330 HOT BITUMINOUS MIXTURES – GENERAL CONSTRUCTION REQUIREMENTS.
(REV 1-26-10) (FA 2-2-10) (7-10)

SECTION 330 (Pages 250–265) is deleted and the following substituted:

SECTION 330
HOT BITUMINOUS MIXTURES - GENERAL CONSTRUCTION REQUIREMENTS

330-1 Description.

Construct plant-mixed hot bituminous pavements and bases. Establish and maintain a quality control system that provides assurance that all materials, products and completed construction submitted for acceptance meet Contract requirements.

330-2 Quality Control Requirements.

330-2.1 Minimum Quality Control Plan Requirements: In addition to the requirements set forth in Section 105, perform as a minimum the following activities necessary to maintain process control and meet specification requirements:

Stockpiles: Assure materials are placed in the correct stockpile; assure good stockpiling techniques; inspect stockpiles for separation, contamination, segregation, etc.; properly identify and label each stockpile.

Incoming Aggregate: Obtain gradations and bulk specific gravity (G_{sb}) values from aggregate supplier for reference; determine the gradation of all component materials; routinely compare gradations and G_{sb} values to mix design.

Cold Bins: Calibrate the cold gate/feeder belt for each material; determine cold gate/feeder belt settings; observe operation of cold feeder for uniformity.

Dryer: Observe pyrometer for aggregate temperature control; observe efficiency of the burner.

For Batch Plants, determine percent used and weight to be pulled from each bin to assure compliance with Mix Design, check mixing time, and check operations of weigh bucket and scales.

For Drum Mixer Plants, determine aggregate moisture content, and calibrate the weigh bridge on the charging conveyor.

Control Charts: Plot and keep charts updated daily for all Quality Control Sampling and Testing and post in the asphalt lab where they can be seen. Provide the following charts:

1. All components used to determine the composite pay factor (No. 8 sieve, No. 200 sieve, asphalt binder content, air voids, and density) by lot.
2. Gradation of incoming aggregate.
3. Gradation, asphalt binder content, and maximum specific gravity (G_{mm}) of RAP.
4. Any other test result or material characteristic (as determined by the Contractor) necessary for process control.

The above listed minimum activities are to be considered normal activities necessary to control the production of hot mix asphalt at an acceptable quality level. It is

recognized, however, that depending on the type of process or materials, some of the activities listed may not be necessary and in other cases, additional activities may be required. The frequency of these activities will also vary with the process and the materials. When the process varies from the defined process average and variability targets, the frequency of these activities will be increased until the proper conditions have been restored.

330-2.2 Minimum Process Control Testing Requirements: Perform, as a minimum, the following activities at the testing frequencies provided below:

Asphalt Plant

1. Asphalt Mix: Determine the asphalt binder content; mix gradation and volumetric properties at a minimum frequency of one per day. In the event that the daily production exceeds 1,000 tons, perform these tests a minimum of two times per day. Quality Control tests used in the acceptance decision may be used to fulfill this requirement. Verify modifier addition.

2. Aggregate: Test one sample for gradation per 1,000 tons of incoming aggregate, as it is stockpiled.

3. Aggregate moisture content from stockpiles or combined cold feed aggregate - one per day.

4. RAP: Test one sample per 1000 tons of incoming material (prior to incorporation into the mix) for gradation and asphalt binder content. Test one sample per 5,000 tons of incoming material (prior to incorporation into the mix) for maximum specific gravity (G_{mm}) and recovered viscosity.

5. Mix temperature at the plant for the first five loads and one out of every five loads thereafter.

6. Other tests (as determined necessary by the Contractor) for process control.

Roadway

1. Monitor the pavement temperature with an infrared temperature device. Monitor the roadway density with either 6 inches diameter roadway cores, a nuclear density gauge, or other density measuring device, at a minimum frequency of once per 1,500 feet of pavement. When the layer thickness is greater than or equal to 1 inch (or the spread rate is greater than or equal to 105 lb per yd^2) and an approved rolling pattern is used in lieu of density testing, identify in the QC Plan how the pavement density will be monitored.

2. Mix temperature at the roadway for the first five loads and one out of every five loads thereafter.

3. Monitor the pavement smoothness with a 15-foot rolling straightedge, as required by these specifications.

4. Monitor the pavement cross slope at a frequency necessary to fulfill the requirements of these specifications, and identify a system to control the cross slope of each pavement layer during construction.

5. Monitor the mix spread rate at the beginning of each day's production, and as needed to control the operations, at a minimum of once per 200 tons placed to ensure that the spread rate is within 5% of the target spread rate. When determining the spread rate, use, at a minimum, an average of five truckloads of mix. When the average spread rate is beyond plus or minus 5% of the target spread rate,

monitor the thickness of the pavement layer closely and adjust the construction operations.

If the Contractor fails to maintain an average spread rate within plus or minus 5% of the target spread rate for two consecutive days, the Engineer may elect to stop the construction operation at any time until the problem is resolved.

330-2.3 Minimum Quality Control System Requirements:

330-2.3.1 Personnel Qualifications: Provide Quality Control Technicians in accordance with Section 105.

