SECTION 330
HOT BITUMINOUS MIXTURES - QUALITY ASSURANCE, GENERAL CONSTRUCTION REQUIREMENTS AND ACCEPTANCE PROCEDURES

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. This Section establishes Acceptance Procedures for materials and work performed under Sections 280, 290, 331, 332, 333, 334, 335, and 337. More specific requirements pertaining to hot bituminous base and base widening construction are contained in Section 280.

This Section also includes the method of determining the thickness of pavement the Department will pay for when payment is on a square yard [square meter] basis.

330-2 Acceptance Procedures.

The Department will approve all materials for acceptance through the Department's Acceptance Procedures specified herein. The Engineer is responsible for determining the acceptability of the construction and materials incorporated therein. Take responsibility for the quality of construction and materials incorporated therein. Accomplish all quality control sampling and testing on a random basis in accordance with the approved Quality Control Plan. The Department will perform all necessary sampling and testing for acceptance purposes on a random basis as specified herein, in addition to monitoring and observing the Contractor's quality control test procedures and results. Maintain effective quality control until final project acceptance.

A LOT is defined as an isolated quantity of a specified material produced from a single source or operation, or it is a measured amount of specified construction produced by the same process. In order to change the process, thereby necessitating the termination of the current LOT and starting a new LOT, submit a written request, with justification, to the Engineer for approval. Obtain the Engineer's approval prior to making the process change.

Perform all quality control sampling and testing of materials in strict conformance with the Florida Method of Sampling and Testing as found in the Field Sampling and Testing Manual. The Department will perform all acceptance sampling and testing of materials in strict conformance with the Florida Method of Sampling and Testing as found in the Field Sampling and Testing Manual. This manual, developed and distributed by the FDOT Materials Office, contains the detailed sampling and testing procedures from AASHTO and ASTM as modified by the Department.

330-2.1 Acceptance Plans:

330-2.1.1 Payment Based on Acceptance Results: The Department will adjust the payment for each LOT of material, product, item of construction or completed construction on the basis of acceptance test results in accordance with the requirements specified hereinafter in the applicable Sections.

330-2.1.2 Resampling of LOTs: The Department requires that LOTs of materials, products, items of construction or completed construction meet the requirements of these Specifications at the time of submission. The Department will not take check samples for acceptance purposes.

330-2.1.3 Referee System: The Department has established a referee system to verify the validity of the acceptance test results on LOTs at the asphalt plant. The Department will evaluate the acceptance test results with data from split samples run by the District and Central Labs. The Engineer will make a final determination and disposition of the acceptance test results. When the referee analysis indicates that one or more test results are not representative, the Engineer will discard the non-representative test value(s) and base payment calculations for the LOT (including the sublot with the non-representative test values) on the remaining sublot(s) test data as defined in 331-5.

330-2.2 Quality Control by the Contractor: Provide and maintain a quality control system that provides reasonable assurance that all materials, products and completed construction submitted for acceptance meet Contract requirements. Develop and maintain a quality control system in conformance with the following requirements:

CONTRACTOR QUALITY CONTROL SYSTEM

I. SCOPE:

These Specifications establish minimum requirements and activities for a Contractor quality control system. These requirements pertain to the inspections and tests necessary to substantiate material and product conformance to Contract requirements and to all inspections and tests required by the Contract.

II. FUNCTIONS AND RESPONSIBILITIES:

1. The Department. The Department will verify the Contractor's design mixes, inspect plants and monitor control of the operations to ensure conformance with these Specifications. The Department will design all open-graded friction mixes (FC-2 and FC-5).

At no time will the Engineer issue instructions to the Contractor or producer as to the setting of dials, gauges, scales and meters. However, the Department's representatives may question and warn the Contractor against the continuance of any operations or sequence of operations that obviously do not result in satisfactory compliance with the requirements of these Specifications.

2. The Contractor. Submit in writing the proposed Quality Control Plan for each asphalt plant for the Engineer's approval. Maintain the approved Quality Control Plan in effect for the plant to which it is assigned until the Engineer rejects it in writing. Include in the plan the sampling, testing, inspection and the anticipated frequencies of each to maintain process control. A recommended series of sampling, testing and inspecting activities are shown in Table 330-1.

Table 330-1

RECOMMENDATIONS FOR A CONTRACTOR
QUALITY CONTROL PLAN

A. All Types of Plants

1. Stockpiles
    a. Place materials in the correct stockpile.
    b. Use good stockpiling techniques.
    c. Inspect stockpiles for separation, contamination, segregation, etc.
2. Incoming Aggregate
    a. Obtain gradations and bulk specific gravity (BSG) values from the aggregate supplier.
    b. Determine gradation of all component materials.
    c. Compare gradations and BSG to mix design.
3. Cold Bins
    a. Calibrate the cold gate/feeder belt settings.
    b. Observe operation of cold feed for uniformity.
4. Dryer
    a. Observe pyrometer for aggregate temperature control.
    b. Observe efficiency of the burner.
5. Hot Bins
    a. Determine gradation of aggregates in each bin.
    b. Determine theoretical combined grading.
6. Bituminous Mixture
    a. Determine asphalt content.

b. Determine mix gradation.
c. Check mix temperature.
d. Verify modifier addition.

B. Batch Plants

1. For batch weights, determine percent used and weight to be pulled from each bin to ensure compliance with the mix design.
2. Check mixing time.
3. Check operations of weigh bucket and scales.

C. Continuous Mix Plant

1. Determine gate calibration chart for each bin.
2. Determine gate settings for each bin to ensure compliance with the mix design.
3. Determine gallons [cubic meters] per revolution or gallons [cubic meters] per minute to ensure compliance with the mix design.

