Amend **Section 401 – HOT MIX ASPHALT (HMA) PAVEMENT** to read as follows:

"SECTION 401 - HOT MIX ASPHALT (HMA) PAVEMENT

401.01 Description. This section describes furnishing and placing HMA pavement on a prepared surface.

401.02 Materials.

Asphalt Cement (Mix IV) (PG 64-16) 702.01

Asphalt Cement (Polymer Modified Asphalt (PMA) Mix) (PG 64E-22) 702.01

Performance Graded (PG) Binder. Performance graded binder shall conform to Performance Graded Asphalt Binder Specifications, AASHTO M 332 and meet the following additional requirement:

> AASHTO T 315 Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR). Phase angle on original binder shall be less than 77 degrees.

Submit, before usage, a Certificate of Compliance, accompanied by substantiating test data, showing conformance with Performance Graded Asphalt Binder Specification. The Engineer will not accept the PG binder without adequate documentation.

Grade PG binder using AASHTO MP 19 Performance Graded Asphalt Binder Using Multiple Stress Creep Recovery (MSCR) Test. Submit MSCR grading report accompanied by substantiating test data.

PERFORMANCE GRADED BINDERS FOR SPECIFIC MIXES (Performance Graded Mixes)	
MIX	**BINDER***
Asphalt Cement for Surface Course (Mix IV)	PG 64-16
Asphalt Cement for Surface Course (PMA Mix)	PG 64E-22
*Neat asphalt with elastomer polymer modification shall be used to achieve the specified performance grading.	

Emulsified Asphalt 702.04

Warm Mix Asphalt Additive 702.06

Aggregate for Hot Mix Asphalt Pavement	703.09
Filler	703.15
Hydrated Lime	712.03

(A) General. HMA pavement shall be plant mixed and shall include mixture of aggregate and asphalt cement and may include reclaimed asphalt pavement (RAP) or filler, or both.

The manufacture of HMA may include warm mix asphalt (WMA) processes in accordance with these specifications. WMA processes include combinations of organic additives, chemical additives, and foaming.

HMA pavement shall include surface course and may include one or more binder courses, depending on HMA pavement thickness indicated in the contract documents.

RAP is defined as removed or reprocessed pavement materials containing asphalt and aggregates. Process RAP by crushing until 100 percent of RAP passes 3/4-inch sieve. Size, grade uniformly, and combine materials such that blend of RAP and aggregate material conforms to grading requirements of Subsection 703.09 - Aggregate for Hot Mix Asphalt Pavement.

In surface and binder courses, aggregate for HMA may include RAP quantities up to 20 percent of total mix weight. RAP shall not be used in stone matrix asphalt pavement.

Quantity of filler material to correct deficiencies in aggregate gradation passing the No. 200 sieve shall not exceed 3 percent by weight of fine aggregates.

(B) Job-Mix Formula and Tests. Design job-mix formula in accordance with procedures contained in current edition of Asphalt Institute's *Mix Design Methods for Asphalt Concrete and Other Hot Mix Types,* Manual Series No. 2 (MS-2) for either Marshall Method or Hveem Method of Mix Design.

Limit compacted lift thickness and asphalt content of job-mix formula as specified in Table 401.02-1 - Limits of Compacted Lift Thickness and Asphalt Content.

TABLE 401.02-1 - LIMITS OF COMPACTED LIFT THICKNESS AND ASPHALT CONTENT				
MIX NO.	**II**	**III**	**IV, PMA**	**V**
Minimum to Maximum Compacted Thickness for Individual Lifts (Inches)	2-1/4 to 3	2 to 3	1-1/2 to 3	1-1/4 to 3
Asphalt Content Limits (Percent of Total Weight of Mix)	3.8 to 6.1	4.3 to 6.1	4.3 to 6.5	4.8 to 7.0

Asphalt content limits for porous aggregate may be exceeded only if it is requested ahead of placement and is reviewed then accepted in writing by the Engineer.

Limit the re-refined engine oil bottoms (REOB) content to a maximum of 5 percent in all asphalt binders.

Meet job-mix formula design criteria specified in Table 401.02-2 - Job-Mix Design Criteria for Performance Graded Binders or Table 401.02-2A - Job-Mix Formula Design Criteria For Non-Performance Graded Binder HMA based on the type of binder require by the Contract Documents or as directed by the Engineer and MTRB.

TABLE 401-02 JOB-MIX DESIGN CRITERIA FOR PERFORMANCE GRADED BINDERS	
$N_{initial}$, N_{design}, N_{max}	8,100,160
Air Voids at N_{design}	4%
Voids in Mineral Aggregate (VMA) at N_{design} (for 1/2 inch Nominal Maximum Particle Size)	14.0% Minimum
Voids in Coarse Aggregate (VCA)	Less than VCA_{DRC}
Density at $N_{initial}$ (% of Theoretical Maximum Specific Gravity)	Not more than 89.0%
Density at N_{design} (% of Theoretical Maximum Specific Gravity)	96.0 %
Density at N_{max} (% of Theoretical Maximum Specific Gravity)	Not more than 98.0%
Stabilizer (by weight of total mix)	0.2 - 0.4 %

TABLE 401.02-2A - JOB-MIX FORMULA DESIGN CRITERIA FOR NON-PERFORMANCE GRADED BINDER HMA	
Hveem Method Mix Criteria (AASHTO T 246 and AASHTO T 247)	
Stability, minimum	37
Air Voids (percent)[1]	3 - 5
Marshall Method Mix Criteria (AASHTO T 245)	
Compaction (number of blows each end of specimen)	75
Stability, minimum (pounds)	1,800
Flow (x 0.01 inch)	8 - 16
Air Voids (percent)[1]	3 - 5
Notes: 1. Air Voids: AASHTO T 166 or AASHTO T 275; AASHTO T 209, AASHTO T 269.	

Minimum percent voids in mineral aggregates (VMA) of job-mix formula shall be as specified in Table 401.02-3 - Minimum Percent Voids in Mineral Aggregates (VMA).

TABLE 401.02-3 - MINIMUM PERCENT VOIDS IN MINERAL AGGREGATES (VMA)					
Nominal Maximum Particle Size, (Inches)	1-1/2	1	3/4	1/2	3/8
VMA, (percent)[1]	11.0	12.0	13.0	14.0	15.0
Notes: 1. VMA: See Asphalt Institute Manual MS-2, Chapter 4.					

(C) Submittals. Establish and submit job-mix formula for each type of HMA pavement mix indicated in the contract documents a minimum of 30 days before production. Job mix shall include the following applicable information:

(1) Design percent of aggregate passing each required sieve size.

(2) Design percent of asphalt content or PG binder material (type determined by type of mix) added to the aggregate (expressed as% by weight of total mix),

(3) Design proportion of processed RAP.

(4) Design temperature of mixture at point of discharge at paver or MTV.

(5) Source of aggregate.

(6) Grade of asphalt cement or PG binder.

(7) Type and percentage of stabilizer, or fiber

(8) Test data used to develop job-mix formula.

Except for item (4) in this subsection, if design requirements are modified after the Engineer accepts job-mix formula, submit new job-mix formula before using HMA produced from modified mix design. Submit any changes to the design temperature of mixture at point of discharge for acceptance by the Engineer.

Submit a certificate of compliance for the asphalt cement or PG binder, accompanied by substantiating test data from a certified testing laboratory.

The Contractor may use WMA processes in the production of HMA. Submit to the Engineer for acceptance, the proposed process and how it will be used in the manufacture of HMA. The process submittal shall include the temperature range of the WMA."

(D) Range of Tolerances for HMA. Provide HMA within allowable tolerances of accepted job-mix formula as specified in Table 401.02-4 - Range of Tolerances for Performance Graded Binders and Table 401.02-4A – Range of Tolerances for Non-Performance Graded Binder HMA. These tolerances are not to be used for the design of the job mix, they are solely to be used during the testing of the production field sample of the HMA mix and its comparison with laboratory mix design.

TABLE 401-02-4 – RANGE OF TOLERANCES FOR PERFORMANCE GRADED BINDERS	
Passing 3/8 inch and larger sieves	±5.0
Passing No. 4 to No. 16 sieves (inclusive)	±4.0
Passing No. 30 to No. 100 sieves (inclusive)	±3.0
Passing No. 200 sieve	±2.0
Binder Content (expressed as% by weight of total mix)	±0.4
Temperature of Mixture	± 20
Voids, total mix	± 1.0

TABLE 401.02-4A - RANGE OF TOLERANCES FOR NON-PERFORMANCE GRADED BINDER HMA	
Passing No. 4 and larger sieves (percent)	± 7.0
Passing No. 8 to No. 100 sieves (inclusive) (percent)	± 4.0
Passing No. 200 sieve (percent)	± 3.0
Asphalt Content (percent)	± 0.4
Mixture Temperature (degrees F)	± 20

401.03 Construction.

(A) Weather Limitations. Placement of HMA will not be allowed under the following conditions:

(1) On wet surfaces, e.g., surface with ponding or running water, surface that has aggregate or surface that appears beyond surface saturated dry, as determined by the Engineer.

(2) When air temperature is below 50 degrees F and falling. HMA may be applied when air temperature is above 40 degrees F and rising. Air temperature will be measured in shade and away from artificial heat.

(3) When weather conditions prevent proper method of construction.

(B) Equipment.

(1) Mixing Plant. Use mixing plants that conform to AASHTO M 156, supplemented as follows:

(a) All Plants.

1. Automated Controls. Control proportioning, mixing, and mix discharging automatically. When RAP is incorporated into mixture, provide positive controls for proportioning processed RAP.

2. Dust Collector. AASHTO M 156, Requirements for All Plants, Emission Controls is amended as follows:

Equip plant with dust collector. Dispose of collected material. In the case of baghouse dust collectors, dispose of collected material or return collected material uniformly.

3. Modifications for Processing RAP. When RAP is incorporated into mixture, modify mixing plant in accordance with plant manufacturer's recommendations to process RAP.

(b) Drum Dryer-Mixer Plants.

1. Bins. Provide separate bin in cold aggregate feeder for each individual aggregate stockpile in mix. Use bins of sufficient size to keep plant in continuous operation and of proper design to prevent overflow of material from one bin to another.

2. Stockpiling Procedures. Separate aggregate into at least three stockpiles with different gradations as follows: coarse, intermediate, and fine. Separate aggregates for Mix V into at least two stockpiles. Stockpile RAP separately from virgin aggregates.

3. Checking Aggregate Stockpile. Check condition of the aggregate stockpile often enough to ensure that the aggregate is in optimal condition.

(c) Batch and Continuous Mix Plants.

1. Hot Aggregate Bin. Provide bin with three or more separate compartments for storage of screened aggregate fractions to be combined for mix. Make partitions between compartments tight and of sufficient height to prevent spillage of aggregate from one compartment into another.

2. Load Cells. Calibrated load cells may be used in batch plants instead of scales.

(2) Hauling Equipment. Use trucks that have tight, clean, smooth metal beds for hauling HMA.

Thinly coat truck beds with a minimum quantity of non-stripping release agent to prevent mixture from adhering to beds. Diesel or petroleum-based liquid release agents, except for paraffin oil, shall not be used. Drain excess release agent from truck bed before loading with HMA.

Provide a designated clean up area for the haul trucks.

Equip each truck with a tarpaulin conforming to the following:

(a) In good condition, without tears and holes.

(b) Large enough to be stretched tightly over truck bed, completely covering mix thereby aiding in keeping the mix unexposed to ambient air and aid in keeping the mix hot.

(3) Asphalt Pavers. Use asphalt pavers that are:

(a) Self-contained, power-propelled units.

(b) Equipped with activated screed or strike-off assembly, heated if necessary.

(c) Capable of spreading and finishing courses of HMA mixtures in lane widths applicable to typical section and thicknesses indicated in the Contract Documents.

(d) Equipped with receiving hopper having sufficient capacity for uniform spreading operation.

(e) Equipped with automatic feed controls to maintain uniform depth of material ahead of screed.

(f) Equipped with automatic screed controls with sensors capable of sensing grade from outside reference line, sensing transverse slope of screed, and providing automatic signals to control screed grade and transverse slope.