330-2.3.2 Hot Mix Asphalt Testing Laboratory Requirements: Furnish or have furnished a fully equipped asphalt laboratory (permanent or portable) at the production site. The Laboratory must be qualified under the Department's Laboratory Qualification Program, as described in Section 105-6. In addition, the laboratory shall meet the following requirements:

1. Area - The effective working area of the laboratory shall be a minimum of 180 ft^2, with a layout of which will facilitate multiple tests being run simultaneously by two technicians. This area does not include the space for desks, chairs and file cabinets. Any variations shall be approved by the Engineer.

2. Lighting - The lighting in the lab must be adequate to illuminate all areas of the work.

3. Temperature Control - Equip the lab with heating and air conditioning units that provide a satisfactory working environment.

4. Ventilation - Equip the lab with fume hoods and exhaust fans that will remove all hazardous fumes from within the laboratory in accordance with OSHA requirements.

5. Equipment and Supplies - Furnish the lab with the necessary sampling and testing equipment and supplies for performing contractor Quality Control and Department Verification Sampling and Testing. A detailed list of equipment and supplies required for each test is included in the appropriate FDOT, AASHTO, or ASTM Test Method.

6. Calibration of the Superpave Gyratory Compactor: Calibrate the Superpave Gyratory Compactor in accordance with the manufacturer's recommendations. Identify in the Quality Control Plan the established frequencies and document all calibrations.

7. Personal Computer - Provide a personal computer capable of running a Microsoft Excel™ spreadsheet program, along with a printer.

8. Communication - Provide a telephone and fax machine (with a private line) for the use of the testing facility's quality control personnel. In addition, provide an Internet connection capable of uploading data to the Department's database and for e-mail communications.

330-3 Limitations of Operations.

330-3.1 Weather Limitations: Do not transport asphalt mix from the plant to the roadway unless all weather conditions are suitable for the laying operations.

330-3.2 Limitations of Laying Operations:

330-3.2.1 General: Spread the mixture only when the surface upon which it is to be laid has been previously prepared, is intact, firm, dry, clean, and the tack or

prime coat, with acceptable spread rate, is properly broken or cured. Do not place friction course until the adjacent shoulder area has been dressed and grassed.

330-3.2.2 Temperature: Spread the mixture only when the air temperature in the shade and away from artificial heat is at least 40ºF for layers greater than 1 inch (100 lb/yd^2) in thickness and at least 45ºF for layers 1 inch (100 lb/yd^2) or less in thickness (this includes leveling courses). The minimum temperature requirement for leveling courses with a spread rate of 50 lb/yd^2 or less is 50ºF. The minimum ambient temperature requirement may be reduced by 5ºF when using warm mix technology, if mutually agreed to by both the Engineer and the Contractor.

330-3.2.3 Wind: Do not spread the mixture when the wind is blowing to such an extent that proper and adequate compaction cannot be maintained or when sand, dust, etc., are being deposited on the surface being paved to the extent that the bond between layers will be diminished.

330-3.2.4 Night Paving: Meet the requirements of 8-4.1.

330-4 Preparation of Asphalt Binder.

Deliver the asphalt binder to the asphalt plant at a temperature not to exceed 370ºF, and equip the transport tanks with sampling and temperature sensing devices meeting the requirements of 300-3.2. Maintain the asphalt binder in storage within a range of 230 to 370ºF in advance of mixing operations. Maintain constant heating within these limits, and do not allow wide fluctuations of temperature during a day's production.

330-5 Preparation of Aggregates.

330-5.1 Stockpiles: Place each aggregate component in an individual stockpile, and separate each from the adjacent stockpiles, either by space or by a system of bulkheads. Prevent the intermingling of different materials in stockpiles at all times. Identify each stockpile, including RAP, as shown on the mix design.

330-5.2 Prevention of Segregation: Form and maintain stockpiles in a manner that will prevent segregation. If a stockpile is determined to have excessive segregation, the Engineer will disapprove the material for use on the project until the appropriate actions have been taken to correct the problem.

330-5.3 Blending of Aggregates: Stockpile all aggregates prior to blending or placing in the cold hoppers. Place all aggregates to be blended or proportioned in separate bins at the cold hopper. Proportion by means of securely positioned calibrated gates or other approved devices.

330-5.4 Cold Bins:

330-5.4.1 Adequacy of Bins: Use separate bin compartments in the cold aggregate feeder that are constructed to prevent any spilling or leakage of aggregate from one bin to another. Ensure that each bin compartment has the capacity and design to permit a uniform flow of aggregates. Mount all of the bin compartments over a feeder of uniform speed, which will deliver the specified proportions of the separate aggregates to the drier at all times. If necessary, equip the bins with vibrators to ensure a uniform flow of the aggregates at all times.

330-5.4.2 Gates: Provide each bin compartment with a gate which is adjustable in a vertical direction. Provide gates that can be held securely at any specified vertical opening. Equip the gates with a measuring device for measuring the vertical opening of the gates from a horizontal plane level with the bottom of the feeder.

330-5.5 Mineral Filler: If mineral filler is required in the mix, feed or weigh it in separately from the other aggregates.

330-5.6 Heating and Drying: Heat and dry the aggregates before screening. Control the temperature of the aggregates so that the temperature of the completed mixture at the plant falls within the permissible range allowed by this Section.

