine aggregate
8.2	Replace the first sentence with the following: A nested set of sieves (8-inch, 12-inch or large Gilson) shall be gathered and stacked.
10.5	Add the following: Upload test reports into E-Builder (or I-MIRS if applicable) within 72 hours of sampling.
11.1	Replace with the following. QC/QA comparisons for PGE shall have the following tolerances. <ul style="list-style-type: none"> <li>• 8", 6", 5", 4", and 2" sieves: 10%</li> <li>• #4 sieve: 5%</li> <li>• #200 sieve: 3%</li> </ul>



Illinois Tollway Testing Procedure  
Effective Date: 03/14/2019  
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Standard Method of Test  
For

**ProVAL Protocol for Bridge Section Smoothness Calculation**

**Illinois Tollway Test Procedure (TTP) 004**

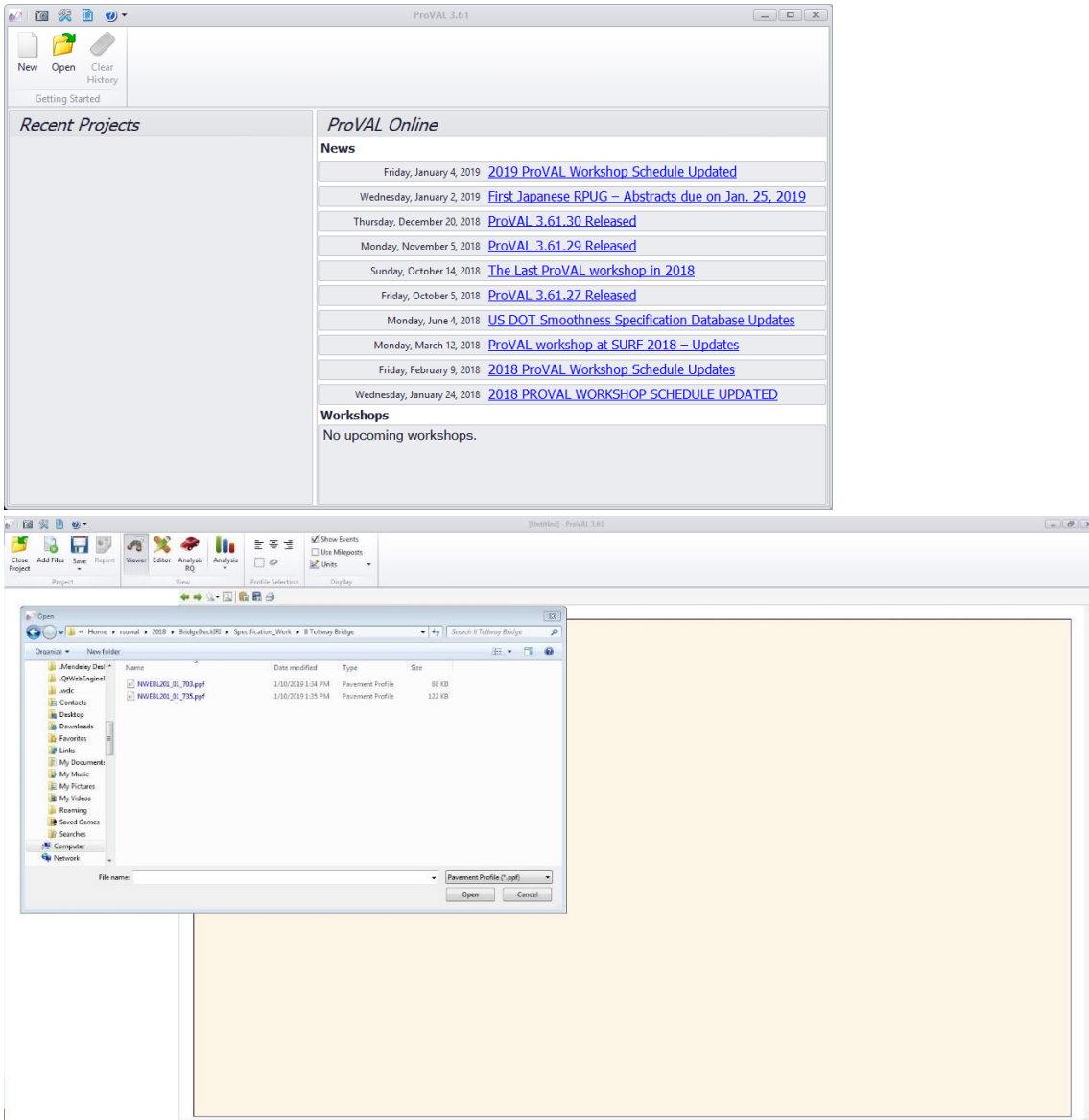
1. **Scope.** This testing procedure provides guidelines and procedures for the use of ProVAL software for measuring and evaluating IRI-based bridge sections.
2. **Acquiring Software.** ProVAL (Profile Viewing and Analysis) software is a computer program originally developed by the Federal Highway Administration that is currently maintained by a Transportation Pooled Fund Program. The software provides users the ability to view and analyze roadway pavement and bridge profiles.

The software can be downloaded by following the links from the FHWA at  
<https://www.fhwa.dot.gov/pavement/proval/>

or from the ProVAL site at  
<http://www.roadprofile.com/>

There is no cost for the software

3. **Cropping an inertial profile trace with ProVAL.** This section defines how to crop a road profile before analyzing the profiles for localized IRI roughness for each wheel path and for the overall bridge section.
  - 3.1. Install ProVAL version 3.61 or later and open.

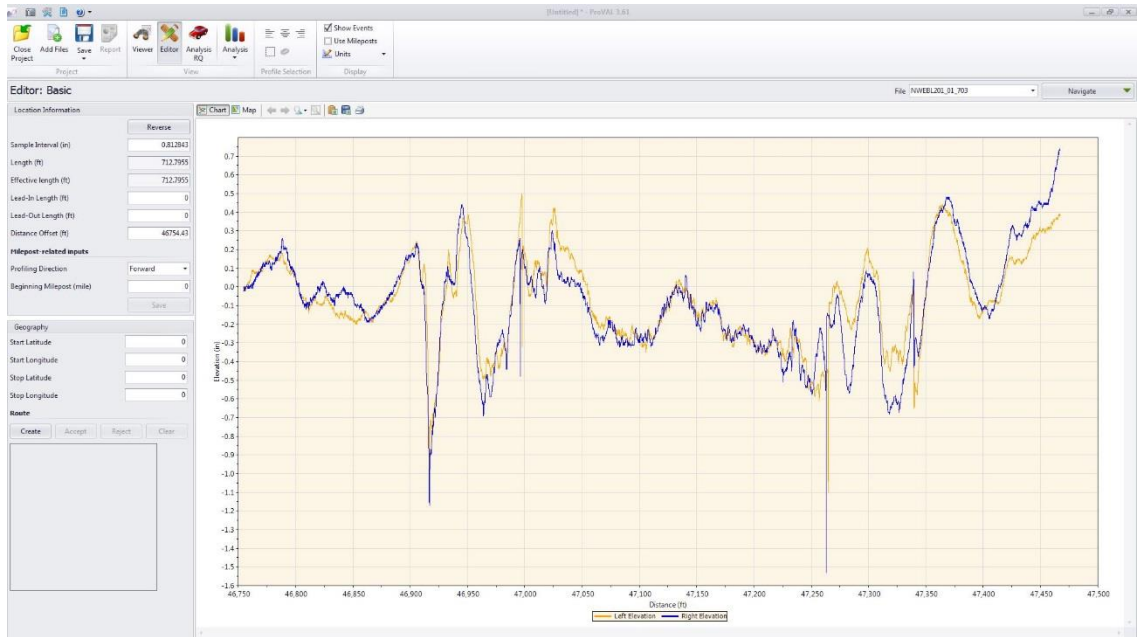


3.2. Open ProVAL compatible profile(s) by clicking on the New button and then clicking on the Add Files button and selecting profile file(s) to load.

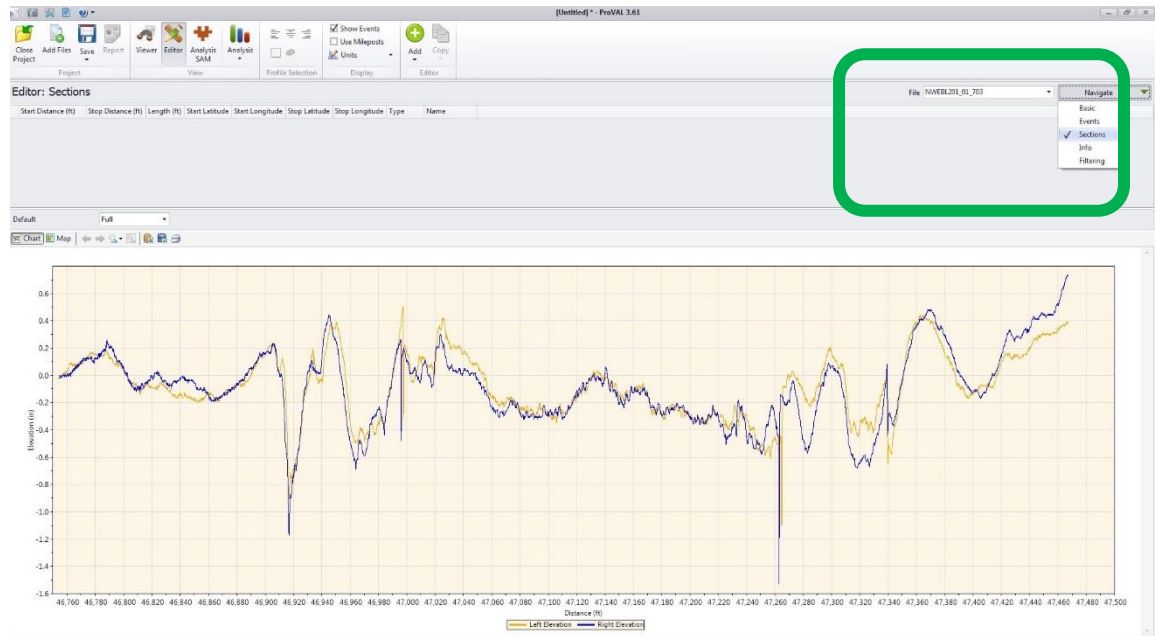
Sections 3.3 through 3.9 use an example profile to help with instruction on how to crop the data. For this example the following are values are used:

- Approach Slab = 30 feet (on each end)
  - Transition Approach Slab = 79 feet
  - Transition Leave Slab = 75 feet
  - Included Pavement = 25 feet (on each end)
- } Verify actual distances on the plans

3.3. Open road profile in ProVAL by selecting the editor button and then selecting the file in the file drop down box.



Click on the Navigate drop down box and select Sections.



- 3.4. There is a bridge in the above profile trace. Zoom in to find the bridge. Find the general distance location for the bridge when collecting the profile. For this example, it is between 46,760 and 47,460 ft. Even if manual or automatic event marks are entered in the profile at various anchor points of the bridge section at the time of profile collection, these must be visually verified by zooming in on the profile as shown below.



Zoom in to find the entry to the bridge section. See zoom below. Use event marks for such features when collecting the profiles. It might be easier to locate either start of bridge deck or start of approach slab. In this example, start of approach slab is easier to locate.

### Entry

Zoom in on the Bridge Approach slab entry joint. For this example, it is 46,996 ft. Approach slab is 30 ft long. Hence, start of bridge deck is at 47,026 ft.



### Exit

Zoom in on the other end of the Bridge Leave slab joint. For this example it is 47,265 ft. Leave slab is 30 ft long. Hence, end of bridge deck is at 47,235 ft.



3.5. Locate the two ends of the bridge section.

Generally, tollway bridge transitions are 70 feet long, however, due to skew the length of approaches can vary. In this example, the approach slab is 79 feet long and leave slab is 75 feet long and the specification includes 25 feet of pavement. Therefore, the start and stop crop distances are:

Beginning of bridge section is 47,026 ft (location of deck start)

$$- 30 \text{ ft approach} - 79 \text{ ft transition} - 25 \text{ ft of pavement} \\ = \underline{46,892 \text{ ft.}}$$

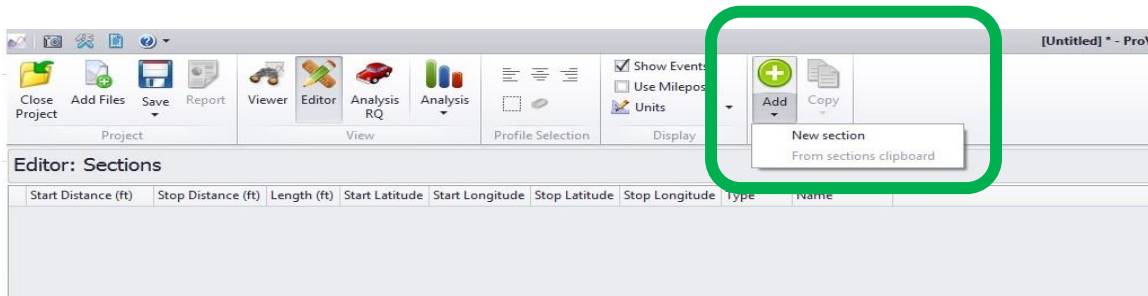
Ending bridge section is 47,235 ft (location of deck end)

$$+ 30 \text{ ft approach} + 75 \text{ ft transition} + 25 \text{ ft of pavement} = \\ \underline{47,365 \text{ ft.}}$$

Use these two values as cropping points.

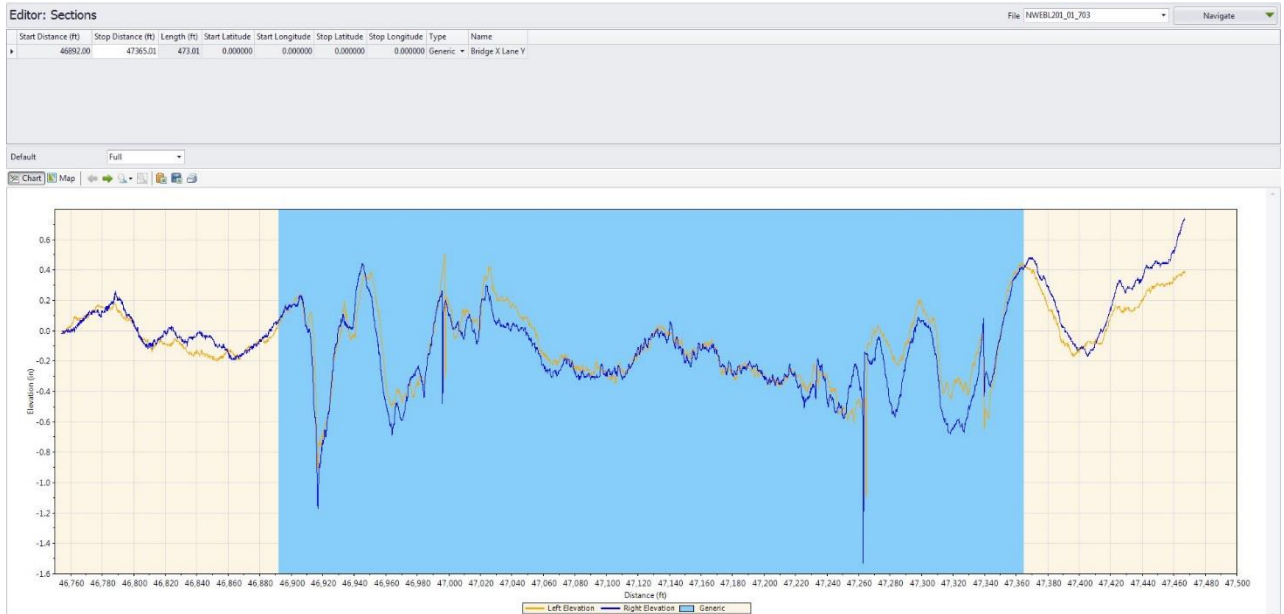
*NOTE: If the bridge section is built on a skew, determine the start profile distance based on the wheel path which first hits the bounds of the bridge section and the end profile distance based on the opposite wheel path which last falls within the bridge section.*

3.6. Click on the Add Section selection at the right end of the ribbon bar at the top of the screen, and select New section. Type in the desired cropped section name, "Bridge X Lane Y."

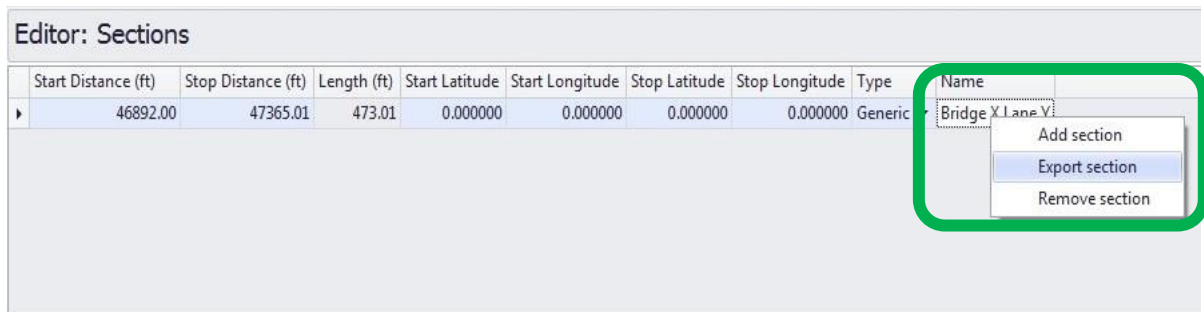


3.7. Now crop the profile for this specific lane of this specific bridge section. The cropped section will be from 11.5 ft to 601 ft as determined in Section 3.5.

Enter 46,892 for the Start Distance and then 47,365 for Stop Distance as show below.



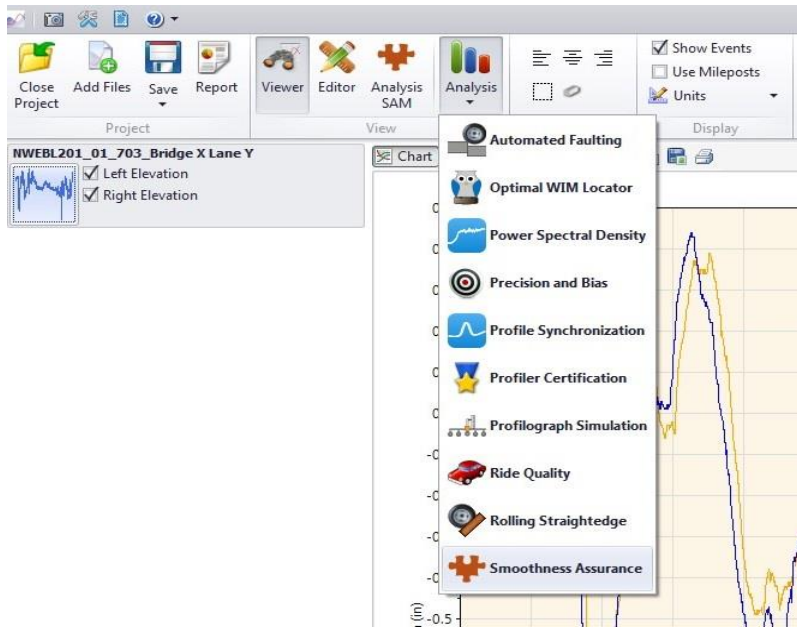
3.8. To save the section as its own unique cropped profile, right click and select the Export Section button at the right end of the ribbon bar. The cropped file will be saved on original file location.



3.9. Load the cropped bridge section profile by clicking on the Add Files button in the top ribbon bar and selecting the required file.

#### 4. Using ProVAL to calculate IRI – Prior to grinding (if needed)

- 4.1. Open the cropped road profile in ProVAL (from section 3).
- 4.2. Select Smoothness Assurance from the Analysis drop down box in the ribbon bar.



4.3. Enter the appropriate values for the Smoothness Assurance: Inputs screen:

- Select IRI for Ride Quality Index
- Short Continuous Segment Length will be 25 with a Threshold of 200
- Long Continuous Segment Length will be equal and set to the bridge section length. (In this example it is 473 ft.)
- Fixed Interval Segment Length will be set at the bridge section length.
- Profile will be selected from the Comparison Type drop down box.
- None will be selected from the Comparison Filter options.