(g) Capable of operating at constant forward speeds consistent with satisfactory laying of mixture.

(h) Equipped with a means of preventing the segregation of the coarse aggregate particles from the remainder of the bituminous plant mix when that mix is carried from the paver hopper back to the paver augers. The means and methods used shall be approved by the paver manufacturer and may consist of chain curtains, deflector plates, or other such devices and any combination of these.

The following specific requirements shall apply to the identified bituminous pavers:

1. **Blaw-Knox Bituminous Pavers.** Blaw-Knox bituminous pavers shall be equipped with the Blaw-Knox Materials Management Kit (MMK).

2. **Cedarapids Bituminous Pavers.** Cedarapids bituminous pavers shall be those that were manufactured in 1989 or later.

3. **Barber-Green/Caterpillar Bituminous Pavers.** Barber-Green/Caterpillar bituminous pavers shall be equipped with deflector plates as identified in the December 2000 Service Magazine entitled "New Asphalt Deflector Kit {6630, 6631, 6640}".

Bituminous pavers not listed above shall have similar attachments or designs that shall make them equivalent to the bituminous pavers listed above. The Engineer will solely decide if it is equal to or better that the setups described for the equipment listed above.

Submit for review and acceptance, prior to the start of using the paver for the placing of plant mix, a full description in writing of the means and methods that will be used to prevent the bituminous paver from having both aggregate and temperature segregation. Use of any paver that has not been accepted is prohibited until acceptance of the paver is received from the Engineer. Any pavement placed with an unaccepted paver will be regarded as not compliant work and may not be paid for and may require removal.

Supply a Certificate of Compliance that verifies that the manufacturer's approved means and methods used to prevent bituminous paver from having both aggregate and temperature segregation have been implemented on all pavers used on the project and are working in accordance with the manufacturer's requirements and Contract Documents.

(4) Rollers. Rollers shall be self-propelled, steel-tired tandem, pneumatic-tired, or vibratory-type rollers capable of reversing without shoving or tearing the just placed HMA mixture. Provide sufficient number, sequencing, type, and rollers of sufficient weight to compact the mixture to required density while mixture is still in workable condition unless otherwise indicated in the Contract Documents. Equipment shall not excessively crush aggregate. Operate rollers in accordance with manufacturer's recommendations and Contract Documents. The use of intelligent compaction is encouraged and may be required elsewhere in the Contract Documents.

(a) Steel-Tired Tandem Rollers. Steel-tired tandem rollers used for initial breakdown or intermediate roller passes shall have minimum gross weight of 12 tons and shall provide minimum 250-pound weight per linear inch of width on drive wheel.

Steel-tired tandem rollers used for finish roller passes shall have minimum total gross weight of 3 tons.

Do not use roller with grooved or pitted rolling drum or worn scrapers or wetting pads. Replace excessively worn scrapers and wetting pads before use.

(b) Pneumatic-Tired Rollers. Pneumatic-tired rollers shall be oscillating-type, equipped with smooth-tread pneumatic tires of equal size and diameter. Maintain tire pressure within 5 pounds per square inch of designated operational pressure when hot. Space tires so that gaps between adjacent tires are covered by following set of tires.

Pneumatic-tired rollers used for breakdown or intermediate roller passes shall have a ballast capable of establishing an operating weight per tire of not less than 3,000 pounds. Equip rollers with tires having minimum 20-inch wheel diameter with tires inflated to 70 to 75 pounds per square inch pressure when cold and 90 pounds per square inch when hot. Equip rollers with skirt-type devices to maintain temperature of tires during rolling operations.

Pneumatic-tired rollers used for kneading finished asphalt surfaces shall have a ballast capable of establishing an operating weight per tire of not less than 1,500 pounds. Equip rollers with tires having minimum 15-inch wheel diameter with tires inflated to 50 to 60 pounds per square inch pressure. Equip rollers with skirt-type devices to maintain temperature of tires during rolling operations.

Pneumatic-tired rollers and rubber-tired equipment shall not be used on stone matrix asphalt pavement.

(c) Vibratory Rollers. Vibratory rollers shall be steel-tired tandem rollers having minimum total weight of 3 tons. Equip vibratory rollers with amplitude and frequency controls and speedometer. Operate vibratory roller in accordance with manufacturer's recommendations. For very thin lifts, 1 inch or less in thickness, vibratory rollers shall not be used in the vibratory mode. Instead, operate the unit in the static mode.

(5) Hand Tools. Keep hand tools used in production, hauling, and placement of HMA clean and free of contaminants. Diesel or mineral spirits or other cleaning material that is potentially deleterious to HMA may be used to clean hand tools providing:

(a) It does not contaminate HMA with cleaning material.

(b) Clean hand tools over catch pan with capacity to hold all the cleaning material.

(c) Remove all diesel or mineral spirits or other cleaning material that is potentially deleterious to HMA from hand tools before using with HMA.

Hand tools used shall be in a condition such that it meets the requirements that it was manufactured for, e.g., a straightedge shall meet the straightness requirement of the manufacturer.

(6) Material Transfer Vehicle (MTV).

(a) Usage. MTV usage applies to surface courses of paving projects on all Islands except Lanai, unless otherwise indicated in the Contract Documents. When placing HMA surface use MTV to independently deliver mixtures from hauling equipment to paving equipment. MTV usage will not be required for the following:

1. Projects with less than 1,000 tons of HMA.

2. Temporary pavements.

3. Bridge deck approaches.

4. Shoulders.

5. Tapers.

6. Turning lanes.

7. Driveways.

8. Areas with low overhead clearances.

(b) Equipment. When using MTV, install minimum 10-ton-capacity hopper insert in conventional paver hopper. Provide the following equipment:

1. High-capacity truck unloading system in MTV capable of receiving HMA from hauling equipment.

2. MTV storage bin with minimum 15-ton capacity.

3. An auger mixing system in one of the following: the MTV storage bin, or paver hopper insert, or paver hopper to continuously mix HMA prior to discharging to the paver's conveyor system.

Avoid stop-and-go operations by coordinating plant production rate, number of haul units, and MTV and paver speeds to provide a continuous, uniform, segregation-free material flow and smooth HMA pavement. Maintain uniform paver speed to produce smooth pavements.

(c) Performance Evaluation. Evaluate the performance of MTV and mixing equipment by measuring mat temperature profile immediately behind paver screed on first day of paving and when it feels the need to do so due to perceived changes in performance or as directed by the Engineer.

Use a hand-held temperature device that has been calibrated within the past 12 months. It shall be an infrared temperature gun is capable of measuring in one degree or finer increments between the temperatures of 80 degrees to 400 degrees F with a laser to indicate where the temperature reading is being taken. Six temperature profile measurements shall be taken of mat surface using infrared temperature gun at 50-foot intervals behind paver. Each temperature profile shall consist of three surface temperature measurements taken transversely across the mat in approximately a straight line from screed while paver is operating. For each profile, temperatures shall be measured approximately 1 foot from each edge and in middle of mat. The difference between maximum and minimum temperature measurements for each temperature profile shall not exceed 10 degrees F. If any two or more temperature profiles exceeds the allowable 10-degree F temperature differential, halt paving operation and adjust MTV or mixing equipment to ensure that material placed by paver meets specified temperature requirements. Redo the measuring of mat temperature profile until adjustment of the MTV or mixing equipment is adequate. Submit all temperature profiles to the Engineer by next business day. Information on the report shall show location and temperature readings and time test was performed. Enough information shall be given, so the Engineer will be able to easily locate the test site of the individual measurement.

When requested temperature profile measurements shall be done in the presence of the Engineer.

Once adjustments are made, repeat measurement procedure for the next two placements to verify that material placed by paver meets specified temperature requirements. Terminate paving if temperature profile requirements are not met during repeated measurement procedure. If equipment fails to meet requirements after measurement procedure is repeated once, replace equipment before conducting any further temperature profile measurements

The Engineer may perform surface temperature profile measurements at any time during project. The Engineer may in lieu of a hand-held infrared temperature device use an infrared camera or device that is capable of measuring temperatures to locate cold spots. If such cold spots exist, the Engineer may require adjustments to the MTV.

If bleeding or fat spots occur in the pavement adjust means and methods to eliminate such pavement defects and perform remedial repair to pavement acceptable to the Engineer. Bleeding is defined as excess binder occurring on the surface of the pavement. It may create a shiny, glass-like, reflective appearance and may be tacky to the touch. Fat spots are localized bleeding.

(d) Transport.

1. Trailered MTV. Transport MTV by means of truck-tractor/trailer combination in accordance with Chapter 104 of Title 19, Department of Transportation, entitled "The Movement by Permit of Oversize and Overweight Vehicles on State Highways".

2. Crossing Bridges for Self-Powered MTV. When self-powered MTV exceeds legal axle or total weight limits for vehicles under the HRS, Chapter 291, conform to the following when crossing bridges within project limits unless otherwise indicated in the Contract Documents:

a. Completely remove mix from MTV.

b. Move MTV at relatively constant speed not exceeding 5 miles per hour. MTV will not be allowed to stop on bridge.

c. No other vehicle or equipment will be allowed on bridge.

d. The MTV shall not attempt to cross a bridge where the posted load limit is less than or equal to the weight of the MTV empty. Permission to cross the bridge shall be obtained from the Engineer and HWY-DB in writing.

(C) Preparation of Surface. Clean existing pavement in accordance with Section 310 - Brooming Off. Apply tack coat in accordance with Section 407 - Tack Coat.

Where indicated in the Contract Documents, bring irregular surfaces to uniform grade and cross section by furnishing and placing one or more leveling courses of HMA Mix V. Spread leveling course in variable thicknesses to eliminate irregularities in existing surface. Place leveling course such that maximum depth of each course, when thoroughly compacted to the Contract Documents' requirements, does not exceed 3 inches.

In multiple-lift leveling course construction, spread subsequent lifts beyond edges of previously spread lifts in accordance with procedures contained in current edition of the Asphalt Institute's *Construction of Hot Mix Asphalt Pavements,* Manual Series No. 22 (MS-22) for leveling wedges.

Notify the Engineer of existing surfaces that may not be in a condition that will have enough strength to be a good bonding surface or foundation and should be removed or have remedial repairs done before new pavement placement.

(D) Plant Operation.

(1) Preparation of Asphalt Cement. Uniformly heat asphalt cement and provide continuous supply of heated asphalt cement from storage to mixer. Do not heat asphalt cement above 350 degrees F.

(2) Preparation of Aggregate. Dry and heat aggregate material at temperature sufficient to produce design temperature of job-mix formula. Do not exceed 350 degrees F. Adjust heat source used for drying and heating to avoid damage to and contamination of aggregate. When dry, aggregate shall not contain more than 1 percent moisture by weight.

For batch plants, screen aggregates immediately after heating and drying into three or more fractions. Convey aggregates into separate compartments ready for batching and mixing with asphalt cement.

(3) Mixing. Measure aggregate and asphalt; or aggregate, RAP, and asphalt into mixer in accordance with accepted job-mix formula. Mix until components are completely mixed and adequately coated with asphalt in accordance with AASHTO M 156. Percent of coated particles shall be 95 percent when tested in accordance with AASHTO T 195.

(4) Plant Inspection. For control and acceptance testing during periods of production, provide a testing laboratory next to plant that is acceptable to the Engineer. Provide space, utilities, and equipment required by the Engineer for performing specified tests. Do not start production of the project's HMA mix until the testing laboratory is acceptable to the Engineer. If the tests the Engineer needs to perform are not able to be done the mix shall not be used on the project unless the Engineer provides a waiver to this requirement.

(E) Spreading and Finishing. Prior to each day's paving operation, check screed or strike-off assembly surface with straight edge to ensure straight alignment and there is no damage or wear to the machine that will affect performance. Provide screed or strike-off assembly that produces finished surface without tearing, shoving, and gouging HMA. Discontinue using spreading equipment that leaves ridges, indentations, or other marks, or combination thereof in surface that cannot be eliminated by rolling or affects the final smoothness of the pavement or be prevented by adjustment in operation.