330-5.7 Screening Unit:

330-5.7.1 Oversize Aggregate: Remove any oversized pieces of aggregate by the use of a scalping screen. Do not return this oversized material to the stockpile for reuse unless it has been crushed and reprocessed into sizes that will pass the scalping screen.

330-5.7.2 Screening: Ensure that the quantity of aggregates being discharged onto the screens does not exceed the capacity of the screens to actually separate the aggregates into the required sizes. Allow up to a maximum of 10% plus-10 material in the minus-10 bin. The Engineer will determine the maximum amount of minus-10 material allowed in the plus-10 bins, in accordance with its effect on the uniformity of the mix.

330-6 Preparation of the Mixture.

330-6.1 Batch Mixing:

330-6.1.1 Aggregates: Once the dried aggregates and mineral filler (if required) are prepared in the manner previously described and combined in batches to meet the verified mix design by weighing each separate bin size, convey them to the empty mixer.

330-6.1.2 Asphalt Binder: Introduce the accurately measured hot asphalt binder into the mixer simultaneously with, or after, the hot aggregates. Continue mixing until the mixture is thoroughly uniform with all particles fully coated.

330-6.1.3 Mixing Time: The mixing time begins when the measuring devices for both the asphalt and the aggregates indicate that all the material is in the mixer, and continues until the material begins to leave the mixing unit. Since the mixing time varies in relation to the nature of the aggregates and the capacity of the mixer, mix sufficiently to produce a thoroughly and uniformly coated mixture.

330-6.2 Continuous Mixing: Introduce the dried aggregates and mineral filler (if required), prepared as specified and proportioned to meet the verified mix design, into the mixer in synchronization with the accurate feeding of the hot asphalt binder. Mix sufficiently to produce a thoroughly and uniformly coated mixture.

330-6.3 Mix Temperature: Heat and combine the ingredients of the mix in such a manner as to produce a mixture with a temperature, when discharged from the pugmill or surge bin, which is within the master range as defined below.

Determine the temperature of the completed mixture using a quick-reading thermometer through a hole in the side of the loaded truck immediately after loading. Locate 1/4 inch hole on both sides of the truck body within the middle third of the length of the body, and at a distance from 6 to 10 inches above the surface supporting the mixture. If a truck body already has a hole located in the general vicinity of the specified location, use this hole. At the Engineer’s discretion, the Contractor may take the temperature of the load over the top of the truck in lieu of using the hole in the side of the truck.

The normal frequency for taking asphalt mix temperatures will be for each day, for each design mix on the first five loads and one out of every five loads thereafter. Take the temperature of the asphalt mix at the plant and at the roadway before the mix is placed at the normal frequency. Record the temperature on the front of the respective delivery ticket. The Engineer shall review the plant and roadway temperature readings and may take additional temperature measurements at any time.

The master range for all mix designs will be the target mix temperature from the mix design ±30ºF. There are two master ranges; one at the asphalt plant (mixing temperature from the mix design ±30ºF) and one at the roadway (compaction temperature from the mix design ±30ºF). Reject any load or portion of a load of asphalt mix at the plant with a temperature outside of this master range. Reject any load or portion of a load of asphalt mix at the roadway with a temperature outside of this master range. The Engineer will be immediately notified of the rejection.

If any single load at the plant or at the roadway is within the master range but differs from the target mix temperature by more than ±25ºF or if the average difference of the temperature measurements from the target mix temperature for five loads exceeds ±15ºF, the temperature of every load will be monitored until the temperature falls within the specified tolerance range in Table 330-1; at this time the normal frequency may be resumed.

Table 330-1	
Temperature Tolerance From Verified Mix Design	
Any Single Measurement	±25ºF
Average of Any Five Consecutive Measurements	±15ºF

330-6.4 Maximum Period of Storage: Allow the maximum time that any mix may be kept in a hot storage or surge bin to be 72 hours.

330-6.5 Contractor's Responsibility for Mixture Requirements: Produce a homogeneous mixture, free from moisture and with no segregated materials, that meets all specification requirements. Also apply these requirements to all mixes produced by the drum mixer process and all mixes processed through a hot storage or surge bin, both before and after storage.

330-7 Transportation of the Mixture.

Transport the mixture in tight vehicles previously cleaned of all foreign material. After cleaning, thinly coat the inside surface of the truck bodies with soapy water or an asphalt release agent as needed to prevent the mixture from adhering to the beds. Do not allow excess liquid to pond in the truck body. Do not use diesel fuel or any other hazardous or environmentally detrimental material as a coating for the inside surface of the truck body. Cover each load during cool and cloudy weather and at any time it appears rain is likely during transit with a tarpaulin or waterproof cover meeting requirements of 320-5.4.

330-8 Preparation of Application Surfaces.

330-8.1 Cleaning: Prior to the laying of the mixture, clean the surface of the base or pavement to be covered of all loose and deleterious material by the use of power brooms or blowers, supplemented by hand brooming where necessary.

330-8.2 Patching, Leveling, and Overbuild Courses: Where an asphalt mix is to be placed on an existing pavement or old base which is irregular, and wherever the plans indicate, bring the existing surface to proper grade and cross-section by the application of patching, leveling, or overbuild courses.

