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The requirements of Section 403 - Hot Mix Asphalt Concrete Pavement shall apply except as modified and/or revised below.

DESCRIPTION

This work shall consist of developing Hot Mix Asphalt pavement courses using the *SUPERPAVE* Mix Design procedure in accordance with these specifications and in reasonable close conformity with the required lines, grades, thicknesses, and typical sections shown on the plans or established by the Engineer. This is a performance based specification in which the Contractor is responsible for compacting the pavement within a specified density range. Written instructions for determining pavement density and quantity adjustment factors are available from the Regional Materials Engineer or the Director, Materials Bureau.

MATERIALS

The materials and composition for these mixtures shall meet the requirements specified in Subsection 403-2 Materials, except as noted herein. The specific Performance Graded Binder and the Design Estimated Traffic in 80 kN ESALs will be specified by a special note in the Contract Proposal.

Subsection 401-2.02 Composition of Mixtures shall be deleted and replaced with the following:

"Formulate and submit to the Regional Director, a *SUPERPAVE* Mix Design that satisfies the design control points listed in Table 1 and does not pass through the restricted zone listed in Table 2 based on the specified nominal maximum aggregate size.

If for any reason, a change in gradation or materials occurs or is contemplated, prepare a separate job mix formula and *SUPERPAVE* mixture design to fit each change in material or gradation. Changes in Performance Graded Binder content can be made by the Regional Director or his representative providing the resultant mixture has properties within the specified mechanical and volumetric properties.

The mixtures shall be produced, delivered to the work site, and incorporated into the work within 10°C of the temperature specified by the Engineer but within the mixing and compaction range of 120°C and 165°C. Additionally, the Performance Graded Binder shall be introduced into the pugmill at a temperature compatible with that of the aggregate as determined by the Regional Director or his representative, between the limits of 110°C and 175°C.

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The aggregates shall be those approved for use by the approved job mix formula and will be accepted at the plant site. The Performance Graded Binder will be conditionally accepted at the supplier's source and at the plant on the basis of certification. Samples taken at the plant will be tested by the Department to determine specification compliance. The gradation of the plant mixed material will be tested to determine compliance with the job mix formula during the production of the material. The plant mixed material will be accepted after blending and mixing at the plant. The pavement courses will be accepted after all paving operations are completed.

Standard Sieves, mm	**Percent Passing Criteria (*Control Points*)**									
	Nominal Maximum Aggregate Size									
	37.5 mm		**25.0 mm**		**19.0 mm**		**12.5 mm**		**9.5 mm**	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
50.0		100.0								
37.5	100.0	90.0		100.0						
25.0	90.0		100.0	90.0		100.0				
19.0			90.0		100.0	90.0		100.0		
12.5					90.0		100.0	90.0		100.0
9.5							90.0		100.0	90.0
4.75									90.0	
2.36	41.0	15.0	45.0	19.0	49.0	23.0	58.0	28.0	67.0	32.0
0.075	6.0	0.0	7.0	1.0	8.0	2.0	10.0	2.0	10.0	2.0

Table 1 - Design Control Points

Standard Sieves, mm	**Percent Passing Criteria (*Control Points*)**									
	Nominal Maximum Aggregate Size									
	37.5 mm		**25.0 mm**		**19.0 mm**		**12.5 mm**		**9.5 mm**	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4.75	34.7	34.7	39.5	39.5						
2.36	27.3	23.3	30.8	26.8	34.6	34.6	39.1	39.1	47.2	47.2

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1.18	21.5	15.5	24.1	18.1	28.3	22.3	31.6	25.6	37.6	31.6
0.600	15.7	11.7	17.6	13.6	20.7	16.7	23.1	19.1	27.5	23.5
0.300	10.0	10.0	11.4	11.4	13.7	13.7	15.5	15.5	18.7	18.7

Table 2 - Restricted Zone

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The mixtures shall meet the volumetric and mechanical properties detailed in Tables 3 and 3.1.