Maintain HMA at minimum 250 degrees F temperature at discharge to paver. Measure temperature of mix in hauling vehicle just before depositing into spreader or paver or MTV.

Deposit HMA in a manner that minimizes segregation. Raise truck beds with tailgates closed before discharging HMA.

Lay, spread, and strike off HMA upon prepared surface. Use asphalt pavers to distribute mixture.

Control horizontal alignment using automatic grade and slope controls from reference line, slope control device. Existing pavements or features shall not be used for grade control alone.

Obtain sensor grade reference, horizontal alignment by using established grade and slope controls. For subsequent passes, substitution of one ski with joint-matching shoe riding on finished adjacent pavement is acceptable. Use of a comparable non-contact mobile reference system and joint matching shoe is acceptable.

Avoid stop-and-go operation. Maintain a constant forward speed of paver during paving operation and minimize other methods that impact smoothness.

Offset longitudinal joint in successive lifts by approximately 6 inches. Incorporate into paving method an overlap of material of 1-inch +/- 0.5 inches at the longitudinal joint. The HMA overlap material shall be left alone when initially placed and shall not be bumped back or pushed back with a lute or any other hand-held device. If the overlap exceeds the maximum amount, remove the excess with a flat shovel, allowing recommended amount of overlap HMA material to remain in place to be compacted. Do not throw the removed excess HMA material on to the paving mat. The longitudinal joint in a surface course when total roadway width is comprised of two lanes shall be near the centerline of pavement or near lane lines when roadway is more than two lanes in width. The longitudinal joint shall not be constructed in the wheel path. Every effort should be made to not locate the longitudinal joint under the longitudinal lane lines. Make a paving plan drawing showing how the longitudinal joint will not located in these areas.

Control the horizontal alignment of the longitudinal edge of the HMA mat being installed so that the edge is parallel to the centerline or has a uniform alignment, e.g., the edge of the mat is straight line or uniform curve, no wavy edge, etc. to have a consistent amount of HMA material at the joint.

Check the compaction of the longitudinal joint during paving often enough to ensure that it will meet the compaction requirements.

If nuclear gauges are used as the contractor's quality control method, they shall be properly calibrated and periodically checked by comparison to cores taken from the pavement. The use of sand as an aid in properly seating the gauge may also be considered for improving the accuracy of the gauge.

In areas where irregularities or unavoidable obstacles make use of mechanical spreading and finishing equipment impracticable, spread, rake, and lute mixture by hand tools. For such areas, deposit, spread evenly, and screed mixture to required compacted thickness.

Demonstrate competence of personnel operating grade and crown control device before placing surface courses. If automatic control system becomes inoperative during the day's work, the Engineer will permit the Contractor to finish day's work using manual controls. The Engineer may also allow addition HMA to be ordered and placed using manual controls if it will provide a safer work site for the public to travel through. Do not resume work until automatic control system is made operative and will reliably function during the placement of HMA and has been demonstrated as being fully operational to the Engineer. The Engineer may waive requirement for electronic screed control device when paving gores, shoulders, transitions, and miscellaneous reconstruction areas where the use of the devices is not practical.

When production of HMA can be maintained and when practicable, use pavers in echelon shall be used to place surface course in adjacent lanes.

At the end of each workday; HMA pavement that is open to traffic shall not extend beyond the panel of the adjacent new lane pavement by more than distance normally placed in one workday. At end of each day's production, construct tapered transitions along all longitudinal and transverse pavement drop-offs; this shall apply to areas where existing pavement is to meet newly placed pavement. Use slopes of 6:1 for longitudinal taper transitions and 48:1 for transverse tapered transitions. Maximum drop-off height along the joints shall be 3 inches. Also, using a 48:1 slope provide a taper around any protruding object, e.g., manholes, drain boxes, survey monuments, inlets, etc., that may be above pavement surface when opened to the public. If the object is below the surface of the pavement then fill the depression until it is level with the surrounding pavement or raise depressed objects to the finish grade of the placed pavement. Remove and dispose of all transition tapers before placing adjoining panel or next layer of HMA. Notify traveling public of pavement drop-offs or raised objects with signs placed in every direction of traffic that may use and encounter pavement drop-offs or protruding objects or holes.

Use the same taper rates for areas where there is a difference in elevation due to construction work.

At end of each workweek, complete full width of the roadway's pavement, including shoulders, to same elevation with no drop-offs.

(F) Compaction. Immediately after spreading and striking off HMA and adjusting surface irregularities, uniformly compact mixture by rolling.

Initiate compaction at highest mix temperature allowing compaction without excessive horizontal movement. Temperature shall not be less than 220 degrees F.

Finish rolling using tandem roller while HMA temperature is at or above 175 degrees F.

On superelevated curves, begin rolling at lower edge and progress to higher edge by overlapping of longitudinal trips parallel to centerline.

If necessary, repair damage immediately using rakes and fresh mix. Do not displace line and grade of HMA edges during rolling.

Keep roller wheels properly moistened with water or water mixed with small quantities of detergent. Use of excess liquid, diesel, and petroleum-based liquids will not be allowed on rollers.

Along forms, curbs, headers, walls and other places not accessible to rollers, compact mixture with hot hand tampers, smoothing irons, or mechanical tampers. On depressed areas, trench roller or cleated compression strips under roller may be used to transmit compression.

Before the start of compaction or during compaction or both remove pavement that is loose, broken, or contaminated, or combination thereof; pavement that shows an excess or deficiency in asphalt cement content; and pavement that is defective in any way. Replace with fresh HMA pavement of same type, and compact. Remove and replace defective pavement and compact at no increase in contract price or contract time.

Operate rollers at slow and uniform speed with no sudden stops. The drive wheels shall be nearest to the paver. Continue rolling to attain specified density and until roller marks are eliminated.

Rollers shall not be parked on the pavement place that day or shift.

(1) HMA Pavement Courses One and a Half Inches Thick or Greater. Where HMA pavement compacted thickness indicated in the Contract Documents is 1-1/2 inches or greater, compact to not less than 93.0 percent nor greater than 97.0 percent of the maximum specific gravity determined in accordance with AASHTO T 209, modified by deletion of Supplemental Procedure for Mixtures Containing Porous Aggregate.

Place HMA pavement in individual lifts that are within minimum and maximum allowable compacted thickness for various types of mixture as specified in Table 401.02-1 - Limits of Compacted Lift Thickness and Asphalt Content.

(2) HMA Pavement Courses Less Than One and a Half Inches Thick. Where HMA pavement compacted thickness indicated in the contract documents is less than 1-1/2 inches, compaction to a specified density will not be required.

Use only non-vibratory, steel-tired, tandem roller. Roll entire surface with minimum of two roller passes. A roller pass is defined as one trip of the roller in one direction over any one spot.

For intermediate rolling, roll entire surface with minimum of four passes of roller.

Finish rolling using steel-tired, tandem roller. Continue rolling until entire surface has been compacted with minimum of three passes of roller, and roller marks have been eliminated.

Do not use rollers that will excessively crush aggregate.

(3) HMA Pavement Courses One and a Half Inches Thick or Greater In Special Areas Not Designated For Vehicular Traffic. For areas such as bikeways that are not part of roadway and other areas not subjected to vehicular traffic, compact to not less than 90.0 percent of maximum specific gravity determined in accordance with AASHTO T 209, modified by deletion of Supplemental Procedure for Mixtures Containing Porous Aggregate. Increase asphalt content by at least 0.5 percent above that used for HMA pavements designed for vehicular traffic. Paved shoulders shall be compacted in the same manner as pavements designed for vehicular traffic.

(G) Joints, Trimming Edges and Utility Marking. At HMA pavement connections to existing pavements, make joints vertical to depth of new pavement. Saw cut existing pavement and cold plane in accordance with Section 415 - Cold Planing of Existing Pavement to depth equal to thickness of surface course or as indicated in the Contract Documents.

At HMA connections to previously placed lifts, form joints by cutting back on previous run to expose full depth of course. Dispose of material trimmed from edges. Protect end of freshly laid mixture from rollers.

Before and after paving, identify and mark location of existing utility manholes, valves, and handholes on finished surface. Adjust existing frames and covers and valve boxes to final pavement finish grade in accordance with Section 604 - Manholes, Inlets and Catch Basins and Section 626 - Manholes and Valve Boxes for Water and Sewer Systems.

(1) Longitudinal joints. Submit for review the means and methods that will be used to install longitudinal joints at the required compaction and density. The Engineer may allow a waiver to the Contract Documents by allowing the compaction of the HMA at the longitudinal joints to be no lower than 91.0 percent of the maximum specific gravity determined in accordance with AASHTO T 209, modified by deletion of Supplemental Procedure for Mixtures Containing Porous Aggregate. The air voids at the longitudinal joints shall not exceed 5 percent. Verify the compaction of the longitudinal joints meets the Contract Documents' requirements by using non-destructive testing methods during paving and submit the results on the daily quality control test reports.

Overband all longitudinal joints within the entire lot the non-compliant core represented with PG binder seal coat or other type of joint enrichment accepted by the Engineer when the longitudinal joints are found to have less than 93.0 percent but is no less than 90 percent of the maximum specific gravity or has an air void that exceeds 5 percent. The overband shall not decrease the skid resistance of the pavement under any ambient weather condition. Submit overband material's catalog cuts, test results and application procedure for review and acceptance by the Engineer before use. Center the overband over the longitudinal joint. The overband shall be placed in a uniform width and horizontal alignment. The overband shall have no holidays or streaking in its placement. The width of the overband shall be based on how the longitudinal joint was constructed or as directed by the Engineer. If a butt joint is used, the overband width shall be a minimum of 12-inches. For butt wedge or wedge joints the overband width shall be the width of the wedge plus an additional six-inches minimum. Replace any pavement markings damaged or soiled by the overband remedial repair process.

For longitudinal joints that have a compaction of less than 90 percent of the maximum specific gravity; removal may be required by the Engineer instead of overbanding the non-compliant joint. The Engineer will solely decide if removal or overbanding is required.

Persistent low compaction results may be cause to suspend work and remove non-conforming work. During the suspension of paving, revise means and methods used in constructing longitudinal joints and submit to the Engineer for review and acceptance. Suspension may occur when:

(1) Two or more longitudinal joints tests fail to meet the minimum compaction

(2) One sample reveals that the joint compaction is 90 percent or less.

(3) The maximum air void requirement exceeds 5 percent.

Test for compaction and density regardless of layer thickness. Compaction and density shall be determined by using six-inch diameter or larger cores instead of four-inch diameter cores. For longitudinal joints made using butt joints cores shall be taken over the joint with half of the core being on each side of the joint. For longitudinal joints using butt wedge joints, center core over the center of the wedge so that 50 percent of the material is from the most recently paved material and the remaining 50 percent of the core is from the material used to pave the previous layer. One core shall be taken at a maximum of every 250 feet of longitudinal joint and any fraction of that length for each day of paving with a minimum of three cores taken for each longitudinal joint per day. Cores taken for the testing of the longitudinal joint may be used to determine pavement thickness.

Compaction results for longitudinal joints until January 1, 2023 will not be included in any Sliding Scale Pay Factor for Compaction payment calculation. After, January 1, 2023 it will be included.

(H) HMA Pavement Samples. Obtain test samples from compacted HMA pavement within 72 hours of lay down. Provide minimum 4-inch diameter cores consisting of undisturbed, full-depth portion of compacted mixture taken at locations designated by the Engineer in accordance with the "Sampling and Testing Guide for Acceptance and Verification" in Hawaii DOT Highways Division, *Quality Assurance Manual for Materials*, Appendix 3. Turn cores over to Engineer immediately after cores have been taken. Before cores are taken inform Engineer so that the work may be observed by the Engineer and cores turned over to the Engineer at that time.

For pavement samples for longitudinal joints provide 6-inch diameter cores minimum. For pavement samples for other than longitudinal joints 4-inch diameter cores minimum shall be taken. All cores shall consist of undisturbed, full-depth portion of compacted mixture taken at locations designated by the Engineer in accordance with the "Sampling and Testing Guide for Acceptance and Verification" in Hawaii DOT Highways Division, *Quality Assurance Manual for Materials*, appendix 3. Coring of longitudinal joints shall use a modified HDOT Sampling and Testing Guide as required by the Contract Documents.