D. Drum Mixer Plant

1. Calibrate the cold feed and prepare a calibration chart for each cold gate.
2. Develop information for the synchronization of the aggregate feed, reclaimed asphalt pavement (RAP) feed and the bituminous material feed.
3. Calibrate the weigh bridge on the changing conveyor.

The activities shown in Table 330-1 are the normal activities necessary to control the production of bituminous concrete at an acceptable quality level. The Department recognizes, 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, increase the frequency of these activities until the proper conditions are restored. Take one sample and test for every 1,000 tons [900 metric tons] of incoming aggregate (including RAP) as it is stockpiled. Test RAP material for extracted gradation and asphalt content.

Plot and keep up-to-date control charts for all quality control sampling and testing. Provide control charts for the following:

a. gradation of incoming aggregates
b. gradation and asphalt content of RAP
c. combined gradations of hot bins
d. extracted asphalt content
e. mix gradation
f. gradation of cold feed (drum mixers)

Post all current control charts in the asphalt lab where they can be seen.

Formulate all design mixes with the exception of open-graded friction mixes (FC-2 and FC-5). Submit design mixes to the Engineer for verification prior to their use. Provide process control of all materials during handling, blending, mixing and placing operations.

III. QUALITY CONTROL SYSTEM:

1. General Requirements. Furnish and maintain a quality control system that provides reasonable assurance that all materials and products submitted to the Engineer for acceptance meet the Contract requirements. Perform, or have performed, the inspection and tests required to substantiate product conformance to Contract requirements, and also perform, or have performed, all inspections and tests otherwise required by the Contract. Keep a quality control technician, who has been certified by the Department as a Certified Asphalt Plant Technician, available at the asphalt plant at all times when producing asphalt mix for the Department. Place a person in responsible charge of the paving operations who is certified by the Department as an Asphalt Paving Technician and who possesses a valid certificate of qualification. Document the quality control procedures, inspection and tests, and make that information available for review by the Engineer throughout the life of the Contract.

2. Documentation. Maintain adequate records of all inspections and tests. Record the nature and number of tests made, the number and type of deficiencies found, the quantities approved and rejected, and the nature of corrective action taken, as appropriate. The Department may review and approve all documentation procedures prior to the start of the work. The Department will take ownership of all charts and records documenting the Contractor's quality control tests and inspections upon completion of the work.

3. Charts and Forms. Record all conforming and nonconforming inspections and test results on approved forms and charts, and keep them up to date and complete and make them available at all times to the Engineer during the performance of the work. Prepare charts of test properties for the various materials and mixtures on forms that are in accordance with the applicable requirements of the Department. The Engineer will furnish a copy of each applicable chart and form. Provide a supply of the charts and forms from the copy furnished. Obtain the Engineer's approval of non-standard forms and charts prior to using them.

4. Corrective Actions. Take prompt action to correct any errors, equipment malfunctions, process changes or other problems that result or could result in the submission of materials, products or completed construction that do not meet the requirements of these Specifications. When it becomes evident to the Department that the Contractor is not controlling his process and is making no effort to take corrective actions, the Department will require the Contractor to cease plant operations until such time as the Contractor can demonstrate that he can and is willing to control the process.

5. Laboratories with Measuring and Testing Equipment. Furnish a fully equipped asphalt laboratory (permanent or portable) at the production site, and meeting the following requirements:

a. Area - Provide an effective working area for the laboratory that is a minimum of 180 ft^2 [17 m^2]. This area does not include the space for desks, chairs and file cabinets.

b. Lighting - Provide lighting in the lab adequate to illuminate all areas of work.

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

d. 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.

e. Equipment and Supplies - Furnish the lab with the necessary sampling and testing equipment, and supplies, for performing Contractor quality control and Department acceptance sampling and testing. A detailed list of equipment and supplies required for each test is included in the Field Sampling and Testing Manual.

When running plants at a high production rate, furnish additional testing equipment as necessary to allow the completion of the Contractor's quality control tests and the Department's Acceptance tests within the specified time frame.

6. Sampling and Testing. Use the sampling and testing methods and procedures that the Department provides to determine quality conformance of the materials and products. The Department will use these same methods and procedures for its acceptance tests. Include the sampling for other material characteristics on a random basis and the plotting of the test results on control charts in the Quality Control Plan.

7. Alternative Procedures. The Contractor may use alternative sampling methods, procedures and inspection equipment when such procedures and equipment provide, as a minimum, the quality assurance required by the Contract Documents. Prior to applying such alternative procedures, describe them in a written proposal and demonstrate for the Engineer's approval that their effectiveness is equal to or better than the Contract requirements. In case of dispute as to whether certain proposed procedures provide equal assurance, use the procedures stipulated by the Contract Documents.

8. Nonconforming Materials. Establish and maintain an effective and positive system for controlling nonconforming materials, including procedures for identification, isolation and disposition. Reclaim or rework nonconforming materials in accordance with procedures acceptable to the Engineer.

Discuss the details of this system at the preconstruction conference, and make these details a part of the record of the conference.

9. Department Inspection at Subcontractor or Supplier Facilities. The Department reserves the right to inspect materials not manufactured within the Contractor's facility. The Department's inspection does not constitute acceptance and does not, in any way, replace the Contractor's inspection or otherwise relieve the Contractor of his responsibility to furnish an acceptable material or product. When the Department inspects the subcontractor's or supplier's product, such inspection does not replace the Contractor's responsibility to inspect such subcontractor's or supplier's product.

Inspect subcontracted or purchased materials when received, as necessary, to ensure conformance to Contract requirements. Report to the Engineer any nonconformance found on Department source-inspected material, and require the supplier to take necessary corrective action.