330-8.3 Application Over Surface Treatment: Where an asphalt mix is to be placed over a newly constructed surface treatment, sweep and dispose of all loose material from the paving area.

330-8.4 Coating Surfaces of Contacting Structures: Paint all structures which will be in actual contact with the asphalt mixture, with the exception of the vertical faces of existing pavement, curbs and gutter, with a uniform coating of asphalt binder to provide a closely bonded, watertight joint.

330-8.5 Tack Coat:

330-8.5.1 Tack Coat Required: Apply a tack coat, as specified in Section 300, on existing pavement structures that are to be overlaid with an asphalt mix and between successive layers of all asphalt mixes.

330-8.5.2 Tack Coat at Engineer's Option: Apply a tack coat on the following surfaces only when so directed by the Engineer:

1. Freshly primed bases.
2. Surface treatment.

330-9 Placing Mixture.

330-9.1 Requirements Applicable to All Types:

330-9.1.1 Alignment of Edges: Lay all asphalt concrete mixtures, including leveling courses, other than the pavement edge just adjacent to curb and gutter or other true edges, by the stringline method to obtain an accurate, uniform alignment of the pavement edge. Control the unsupported pavement edge to ensure that it will not deviate more than ±1.5 inches from the stringline.

330-9.1.2 Temperature of Spreading: Maintain the temperature of the mix at the time of spreading within the master range as defined in 330-6.3. The minimum frequency for taking mix temperatures on the roadway will be as indicated in 330-6.3. Any load or portion of a load of asphalt mix on the roadway with a temperature outside of the master range shall be rejected for use on the project. The Engineer will be immediately notified of the rejection.

330-9.1.3 Rain and Surface Conditions: Immediately cease transportation of asphalt mixtures from the plant when rain begins at the roadway. Do not place asphalt mixtures while rain is falling, or when there is water on the surface to be covered. Once the rain has stopped and water has been removed from the tacked surface to the satisfaction of the Engineer and the temperature of the mixture caught in transit still meets the requirements as specified in 330-9.1.2, the Contractor may then place the mixture caught in transit.

330-9.1.4 Speed of Paver: Establish the forward speed of the asphalt paver based on the rate of delivery of the mix to the roadway but not faster than the optimum speed needed to adequately compact the pavement.

330-9.1.5 Number of Crews Required: For each paving machine operated, use a separate crew, each crew operating as a full unit. The Contractor's CTQP Paving Level II technician in charge of the paving operations may be responsible for more than one crew but must be physically accessible to the Engineer at all times when placing mix.

330-9.1.6 Checking Depth of Layer: Check the depth of each layer at frequent intervals, and make adjustments when the thickness exceeds the allowable tolerance. When making an adjustment, allow the paving machine to travel a minimum distance of 32 feet to stabilize before the second check is made to determine the effects of the adjustment.

330-9.1.7 Hand Spreading: In limited areas where the use of the spreader is impossible or impracticable, the Contractor may spread and finish the mixture by hand.

330-9.1.8 Straightedging and Back-patching: Straightedge and back-patch after obtaining initial compaction and while the material is still hot.

330-9.2 Requirements Applicable to Courses Other Than Leveling:

330-9.2.1 Spreading and Finishing: Upon arrival, dump the mixture in the approved mechanical spreader, and immediately spread and strike-off the mixture to the full width required, and to such loose depth for each course that, when the work is completed, the required weight of mixture per square yard, or the specified thickness, is secured. Carry a uniform amount of mixture ahead of the screed at all times.

330-9.2.2 Thickness and Spread Rate of Layers: Construct each course of Type SP mixtures in layers of the thickness shown in Section 334.

When the deficiency of the average spread rate for the total course pavement thickness measured in accordance with 330-2.2 exceeds the following maximum spread rate tolerance, address the deficient area in accordance with 330-12.5.

1. Structural Course (non-friction)
    a. For pavement of a design thickness of 2-1/2 inches or more: plus or minus 50 lbs per sy.
    b. For pavement of a design thickness of less than 2-1/2 inches: plus or minus 25 lbs per sy.
2. Friction course
    a. For open grade friction course: plus or minus 15 lbs per sy.
    b. For dense grade friction course: plus or minus 25 lbs per sy.

As an exception, the Engineer may allow the Contractor to leave areas in place if it is determined by the Engineer that the deficiency is not a significant detriment to the pavement quality. A reduction to the pay item quantity will be made in accordance with 330-12.5.2.

330-9.2.3 Laying Width: If necessary due to the traffic requirements, lay the mixture in strips in such a manner as to provide for the passage of traffic. As an option, where the road is closed to traffic, lay the mixture to the full width with machines traveling in echelon.

330-9.2.4 Correcting Defects: Before starting any rolling, check the surface; correct any irregularities; remove all drippings, fat sandy accumulations from the screed, and fat spots from any source; and replace them with satisfactory material. Do not

skin patch. When correcting a depression while the mixture is hot, scarify the surface and add fresh mixture.

330-9.3 Requirements Applicable Only to Leveling Courses:

330-9.3.1 Patching Depressions: Before spreading any leveling course, fill all depressions in the existing surface more than 1 inch deep by spot patching with leveling course mixture, and then compact them thoroughly.

