704-R-794 BRIDGE ENCOUNTER SMOOTHNESS

(Adopted 02-21-25)

Description

This work shall consist of measuring and correcting the smoothness of bridge encounters, in accordance with 105.03 and as specified herein.

Construction Requirements

Longitudinal smoothness of the bridge encounter will be accepted by means of an inertial profiler or a 16 ft long straightedge as specified herein. Transverse smoothness of the bridge encounter will be accepted by means of a 10 ft long straightedge as specified herein. The smoothness of the bridge encounter mainline travel lanes shall be measured and corrected as required prior to the final longitudinal grooving surface finish.

The bridge encounter will be defined as 50 ft of existing entry pavement, the entry RCBA slab, the bridge concrete floor slab, the exit RCBA slab, and 50 ft of existing exit pavement including all joints. When the plans specify a rigid bridge deck overlay, the full extent of the rigid overlay material shall be included in the bridge encounter including bridge floor slab overlay, RCBA overlay, terminal joints overlay, and PCCP transition overlay. When the contract includes any of the following work: PCCP or HMA terminal joints, concrete lugs, JRCP transition slabs, HMA pavement wedges, transition milling and transition overlays whether HMA or PCCP, the length of the bridge encounter shall be extended at each end to include all such components, and the bridge encounter shall extend an additional 50 ft into the entry and exit existing pavements.

Bridge encounter smoothness measurements shall be performed after all final surfaces are in place within the bridge encounter lanes being measured and all HMA and concrete surfaces have reached specified curing and equipment loading requirements. The placement of expansion joint material, strip seals, expansion seals, or similar material shall occur after completing any required corrective grinding specified herein. Temporary material shall be placed in lieu of expansion joint material prior to profile measurement to prevent errors in profile measurement caused by an empty joint. For structural expansion joints required to be cast in place only the straightedge requirements will apply to joint smoothness.

The Contractor may choose to place the bridge concrete floor slab and approach slabs, including overlays, up to 1/4 in. thicker than designed to allow for loss of cover during corrective grinding and mitigate the risk of replacement as specified herein when smoothness thresholds are exceeded.

(a) Inertial Profiler

When a pay item for Inertial Profiler, Bridge Encounter is included in the contract, the Contractor shall furnish, calibrate, and operate an approved inertial profiler in accordance with ITM 917 for the acceptance of longitudinal smoothness on the final surfaces throughout the length of the bridge encounter in each travel lane. Operating the Inertial Profiler on a bridge encounter will only be required when the posted speed is greater than 30 mph. When the posted speed is 30 mph or less, section (b) requirements for longitudinal smoothness shall apply.

The International Roughness Index, IRI, profiles and results, including areas of localized roughness, will become the property of the Department. The inertial profiler shall remain the property of the Contractor.

After final placement of all new bridge encounter slabs, pavements, overlays, terminal joints, lugs, and transitions, the Contractor shall collect inertial profiler smoothness measurements in accordance with section (d) in both wheel paths in each travel lane during one continuous pass per lane throughout the length of the bridge encounter. The bridge encounter shall be corrected in accordance with section (e) to meet the required thresholds.

(b) 16 ft Straightedge

The Contractor shall furnish and operate a 16 ft straightedge in accordance with 306.03(d) and as described below. The 16 ft straightedge or the inertial profiler simulating the 16 ft straightedge shall be used to measure bridge encounter smoothness along the direction of mainline traffic.

The 16 ft straightedge shall be utilized to ensure longitudinal smoothness is corrected to within 1/4 in. prior to the final longitudinal grooving surface finish. Locations on the bridge encounter surface scraped by the straightedge shall be marked. The bridge encounter shall be corrected in accordance with section (e) to meet the required tolerance.

(c) 10 ft Straightedge

The 10 ft straightedge will be in accordance with 306.03(d). The 10 ft straightedge will be used to check transverse slopes across travel lanes and shoulders on the full bridge encounter surface.

The 10 ft straightedge will be utilized to ensure transverse smoothness is corrected to within 1/8 in. prior to the final longitudinal grooving surface finish. Locations on the bridge encounter surface scraped by the straightedge shall be marked. The bridge encounter shall be corrected in accordance with section (e) to meet the required tolerance.

(d) Areas of Localized Roughness, ALR

The inertial profiler shall be used to measure longitudinal smoothness on the final surfaces throughout the length of the bridge encounter. The bridge encounter will be analyzed utilizing continuous IRI with a 25 ft window for each wheel path in each lane to locate individual ALR's. All bridge encounter areas having a localized roughness in excess of the following IRI thresholds, in./mi., shall be corrected subject to approval by the Engineer:

Bridge Encounter Areas	**All Interstate Bridges; All Other Bridges - Greater Than 50 mph IRI (in./mi.)**	**All Other Bridges – 50 mph or less IRI (in./mi.)**
Full Depth Floor Slab Deck	150	175
RCBA	150	175
Rigid Overlay, Deck and RCBA	175	200
Transitional Lengths, HMA and Concrete	175	200
Lugs and Terminal Joints	175	200

Expansion Joints, 2 in. wide and greater	225	250
*Existing RCBAs including Patching	225	250
*Existing Entry and Exit Pavement Areas, HMA and Concrete	225	250
* The Contractor will be permitted to submit prework IRI profiles of the existing pavement smoothness condition at these locations to demonstrate that the required thresholds were exceeded prior to beginning work on the project due to the existing conditions. The Engineer will review the profiles and determine an acceptable threshold for such existing pavement and existing approach areas.		