330-2.3 Defective Materials:

330-2.3.1 Acceptance or Rejection: Following the application of the appropriate acceptance plan, the Engineer will make the final decision as to the acceptance, rejection or acceptance at an adjusted payment of the LOTs.

330-2.3.2 Disposition of LOTs: For nonconforming LOTs of materials, products, items of construction or complete construction that are not adaptable to correction by reworking, either remove and replace the nonconforming work, or accept no payment or an adjusted payment as stated in these Specifications, or, if not stated, as directed by the Engineer.

330-2.4 General Basis of Adjusted Payment For Deficiencies: When the Engineer determines that a deficiency exists, the Engineer will apply the applicable payment factor as shown in these Specifications to the entire LOT. When the Engineer determines that multiple deficiencies exist, the Engineer will apply an adjustment to the LOT of material that is identified by each deficiency. The Engineer will apply the adjustment for each deficiency separately as it occurs. The Engineer will not allow an adjustment to be affected by any other adjustment occurring for the same LOT. As an exception to the foregoing requirements, when there are two or more deficiencies in the gradation acceptance tests (% pass No. 4 [4.75 mm] sieve, % pass No. 10 [2.0 mm] sieve, % pass No. 40 [425 μm sieve], % pass No. 200 [75 μm] sieve) the Engineer will only apply the greater adjustment. The Engineer will express all reductions in payment in terms of equivalent pay items at no pay. When the item is measured by the ton [metric ton], the Engineer will convert the LOT in the field, which is measured in feet [meters], to equivalent tons [metric tons] and by using the average calculated spread for that LOT. When the pay item is measured by the square yard [square meter], the Engineer will convert the LOT at the production point, which is measured in tons [metric tons], to equivalent square yards [square meters] at the design thickness and by using the laboratory density as a conversion factor.

330-3 Substitution of Types of Hot Bituminous Mixtures.

Except for asphaltic concrete friction courses and other wearing surfaces, the Contractor may substitute certain types of hot bituminous mixtures as follows:

1. Substitute Type S Asphaltic Concrete mixtures for other Type S mixtures, as specified in the Design Standards, Index No. 513.

2. Substitute Type S Asphaltic Concrete mixtures for other non-structural mixtures provided the gradation criteria as shown in Table 331-1 are met for the specified mixture.

3. Substitute Type III Asphaltic Concrete for Type II Asphaltic Concrete or Sand-Asphalt Hot Mix. Substitute Type II Asphaltic Concrete for Sand-Asphalt Hot Mix.

In each case, meet the Marshall and volumetric properties for the higher quality mix. Make all substitutions at no additional expense to the Department over that which would have accrued had the specified mixture been used.

330-4 Limitations of Operations.

330-4.1 Weather Limitations: Do not begin plant operations unless all weather conditions are suitable for the laying operations.

330-4.2 Limitations of Laying Operations:

330-4.2.1 General: Spread the mixture only when the surface upon which it is to be laid has been previously prepared, is intact, firm, and properly cured, and is dry. Do not spread mixture that cannot be finished and compacted during daylight hours. Do not place friction course until the adjacent shoulder area has been dressed and grassed.

330-4.2.2 Temperature: Spread the mixture only when the air temperature in the shade and away from artificial heat is at least 40ºF [4ºC] for layers greater than 1 inch (100 lb/yd^2) [25 mm (55 kg/m^2)] in thickness and at least 45ºF [7ºC] for layers 1 inch (100 lb/yd^2) [25 mm (55 kg/m^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 [25 kg/m^2] or less is 50ºF [10ºC].

330-4.2.3 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.

330-5 Preparation of Asphalt Cement.

Deliver the asphalt cement to the asphalt plant at a temperature not to exceed 350ºF [175ºC], and equip the transport tanks with sampling and temperature sensing devices meeting the requirements of 300-3.2. Maintain the asphalt cement in storage within a range of 230 to 350ºF [110 to 175ºC] in advance of mixing operations. Maintain constant heating within these limits, and do not allow wide fluctuations of temperature during a day's production.

330-6 Preparation of Aggregates.

330-6.1 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 approved mix design.

330-6.2 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.

330-6.3 Blending of Aggregates: The Engineer will not allow blending or proportioning from railroad cars. 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.

330-6.4 Cold Bins:

330-6.4.1 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.

330-6.4.2 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.

330-6.5 Mineral Filler: If mineral filler is required in the mix, feed or weigh it in separately from the other aggregates.

330-6.6 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.

330-6.7 Screening Unit:

330-6.7.1 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.

330-6.7.2 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.

330-6.8 Mixing Different Materials: Unless written permission is obtained, do not mix coarse aggregates of different types, and do not use coarse aggregates of different types alternately in sections less than 1 mile [1.5 km] in length.

330-7 Preparation of the Mixture.

330-7.1 Batch Mixing:

330-7.1.1 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.

330-7.1.2 Bitumen: Introduce the accurately measured hot asphalt cement into the mixer simultaneously with, or after, the hot aggregates. Continue mixing until the mixture is thoroughly uniform with all particles fully coated.

330-7.1.3 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, the Engineer will designate the mixing time. In no case will the Engineer allow the mixing time to be less than 35 seconds.

330-7.2 Continuous Mixing: Introduce the dried aggregates and mineral filler (if required), prepared as specified and proportioned to meet the verified mix design by volumetric measurements, into the mixer in synchronization with the accurate feeding of the hot asphalt cement. Ensure that the rate of flow of material to the pugmill is such that the maintained depth of the mix does not exceed the tips of the paddles when in the upright position. Mix sufficiently to produce a thoroughly and uniformly coated mixture.

