Section 11:

Pavement Smoothness, High Speed Inertial Profilers, and the IRI Index

SECTION 11 – PAVEMENT SMOOTHNESS, HIGH SPEED INERTIAL PROFILERS, AND THE IRI INDEX

11.1 INTRODUCTION

All contracts containing QC/QA HMA and QC/QA PCCP require the final surface to be evaluated to determine the pavement smoothness. Smoothness is evaluated utilizing high-speed inertial profiler equipment to collect longitudinal vehicular reaction profiles of the finished surface. The profiles are then analyzed using specific software to compute the IRI for each profile collected on the contract.

Information on implementing IRI can be found under the **IRI Information** heading on the Department's website (https://www.in.gov/indot/doing-business-with-indot/home/construction-information/). The information provided includes links to the following:

- Certified Profilers & Operators
- IRI Field Guide
- IRI Field Guide for Areas of Localized Roughness, ALR
- IRI Payment Adjustment Spreadsheet – HMA
- IRI Payment Adjustment Spreadsheet – PCCP.

11.2 VERIFYING CONTRACTOR PERSONNEL AND EQUIPMENT

When the Inertial Profiler equipment arrives on the jobsite, Department field personnel will first review the **Certified Profilers & Operators** list on the Department's website under the **IRI Information** heading to verify that the Contractor's equipment has an active certification with the Department.

To confirm the accuracy and reliability of the equipment prior to operation, ITM 917 requires the **Checklist for Verification of the Inertial Profiler** to be completed while observing the Contractor performing the block test, the bounce test, and the longitudinal distance test. This checklist can be found in the appendix of ITM 917.

Inertial Profiler operators arriving on the jobsite will also need to be validated by Department field personnel by reviewing the **Certified Profilers & Operators** list on the Department's website to verify the Contractor's operator has an active certification with the Department.

11.3 OPERATION AND DATA COLLECTION

Once both the Contractor and their equipment have been verified, the collection of profile data with the high-speed inertial profiler can begin. The equipment is required to be operated at a constant speed within the manufacturer's recommended range and without braking or stopping so the introduction of false bumps or dips in the data can be avoided. All data collected outside of the manufacturer's recommended speed range or collected with braking or stopping events are required to be remeasured by performing additional data collection runs. Upon completion

of data collection, the Contractor shall save the files in an unfiltered electronic format and follow the naming convention of ITM 917 to correctly organize the files.

There may be areas of the project that are exempt from Inertial Profiler operation. These areas are defined in the SS and within ITM 917. The Contractor may locate these areas prior to beginning any data collection runs so that these areas can be excluded from the final results. Any exempted areas will be checked for smoothness utilizing a 16 ft straightedge as described below.

11.4 DATA SUBMISSION, ANALYSIS, AND PAYMENT

The review, analysis, and smoothness pay factor determination utilize ProVAL software. The Contractor must submit formatted ProVAL files for each profile trace, in accordance with ITM 917, by following the steps outlined in the **IRI Field Guide** and **IRI Field Guide for ALR**, both of which are available on the Department's website. The Contractor's submitted ProVAL files shall include two components:

- Smoothness Mean Roughness Index, MRI, analysis for each 0.1-mile section of each profile – utilizing ProVAL's Ride Quality Module as described in the **IRI Field Guide**, and

- Smoothness IRI analysis for Areas of Localized Roughness, ALR – utilizing ProVAL's Smoothness Assurance Module, SAM, as described in the **IRI Field Guide for ALR.**

The MRI is determined for each 0.1-mile section of pavement by taking the average of the IRI for the two wheel paths. IRI is the roughness index for an individual wheel path. For the overall smoothness incentive, MRI is the method of analysis as described in the **IRI Field Guide**.

For ALR's, the IRI for each individual wheel path is utilized, as described in the **IRI Field Guide for ALR**. Additionally, MRI pay factors for smoothness are required to be determined prior to any smoothness correction described in the sections below.

