ITEM 18403.1291 M - SUPERPAVE HOT MIX ASPHALT WITH ICE RETARDANT,12.5mm FX NOMINAL MAXIMUM SIZE

ITEM 18403.9591 M - SUPERPAVE HOT MIX ASPHALT WITH ICE RETARDANT, 9.5 mm FX NOMINAL MAXIMUM SIZE

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 with an ice retardant additive using *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 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 and does not pass through the restricted zone listed in Table 1 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.

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.

This
Specification
has been
Disapproved
and replaced by item
18403.129101 which was
also disapproved as a result of
the issuance of
ED 99-1

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Standard Sieves, mm	Percent Passing Criteria (*Control Points*)							
	Nominal Maximum Aggregate Size							
	12.5 mm				9.5 mm			
	Design Control Points		Restricted Zone Control Points		Design Control Points		Restricted Zone Control Points	
	Max	Min	Max	Min	Max	Min	Max	Min
19.0		100.0						
12.5	100.0	90.0				100.0		
9.5	90.0				100.0	90.0		
4.75					90.0			
2.36	58.0	28.0	39.1	39.1	67.0	32.0	47.2	47.2
1.18			31.6	25.6			37.6	31.6
0.600			23.1	19.1			27.5	23.5
0.300			15.5	15.5			18.7	18.7
0.075	10.0	2.0			10.0	2.0		

Table 1 - Design and Restricted Zone Control Points

The mixtures shall meet the volumetric and mechanical properties detailed in Tables 2 and 2.1.

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 2.1
Voids Filled with Asphalt	See Table 2.1
Fines to Effective Asphalt Ratio	See Table 2.1

Table 2 - *SUPERPAVE* Design Criteria

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Estimated Traffic, Million 80 kN ESALs	Voids in the Mineral Aggregate		Voids Filled with Binder		Fines to Effective Asphalt Ratio	
	9.5 mm	12.5 mm	Min	Max	Min	Max
	Minimum					
<0.3	15.0 %	14.0 %	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 2.1 - *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 3 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	<100.0	>100.0
$N_{initial}$	7	7	7	8	8	9	9
N_{design}	68	76	86	96	109	126	142
$N_{maximum}$	104	117	134	152	174	204	233

Table 3 - Design Number of Gyrations

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Once the target gradation is selected the following production tolerances listed in Table 4 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	19	12.5	9.5	4.75	2.36	1.18	0.6	0.3	0.15	0	Additive
Tolerance	± 5	± 5	± 5	± 5	± 5	± 4	± 4	± 4	± 3	± 3	± 3	± 2	± 0.1

Table 4 - 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:

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					
	<100 mm	>100 mm	<100 mm	>100 mm		
<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 5 - 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 FX and 9.5 mm FX 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 having an acid insoluble residue content of not less than 17%, excluding particles of chert and similar siliceous rocks.

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, dolomite, 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.

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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.

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

Blotting Aggregate. Aggregate for blotting shall be crushed screenings approved by the Engineer.

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 a 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."

Ice Retardant Additive. The Ice Retardant additive shall be selected from Department's current Approved List. The percentage of additive is based on the total weight of the mix and shall be 5.0%, 5.25%, 5.5% as specified by Special Note in the project proposal.

Subsection 401-2.06 Reclaimed Asphalt Pavement shall be deleted.

CONSTRUCTION DETAILS

The details of §401-3 Construction Details shall apply except as modified below:

The Ice Retardant additive may be batched and recorded manually. Proportioning of the additive shall be accurate to ±0.1% of the total batch weight mixture. The additive shall be sieved through a 19.0 mm sieve to eliminate lumps prior to its addition to the mixer.

The aggregate dry mix shall be at least 15 seconds. The aggregate and asphalt wet mix time shall be at least 30 seconds. The Ice Retardant additive shall then be added to the mixture and mixed for additional 15 seconds or until all the additive particles are thoroughly coated.

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Prior to paving operations for this item, determine the Project Target Density (PTD) for this item by using one of the procedure established below:

1. If the paving distance is 1500 linear meters or more 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.

2. If the paving distance is less than 1500 linear meters, use the PTD established from the mix placed adjacent to this item, if available. Otherwise, determine the PTD using the method outlined in the MP96-08M, "Pavement Density Monitoring of Hot Mix Asphalt with Ice Retardant Additive". Routine paving operations may begin immediately following the determination of Target Density to the satisfaction of the Engineer.

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 kPa ± 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 m^3 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. Use minimum amount of water necessary to prevent pickup."

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

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"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. The types of rollers used, the number of rollers used, and the number of roller passes made will be at contractor's discretion.