330-7.3 Mixing Temperature: Heat and combine the ingredients of the mix in such a manner as to produce a mixture at a temperature, when discharged from the pugmill or surge bin, within the range of 230 to 310ºF [110 to 155ºC] and within the tolerance shown in Table 330-2.

Table 330-2	
Temperature Tolerance From Verified Mix Design	
Any Single Measurement	±25ºF [±14ºC]
Average of Any Five Consecutive Measurements	±15ºF [±8ºC]

Reject any load or portion of a load of asphalt mix at the plant or on the road with a mix temperature exceeding 335ºF [170ºC].

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 the hole within the middle third of the length of the body, and at a distance of from 6 to 10 inches [150 to 250 mm] above the surface supporting the mixture. If a truck body already has a hole located in the general vicinity of the above

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.

Take the mix temperature at the plant and allow the Engineer to take the mix temperature at the roadway for each day for each design mix on the first five loads and an average of once every five loads thereafter. Take and record the temperature measurements at the plant for review by the Engineer. The Engineer will take the temperature measurements at the roadway and record them on the backside of the delivery ticket. If the temperature exceeds the specified tolerance, take immediate corrective action.

330-7.4 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.

330-7.5 Contractor's Responsibility for Mixture Requirements: Produce a homogeneous mixture, free from moisture and with no segregated materials, that meets all specification requirements for the mixture, including compliance with the Marshall Properties. 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.

330-8 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 approved emulsion containing not more than 5% oil. Apply the coating prior to the first loading each day and repeat as necessary throughout the day's operations. After the truck bodies are coated and before any mixture is placed therein, raise them to drain out all excess liquids. Cover each load during cool and cloudy weather and at any time there is a probability of rain.

330-9 Preparation of Application Surfaces.

330-9.1 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.

330-9.2 Patching and Leveling 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 or leveling courses.

330-9.3 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.

330-9.4 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 pavements and curbs or curb and gutter, with a uniform coating of asphalt cement to provide a closely bonded, watertight joint.

330-9.5 Tack Coat:

330-9.5.1 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.

330-9.5.2 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.

330-10 Placing Mixture.

330-10.1 Requirements Applicable to All Types:

330-10.1.1 Alignment of Edges: Lay all asphaltic concrete mixtures, including leveling courses, other than adjacent to curb and gutter or other true edges, by the stringline method to obtain an accurate, uniform alignment of the pavement edge.

330-10.1.2 Temperature of Spreading: The Contractor shall maintain the temperature of the mix at the time of spreading within ±25ºF [±14ºC] of the established mix temperature selected by the Contractor. As a minimum, the Engineer will take mix temperatures of the mix on the road in an average frequency of one per five trucks. If the temperature fails to fall within the specified tolerance range, take corrective action.

330-10.1.3 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. As an exception, the Contractor may place mixture caught in transit at the Contractor's risk if the only option is to waste this mixture and provided the surface has been tacked as required prior to the rain and the surface is broomed in front of the spreading operation. The Engineer will evaluate such placed mixture separately, and if the mixture is unsatisfactory in any way, remove and replace it with satisfactory mixture at no expense to the Department.

330-10.1.4 Speed of Spreader: The Engineer will establish the forward speed of the asphalt spreader.

330-10.1.5 Number of Crews Required: For each paving machine operated, use a separate crew, each crew operating as a full unit. The Contractor's Certified Paving 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.

330-10.1.6 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 [10 m] to stabilize before the second check is made to determine the effects of the adjustment.

330-10.1.7 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.

330-10.1.8 Straightedging and Back-patching: Straightedge and back-patch after obtaining initial compaction and while the material is still hot.

330-10.2 Requirements Applicable to Courses Other Than Leveling:

330-10.2.1 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 [square meter], or the specified thickness, is secured. Carry an excess amount of mixture ahead of the screed at all times. Hand rake behind the machine as required.

330-10.2.2 Thickness of Layers: Construct each course in layers of the thickness shown on Design Standards, Index No. 513.

330-10.2.3 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.

330-10.2.4 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.

330-10.3 Requirements Applicable Only to Leveling Courses:

330-10.3.1 Patching Depressions: Before spreading any leveling course, fill all depressions in the existing surface more than 1 inch [25 mm] deep by spot patching with leveling course mixture, and then compact them thoroughly.

330-10.3.2 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.

330-10.3.3 Rate of Application: When the total asphalt mix provided for leveling exceeds 50 lb/yd^2 [27 kg/m^2], place the mix in two or more layers, with the average spread of any layer not to exceed 50 lb/yd^2 [27 kg/m^2]. When using Type S-III Asphaltic Concrete for leveling, do not allow the average spread of a layer to be less than 50 lb/yd^2 [27 kg/m^2] or more than 75 lb/yd^2 [40 kg/m^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.

330-10.3.4 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 asphaltic surface, place the first layer of leveling course as soon as possible but no later than 48 hours after cracking the concrete.

330-10.3.5 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.

330-11 Compacting Mixture.

330-11.1 Provisions Applicable to All Types:

330-11.1.1 Equipment and Sequence: For each paving or leveling train in operation, furnish a separate set of rollers, with their operators.

When density testing is required, select equipment, sequence, and coverage of rolling to meet the minimum density requirement in accordance with Table 330-3. 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 below 160ºF [70ºC].

Once the Contractor selects the equipment and establishes the rolling procedures and has used these for an acceptable control strip density, then the Contractor shall continue to use the same equipment and rolling procedures for all asphalt mix represented by the control strip. If the Contractor changes the mix design, lift thickness, underlying pavement structure, equipment, or rolling procedures, the Department will require a new control strip density determination. Notify the Engineer prior to changing the rolling process.