Design Property	Criteria
% Compaction at N_{init}	<89.0% of G_{mm}
% Compaction at N_{design}	=96.0% of G_{mm}
% Compaction at N_{max}	<98.0% of G_{mm}
Voids in the Mineral Aggregate	See Table 3.1
Voids Filled with Asphalt	See Table 3.1
Fines to Effective Asphalt Ratio	See Table 3.1

Table 3 - *SUPERPAVE* Design Criteria

Estimated Traffic, Million 80 kN ESALs	Voids in the Mineral Aggregate					Voids Filled with Binder		Fines to Effective Asphalt Ratio	
	9.5mm	12.5mm	19.0mm	25.0mm	37.5mm	Min	Max	Min	Max
	Minimum								
<0.3	15.0 %	14.0 %	13.0 %	12.0 %	11.0 %	70	80	0.6	1.2
<1.0						65	78		
<3.0						65	78		
<10.0						65	75		
<30.0						65	75		
<100.0						65	75		
>100.0						65	75		

Table 3.1 *SUPERPAVE* Volumetric Design Criteria

Voids in the Mineral Aggregate. The voids in the mineral aggregate are defined as the intergranular void space between the aggregate particles in a compacted paving mixture that includes the air voids and the effective binder content, expressed as a percent of total volume.

Voids Filled with Binder. The voids filled with binder are defined as the voids in the mineral aggregate that are filled with binder (excluding absorbed binder), expressed as a percent of the volume of the voids in the mineral aggregate.

Fines to Effective Asphalt Ratio. The Fines to Effective Asphalt Ratio is defined as the ratio of the percent by weight of aggregate passing the 75 µm sieve to the effective binder content expressed as percent by weight of the total mix.

The *SUPERPAVE* specimens shall be prepared, mix properties determined, and completed mix design submitted in accordance with the procedures outlined by Department written instructions. The Design Number of Gyrations shall be determined from Table 4 based on an estimation of the cumulative ESALs in the design lane over the design life.

Estimated Traffic, Million 80 kN ESALs	**<0.3**	**<1.0**	**<3.0**	**<10.0**	**<30.0**
$N_{initial}$	7	7	7	8	8
N_{design}	68	76	86	96	109
$N_{maximum}$	104	117	134	152	174

Table 4 - Design Number of Gyrations

Once the target gradation is selected the following production tolerances listed in Table 5 shall be applied for control of the mixture through the plant. The production tolerance range will be permitted to exceed the control points and enter the restricted zone.

Standard Sieves, mm	**37.5**	**25.0**	**19.0**	**12.5**	**9.5**	**4.75**	**2.36**	**1.18**	**0.600**	**0.300**	**0.150**	**0.075**
Tolerance	±5	±5	±5	±5	±5	±4	±4	±4	±3	±3	±3	±2

Table 5- Production Tolerances

The details of §401-2.03 Aggregates shall apply except as modified below:

In addition to the requirements detailed in §401-2.03 Aggregates, the aggregates utilized must conform to the following additional requirements based on the design traffic level and depth from the surface:

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Estimated Traffic, Million 80 kN ESALs	Coarse Aggregate Angularity (Minimum)		Uncompacted Void Content of Fine Aggregate (Minimum)		Flat and Elongated Particles (Maximum)	Sand Equivalent (Minimum)
	Depth from Surface					
	<100mm	>100mm	<100mm	>100mm		
<0.3	55/-	-/-	-	-	-	40
<1.0	65/-	-/-	40	-	-	40
<3.0	75/-	50/-	40	40	10	40
<10.0	85/80	60/-	45	40	10	45
<30.0	95/90	80/75	45	40	10	45
<100.0	100/100	95/90	45	45	10	50
>100.0	100/100	100/100	45	45	10	50

Table 6 - Additional Aggregate Criteria

Coarse Aggregate Angularity. Coarse aggregate angularity is defined as the percent by weight of the aggregate particles larger than 4.75 mm with one or more fractured faces measured on the coarse particles of the blended aggregate by Pennsylvania Department of Transportation Test Method No. 621, *Determining the Percentage of Crushed Fragments in Gravel.* Note that "95/90" denotes that 95% of the coarse aggregate has one fractured face and 90% has two fractured faces. Note that the criteria is presented as the minimum percent of coarse aggregate with the required number of fractured faces.