### Smoothness Assurance

Ride Quality

Ride Quality Index IRI

Analysis	Segment Length (ft)	Threshold (in/mi)	Histogram
Short Continuous	25	200	<a href="#">Histogram</a>
Long Continuous	473	100	<a href="#">Histogram</a>
Fixed Interval	473	100	

Comparison

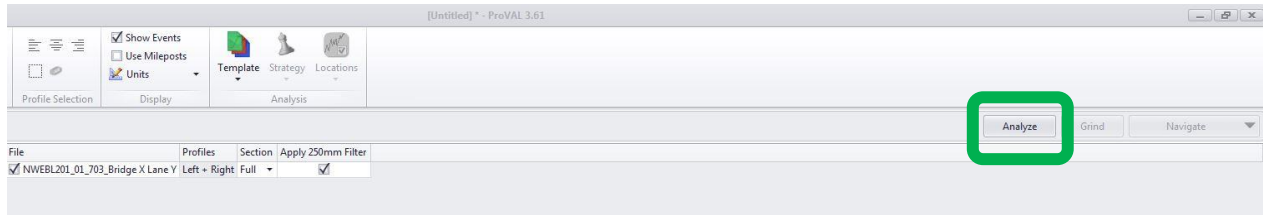
Type Profile

Straightedge Length (ft) 10.00

Filter [None](#)

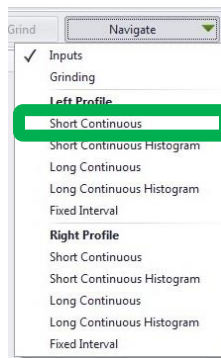


4.4. Ensure that the correct file is selected and select Apply 250mm Filter and then hit the Analyze button.



If the “Analyze” button is grayed out, double check the Segment Length, as it cannot be rounded up.

4.5. Select Short Continuous from the Navigate drop down box at the upper right hand corner of the screen to evaluate localized roughness for left and right profile.



The results will look like the examples as below for left and right profile respectively:



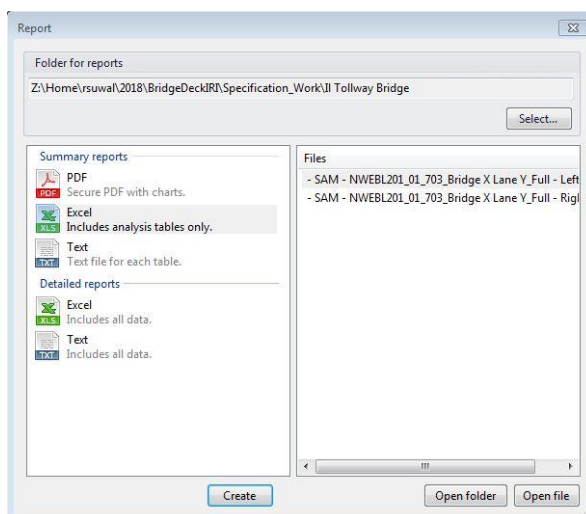




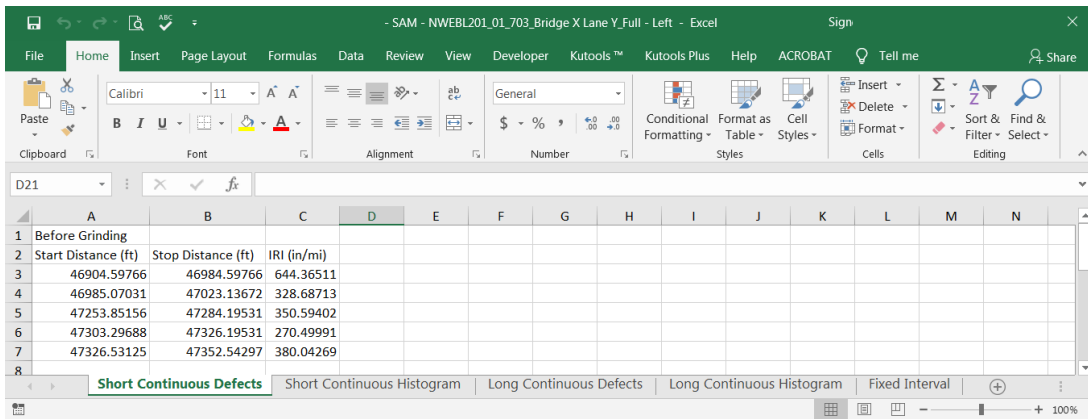
The table at the left lists all the locations that exceed the threshold of 200 inches/mile in 25 ft. The upper chart on the right graphically displays the same. The lower graph on the right shows the inertial road profile for the bridge section. The two graphs show what feature(s) in the profile caused any areas to exceed the localized roughness threshold. In above examples, both left and right wheel path have localized violations.

Export the localized violation results to Excel using following procedure:

- Select the Report Tab.
- Enter the destination folder location where you want to save the data on Folder for reports section.
- Select Excel from Summary reports menu and click Create button as shown below.
- Save the Excel file with the appropriate name (i.e. Bridge X Lane Y - SAM) on destination folder location.



The Excel file will look similar to the example below.



This is the “Before Grinding” IRI detail.

4.6. Once any needed grinding is completed, a Short Continuous IRI PDF is needed for submittal of final data.

- Follow through step 4.5 above, select PDF from Summary reports menu and click Create button as shown below.
- Save the PDF file with the appropriate name (i.e. Bridge X Lane Y - SAM) on destination folder location.

5. Using ProVAL to calculate MRI – Prior to grinding (if needed)

5.1. Continuing from Step 4.5 above, select Long Continuous from the Navigate drop down box at the upper right hand corner of the screen to evaluate the overall bridge section roughness for left and right profile separately. The results will look similar to the examples as below for left and right profile respectively:





In above examples for left and right profile, there is overall violation for both left and right profile (circled in green). To get the exact value of the overall IRI for this wheel path of the bridge section, zoom in (by dragging the cursor to create a dashed box around the violation) on the upper graph and find the value at the center of the bridge section as shown in figures below.



In above examples for left and right profile, the center of the bridge section is at 47,128.5 ft. The corresponding value is 201.9 inches per mile for left profile and 210.4 inches per mile for right profile (the exact IRI is listed when the cursor is placed on the deviation).

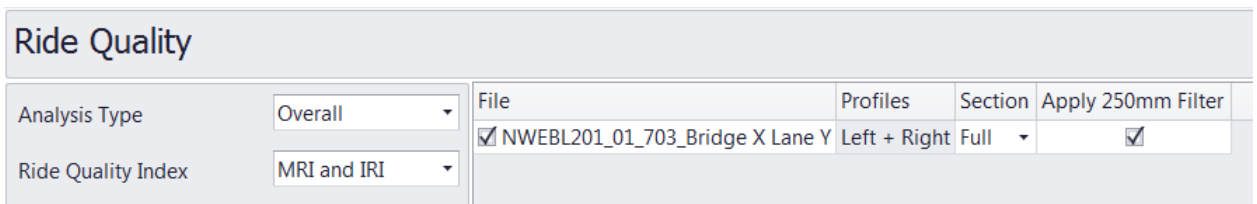
**6. Using ProVAL to calculate MRI and prepare final report – after completion of any needed grinding**

6.1. Continuing from Step 4.5 above, select Long Continuous from the Navigate drop down box Overall IRI and MRI value can be calculated using the following procedure also:

- Open the cropped road profile in ProVAL (from section 3).
- Select Analysis tab and select Ride Quality.
- Select the required file and ensure Apply 250 mm Filter is selected.
- Select the required file and ensure Apply 250 mm Filter is selected.
  - Select Analysis Type as Overall
  - Select Ride Quality Index as MRI and IRI
- Click on Analyze button on the right hand side as shown below.



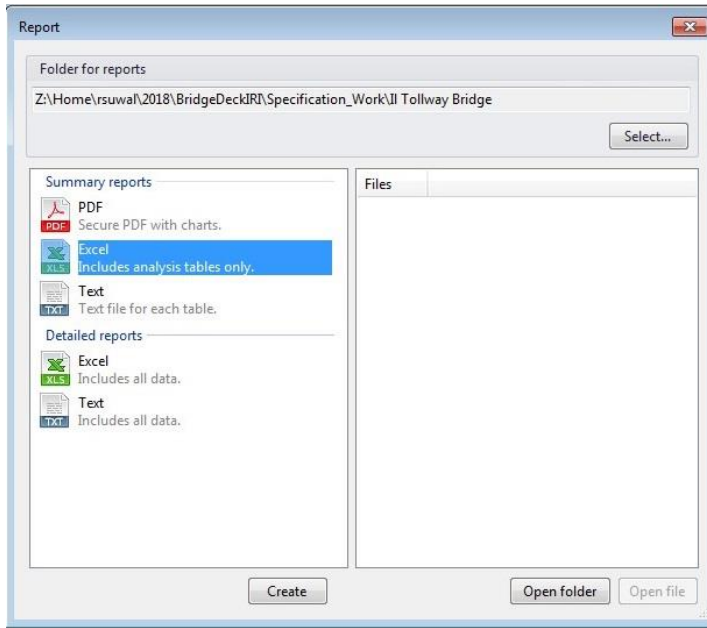
6.2. The ProVAL results should look like this:



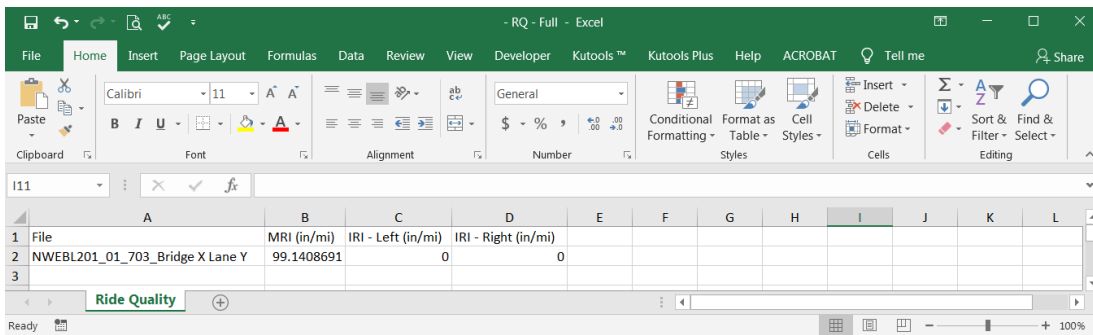
*NOTE: MRI (Mean IRI) is the overall requirement. Overall IRI values for each wheel path and MRI are shown automatically. Review the MRI value. If any bridge is above 100 in/mile, then correction is required.*

6.3. Export the Ride Quality results to Excel.

- Select the Report Tab.
- Enter the destination folder location where you want to save the data on Folder for reports section.
- Select Excel from Summary reports menu and click Create button.
- Save the Excel file with the appropriate name (i.e. Bridge X Lane Y) on destination folder location.



The Excel file will look similar to the example below.



6.4. This analysis needs to be conducted for each lane profiled. The data for each profiled lane is entered into the Tollway Profile Report for Bridge Section Smoothness.

File Name	Direction	Lane	Bridge Section Length	Start Distance (ft)	Stop Distance (ft)	MRI (in/mi)
NWEBL2001_01_703_Bridge X Lane 1	NB	1	473	46,892	47,365	99

Illinois Tollway Testing Procedure  
Effective Date: 03/14/2019  
Revised Date: 07/07/2020

Standard Method of Test  
For

**Asphalt Mixtures Design Verification Procedure**

**Illinois Tollway Test Procedure (TTP) 005**

1. **Scope.** This testing procedure provides guidelines and procedures for the verification of Contractors' asphalt mixture designs for use on Tollway contracts. All designs must meet the criteria in the Tollway Asphalt Mixtures Special Provision.

The Illinois Tollway will permit contractors to submit an annual request for an approved WMA mix design to be recertified. Existing WMA mix designs will be eligible for an annual recertification except for mainline SMA and IL-4.75 mix designs. The request for recertification, along with the information described below, must be received by the Illinois Tollway not later than January 15 of the recertification year. (See Section 4 of this TTP for more details)

IDOT verified mix designs will be accepted as long as they meet the requirements of this special provision. If the contractor requests to use an IDOT verified mix design and intends to add a warm mix chemical additive for use on the Tollway, the contractor must provide test results of a 1-point at optimum AC using the additive, showing compliant volumetrics, SIP, Hamburg and DCT.

For all non-IDOT approved mix designs, the Tollway Mix Design Verification Process will follow the procedure herein.

2. **Required Design Data/Material Samples.** The Contractor shall provide an asphalt mixtures design prepared by a Hot-Mix Asphalt Level III Technician in accordance with IDOT's "Hot-Mix Asphalt Design Procedure" in the current *Hot-Mix Asphalt Level III Technician Course* manual. All testing shall be performed by Hot-Mix Asphalt Level I Technicians or higher. The asphalt mixture design shall be submitted with the following design data:

- 2.1. **Design Data.** The material name, materials code number, source name, source Producer/Supplier Number, and source location shall be provided for all materials used in the asphalt mixtures design.
- 2.2. **Material Samples.** The contractor shall provide the average mix plant stockpile gradations and aggregate blend percentages used to design the mix. Each of the individual aggregate gradations used in the Contractor design shall be an average of a minimum of 5 (five) stockpile gradations from existing stockpiles at the plant. Adjusted average aggregate source gradations (stockpile gradations preferred) may be substituted if aggregate has not

been shipped to the mix plant. The adjustment shall be based on the amount of aggregate degradation during shipment to, and handling at, the mix plant. A design using gradation information not comparing to mix plant or aggregate source gradations shall be considered unacceptable.

Any aggregate sources, including RAP, FRAP or RAS shall be IDOT approved. If the contractor proposes a non-IDOT-approved source, testing and acceptance procedures must be reviewed and approved by Tollway Materials.

**2.3. Required Design Data.** The Contractor shall provide a summary of design test data and optimum design data utilizing a design package with the same output format as CARE-AC. Paperwork will be submitted in a packet in the following order.

- 1) Bituminous Mixture Design summary signed and dated by Level III
- 2) The four point Gmm and Gmb data worksheet summary
- 3) Batching worksheet
- 4) Height sheets of all four points and verification point of the compacted samples
- 5) Dust correction factor worksheet
- 6) TSR individual briquettes worksheet and supporting data (if applicable)
- 7) Power 45 gradation graph
- 8) AC vs. Voids (total mix) graph
- 9) AC vs. VFA (voids filled) graph
- 10) AC vs. VMA graph
- 11) AC vs. Specific Gravities (Gmm and Gmb) graph
- 12) Supporting documentation for representative aggregate, RAS, and FRAP gradations
- 13) Contractor results from ignition oven calibrations, if a different laboratory is being used for mix design purposes, the oven calibrations shall be submitted as soon as possible, before performing a test strip on the mix.
- 14) Hamburg (Tollway Modified AASHTO T314) and SIP Calculation
- 15) WMA Technology and additive information and dosage (if applicable)
- 16) DCT (Tollway Modified ASTM D7313)
- 17) Micro Deval (ASTM D6928 or AASHTO T327) if applicable

**3. Tollway Verification.** The Tollway will verify mix designs using either Method A or Method B.

**3.1. Method A.** Tollway verification for asphalt mixture designs will include a review of all the mix design data (including all aggregate field gradations) submitted by the Contractor.

The mix design must be prepared in an AASHTO Re:Source Accredited laboratory, and signed by a Professional Engineer. Upon submittal, the Tollway shall review of all mix design paperwork for compliance.

The AASTHO Re:Source laboratory creating the mix design and/or testing the performance samples, must be accredited in AASHTO T164, T166, T209, and T312. To complete all the mix design testing requirements, it is acceptable to have tests run in more than one AASHTO Re:Source accredited laboratory.

All design data shall be submitted to the Tollway a minimum of 7 calendar days for Method A, prior to production.

3.2. **Method B.** If the Asphalt Mix Design was prepared by a non-AASHTO Re:Source accredited laboratory, the Tollway verification will include a review of all mix design data submitted, in addition to the following testing:

- 1) Gse
- 2) Gmb
- 3) Gmm
- 4) Air Voids
- 5) Gradation
- 6) AC Content
- 7) Hamburg, including SIP (Tollway Modified AASHTO T314)
- 8) DCT (Tollway Modified ASTM D7313)

All design data and material samples shall be submitted to the Tollway a minimum of 14 calendar days for Method B, prior to production.

The Contractor shall provide samples of blended aggregate, asphalt binder, and additives which represent the materials in the mix design. The representative samples shall be identified and submitted as follows:

- A. Aggregate, FRAP and RAS – Aggregate, FRAP and RAS shall be dried, split into the individual sizes for the Batching Worksheet as stated in the current *Hot-Mix Asphalt Level III Technician Course* manual, and then blended to the chosen gradation. FRAP and RAS shall be kept separate from the Aggregate. The total amount submitted shall be enough to comprise two (2) 12,000-gram samples of dry aggregate, FRAP and RAS. All material shall be bagged in plastic bags or other airtight containers. Each container shall be identified with the source names, source locations, source Producer/Supplier Numbers, material codes, sample location, and sample date.
- B. Asphalt Binder – A minimum of 1 gallon. Identified with source name, source location, source Producer/Supplier Number, material code, sample location, and sample date.
- C. Approved Additive(s) – The same approved additive(s) as used in the Contractor’s design, identified by the additive source name, source location, brand name or number, material code, sample location, sample date, additive MSDS, the manufacturer’s recommended dosage rate, and the rate used in the design if different than the manufacturer’s dosage rate. NOTE: Prior to submitting the additive(s), the Contractor shall contact the Tollway for the required sample size.
- D. Mixed/Compacted Samples – If the Hamburg or DCT testing was performed in an AASHTO Re:Source Accredited Lab, submitted samples (b. and c. below respectively) are not required.
  - a. Two (2) 1,400 g mixed loose samples
  - b. Two (2) 115mm bricks compacted at optimum AC and Design Air Voids
  - c. Two (2) 63mm bricks compacted at optimum AC and 3% above the Mix Design Target Air Voids  $\pm$  0.5% Air Voids
  - d. Two (2) 150mm bricks compacted at optimum AC and 3% above the Mix Design Target Air Voids  $\pm$  0.5% Air Voids



- e. One (1) 2,000 g mixed loose sample

The Contractor shall certify in writing that all materials submitted for mix design verification meet the Tollway requirements and represent the materials to be used during mix design.

3.3. **Verification Tolerance.** The Contractor asphalt mixture design and Tollway verification testing shall meet the mix design criteria in the Tollway Asphalt Mixtures Special Provision and any other Special Provisions in the Contract, and the following tolerances (where applicable):

Volumetric Testing	Tolerance
Gse (effective SG of combined aggregates)	± 0.014
Gmb	± 0.020
Gmm	± 0.014
Air Voids	± 0.5%

Gradation	Tolerance
12.5mm (1/2 in)	± 3.0
4.75mm (No. 4)	± 2.0
2.36mm (No. 8)	± 2.0
600 µm (No. 30)	± 1.0
75 µm (No. 200)	± 0.5
Pb (Asphalt Binder Content)	± 0.15

Performance	Tolerance
SIP (SIP @ # of Passes)	Above Minimum
Hamburg (Failure @ # of Passes)	Below Maximum
DCT	Above Minimum

All aggregate field gradations submitted by the Contractor will be compared to previous mix plant and/or Aggregate Gradation Control System gradations.

3.4. **Timeline.** The Tollway will notify the Contractor in writing within the required time frame for Method A or B. If the verification fails, the time for the Tollway to notify the Contractor starts over. Acceptable designs may be used in Tollway contracts, provided the design is reproducible in the mix plant.

4. **Annual Recertification.** To be eligible for recertification, the mix design must have been used in the last calendar year. The contractor must demonstrate that the mix design performed well during production and construction (as described below), and that mix properties have not varied from the original mix design. At a minimum, the contractor must provide the following documentation:

- Approval letter(s) for the original mix design and subsequent recertifications
- Affirmation of no material source changes (aggregate, asphalt binder, modifier, WMA technology, or recycled products), and that the mix design meets the most recent Tollway Asphalt Mixtures SP.
- QC/QA records for the last construction season, including:
  - Control charts showing test results and individual & running average tolerances for Air Voids, Gmm, Gmb, Field VMA, field density, asphalt content and gradation.
  - Explanation of any corrective action taken when mix test results triggered resampling and testing.
  - Design and production test results annually for Hamburg and DCT.
  - Aggregate stockpile gradations, and recycled product stockpile test results per the Reclaimed Asphalt Materials (RAM) SP.
  - A cover sheet with the current mix proportions and aggregate specific gravities.
  - When compared to the original mix design, the allowable mix adjustments are shown below. The documentation must include a list of these items, with a side-by-side comparison of the original and current values.
    - Mix components have not changed by more than 5.0% from the original design blend proportions.
    - The current job-mix formula does not exceed these limits from the original mix design on the following sieves:
      - ½" Sieve  $\pm$  5.0%, #4 Sieve  $\pm$  4.0%, and #8 Sieve  $\pm$  3.0%.
      - Any change where the adjustment exceeds the original design on the #30 and #200 sieves
    - The optimum asphalt content or virgin asphalt content has not changed by more than  $\pm$  0.2%.
    - No ABR changes greater than  $\pm$  5%, and not exceeding the current allowable limits.
    - No change to the design RAS percentage.
    - AGCS bands or average target gradations have not changed by more than 5.0%.
    - An individual aggregate specific gravity has not changed by more than  $\pm$  0.04.
    - The cumulative aggregate specific gravity has not changed by more than  $\pm$  0.02.

