

PN 420 - 10/21/2016 - SURFACE SMOOTHNESS REQUIREMENTS FOR PAVEMENTS

DESCRIPTION: The surface tolerance specification requirements are modified as follows for all pavements of constant width with at least 1 centerline mile (1.6 km) of continuous paving. Short breaks in paving such as bridge decks, intersections, etc. are not considered breaks in continuous paving. Also included is pavement for ramps, acceleration lanes, and deceleration lanes greater than 0.5 miles (0.8 km) in length. Do not include pavement for turn lanes including center turn lanes, shoulders, crossovers, approach slabs, and bridge decks.

Roads with less than 1 centerline mile (1.6 km) of paving; ramps, acceleration lanes, and deceleration lanes less than 0.5 miles (0.8 km); and sections of undivided highways, as defined in this note, within corporation limits with posted speed limits less than 40 miles per hour require smoothness measurement and corrective action for all areas of localized roughness with an IRI in excess of 250 inches per mile (3.95 m/km) in 25 feet (7.6 m) only. Do not include pavement for turn lanes including center turn lanes, shoulders, crossovers, approach slabs, and bridge decks.

Areas not part of this specification are subject to the requirements of the original item(s) specified.

If the pavement surface is Rubberized Open Graded Asphalt Friction Course (Supplemental Specification 803), this specification applies to the surface of the course immediately below and references to the number of courses placed do not include the SS803 course.

MATERIALS AND EQUIPMENT: Provide smoothness measuring equipment conforming to Supplement 1058. Furnish the Department's approval letter of the profiler and the operator to the Engineer. The Engineer will verify the smoothness measuring equipment conforms to Supplement 1058. The Engineer will complete the Smoothness Profiler Verification Report found in Supplement 1058, Appendix A, to document profiler calibration prior to measurement. The Engineer will verify the profile operator's certification against the operator list posted on the Office of Technical Services webpage. Furnish equipment meeting the requirements of C&MS 257.02 for performing corrective diamond grinding.

SMOOTHNESS MEASUREMENT: Measure the pavement surface smoothness in both wheel paths. Wheel paths are located parallel to the centerline or baseline of the roadway or ramp and approximately 3.0 feet (1.0 m) from the centerline of the lane or ramp, measured transversely in both directions. Ensure the path of the profiler is parallel to the lane centerline at all times. Measure the entire length of pavement, event marking the profile runs such that profile data can later be identified when the profile sensor(s) is within 1.0 foot (0.3 m) of any existing pavement not constructed on the project, pressure relief joint, approach slab, or other non pavement features (i.e. manholes, valve boxes). Remove any objects such as dirt, debris, curing covers, etc., prior to performing the surface smoothness measurements. Replace any curing covers after the measurements are taken. Repair any membrane curing damaged during the measurements.

Do not perform any surface smoothness measurements until the pavement has cured sufficiently to allow measuring without damaging the pavement. When the pavement will not support the profiler on the next working day, notify the Engineer and inform the Engineer when the

measurements will be taken. Provide the Engineer at least 24 hours' notice prior to performing any measurements. Do not take measurements until project site verification is demonstrated to the Engineer according to Supplement 1058.

Develop an International Roughness Index (IRI) according to ASTM E 1926 for each 0.1-mile (0.16 km) section. Submit two copies of the summary report from ProVAL conforming to Supplement 1110 and two electronic copies of all longitudinal pavement profiles in ProVAL compatible format to the Engineer. The Engineer will submit one copy of the summary report and one electronic copy of the profiles to the Office of Technical Services.

Provide necessary traffic control and survey stationing for all surface smoothness measurements.

MANDATORY CORRECTIVE ACTION: Perform corrective action for the applicable surface type as required. Do not include pavement within 40 feet (12.2 m) of a bridge deck or approach slab in any 0.1-mile (0.16 km) section evaluated for pay adjustment. Measure and evaluate these 40 foot (12.2 m) sections for localized roughness corrections. Provide a list of all mandatory corrective action locations, with station, lane, and proposed corrections to the Engineer for approval. Do not perform any corrective actions without approval of the Engineer.

Asphalt Concrete Surface: Classify asphalt pavement areas into one of the following types based on the work performed as part of the Project.

Type A: Asphalt pavement specified as at least two uniform courses with the total thickness placed greater than or equal to 3 inches (75 mm).

Type B: Asphalt pavement specified as either: a) at least one uniform course with the total thickness placed less than 3 inches (75 mm) and including Item 254 or SS897 planing prior to resurfacing, or b) at least two uniform courses with the total thickness less than 3 inches (75 mm) without including Item 254 or SS897 planing prior to resurfacing.

Type C: Asphalt pavement specified as a single uniform course not meeting the criteria of Type B. The uniform course may be placed on a non-uniform leveling course.