After the Contractor completes the initial analysis, all data files collected by the inertial profiler and all data files created during ProVAL analysis are required to be submitted to the PEMS in a timely manner. The PEMS will review the submitted ProVAL files utilizing the **IRI Field Guide** and **IRI Field Guide for ALR** located on the Department's website under the **IRI Information** heading. The PEMS will utilize the results from the ProVAL analysis to generate smoothness pay factors based on the **IRI Payment Adjustment Spreadsheet**. The PEMS will notify the Contractor of the results within seven days or provide notification of any issues with the files that require modification. After accepting the submitted files and completing smoothness pay factor and payment determination, the PEMS will place all completed files in the ProjectWise Intelligent File Cabinet for the contract within seven days. All pavement smoothness files are to be placed in the Pay Items Documentation folder of Intelligent File Cabinet.

Upon completion of analysis and payment, the Contractor is required to complete the **Contractor IRI Data Submission Form** by selecting the link under the **IRI Information** heading within the

Department's Construction Information website. This survey form is required to be filled out for all IRI Inertial Profiler data collection performed on PCCP or HMA final surfaces. Submission of this form will automatically notify INDOT Research that contract IRI smoothness work is complete and enable QA reviews, in accordance with ITM 917, on selected contracts each construction season. If the contract has smoothness data collection completed in phases, the Contractor will be required to submit the **Contractor IRI Data Submission Form** for each phase. In accordance with ITM 917, the Contractor is also required to submit raw unfiltered unmodified data files taken directly from the inertial profiler equipment for each lane in each direction and for each status to: iriuploads@indot.in.gov.

11.5 REVIEWING AND DETERMINING CORRECTIVE GRINDING AREAS

Corrective grinding may be required for areas exceeding the thresholds established for overall smoothness on each 0.1-mile section or for areas exceeding the thresholds established for ALRs. The PEMS should review the **IRI Pay Adjustment Spreadsheet** for the appropriate pavement material for each 0.1-mile section and determine which sections exceed the specified thresholds.

- Type A, HMA pavement sections with an MRI over 90 in/mi will require corrective grinding.
- Type B HMA pavement sections with an MRI over 110 in/mi will require corrective grinding.
- All PCCP pavement sections with an MRI over 90 in/mi will require corrective grinding.

Review the ALR report from ProVAL to determine each ALR location which exceeds the specified thresholds.

- Type A HMA pavement with an ALR exceeding 160 in/mi IRI or
- Type B HMA pavement with an ALR exceeding 170 in/mi IRI will require corrective grinding.
- All PCCP pavements with an ALR exceeding 160 in/mi will require corrective grinding.

Prior to beginning corrective grinding work, the Contractor should perform a grinding simulation in the ProVAL software to determine if the problematic area can be corrected with a 1/4 in. maximum grinding depth at any location. If a 1/4 in. maximum grinding depth will not resolve the issue, the results of the grinding simulation will need to be reviewed alongside the specified requirements to determine whether the ALR may remain in place or require full depth removal.

Appendix A of the **IRI Field Guide** has guidance on confirming the IRI data provided by the Contractor and making determinations about grinding. The PEMS should review this document and verify the Contractor's data prior to accepting and allowing any corrective action to proceed on the jobsite.

11.6 USE OF STRAIGHTEDGE FOR AREAS EXEMPT FROM INERTIAL PROFILER

The Contractor shall furnish and operate acceptable 16 ft straightedge for areas exempt or

excluded from Inertial Profiler requirements. The exempt and excluded areas are defined in the SS and in ITM 917. Exempts and exclusions include such areas as bridges, railroads, lanes shorter than 0.5 mi, lanes with speed limits less than or equal to 45 mph, tapers, ramps, shoulders, and turn lanes. In accordance with the requirements, the Contractor has the option of electing to operate their approved Inertial Profiler under the mode of simulating the 16 ft straightedge for these exempt or excluded areas, as long as the equipment is operated within the manufacturers speed range with appropriate lead-in and lead-out distances, which may require additional MOT setup by the Contractor.

11.7 IRI ONLINE TRAINING

For additional information on how high-speed Inertial Profilers operate and further details on the IRI index, the Department has produced an introductory course on the topic. The course is available within SuccessFactors under the learning tab. The course can be located by entering the title “IRI Introduction Course” in the search box under “Find Learning” and then selecting to start the course.