The Tollway reserves the right to request individual components and mixed samples for independent assurance of the requirements herein.

Once the full documentation is received, the Tollway will respond within 15 business days.

Illinois Tollway Testing Procedure  
Effective Date: TBD  
Revised Date:

Standard Method of Test  
For

**Surface Smoothness Equipment and Procedural Requirements**

**Illinois Tollway Test Procedure (TTP) 007**

1. **Scope.** This testing procedure provides guidelines for the Inertial Profiler (IP) equipment, operation and analysis settings.
2. **Equipment.** The IP shall conform to the Class I requirements of the most recent revision of AASHTO M 328 and is operated according to AASHTO R 57 except as modified herein. The IP shall be outfitted with wide footprint displacement transducers (line lasers). The IP shall be outfitted with transducers to simultaneously measure the left and right wheelpath IRI. The left and right transducers shall be centered on the vehicle. The distance between the outer edge of the left wheelpath laser and the outer edge of the right wheelpath laser, as shown on the pavement, shall be  $68 \pm 3.0$  inches. The Contractor shall provide equipment verification documentation to the Construction Manager prior to the IP being used on the project.

The profile testing device shall have a decal displayed to indicate it has been tested through the IDOT Profile Equipment Verification (PEV) process.

3. **Operation.** The IP operator shall perform and report the Daily Profiler Calibration Verification (Tollway Testing Form 002) prior to each use. This shall consist of the following:
  - Longitudinal (Distance) Verification.
  - Vertical (Height) Verification.
    - Block Test.
    - Bounce Test.

Run the IP in the direction of traffic. Collect surface smoothness measurements for both wheelpaths in each proposed travel lane during one continuous pass. Measure profiles in the left and right wheelpaths of each lane. Test and evaluate each lane separately. During collection high-pass and low-pass filters shall be set at zero.

The wheelpaths shall be located parallel to the centerline or baseline of the roadway or ramp and approximately 3.0 feet from the centerline of the proposed travel lane, measured transversely in both directions. The travel lane is defined by the permanent striping as shown in the plans.

Operate the IP within the speed range recommended by the manufacturer. Avoid harsh braking or large speed variations to maintain a consistent speed.

4. **Analysis.** The software program for IRI calculation shall be the FHWA's Profile Viewing and Analysis (ProVAL) software. The software can be downloaded by following the links from the FHWA at <https://www.fhwa.dot.gov/pavement/proval/> or from the ProVAL site at <http://www.roadprofile.com/>

Obtain IRI values in a segment or subplot using the ProVAL "Smoothness Assurance" analysis with the 250mm filter or equivalent method demonstrated to provide the same result.

Obtain the Localized Roughness (LR) values in each segment or subplot using the ProVAL "Ride Quality" analysis with a segment length of 25 feet and the 250 mm filter or equivalent method demonstrated to provide the same result.

Illinois Tollway Testing Procedure  
Effective Date: 08/14/2019  
Revised Date: 12/01/2020

Standard Method of Test  
For

**Witness Panel for Fiber Wrap Repair (Fiber Reinforced Polymer (FRP))**

**Illinois Tollway Test Procedure (TTP) 008**

1. **Scope.** This sampling procedure provides guidelines for a Witness Sample for Fiber Wrap Repair. This procedure refers to the Fiber Wrap Repair (Illinois Tollway GBSP), ASTM D3039 Standard Test Method for Tensile Properties of Polymer Matrix Composite Materials, and ASTM D7565 Standard Test Method for Determining Tensile Properties of Fiber Reinforced Polymer Matrix Composites Used for Strengthening of Civil Structures. Sampling shall follow ASTM D7565 except as modified herein.
2. **Sample Board Materials.** The certified application installer, or Manufacturer, shall prepare or provide a sample board in advance of taking sample. Flat medium density fiberboard (MDF) board or high-density polyethylene (HDPE) board are acceptable mediums. The board shall be a minimum size of 13"x13".
3. **Release Film Materials.** If using a 0.100" thick HDPE board, a release film is not necessary. This method typically produces the best witness panels. Otherwise Butcher Paper (wax side up) is an acceptable release film. Cut the Butcher Paper so that it is slightly larger than the sample board. Wrap the Butcher Paper around the edges of the sample board and tape it to the backside of the board, creating a taut surface on the front.

Sample board with Butcher paper release film:      Avoid Ripples:



4. **Photographs.** Before saturating the fabric with resin take photographs of the dry fabric and submit with the sample. Also clearly mark the orientation of the strengthening glass fibers on the test panel. Additionally, provide pictures while making the test panels.



5. **Sample Procedure.** The Witness Sample shall be observed by the Construction Manager (CM) or Material Coordinator (MC). The application installer shall conduct the following steps:

- 5.1. Roll or brush a layer of at least 2mm of epoxy onto the sample board or plastic release film, then place the minimum size 12"x12" fabric upon it.
- 5.2. The application installer shall roll a second layer of at least 2mm of epoxy on top of the fabric, making sure there is enough resin on the sample
- 5.3. The application installer shall push the air bubbles out of the sample using the roller in the direction of the primary fibers.
- 5.4. Keep the sample on the flat sample board, the test panel shall be protected from rain, sand, dust, and other foreign particles during curing as per the CM and manufacturer's recommendations. The CM or MC can take the test panel and sample board (preferably placed in a box) to a safe, dry, warm location to cure (overnight to 48 hours).





6. **Sample Identification.** After Curing, label each test panel or box with a sample ID. Use a marker or other means to identify the test panel with the contract number, date of application and a sample number.



7. **Sample Submittal.** Fill out TTF 006 and email Jeanne McDonald (jmcdonald@statetestingllc.com) to coordinate sample drop off. The MEC field office is located at 2223 Ogden Ave, Downers Grove, IL 60515.

8. **Non-viable samples:**

Made on the wrapper:



Epoxy voids:



Not flat and without hardener:



Epoxy voids and not enough resin:



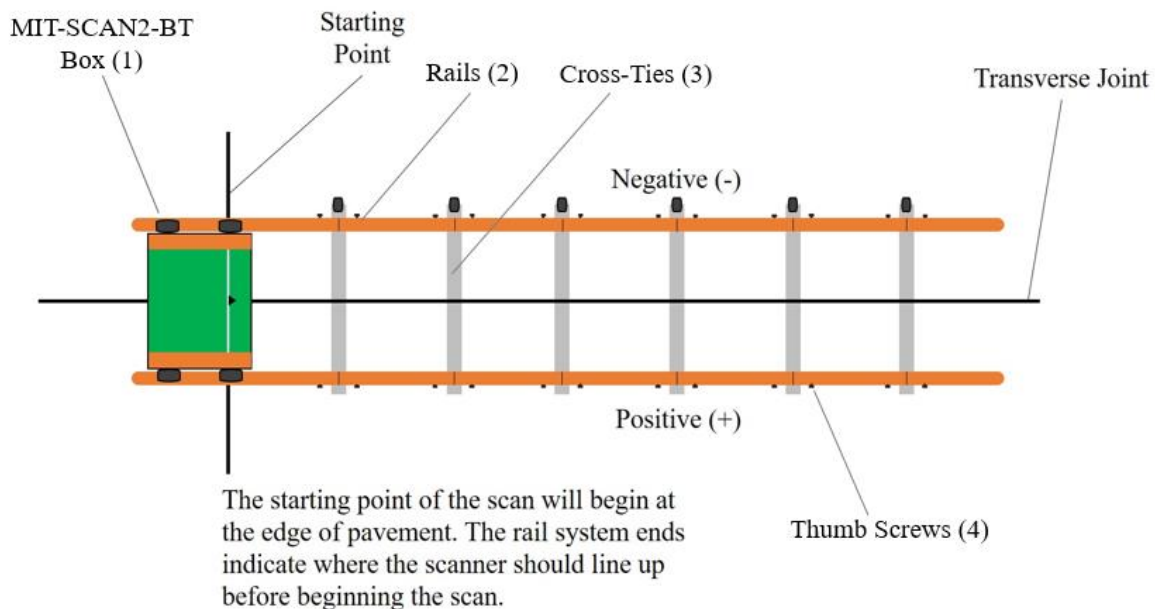
Illinois Tollway Testing Procedure  
Effective Date: 09/18/2019  
Revised Date:

Standard Method of Test  
For

**MIT-SCAN2-BT Dowel Bar Alignment Testing**

**Illinois Tollway Test Procedure (TTP) 009**

1. **Scope.** This testing procedure provides guidelines and procedures for the use of the MIT-SCAN2-BT device for testing dowel bar alignment.
2. **Equipment.** MIT-SCAN2-BT is a non-destructive testing device operating based on magnetic tomography technology for measuring the position/alignment of dowel bars and dowel bar baskets.



The MIT-SCAN2-BT system includes the following components:

- 1) MIT-SCAN2-BT Box
- 2) Rails
- 3) Cross-ties
- 4) Thumb screws
- 5) Pocket PC
- 6) MagnoProof computer software



3. **Setting Up The MIT-SCAN2-BT Device.** This section details how to prepare the MIT-SCAN2-BT device, its components, and the pavement for testing in the field.

3.1 Clean the pavement surface of debris.

Using a metal scraper, clean any debris from the pavement surface in the vicinity of the joints to be tested such that the MIT-SCAN2-BT box can roll smoothly along the rails. The cleared path must be wide enough for the rail system to sit flat on the pavement.

3.2 Preparing the rail system.

The rail system is made of glass fiber-reinforced plastic. Each individual rail piece shall be connected to the cross-ties using thumb screws. Rails shall be free of cracking and extensive wear.

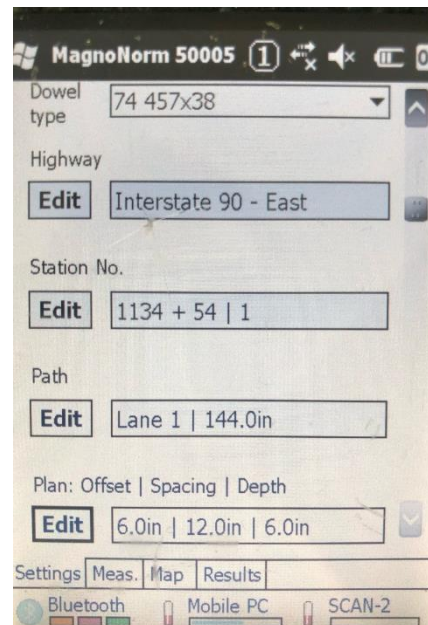
The length of the assembly can be altered by adding or removing rails to fit the width of the lane(s) to be tested. Once assembled, the rail system can be moved from joint to joint using the wheels on the cross-ties.

At the end of the rail system where the MIT-SCAN2-BT box will begin its scan, two end rail pieces shall be used. The end pieces serve as support for the box on the edge of the pavement, as well as a starting point for the scan.

3.3 Programming the MIT-SCAN2-BT handheld Pocket PC device.

Prior to testing, the operator shall review the settings in the MagnoNorm program in the Pocket PC. In the Settings tab, the operator shall adjust the following to match the conditions in the field:

- Dowel Type: Each specific dowel type has its own calibration parameter file (.cpf). If the incorrect dowel type is selected, the test data will be inaccurate. Dowel types are shown in millimeters.
- Highway: For informational purposes, the highway number, direction, and the highway type can be selected.
- Station No.: The station and joint number can be edited for the next joint to be tested. Joint spacing information can also be entered, which will automatically add/subtract from the joint station and joint number when moving from joint to joint.
- Path: The length of the test in inches, which is typically the width of the lane(s). This measurement will specify at what point to stop the test. The path length can be edited at any time if field conditions change. Lane number can also be selected for informational purposes.



- Plan: This section outlines the typical plan layout of the joints to be tested. Offset represents the distance from the starting point to the first dowel bar. Bar Spacing is the distance between dowel bars. Nominal Depth is the depth of the dowel bars.
- General: In this section, units can be selected between International and US units (Anglo Saxonian).US units shall be selected.

4. **Testing Dowel Bar Alignment with the MIT-SCAN2-BT Device.** This section describes the steps necessary to properly test dowel bar alignment using the MIT-SCAN2-BT device.

4.1 Influences on results.

Metallic material can cause interference in the test results. To avoid potential interference during the scanning process, vehicles and large construction equipment should be kept at least six feet from the MIT-SCAN2-BT box. Other potential sources of interference include reinforcing steel, shipping tie wires, framing, conduits, manholes, and inlet grates. In addition, operators wearing steel-toe boots should stay at least six feet from the device.

If metallic material is in the vicinity and cannot be avoided, it should be noted and considered when performing the data analysis.

4.2 Performing a test.

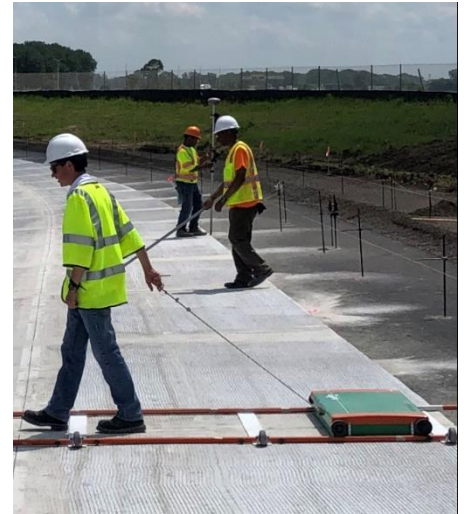
Position the rail system by lining up the black centerlines in the cross-ties with the joint to be tested. The rail system shall be positioned so that the first white line on the end-piece rail is lined up with the starting point, which may be the edge of pavement or longitudinal joint. The box shall sit on the end-piece rails against the pins, so that the white guides on the box are lined up with the starting point.

Once the box is in position and the correct settings have been entered into the Pocket PC, the operator shall open the Measure tab and hit "Start". At this point, the scan will begin and the operator shall pull the MIT-SCAN2-BT box along the rails. For the most accurate results, the device must be pulled with a maximum speed of 2 feet along the rails. Pulling the device at a rate faster than this may decrease the accuracy of the results.

When the MIT-SCAN2-BT device has reached the end of the previously set path length, the scan will stop and the data will load onto the Pocket PC under the Results tab. An image of the scan will also be available under the Map tab.

If the joint needs to be retested, the operator shall hit “Repeat” under the Results tab. By doing this, the joint number/station will stay the same and the new scan results will overwrite the initial results.

If the scan results are acceptable, the operator shall hit “Continue” under the Results tab. Hitting “Continue” will save the scan results onto the Pocket PC, as well as prepare the device for the next scan. The screen will move to the “Measure” tab, and the joint number/station will be automatically updated as specified in the settings. The rail system and box can then be moved to the next joint to be tested, and the process shall be repeated.



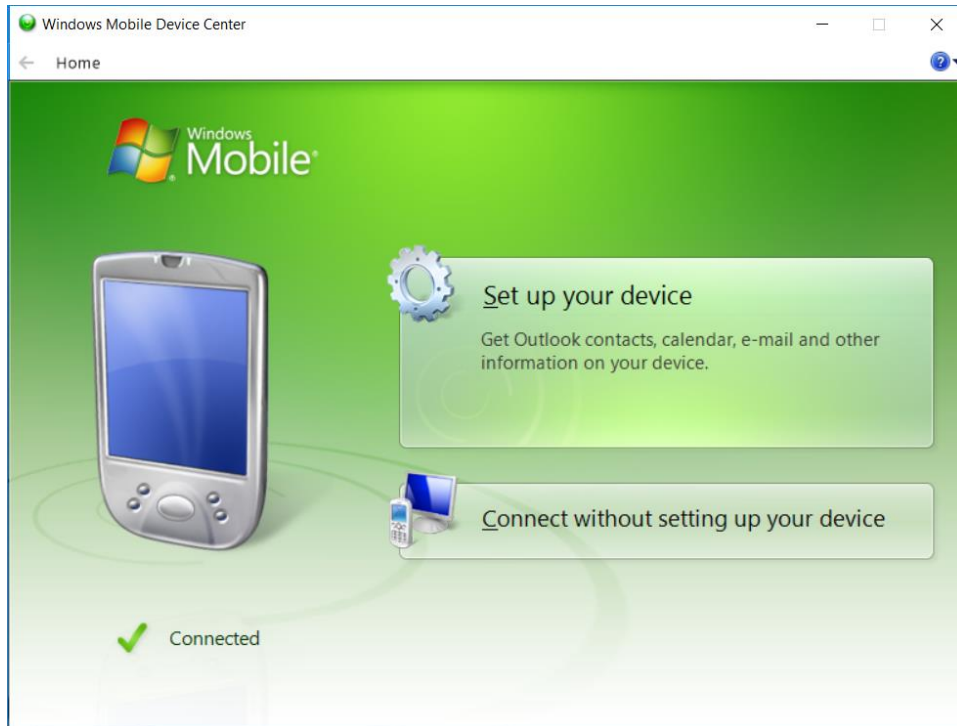
## 5. Calibration and Standardization

5.1 The MIT-SCAN2-BT device is calibrated by the manufacturer for each bar type. As part of the calibration process, the manufacturer develops a calibration parameter file (.cpf) for each bar type to be tested with the MIT-SCAN2-BT device. The calibration parameter files are specific to the individual scanner and are not interchangeable. Per the manufacturer’s user manual, the MIT-SCAN2-BT device does not require periodic calibration unless the device is damaged.

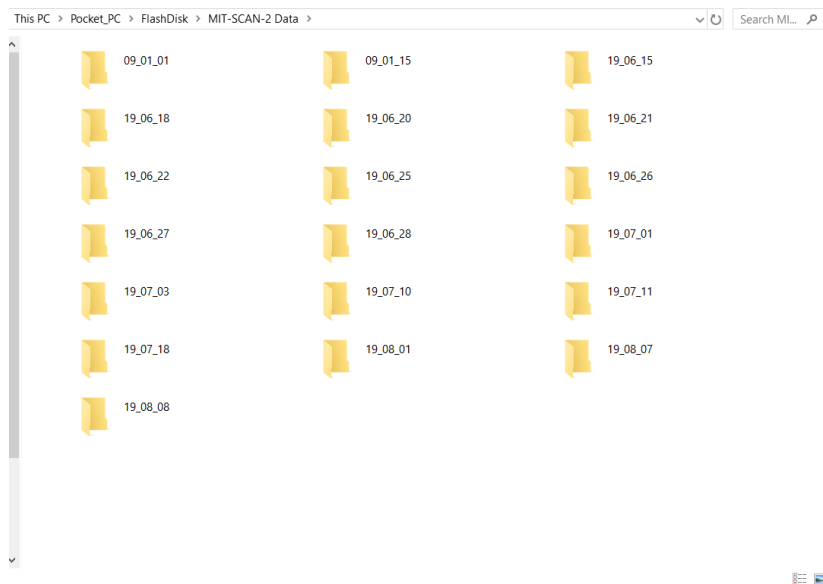
Although the device does not regularly require calibration, the device’s sensors and calibration parameter files may “drift” apart over long periods of time. To determine if the device’s calibration parameter files need to be adjusted to account for any potential “drift”, the device needs to be operated on a test stand that allows measurement of bars for each calibration file. A comparison between actual and measured bar locations will identify if the device is operating outside of the manufacturer’s accuracy tolerances. If discrepancies are present the manufacturer can make adjustments to the calibration files to correct the “drift”.

6. **Batching Data.** This section describes how to transfer the collected data from the Pocket PC to the computer and how to prepare excel files for data analysis using the MagnoProof program. The data shall be processed using the most current version of the MagnoProof program.

6.1 The Pocket PC shall be connected via USB cable to the computer while placed on its docking station. After connecting to the computer, Windows Mobile Device Center will appear. From here, the scan files (.hdfx) can be accessed on the flash disk of the Pocket PC.