Fine Aggregate Angularity. Fine aggregate angularity is defined as the percent of air voids present in loosely compacted aggregate that passes the 2.36 mm sieve measured on the fine aggregate portion of the blended aggregate by AASHTO Standard Method of Test TP33, *Uncompacted Void Content of Fine Aggregate.* Note that the criteria is presented as the minimum percent air voids required in loosely compacted fine aggregate.

Flat and Elongated Particles. Flat and elongated particles are defined as the coarse aggregate particles which have a ratio of maximum to minimum dimensions greater than five (5). The percentage of flat and elongated particles is measured on the portion of the blended aggregate retained on the 9.5 mm sieve by ASTM Standard Method of Test D 4791-95, *Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate*. Note that the criteria is presented as the maximum percent allowed by weight of flat and elongated

particles.

Sand Equivalent. Sand equivalent is defined as the percent of the sand reading to the clay reading measured on the portion of aggregate that passes the 4.75 mm sieve by AASHTO Standard Method of Test T 176, *Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.* Note that the criteria is presented as the minimum percent sand equivalent required in the fine aggregate.

Subsection 401-2.03A. Coarse Aggregate and 401-2.03B. Blending shall be deleted and replaced with the following:

"A. **COARSE AGGREGATES.** The coarse aggregates used in 12.5 mm F and 9.5 mm F top course HMA mixtures shall be from approved sources and meet one of the following requirements:

1. Coarse aggregates shall be crushed limestone having an acid insoluble residue content of not less than 20%, excluding particles of chert and similar siliceous rocks.

2. Coarse aggregates shall be crushed dolomite.

3. Coarse aggregates shall be crushed sandstone, granite, chert, traprock, ore tailings, slag or other similar non-carbonate materials. Non-carbonate particles are defined as those having an acid insoluble residue content not less than 80%.

4. Coarse aggregates shall be crushed gravel or blends of two or more of the following types of materials; crushed gravel, limestone, sandstone, granite, chert, traprock, ore tailings, slag or other similar materials. These aggregates must meet the following requirements:

   12.5 mm Nominal Maximum Size Aggregate Mixes - Not less than 20% (by weight with adjustments to equivalent volumes for materials of different specific gravities) of the total coarse aggregate particles (plus 4.75 mm material) shall be non-carbonate. In addition, not less than 20% of the plus 9.5 mm particles shall be non-carbonate.

   9.5 mm Nominal Maximum Size Aggregate Mixes - Not less than 20% (by weight with adjustments to equivalent volumes for materials of different specific gravities) of the total coarse aggregate particles (plus 4.75 mm material) shall be non-carbonate.

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Non-carbonate particles are defined as those having an acid insoluble content not less than 80%.

B. **BLENDING.** Where coarse aggregates for these mixes are from more than one source or of more than one type of material, they shall be proportioned and blended to provide a uniform mixture."

Subsection 401-2.05 Bituminous Materials shall be deleted and replaced with the following:

"The Performance Graded Binder (PGB) used in the production of these mixes shall be defined by AASHTO Provisional Standard MP1 - Standard Specification for Performance Graded Asphalt Binder.

Acceptance of the PGB is based on the primary source appearing on the Department's Approved List for Bituminous Material Primary Sources, A. Asphalt Cements for Paving. Acceptance of the PGB is contingent upon satisfactory test results from samples taken, as required by the Department's procedural directives, at the location where the material is incorporated into the work. A primary source is defined as a firm that samples, tests, and certifies by Production Lot that the PGB is in conformance with the specifications. The procedural directives for sampling, testing, and certifying the PGB, and for achieving and maintaining approved list status, are available from the Materials Bureau.

The PGB shall not be delivered to the HMA Production Facility at a temperature in excess of 175°C."

Subsection 401-2.06 Reclaimed Asphalt Pavement shall be deleted.

CONSTRUCTION DETAILS

The details of §403-3 Construction Details shall apply except as modified below:

Prior to paving operations for this item, construct a test section, as detailed in "Test Section" in this specification, on the project site at a location approved by the Engineer, using the same equipment and procedures to be used in the construction of the remainder of the course being laid, and stop.