330-11.1.2 Standard Rolling Procedure: Meet the following equipment, sequence, and coverage requirements:

1. Seal Rolling: Provide two coverages with a tandem steel-wheeled roller (either vibratory or static), weighing 5 to 12 tons [4.5 to 11 metric tons], following as close behind the spreader as possible without pick-up, undue displacement, or blistering of the material. Use vibratory rollers in the static mode for layers of 1 inch [25 mm] or less in thickness.

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

3. Final rolling: Provide one coverage with a tandum steel-wheeled roller (static mode only), weighing 5 to 12 tons [4.5 to 11 metric tons], after completing the seal rolling and intermediate rolling, but before the surface pavement temperature drops below 160ºF [70ºC].

The Contractor may use equipment, sequences, or coverages other than those specified in the standard rolling procedure if so authorized in writing by the Engineer.

330-11.1.3 Compaction at Crossovers, Intersections, etc.: When using a separate paving machine to pave the crossovers, compact the crossovers with one, 8 to 10 ton [7 to 9 metric ton] tandem steel roller. If placing crossovers, intersections, and acceleration and deceleration lanes with the main run of paving, also use a traffic roller to compact these areas.

330-11.1.4 Rolling Procedures: Ensure that the initial rolling is longitudinal. Where the lane being placed is adjacent to a previously placed lane, pinch or roll the center joint prior to the rolling of the rest of the lane.

Roll across the mat, overlapping the adjacent pass by at least 6 inches [150 mm]. 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.

330-11.1.5 Speed of Rolling: Operate the self-propelled, pneumatic-tired roller at a speed of 6 to 10 mph [10 to 16 km/h]. For each roller, do not exceed an area of coverage of 4,000 yd^2/h [3,300 m^2/h] if rolling Type S Asphaltic Concrete, do not exceed an area of coverage of 3,000 yd^2/h [2,500 m^2/h].

330-11.1.6 Number of Pneumatic-tired Rollers Required: Use a sufficient number of self-propelled pneumatic-tired rollers to ensure that the rolling of the surface for the required number of passes does not delay any other phase of the laying operation and does not result in excessive cooling of the mixture before completing the rolling. In the event that the rolling falls behind, discontinue the laying operation until the rolling operations are sufficiently caught up.

330-11.1.7 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, headers, gutters, bridges, manholes, etc..

330-11.1.8 Rolling Patching and Leveling Courses: Use self-propelled pneumatic-tired rollers to roll all patching and leveling courses. Where placing the initial leveling course over broken concrete pavement, use a pneumatic-tired roller that weighs at least 15 tons [14 metric tons]. For Type S-III Asphaltic Concrete leveling courses, use a steel-wheeled roller to supplement the traffic rollers. On other leveling courses, use a steel-wheeled roller to supplement the traffic rollers on all passes after the first pass.

330-11.1.9 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.

330-11.1.10 Use of Traffic Roller on First Overbuild Course: Use a self-propelled pneumatic-tired roller on the first overbuild course. Compact with a minimum of five passes.

330-11.1.11 Use of Traffic Roller on First Structural Layer Placed on a Milled Surface: Use a self-propelled pneumatic-tired roller on the first structural layer placed on a milled surface. Compact with a minimum of three passes.

330-11.1.12 Use of Traffic Roller on First Structural Layer Placed on an Asphalt Rubber Membrane Interlayer (ARMI): Use a self-propelled pneumatic-tired roller on the first structural layer placed on an ARMI. Cover with a minimum of three passes.

330-11.2 Provisions Applicable to Shoulder Pavement Only: Compact shoulder pavements wider than 3 feet [1 m] with equipment as required for other asphaltic concrete pavements. Determine the density on shoulder pavements wider than 3 feet [1 m] when the thickness is 1 inch [25 mm] or greater. Determine these densities, including the control strip, separately from the pavement lane densities even when placing the pavement lane and shoulder in the same pass.

Do not determine the density on asphaltic concrete or sand-asphalt hot mix shoulders that are 3 feet [1 m] or less in width. Use tandem steel rollers not exceeding 12 tons [11 metric tons] in weight to compact these shoulder areas. In restricted areas, the Engineer may approve of other equipment that will effectively exert a compactive effort. Submit to the Engineer what equipment and compactive effort (coverage) is proposed to be used, and obtain the Engineer's approval before starting the operation. Where constructing sand-asphalt hot mix shoulders within the limits of curb and gutter, compact the shoulders

using light weight rolling equipment approved by the Engineer that does not displace the previously constructed curb and gutter.

Place friction courses such that longitudinal joints do not extend into the final travel lane shown on the plans by more than 4 inches [100 mm].

330-11.3 Density Control:

330-11.3.1 Density Control Nuclear Method: Determine the in-place density of each course of asphalt mix construction using the Nuclear Density Backscatter Method as specified by FM 1-T238 (Method B). For a completed course, obtain an average in-place LOT density of at least 98% of the valid control strip density.

Do not perform density testing on patching courses, leveling and intermediate courses less than 1 inch [25 mm] thick (or a specified spread rate less than 100 lb/yd^2 [55 kg/m^2]), overbuild courses where the minimum thickness is less than 1 inch [25 mm], projects less than 1,000 feet [300 m], sections with variable width, or open-graded friction courses. Compact these courses, with the exception of open-graded friction courses in accordance with 330-11.1.1.