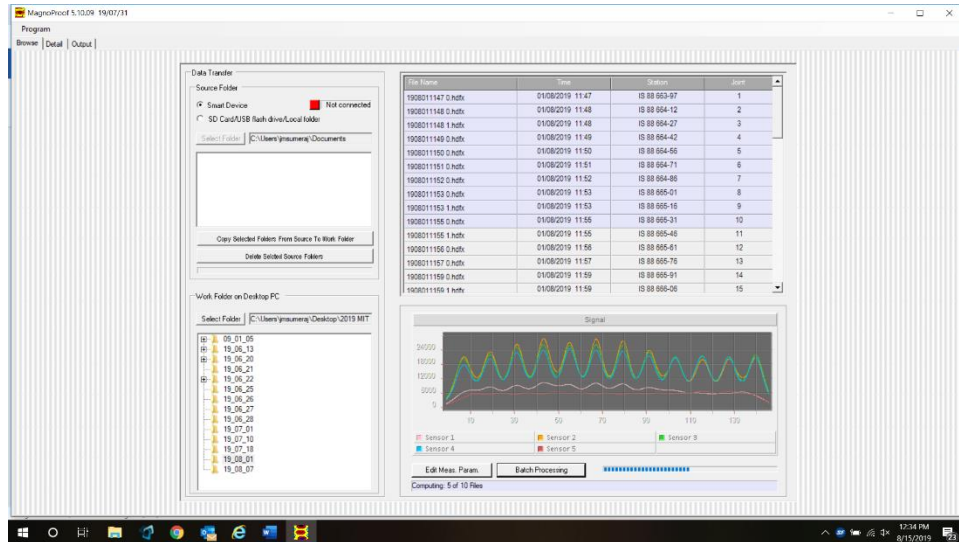


6.2 Choose and select the desired file data and copy-and-paste the folder onto the computer. The folder names correspond to the dates that the tests took place. Once the files are pasted onto the computer, the Pocket PC can be disconnected.



6.3 Open the MagnoProof software and select the folder containing the desired .hdfx files under "Work Folder on Desktop PC." All .hdfx files in that folder will appear. If needed, measuring

parameters can be edited using the “Edit Meas. Param.” button. Select the range to be analyzed and click “Batch Processing.”

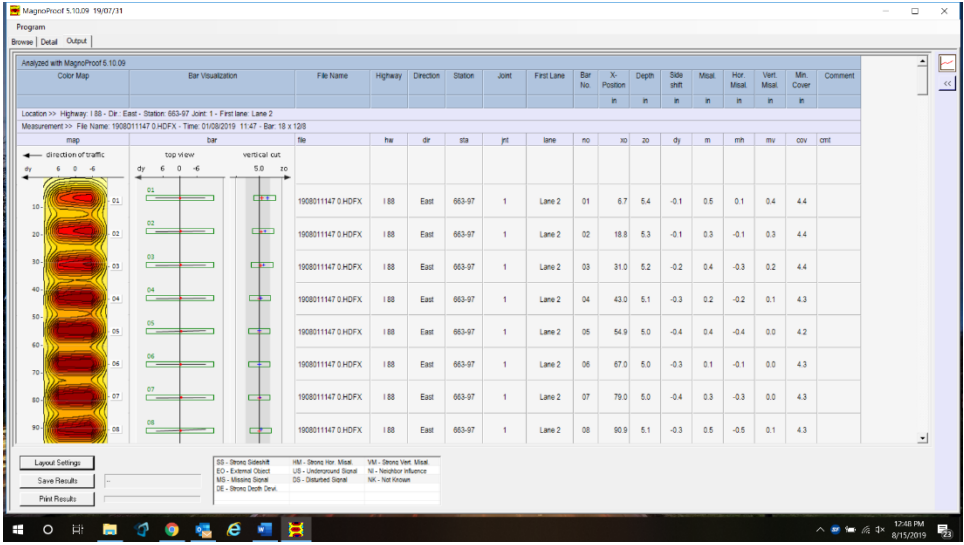


6.4 When batch processing is complete for the range of joints selected, a new window will appear containing the map image and positioning data for each joint. Which data columns are displayed can be edited using the “Layout Settings” button.

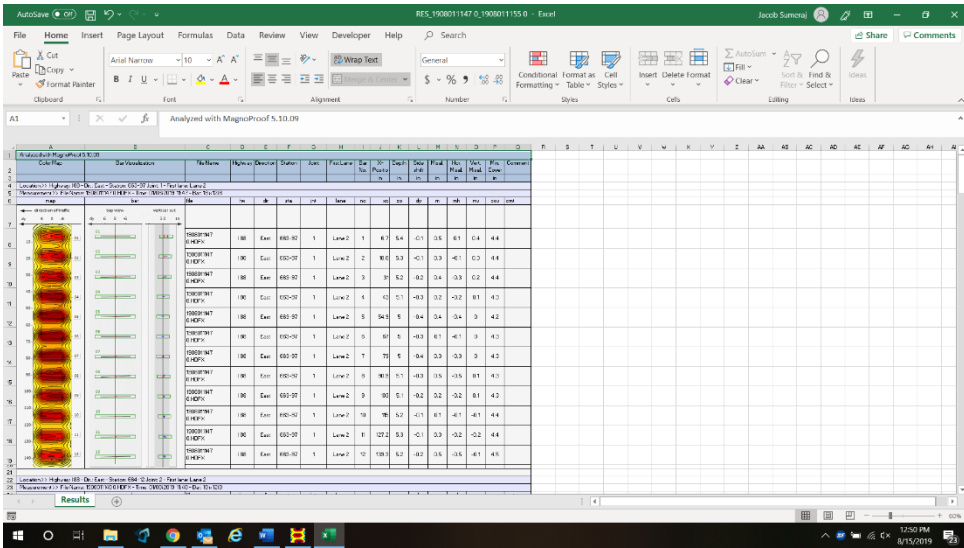
The final report shall include the following:

1. Contract number, date, highway number and direction of traffic.
2. Joint number, lane number and station.
3. Bar number and x-location of dowel bar.
4. Horizontal skew and vertical tilt (misalignment) in inches.
5. Embedment (Sideshift) in inches.
6. Depth to center of dowel bar in inches.
7. Depth to the top end of the dowel bar in inches.
8. Joint Score.
9. All out-of-tolerance readings shall be highlighted in red. Tolerances can be found in the project’s contract documents.
10. Joint images generated by the latest MagnoProof software.
11. Scan direction.
12. Any external sources of interference noted.

When the data layout is acceptable, a Microsoft Excel file can be generated by clicking on “Save Results.”



6.5 The Microsoft Excel File shows the data layout previously selected in Magnoproof. This file can be used to analyze and interpret the dowel bar alignment data.



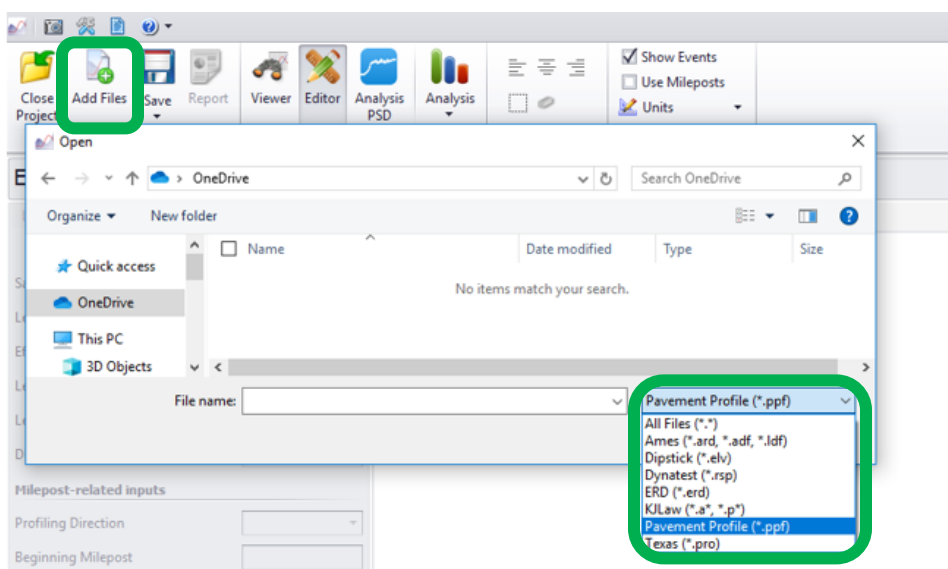
Illinois Tollway Testing Procedure  
Effective Date: 09/18/2019

Standard Method of Test  
For

**ProVAL Protocol for Pavement Smoothness Calculation**

**Illinois Tollway Test Procedure (TTP) 010**

1. **Scope.** This testing procedure provides guidelines and procedures for the use of ProVAL software for measuring and evaluating International Roughness Index (IRI) and Localized Roughness (LR) for non-PRS pavements, and how to enter data into the TTF 005 form.
2. **Acquiring Software.** ProVAL (Profile Viewing and Analysis) software is a computer program originally developed by the Federal Highway Administration that is currently maintained by a Transportation Pooled Fund Program. The software provides users the ability to view and analyze roadway pavement and bridge profiles. The software can be downloaded by following the links from the FHWA at <https://www.fhwa.dot.gov/pavement/proval/> or <http://www.roadprofile.com/>  
Recommended to use Chrome or Firefox to download software.
3. **Open a File:**
  - 3.1. Install ProVAL version 3.61 or later and open.
  - 3.2. Once ProVAL is open, select Add File and browse for a .ppf or .ERD file

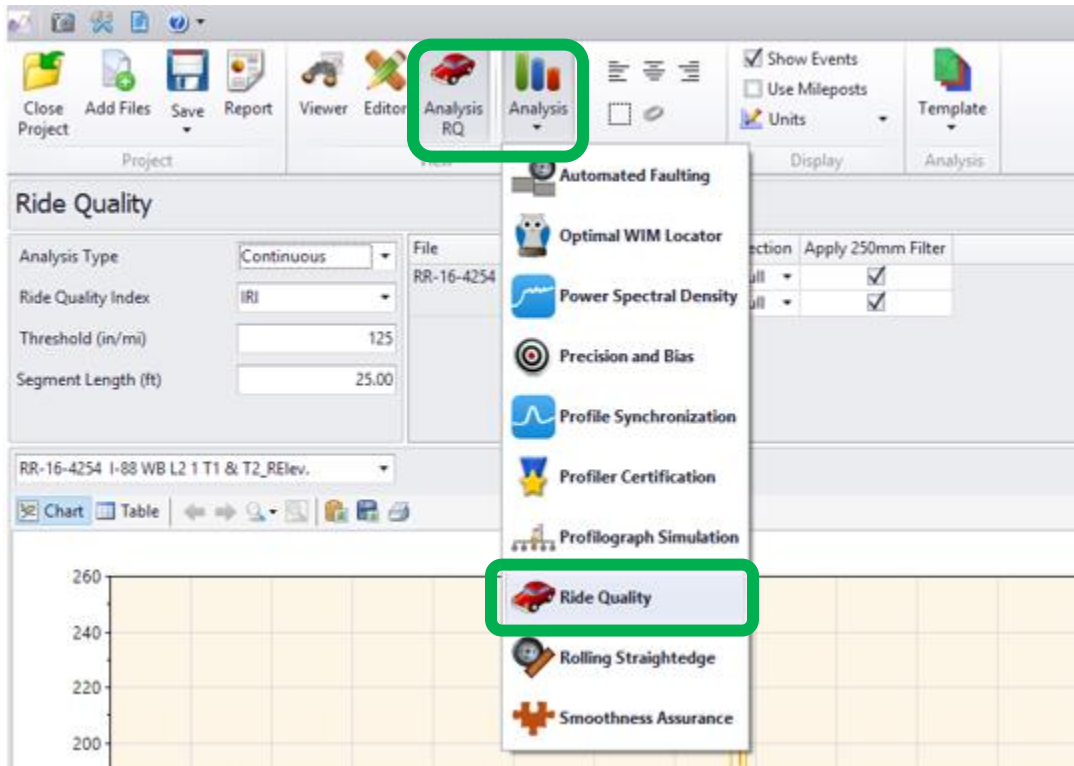




4. **Ride Quality Analysis:** This section defined how to create a Ride Quality Analysis Report. A Ride Quality Analysis Report is a PDF of the LR summary data including the right and left wheel paths.

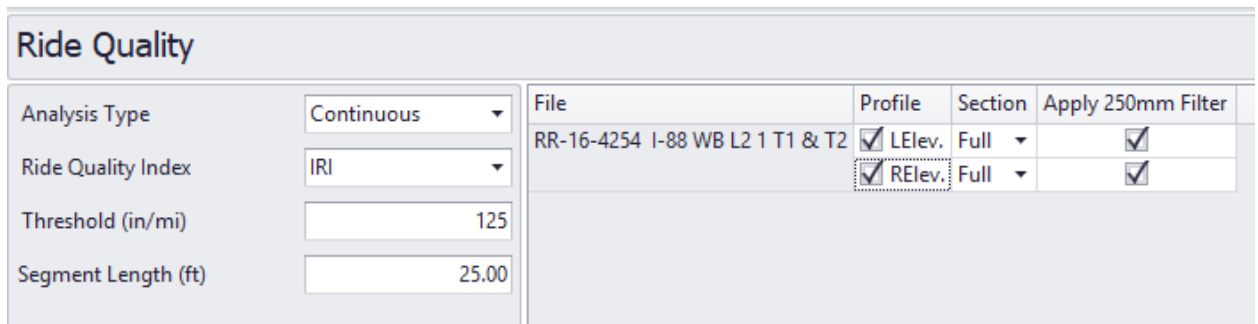
4.1. Select the following items:

- Analysis
- Ride Quality



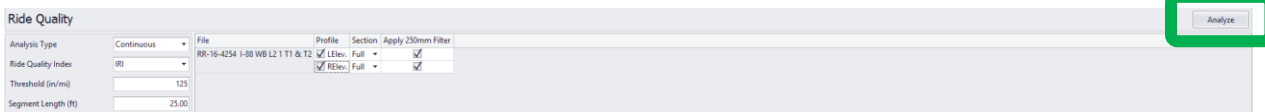
4.2. Select both wheel paths and apply the 250mm Filter. Then, input the following parameters:

- Analysis Type: **Continuous**
- Ride Quality Index: **IRI**
- Long Continuous: **LR Requirement** (for this example: 125)
- Segment Length: **25**

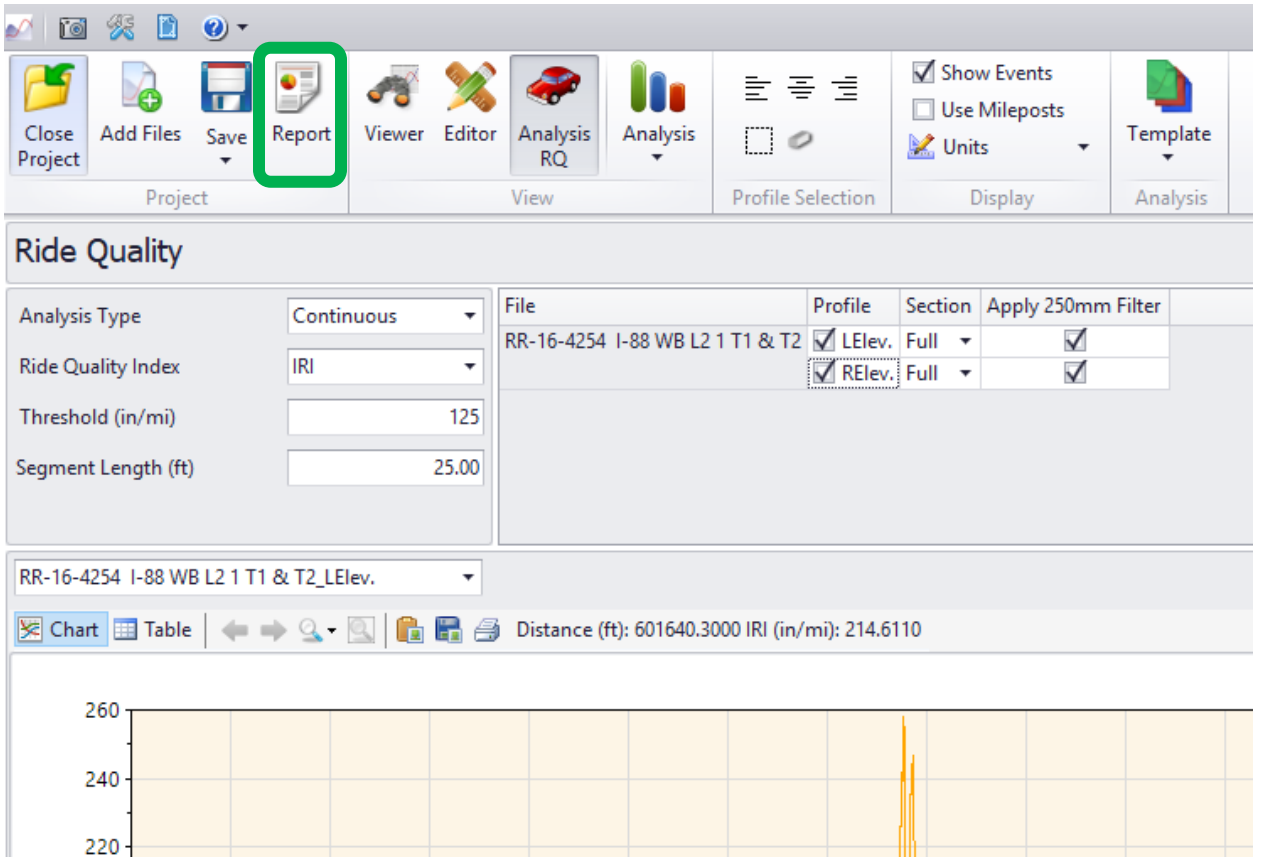


4.3. Select Analyze in the upper right-hand corner:

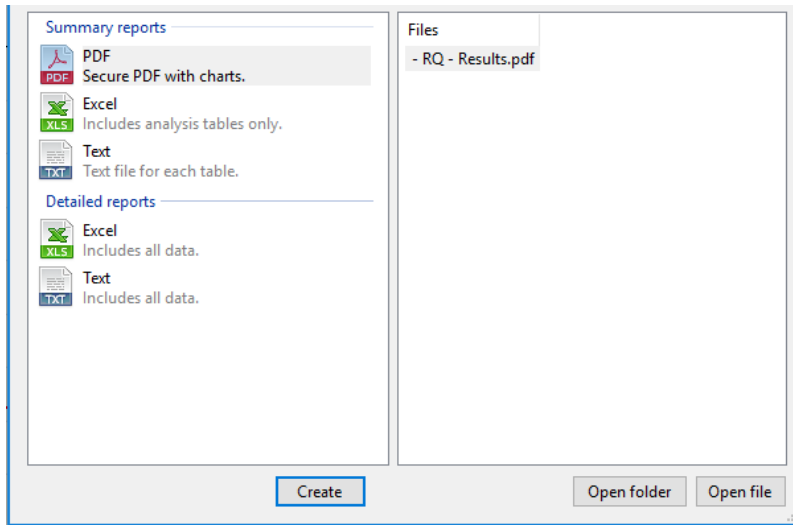




4.4. Select the Report button to create the PDF.



4.5. Select PDF and Create. Then the file will appear on the right. Select open file and save.



4.6. Produce filenames in the format shown below:

File Naming Convention for Ride Quality Report	
RQ_YYMMDD_N_D_L_Q_B-E	
RQ	RQ – Ride Quality Report
CN	Contract Number
MM	Month (two digit)
DD	Day (two digit) (day data was collected)
YY	Year (two digit)
N	Route Name
D	Direction of travel
L	Lane Number
Q	Unique identifier for the particular stretch of road in a lane and direction
B	Begin Station
E	End Station

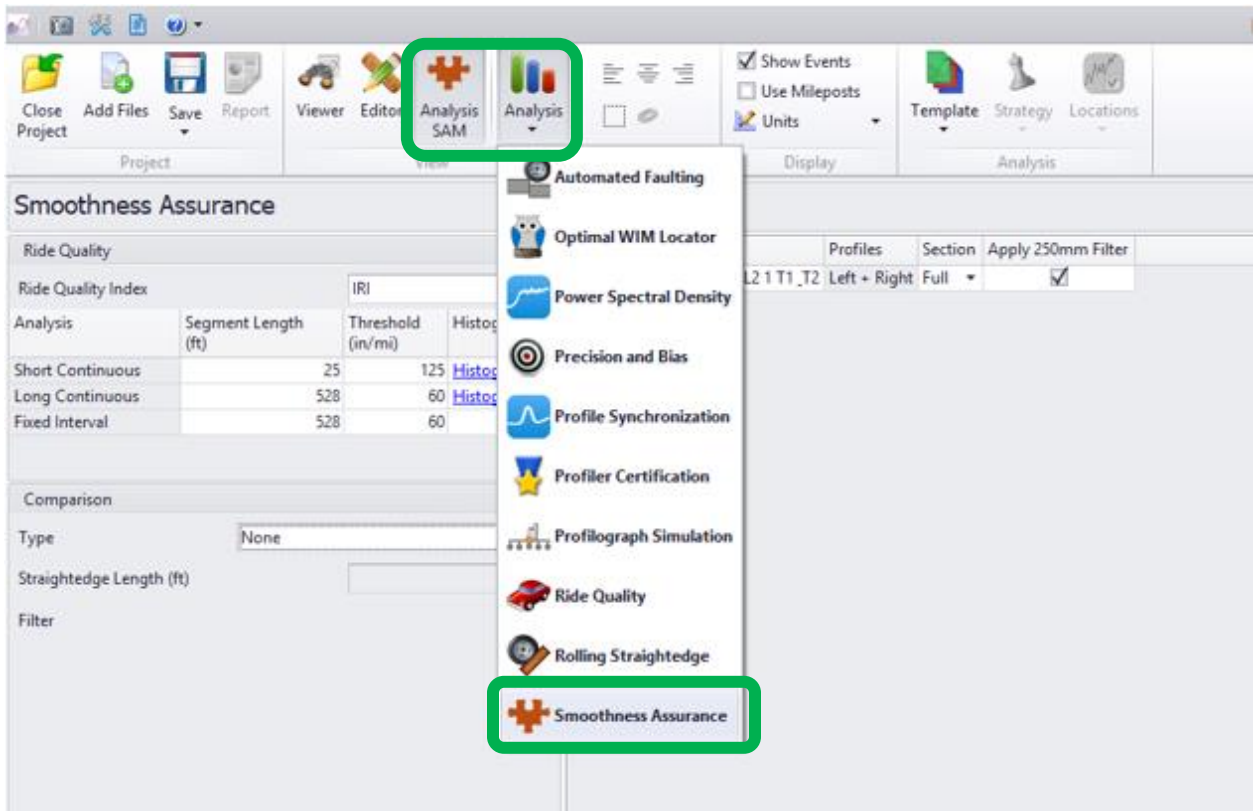
For this example, the file name for the Ride Quality Report should be:

**RQ\_4116\_070118\_I88\_WB\_2\_T1\_6013+00-6060+22.pdf**

5. **Smoothness Assurance Analysis.** This section defines how to create a Smoothness Assurance Report. A Smoothness Assurance Report is a PDF which includes a detailed summary of both the IRI and LR analysis for the right and left wheel paths.