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Add the following to the end of Subsection 401-3.02 Bituminous Mixing Plant A. Requirements for All Plants No. 11:

"Y. Gyratory Compactor - A power driven gyratory compactor capable of maintaining an angle of gyration of 1.25° ± 0.02°, a speed of gyration of 30.0 rpm ± 0.5 rpm, and a consolidation pressure of 600 k Pa ± 10% for gyrations zero to five and ± 3% for gyrations six and greater. The make and model of the gyratory compactor supplied must be approved by the Director, Materials Bureau.

Z. Gyratory Specimen Mold Assembly - The specimen mold assembly consisting of the mold 150.00 mm + 0.00 mm and - 0.01 mm, base plate and top plate (if required). The minimum height of the mold is 250.00 mm. A minimum of 4 mold assemblies and an adequate supply of 150.00 mm paper discs shall be provided.

AA. Gyratory Specimen Extractor - A simple means of specimen extraction from the gyratory molds shall be supplied.

BB. Oven - A thermostatically controlled convection type oven having a minimum capacity of 0.15 cubic meters shall be supplied to preheat the *SUPERPAVE* Gyratory Compactor mold assemblies and asphalt mix samples. The oven shall have a controlled temperature range up to 190°C with a ± 3°C accuracy throughout the range."

Add the following to the end of Subsection 401-3.06 Rollers.

"The compaction equipment shall conform to the requirements of this Subsection. Control the operation of the rollers during the placement of these items including the speed, the amplitude settings, the vibration frequency, and the weight of the rollers."

Subsection 401-3.12 Compaction shall be deleted and replaced with the following:

"Immediately after the hot mix asphalt (HMA) has been spread, struck off and surface irregularities adjusted, compact the mix by rolling thoroughly and uniformly. Roll the surface when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking or shoving. Initially roll the pavement with the roller traveling parallel to the centerline of the pavement beginning at the low edge and working toward the super-elevated edge.

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Use a nuclear density gauge to monitor and record the pavement density in accordance with this section and Materials Procedure 96-01M, "Nuclear Gauge Density Data Collection and Determination of Pavement Core Locations for Rut Avoidance Asphalt Concrete." The nuclear density gauge should consist of a radioactive source, scaler and other basic components housed in a single backscatter unit. The gauge must be operated by personnel trained in the principles of nuclear testing and safety practices. Only gauge(s) calibrated during the construction of the test section will be used during normal paving operation. If another nuclear gauge is to be used, a new test section must be constructed to calibrate that gauge and to establish a new PTD.

Compact the pavement sufficiently to achieve a minimum density of 96% of the PTD in a single test location and 98% of the PTD calculated as a moving average of the last 10 test locations as determined by a nuclear density gauge. Take nuclear gauge readings at each site, randomly selected by the Engineer, approximately every 60 meters along the length of the pavement for each pass of the paver and record them on a BR340M.

If the average of 4 nuclear density gauge measurements taken at 90° angles over two consecutive locations falls below 96% of the PTD or if the moving average of the last 10 nuclear gauge test sites falls below 98% of the PTD, stop routine paving operations and construct a new test section. Normal production will only resume after establishing a new PTD.

Placement and compaction on shoulders, ramps, maintenance widening, crossovers, and bridges will be deemed satisfactory by the Engineer when the procedures used in these areas are the same as those used on the mainline pavement sections. Nuclear gauge(s) used to monitor the mainline paving should be used to monitor the above referenced areas to insure that the pavement density is between 92% to 97% of the mixture’s average daily maximum theoretical density.

The Engineer may require additional daily density verification consisting of four cores, nuclear density readings at each core location, and two loose mix samples on any day during routine production with adequate notice. Deliver the cores, nuclear density readings, and loose mix samples to the Department Regional Laboratory no later than the day following placement. If the average density of the four cores is not between 92% and 97% of the mixture's average daily maximum theoretical density, a payment adjustment will be applied to the material placed between the time the Engineer requests additional pavement cores and the time the Regional Materials Engineer establishes as new PTD based on the core results, not to exceed 1 business day following delivery of the cores to the Department Regional Laboratory. The payment adjustments will be made according to Table 7 - Quantity Adjustment Factors.