Cores that separate shall indicate to the Engineer that there is insufficient bonding of layers. Modify the previously used paving means and methods to prevent future debonding of layers. Debonding of a core sample after adjustment of the Contractor's methods will be an indication of continued non-conforming work and the Engineer may direct removal of the layer at no additional cost or contract time.

Restore HMA pavement immediately after obtaining samples. Clean core hole and walls of all deleterious material that will prevent the complete filling of the core hole and the bonding of the new HMA to the existing. Apply pavement joint cement to vertical faces of sample holes. Fill sampled area with new HMA pavement of same type as that removed. If hand compaction is used; fill in layers not exceeding the minimum thickness stated in Table 401.02-1 - Limits Of Compacted Lift Thickness And Asphalt Content and Compact. If Mechanical Compaction methods are used, then layers may be the maximum layer thickness stated in Table 401.02-1 - Limits Of Compacted Lift Thickness And Asphalt Content. Using tires or hand tamping to compact the HMA material to restore the pavement shall not be considered as mechanical compaction.

Only sample and test leveling course if 1-1/2 inches or greater. No compaction requirements for less than 1-1/2 inches.

(l) HMA Pavement Thickness Tolerances.

The Engineer will measure thickness of pavement by cores obtained by the Contractor in accordance with HDOT TM 09-19 Field Sampling Bituminous Material after Compaction (Obtaining Cores). The Engineer will measure cores in accordance with HDOT TM 09-19, except that measurement will be taken to nearest one thousandth of an inch; and average of such measurements will be taken to nearest one hundredth of an inch.

Thickness of finished HMA pavement shall be within 0.25 inch of thickness indicated in the Contract Documents. Pavement not meeting the thickness requirements of the Contract Documents may be required by the Engineer to be removed and replaced.

Corrective methods taken on pavement exceeding specified tolerances, e.g., insufficient thickness by methods accepted by the Engineer, including removal and replacement, shall be at no increase in contract price or contract time.

The checking of pavement thickness shall be done after all remedial repairs, e.g., smoothness compliance repairs, compaction, have been completed, reviewed and accepted by the Engineer.

(J) Quality Control Using New Technology. The Engineer and MTRB reserves the right to utilize new technology and methods to improve the detection of noncompliant work on the project. The technology or method may be used to locate defects in the work, e.g., ground penetrating radar to locate delaminations, moisture damage, thin sections, voids, non-compliant compaction, other non-destructive testing to locate flaws. The defect will be verified by the methods stated in the Contract Documents or by other established conventional means. If the technology or method has already been accepted elsewhere or has standardized testing procedures the results may be judged acceptable by the Engineer and no further testing will be required. These new technologies and methods may be used for the selection of sampling locations.

(K) Protection of HMA Pavement. Except for construction equipment directly connected with paving operations, keep traffic off HMA pavement.

Protect HMA pavement from damage until it has cooled and set.

Do not refuel equipment or clean equipment or hand tools over paved surfaces unless catch pan or device that will contain spilled fuel and other products is provided. After completion of refueling or cleaning, remove catch pan or device without spilling any of the collected content.

(L) Pavement Joint Adhesive

(1) Pavement Joint Adhesive on Joints. Use on all asphalt pavement construction where joints are formed at such locations but not limited to the following:

(a) Adjacent asphalt pavements, e.g., trafficked lanes, shoulders, etc.

(b) Asphalt pavement and adjacent concrete pavement or curb and gutter or any other surface where the bonding of the asphalt pavement and concrete surface is desired,

(c) Transverse joints between asphalt pavements not placed at the same time or if the pavement's temperature on one side of the joint is below the minimum temperature the mix can be at, during asphalt pavement compaction or installation.

(d) Entire wall and bottom of sample core holes in HMA pavement.

(e) Cut face of an existing pavement where it will have new HMA pavement placed against it, e.g., utility trenches, partial or full depth repairs, etc.

(f) Entire frame or face of a utility facility or similar feature that is to be imbedded in the asphalt pavement, e.g., manholes, pullboxes, handholes, survey monuments, valve boxes, etc.

Pavement joint adhesive is not required on a longitudinal construction joint between adjacent hot mix asphalt pavements formed by echelon paving. Echelon paving is defined as: paving multiple lanes side-by-side with adjacent pavers slightly offset at the same time.

A longitudinal construction joint between one shift's work and another shall have pavement joint adhesive applied at the joint. Any longitudinal construction joint formed with the temperature on one side of the joint that is below the minimum temperature, the mix can be, when compacted to contract requirements during asphalt pavement installation shall have pavement joint adhesive applied at the joint.

(2) Material requirements. Asphalt joint adhesive shall meet requirements as specified in Table 401.03-1 - Asphalt Joint Adhesive Specifications.

TABLE 401.03-1 – ASPHALT JOINT ADHESIVE SPECIFICATIONS		
TEST		**SPECIFICATION**
Brookfield Viscosity, 204 °C [**400 °F**]	ASTM D 3236	4,000-10,000 cp
Cone Penetration, 25 °C [**77 °F**]	ASTM D 5329	60-100 dmm
Resilience, 25 °C [**77 °F**]	ASTM D 5329	30% minimum
Ductility, 25 °C [**77 °F**]	ASTM D 113	30 cm minimum
Ductility, 4 °C [**39.2 °F**]	ASTM D 113	30 cm minimum
Tensile Adhesion, 25 °C [**77 °F**]	ASTM D 5329	500% minimum
Softening Point	ASTM D 36	77 °C [**170 °F**] min.
Asphalt Compatibility	ASTM D 5329	Pass

(3) Construction Requirements for Asphalt Joint Adhesive

(a) Equipment Requirements. Use a jacketed double boiler type melting unit, with both agitation and recirculation systems. Provide a pressure feed wand application system.

(b) Material Handling. Submit a copy of the manufacturer's recommendations for heating, re-heating, and applying the joint adhesive material. Follow manufacturer's recommendations. Do not remove the joint adhesive from the package until immediately before it is placed in the melter. Joint adhesive boxes must be clearly marked with the name of the manufacturer, the trade name of the adhesive, the manufacturer's batch and lot number, the application/pour temperature, and the safe heating temperature. Feed additional material into the melter at a rate equal to the rate of material used.

Verify the pouring temperature of the joint adhesive at least once per hour at the point of discharge. Stop production if the adhesive falls below the recommended application/pour temperature. When the temperature of the adhesive exceeds the maximum safe heating temperature, stop production, empty the melter, and dispose of that adhesive in an environmentally safe method. No payment will be made for this material or its disposal.

Do not blend or mix different manufacturer's brands or different types of adhesives.

(c) Joint Adhesive Application: The face of the joint that the new asphalt pavement will bind to shall be clean and dry before the joint adhesive is applied. Apply the pavement joint adhesive material to the entire face of the surface where HMA pavement shall be installed. The thickness of the asphalt adhesive application shall be approximately 1/8 inch. Use an application shoe attached to the end of application wand. Do not overlap the joint by greater than 1/2-inch at the top of the joint or two-inches at the bottom of the joint. Apply the joint adhesive immediately in front of the paving operation. If the adhesive is tracked by construction vehicles, repair the damaged area and restrict traffic from driving on the adhesive.

(d) Field Sampling. Take a sample during each shift from the application wand during the first 20 minutes of placing sealant from each melter on the Project in the presence of the Engineer.

Each sample shall consist of two aluminum or steel sample containers with the capacity to hold five pounds of sealant each. The two sampling containers shall be labeled with Contractor's name; project name and number; date and time sample taken; location of where material was used at, e.g., from where to where it was used at in stations; manufacturer and lot number of the sealant. Each container shall be numbered one of two, or two of two. Turn over samples to Engineer without Engineer losing sight of the sample. The Engineer reserves the right to conduct supplementary sampling and testing of the sealant material.

1. Document the locations where the material came from, each lot number of sealant that is placed and submit the document to the Engineer within 2 working days of placement.

2. If a field sample fails to meet any of the requirements in Table 401.03-1 - Asphalt Joint Adhesive Specifications; the work completed using the material from the lot that the field sample represents, shall be subject to a five percent reduction in the contract price of the lift of the HMA pavement it was used on; for example, if two lanes are paved and the longitudinal joint between the two lanes uses material not meeting the

contract requirements both of the lanes' asphalt pavement used for both lanes will be subject to a price reduction. If the joint was between an existing pavement and a new the price reduction will be based on the new pavement.

3. Overband with PG binder seal coat or other type of joint enrichment material over the entire length of the joint where the use of non-compliant material occurred.

4. Width of the overband shall follow the criteria used for low density longitudinal joints. In areas where the joint was formed with a curb or gutter use a joint sealer acceptable to the Engineer.

(M) Pavement Smoothness Rideability Test. Perform surface profile tests frequently to ensure that the means and methods being used produces pavement that is compliant with the Contract Document's surface profile smoothness requirement. Make every effort to perform surface tests before opening pavement to the public. Test the pavement surface for smoothness with a 12-foot-long straightedge, a 12-foot-long rolling straightedge, or a California Type Profilograph as required by this Section.

All submittals shall be sent directly to MTRB.

The finished pavement shall comply to all the following requirements:

(a) Definitions. The following definitions shall be used for this Section and related areas of work. It is meant to work in conjunction with Subsection 101 - Definitions. Should a conflict arise Subsection 105.05 - Interpretations of the Contract Documents; Conflicts and Ambiguity shall apply.

Blanking Band -- A band of uniform height with its longitudinal center positioned optimally between the highs and lows of the surface record depicting at least 0.10 mile of pavement.

Deficiency – An area that exceeds the required profile index or exceeds the requirement for a manual or rolling straightedge, a scallop or spike or bump or dip in the pavement.

Profile Index – Inches per mile in excess of the blanking band. This determines the pavement or road smoothness.

Profile index scale - Transparent plastic scale 1.70 inch x 21.12 inch representing a scaled pavement length of 0.10 mile. The center of the

scale shall be a 0.2-inch opaque 'blanking' band that extends the length of the scale. On both sides of this band are lines scribed 0.1 inch apart, parallel to the centerline of the scale, serving as a scale to measure deviations of the profilogram above and below the blanking band.

Profilogram - Scaled with 1 inch equal to 25 ft. longitudinally and 1 inch equal to 1 inch vertically.

Profilograph - California-type, constructed with a metal frame with approximately 25-feet between the front and rear wheel assembly supports. It shall allow field calibration using vertical deflection standards. Each wheel assembly consists of six averaging rubber-tired wheels arranged so the center of the frame represents the mean evaluation of the road surface between the wheel assemblies. For consistent graph recording, maintain air pressure in the profile wheel to the manufacturer's specification. Propulsion power may be manual, or a small propulsion unit attached to assembly may be used.

1. Example of commercially available profilographs

1) Cox Automated Profilograph

2) Ames Automated Profilograph

3) McCracken Automated Profilograph.

Scallop - A vertical projection above or below the blanking band.

Spike - A scallop with a width of less than 0.08 inch on the profilogram. (about 2 feet on the roadway).

(b) Surface Test Using 12-Foot Manual Straightedge. At locations determined by the Engineer and Contract Documents use a 12-foot manual straightedge. When the straightedge is laid on finished pavement in direction parallel or normal to centerline as determined by the Engineer, the 12-foot manual straightedge surface shall not vary more than 1/8 inch from lower edge in any direction. Perform the profiling in lines at a distance determined by the Engineer, but at not less than one foot on center or more than a four foot on center spacing. Profiling shall extend across the transverse joints when they are located within testing area. The Engineer may decrease the spacing of the surface test to verify the limits of an irregularity of a surface determined by the Contactor. Check the following with a 12-foot Straightedge:

1. Construction joints where a day's paving ended and another day's began.

2. Longitudinal profiling parallel to centerline, when within 15 feet of a bridge approach or existing pavement (pavement not constructed under the current project) which is being joined.