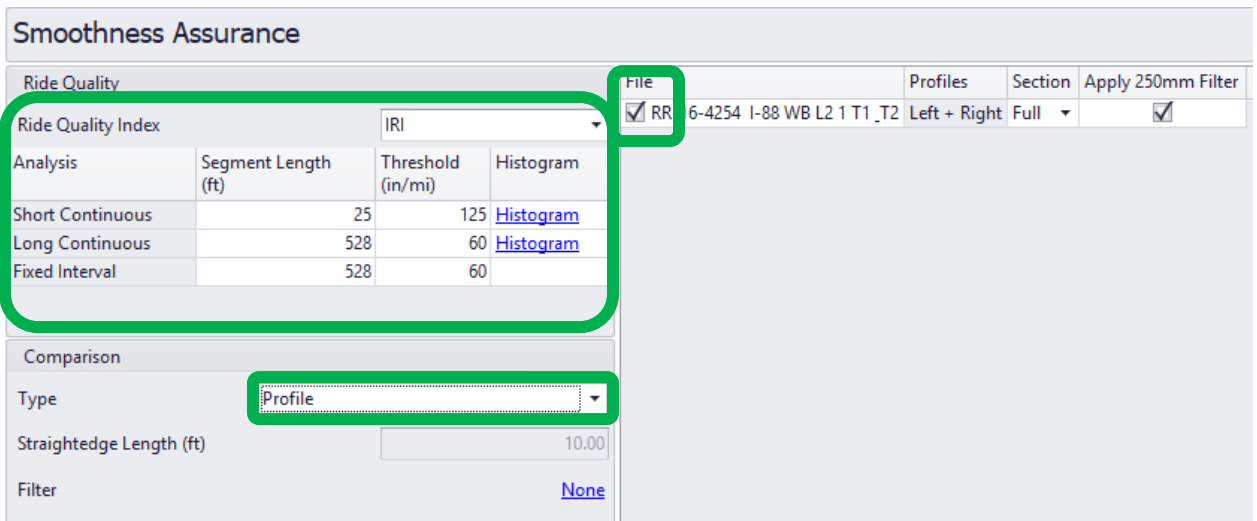
5.1. Select the following items:

- Analysis
- Smoothness Assurance
- Select the profile run to analyze

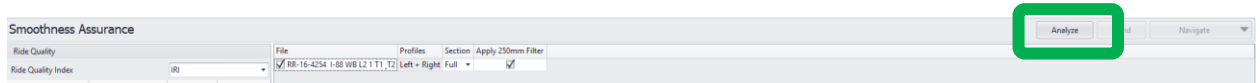


5.2. Select the run and apply the 250mm Filter. Then, input the following parameters:

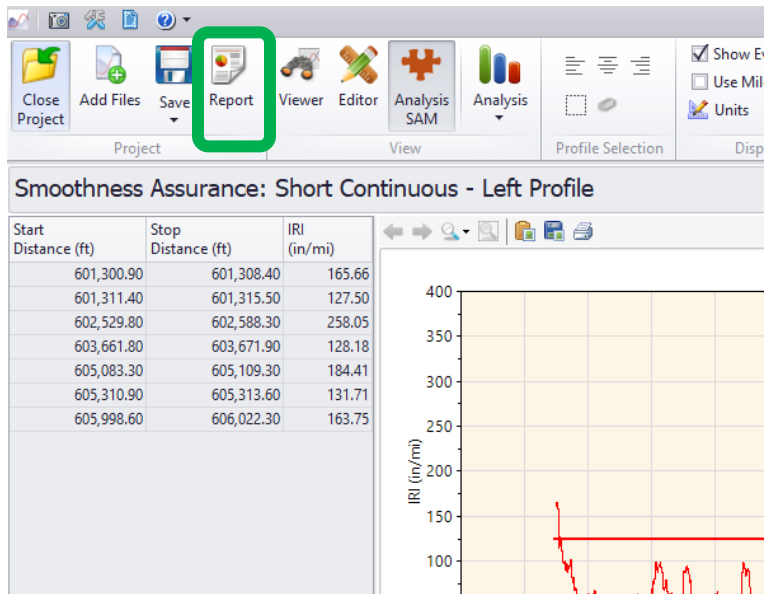
- Short Continuous: **25** (length) **LR Requirement** (for this example: 125)
- Long Continuous: **528** (length) **IRI Requirement** (for this example: 60)
- Fixed Interval: **528** (length) **IRI Requirement** (for this example: 60)
- Select **Profile** from the Comparison Type drop down box



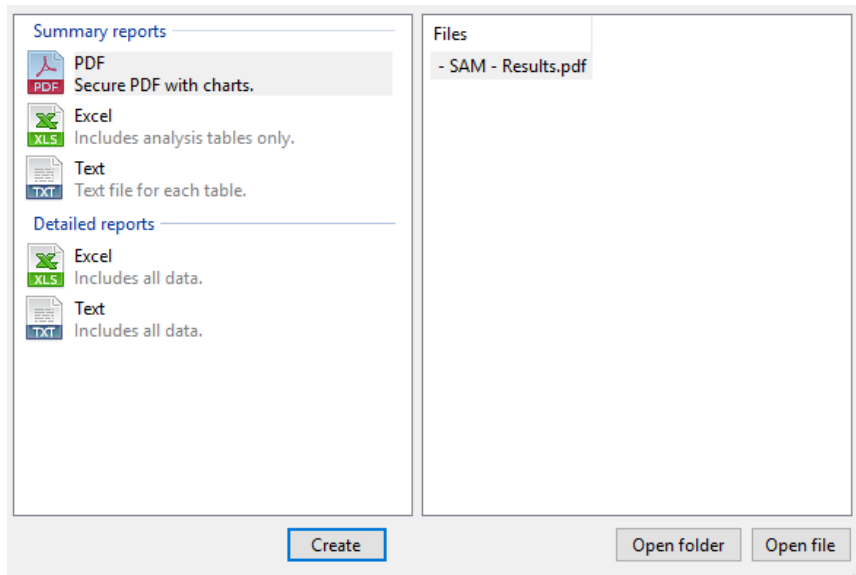
5.3. Select Analyze in the upper right-hand corner:



5.4. Select the Report button to create the PDF and excel export.



5.5. Select PDF and Create. Then the file will appear on the right. Select open file and save (noting the left or right wheel path).



5.6. Produce filenames in the format shown below:

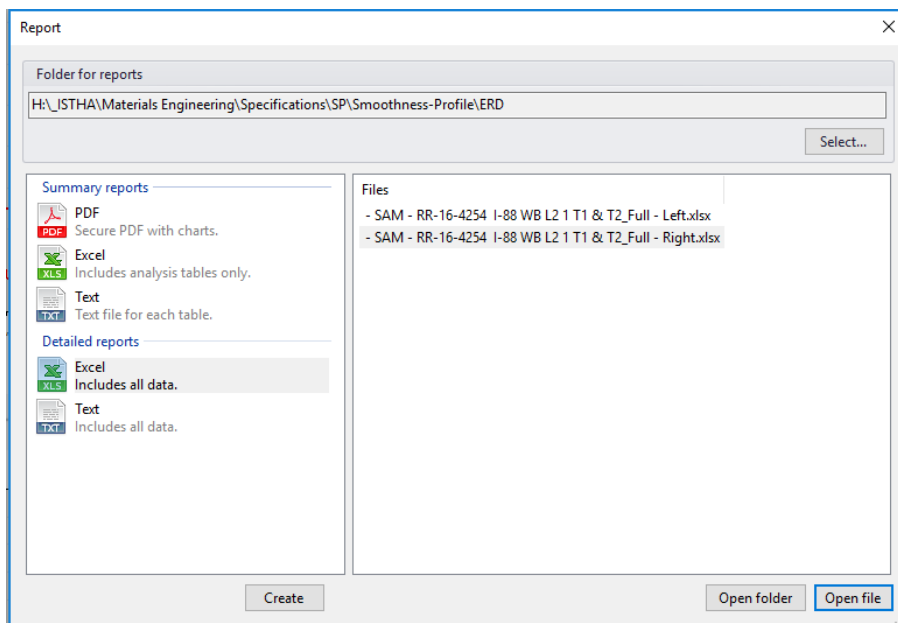
File Naming Convention for Smoothness Assurance Report	
SA_CN_YYMMDD_N_D_L_Q_B-E	
SA	SA – Smoothness Assurance Report
CN	Contract Number
MM	Month (two digit)
DD	Day (two digit)
YY	Year (two digit)
N	Route Name
D	Direction of travel
L	Lane Number
Q	Unique identifier for the particular stretch of road in a lane and direction
B	Begin Station
E	End Station

For this example, the file name for the Smoothness Assurance Report should be:  
**SA\_4116\_070118\_I88\_WB\_2\_T1\_6013+00-6060+22.pdf**

6. **Completion of TTF 005 from ProVAL.** This section defines how to populate the TTF 005 excel file. The TTF 005 excel file will be continually populated as more profile runs are collected. Unlike the Ride Quality and Smoothness Assurance PDFs, the TTF 005 shall encompass all profile runs for the entire project.

6.1. Repeat Sections 5. – 5.4.

6.2. Select Excel (includes all data) and Create



6.3. Open file for the left wheel path, select the **Short Continuous Defects** Tab and copy the LR in the Start Distance column:

	A	B	C	D	E	F
1	Before Grinding					
2	Start Distance (ft)	Stop Distance (ft)	IRI (in/mi)			
3	601300.875	601308.375	165.664078			
4	601311.375	601315.5	127.499153			
5	602529.8125	602588.25	258.048065			
6	603661.75	603671.875	128.179581			
7	605083.3125	605109.3125	184.407562			
8	605310.875	605313.625	131.712921			
9	605998.5625	606022.3125	163.751709			
10						
11						
12						
13						
14						

Short Continuous    **Short Continuous Defects**    Short Continuo

6.4. Open TTP005 excel file for this project. Fill in the header information as required in the TTP005 directions. Select the first open cell located in the “LR Summary” in the “Location (station)” column. Right click and select Paste Special – “123”.

Project Information										IP Operator and Equipment		Smoothness Requirements			
Contract Number		Route		Pavement Type		Profiler Operator		Comments		IRI		60			
RR-16-4254		I-88		SMA		Joe Schmo				LR		125			
CM Name		Contractor		Section Type		PEV Cert #									
Jane Smith		PaveBest, LLC		Mainline		503-19									
Data Collection Summary					IRI Summary					LR Summary					
Paving Date	Profile Date	Time of Day	Weather	Direction	Lane Number	Begin Station	End Station	Segment Length (ft)	Left Wheelpath IRI (in/mi)	Right Wheelpath IRI (in/mi)	IRI Average				

- 6.5. Repeat Section 6.4 for End Station and LR Height. Select the correct wheel path from the drop down for each LR.

Project Information										IP Operator and Equipment		Smoothness Requirements			
Contract Number		Route		Pavement Type		Profiler Operator		Comments		IRI					
RR-16-4254		I-88		SMA		Joe Schmo				60					
CM Name		Contractor		Section Type		PEV Cert #				LR					
Jane Smith		PaveBest, LLC		Mainline		503-19				125					
Data Collection Summary					IRI Summary					LR Summary					
Paving Date	Profile Date	Time of Day	Weather	Direction	Lane Number	Begin Station	End Station	Segment Length (ft)	Left Wheelpath IRI (in/mi)	Right Wheelpath IRI (in/mi)	IRI Average	Begin Station	End Station	LR Height (inches)	Wheelpath
												6013+01	6013+08	165.66	L
												6013+11	6013+16	127.50	R
												6025+30	6025+88	258.05	
												6036+62	6036+72	128.18	
												6050+83	6051+09	184.41	
												6053+11	6053+14	131.71	
												6059+99	6060+22	163.75	

- 6.6. Repeat Sections 6.2-6.4 for the other wheel path.  
 6.7. Open file for the left wheel path, select the **Fixed Interval** Tab and copy the IRI in the Start Distance column:

Start Distance (ft)	Stop Distance (ft)	Length (ft)	Before Grinding IRI (in/mi)	Before Grinding Defect Count
601288.3125	601816.3125	528	62.28762054	2
601816.3125	602344.3125	528	47.79254913	0
602344.3125	602872.3125	528	66.81695557	1
602872.3125	603400.3125	528	43.43657684	0
603400.3125	603928.3125	528	48.66226196	1
603928.3125	604456.3125	528	34.59441757	0
604456.3125	604984.25	527.916687	40.29537582	0
604984.25	605512.25	528	61.66872406	2
605512.25	606040.25	528	43.28381729	1
606040.25	606561.5	520.416687	38.47365189	0

Long Continuous | Long Continuous Defects | Long Continuous Histogram | **Fixed Interval** | profile

- 6.8. Select the first open cell located in the "IRI Summary" in the "Location (station)" column. Right click and select Paste Special – "123".

TTF 005 - Profile Summary Form										REV 09/18/19					
Project Information						IP Operator and Equipment				Smoothness Requirements					
Contract Number		Route		Pavement Type		Profiler Operator		Comments		IRI					
RR-16-4254		I-88		SMA		Joe Schmo				60					
CM Name		Contractor		Section Type		PEV Cert #				LR					
Jane Smith		PaveBest, LLC		Mainline		503-19				125					
Data Collection Summary						IRI Summary						LR Summary			
Paving Date	Profile Date	Time of Day	Weather	Direction	Lane Number	Begin Station	End Station	Segment Length (ft)	Left Wheelpath IRI (in/mi)	Right Wheelpath IRI (in/mi)	IRI Average	Begin Station	End Station	LR Height (inches)	Wheelpath
												6013+01	6013+08	165.66	L
												6013+11	6013+16	127.50	L
												6025+30	6025+88	258.05	L
												6036+62	6036+72	128.18	L
												6050+83	6051+09	184.41	L
												6053+11	6053+14	131.71	R
												6059+99	6060+22	163.75	R

6.9. Repeat Section 6.7 for End Station and IRI Height (segment length will automatically calculate).

6.10. Repeat Section 6.6 – 6.8 for other wheel path. (IRI Average will automatically calculate). The final summary for this example is the following:

TTF 005 - Profile Summary Form										REV 09/18/19					
Project Information						IP Operator and Equipment				Smoothness Requirements					
Contract Number		Route		Pavement Type		Profiler Operator		Comments		IRI					
RR-16-4254		I-88		SMA		Joe Schmo				60					
CM Name		Contractor		Section Type		PEV Cert #				LR					
Jane Smith		PaveBest, LLC		Mainline		503-19				125					
Data Collection Summary						IRI Summary						LR Summary			
Paving Date	Profile Date	Time of Day	Weather	Direction	Lane Number	Begin Station	End Station	Segment Length (ft)	Left Wheelpath IRI (in/mi)	Right Wheelpath IRI (in/mi)	IRI Average	Begin Station	End Station	LR Height (inches)	Wheelpath
08/01/19	08/02/19	8:02	Sunny 75	WB	2	6012+88	6018+16	528	62.29	60.46	61.37	6013+01	6013+08	165.66	L
08/01/19	08/02/19	8:45	Sunny 75	WB	2	6018+16	6023+44	528	47.79	45.17	46.48	6013+11	6013+16	127.50	L
08/01/19	08/02/19	9:35	Sunny 75	WB	2	6023+44	6028+72	528	66.82	39.74	53.28	6025+30	6025+88	258.05	L
08/01/19	08/02/19	10:10	Sunny 75	WB	2	6028+72	6034+00	528	43.44	37.97	40.70	6036+62	6036+72	128.18	L
08/01/19	08/02/19	11:25	Sunny 75	WB	2	6034+00	6039+28	528	48.66	37.73	43.20	6050+83	6051+09	184.41	L
08/01/19	08/02/19	12:05	Sunny 75	WB	2	6039+28	6044+56	528	34.59	39.51	37.05	6053+11	6053+14	131.71	R
08/01/19	08/02/19	12:45	Sunny 75	WB	2	6044+56	6049+84	528	40.30	31.31	35.80	6059+99	6060+22	163.75	R
08/01/19	08/02/19	13:25	Sunny 75	WB	2	6049+84	6055+12	528	61.67	47.28	54.48				
08/01/19	08/02/19	13:55	Sunny 75	WB	2	6055+12	6060+40	528	43.28	45.24	44.26				
08/01/19	08/02/19	14:25	Sunny 75	WB	2	6060+40	6065+62	521	38.47	31.53	35.00				

6.11. Produce filenames in the format shown below:

File Naming Convention for TTF 005	
PS_Company_RN_MMDDYYYY_N.pdf	
PS	PS – Profile Summary
CN	Contract Number
MM	Month (two digit)
DD	Day (two digit)
YY	Year (two digit)
N	Route Name



For this example, the file name for the Profile Summary shall be:  
**PS\_4116\_070118\_I88.pdf**

- 6.12. Submit this file within the timeline required by the Tollway SP after each profile run. Continue to populate this file as more profile runs are collected for the entire project, and rename the file with the updated date.

Illinois Tollway Test Procedure  
Effective Date: 07/07/2020

Standard Method of Test  
For

**Sampling and Testing of Calcium Aluminate Cement – Latex Modified Concrete (Class CAL) and Calcium Sulfoaluminate Cement – Latex Modified Concrete (Class CSL)**

**Illinois Tollway Test Procedure TTP 011**

1. **Scope.** This testing procedure provides guidelines and procedure for sampling and testing freshly mixed Calcium Aluminate Cement – Latex Modified Concrete (Class CAL) and Calcium Sulfoaluminate Cement – Latex Modified Concrete (Class CSL).
2. **Referenced Documents.**
  - ASTM C1064 Temperature of Freshly Mixed Hydraulic Cement Concrete
  - AASHTO T 152 Air Content of Freshly Mixed Concrete by Pressure Method
  - AASHTO T 23 Making and Curing Concrete Test Specimens
3. **Temperature of Class CAL and CSL.** The temperature test shall be according to Illinois Modified ASTM C1064. Temperature is required on the first load of the pour and whenever strength specimens are prepared.
4. **Air Content of Freshly Mixed Class CAL and CSL.** The air content test shall be according to Illinois Modified AASHTO T 152, except that the bowl shall be filled in one lift directly from the chute of the mobile mixer. The sample shall be rodded 25 times penetrating the entire depth of the bowl. The rod shall not strike the bottom of the bowl.

A 1" vibrator may be used for consolidation instead of rodding. If a vibrator is used, it shall be inserted completely two times. The vibrator shall not contact the bottom of the bowl.