330-11.3.2 Control Strips: In order to determine the density of compacted asphalt mixtures for the purpose of acceptance, first establish a control strip. Construct one or more control strips for the purpose of determining the control strip density. Construct a control strip at the beginning of asphalt construction and one thereafter for each successive course. Construct a new control strip for any change in the composition of the mix design, underlying pavement structure, compaction equipment, or procedures. The Engineer may require an additional control strip when the Engineer deems it necessary to establish a new control strip density or confirm the validity of the control strip density being used at that time. The Contractor may also request a confirmation of the control strip density. Construct the control strip as a part of a normal day's run.

Construct a control strip 300 feet [100 m] in length and of an adequately uniform width to maintain a consistent compactive effort throughout the section. When constructing the control strip, start it between 300 and 1,000 feet [100 and 300 m] from the beginning of the paving operation. Construct a control strip of a thickness that is the same as that specified for the course of which it is a part. Construct the control strip using the same mix, the same paving and rolling equipment, and the same procedures as those used in laying the asphalt course of which the control strip is to become a part. Leave every control strip in place to become a portion of the completed roadway.

In order to determine the acceptability of the control strip, make ten nuclear density determinations at random locations within the control strip after completing the compaction of the control strip. Do not make any determinations within 12 inches [300 mm] of any unsupported edge. Use the average of these ten determinations for the Control Strip Density. For purposes of determining the percent of laboratory density, as required in Table 330-3, the Engineer will develop a correction factor at four nuclear density locations from 6 inch [150 mm] diameter cores or by direct transmission nuclear determination where applicable. Cut the cores prior to opening the roadway to traffic. The Engineer will calculate the percent of lab density to the nearest 0.01% and round it to the nearest 0.1%. Should the percent of lab density in a control strip exceed 99.0%, notify the Engineer immediately.

In the event that a control strip does not meet the minimum density requirements specified in Table 330-3, take appropriate corrective actions and construct a new control strip. If three consecutive control strips fail to meet specification requirements, the Engineer will limit production and placement of the mix to 800 to 1,000 feet [250 to 300 m], regardless of the thickness and width the Contractor is placing, until the Contractor obtains a passing control strip.

Once the Contractor has obtained a passing control strip after a failing control strip (for the same mix, layer, and project), the Department will use the passing control strip to accept all previously laid mix. In the event the Contractor does not obtain a passing control strip, and this particular mix, layer, etc., is completed on the project, the Engineer will evaluate density in accordance with FM 5-543.

Table 330-3 Roadway Requirements for Bituminous Concrete Mixes			
Mix Type	Density	Minimum Control Strip Density* (% of Lab Density)	Surface Tolerance
S-I, S-II, S-III, Type II, Type III, SAHM	per 330-11.3	96	per 330-13
ABC-1, ABC-2, ABC-3	per 280-8.6	96	per 200-7
FC-2	No density required	N/A	per 330-13
FC-3	per 330-11.3	96	per 330-13
* The minimum control strip density requirement for shoulders is 95% of lab density.			

330-11.3.3 LOTs: For the purpose of acceptance and partial payment, the Engineer will divide each day's production into LOTs. The Engineer will close out all LOTs at the end of the day. The standard size of a LOT is 5,000 feet [1,500 m] of any pass made by the paving train regardless of the width of the pass or the thickness of the course. A sublot will be 1,000 feet [300 m] or less. The Engineer will consider pavers traveling in echelon as two separate passes. When at the end of a production day, the completion of a given course, layer, or mix, or at the completion of the project, and a LOT size is determined to be less than 5,000 feet [1,500 m], it will be considered a partial LOT. Handle partial LOTs as follows:

If the length of the partial LOT is 2,000 feet [600 m] or less, and a previous full-size LOT from the same day, mix, layer, and project is available, then the previous full-size LOT will be redefined to include this partial LOT and the number of tests required for the combined LOT will be as shown in Table 330-4.

If the partial LOT is 2,000 feet [600 m] or less, and a previous full-size LOT from the same day, mix, layer, and project is not available, the Engineer will evaluate the partial LOT separately and perform the number of tests required for the partial LOT as shown in Table 330-4.

If the partial LOT is greater than 2,000 feet [600 m] long, the Engineer will evaluate the partial LOT separately and perform the number of tests required for the partial LOT as shown in Table 330-4.

Table 330-4 Testing Requirements for Partial LOTs	
LOT Size	Number of Tests
Less than 3,000 feet [900 m]	3
3,001 to 4,000 feet [901 to 1,200 m]	4
4,001 to 5,000 feet [1,201 to 1,500 m]	5
5,001 to 6,000 feet [1,501 to 1,800 m]	6
6,001 to 7,000 feet [1,801 to 2,100 m]	7
Greater than 7,000 feet [2,100 m]	2 LOTs

For each LOT and partial LOT, the Engineer will make density determinations at a frequency shown in Table 330-4 at random locations within the LOT, but will not take them within 12 inches [300 mm] of any unsupported edge. The Engineer will determine the random locations by the use of statistically derived stratified random number tables. For the Contractor to receive full payment for density, the average density of a LOT shall be a minimum of 98.0% of the control strip density. Once the Engineer determines the average density of a LOT, do not provide additional compaction to raise the

average. Notify the Engineer should the average density for two consecutive LOTs be greater than 102% of control strip density.

330-11.3.4 Acceptance: The Engineer will accept the completed pavement with respect to density on a LOT basis. The Department will make partial payment for those LOTs that have an average density less than 98.0% of the Control Strip Density based on the following schedule:

Table 330-5	
Payment Schedule For Density	
Percent of Control Strip Density*	Percent of Payment
98.0 and above	100
97.0 to less than 98.0	95
96.0 to less than 97.0	90
Less than 96.0**	75

* In calculating the percent of control strip density, do not round off the final percentage.
** If approved by the Engineer, based on an engineering determination that the material is acceptable to remain in place, the Contractor may accept the indicated partial pay; otherwise, remove and replace the material at no expense to the Department. The Contractor may remove and replace the material at no expense to the Department at any time.