3. Transverse profiling of cross slopes, approaches, and as otherwise directed with respect to the requirements below:

a) Lay the straightedge in a direction perpendicular to the centerline.

b) When pavement abuts bridge approaches or pavement not under this Contract, ensure that the longitudinal slope deviations of the finished pavement comply with Contract Document's requirements.

c) Short pavement sections up to 250 feet long, including both mainline and non-mainline sections on tangent sections and on horizontal curves with a centerline radius of curve less than 1,000 feet.

d) Within a superelevation transition on horizontal curves having centerline curve radius less than 1,000 feet, e.g., curves, turn lanes, ramps, tapers, and other non-mainline pavements.

e) Within 15 feet of transverse joint that separates pavement from existing pavement not constructed under the contract, or from bridge deck or approach slab for longitudinal profiling.

f) As otherwise directed by the Engineer.

4. The Engineer may confine the checking of through traffic lanes with the straightedge to joints and obvious irregularities or chose to use it at locations not specifically stated in this Section.

(c) Surface Test Using 12-Foot Rolling Straightedge. In lieu of using a 12-foot manual straightedge the Contractor may use a 12-foot rolling straightedge, California-type profilograph or other roadway profiling device upon acceptance by the Engineer. The Engineer however, is under no obligation to provide such a waiver and

may place limitations to their use if accepted or rescind the waiver at any time at no additional cost or increase in contract time.

(d) Surface Test Using California-type Profilograph. In all areas not listed to be measured by the 12-foot manual straightedge a California-type profilograph shall be used unless otherwise directed by the Engineer. To determine the profile for each lane of pavement surface use the California-type profilograph in accordance with HDOT TM 6 and these specifications.

1. HDOT TM 6 shall be modified in the following way:

   a) Electronic recorder shall be used. The electronic recorder shall:

      1) Collect data by means of a digital response resulting from the vertical movement of the profile wheel.

      2) Record the data digitally and shall be able to produce a hard copy profilogram on a scale of 1 in. = 25 ft longitudinally and 1 in. = 1 in. vertically (full scale).

   b) The profilograph shall have a software program capable of generating a computerized profile trace based on the collected data. The computer software shall be set with the following data filter settings.

      1) Filter Type: 3rd Order Butterworth

      2) Filter Length: 2.0 feet

      3) Filter Grain: 1.00

      4) Blanking Band: 0.2

      5) Bump Locator: On

      6) Bump Checkbox: Check

      7) Dip Checkbox: Check

      8) Bottom Bump: Off

c) Movement of the profilograph may be provided by manually propelling the profilograph.

d) A golf cart or other similar type lightweight vehicles may be used to provide propulsion. It shall operate at the slow rate of speed required, be able to maintain a constant speed and it shall not adversely affect the operation or function of the profilograph in any manner.

1) The propulsion unit shall not be used to push the profilograph from behind.

2) The propulsion unit shall be use at a speed not to exceed 3 miles per hour or walking speed. Reduce speed if speed adversely affects the operation or function of the profilograph in any manner.

3) Use the profilograph manufacturer's recommendation for attaching propulsion unit to profilograph.

e) Provide the use of the propulsion unit with operator to the Engineer for its profile check.

(e) Alternative Profile Measuring Machines.

1. Around January 1, 2023 or when it is specified in the Contract Documents, all HDOT projects being bid on requiring profiling of pavement shall use an inertial profiler. Both inertial profiler and the technicians using it as well as those technicians processing the data obtained shall be certified by a certifying entity accepted by the Engineer. Submit certifications for review and acceptance by the Engineer.

2. Until January 1, 2023, or when it is specified in the Contract Documents, if the Contractor chooses to use an inertial profiler it may do so, providing it meets the requirements of TxDOT's TEX-1001-S unless the portion is overridden by these Contract Documents.

a) TxDOT's TEX-1001-S requires the use of TxDOT's RIDE QUALITY software. It is available at http://apps2.dot.state.tx.us/apps/rideqc.

b) The Engineer may waive portions of TEX-1001-S if it solely chooses to do so unilaterally or upon application by the Contractor.

1) The following modifications shall be applied to TEX-1001-S:

a. Paragraph 4.3.4 does not apply.

b. Paragraph 5.9 and 5.10 does not apply.

2) Subsection 6 Test Data Description and Format does not apply, Contractor shall supply an acceptable substitute to the Engineer.

3) Paragraph 8.3.2.3 does not apply. The Department will not supply or designate test sections. Contractor shall provide a proposed section meeting the criteria listed in TEX-1001-S or as directed by the Engineer or MTRB.

c) Submit all IRI test data to the Engineer to the Engineer in a format acceptable to the Engineer within 48 hours after completion of the test. If the deadline falls on a non-work day for the Engineer, submit by noon of the next work day after the non-working day.

d) ProVAL Software may be used in lieu of TxDOT's RIDE QUALITY software providing that the analysis provides acceptable results equal to TxDOT's RIDE QUALITY. ProVAL is an engineering software application that allows users to view and analyze pavement profiles in many ways. It is available at http://www.roadprofile.com/proval-software/ at no cost.

(f) Submission of Profile Reports.

1. Submit the daily reports and analysis of the day's profiling within three working days of the profile test.

a) Profilograms that report smoothness that fails to meet the Contact Document's requirements shall be highlighted and noted as such on the transmittal cover sheet.

b) The cause for the contractually non-compliant profile and remedial action, e.g., change of construction method, grinding of pavement, shall be included in the submittal as a separate report and shall be noted and highlighted on the cover sheet.

c) Submit all data files of the final pavement surface profile to the Engineer upon completion of all profile testing in a format, form and on storage media determined by the Engineer in one complete submittal before requesting a pre-final inspection.

d) If the Contractor is using a device that produces IRI results, submission of that data in that form will be acceptable. However, the Engineer is not obligated to accept those results as a definitive result to base acceptance or payment. Since conversion between IRI and PI is not exact, HDOT's profile test may result in finding the pavement having a non-compliant smoothness. Only profiles based on a profilograph are acceptable, and profiles done with an inertial profiler will not be considered an acceptable basis for a dispute until the Engineer's road profile is based on a reading by an inertial profiler.

2. Until HDOT requires profiling to be done by an inertial profiler, incentive payments will be determined by a California-type profilograph. An incentive payment adjustment schedule in IRI is provided as a non-binding reference only. The PI incentive payment adjustment schedule is the only payment adjustment schedule that will be used to calculate incentive adjustments unless a waiver to this requirement is granted by the Engineer.

(N) Location of Profile Testing. Take a minimum of two profiles per lane, one profile in each of the two-wheel paths which is located parallel to and three feet from each lane's edge.

The profiles shall be taken in the direction of traffic only.

When the final permanent markings have not been installed at the time of the Department's profile test, mark the pavement so that the location of the wheel paths can be determined and laid out. This should also be done before the Contractor does its profile test so that the same approximate area is measured.

Take profiles 3 feet from and parallel to each pavement edge in shoulder, median areas or areas with an edge that is not a travel lane.

If an inertial profiler is used to take a profile perform three runs in each wheel path. Additional, runs may be required by the Engineer if the data indicate a lack of repeatability of results. A 92% agreement is required for repeatability and IRI values shall have at minimum a 95% confidence level.

(O) Required Road Profile. The profile index using a California-type profilograph shall not exceed 7.0.

Where the 12-foot manual straightedge is required to be used the surface shall not vary more than 1/8 inch from the lower edge of a straightedge.

Any pavement with a profile index more than 7.0 or has a surface vary more than 1/8 inch from the lower edge of a straightedge as determined by the Contractor's profile test shall be removed or have a remedial repair performed on it that is acceptable to the Engineer.

No payment for the non-compliant, pavement will be made or if it has been made, in full or partial amounts, the entire payment for the area will be deducted from the monthly payment, unless the area is made compliant with the Contract Document requirements as determined by the Contractor's profile retest before the deduction is made.

If the monthly payment is insufficient to cover the deduction the Engineer will request from the Contractor a refund for the amount paid. The Contractor shall pay the refund within 30 days or interest payments equal to those paid by the Department for late payments shall be charged.

No pre-final inspection, final inspection, substantial completion granted, or payment made for the work will be made until the pavement meets the profile index requirement of 7.0 or manual straightedge requirement and other Contract Document requirements and all required profile reports are submitted to the Engineer and MTRB and are accepted.

(P) Request for Acceptance Profile Testing by the Department.

When the pavement surface is determined by the Contractor to meet the road profile requirements of the Contract Documents, the Contractor may submit a written request to the Engineer to perform an acceptance profile test.

The request shall be made at least 60 days before desired testing date and shall include an approximate acceptance profile testing date, a plan view

drawing of the area to be tested with the limits of the test area highlighted, and the Contractor's profile test results of the area to be tested.

If the Contractor has not profiled the proposed test area at the time of request it may delay the submittal of the profile testing data to no later than 14 days before the date of testing.

No acceptance testing will be made without the submittal of the Contractor pavement profile test results and required drawing. Failure to submit the pavement profile results and required drawing by the stated deadline or by an Engineer accepted deadline date will be considered a cancellation of the acceptance test and the Contractor shall request another profile test date. The Contractor shall reimburse HDOT for any incurred cost related to any Contractor-caused cancellation or a deduction to the monthly payment will be made.

(Q) Department Requirements for Acceptance Profile Testing. When a request for testing is made, the requested area to be tested shall be 100% of the total area indicated to be paved in the Contract Documents unless the requirement is waived by the Engineer and MTRB.

Department acceptance surface tests will not be performed earlier than 28 days following concrete placement and 14 days for HMA.

Provide labor, equipment and material, including manuals for the manuals for the machine that will be used for the profiling of the pavement surface when requested by the Engineer or MTRB or both. The Engineer or MTRB or both may request in addition to what was initially supplied additional labor, equipment and material, etc. at no additional cost or increase in contract time.

Clean debris and clear obstructions from area to be tested, as well as a minimum of 100 feet before and beyond the area to be tested before testing starts for use as staging areas. Provide traffic control for all profile testing.

The Engineer or MTRB or both may cancel the profile testing if the test area is not sufficiently clean, traffic control is unsatisfactory, or the area is not a safe work environment or test area does not meet Contract Document requirements. This canceled profile test will count as one profile test.

(R) Cost of Acceptance Profile Testing by The Department. The Engineer or MTRB or both will perform one initial profile test, at no cost to the Contractor for each area to be tested.

Based on the Engineer's or MTRB's profilogram or an inertial profiler pavement profile, it will be determined if the pavement's profile, i.e., smoothness is acceptable.

If the profile of the pavement does not meet the requirements of the Contract Documents the Contractor shall perform remedial work, i.e. corrective work then retest the area to ensure that the area has the required profile index, i.e., smoothness, before requesting another profile test by the Engineer.

(1) Additional testing. Additional testing, by the Department beyond the initial test will be performed at cost to the Contractor as follows:

(a) $2,500 per test and an additional $3,500 per six-hour day if airline travel or traveling of 25miles or more is required when Department personnel is used

(b) If HDOT equipment is allowed to be used by the Engineer or MTRB or both an additional cost for mobilization of $4,500 will be charged for each time HDOT's equipment is required to be shipped to the test location on a different island.

(c) $750 will be charged for each time equipment is required to be transported to the project location on the same island. HDOT is under no obligation to allow its equipment to be used for the measuring of the pavement profile and the Contractor shall allow for the required equipment to be available for its and HDOT's use. Any delay due to the Contractor not having acceptable equipment available will be considered a Contractor caused delay.

(d) Should the additional testing not require airline travel or traveling of 25 miles or more a charge of $2,000 per six-hour day will be made after the initial test for any retesting and $2,500 for each additional test.

(e) When a third-party testing entity performs the test, the Contractor will be charged the invoice charges plus any other incurred costs related to the test, e.g., supplies additional equipment, travel, housing, meals plus an additional 10% charge.

(2) Equipment for Acceptance Profile Testing. Provide the profilograph machine and labor and other equipment needed to operate it or collect profile data, e.g., generator, lights, follow vehicle.