The bowl shall be smartly struck with a mallet 10-15 times after rodding.

Testing of air content shall be required on every load.

In the case of borderline results (4.0, 4.1, 4.2, 6.8, 6.9, 7.0), the load shall be adjusted and retested prior to continuing the pour.

5. **Making and Curing Class CAL and CSL Strength Test Specimens.** Compressive strength test specimens shall be made and cured according to Illinois Modified AASHTO T 23, except for the following:

- Only 6x12 inch cylinder molds shall be utilized for preparing strength specimens
- CAL and CSL cylinders shall be filled in one lift directly from the chute of the mobile mixer.
- A 1'' concrete vibrator shall be used for consolidation. The cylinders shall be tapped 10–15 times to close any air voids.
- Test specimens shall be stored on-site in a commercially manufactured hard plastic cooler or curing bag and should not be covered with lids or plastic bags.
- Strength specimens shall remain on-site for a minimum of two hours prior to transporting.

The digital readout of all compressive strength test results shall be uploaded to the 03 11 03 Compressive Strength Test Results folder in eBuilder, in addition to uploading the test results to I-MIRS.

Illinois Tollway Test Procedure  
Effective Date: 07/07/2020

Standard Method of Test  
For

**Verification of Open Graded Aggregate Compaction**

**Illinois Tollway Test Procedure TTP 012**

1. **Scope.** This testing procedure provides guidance for an acceptable method of compaction acceptance of open-graded coarse aggregate (OGCA).
2. **Purpose.** OGCA (CA-7, CA-11 or CA-16) must be compacted to densify and interlock the aggregate into stable layers.
3. **Compaction Method.** Compaction of the OGCA will be performed via a rolling pattern procedure. The rolling pattern shall be developed by recording the number of passes of a vibratory roller needed to ensure proper compaction of the OGCA material.
4. **Verification of Compaction.** The proper compaction shall be determined using a growth curve with a nuclear gauge, or with survey elevation data. The OGCA shall be placed in lifts no greater than ten (10) inches thick and rolled to an acceptable number of times until the growth curve flattens out (three consecutive readings within 1 lb per cubic foot), or survey data shows that the compaction of the material is negligible (less than ½-inch) between three consecutive passes and acceptable to the Engineer.

The Contractor must verify the rolling pattern once per week, or every time a new piece of equipment is used, or as per Engineer's request. The rolling pattern development must be performed in the presence and to the satisfaction of the Engineer.

5. **Verified Rolling Pattern.** The specified number of passes determined by the verification will be the required number of passes used for each lift of the OGCA material and that particular vibratory roller for the project. If the Contractor wishes to change vibratory rollers during the project, then a new rolling pattern must be developed.
6. **Inaccessible Areas.** Along places inaccessible to rollers, the OGCA subbase material must be tamped thoroughly with mechanical or hand tampers, using the same acceptance procedures as above.

Illinois Tollway Testing Procedure  
Effective Date: 07/07/2020

Standard Method of Test  
For

**Measuring Thickness of Chemically Modified or Stabilized Soils Using Phenolphthalein**

**Illinois Tollway Test Procedure (TTP) 013**

1. **Scope.** This procedure determines the thickness of cement, lime and/or fly ash treated soils.
2. **Significance and Use.**
  - 2.1. This test method determines the thickness of chemically modified or stabilized soils using a chemical compound indicator to confirm compliance with contract specifications.
3. **Apparatus.**
  - 3.1. Drill rod with a minimum of  $\frac{1}{8}$ " by  $\frac{1}{8}$ " longitudinal notch along its shaft greater than 20 inches long. The standard soil density gauge probe with a minimum  $\frac{1}{8}$ " by  $\frac{1}{8}$ " longitudinal notch along its shaft is an acceptable tool. (See picture in Section 6)
  - 3.2. Extractor tool for the drill rod – Soil density gauge drill rod extractor is acceptable.
  - 3.3. Drill rod plate – Soil density gauge drill rod plate is acceptable.
  - 3.4. Drilling hammer (2.5 lbs. minimum) – used to drive the drill rod.
  - 3.5. Phenolphthalein (HIn or phph)  $C_{20}H_{14}O_4$  – chemical indicator.
  - 3.6. Medicine dropper – used to apply drops of Phenolphthalein on the rod.
  - 3.7. Marker
  - 3.8. Measuring tape
4. **Procedure.**
  - 4.1. After the final grading of lime, cement and/or flyash treated soil, determine a random location and drive the drilling rod including the drill rod plate and extractor tool into the chemically modified or stabilized treated soil using a drilling hammer. Mark the initial line on the rod with a marker. This is a similar method to probing the drilling rod for soil density testing.
  - 4.2. Twist the extractor tool and drilling rod several times to ensure the notch along the shaft of the drill rod captures chemical modifier material on the rod.
  - 4.3. Remove the drill rod from the soil using a pulling and twisting motion with the extractor tool.
  - 4.4. Lay the drill rod on the flat surface and immediately use the medicine dropper to apply a small amount of Phenolphthalein on the  $\frac{1}{8}$ " by  $\frac{1}{8}$ " notch along the shaft.
  - 4.5. When applied with Phenolphthalein, the chemical modifier and soil will turn "pink" or "dark red" after a few minutes.
  - 4.6. Measure the distance from the initial point to the end of the rod where "pink" or "dark red" after few minutes.

4.7. After five minutes, measure the distance from the initial point to the end of the rod where the “pink” or “dark red” chemical reaction stopped and subtract the distance from the initial line to the bottom of the plate (plate and extractor thickness).

5. **Report.**

5.1. Report the final measurement to the nearest quarter-inch ( $\frac{1}{4}$ ”).

5.2. Report the location of the test.

5.3. Include a picture of the rod and measuring tape, as seen in Section 6.

6. **Photo Example.** Drill Rod with  $\frac{1}{8}$ ” by  $\frac{1}{8}$ ” notch showing “pink” or “dark red” indicator.



Illinois Tollway Testing Procedure

Effective Date: 12/01/20

Revised Date: 03/11/22

Standard Method of Test  
For

**Estimating Concrete Strength by Maturity**

**Illinois Tollway Test Procedure (TTP) 014**

**1. Scope.**

The maturity method utilizes the principle that directly relates the strength of concrete to the cumulative temperature history of the concrete. Using this principle, the Engineer and Contractor can quickly and reliably estimate the field strength of concrete based on the *maturity index* (time-temperature factor) rather than by cylinder tests. The maturity as applied to a concrete mixture is specific to that particular mixture. When the mixture design is changed, the Contractor may need to develop a new maturity relationship, or *maturity curve*. Until an acceptable maturity-strength relationship is established, concrete cylinders shall be used to verify strength.

The development of a maturity-strength relationship requires three steps. These include:

- 1) developing the maturity-strength curve,
- 2) estimating the in-place strength in the field, and
- 3) verifying the maturity-strength relationship in the field.

This procedure utilizes the Nurse-Saul method for developing maturity-strength curves, as described in ASTM C 1074. The Nurse-Saul method uses a specific datum temperature to calculate the time-temperature factor (T-TF) and to relate this to the measured concrete compressive strength at the particular T-TF value. The general form of the Nurse-Saul method is shown in Equation 1.

$$T-TF = \sum (T_a - T_0)\Delta t \quad \text{Equation 1}$$

where

- T-TF = the time-temperature factor at age t, degree-days or degree-hours,  
 $\Delta t$  = time interval, days or hours,  
 $T_a$  = average concrete temperature during time interval,  $\Delta t$ , °F, and  
 $T_0$  = datum temperature, 32°F.

This test method describes the procedure for developing maturity-strength relationships to estimate concrete strength using the maturity method. This method uses cylinders for compressive strength.

## 2. Definitions.

- a. *Temperature Sensor*  
The device on a maturity meter or data logger that is inserted into the concrete and provides a measure of temperature.
- b. *Data Logger*  
A commercially available device that records temperature measurements from a temperature sensor at various intervals.
- c. *Maturity Meter*  
A commercially available device that includes a temperature sensor, data logger, and conducts maturity calculations automatically.
- d. *Maturity Index*  
The cumulative area under the time-temperature curve developed as concrete cures. The units of maturity index are in degree-hours (F-hr). For the purposes of this procedure, the maturity index called the time-temperature factor (T-TF).
- e. *Maturity Curve*  
The relationship between the time-temperature factor and the strength of the concrete.
- f. *Verification Test*  
At various intervals during construction, the maturity curve is verified by casting additional specimens and comparing the T-TF-strength relationship with the original maturity curve for a particular mix.

## 3. Apparatus.

- a. *Maturity Meter or Temperature Sensor and Data Logger*  
A maturity meter or a temperature sensor and data logger combination, accurate to  $\pm 2^{\circ}\text{F}$ , and capable of recording data at a time interval of 1 hour or less shall be the equipment used.  
  
Calibrate maturity meters yearly to ensure proper operation and temperature sensing.  
  
Verify proper operation of maturity meters and temperature sensors every 30 days during normal plant production. Perform verification by comparing the temperature recorded by the maturity meter or temperature sensor to a known temperature, as provided by a calibrated thermometer. Use at least three temperature points (e.g.  $40^{\circ}\text{F}$ ,  $75^{\circ}\text{F}$ , and  $110^{\circ}\text{F}$ ) in the sensor verification.
- b. *Cylinder Specimen Molds*  
Developing a maturity relationship, a minimum of 17 cylinders specimen molds are required. Use 6-inch x 12-inch molds.
- c. *Compressive Strength Test Apparatus*  
The apparatus for testing compressive strength shall conform to the requirements of Illinois Modified AASHTO T 22.



#### 4. Procedure.

##### a. Develop Maturity-Strength Relationship

Prior to any concrete placement, the Contractor shall develop a maturity-strength relationship (maturity curve) for any concrete mixture for which the maturity method will be used. The Contractor shall notify the Engineer prior to developing the maturity curve. The batch of concrete from which samples are taken shall be a minimum of 4 yd<sup>3</sup> and the project's actual batching and mixing equipment or ready-mix plant shall be used to produce the batch. The concrete used to develop the maturity-strength relationship shall be at the maximum w/cm ratio expected during production, or within 0.02 of the maximum w/cm ratio of the mixture design. Air content shall be within +/- 0.5% of the maximum allowed by specification. Prepare a minimum of 17-cylinder specimens. Embed temperature sensors in the center of two of the specimens, record the data and do not test. Specimens shall be molded and cured in accordance with Illinois Modified AASHTO T 23.

Cylinder specimens shall be tested in accordance with Illinois Modified AASHTO T 22 at chronological ages of 1, 2, 3, 7, and 14 days. The ages shall be modified at the Contractor discretion, with the Engineer's approval, so at least 2 tests are before, 2 tests are after, and up to at least 120 percent of the intended strength. Test three specimens at each age and compute the average strength. If an individual cylinder strength is greater than 10 percent outside the average of three cylinders, the cylinder can be considered defective and be discarded. When two of the three cylinders are defective, a new batch must be evaluated unless additional acceptable cylinders are available.

At each test age, determine the average maturity index (T-TF) at the time the specimens are tested, by averaging the values obtained from the two maturity meters or data loggers. If using a maturity meter, read the maturity index directly from the meter. If using a temperature sensor and data logger, calculate the maturity index using the time-temperature history from the logger, and Equation 1 in Section 1 of this procedure. Average the two maturity index values and report this in the appropriate location on the *Concrete Maturity-Strength Development* form, TTF 010. See Figure 1 for an example.

The *Concrete Maturity-Strength Development* form is a Microsoft Excel® spreadsheet that plots the average compressive strength vs. the average maturity index for each test age, and determines the best-fit logarithmic curve using the form.

$$S = S_u e^{-\left(\frac{t}{T-TF}\right)^\alpha} \quad \text{Equation 2}$$

where:

- S = compressive strength, psi
- T-TF = the time-temperature factor at age t, degree-days or degree-hours,
- S<sub>u</sub> = ultimate expected compressive strength, psi
- t, α = time and shape coefficients.

Use the resulting fitted curve maturity-strength relationship for estimating the in-place strength of concrete cured under any conditions including those in the lab or in the field.

Refer to the Portland Cement Concrete special provision to determine the strength criteria for each mixture type. Enter all collected and recorded data in the *Concrete Maturity-Strength Development* form, TTF 010.



Illinois Tollway

Tollway Testing Form (TTF) 010

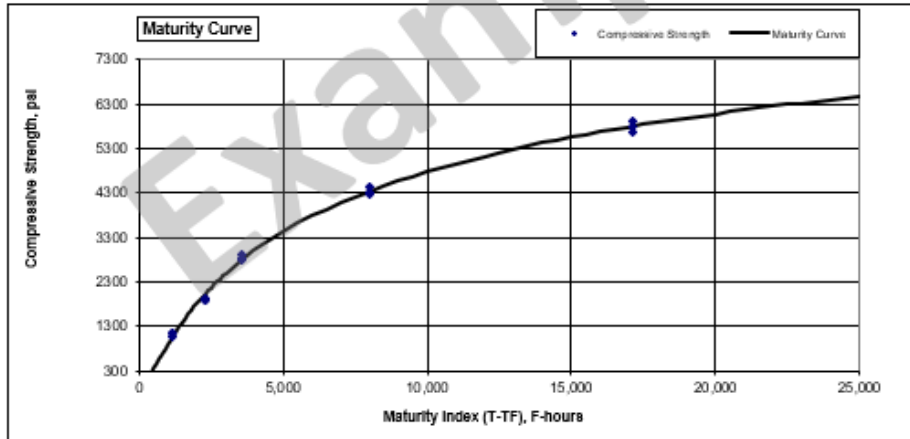
12/01/2020

## Concrete Maturity - Strength Development

Using Compressive Strength

Project No.:	I-20-2020	Tester:	John Doe	Report Date:	7/8/20
Location:	I-294, MP 20.2 - 22.2	Contractor:	Smooth Paving	Casting Date:	6/24/20
Curve #:	1	Engineer:	Jane Smith	Casting Time:	8:00 AM
				Opening Strength, psi	2500

Beam No.	Age at Break (hours or days)	Ave. Diameter "D" (in)	Ave. Length "L" (in)	Total Test Load (lbs)	Failure Type	Compressive Strength (psi)	T-TF Sensor 1 (F-Hours)	T-TF Sensor 2 (F-Hours)	Ave. T-TF (F-Hours)
1	1	5.98	12.00	30215	Cone	1075	1152	1180	1165
2		6.01	12.02	32145	Cone	1135			
3		6.00	12.00	31895	Cone	1130			
4	2	5.99	12.00	53157	Cone	1885	2304	2219	2260
5		6.01	12.01	53440	Cone	1885			
6		6.02	12.03	55555	Cone/Split	1950			
7	3	6.00	12.01	82555	Cone	2920	3456	3655	3555
8		6.00	12.00	79585	Cone	2815			
9		6.01	12.00	80985	Shear	2855			
10	7	5.99	12.02	125055	Cone	4440	8064	7996	8030
11		5.99	12.03	120950	Cone	4290			
12		6.01	12.00	122955	Columnar	4335			
13	14	6.02	12.01	165525	Cone	5815	17035	17211	17125
14		6.01	12.01	167890	Cone	5920			
15		6.00	11.99	160255	Cone	5670			



Required T-TF for Opening  F-hours

Su=	11394.48	Solve Maturity Curve
t=	7368.65	
a=	0.467	

**Comments:**

Mix Information		Certified Contractor Rep: _____  Maturity Curve Reviewed by _____
Mix No.	2020	
Truck No.	99	
Air, %	7.8	
Slump, in.	2.5	
W/C Ratio	0.39	

Figure 1: Example of *Maturity-Strength Development* form, TTF 010

b. *Estimate In-Place Concrete Strength*

The Contractor shall submit the maturity-strength development form, TTF 010, to the Engineer for each concrete mixture to be placed with the maturity method, prior to placing any concrete using the maturity method.

To estimate the in-place concrete strength in the field for pavement, place maturity meters or temperature sensors in the pavement at a rate of at least one for every 2,000 square yards of paving, including one in the last 50 feet of each day's paving. For pavement patches, maturity meters or temperature sensors should be placed in the last patch of each day's paving. Temperature sensors shall be embedded within +/- 0.5 in. of mid-depth and approximately 18 (but no less than 12) inches from the edge of the pavement. To estimate the in-place concrete strength in the field for structures, attach maturity meters or temperature sensors to the reinforcing steel near the edge of an exposed surface using a non-metallic fastener at 2 separate locations selected by the Engineer. The surface of the concrete shall be finished as with any other location on the surface. Sensors shall not be started until they are covered with concrete. Any wires protruding from the surface or edge shall be protected from finishing and equipment until the maturity index is reached indicating that the strength has exceeded the strength requirements for construction traffic, public traffic, or completion of low air temperature protection.

Record the identification number(s) of the maturity meters or data loggers on the *Maturity - Field Data* form, TTF 011. See Figure 2 for an example of the form.

Initiate data collection and recording according to the manufacturer's instructions. Use a datum temperature value of 32°F.

At least each morning, check the recorded maturity index (or temperature history and compute the maturity index). Record the temperature readings and calculate the maturity values on the *Maturity - Field Data* form, TTF 011 to estimate the strength of the in-place concrete.

The Contractor shall provide the Engineer with the following information prior to opening to traffic or removing low air temperature protection:

- 1) Project number
- 2) Placement date
- 3) Locations represented by the test data
- 4) Quantity of concrete placed
- 5) Estimated strength determined for each sensor location

The maturity-field data form, TTF 011 shall be submitted. Electronic data from the maturity meters or temperature loggers shall also be submitted in the form of a text file or a spreadsheet.



## 5. Verify Maturity-Strength Relationship.

Once every 7 calendar days during operations, a verification test shall be conducted by the Engineer to ensure that the in-place concrete strength is accurately estimated by the maturity-strength relationship. At a location designated by the Engineer, a minimum of three-cylinder strength specimens and one-cylinder specimen for the sensor shall be molded and cured by the Contractor in accordance with Illinois Modified AASHTO T 23. The Contractor shall deliver the 3 compressive strength cylinders to the Engineer after attaining 50 percent of their intended maturity. The Contractor shall notify the Engineer promptly when the instrumented cylinder reaches the intended maturity so the Engineer can perform verification testing as closely as possible to that maturity. Alternatively, the Contractor may provide the Engineer the instrumented cylinder and a maturity meter to read the instrumented cylinder. The Engineer shall be notified at least 24 hours in advance of the time and location of both the verification specimen's casting and strength testing. Test the three specimens without the temperature sensor as described in this test procedure as close to the maturity index (T-TF) for the strength criteria as possible. Compute the average strength as described in Section 4a. above using the *Concrete Maturity-Strength Verification* form, TTF 012. See Figure 3 for an example of the form.

Plot the average strength and maturity index on the *Concrete Maturity-Strength Verification* form, TTF 012.

Report the results of the validation testing on the *Concrete Maturity-Strength Verification* form, TTF 012 and submit the form to the Engineer the day that the verification test is completed.

If the actual compressive strength measured in the verification test is within 10% of the strength predicted by the maturity-strength relationship, the relationship may continue to be used.

If the actual compressive strength measured is more than 10% greater than the predicted strength, the relationship will not be considered verified, but will be considered acceptable for further use. A new maturity-strength relationship may be developed at the discretion of the Contractor.

If the actual compressive strength measured is more than 10% lower than the predicted strength, the relationship will no longer be acceptable and a second verification test may be conducted, or a new maturity-strength relationship may be developed, at the Contractor's discretion. If the second verification test does not fall within 10% of the maturity curve, a new maturity-strength relationship must be developed. The maturity method may not be utilized until a new relationship is developed.

Proper operation of maturity meters and temperature sensors is required to be verified every 30 days during operations. Verification is done by comparing the temperature recorded by the maturity meter or temperature sensor to a known temperature, as provided by a calibrated thermometer. At least three temperature points (e.g. 40°F, 75°F, and 110°F) must be used in the sensor verification.