When the rolling operation is complete there should be no visible shallow ruts, ridges, other

roller marks, or irregularities in the pavement. If these imperfections are present, correct the imperfections or relay the pavement to the satisfaction of the Engineer. Perform all corrective work at no additional cost to the Department.

Correct at once any displacement occurring as a result of reversing the direction of the roller, or from other causes, by the use of rakes and addition of fresh mixture as required. Exercise care in rolling not to displace the line and grade of the edges of the bituminous mixture. To prevent adhesion of the mixture to the drum(s) of the roller, properly moisten the drum(s) with water, or water mixed with small quantities of detergent or other Department approved asphalt release compounds. If a pneumatic tire roller is used, the pneumatic drive wheels may be coated with a fine mist spray of fuel oil or other similar materials to prevent pneumatic tire pickup. In all instances, protect the surface of the pavement from drippings of fuel oil or any other solvents used in paving, compaction or cleaning operations.

Unless otherwise directed by the Engineer, compact the longitudinal joint by using one of the pneumatic drive wheels to overlap the joint in two (2) passes with the drum operating static where vibratory rollers having pneumatic drive wheels are used. If dual vibrating drum rollers are used compact the joint by overlapping the joints in two (2) passes with both drums operating static.

Along forms, curbs, headers, walls and other areas not accessible to the rollers, compact the mix thoroughly with mechanical tampers as directed by the Engineer. On depressed areas, a trench roller or small vibratory roller approved by the Engineer may be used. Cleated compression strips also may be used under the roller to transmit compression to the depressed area.

Remove any mixture that becomes loose and broken, mixed with dirt, or is in any way defective and replace with fresh hot mixture and compact to conform with the surrounding area. Correct any area showing an excess or deficiency of bituminous materials to the satisfaction of the Engineer.

If vibratory compaction equipment is used, the Contractor assumes full responsibility for the cost repairing all damage which may occur to highway components and adjacent property including buried utility and service facilities.

When multiple paving operations are utilized with material production from a single plant each paving operation will be evaluated separately.

Routine paving operations will not begin unless both a project calibrated nuclear density gauge and an operator are present.

Backfill all core holes, with a similar HMA material as was cored, as soon as possible after coring, using a procedure approved by the Engineer."

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Add the following to the end of §401-3:

"**Test Section**. Prior to paving operations for this item, construct a test section on the project site at a location approved by the Engineer, using the same equipment and procedures to be used in the construction of the remainder of the course being laid, and stop. The amount of mixture prepared according to the job mix formula should be sufficient to construct a test section 500 linear-meters long, the full width of pavement, and shall be of the same depth specified for the construction of the course which it represents. Routine paving will only begin after a Project Target Density (PTD) has been established by the Regional Materials Engineer based on testing of the pavement cores. The test section is for determining the Project Target Density (PTD) for this item and for calibration of the nuclear density gauge. The PTD will be established within one business day of the delivery of the four cores, the two loose mix samples, and the four nuclear density readings.

NOTE: Routine paving will only begin after a Project Target Density (PTD) has been established by the Regional Materials Engineer. Also, construction of a test section will not begin unless both a nuclear density gauge and an operator are present.

Use the first 150 linear meters of the test section to stabilize the paving operation. The remainder of the length will be used to determine the PTD. During construction of the test section, take two loose mix samples, in accordance with AASHTO T168-91. These samples will represent the material placed on this test section. At the conclusion of the test section, take four cores from the test section (excluding the initial 150 meters) at locations randomly selected by the Engineer in accordance with Materials Procedure 96-01M. If coring is performed the same day as placement, cool the pavement so that the core sample is not damaged during coring. At each core location, take density readings with a nuclear density gauge(s). A nuclear density reading at each core location will be the average of the four measurements taken at 90˚. Only gauge(s) calibrated during the construction of the test section will be allowed to be used during normal paving operations. Deliver the four cores, the two loose mix samples, and the four nuclear density readings to the Department Regional Laboratory. With the nuclear density readings, include gauge model number and serial number for each gauge calibrated on the test section. The Regional Materials Engineer will use the test section cores and nuclear gauge readings to establish the PTD.