TABLE 420-1 ASPHALT CONCRETE PAVEMENT CLASS CRITERIA				
Pavement Class	Divided Highways*		Undivided Highways*	
	Corrective Action	Pay Adjustment Schedule (Table 420-3)	Corrective Action	Pay Adjustment Schedule (Table 420-3)
Type A [\geq 3in. + 2-course]	[1],[5]	A	[2],[5]	A
Type B [$<$ 3in. + Milling] or [$<$ 3in. + 2-course]	[1],[5]	A	[3],[5]	A
Type C [$<$ 3in. + 1-course]	[2],[5]	A	[4]	B

* Divided highways have physical separation such as a grass median, raised concrete median, guardrail, or barrier between the two directions of travel. Highways with continuous two way left turn lanes are considered undivided. Undivided highways with short sections, less than 1000 feet (300 m), of physical separation are considered undivided for the entire length.

Corrective Action:

- [1] Correct all areas of localized roughness having deviations, high or low points, with an IRI in excess of 160 inches per mile (2.53 m/km) in 25 feet (7.6 m).
- [2] Correct all areas of localized roughness having deviations, high or low points, with an IRI in excess of 200 inches per mile (3.16 m/km) in 25 feet (7.6 m).
- [3] Correct all areas of localized roughness having deviations, high or low points, with an IRI in excess of 225 inches per mile (3.55 m/km) in 25 feet (7.6 m).
- [4] Correct all areas of localized roughness having deviations, high or low points, with an IRI in excess of 250 inches per mile (3.95 m/km) in 25 feet (7.6 m).
- [5] Correct any 0.1-mile (0.16 km) sections having an IRI greater than 90 inches per mile (1.42 m/km).

Perform corrective action as required in Table 420-1 by removing and replacing to the depth necessary to correct the deviations or by diamond grinding. Use asphalt concrete meeting the contract requirements for the replacement work. Apply Item 407 Tack Coat prior to placing the surface course. The total amount of grinding is limited to no more than 5% by longitudinal length of the lane-miles (lane-km) eligible for a pay adjustment.

Re-measure each 0.1-mile (0.16 km) section where corrective action was performed to ensure compliance with Table 420-1.

If the final surface course is Item 803, seal any diamond ground areas with material meeting the requirements of 702.04 prior to placing the Item 803.

Portland Cement Concrete Surface: Classify pavement areas into one of the following types based on the work performed as part of the Project.

Type A: Concrete pavement with the total specified thickness greater than or equal to 8 inches (200 mm).

Type B: Concrete pavement with the total specified thickness greater than 6 inches (150 mm) and less than 8 inches (200 mm).

Type C: Concrete pavement with the total specified thickness less than or equal to 6 inches (150 mm).

TABLE 420-2 PORTLAND CEMENT CONCRETE PAVEMENT CLASS CRITERIA				
Pavement Class	Divided Highways*		Undivided Highways*	
	Corrective Action	Pay Adjustment Schedule (Table 420-3)	Corrective Action	Pay Adjustment Schedule (Table 420-3)
Type A [\geq 8in.]	[1],[5]	A	[1],[5]	A
Type B [$>$ 6 in. & $<$ 8in.]	[1],[5]	A	[2],[5]	A
Type C [\leq 6 in.]	[2],[5]	A	[3]	B

* Divided highways have physical separation such as a grass median, raised concrete median, guardrail, or barrier between the two directions of travel. Highways with continuous two way left turn lanes are considered undivided. Undivided highways with short sections, less than 1000 feet (300 m), of physical separation are considered undivided for the entire length.

Corrective action:

- [1] Correct all areas of localized roughness having deviations, high or low points, with an IRI in excess of 160 inches per mile (2.53 m/km) in 25 feet (7.6 m).
- [2] Correct all areas of localized roughness having deviations, high or low points, with an IRI in excess of 200 inches per mile (3.16 m/km) in 25 feet (7.6 m).
- [3] Correct all areas of localized roughness having deviations, high or low points, with an IRI in excess of 225 inches per mile (3.55 m/km) in 25 feet (7.6 m).
- [5] Correct any 0.1-mile (0.16 km) sections having an IRI greater than 90 inches per mile (1.42 m/km).

Perform corrective action as required in Table 420-2 by diamond grinding or removing and replacing. Use Portland cement concrete meeting the contract requirements for the replacement work.

Re-measure each 0.1-mile (0.16 km) section where corrective action was performed to ensure compliance with Table 420-2.

Complete all corrective action prior to determination of pavement thickness. If corrective action is required, the surface texture after diamond grinding is acceptable and no additional texturing is required.

Asphalt and Portland Cement Concrete Surfaces: If corrective action is required, develop a corrective action plan at least 7 days before beginning corrective action. Include in the plan identification and detailed location descriptions of all localized and lot violations and proposed corrective action. Do not begin corrective action until receiving the Engineer's acceptance of the corrective action plan. The corrective action plan is limited to grinding, pavement removal and replacement or a combination of the two. Upon completion of the corrective action, re-measure surface smoothness according to this specification. In the event the Contractor is not able to correct the surface smoothness to meet the Specification, the DCA may establish a deduction to the Contract in accordance with section 105.03 of the C&MS.