330-11.3.5 Density Requirements for Small Projects and Other Non-mainline Roadway Areas: For projects less than 1,000 feet [300 m] in length and bridge projects with approaches less than 1,000 feet [300 m] each side, do not apply the requirements for control strips and nuclear density determination. Use the standard rolling procedures as specified in 330-11.1.2. Do not apply the provisions for partial payment to these small projects.

In other non-mainline roadway areas where it is not practical to establish a control strip, such as parking areas, toll plazas, turn lanes, and acceleration/deceleration lanes, the Contractor may use the standard rolling procedure to determine density requirements if so authorized in writing by the Engineer.

330-12 Joints.

330-12.1 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.

330-12.2 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 [150 to 300 mm] laterally between successive layers. The Engineer may waive this requirement where offsetting is not feasible due to the sequence of construction.

330-12.3 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.

330-13 Surface Requirements.

330-13.1 Contractor's Responsibility: Obtain a smooth surface on all pavement courses placed, and then straightedge all intermediate and final courses with a 15 foot [4.572 m] rolling straightedge. Furnish a 15 foot [4.572 m] manual straightedge, and make it available at the job site at all times during the paving operation for checking joints and surface irregularities.

330-13.2 Texture of the Finished Surface of Paving Layers: Produce a finished surface of uniform texture and compaction with no pulled, torn, or loosened portions and free of segregation, sand streaks, sand spots, or ripples. Correct any area of the surface that does not meet the foregoing requirements in accordance with 330-13.4.

Do not use asphalt concrete mixtures containing aggregates that cause a different color appearance in the final wearing surface in sections less than 1 mile [1.5 km] in length without written permission.

330-13.3 Acceptance Testing for Surface Tolerance:

330-13.3.1 General: The Engineer will perform acceptance testing for surface tolerance on all pavement lanes and ramps where the width is constant, including all construction joints.

The Engineer will not test intersections, tapers, crossovers, transitions at beginning and end of project, and similar areas for surface tolerance with the rolling straightedge as provided below. However, correct any individual surface irregularity in these areas in excess of 3/8 inch [10 mm] as determined by a 15 foot [4.572 m] straightedge, and that the Engineer deems to be objectionable, in accordance with 330-13.4.

When the Engineer is ready to perform acceptance testing for surface tolerance, provide the required traffic control in accordance with standard maintenance of traffic requirements as specified in the Contract. Include the cost of this traffic control in the Contract bid prices for the asphalt items.

Also provide a representative to be present during the entire operation of straightedging for acceptance purposes.

330-13.3.2 Test Method: The Engineer will perform acceptance testing with one pass of a standard 15 foot [4.572 m] rolling straightedge operated along the centerline of each lane tested. This does not preclude the Engineer from performing additional acceptance testing at other locations within the lane being tested.

330-13.3.3 Acceptance Criteria for Last Layer Prior to Friction Course: Furnish and operate an acceptable 15 foot [4.572 m] rolling straightedge for testing of the last layer prior to the friction course as directed and supervised by the Engineer. Correct all deficiencies in excess of 3/16 inch [5 mm] in accordance with 330-13.4, and retest the last layer prior to placement of the friction course. Where the final surface is not a friction course, meet acceptance criteria in accordance with 330-13.3.4.

330-13.3.4 Acceptance Criteria for Final Surface or Friction Course: Upon completion of the final surface or friction course, the Engineer will test the finished surface with a 15 foot [4.572 m] rolling straightedge. Correct all deficiencies in excess of 3/16 inch [5 mm] in accordance with 330-13.4, except do not correct by overlaying when the final surface is a friction course.

The Engineer may waive corrections specified above if an engineering determination indicates that the deficiencies are sufficiently separated so as not to significantly affect the ride quality of the pavement and corrective action would unnecessarily mar the appearance of the finished pavement.

Where the Engineer elects to waive correction and the finished pavement surface is a friction course, the Department will reduce the pay quantity for Asphaltic Concrete Friction Course by the amount of friction course that the Contractor would have removed and replaced if the Contractor had made the correction.

Where the Engineer elects to waive a correction and the finished pavement surface is other than a friction course, the Department will reduce the appropriate pay quantity for Asphaltic Concrete by the equivalent quantity of materials that the Contractor would have removed and replaced if the Contractor had made the correction.

a. Where the pay quantity is in square yards [square meters], the Department will base the reduction on the area that the Contractor would have removed (100 feet by lane width) [(30 m by lane width)] multiplied by the ratio of the layer thickness to the total thickness of the type of mix specified.

b. Where the pay quantity is in tons [metric tons], the Department will base the reduction on the volume that the Contractor would have removed 100 feet by lane width by layer thickness) [(30 m by lane width by layer thickness)] multiplied by the laboratory density for the mix.

330-13.4 Correcting Unacceptable Pavement: The Contractor may select one of the following methods, unless 330-13.3.4 prohibits overlaying:

a. Removing and Replacing: If correction is made by removing and replacing the pavement, remove the full depth of the course and extend at least 50 feet [15 m] on either side of the defective area for the full width of the paving lane.

b. Overlaying: If correction is made by overlaying, cover the length of the defective area and taper uniformly to a featheredge thickness at a minimum distance of 50 feet [15 m] on either side of the defective area. Extend the overlay the full width of the roadway. Maintain the specified cross slope. The Engineer may adjust, as necessary, the mix used for the overlay for this purpose.

c. Other Methods: For courses which will not be the final pavement surface, correct minor straightedge deficiencies by methods other than specified above as approved by the Engineer.