Profile testing will be under the supervision of the Engineer and the previously mentioned items shall be for the exclusive use of the Engineer or MTRB or both during the acceptance testing unless otherwise allowed by the Engineer.

(a) California-Type Profilograph. The Contractor's California-type profilograph machine shall be in a condition, type and have features that are acceptable to the Engineer or MTRB or both before it can be used for acceptance profiling.

1) Submit catalog cuts of the contractor's California-type profilograph machine.

2) Submit a current calibration certificate from an entity acceptable to the Engineer for the profilograph to be used. The certification shall not be more than 12 months old at the time of the test.

When the profilograph machine is found acceptable by the Engineer no equipment mobilization charges will be made for additional tests.

(b) Inertial Profiler. When acceptable to the Engineer and MTRB or required by the Contract Documents an inertial profiler may be provided in lieu of a profilograph. Submit the same documents as required for the profilograph as well as an inertial profiler and technician certification from an entity acceptable to the Engineer.

Cancellation of a Department acceptance profile test within 14 days of the requested or agreed to test date will be counted as the initial test of the area and all profile testing for that area shall be at additional cost to the Contractor.

(S) Pavement Profiling Testing.

(1) During the initial paving operations or after a long break from placing pavement perform a profile test when the newly placed pavement has cured or cooled sufficiently to allow profile testing. Test pavement surface using California-type profilograph, to calculate profile index or other accepted measuring device. Test pavement surface once pavements are old enough. Pavement profiles may be taken earlier than previously mention to check the quality of work, but it shall be understood that the earlier pavement profiles may not be the same when taken at a later date.

(2) Use profile testing results to aid in evaluating the paving method's and equipment's ability to produce pavement meeting the Contract Documents' requirements.

(3) Submit all profile test results with the average profile index to the Engineer or MTRB. Provide other information when requested.

(4) When average profile index exceeds 10 inches per mile, suspend paving operations.

a) Resumption of paving operations shall not occur until corrective action to the paving plan, which may include a revised paving method, is submitted to the Engineer or MTRB and accepted.

b) Profile test area where corrective action to the paving plan has taken place. Verify that area is in accordance with Contract Document requirements. If the area has a profile index that still exceeds 10 inches per mile, suspend paving operations and revise the corrective paving plan.

c) Repair curing membrane on concrete pavement if damaged during surface remediation and testing operations if curing is still required.

d) Repair surface on HMA pavement if damaged during surface remediation. A pavement shall be considered damaged if the surface is gouged or made more permeable or susceptible to "birdbaths" forming or other deleterious physical characteristics.

e) Maintain slopes as shown in the Contract Documents. Slopes not meeting the slopes in the Contract Documents or the accepted road profiles will be considered a deficiency. Remove non-compliant area or submit for review and acceptance by the Engineer a remedial work plan to correct the deficiency.

(T) Furnish, Operate and Maintain the Straightedge.

(1) Manual straightedge. Manual straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with a flat bottom reinforced to ensure rigidity and accuracy. They shall be used for all types of paving and the checking of cold-milled surfaces.

(a) The manual straightedge should be 12 feet ± 2 inches in length, rigid and in good working order.

(b) When suspended at the end points its measurement edge shall not deviate from a true plane by more than 0.02 inch at any point above or below the true plane. The manual straightedge shall be rigid enough not to deform or sag when suspended at the ends.

(c) The manual straightedge shall also be straight along its length and shall not deviate from straight horizontal axis down the middle of the straight edge by more than 0.06 inch.

(d) Manual Straightedges shall have handles to facilitate movement on pavement or other methods to facilitate movement.

(e) Screeds are not acceptable as a manual straightedge.

(f) Provide and operate a 12-foot manual straightedge of a design acceptable to the Engineer, that can accurately measure surface irregularities that exceed 1/8 inch in the 12-foot effective length of the straightedge.

(2) Rolling straightedge. The rolling straightedge should be 12 feet ± 2 inches in length measured from center-to-center of the wheel axles and in a proper working order giving accurate repeatable results.

(a) The rolling straightedge shall have a read-out gauge with low and high reading marks in 1/16-inch increments measuring a maximum of 1/4 inch deviation in the pavement.

(b) Provide and operate a 12-foot rolling straightedge of a design acceptable to the Engineer, able to accurately measure surface irregularities that exceed 1/8 inch in the 12-foot effective length of the straightedge.

(U) Calibration of Straightedges.

(1) Manual Straightedges.

(a) Check the manual straightedge with a string line, using a line that does not sag when pulled taut, e.g., piano wire, for accuracy. Testing of the straightedge shall be done at a

minimum on a weekly basis or more frequently if it is suspected that the straightedge may be damaged.

1) A laser could be acceptable providing it could equal the ability to determine the straightness of the straightedge to the same degree as piano wire.

(b) The edge of the manual straightedge that contacts the pavement shall not have any vertical deviation more than 0.02 inch.

(2) Rolling Straightedges.

(a) Verify the calibration of the rolling straightedge each day before the rolling straightedge is used. The following steps should be used to verify the calibration:

1) Before the beginning of the verification, make sure the center wheel moves up and down freely. Make sure all wheels are free of deposits and contamination and rotate freely.

2) When tested with a straightedge, ensure that the finished pavement profile provides a uniform surface with no deviation greater than 1/8 inch in a 12-foot length.

3) Locate a flat area with the manual straightedge. A flat area is an area where the entire length of the bottom of the manual straightedge is in full contact with the surface of the flat area, there shall be no gaps for the entire length. The length of the flat area shall be at a minimum of 20 feet and the width three times the width of the rolling straight edge or five feet whichever is greater. Place the rolling straightedge next to the manual straight edge on the flat area and read the gauge. The gauge should read zero on both sides of the gauge.

4) Place a 3/16-inch shim under the center wheel. The gauge should read 3/16 inches high on both sides of the gauge.

5) Remove the 3/16-inch shim and place the 3/8-inch shim under the center wheel. The gauge should read 3/8 inches high on both sides of the gauge.

6) Remove the 3/8-inch shim and place a 3/16-inch shim under each outside wheel. The gauge should read 3/16 inches low on both sides of the gauge.

7) Remove each 3/16-inch shim and place a 3/8-inch shim under each outside wheel. The gauge should read 3/8 inches low on both sides of the gauge.

8) If any of the readings are incorrect, the rolling straightedge shall be adjusted according to the manufacturer's specifications and the calibration rechecked before profile testing begins.

(V) Procedure.

(1) Always maintain proper traffic management and safety precautions as required in the Contract Documents and the laws of the land. The pavement shall be cleaned just prior to performing straightedging operations. Remove all obstructions as required previously in this Section. The rolling straightedge shall be propelled at a speed of 3 mph or less.

(2) During rolling straightedging operations, mark the pavement at the center wheel where the needle initially shows a deficiency and where the deficiency ends. A deficiency is defined according to the specifications. All rolling and manual straightedging shall be conducted in the wheel path or as defined in the specifications.

(3) At the first transverse joint of the project, place a 12-foot manual straightedge on the new pavement while overlapping the transverse joint at the beginning of the project by one inch. Mark the pavement at any location that shows a deficiency.

(4) Locate the back wheel of the rolling straightedge at the transverse joint at the beginning of the project. If continuing straightedging operations from a previous stopping point (such as the end of a day's production), then place the rolling straightedge at the same location where straightedging was previously stopped. Pull the rolling straightedge along the wheel path toward the new pavement to be tested. Perform the profiling in lines parallel to the centerline, at not more than a 4-foot transversal spacing and extending across the transverse joints.

(5) Stop the front wheel of the rolling straightedge at the transverse joint at the end of the area being tested. At the transverse joint at the end of the test area place a 12-foot manual straightedge on the new pavement while overlapping the transverse joint at the end of the test

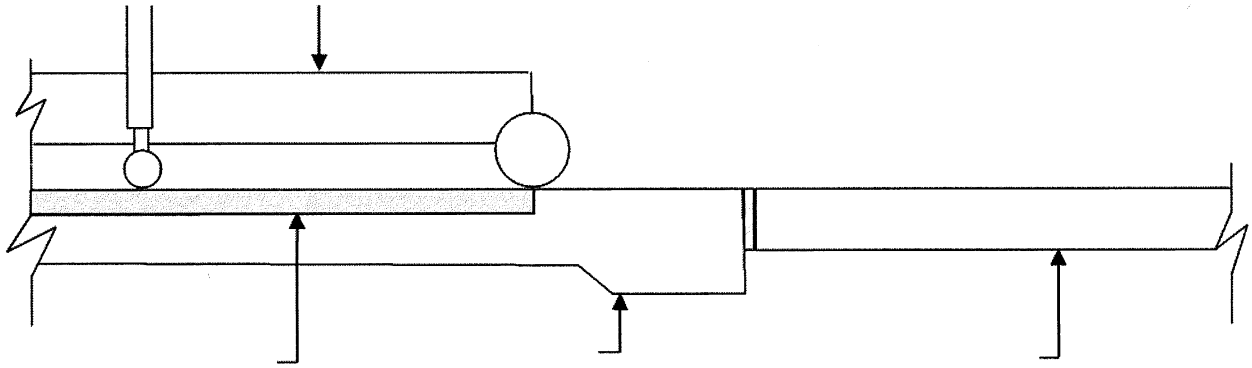
area by one inch. Mark the pavement at any location that shows a deficiency.

(6) For bridge approaches, place the rolling straightedge on the new pavement and start the rolling straightedge at the same location from the previous straightedging operation. Pull the rolling straightedge toward the joint until the front wheel reaches the end of the HMA or concrete pavement layer (see Figure 1 - 12-foot Rolling Straightedge at Approach Slab). Mark any deficiencies up to that point, as described in paragraph (B). Place a 12-foot manual straightedge in the same location while overlapping the approach slab by one inch (see Figure 2 - 12-foot Manual Straightedge at Approach Slab). Mark the pavement at any location that shows a deficiency.

(7) For bridge departures, place a 12-foot manual straightedge at the joint of the bridge departure slab and HMA or concrete pavement layer, while overlapping the departure slab by one inch. Mark the pavement at any location that shows a deficiency. Place the rolling straightedge on the new pavement with the back wheel at the joint of the bridge departure slab and HMA or concrete pavement layer. Pull the rolling straightedge away from the joint toward the new pavement to be tested. Mark any deficiencies, as described in paragraph (B).

(8) Areas measured with the manual straightedge or rolling straightedge will not be included in the incentive price adjustment. These areas shall meet the Contract Document requirement of not exceeding 1/8 inch in 12-foot length. Perform remedial work to the pavement surface until it does not exceed 1/8 inch in 12-foot length.

12-foot Rolling Straightedge



HMA or concrete Layer Approach Slab Bridge Deck

Figure 1 – 12-foot Rolling Straightedge at Approach Slab

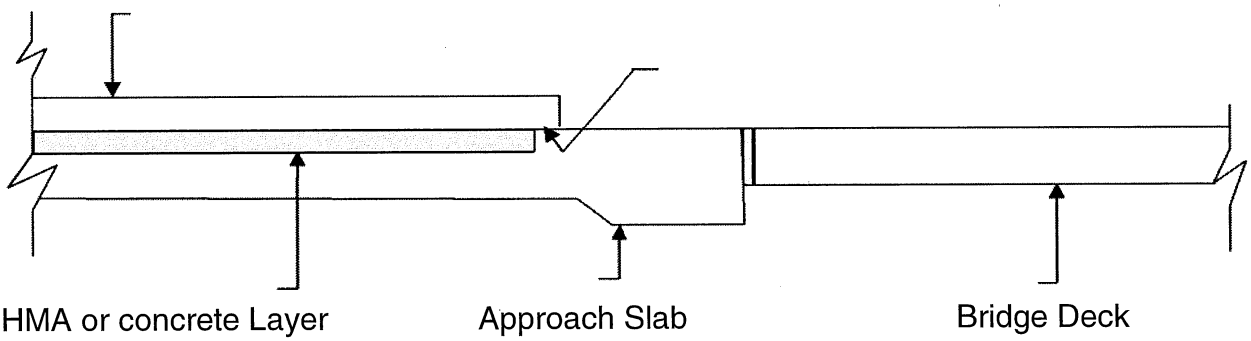


Figure 2 – 12-foot Manual Straightedge at Approach Slab

(W) Remedial Work for Pavements.