330-9.3.2 Spreading Leveling Courses: Place all courses of leveling by the use of two motor graders, equip one with a spreader box. Use other types of leveling devices after they have been approved by the Engineer.

330-9.3.3 Rate of Application: When using Type SP-9.5 (fine graded) for leveling, do not allow the average spread of a layer to be less than 50 lb/yd^2 or more than 75 lb/yd^2. The quantity of mix for leveling shown in the plans represents the average for the entire project; however, the Contractor may vary the rate of application throughout the project as directed by the Engineer. When leveling in connection with base widening, the Engineer may require placing all the leveling mix prior to the widening operation.

330-9.3.4 Placing Leveling Course Over Existing Pavement: When the Contract Documents specify a leveling course to be placed over cracked concrete pavement, including existing concrete pavement covered with an asphalt surface, place the first layer of leveling course as soon as possible but no later than 48 hours after cracking the concrete.

330-9.3.5 Removal of Excess Joint Material: Where placing a leveling course over existing concrete pavement or bridge decks, trim the excess joint filler in the cracks and joints flush with the surface prior to placing the first layer of the leveling course.

330-10 Compacting Mixture.

330-10.1 Provisions Applicable to All Types:

330-10.1.1 Equipment and Sequence: For each paving operation, furnish a separate set of rollers, with their operators.

When density testing for acceptance is required, select equipment, sequence, and coverage of rolling to meet the specified density requirement. The coverage is the number of times the roller passes over a given area of pavement. Regardless of the rolling procedure used, complete the final rolling before the surface temperature of the pavement drops to the extent that effective compaction may not be achieved or the rollers begin to damage the pavement.

When density testing for acceptance is not required, propose an alternative rolling pattern to be approved by the Engineer or use the following standard rolling procedure:

1. Seal (breakdown) Rolling: Provide two static coverages with a tandem steel-wheeled roller, weighing 5 to 15 tons, following as close behind the paver as possible without pick-up, undue displacement, or blistering of the material.

2. Intermediate rolling: Provide five static coverages with a pneumatic-tired roller, following as close behind the seal (breakdown) rolling operation as the mix will permit.

3. Final rolling: Provide one static coverage with a tandem steel-wheeled roller, weighing 5 to 15 tons, after completing the seal (breakdown) rolling and intermediate rolling, but before the surface pavement temperature drops to the extent

that effective compaction may not be achieved or the rollers begin to damage the pavement.

330-10.1.2 Rolling Procedures: Utilize procedures that will uniformly compact the pavement layer to the desired density level.

Roll across the mat, overlapping the adjacent pass by at least 6 inches. Roll slowly enough to avoid displacement of the mixture, and correct any displacement at once by the use of rakes and the addition of fresh mixture if required. Continue final rolling to eliminate all roller marks.

330-10.1.3 Compaction of Areas Inaccessible to Rollers: Use hand tamps or other satisfactory means to compact areas which are inaccessible to a roller, such as areas adjacent to curbs, gutters, bridges, manholes, etc.

330-10.1.4 Rolling Patching and Leveling Courses: Use pneumatic-tired rollers to roll all patching and leveling courses. When placing the initial leveling course over broken concrete pavement, use a pneumatic-tired roller that weighs at least 15 tons.

330-10.1.5 Correcting Defects: Do not allow the rollers to deposit gasoline, oil, or grease onto the pavement. Remove and replace any areas damaged by such deposits as directed by the Engineer. While rolling is in progress, test the surface continuously, and correct all discrepancies to comply with the surface requirements. Remove and replace all drippings, fat or lean areas, and defective construction of any description. Remedy depressions that develop before completing the rolling by loosening the mixture and adding new mixture to bring the depressions to a true surface. Should any depression remain after obtaining the final compaction, remove the full depth of the mixture, and replace it with sufficient new mixture to form a true and even surface. Correct all high spots, high joints, and honeycombing as directed by the Engineer. Remove and replace any mixture remaining unbonded after rolling. Correct all defects prior to laying the subsequent course.

330-10.1.6 Use of Traffic Roller on First Overbuild Course: Use a pneumatic-tired roller on the first overbuild course. Compact the pavement with a minimum of five coverages.

330-10.1.7 Use of Traffic Roller or Vibratory Roller on First Structural Layer Placed on a Milled Surface: Use a pneumatic-tired roller or vibratory roller on the first structural layer placed on a milled surface.

330-10.1.8 Use of Traffic Roller or Vibratory Roller on First Structural Layer Placed on an Asphalt Rubber Membrane Interlayer (ARMI): Use a pneumatic-tired roller or a vibratory roller on the first structural layer placed on an ARMI.

330-10.1.9 Compaction at Bridge Structures: Compact asphalt mixtures placed over bridge decks and approach slabs using static compaction only. Utilize the standard rolling procedure described in 330-10.1.1 or an alternative procedure approved by the Engineer.

330-11 Joints.

330-11.1 Transverse Joints: Place the mixture as continuously as possible. Do not pass the roller over the unprotected end of the freshly laid mixture except when discontinuing the laying operation long enough to permit the mixture to become chilled. When thus interrupting the laying operation, construct a transverse joint by cutting back on the previous run to expose the full depth of the mat.