EXEMPTED CORRECTIONS: Required corrective action resulting from contract requirements for maintaining traffic and construction joints placed at the beginning and end of each work period are considered exempted corrections. The contractor will identify and define all exempted correction locations. Exempted corrections for maintaining traffic occur primarily at ramps or other access points where paving must be suspended. Required corrective action due to material availability, weather, or any other reason not listed above, is not considered an exempted correction. No exempted corrections for maintaining traffic exist on projects where the maintenance of traffic plan does not interfere with paving operations. Perform exempted corrections according to the requirements for mandatory corrective action.

METHOD OF MEASUREMENT: Determine the IRI for each lane for each 0.1-mile (0.16 km) section of paving. The IRI for a 0.1-mile (0.16 km) section is the average of the IRI of the two wheel paths.

PAY ADJUSTMENTS: A lump sum pay adjustment will be made according to the following schedule and calculations for each lane for each 0.1-mile (0.16 km) section. Payment will be based on a 12 foot (3.7 m) lane width, regardless of lane width. Pay adjustments are based on the weighted average bid unit cost per square yard for the section multiplied by the pay factor as determined in Table 420-3. Pavement thickness is the total thickness of asphalt concrete, Portland cement concrete, or both placed as part of the contract and does not include any SS803 course, free draining base, aggregate base, stabilized subgrade, etc.

TABLE 420-3 PAY SCHEDULE			
SCHEDULE A		SCHEDULE B	
IRI	PAY ADJUSTMENT	IRI	PAY ADJUSTMENT
Inches per mile per 0.1 mile section (m/km per 0.16 km section)	Percentage of Unit Cost (PUC) (%)	Inches per mile per 0.1 mile section (m/km per 0.16 km section)	Percentage of Unit Cost (PUC) (%)
35 (0.55) or less	4	45 (0.71) or less	4
Over 35 to 50 (0.55 to 0.79)	$(50 - \text{IRI}) * \left(\frac{4}{15}\right)$	Over 45 to 60 (0.71 to 0.95)	$(60 - \text{IRI}) * \left(\frac{4}{15}\right)$
Over 50 to 70 (0.79 to 1.10)	0	Over 60 (0.95)	0
Over 70 to 90 (1.10 to 1.42)	$-(\text{IRI} - 70) * \left(\frac{6}{20}\right)$		
Over 90 (1.42)	(1)		

(1) Corrective action required

Asphalt Pavements:

$$WUC = \frac{(t_1 \times u_1) + (t_2 \times u_2) + (t_3 \times u_3) \dots}{36}$$

Where: WUC = weighted unit cost (\$/SY).

t = lift thickness (in.).

u = bid unit cost (\$/CY).

Concrete Pavements:

$$WUC = \text{bid unit cost } (\$/SY)$$

Pay Adjustment (PA):

$$PA = WUC \times 704 \times PUC$$

Where: WUC = weighted unit cost (\$/SY).

PUC = percentage of unit cost from Table 420-3, expressed as a decimal.

Pay adjustments will be based on the measured IRI after any mandatory corrective action however no incentive will be paid for any 0.1-mile (0.16 km) section where mandatory corrective action was performed regardless of the resulting IRI.

One-tenth mile (0.16 km) sections with exempted corrections only are eligible for incentive pay based on IRI measurements taken after completion of the exempted corrections.

At the Contractor's option, corrective action may be performed on any section with an IRI greater than 70 inches per mile (1.10 m/km) to reduce or eliminate the negative pay adjustment however, no incentive will be paid regardless of the resulting IRI. As an option the Department may allow corrective action, in the form of diamond grinding, Item 254, or SS897 pavement planing, to improve the profile on any course prior to the surface course. If the final course is Item 803 do not perform corrective action on the Item 803. Only diamond grinding may be performed on the course immediately below Item 803.

Negative pay adjustments apply to sections with mandatory corrective action and exempted corrections.

No payment will be made for any 0.1-mile (0.16 km) section subject to Schedule A that has an IRI greater than 90 inches per mile (1.42 m/km) until corrective action has been completed and the IRI has been reduced to less than 90 inches per mile (1.42 m/km).

BASIS OF PAYMENT: Include the cost of all labor, equipment, and materials necessary to meet this specification in the contract unit or lump sum price for the applicable pavement items.

PN 420 Designer Notes: This note should be used on all paving projects at least 1 centerline mile (1.6 km) long (both divided and undivided highways). Undivided highway sections totally within corporation limits should be excluded.

The designer should consider clarifying in the plans which locations are considered divided highways and which are undivided highways according to the definition in the note if there is any chance of misinterpretation.

If there are any questions on the use or application of this note contact:

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