(1) Reduce individual high points over 0.3 inch, as determined by profilograph measurements in accordance with HDOT TM 6, by using the remedial repair methods accepted by the Engineer until such high points shown by profilograph reruns do not exceed 0.3 inch.

(2) After completing remedial repairs of high points, perform additional remedial repairs as necessary to reduce the profile index to meet the smoothness requirements of a PI equal to 7 or less or 1/8 inch in 12-foot length at areas where method is required.

(3) Perform additional remedial repairs as necessary so that lateral limits of the remedial repair area are at constant offset from and parallel to nearest lane line or pavement edge.

(4) Perform additional remedial repairs, as necessary, to extend remedial repair area within any one surface area, in each longitudinal direction so that the remedial repair area begins and ends at straight transverse lines normal to pavement centerline.

(5) Remedial repair areas shall be neat, rectangular areas having a uniform surface appearance.

(6) For concrete pavements, unless otherwise indicated in the Contract Documents, grinding shall provide a line-type texture that contains parallel, longitudinal corrugations with ridge peaks approximately 1/16 inch higher than groove bottoms; and with approximately 55 to 60 evenly spaced grooves per foot.

(a) If grinding is used for an HMA pavement, the surface shall have nearly invisible grinding marks to passing motorist.

Coat surface with a coating acceptable to the Engineer or MTRB to restore original impermeability level.

(7) The finished repaired pavement surface shall leave no ridges or valleys or fins of pavement other than those allowed below.

(8) Remedial repairs shall not leave any drainage structures' inlets higher than the surrounding pavement or alter the Contract Document's drainage pattern.

(9) For items in the pavement other than drainage structures, e.g., manhole frame and covers, survey monuments, expansion joints etc., the finish pavement, ground or not, shall not be more than 1/8 inch in elevation difference. Submit to the Engineer remedial repair method to correct these conditions for acceptance.

(10) Do not grind pavement to smooth or polished finish, i.e., do not decrease the friction coefficient of the pavement.

(a) When the Engineer determines that the ground pavement surface is smooth or has a polished finish; i.e., has the appearance to the Engineer that the roadway surface's coefficient of friction has decreased, submit remedial repair method to correct the condition.

(11) Pick up immediately grinding operation residue by using a vacuum attached to grinding machine or other method acceptable to the Engineer.

(a) Any remaining residue shall be picked up before the end of shift or before the area is open to traffic, whichever is earlier.

(b) Prevent residue from flowing across pavement or from it being left on pavement surface or both.

(c) Residue shall not be allowed to enter the drainage system.

(d) The residue shall not be allowed to dry or remain on the pavement.

(e) The collection effectiveness of the method being used to pick up reside shall be at a level that when vehicles drive across the ground surface there is no visible tracking of residue or dust. No dust shall be "kicked up" by passing vehicles.

(f) Dispose of all material that is the result of the remedial repair operation, e.g., concrete or HMA residue, waste water, dust at a legal facility.

(12) For concrete pavement, the following apply:

(a) Profile grinding to obtain surface smoothness is not a substitute for diamond grinding grooves for texture or artificial turf drag and tining.

(b) Diamond grinding grooves into the concrete surface for texture shall be performed separately and, in a pattern, acceptable to the Engineer.

(c) No curing compound shall be sprayed on top of the residue.

(d) Curing compound shall be applied at the required rate on top of the ground surface immediately after grinding is complete and residue is picked up unless the pavement is 28 days or older.

(13) Use of bush hammers and other impact devices shall not be used for pavement surface remediation.

(14) Complete corrective work before determining pavement thickness for HMA pavements in accordance with Subsection 401.03(I) – HMA Pavement Thickness Tolerances or for portland concrete pavements with Subsection 411.03(T) - Pavement Thickness.

(15) All HMA wearing surface areas that have been ground shall receive a coating, e.g., a coating material that will restore any lost impermeability of the HMA due to the grinding of the surface. The coating used shall not be picked up or tracked by passing vehicles or be degraded after a short period of time has passed, i.e., it shall have a service life equal to or greater than the HMA pavement. The coating shall not decrease the pavement's friction value. The coating's limits shall be the full width of the lane regardless how small. If the remedial repair area extends in to the next lane the that repair area will be full lane width also. Extend the length of coating areas in order for the coating area to look like the rest of the road and does not have patches on it, i.e., make the road look uniform in color. The coating shall be of a color that matches the surrounding pavement. The areas receiving the coating shall not be open to traffic until it has cured enough so that it cannot be picked up or tracked by passing vehicles or degrade.

Submit means and methods of the coating and type of coating to the Engineer or MTRB for review and acceptance. Do not proceed with the coating without acceptance from the Engineer.

(16) Recompacting cold HMA, i.e., HMA that has reached ambient temperature is not an acceptable remedial repair method.

(17) Replace all pavement markings damaged or discolored by remedial repairs.

(18) Hot mix asphalt base course (HMAB) will not be required to have a profilograph profile test run on it. However, the smoothness of the HMAB does contribute to the smoothness of the final wearing course so the HMAB's surface tolerances shall be checked in the following manner:

(a) When an HMA pavement is to be placed on a HMAB, the final surface course of the HMAB shall not deviate at any point more than 1/4 inch from the bottom of a 12-foot straightedge laid in any direction on the surface on either side of the pavement crown.

(b) When a portland cement concrete pavement is to be placed on a HMAB, the surface tolerance of the HMAB shall be such that no elevation lies more than 0.05 feet below above the plan grade minus the specified plan depth of portland cement concrete pavement. The HMAB's elevation shall not exceed the plan grade minus the specified plan depth of portland cement concrete pavement.

(c) When the HMAB is the wearing course it shall meet the smoothness requirements of an HMA pavement.

(d) Submit report of the week's grade checks to the Engineer and MTRB denoting at the minimum, date, time, location. Submit results of the grade checks to the Engineer and MTRB at a minimum of 24 hours before the weekly meeting after the week the grade check was performed so if needed it could be discussed.

(e) Perform remedial repairs if work failed to meet the surface tolerances of this section. Remedial repairs shall be performed until the required surface tolerances are achieved. Suspend paving in the areas of non-compliance, until the surface meets the required surface tolerances. The Engineer will decide the limits of the area of non-compliance, and where

paving is being suspended. Achieve acceptance of the remedial repair method from the Engineer and MTRB prior to its use.

(X) Third-party Profile Testing.

(1) The Engineer may choose to have a third-party testing entity do the pavement profile and to process the data into a recommendation for acceptance or rejection of the pavement's smoothness.

(2) The third-party testing entity will be chosen by agreement and acceptance by the HDOT's Highway Materials Testing Research Branch (MTRB), and the Engineer. If no agreement can be reached the MTRB will choose the third-party testing entity as its sole recognizance.

(3) The third-party testing entity will be paid by the Department by deducting the Allowance amount from the Contractor's payment.

(a) The Allowance amount will cover the third-party testing entity's cost to do the project's pavement profile, e.g., fees, transportation, lodging, additional equipment, training and supplies, plus a 10-percent processing fee for the Department. This includes all the initial acceptance profile testing. All surplus material will be turned over to the MTRB at the end of the pavement profile testing including all data and reports generated by the third-party testing entity or items requested by the MTRB. Surplus material, data, reports, etc. will be in the sole custody of the Department for its use and reference.

(b) If retesting of the pavement profile is done by the third-party testing entity it will be paid based on the submitted invoices and receipts plus a 10-percent processing fee for HDOT. This testing is retesting required due to the Contractor's failure to meet the Contract Document's requirements and not the profile testing done for the dispute resolution process.

(Y) Dispute Resolution Procedures.

(1) If the Contractor has determined that its pavement profile has met the Contract Document requirements, but the Engineer's pavement profile has found the pavement profile does not meet the Contract Documents requirements it may dispute the Engineer's findings if it is so inclined. It shall follow the Pavement Smoothness Dispute Resolution Procedure.

(2) The Pavement Smoothness Dispute Resolution Procedure is as follows:

(a) Submit with the resubmittal of the pavement profile and data of the disputed area, a notice informing the Engineer that the results of the Engineer's pavement profile are being disputed and request a copy of the Engineer's pavement profile and data.

(b) If after receiving the Engineer's pavement profile and data and doing a detail analysis of the documents, the Contractor still feels that the Engineer's pavement profile is in error submit a document notifying the Engineer of that fact along with the detailed analysis of the Engineer's pavement profile and data showing where the errors were made and if corrected the pavement profile would meet the Contract Document requirements.

(c) The Engineer upon receiving the Contractor's pavement profile documents will do a detailed analysis of the document to find any errors that may have caused the Contractor to believe the pavement profile was acceptable.

(d) If either party discovers their position was in error notify the other party of the change in position and take appropriate action.

(e) If both parties maintain that their positions are correct, then both parties shall meet to discuss and present their positions. If the Department used a third-party testing entity it shall also attend. Both the Department and the Contractor shall and will bring a copy of their submittal to the meeting. Parties involved shall be allowed to inspect the other party's documents to verify that it had been presented to them before. Before the meeting starting, the submittals are to be placed in a box and sealed and given to a Materials Testing Research Branch (MTRB) personnel. The MTRB is an HDOT entity, however in this instance it shall be regarded as a neutral party. It is mandatory that during the meeting all parties are to be transparent and have an open discussion with the goal being reaching an agreement. If after the following has occurred:

(f) If after meeting or after having several meetings with all parties and having performed their due diligence in meeting the above meeting's requirements the Department and the

Contractor agree that they have come to an impasse in discussions i.e., further discussions would be futile.

(3) An impasse will be declared, and no further meeting shall be suspended. If an impasse cannot be agreed to then one more meeting shall be held with both parties attending giving their due diligence in the goal of coming to an agreement. Within 48 hours after the last meeting a third-party pavement profile testing entity will be chosen to evaluate the Department's and Contractor's submittals or run a new smoothness profile or both.

(4) The third-party pavement profile testing entity shall evaluate the documents being held in the sealed box by the MTRB.

(5) No additional documents shall be added by the Contractor or the Department unless it was presented during the meetings. If additional documents were used during the meetings the following shall be done.

(a) Both HDOT and the Contractor will meet to put the documents presented during the meetings into a box, then seal it and turn it over to MTRB.

(b) Parties involved shall be allowed to inspect the other party's documents to verify that it had been presented during the meetings.

(c) If it should feel that this is new material the document can be marked as such. The document then will be put into the box and sealed.

(d) The party that feels it discovered a new document is required to submit a document listing the document it feels was previously not presented and any additional information related to it. It shall not be used to submit additional information or arguments not previously discussed. This submittal shall be submitted to the other party and the third-party pavement profile testing entity through the MTRB.

(7) The third-party pavement profile testing entity after analyzing all the data it gathered and was given shall make a report and provide a recommendation. It shall meet with all parties at one time, discuss the recommendations and show where the errors occurred causing the erroneous position.

(8) The Department or the Contractor may reject the third-party pavement profile testing entity's recommendation. Notification of the

rejection shall be within three working days after the meeting. The Contractor shall perform any additional work required if the recommendation is not favorable to it. The Contractor shall pay the third-party pavement profile testing entity invoice for its work done regardless of recommendation. The Contractor may file a claim if it still feels it is correct. The Contractor shall comply with the requirements in Subsection 107.16 Disputes and Claims. The Contractor's claim shall be regarded as a new claim and the Engineer will regard it as such. Since all documents have been evaluated the Engineer will expedite the claim process after it initial claim requirements are met to Subsection 107.16(G) Appeal of the Engineer's Decision to obtain the Director's decision.

(9) Payment for the total cost of the third-party pavement profile testing entity's dispute resolution work is the responsibility of the party that its recommendation found was in error. If the recommendation finds the Department the erroneous party the Department will reimburse the Contractor in the amount of the third-party pavement profile testing entity's invoice with no additional overhead or profit added. If portions of the profile testing were correct in some areas and erroneous in others the cost of the third-party pavement profile testing entity's dispute resolution work shall be split in proportion to the erroneous area verses the total area reviewed.