330-11.2 Longitudinal Joints: For all layers of pavement except the leveling course, place each layer so that longitudinal construction joints are offset 6 to 12 inches laterally between successive layers. Plan offsets in advance so that longitudinal joints of the friction course are not in wheel path areas. The longitudinal joints for friction course layers should be within 6 inches of the lane edge or at the center of the lane. The Engineer may waive this requirement where offsetting is not feasible due to the sequence of construction.

330-11.3 General: When laying fresh mixture against the exposed edges of joints (trimmed or formed as provided above), place it in close contact with the exposed edge to produce an even, well-compacted joint after rolling.

330-11.4 Placing Asphalt Next to Concrete Pavement: When placing asphalt next to concrete pavement, construct the joint in accordance with Section 350.

330-12 Surface Requirements.

330-12.1 General: Construct a smooth pavement with good surface texture and the proper cross-slope.

330-12.2 Texture of the Finished Surface of Paving Layers: Produce a finished surface of uniform texture and compaction with no pulled, torn, raveled, crushed or loosened portions and free of segregation, bleeding, flushing, sand streaks, sand spots, or ripples. Address any pavement not meeting the requirements of this specification in accordance with 330-12.5.

Do not use asphalt concrete mixtures containing aggregates that cause a different color appearance in the final wearing surface unless the section is greater than or equal to one mile in length and across the full width of the pavement, including shoulders and turn lanes. Exceptions to these requirements will be permitted if approved by the Engineer.

330-12.3 Cross Slope: Construct a pavement surface with cross slopes in compliance with the requirements of the Contract Documents. Furnish an electronic level with a length of 4 feet and an accuracy of 0.1 degree, approved by the Engineer for the control of cross slope. Make this electronic level available at the jobsite at all times during paving operations.

330-12.3.1 Quality Control Requirements: Calibrate the electronic levels a minimum of once per day before any paving operation, in accordance with manufacturer's instructions.

Compare the Quality Control level with the Verification level before any paving operation, and at any time directed by the Engineer.

Measure the cross slope of the compacted pavement surface by placing the level at the center location of a lane and perpendicular to the roadway centerline. Record all the measurements to the nearest 0.1% on an approved form and submit to the Engineer for documentation.

1. Tangent Sections: Measure the cross slope per lane at a minimum frequency of one measurement every 100 feet. Calculate the absolute deviation of cross slope at each measurement and then average the absolute deviation of ten consecutive cross slope measurements. The absolute deviation is the positive value of a deviation. When the average absolute deviation cross slope is consistently within the acceptance tolerance as shown in Table 330-2 and upon the approval of the Engineer, the

frequency of the cross slope measurements can be reduced to one measurement every 200 feet during paving operations.

2. Superelevated Sections: Measure the cross slope every 100 feet per lane within the length of full superelevation. Calculate the absolute deviation of each measurement and then average the absolute deviation of ten consecutive cross slope measurements. For every transition section, measure the cross slope at control points identified in the plans, or if not shown in the plans, at a control point at the location of 0.0% cross slope and calculate the absolute deviation. For curves where the length of full superelevation is less than 250 feet, measure the cross slope at the beginning point, midpoint and ending point of the fully superelevated sections, calculate the absolute deviation, and average . When the number of measurements is less than ten and the length of full superelevation is greater than 250 feet, average the absolute deviation of all measurements.

If the average absolute deviation of the cross slope measurements falls outside the acceptance tolerance, as shown in Table 330-2, stop the paving operations and make adjustments until the problem is resolved to the satisfaction of the Engineer. If an individual cross slope deviation falls outside the acceptance tolerance as shown in Table 330-2, make corrections in accordance with 330-12.5 only to cover the deficient area for the structural course at no cost to the Department. For pavement with multiple layers, the deficient areas for the structural course may be left in place, upon the approval of the Engineer. Complete corrections before placement of the final design surface layer (Type SP layer or friction course layer), unless stated otherwise in the plans, or as determined by the Engineer. For friction course layers, make corrections in accordance with 330-12.5.

The limits of deficient areas requiring correction may be verified and adjusted with more accurate measurement methods, including survey instruments, upon approval by the Engineer at no cost to the Department.

Should the Contractor wish to have any corrections waived, submit a request to the Engineer for approval. The Engineer may waive the corrections at no reduction in payment if the deficiencies are sufficiently separated so as not to affect the overall traffic safety, surface drainage and ride quality characteristics of the pavement and the corrective action would unnecessarily mar the appearance of the finished pavement.

For intersections, tapers, crossovers, transitions at the beginning and end of the project, bridge approaches and similar areas, adjust the cross slope to match the actual site conditions, or as directed by the Engineer.

Table 330-2
Cross Slope Acceptance Tolerance

Roadway Feature	Individual Absolute Deviation	Average Absolute Deviation
Tangent section (including turn lanes)	0.4%	0.2%
Superelevated curve	0.4%	0.2%
Shoulder	0.5%	0.5%

In the event that the distance between two edges of deficient areas is less than 100 feet, the correction work shall include the area between the deficient sections.