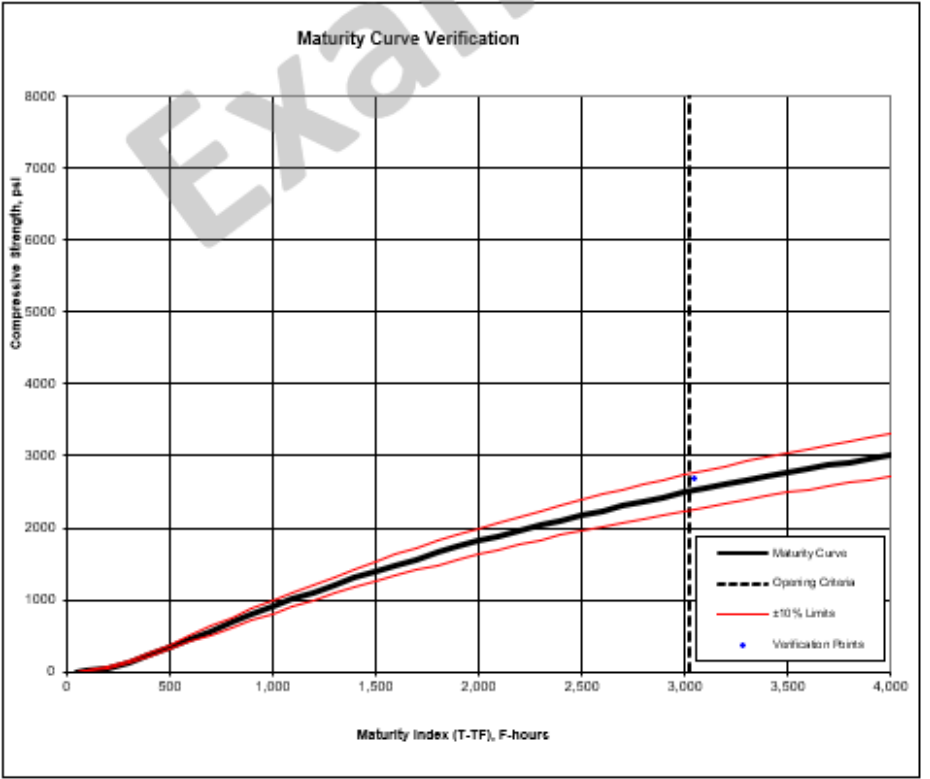


### Concrete Maturity - Strength Verification Using Compressive Strength

Project No.:	I-20-2020	Tester:	John Doe	Mix No.:	2020
Location:	I-294, MP 20.2 - 22.2	Contractor:	Smooth Paving	Air, %:	7.3
Curve:	1	Engineer:	Jane Smith	Slump, in.:	2
				W/C Ratio:	0.38

<b>Curve Coefficients</b>	$S_e = 11334$	Opening Strength, psi	2500
(from Maturity-Strength Development Report)	$t = 7368.7$	Required T-TF for Opening	<b>3020</b>
	$a = 0.467$		

Test No.	Cylinder No.	Age at Break (hours/days)	Date	Time	Ave. Diameter "D" (in)	Ave. Length "L" (in)	Total Test Load (lbs)	Failure Type	Compressive strength (psi)	T-TF (F-Hours)	Verification Test Passes?
1	1	3	7/11/20	8 AM	6.01	12.01	75830	Cone	2675	3050	PASS
	2				6.00	12.00	76330	Cone	2725		
	3				5.99	12.01	74585	Cone	2645		



<b>Comments</b>	Certified Contractor Representative:	
	Verification Test Reviewed by:	

Figure 3: Example of Concrete Maturity-Strength Verification form, TTF 012

## **6. Changes in Concrete Mixture.**

The maturity-strength relationship is specific to the accepted mixture design number. No changes will be allowed from the material sources, types, and proportions on the accepted Tollway A-30 or A-70 form. The water/cementitious ratio shall be within the range of design - 0.03, +0.00. If any of these changes occur, a new maturity-strength relationship must be developed for the new mixture design, and no additional concrete may be placed using the maturity method until a new relationship is developed.

At the Contractor's discretion, if the new mixture design is anticipated to have similar performance, a verification test may be conducted in lieu of a new maturity-strength relationship. If the verification test indicates that the relationship remains acceptable, a new relationship is not required.

Illinois Tollway Testing Procedure

Effective Date: 01/01/22

Revised Date: 03/11/22

Standard Method of Test

For

**Warm Mix Asphalt Mixture Sampling From the Paver Auger**

**Illinois Tollway Test Procedure (TTP) 015**

**Purpose:** This procedure describes QV sampling of warm mix asphalt (WMA) at the point of delivery in the field.

**Apparatus:** Square ended flat scoop shovel with vertical sides

**Procedure:**

1. Select all sample locations without prior notification to the contractor.
2. Maintain custody of the samples from obtaining the sample through testing.
3. While the paver is in motion, observe the operation of the augers which transport the mixture from the slat feeder to either side of the paver. These augers should be operating eighty percent or more of the time and be at least two-thirds covered with the mixture.
4. Insert a flat scoop shovel into the mixture ahead of the augers to remove two approximately equal shovels of the mixture with minimal loss of larger particles. Two samples shall be taken at different locations and recombined as a representative sample of the mixture being produced.
5. Take care throughout the procedure to avoid segregation of the sample or contamination by dust or other foreign matter.



Illinois Tollway Testing Procedure  
Effective Date: 11/06/2023

Standard Method of Test  
For

**Volumetric Mobile Mixer Approval Procedures**

**Illinois Tollway Test Procedure (TTP) 016**

This document describes requirements for volumetric mobile mixers that provide mixed-on-site concrete. These procedures are intended to assure concrete quality, consistency of product, and compliance with the IDOT SSRBC as well as any applicable Tollway Special Provisions. A volumetric mixer is defined as being either a truck or trailer mounted mobile mixer that stores concrete ingredients in individual compartments, and combines and mixes the ingredients in accordance with the mixture design at the job site.

Volumetric concrete mixers must undergo a complete inspection of equipment and calibration of the mixer. The producer must have a qualified lab to allow required testing. A trained PCC Level II technician will be on site throughout the inspection, calibration, and production process.

The approval process is as follows:

**1.0 Preconstruction Documentation Requirements**

Prior to volumetric mixer inspection, the following documents shall be submitted:

- 1.1 Annual QC plan for Volumetric Mix Production (A-73).
- 1.2 IDOT or Tollway approval letter for the plant QC lab annual inspection.
- 1.3 Approved mix designs.
- 1.4 Bills of lading (cement, admixtures, latex admixture) and aggregate shipping tickets for each aggregate used.

**2.0 Producer Qualification Requirements**

- 2.1 Quality Control Plan  
The producer shall develop an annual quality control plan in accordance with the Model Quality Control Plan for Volumetric Mix Production (A-73). The quality control plan must be submitted to the Engineer for approval prior to inspection.
- 2.2 Personnel Qualifications  
The producer shall have QC personnel qualified according to their Quality Control Plan for Volumetric Mix Production.

- 2.3 **Laboratory**  
The mobile mix producer shall provide a qualified laboratory capable of performing calibrations and all tests described in this document. The producer shall have immediate access to the qualified laboratory as defined in IDOT Supplemental Specifications and Recurring Special Provision for QC/QA of Concrete Mixtures Art. 1020.16(a), Check Sheet #23 to conduct required testing. The lab shall be inspected and approved by IDOT or the Tollway
- 2.4 **Mix Designs**  
The producer shall submit an approved mix design created by an IDOT PCC Level III trained technician. The mix design shall be submitted for approval by the Tollway. The Tollway may request a trial batch to be performed prior to mix production.

### **3.0 Volumetric Mixer Requirements**

The inspection of each mobile unit shall include a review of the proportioning devices, admixture dispensers, auger/mixer wear, storage bins, and recording meters. All contents in tanks and bins shall be labeled with type of material.

The volumetric mixer shall meet the provisions of the IDOT SSRBC Article 1103.04 and the following:

- 3.1 **Conveyor System**
- 3.1.1 A main conveyor shall meter and convey aggregates to discharge at the rear of the unit.
  - 3.1.2 Separate hydraulic drives to operate the cement bin independently of the combined conveyor are not acceptable unless interlocked by computer control.
  - 3.1.3 The conveyor assembly shall extend full length under the aggregate bins.
  - 3.1.4 If the conveyor system is a belt, to ensure that all materials transfer from the conveyor belt to the mixer, an adjustable belt wiper shall be located at the discharge end of the conveyor assembly.
  - 3.1.5 The conveyor discharge shall be enclosed by shields and guards to reduce dust and ensure safety. These shields shall be capable of being opened or removed easily for inspection.
- 3.2 **Mixer System**
- 3.2.1 The mixer shall be hydraulically powered and independently controlled.
  - 3.2.2 It shall thoroughly mix a wide range of concrete mixtures from low to high slump mixes.
  - 3.2.3 The boot on the mixer assembly shall be non-adjustable and made of flexible material. The top cover shall open for easy cleanout and inspection.

- 3.2.4 Mixer control functions shall include mix, reverse, and stop.
- 3.2.5 The mixer auger shall ensure a completely homogenized mix.
  
- 3.3 Aggregate System
  - 3.3.1 A center bin divider shall separate the two aggregates.
  - 3.3.2 The sides of the aggregate bin shall be angled, and flush with the aggregate belt, to insure a continuous and accurate flow of aggregate to the mixer.
  - 3.3.3 The truck shall be equipped with a tarp to cover aggregate bins.
  - 3.3.4 To promote sand flow, the sand side shall be equipped with automated vibrators. These vibrators shall be cycled whenever the main conveyor is in operation. Electronic switch shutoffs shall be included so that the vibrators can be shutoff at any time. Vibrators shall be programmable by a programmable logic controller (PLC) or mechanical system so frequency and cycle time can be adjusted.
  - 3.3.5 Strike off gates that control the amount of aggregate discharged shall be located at the discharge end of each aggregate bin.
  - 3.3.6 The gate height shall be controlled by a system with legible, numbered position indicators.
  - 3.3.7 To eliminate spillage, guides shall be located at the bottom of the sides and divider of the aggregate bin.
  
- 3.4 Cement System
  - 3.4.1 Cement shall be carried in a watertight cement bin with a means to verify low-level.
  - 3.4.2 The cement drop shall be free of excess build up. If a separate horizontal cement transfer auger with discharge sock is utilized, it shall discharge directly into the homogenizing mix auger. The auger shall be free of excess build up.
  - 3.4.3 A disconnect system shall be included so that the cement feed can be disengaged easily and only aggregates discharged, unless otherwise approved by the Engineer.
  - 3.4.4 A mechanical vibrating system along with an aerator system shall be installed on the cement bin to insure the constant flow of cement. The vibrators shall be cycled during normal operation of the cement metering system and controlled through the electronic vibrator timer.
  
- 3.5 Water System
  - 3.5.1 A flow meter showing the gallons per minute of water shall be included and visible from the outside of the vehicle. The flow meter shall have a visible range of 0-40 GPM. A separate meter visible from the outside of the vehicle showing total gallons delivered to the vehicle shall also be included.
  - 3.5.2 Operation of the water shall occur concurrently with the operation of the main conveyor.
  - 3.5.3 The unit shall include a clean-up hose with a spray nozzle attached.

- 3.6 Admixture System
  - 3.6.1 Liquid admixture system shall be capable of consistent flow of liquid admixtures.
  - 3.6.2 A flow meter indicating the injection rate shall be located at the operator's station.
- 3.7 Swivel System

A power swivel with the ability to swing the auger for ease of material placement is required. If equipped with a chute swivel, the geometry of the swivel and hoist shall keep the mixer at the same inclination with respect to the truck axis at all positions without adjusting the hoist cylinder.
- 3.8 Control Station
  - 3.8.1 The volumetric mixer shall have an easily accessible control center able to maintain and control mixing of concrete. It shall be equipped with a counter mounted in a location clearly visible to operator and inspector for proper feed adjustments. In addition, the counter shall enable the operator to calculate amounts of concrete produced. The unit shall have a governor to maintain preset engine speed under different loads and mixing conditions.
  - 3.8.2 Wireless remote control is permitted.
  - 3.8.3 Instantaneous rate of flow for latex shall be displayed at the control station.
- 3.9 Fiber System

Fiber feed systems shall be installed, calibrated, and operated as per the equipment manufacturer's guidelines.
- 3.10 Tickets shall be provided for each load. Tickets shall include the following information:
  - a. Start date and time
  - b. Mixer truck number
  - c. Delivery ticket number
  - d. Name of purchaser
  - e. Contract/Project number
  - f. Project location and description
  - g. Producer name
  - h. IDOT producer number
  - i. Mix design number
  - j. Concrete material code
  - k. Total quantity delivered
  - l. Aggregate gate settings
  - m. Total cement meter count and calibrated 1.0 cubic yard count
  - n. Water added (flow meter rate setting and total gallons)
  - o. Latex added (flow meter rate setting and total gallons) (when applicable)
  - p. Admixture type/name (flow meter rate setting and total ounces)
  - q. Stop date and time

## 4.0 Mix Production Requirements

### 4.1 Calibration

- 4.1.1 Calibrations shall be performed according to the IDOT PCC Level II Technician Course, Section 4.3.1. Fiber calibrations shall be performed according to the equipment manufacturer's recommendation.
- 4.1.2 Each mixer shall be calibrated for each mix design prior to production, and at least annually. Calibration must be witnessed by IDOT or the Tollway. The calibration shall be documented on the Volumetric Mixer Calibration Form (TTF 013).
- 4.1.3 The calibration sheet(s) shall be provided to and approved by the Tollway upon completion of calibration. A copy of all calibration sheets and agency approval letters shall be kept with each mobile mixer.
- 4.1.4 Calibrations performed by other agencies may be accepted at the discretion of the Tollway.

### 4.2 Yield Test

- 4.2.1 A yield test by the quarter cubic yard box method shall be performed to determine if the final mix proportions are correct. An acceptable yield test, as determined by the Tollway, shall be defined as the quarter cubic yard box being nominally full when struck.
- 4.2.2 A quarter cubic yard box method is determined by counts quantified in the calibration after the first cubic foot of material is wasted.
- 4.2.3 The quarter cubic yard box shall be a metal 27" square box with 16" sidewalls.

### 4.3 Mixture Verification

- 4.3.1 The gates and meter settings shall be set as determined and documented on the Volumetric Mixer Calibration Form (TTF 013) for the specific mixer and mix design.
- 4.3.2 The first cubic foot of concrete produced may not meet the mix design proportions and shall be discarded, as per IDOT SSRBC Article 1020.12.
- 4.3.3 If the yield test is acceptable, then the concrete materials in the box may be used for testing.
- 4.3.4 Test batch: the producer shall test slump, air content, temperature, and cast strength specimens as required by the IDOT PCC Level III Technician Course, Section 7.0, Concrete Mix Design – Trial Mixture. The producer shall wait 5 minutes prior to conducting slump tests, as per IDOT SSRBC Article 1020.12.
- 4.3.5 Test batches performed by other agencies may be accepted at the discretion of the Tollway.

### 4.4 Annual Startup

- 4.4.1 Prior to start of mix production, calibrations (Section 4.1), yield tests (Section 4.2), and test batches (Section 4.3) shall be performed.
- 4.4.2 Calibrations and test batches performed by other agencies may be accepted at the discretion of the Tollway.
- 4.5 Verification of Calibrations
  - 4.5.1 The producer shall verify calibration of the volumetric mixer every 90 days. In lieu of a new calibration, the producer may perform a yield test and test batch per mix design per mixer, as defined in Sections 4.2 and 4.3.
  - 4.5.2 Mixture performance provided by the producer may be accepted in lieu of test batches as defined in Section 4.5.1.
- 4.6 Recalibration of the volumetric mixer shall take place if any of the following situations exist:
  - 4.6.1 Mechanical adjustments are made to a volumetric mixer that impact the movement, control, proportioning or mixing of the cement, admixtures, aggregates, or water.
  - 4.6.2 A particular mix design or mixer demonstrates inconsistent test results.
  - 4.6.3 If verification, as defined in Section 4.5, is rejected.
  - 4.6.4 Recalibration has been deemed necessary by the Tollway.
- 4.7 Mix Production
  - 4.7.1 Stockpiles of aggregates stored on site shall be checked for gradation and moisture prior to start of production.
  - 4.7.2 Stockpiles of aggregates stored on site shall be tarped.
  - 4.7.3 Bills of lading for all component materials shall be made available upon request.
  - 4.7.4 The first cubic foot of concrete produced may not meet the mix design proportions and shall be discarded, as per IDOT SSRBC Article 1020.12.
  - 4.7.5 Any mix adjustments required to produce a consistent mix shall be completed prior to slump and air content testing.
  - 4.7.6 Slump testing shall be delayed a minimum of 5 minutes after mix discharge as per IDOT SSRBC Art. 1020.12.
  - 4.7.7 During periods of continuous production for each volumetric mixer, for purposes of testing frequency, air content shall be tested every 10 cubic yards for all superstructure placements and every 50 cubic yards for all other mixes. Slump shall be checked, at a minimum, on the first load of the day and when strength specimens are made.
  - 4.7.8 For latex modified concrete, yield tests will be performed once per mixer at the start of each day's production.

## **5.0 Documentation**

The following documents shall be approved and completed prior to production. The documents shall be available upon request.

- 5.1 Required Documentation
  - 5.1.1 Approved annual QC Plan for Volumetric Mix Production (A-73).
  - 5.1.2 QC laboratory approval letter.
  - 5.1.3 Approved Volumetric Mixer Calibration Forms (TTF 013).
  - 5.1.4 Agency approval letter for each volumetric mixer, if applicable.
  - 5.1.5 Approved mix design(s).
  - 5.1.6 Volumetric Mixer Requirements Checklist (AC-270).
  
- 5.2 Reference Documents
  - 5.2.1 Volumetric Mixer Requirements Checklist (AC-270).
  - 5.2.2 Model Quality Control Plan for Volumetric Mix Production (A-73).
  - 5.2.3 Volumetric Mixer Calibration Form (TTF 013).

TOLLWAY TESTING FORM (TTF) 001

REV 04/23/2020

GRADATION WORKSHEET FOR POROUS GRANULAR EMBANKMENT

EQUIPMENT NAME \_\_\_\_\_  
 EQUIPMENT # \_\_\_\_\_  
 CONTRACT # \_\_\_\_\_  
 DATE SAMPLED \_\_\_\_\_

SAMPLE \_\_\_\_\_  
 LOCATION \_\_\_\_\_  
 MATL CODE \_\_\_\_\_  
 DATE TESTED \_\_\_\_\_

LAB \_\_\_\_\_  
 INSP. TYPE \_\_\_\_\_  
 SEQ. # \_\_\_\_\_

GRADATION GRIDSHEET OF COARSE MATERIAL (+3/8")

SIEVE SIZE	RET. WT. LBS OR KG	RET. WT. LBS OR KG	RET. WT. LBS OR KG	RET. WT. LBS OR KG	COMBINE	ACCUM	ACCUM	% PASS	GRADATION RANGE		RESULTS
	R-1	R-2	R-3	R-4	TOT.RET WEIGHT (R-1+R-2+R-3+R-4)	ST. WEIGHT S	% RET T=(S/C*100)	T-100	MIN	MAX	
8"											
6"											
5"											
4"											
3"											
2 1/2"											
2"											
1.5"											
1"											
3/8"											

AGG. WT. \_\_\_\_\_  
 PAN WT./ -3/8 \_\_\_\_\_  
 TOT. WT. \_\_\_\_\_

R 3/8" \_\_\_\_\_ D  
 P 3/8" \_\_\_\_\_ E

GRADATION GRIDSHEET OF FINE MATERIAL (-3/8")

SIEVE SIZE	RET. WT. GRAMS	% RET. WT.	% PASS #3/8"	% RET. WT. #3/8"	% RET. WT. (X)	ACCUM.	ACCUM	% PASS	GRADATION RANGE		RESULTS
	U	V=(U/F)	(E)	W=(V*E)	COMB. WT. X=(W*C/100)	RET. WT. +A Y	% RET. WT. Z=(Y/C*100)	Z-100	MIN	MAX	
#4											
#8											
#16											
#30											
#200											
PAN											
DIFF. (-200)											
TOTAL % RET											

DRY WT. \_\_\_\_\_ F  
 WASH WT. \_\_\_\_\_ G  
 DIFF.(-200) \_\_\_\_\_ H

REMARKS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

TESTED BY: \_\_\_\_\_



## Daily Profiler Calibration Verification Report

1. Contractor Contacted Tollway Engineer 24 Hours in advance of data collection.
2. Profiler Operator produced the PEV Certification Letter issued by IDOT.
3. Tollway Engineer or representative confirmed the operation of profile equipment.