After ALRs have been identified, a grinding simulation shall be performed to estimate whether the ALR can be corrected to an IRI value of less than the specified threshold with no more than 1/4 in. grind depth on floor slab or deck locations and no more than 3/8 in. grind depth at all other locations. If the simulated grinding depth exceeds the specified depths, the corrective grinding shall be capped at the specified depths. Areas unable to be corrected within the established grind depth limitations and still exceeding the specified thresholds, by more than 25 in./mi., shall be replaced or overlayed in a manner acceptable to the Engineer.

When an individual ALR's influence extends into more than one bridge encounter area listed in the table of thresholds, the actual profiled location of the ALR will be determined and the required threshold to be met will be based upon the actual profiled location of the originating roughness event.

(e) Smoothness Correction

When a pay item for Corrective Grinding, Bridge Encounter, is included in the contract, the Contractor shall furnish and operate corrective grinding equipment as determined necessary to meet the thresholds specified in section (d). Every location exceeding the specified thresholds in each wheel path of each lane shall be corrected. Corrective grinding equipment shall be selected from one of the following:

1. **Diamond Grinder** – a power-driven self-propelled grinding machine specifically designed to smooth and texture concrete and HMA surfaces utilizing diamond blades. The grinding head shall be a minimum of 4 ft wide for longitudinal surface grinding and a minimum of 2 ft wide for transverse joint grinding. The diamond saw blades shall be gang mounted on the grinding head at a minimum rate of 50 blades per ft.

2. **Flatliner Precision Grinding Attachment** – a power driven self-propelled bump grinding attachment that consists of a flat tooth drum system attached to a skid steer that is specifically designed to smooth and texture concrete and HMA surfaces utilizing flat tooth cutting technology. The grinding head shall be a minimum of four feet wide for longitudinal surface grinding and a minimum of two feet wide for transverse joint grinding. The cutting heads shall be either: flat tooth carbide or flat tooth PCD cutters, or PCD single round and double round cutters. The flatliner drum and cutters shall be

designed and spaced for effective IRI smoothness correction and improvement.

Grinding of the floor slab will not be allowed until flexural strength testing yields a modulus of rupture meeting the requirements of 702.24(a). Grinding of all other bridge encounter areas defined herein will not be allowed until such materials have met the applicable specification requirements for opening to traffic. The grinding of the bridge encounter to correct the profile shall be accomplished in either the longitudinal or the transverse direction. The texture after grinding shall be uniform.

Longitudinal grooving of concrete surfaces shall be completed after corrective grinding and in accordance with 722.11.

The width of the corrected area may be partial or full lane width, depending on the respective wheel path profiles and IRI results. After the corrective grinding is complete, the inertial profiler or 16 ft straightedge as applicable shall be operated throughout the entire affected smoothness section to verify the adequacy of the corrective action. The post-grind IRIs, profile results, and ALRs will be submitted for approval to the Engineer.

When the inertial profiler is utilized for longitudinal smoothness measurement, a ProVAL grinding simulation shall be performed and submitted for approval to the Engineer. When only the 16 ft straightedge is utilized for longitudinal smoothness, a grinding plan shall be submitted for approval to the Engineer. The depths and extents of grinding shall be planned and controlled to maintain lines, grades, drainage, safety, friction, steel cover, and joint function. Long term structural integrity and retention of steel cover on the bridge floor slab shall override the smoothness goal if the activities are in conflict.

(f) Profile Data File Requirements

The Contractor shall measure smoothness by generating a single data file for each lane in each direction. The files generated shall be named and organized in accordance with ITM 917. Each bridge encounter file for each lane in each direction shall have data flags or events placed in each profile collected to precisely locate the following locations when applicable in each wheel path:

1. Existing Pavement to New Pavement Transition Joint – flag the transition leading into the bridge encounter and leading out of the bridge encounter at each end of the project.

2. PCF Expansion Joint on the pavement side of the RCBA – flag the PCF joints on both ends of the bridge on each RCBA.

3. 1A Joint on the bridge side of the RCBA – flag the 1A joints on both ends of the bridge on each RCBA.

4. All other Expansion Joints on the bridge deck – flag all other expansion joints located throughout the length of the bridge deck and in accordance with 724.

Prior to finalizing the IRI data files and submitting them to the Engineer, ensure the file has been generated in a manner that enables the

GPS coordinates to be active and usable when reviewing the file in ProVAL. When the GPS is enabled, the ALR results in ProVAL will be visible when the map function is selected and will be located at the correct mapped geographic location.

(g) RCBA Finishing

The RCBA shall be finished in accordance with 609.09, except that only a vibratory screed finisher or a mechanical bridge deck finishing machine will be allowed as finishing equipment.

Method of Measurement

Furnishing, calibrating, operating the inertial profiler, and furnishing IRI profile information will not be measured for payment. Furnishing and operating corrective grinding equipment on the bridge encounter will not be measured for payment.

Basis of Payment

Furnishing, calibrating, operating the inertial profiler, and furnishing IRI profile information will be paid for at the contract lump sum price for Inertial Profiler, Bridge Encounter.

Furnishing and operating corrective grinding equipment on the bridge encounter will be paid for at the contract lump sum price for Corrective Grinding, Bridge Encounter.

Payment will be made under:

Pay Item	**Pay Unit Symbol**
Inertial Profiler, Bridge Encounter	LS
Corrective Grinding, Bridge Encounter	LS

The lump sum price for Inertial Profiler, Bridge Encounter will be full compensation regardless of how often the inertial profiler is used or how often the IRI is determined.

The lump sum price for Corrective Grinding, Bridge Encounter will be full compensation regardless of how often the corrective grinding equipment is used or mobilized to the bridge encounter.

Furnishing and operating the 16 ft straightedge and the 10 ft straightedge shall be included in the cost of the pay items within this section.