(Z) Pavement Smoothness and Acceptance.

(1) Price and payment in various paving sections, e.g., 401 (Hot Mix Asphalt Pavement), 411 (Portland Cement Concrete Pavement), will be full compensation for all work and materials specified in those and this section, including but not limited to furnishing all labor, materials, tools, equipment, testing, incidentals and for doing all work involved in micro milling, milling,(cold planing), grinding existing or new pavement, removing residue, cleaning the pavement, necessary disposal of residue, furnishing of any water or air used in cleaning the pavement and any other related ancillary work or material or services. Also, it includes any remedial work, e.g., re-paving, surface grinding, application of a coating, curing compound, replacement of damaged pavement markings.

(2) The contract price in those sections may be adjusted for pavement smoothness by the Engineer. The pavement smoothness contract unit price adjustments and work acceptance will be made in accordance with the following schedules.

PAVEMENT SMOOTHNESS INCENTIVE: CONTRACT UNIT PRICE ADJUSTMENT TABLE		
Average Profile Index (inches/mile) per 0.1-mile Section		**Contract Unit Price Adjustments Percent Multiplier of Pavement Unit Bid Price**
Curvature Radius ≥2,000 ft	**1,000 ft ≤ Curvature Radius < 2,000 ft**	
PI ≤ 2	PI ≤ 2	103
2 < PI ≤ 3	2 < PI ≤ 3	102
3 < PI ≤ 4	3 < PI ≤ 4	101
4 < PI ≤ 7	4 < PI ≤ 7	100
PI > 7	PI > 7	Corrective work required

(3) Pay Price Adjustments for Incentives and disincentives will be based on the initial measured average Profile Index, prior to any corrective work for the 0.10-mile section.

(a) The adjusted Unit Price will be computed using the plan surface area of pavement shown in the Contract Documents. This adjusted Unit Bid Price will apply to the total area of the 0.10-mile section for the lane width represented by the profilograms for the average Profile Index. It does not include any other price adjustments specified in the Contract Documents. Those price adjustments will be, for each adjustment, calculated separately using the original contract price to determine the amount of adjustment to be made to the contract price.

(b) There will be no disincentive price adjustments to the contract prices since a remedial repair is required in lieu of a reduction of contract prices since pavement smoothness and ride quality is of utmost importance. Acceptable pavement smoothness will be a PI of 7.0 or less.

(c) Localized Roughness. The Engineer will determine areas of localized roughness using the average profile from both wheel paths. The Engineer may waive localized roughness requirements for deficiencies resulting from manholes or other similar appurtenances. Adjust manholes or

other similar appurtenances so that using a 12-ft. straightedge the area around that manhole or other similar appurtenance shall not have more than 1/8-in. variation between any 2 contacts on the straightedge.

1) Corrective Action. Use an Engineer accepted method to remove localized roughness. For asphalt concrete pavements, fog-seal the aggregate exposed from diamond grinding.

2) Reprofile the corrected area and provide the Engineer the results that show the corrective action, i.e., remedial repairs were successful.

(d) Incentives will not apply to areas where payment deductions or remedial repairs could be made or has been made for non-compliant work, e.g., low compaction, thin pavement, thermal segregation, low compressive or flexural strength, non-compliant alignment. Incentives will also not apply to areas where corrective work was required to meet contract smoothness requirements. All areas where corrective work was performed shall be tested again to ensure the smoothness requirements are met. Corrective work shall be repeated until it meets the smoothness requirement of the Contract Documents and any other Contract Documents' requirement. Removal of non-compliant work will be tested for compliance until it is determined by the Engineer to be compliant to the requirements of the Contract Documents.

(e) There will be no incentive price adjustments to the contract prices regardless of the pavement meeting the Contract Documents' requirements for incentive contract price adjustment, when 25% of the total area paved of that particular type of pavement on the project has failed to meet any of the Contract document requirements, e.g., smoothness, thickness, unit weight, asphalt content, pavement defects, compaction, flexural or compressive strength. Areas exempt from the smoothness requirements may not be included in the total area calculation unless it is non-compliant.

(f) For contracts using lump sum the method described in Subsection 104.08 Methods of Price Adjustment paragraph (3), will be used to calculated proportionate unit price, i.e., the Engineer's calculated theoretical unit price. This calculated proportionate unit price will be used to calculate the unit price adjustment.

IRI PAY FACTOR REFERENCE TABLE (For Comparative Information Only Not to Be Used for Payment or Acceptance)		
Average IRI (inches/mile) per 0.10-mile Section		**Possible Contract Unit Price Adjustments Percent Multiplier of Pavement Unit Bid Price**
Curvature Radius ≥2,000 ft	1,000 ft ≤ Curvature Radius < 2,000 ft	
IRI ≤ 32	IRI ≤ 32	103
32 < IRI ≤47	32 < IRI ≤47	102
47 < IRI ≤65	47 < IRI ≤65	101
65 < IRI ≤ 110	65 < IRI ≤110	100
IRI greater than 110	IRI greater than 110	Corrective work required

(4) IRI Pay Factor Reference Table provided as reference ONLY and will not be used by the Engineer to calculate incentives disincentives for project or used for acceptance criteria. The Engineer may waive this requirement if it is mutually agreeable with the Contractor and is done at no impact to the project, e.g., at no additional cost or increase in contract time.

401.04 Measurement.

(A) The Engineer will measure HMA and PMA pavement per ton in accordance with the Contract Documents.

(B) The Engineer will measure leveling course per ton in accordance with the Contract Documents.

(C) The Engineer will measure overtime labor premium on a force account basis in accordance with Subsection 109.06 – Force Account Provisions and Compensation and as ordered by the Engineer.

(D) Engineer will measure additional State pavement profiling work when applicable on a cost-plus basis as specified in this section and as ordered by Engineer. The Engineer will issue a billing for the pavement profile work done for the time period with the invoices and receipts that the billing was based

on attached to the Contractor for each contract item. The Contractor's pavement profile work required in this section will not be measured and will be considered incidental to the various paving items unless stated otherwise.

401.05 Payment. The Engineer will pay for the accepted HMA and PMA pavement at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

(A) Price and payment in Section 401 - Hot Mix Asphalt Pavement will be full compensation for all work and materials specified in this Section including furnishing all labor, materials, tools, equipment, testing, pavement profiles and incidentals and for doing all work involved in grinding existing or new pavement, removing residue, and cleaning the pavement, including necessary disposal of residue and furnishing any water or air used in cleaning the pavement and remedial work needed to conform to the requirements of the Contract Documents.

(B) Engineer will deduct from the Contractor's monthly estimate the amount necessary to pay for the services of a third-party pavement profile testing entity plus the additions specified in the Contract documents. Payment will be full compensation for work prescribed in this section, required by the Engineer and Contract Documents. No payment for the Contractor's pavement profile work required in this section will be made. It will be considered incidental to the various paving items unless stated otherwise.

(C) The Engineer will pay for the accepted overtime labor premium on a force account basis in accordance with Subsection 109.06 – Force Account Provisions and Compensation. An estimated amount may be allocated in the proposal schedule under "Overtime Labor Premium", but the actual amount to be paid will be the sum shown on the accepted force account records, whether this sum be more or less than the estimated amount allocated in the proposal schedule.

(D) Engineer will pay or deduct for the following pay items when included in proposal schedule:

Pay Item	**Pay Unit**
_____ HMA Pavement, Mix No. _____	Ton
_____ PMA Pavement	Ton
Third-Party Profile Testing and Equipment	Allowance

Third-Party Dispute Resolution Profile Testing Allowance

Pavement Smoothness Incentive Allowance

An estimated amount for an allowance may be allocated in proposal schedule under "Third-Party Profile Testing and Equipment", "Third-Party Dispute Resolution Profile Testing", but actual amount to be paid will be the combined billing records for the type of pavement profile work, whether this sum is more or less than estimated amount allocated in proposal schedule.

(1) 70% of the contract unit price or the theoretical calculated unit price upon completion of submitting a job-mix formula acceptable to the Engineer; preparing the surface, spreading, and finishing the mixture; and compacting the mixture;

(2) 20% of the contract unit price or the theoretical calculated unit price upon completion of cutting samples from the compacted pavement for testing; placing and compacting the sampled area with new material conforming to the surrounding area; protecting the pavement; and final analysis. Maintain temporary pavement markings and other temporary work zone items, maintain a clean work site.

(3) 10% of the contract unit price or calculate the unit price when the final configuration of the pavement markings is in place.

_____ HMA Pavement, Mix No. _____, Leveling Ton

(1) 80% of the contract unit price upon completion of submitting a job-mix formula acceptable to the Engineer; preparing the surface, spreading, and finishing the mixture; and compacting the mixture;

(2) 20% of the contract unit price upon completion of cutting samples from the compacted pavement for testing; placing and compacting the sampled area with new material conforming to the surrounding area; protecting the pavement; and final analysis.

The Engineer will pay for adjusting existing frames and covers and valve boxes in accordance with and under Section 604 – Manholes, Inlets and Catch Basins. Adjustments for existing street survey monument frames and covers will be paid for as if it were a valve box frame and cover.

The Engineer may, at its sole discretion, in lieu of requiring removal and replacement, use the sliding scale factor to accept HMA pavements compacted below 93.0 percent and above 97.0 percent. The Engineer will make payment for the material in that production day, if it decides to use a sliding scale factor, at a

reduced price arrived at by multiplying the contract unit price by the pay factor. The Engineer is not obligated to allow non-compliant work to remain in place and may at any time chose not to use a sliding scale factor method of payment and instead require removal of the noncompliant pavement that is Greater than 97.0 or less than 91.9.

In compliance with Subsection 105.12 Removal of Non-Conforming and Unauthorized Work remove and replace HMA compacted below 90.0 percent.

The Engineer will solely decide if the noncompliant work would be acceptable if a reduced payment for the noncompliant work is made. The Engineer is not obligated to allow noncompliant work to remain in place and may at any time chose not to use a sliding scale factor method of payment as a method of resolution. Instead, utilize the remedy allowed in Subsection 105.12 Removal of Non-Conforming and Unauthorized Work and require removal of the noncompliant pavement.

Such a reduced payment, if made and accepted by the Contractor, shall be a mutually agreeable resolution to the noncompliant work being addressed. If it is not mutually acceptable, the noncompliant work shall be removed. If the reduced payment is acceptable; the Engineer will make the reduced payments for the noncompliant work in accordance with Table 401.05-21- Sliding Scale Pay Factor for Compaction. The amount of tonnage to be reduced will be determined by the Engineer by using the initial cores taken on the mat. No additional cores shall be taken to determine the limits of the non-compliant area unless requested by the Engineer.

The Engineer, for determining the reduced tonnage for noncompliant work, will assume the level of compaction is linear and will proportion the compaction level from the last core that indicated an acceptable compaction level to the nearest core indicating a noncompliant compaction level to determine the calculated limit of acceptable compaction. The length will be the linear distance between the cores measured along the baseline. If there is no core that was taken for the shift's or day's work that were compliant then the limit will be the end or start of the day's or shift's work. The width will be the nominal paving width. Use the day's specific gravity of the mix to determine tonnage. The thickness will be the nominal paving thickness.

The total reduced noncompliant tonnage to be paid will be determined by multiplying the applicable percent of reduction by the computed tonnage of the noncompliant work. Percent of Quantity Paid will be the percentage shown in Table 401.05-2 - Sliding Scale Pay Factor for Compaction. The reduced tonnage will be used as the payment quantity for the noncompliant work. The reduced quantity paid that is used for the monthly payment will be arrived at by multiplying the contract unit price by the reduced tonnage.

Table 401.05-2 – Sliding Scale Pay Factor for Compaction	
Percent Compaction	**Percent of Quantity Paid**
> 98.0	Removal
>97.0 - 98.0	95
93.0- 97.0	100
90.0 - <93.0	80
<90.0	Removal

Overtime Labor Premium Force Account"

END OF SECTION 401