330-12.3.2 Verification: The Engineer will verify the Contractor's cross slope measurements by randomly taking a minimum of ten cross slope measurements per lane per mile in tangent sections, control points in transition sections, and a minimum of three cross slope measurements on fully superelevated sections over a day's production. The Engineer will measure the cross slope of the compacted pavement surface by placing the level at the center location of a lane and perpendicular to the roadway centerline. If the average absolute deviation or an individual cross slope deviation falls outside of the acceptance tolerance as shown in Table 330-2, immediately make a comparison check at the QC test locations to verify the QC measurements in the questionable section. If the comparisons are beyond the acceptable comparison tolerance in accordance with 330-12.3.1, stop the paving operations until the problem is resolved to the satisfaction of the Engineer. Correct any cross slope not meeting the individual deviation acceptance tolerance in accordance with 330-12.5 at no cost to the Department. The Engineer reserves the right to check the pavement cross slope at any time by taking cross slope measurements at any location.

330-12.4 Pavement Smoothness: Construct a smooth pavement meeting the requirements of this Specification.

330-12.4.1 General: Furnish a 15 foot manual and a 15 foot rolling straightedge meeting the requirements of FM 5-509. Obtain a smooth surface on all pavement courses placed, and then straightedge all layers as required by this specification.

330-12.4.2 Test Method: Perform all straightedge testing in accordance with FM 5-509 in the outside wheel path of each lane. The Engineer, or these specifications, may require additional testing at other locations within the lane.

330-12.4.3 Traffic Control: Provide traffic control in accordance with Section 102 and the Design Standards Index Nos. 607 or 619 during all testing. When traffic control cannot be provided in accordance with Index Nos. 607 or 619, submit an alternative Traffic Control Plan as specified in 102-4. Include the cost of this traffic control in the Contract bid prices for the asphalt items.

330-12.4.4 Process Control Testing: Assume full responsibility for controlling all paving operations and processes such that the requirements of these Specifications are met at all times. Address in the QC Plan the methods to be used to control smoothness.

330-12.4.5 Quality Control Testing:

330-12.4.5.1 General: Straightedge the final Type SP structural layer and friction course layer in accordance with 330-12.4.2, regardless of whether the method of acceptance is by straightedge or laser profiler. Test all pavement lanes and ramps where the width is constant and document all deficiencies in excess of 3/16 inch on a form approved by the Engineer.

330-12.4.5.2 Straightedge Exceptions: Straightedge testing will not be required in the following areas: shoulders, intersections, tapers, crossovers, parking lots and similar areas, or in the following areas when they are less than 250 feet in length: turn lanes, acceleration/deceleration lanes and side streets.

As an exception, in the event the Engineer identifies a surface irregularity in the above areas that is determined to be objectionable, straightedge and address all deficiencies in excess of 3/8 inch in accordance with 330-12.5.

The Engineer may waive straightedge requirements for transverse joints at the beginning and end of the project, at the beginning and end of bridge structures, at manholes, and at utility structures if the deficiencies are caused by factors beyond the control of the Contractor, as determined by the Engineer. In addition, the Engineer may also waive the straightedging requirements on ramps and superelevated sections where the geometrical orientation of the pavement results in an inaccurate measurement with the rolling straightedge.

330-12.4.5.3 Intermediate Layers and Temporary Pavement: When the design speed is 55 mph or greater and the intermediate Type SP layer or temporary pavement is to be opened to traffic, if the Engineer identifies a surface irregularity that is determined to be objectionable, straightedge and address all deficiencies in excess of 3/8 inch within 72 hours of placement in accordance with 330-12.5.

330-12.4.5.4 Final Type SP Structural Layer: Straightedge the final Type SP structural layer in accordance with 330-12.4.2, either behind the final roller of the paving train or as a separate operation. Notify the Engineer of the location and time of straightedge testing a minimum of 48 hours before beginning testing. The Engineer will verify the straightedge testing by observing the Quality Control straight edging operations. Address all deficiencies in excess of 3/16 inch in accordance with 330-12.5.

When the final structural course is to be opened to traffic and the design speed is 55 mph or greater, if any defect is 3/8 inch or greater, the Engineer may require deficiencies to be corrected within 72 hours after opening to traffic.

For bicycle paths, straightedge the final Type SP structural layer with a rolling straightedge, either behind the final roller of the paving train or as a separate operation. Address all deficiencies in excess of 5/16 inch in accordance with 330-12.5. If the Engineer determines that the deficiencies on the bicycle path are due to field geometrical conditions, the Engineer will waive corrections with no deduction to the pay item quantity.

330-12.4.5.5 Friction Course Layer: Straightedge the friction course layer in accordance with 330-12.4.2, either behind the final roller of the paving train or as a separate operation upon completion of all paving operations. Notify the Engineer of the location and time of straightedge testing a minimum of 48 hours before beginning testing. The Engineer will verify the straightedge testing by observing the Quality Control straightedging operations. Address all deficiencies in excess of 3/16 inch in accordance with 330-12.5. For laser acceptance, corrections may be made either before or after laser acceptance testing.