OPTION: Paving may continue after completion of the test section using an interim PTD determined in accordance with Materials Procedure 96-01M, "Nuclear Gauge Density Data Collection and Determination of Pavement Core Locations for Rut Avoidance Asphalt Concrete". If the average density of the four cores taken on the test section is not between 92-97% of the mixture's maximum theoretical density, payment adjustments will be applied to any material placed after the test section and before the Project Target Density (PTD) has been determined by the Regional Materials Engineer. The payment adjustments will be made according to Table 7 - Quantity Adjustment Factors."

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Subsection 401-3.14 Surface Tolerance, shall be deleted and replaced with the following:

401-3.14a. General

1. It is the intent of this Special Provision that the asphalt paving operations produce a finished driving lane surface with a profile index no greater than 500 mm per km.

2. This Special provision establishes a smoothness standard for mainline asphalt concrete pavement. Asphalt concrete pavements for ramps, acceleration and deceleration lanes, shoulders, approach slabs and bridge decks are not considered mainline pavement.

3. The equipment and testing applicable to this Section will be provided and operated by the Contractor. All costs necessary to produce profilograph data under these provisions, with the exception of Item 15502.049701M - Profilograph, shall be included with the corresponding asphalt item bid prices.

401-3.14b. Equipment

The Contractor shall funish and operate 7.5 m automated California type profilograph. The equipment furnished shall meet the requirements of Item 15502.049701M - PROFILOGRAPH.

401-3.14c. Calibration

1. Profilographs shall be calibrated in accordance with the Manufacturer's procedures, and within the tolerance of this specification. Calibration may be repeated as determined by the Engineer at any time, if sufficient warrant exists.

2. Longitudinal Calibration shall be verified by propelling the profilograph over a pre-measured test distance and determining the scale factor by dividing the pre-measured test distance by the length of the paper in millimeters. The scale factor shall be 300$\pm$ 0.2 percent.

3. Vertical calibration shall be verified by sliding a pre-measured calibration block under the sensing wheel while the profilograph is stationary. The measurement of the vertical trace line from the base line to the peak and return shall be the same as the calibration block. The trace line must return to the base line. Tolerances will be :

   1 mm for the 25 mm calibration block.

2 mm for the 50 mm calibration block.

401-3.14d. Profilograph Test Procedures

1. All testing applicable to this specification will be done by the Contractor. The profilograph shall produce a profilogram (profile trace) of the surface tested. Completed traces shall be signed by the profilograph operator and the Engineer.

2. Smoothness will be tested on all paving courses including base, binder, and top. The existing surface will not be profiled for this pilot project. The Contractor will make every reasonable effort to provide test results to the Engineer within two working days after placement. Testing required as a result of surface profile correction should be completed and provided to the Engineer within two working days after completion of the corrective work.

3. Any additional testing or retesting, made necessary by unforseen circumstance, or other provisions of this specification, should be completed and provided to the Engineer as soon as possible, but no later than seven calendar days after placement of that section.

4. Testing will be done in the right-hand wheel path of all travel lanes as determined by the Engineer, and shall be in the direction of traffic. The wheel path chosen shall be adjusted so as to avoid irregularities caused by appurtenances such as manholes, drop inlets, and utility castings.

5. All objects and foreign materials on the pavement surface shall be removed by the Contractor prior to testing.

6. The profilograph shall be propelled at the speed recommended by the manufacturer, or at walking speed, along the specified wheel path of each travel lane. Propelling speed shall be decreased if excessive spikes are produced on the profilogram.

7. Stationing shall be noted on the profilogram at least every 50 meters. Station referencing shall be used to accurately locate deviations greater than 10 mm. All station references used on the profilograms and report forms shall be actual project stationing, or as directed by the Engineer.

8. The Contractor shall label both ends of the profilogram with the project number, test date, test direction, test path, test number, stationing, lane designation, position of the pavement, and operator's name and signature.