Perform all corrective work, at no expense to the Department.

330-14 Protection of Finished Surface.

Keep sections of newly compacted asphaltic 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 by 8 inch [50 by 200 mm] 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 [70ºC].

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.

330-15 Correcting Deficient Thickness.

330-15.1 Allowable Deficiencies: When the Department pays for the pavement on a square yard [square meter] basis, the Engineer will determine the thickness from the length of the core borings as specified in 330-16.1. The Engineer will allow a maximum deficiency from the specified thickness as follows:

1. For pavement of a specified thickness of 2 1/2 inches [60 mm] or more: 1/2 inch [13 mm].

2. For pavement of a specified thickness of less than 2 1/2 inches [60 mm]: 1/4 inch [6 mm].

330-15.2 Pavement Exceeding Allowable Deficiency in Thickness:

330-15.2.1 When Deficiency is Seriously in Excess: Where the deficiency in thickness is: (1) in excess of 3/8 inch [10 mm] for pavement of less than 2 1/2 inches [60 mm] in specified thickness, or (2) in excess of 3/4 inch [20 mm] for pavement of specified thickness of 2 1/2 inches [60 mm] or more, correct the deficiency either by replacing the full thickness for a length extending at least 50 feet [15 m] from each end of the deficient area, or, when the Engineer allows, by overlaying as specified in 330-15.2.3.

As an exception to the above, the Contractor may leave pavement outside the main roadway in place without compensation when the Engineer allows, even though the deficiency exceeds the tolerance as specified above.

The Department will not compensate the Contractor for any pavement removed or for the work of removing such pavement.

330-15.2.2 When Deficiency is Not Seriously in Excess: When the deficiency in the thickness of the pavement is over 1/4 inch [6 mm] but not more than 3/8 inch [10 mm] for pavement of specified thickness less than 2 1/2 inches [60 mm], or when the deficiency in thickness is over 1/2 inch [13 mm] but not more than 3/4 inch [20 mm] for pavement of specified thickness of 2 1/2 inches [60 mm] or greater, the Engineer will allow the Contractor to leave such pavement in place, but without compensation. The Department will determine the square yard [square meter] area, for which it will make no payment, by multiplying the product of the total distance between acceptable cores by the lane width which the Contractor laid at the particular pass in which deficient thickness was indicated. Perform all overlaying and compacting at no expense to the Department.

330-15.2.3 Correcting Deficiency by Adding New Surface Material*:* For any case of excess deficiency of the pavement, if approved by the Engineer for each particular location, correct the deficient thickness by adding new surface material, and compact it to the same density as the adjacent surface. The Engineer will determine the area to be corrected and the thickness of new material added as specified in 330-13.3. Perform all overlaying and compacting at no expense to the Department.

330-16 Calculations for Thickness of Pavement to be Paid for (Applicable Only Where the Pavement Is to be Paid for by the Square Yard [Square Meter]).

330-16.1 Core Borings: When the Department is ready to core the finished asphalt construction for thickness, provide traffic control, coring equipment, and an operator to obtain the cores. Provide traffic control in accordance with the standard maintenance of traffic requirements as specified in this Contract. The Department will make no additional payment for traffic control or coring. The Engineer will select the coring locations and make the acceptance measurements.

Provide a representative to be present during the entire coring operations for acceptance purposes.

The Engineer will determine the thickness of the pavement from the length of cores, at least 2 inches [50 mm] in diameter, taken at random points on the cross-section and along the roadway. The Engineer will locate each core to represent a section of roadway no longer than 200 feet [60 m], regardless of the number of lanes. The Engineer will determine the thickness for paved shoulders and widening separate from the mainline roadway and will locate each core to represent a section no longer than 400 feet [120 m] for each shoulder or widening. The Engineer will determine the average thickness from the measured thicknesses, in accordance with the procedure and criteria as specified herein.

If, during coring operations the Engineer cannot determine the line of demarcation between pay items, the Engineer will direct that cores extend to the full combined depth of the pay items to determine total thickness. In such cases, the Engineer will prorate all adjustments based on the plan thickness of the pay items.

The Engineer will make thickness adjustments in accordance with the following:

$$S_{adj} = (\frac{T_c}{T_p} 1) S_p$$

$$B_{adj} = (\frac{T_c}{T_p} 1) B_p$$

where: S_{adj}= Thickness adjustment of structural course
B_{adj}= Thickness adjustment of base course
T_c= Total combined specification average thickness
T_p= Total combined plan thickness
S_p= Plan thickness of structural course
B_p= Plan thickness of base course

If the Contractor believes that the number of cores taken is insufficient to properly indicate the thickness of the pavement, he may request that the Engineer select additional boring locations. The Department will deduct the cost of selecting additional boring locations and measuring the cores from any sums due the Contractor unless such borings indicate that the pavement within the questioned area is of specified thickness.

330-16.2 Criteria for Calculations:

a. The Engineer will calculate average thickness for the total length of project.

b. When the thickness as measured by the cores is more than 1/2 inch [13 mm] greater than the specified thickness, the Engineer will consider it as the specified thickness plus 1/2 inch [13 mm] in the calculation.

c. The Engineer will not take into account in the calculations areas of deficient-thickness pavement that the Contractor left in place for no compensation as specified in 330-15.2.

d. Where the Contractor corrects areas of defective surface or deficient thickness by overlaying with additional material, the Engineer will use the specified thickness for such areas in the calculations.