330-12.4.6 Acceptance:

330-12.4.6.1 Straightedge Acceptance: For areas of roadways where the design speed is less than 55 miles per hour, acceptance for pavement smoothness of the friction course will be based on verified Quality Control measurements using the straightedge as required by 330-12.4.5. The Engineer will verify the straightedge testing by observing the Quality Control straightedging operations.

330-12.4.6.2 Laser Acceptance: For areas of high speed roadways where the design speed is equal to or greater than 55 miles per hour, acceptance testing for pavement smoothness of the friction course (for mainline traffic lanes only) will be based on the Laser Profiler. Ramps, acceleration and deceleration lanes, and other areas not suitable for testing with the Laser Profiler will be tested and accepted with the straightedge in accordance with 330-12.4.5.5 and 330-12.4.6.1.

The pavement smoothness of each lane will be determined by a Laser Profiler furnished and operated by the Department in accordance with FM 5-549 and a report issued with the Ride Number (RN) reported to one decimal place. If corrections are made, as required following Laser Acceptance, the pavement will not be retested for smoothness using the Laser Profiler.

For this testing, the pavement will be divided into 0.1 mile segments. Partial segments equal to or greater than 0.01 mile will be considered as a 0.1 mile segment. The pavement will be accepted as follows:

1) For segments with a RN greater than or equal to 4.0, the pavement will be accepted at full pay.

2) For segments with a RN less than 4.0, the Engineer will further evaluate the data in 0.01 mile intervals for both wheel paths.

If the RN is 3.5 or above for all 0.01 mile intervals in both wheel paths, the segment will be accepted at full payment.

If the RN is less than 3.5 for one or more 0.01 mile intervals, the segment will be tested with the rolling straightedge in both wheel paths in accordance with FM 5-509. If approved by the Engineer, this straightedging may be completed (in both wheel paths) as part of the Quality Control straightedging operations described in 330-12.4.5.5, prior to testing with the laser profiler. Notify the Engineer of the location and time of straightedge testing a minimum of 48 hours before beginning testing. The Engineer will verify the straightedge testing by observing the Quality Control straightedging operations. Address all deficiencies in excess of 3/16 inch in accordance with 330-12.5.

Test and accept areas at the beginning and ending of the project, bridge approaches and departures, and areas where the segment is less than 0.01 mile, with the straightedge in accordance with 330-12.4.5.5 and 330-12.4.6.1.

330-12.5 Unacceptable Pavement:

330-12.5.1 Corrections: Address all areas of unacceptable pavement at no cost to the Department. Retest all corrected areas and assure the requirements of these specifications are met.

330-12.5.1.1 Structural Layers: Correct all deficiencies, as defined in these Specifications, in the Type SP structural layers by one of the methods described below:

a. Remove and replace the full depth of the layer, extending a minimum of 50 feet on both sides (where possible) of the defective area for the full width of the paving lane.

b. Mill the pavement surface to a depth and width that is adequate to remove the deficiency. (This option only applies if the structural layer is not the final surface layer.)

330-12.5.1.2 Friction Course: Correct deficiencies in the friction course or final surface layer by removing and replacing the full depth of the layer, extending a minimum of 50 feet on both sides (where possible) of the defective area for the full width of the paving lane. As an exception, the Engineer may allow the contractor to leave these areas in place at if it is determined by the Engineer that the deficiency is not a significant detriment to the pavement quality. A reduction to the pay item quantity will be made in accordance with 330-12.5.2.

330-12.5.2 Reduction in Pay Item Quantity: When the Engineer elects to waive corrections, the Department will reduce the pay quantity for the pay item in question by the amount of material that the Contractor would have removed and replaced had the correction been made. When the pay quantity is in tons, the Department will base the reduction on the volume of material that the Contractor would have removed (the length by the lane width by layer thickness) multiplied by the maximum specific gravity of the mix as determined through the following equation:

$$\text{Quantity (tons)} = L \times W \times t \times G_{mm} \times 0.0024$$

Where: L = Lane length (ft.)
W = Lane width (ft.)
t = Layer thickness (in.)
G_{mm} = Maximum specific gravity from verified mix design

For FC-5 open-graded friction course, the Department will base the reduction on the area that the Contractor would have removed (the length by lane width) multiplied by a spread rate of 80 lb/yd^2 as determined through the following equation:

$$\text{Quantity (tons)} = L \times W \times 0.0044$$

Where: L = Lane length (ft.)
W = Lane width (ft.)

330-13 Protection of Finished Surface.

Keep sections of newly compacted asphalt concrete, which are to be covered by additional courses, clean until the successive course is laid.

Do not dump embankment or base material directly on the pavement. Dress shoulders before placing the friction course on adjacent pavement.

Equip blade graders operating adjacent to the pavement during shoulder construction with a 2 inch by 8 inch or larger board, or other attachment providing essentially the same results, attached to their blades in such manner that it extends below the blade edge in order to protect the pavement surface from damage by the grader blade.

To prevent rutting or other distortion, protect sections of newly finished dense-graded friction course and the last structural layer prior to the friction course from traffic until the surface temperature has cooled below 160ºF.

The Contractor may use artificial methods to cool the pavement to expedite paving operations. The Department may direct the Contractor to use artificial cooling methods when maintenance of traffic requires opening the pavement to traffic at the earliest possible time.