9. To calculate the Profile Index (PI), paving lanes shall be divided into 200 meter test sections (herein referred to as segment) in the direction tested with the remaining short pieces also considered as test sections. If a "short" section is less than 100 meters, it will be added to the

preceding segment and a profile index will be calculated for the adjusted length. Sections which are 100 meters or longer will be considered a full segment.

10. Unless otherwise specified, the following areas of pavement will not be profiled:

a) Pavement for exit ramp termini, ramps and connectors
b) Isolated sections less than 200 meters long (e.g. between two bridges)
c) Pavement within 15 meters of railroad crossing and associated transitions
d) Additional exceptions will be shown on the summary sheet in the plans or as directed by the Engineer.

Pavement sections which are not profiled shall be constructed to a 6 mm tolerance. If, in the opinion of the Engineer, the pavement surface is not being constructed or has not been constructed to this tolerance based upon visual observation or upon riding quality, the Engineer may test the surface with a 5 meter straight edge or string line placed parallel to the centerline of the pavement and with a 3 meter straight edge or string line placed transversely to the centerline of the pavement on any portion of the pavement. Variations exceeding 6 mm shall be satisfactorily corrected or the pavement relaid at no additional cost to the Department as ordered by the Engineer.

401-3.14e. Evaluation

1. Pavement shall be evaluated using the profile index as calculated by the automated profilograph computer. PI's shall be provided for 0, 2.5 and 5 mm blanking band widths calculated from a single pass of the profilograph. The units of this measurement are millimeters per kilometer (mm/km).

2. Bumps will be separately identified. These appear as high or low points on the profile trace and correspond to high points or sags (referred to herein as bumps) on the pavement surface. They are identified by locating vertical deviations exceeding 10 mm for an 8 meter span as indicated on the profile trace.

3. A written report, summarizing each paving days profile results, shall be completed and furnished to the Engineer with the profilograms. This information shall be provided within two working days of each days paving.

401-3.14f. Pavement Surface Correction

1. All corrective work shall be done with the approval and in the presence of the Engineer.

2. When the profile index of a section exceeds 500 mm/km, the Contractor, at his/her expense, shall

mark and correct the surface on parts of the segment to reduce the profile index to 500 mm/km or less.

3. When the profile of a pavement placed under this contract is corrected by removal and replacement, the replacement material shall be furnished by the Contractor, at no additional cost to the Department, and shall meet the original Specifications for the material removed. Removal and replacement shall be a minimum depth equal to the final lift thickness and in full lane-widths (neat rectangular areas bound laterally by lane lines or edges of pavement). ***The replacement material shall be retested for smoothness.***

401-3.14g. Traffic Control

The Contractor shall provide all maintenance and protection of traffic necessary to perform the work in accordance with Section 619 as directed by the Engineer. Cost to be included in the unit price bid for item 619.01M - Basic Maintenance and Protection of Traffic.

METHOD OF MEASUREMENT

Subsection 403-4 Method of Measurement shall be deleted and replaced with the following:

"The pavement course shall be measured by the number of adjusted metric tons of compacted material placed in the accepted work.

Each delivery vehicle supplying Hot Mix Asphalt shall be accompanied by a delivery ticket indicating the metric tons of mixture being delivered to the work site. The tonnage on the ticket shall be determined either by:

A. Recorded batch weights,
B. Theoretical weights or
C. Truck scale weights.

The method of payment shall be subject to the approval of the Regional Director. Other information such as tare weights, plant and mix identification, project identification, and time and date shall be provided on the delivery tickets as directed by the Department. The Engineer or his representative shall be provided with the ticket prior to the spreading and finishing of the mixture.

The Department will test the cores from a test section or from any day the Engineer requests cores. If paving is continued using an interim PTD immediately after the

conclusion of a test section, or if the Engineer requests additional cores on any day after the first day, full payment will be made if the average density of the four cores is between 92% and 97% of the mixture's average daily maximum theoretical density. If the average density fails to meet this limit, the quantity placed will be adjusted according to Table 7 - Quantity Adjustment Factors shown below:

Average Core Density	Quantity Adjustment Factor
90.0 ≤ Density < 92.0	90%
88.0 ≤ Density < 90.0	85%
< 88.0	Remove pavement section.