Use a nuclear density gauge to monitor and record the pavement density in accordance with this section and Materials Procedure 96-08M, "Pavement Density Monitoring of Hot Mix Asphalt with Ice Retardant Additive". 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 PTD must be established using one of the procedures outlined earlier.

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. The nuclear gauge density testing frequency will be performed as indicated in Table 3 below.

Lane meters, L	Frequency of Readings
30 m < L ≤ 450 m	every 15 m
451 m < L ≤ 1500 m	every 30 m
L > 1500 m	every 60 m

TABLE 6 - Testing Frequency

Record density readings on a BR 334M "Ice Retardant Asphalt Concrete Pavement Density Data". At the end of each production day provide the Engineer with copies of all BR 334M forms relating to that days work.

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 determine a new PTD using one of the methods described earlier. Normal production will only resume after establishing a new PTD.

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. Vibratory compaction is not permitted on structural bridge decks.

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

Immediately after compaction, while the surface is still warm, the ice retardant overlay shall be covered with a layer of clean, dry, crushed screening. Fine or natural sand must be avoided. The crushed screenings shall be applied at approximately 1.1 kg/m^2. Spreading of the crushed screenings may be done by hand brooming or other methods approved by the Engineer. The crushed screenings shall be rolled with a self propelled steel wheel tandem roller weighing a minimum of 8 metric tons in a separate operation from the compaction train. The temperature of the surface shall not be lower than 90°C. Just prior to opening to traffic, the crushed screenings shall be swept from the pavement surface by a method approved by the Engineer. The sweeping must remove all loose aggregate particles. Before opening the pavement to traffic, the Contractor shall erect warning signs W8-28 "Fresh Oil" as prescribed by the New York State Department of Transportation Manual of Uniform Traffic Control Devices and the pavement surface shall be flushed with water using a pressure distributor. The pressure distributor shall be equipped and operated so that the water can be applied, at a minimum width of 3.6 m at a rate of 9.0 L/m^2 with uniform pressure. The flushing shall be done in two passes. The first pass shall be made using a minimum rate of 2.3 L/m^2. Before the pavement dries,

approximately 10 to 30 minutes, the second pass shall be made using a minimum rate of 9.0 L/m^2. The pavement shall be flushed as many times as necessary each day, as directed by the Engineer, including all locations where traffic has tracked it. The Contractor shall remove the "Fresh Oil" warning signs when directed by the Engineer.

Permanent pavement marking shall be applied either before any sheen develops on the surface of the ice retardant asphalt concrete or after all evidence of it has vanished.

Short-term pavement markings such as preformed tape and raised pavement markers, that fail to adhere to the pavement, shall be mechanically fastened. Fastening materials (e.g. nails, etc.) and fastening methods shall be approved by the Engineer. After removal of the short-term pavement markings, damage to the new asphalt concrete pavement caused by mechanical fastening shall be repaired to the satisfaction of the Engineer."

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. The amount of mixture prepared according to the job mix formula should be sufficient to construct a test section 450 linear-meters long, and shall be of the same depth specified for the construction of the course which it represents. The test section is for determining the PTD for this item and for calibration of the nuclear density gauge.

Use the first 300 meters of the test section to stabilize the paving operation. The next 150 meters will be used to determine the PTD. Once a sufficient amount of material has been placed in the last 150 meters of the test section compact the pavement with 2 machine passes of the breakdown roller. Perform density readings at two sites, randomly selected by the Engineer in accordance with Materials Procedure 96-08M, "Pavement Density Monitoring of Hot Mix Asphalt with Ice Retardant Additive." A nuclear density reading at each location will be the average of the four measurements taken at 90°. Mark these sites so that subsequent density tests can be performed at the same locations. Make two additional machine passes using either the intermediate or finish roller. Perform additional density readings at the two previously selected sites. Continue rolling and density testing until the increase in density is less than 32.0 kg/m^3, or until the Engineer stops further compaction because the pavement shows signs of distress.

The Engineer will immediately determine the average of the final density measurements at the two test locations. This average density will be the PTD. Once a PTD has been established routine paving operations may begin.

Only gauge(s) calibrated during the construction of the test section will be allowed to be used during routine paving operations."

METHOD OF MEASUREMENT

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

"The final Quantity Adjustment Factor shall be 1.00.

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The pavement course shall be measured by the number of 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 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."

BASIS OF PAYMENT

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

"The unit bid price per 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, 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, and routine nuclear density testing.

Payment will be made under:

ITEM NO.	ITEM	PAY UNIT
18403.1291M	*SUPERPAVE* Hot Mix Asphalt with Ice Retardant, 12.5 mm FX Nominal Maximum Size	Metric Ton
18403.9591M	*SUPERPAVE* Hot Mix Asphalt with Ice Retardant, 9.5 mm FX Nominal Maximum Size	Metric Ton"