Representative: \_\_\_\_\_

Test	Laser	Avg Std Dev for Base Plate (Actual)	Avg Std Dev for Block # (Measured)	Height for Block # (Difference)	Tolerance (AASHTO R 57)
Height Sensor Block Test for 1/4" (Block 1)	T1 (Laser 1)				+/- 0.01" per block
	T2 (Laser 2)				
Height Sensor Block Test for 1/2" (Block 2)	T1 (Laser 1)				+/- 0.01" per block
	T2 (Laser 2)				
Height Sensor Block Test for 1" (Block 3)	T1 (Laser 1)				+/- 0.01" per block
	T2 (Laser 2)				
Height Sensor Block Test for 2" (Block 4)	T1 (Laser 1)				+/- 0.01" per block
	T2 (Laser 2)				

Test	Laser	Measured	Tolerance (AASHTO R 57)
Bounce Test	T1 (Laser 1)		< 8 in./mi.
	T2 (Laser 2)		

Test	Set Distance	Measured	Difference	Tolerance (AASHTO R 57)
DMI Calibration Test				+/- 0.15% of Set Distance

Name (PRINT):  
(IP Operator) \_\_\_\_\_

Company: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

### Tollway Profile Report for Bridge Section Smoothness

Contract No.: _____	PEV Certification No.: _____
Bridge No.: _____	Profiler Operator: _____
Bridge Desc: _____	Contractor: _____
Route: _____	Date(s) Tested: _____
RE Name: _____	

File Name	Direction	Lane	Bridge Section Length	Start Distance (ft)	Stop Distance (ft)	MRI (in/mi)

#### Instructions for Completing Profile Report for Bridge Section Smoothness

This form shall be prepared and submitted to the Engineer, along with all other required documentation.

Contract No:	Tollway Contract Number
Bridge No:	Tollway Bridge Number
Bridge Desc:	Bridge Description. For example: I-90 EB Bridge over Fox River
Route:	Tollway Route Number:
RE Name:	Printed name of Tollway's representative witnessing data collection
PEV Cert #:	Certification number provided by IDOT's Profiler Equipment Verification
Profiler Operator:	Printed name of the Contractor personnel operating the profiler
Contractor:	Contractor responsible for grinding the bridge deck
Date(s) Tested:	Date(s) the profile testing was performed

File Name:	Name of ProVAL data file corresponding with the data listed
Direction:	NB, SB, EB and WB depending on the traffic flow of the numbered route
Lane:	1, 2, 3 etc.
Bridge Section Length:	Length of cropped data in ProVAL (includes the approach, transition and bridge deck)
Start Distance (ft):	Length of where the ProVAL analyzation starts (beginning of cropped section)
Stop Distance (ft):	Length of where the ProVAL analyzation ends (end of cropped section)
MRI (in/mi)	Long Continuous MRI value for bridge section and lane



### Instructions for Completing Profile Report for Pavement Smoothness

This form shall be prepared and submitted to the Engineer, along with all other required documentation.

Contract No:	Tollway Contract Number
Route:	Tollway Route Number:
CM Name:	Printed name of Tollway's representative witnessing data collection
Contractor:	Contractor responsible for paving
Pavement Type:	List either WMA, SMA, JPCP, CRC – for the type of material placed
Section Type:	HMA: Surface Course, Binder Course, Ramp <45mph, Ramp>45mph PCC: Mainline, Ramp<40, Ramp>40
PEV Cert #:	Certification number provided by IDOT's Profiler Equipment Verification
Profiler Operator:	Printed name of the Contractor personnel operating the profiler
IRI	IRI requirement from Tollway SP for corresponding pavement type
LR	LR requirement from Tollway SP for corresponding pavement type
Paving Date(s):	Date(s) the pavement was placed
Profile Date(s):	Date(s) the profile was completed
Time of Day:	Time of day (military clock)
Weather:	General weather notes
Direction:	NB, SB, WB or EB
Lane Number:	Lane number for profiled lane
Begin Station:	Begin station for each segment.
End Station:	End station for each segment
Segment Length:	Length between End Station and Begin Station of each segment
Left Wheel Path IRI:	Left wheel path IRI from ProVAL
Right Wheel Path IRI:	Right wheel path IRI from ProVAL
IRI Average:	Average of both wheel paths (for information only)
Comments:	List any pertinent comments here
Begin Station:	Begin Station of LR (does not need to correspond with IRI rows)
End Station:	End Station of LR (does not need to correspond with IRI rows)
Wheel path:	Right or Left wheel path where the LR exists

**NOTE:** The following items shall be followed to create a complete excel document for the entire project. As data is collected, this excel file shall be populated and submitted to the engineer with the corresponding Smoothness Assurance PDF(s).

- Stationing shall start at the beginning of the profile run moving in the direction of traffic
- Multiple profile runs should be combined to create a continuous spreadsheet for each lane.
- Multiple runs shall be listed in order of increasing or decreasing stationing (dependent on the direction) from the beginning of the project until the end of the project.
- Additional tabs shall be created for each lane so there is one excel file that contains all the IRI and LR data for the entire project.



## Witness Panel for Fiber Wrap Repair

Contract number:	
Project location:	
Resident Engineer and email address:	
Material Coordinator and email address:	
Name of representative observing witness panels being cast:	
Application location:	
Application date:	
Time of application:	
Ambient temperature & weather conditions during application:	
Name of approved Application Installer:	
Number of samples:	
Name of Manufacturer:	
Name of Composite Material:	
Thickness to be used for strength calculations: (By default, the lab uses the commonly preferred nominal thickness. Before you specify Actual thickness please double check with your manufacturer)	<input type="checkbox"/> Nominal Ply Thickness <input type="checkbox"/> Actual Ply Thickness
ASTM D-3039 Standard Test Method will be used for required tensile properties; make sure it applies to your project.	Special Instructions:
Did you mark the primary fiber direction on each test sample?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Tests are to be conducted:	<input type="checkbox"/> 0° to primary fiber direction (default) <input type="checkbox"/> 90° to primary fiber direction <input type="checkbox"/> In the direction marked on each sample
Is the product data sheet attached?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Are pictures attached?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Are samples marked with identification?	<input type="checkbox"/> Yes <input type="checkbox"/> No

This form shall be prepared and submitted to Jeanne McDonald via email at [jmcdonald@statetestingllc.com](mailto:jmcdonald@statetestingllc.com) or with the sample at 2223 Ogden Ave, Downers Grove, IL, 60515.



### Dynamic Cone Penetrometer Test Form

Conduct this test according to the Illinois Test Procedure 501 and fill out the following TTF 007 form accordingly.

Date:

Weather:

Inspector:

Company:

IDOT Lab No.:

Type of Inspection:

ISTHA Contract No.:

Location:

Route:

Type of Construction:

Type of Material:

Contractor:

Test Location <sup>1</sup> and Remarks <sup>2</sup>	Initial Depth (Elevation, ft.)	Depth <sup>3</sup>	0-6"	6"-12"	12"-18"	18"-24"	24"-30"
		Blows					
Rate <sup>4</sup>							
IBV							
Qu							
		Depth <sup>3</sup>	0-6"	6"-12"	12"-18"	18"-24"	24"-30"
		Blows					
		Rate <sup>4</sup>					
		IBV					
		Qu					
		Depth <sup>3</sup>	0-6"	6"-12"	12"-18"	18"-24"	24"-30"
		Blows					
		Rate <sup>4</sup>					
		IBV					
		Qu					
		Depth <sup>3</sup>	0-6"	6"-12"	12"-18"	18"-24"	24"-30"
		Blows					
		Rate <sup>4</sup>					
		IBV					
		Qu					

<sup>1</sup> Indicate station and offset  
<sup>2</sup> Indicate soil type, moisture, rutting and etc.  
<sup>3</sup> Depth is cumulative in inches  
<sup>4</sup> Rate is inches penetration per blow

Rate <sup>4</sup>	IBV	Qu	Rate <sup>4</sup>	IBV	Qu
0.462	18.30	5.86	1.000	6.91	2.21
0.500	16.57	5.30	1.200	5.49	1.76
0.545	14.86	4.76	1.500	4.15	1.33
0.600	13.17	4.21	2.000	2.89	0.92
0.666	11.55	3.70	3.000	1.73	0.55
0.750	9.94	3.18	6.000	0.72	0.23
0.857	8.4	2.69	<6	<0.72	<0.72

Quality Manager:

Company:

Resident Engineer:

Company:



**Field Compaction Report**

Conduct this test according to AASHTO T 310 and fill out the following TTF 008 form accordingly

Test I.D. No. \_\_\_\_\_

Inspector: \_\_\_\_\_ ISTHA Contract No.: \_\_\_\_\_ Location: \_\_\_\_\_

Route: \_\_\_\_\_ IDOT Lab No.: \_\_\_\_\_ Lab Name: \_\_\_\_\_

Contractor : \_\_\_\_\_ Material: \_\_\_\_\_ Material Producer: \_\_\_\_\_

	Date Tested	Test No.	Test Location Station	Ref. Offset	Type of Construction	Type of Inspection	Original ID No.	Elevation		
								Grade (ft)	Ground (ft)	Test (ft)
A.										
B.										
C.										
D.										
E.										
F.										

	Material Source	Material Type	Test Method	Optimum Moisture	Actual Moisture	% Optimum	Max. Dry Density	Actual Density	Relative Compaction (%)	Min. Comp. Reqmt (%)	Result
A.											
B.											
C.											
D.											
E.											
F.											

	Date Tested	Test No.	Test Location Station	Reference Offset	Type of Construction	Type of Inspection	Original ID No.	Elevation		
								Grade (ft)	Ground (ft)	Test (ft)
G.										
H.										
I.										
J.										
K.										
L.										

	Material Source	Material Type	Test Method	Optimum Moisture	Actual Moisture	% Optimum	Max. Dry Density	Actual Density	Relative Compaction (%)	Min. Comp. Reqmt (%)	Result
G.											
H.											
I.											
J.											
K.											
L.											

Remarks : \_\_\_\_\_

Quality Manager: \_\_\_\_\_  
 Company: \_\_\_\_\_  
 Resident Engineer: \_\_\_\_\_  
 Company: \_\_\_\_\_

Copies : \_\_\_\_\_  
 \_\_\_\_\_



**Prime and Tack Coats  
Residual Asphalt Form**

Lab Sample ID No.

Please staple this form to the bag. Do not place inside with soaked sample.

Date:	(MM/DD/YYYY)		
Construction Manager:		Contract #:	
Sampled by:	(NAME)	(QC, QA, IA)	
	(EMAIL)		
Location	(ROUTE, #)	(DIRECTION, XX)	(STATION, #####) (LANE, #)
Surface to be treated (check one)	<input type="checkbox"/> Milled Surface <input type="checkbox"/> Poly Level Binder <input type="checkbox"/> Concrete <input type="checkbox"/> HMA Binder <input type="checkbox"/> Other: _____		
Product Applied:	(SS1, SS1-h, SS1-hp, or SS1-wh)	Material Supplier:	
Product applied by: (contractor or subcontractor)		Supplier Code:	
Comments:			

Provide/forward a copy of the Bill of Lading for the sample of Prime or Tack coat delivered.

Lab Use Only			
Lab Name:		Tester:	
Started:	(MM/DD/YYYY)	Completed:	(MM/DD/YYYY)
Was Paper in bag with soaked sample?	Yes / No		
As per Manual of Test Procedures for Materials Appendix B24, "Determination of Residual Asphalt in Prime and Tack Coat Materials"			
Plastic Bag Wt _____	grams	Total wt (bag+mat+tack) _____	grams
Mat Wt _____	grams (a)	Total tack wt (Total -(bag+mat)) <b>0.0</b>	grams
Bag + Mat <b>0.0</b>	grams	Oven-dried mat + tack wt _____	grams (c)
$\left( \frac{\text{ } (c)}{\text{ } (a)} \right) \div 454 = \text{ } \text{ lbs/ft}^2$			
		BLANK PASS FAIL	S.P. Range lb/ft <sup>2</sup> Minimum 0.035 between Lifts 0.055 on Mill or PCC

This is a worksheet only.  
Final data shall be entered into I-MIRS.





Illinois Tollway

Tollway Testing Form (TTF) 010

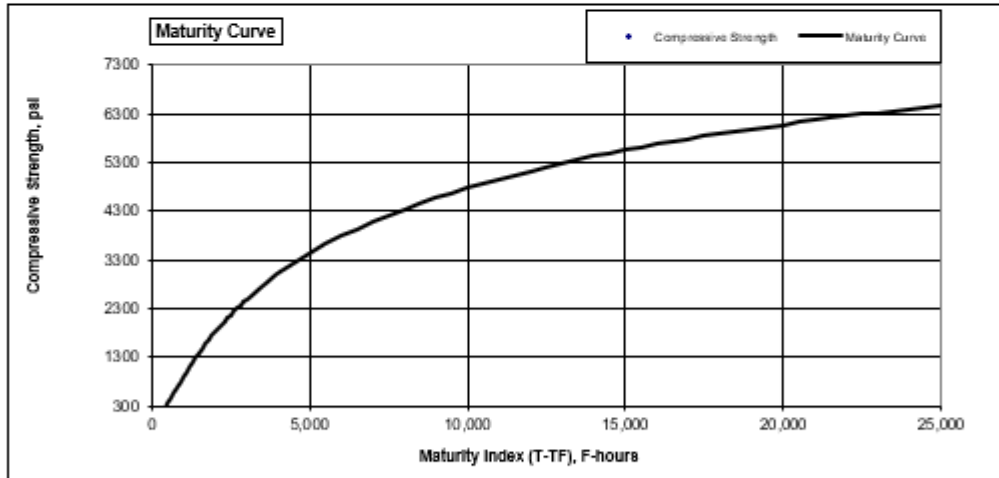
12/01/2020

# Concrete Maturity - Strength Development

Using Compressive Strength

Project No.:	<input type="text"/>	Tester:	<input type="text"/>	Report Date:	<input type="text"/>
Location:	<input type="text"/>	Contractor:	<input type="text"/>	Casting Date:	<input type="text"/>
Curve #:	<input type="text"/>	Engineer:	<input type="text"/>	Casting Time:	<input type="text"/>
				Opening Strength, psi	<input type="text"/>

Beam No.	Age at Break (hours or days)	Ave. Diameter "D" (in)	Ave. Length "L" (in)	Total Test Load (lbs)	Failure Type	Compressive Strength (psi)	T-TF Sensor 1 (F-Hours)	T-TF Sensor 2 (F-Hours)	Ave. T-TF (F-Hours)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									



Required T-TF for Opening  F-hours

<b>Su=</b>	<input type="text" value="11394.48"/>	<b>Solve Maturity Curve</b>
<b>t=</b>	<input type="text" value="7368.65"/>	
<b>a=</b>	<input type="text" value="0.467"/>	

**Comments:**

Mix Information		Certified Contractor Rep:
Mix No.	<input type="text"/>	<input type="text"/>
Truck No.	<input type="text"/>	
Air, %	<input type="text"/>	
Slump, in.	<input type="text"/>	
W/C Ratio	<input type="text"/>	
		Maturity Curve Reviewed by <input type="text"/>





Illinois Tollway

Tollway Testing Form (TTF) 012

12/01/2020

## Concrete Maturity - Strength Verification Using Compressive Strength

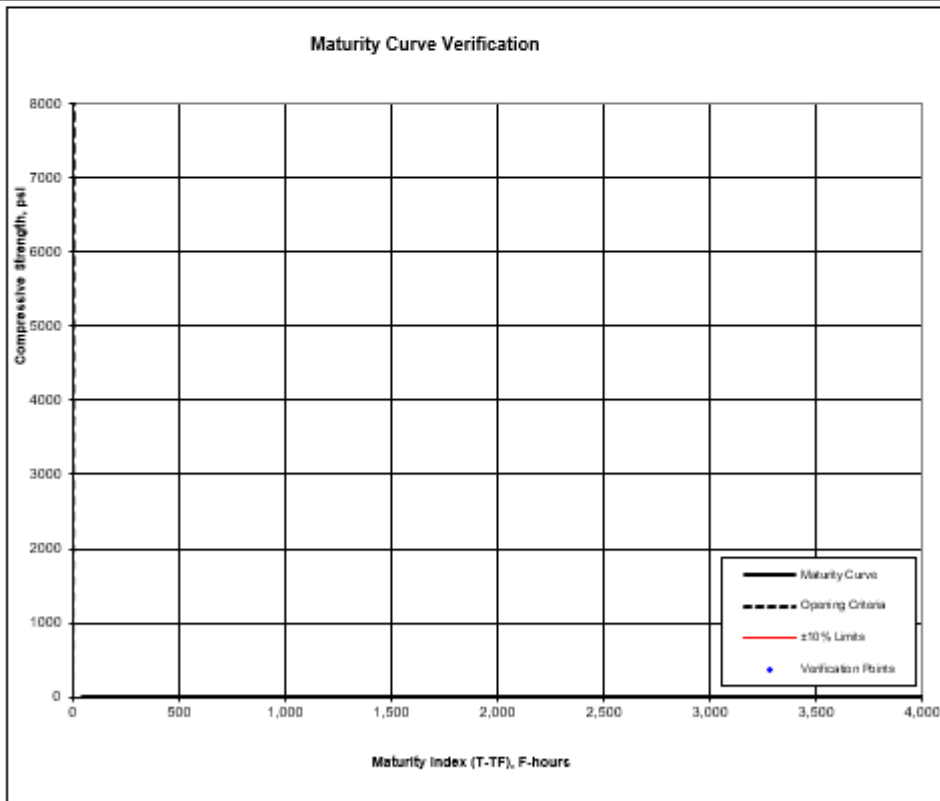
Project No.: <input style="width: 100%;" type="text"/>	Tester: <input style="width: 100%;" type="text"/>	Mix No.: <input style="width: 100%;" type="text"/>
Location: <input style="width: 100%;" type="text"/>	Contractor: <input style="width: 100%;" type="text"/>	Air, %: <input style="width: 100%;" type="text"/>
Curve: <input style="width: 100%;" type="text"/>	Engineer: <input style="width: 100%;" type="text"/>	Slump, in.: <input style="width: 100%;" type="text"/>
		W/C Ratio: <input style="width: 100%;" type="text"/>

**Curve Coefficients**     $S_u =$      Opening Strength, psi

(from Maturity-Strength     $t =$      Required T-TF for Opening

Development Report)     $a =$

Test No.	Cylinder No.	Age at Break (hours /days)	Date	Time	Ave. Diameter "D" (in)	Ave. Length "L" (in)	Total Test Load (lbs)	Failure Type	Compressive Strength (psi)	T-TF (F-Hours)	Verification Test Passes?
1	1										
	2										
	3										



<b>Comments</b>	Certified Contractor Representative: <input style="width: 100%;" type="text"/>
	Verification Test Reviewed by: <input style="width: 100%;" type="text"/>

**VOLUMETRIC MIXER CALIBRATION FORM**  
Tollway Testing Form (TTF) 013

Producer Name :	Producer No. :	Truck No. :
Operator/Driver :	Mix No. :	Bag Mix :
Project :		Date :

CEMENT P/S # :		
Weight (lb.)	Count	Time (sec.)
1		
2		
3		
4		
5		
Σ		

ΣCounts	ΣWts.	Counts/lb.	1 Bag	Cement Count/Bag
÷	=	x	94	=

ΣTime	ΣWts.	Sec./lb.	1 Bag	Time/Bag (sec.)
÷	=	x	94	=

Cement Count	Bag Mix	Count/Cubic Yd	¼ Yard Count
x			

FINE AGGREGATE		
Mat. Code :	P/S # :	
Design SSD Weight Per Cu Yd :		
% Free Moisture (Deviation from SSD) :		
Adjusted Weight Per Cu Yd :		
Tolerances : ± 1.5%		
Target Weight for 1/2 bag:		
Counts	Setting	Weight
Final Gate Setting :	Yield adjusted?	

COARSE AGGREGATE		
Mat. Code :	P/S # :	
Design SSD Weight Per Cu Yd :		
% Free Moisture (Deviation from SSD) :		
Adjusted Weight Per Cu Yd :		
Tolerances : ± 1.5%		
Target Weight for 1/2 bag:		
Counts	Setting	Weight
Final Gate Setting :	Yield adjusted?	

ADMIXTURE 1		
Name :		
Material Code :		
Dosage (oz/cwt or gal/cy) :		
Dosage (oz/cwt/bag or gal/bag) :		
Target :	Time :	sec.
Time (sec.)	Setting	Oz / Gal
Final Setting :		

ADMIXTURE 2		
Name :		
Material Code :		
Dosage (oz / cy) :		
Dosage (oz / bag) :		
Target :	oz	Time : sec.
Time (sec.)	Setting	Ounces
Final Setting :		

ADMIXTURE 3		
Name :		
Material Code :		
Dosage (gal / cy) :		
Dosage (gal / bag) :		
Target :	gal	Time : sec.
Time (sec.)	Setting	Gallons
Final Setting :		

<b>FIELD TEST</b>	Water meter verified? (Optional)	Yes <input type="checkbox"/> No <input type="checkbox"/>
Air Content :	Slump :	Conc. Temp. :
		Unit Weight :
		Yield Check :

Rev. 05/26/23

Prepared by: \_\_\_\_\_

Witnessed by: \_\_\_\_\_