Table 7 - Quantity Adjustment Factors

Payment Quantity Adjustments

1. The payment quantity for asphalt cement concrete corresponding to the mix design and plan thickness of the top course of the pavement will be adjusted according to the following schedule for each segment (200 meter sections) as measured by profilograph.

DAILY PROFILE INDEX 2.5 mm BLANK BAND (mm Per Lane km)	PROFILE ADJUSTMENT FACTOR (PAF)
0 - 75 mm	**1.02**
75.1 - 150 mm	**1.01**
150.1 - 500 mm	**1.00**
OVER 500 mm	**Corrective Action Required**

The Profile Adjustment Factor (PAF) will be applied to top course pavement only. All underlying base and binder courses will have a PAF of 1.00. Any section not tested for profile index shall have a PAF of 1.00.

2. On any segment that has an initial PAF of 150 mm/km or less but bump removal is still required, a second profilogram shall be taken after the bumps are removed. The PAF for that

segment shall be based on a second profilogram, taken after bump removal. If the initial profile index exceeds 150 mm/km then, except for total removal and replacement of the entire segment, the maximum PAF after repair is limited to 1.00.

Profilograph Quantity Adjustment Factor Calculation

1. The Quantity Adjustment Factor (QAF) for smoothness of the top course of asphalt concrete for each paving day will be determined according to the following formula:

$$\text{QAF(Smoothness)} = \frac{A\,(1.02) + B\,(1.01) + C\,(1.00)}{A + B + C}$$

where:

A = length of pavement with a profile index between 0 and 75 mm/km

B = length of pavement with a profile index between 75.1 and 150 mm/km

C = length of pavement with a profile index between 150.1 and 500 mm/km

2. The quantity adjustment factor shall be applied to the asphalt top course tonnage that is subject to profilograph testing for each paving day."

The quantity of the material subject to payment adjustments will be determined from typical sections shown in the plans. The payment adjustments will be applied to material placed on mainline but not shoulders, ramps, maintenance widenings and crossovers, and bridges."

BASIS OF PAYMENT

Subsection 403-5 Basis of Payment shall be deleted and replaced with the following:

"The unit bid price per metric ton for the pavement course shall include the cost of furnishing all materials including performance graded binder and all equipment and labor necessary to complete the work,

ITEM 06403.3762 M - SUPERPAVE HOT MIX ASPHALT, 37.5 mm NOMINAL MAX. SIZE
ITEM 06403.2562 M - SUPERPAVE HOT MIX ASPHALT, 25.0 mm NOMINAL MAX. SIZE
ITEM 06403.1962 M - SUPERPAVE HOT MIX ASPHALT, 19.0 mm NOMINAL MAX. SIZE
ITEM 06403.1262 M - SUPERPAVE HOT MIX ASPHALT, 12.5 mm F NOMINAL MAX. SIZE
ITEM 06403.9562 M - SUPERPAVE HOT MIX ASPHALT, 9.5 mm F NOMINAL MAX. SIZE

including the cost of any cleaning and tack coat applied pursuant to §401-3.01. Also to be included in the unit bid price is the cost of all necessary equipment, labor and materials required in construction of the test sections, nuclear density testing, obtaining the pavement cores, filling all core holes with asphalt concrete and compacting these core holes satisfactorily to the Engineer."

Payment will be made under:

ITEM NO.	ITEM	PAY UNIT
06403.3762M	*SUPERPAVE* Hot Mix Asphalt, 37.5 mm Nominal Max. Size	Mertic Ton
06403.2562M	*SUPERPAVE* Hot Mix Asphalt, 25.0 mm Nominal Max. Size	Metric Ton
06403.1962M	*SUPERPAVE* Hot Mix Asphalt, 19.0 mm Nominal Max. Size	Metric Ton
06403.1262M	*SUPERPAVE* Hot Mix Asphalt, 12.5 mm F Nominal Max. Size	Metric Ton
06403.9562M	*SUPERPAVE* Hot Mix Asphalt, 9.5 mm F Nominal Max. Size	Metric Ton