

**ITEM 01403.1318 M - HEAVY DUTY ASPHALT CONCRETE, TYPE 3 HD**  
**ITEM 01403.1718 M - HEAVY DUTY ASPHALT CONCRETE, TYPE 6F HD**  
**ITEM 01403.1918 M - HEAVY DUTY ASPHALT CONCRETE, TYPE 7F HD**

The requirements of Section 403 - Hot Mix Asphalt Concrete Pavement of the Standard Specifications of January 2, 1995 shall apply except as modified and/or revised below.

**DESCRIPTION:**

This work shall consist of constructing Heavy Duty Asphalt concrete pavement courses 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, joint 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 for Type 3 binder course, Type 6F and Type 7F top course in Subsection 401-2.01 through 401-2.05, except as noted herein. Mixture requirements shall be as follows:

Formulate and submit to the Regional Director, a job mix formula that satisfies the design general limits listed in Table 1 - Heavy Duty Mix Composition. The production tolerances in Table 1 will be permitted to exceed the design general limits.

Screen Size	BINDER		TOP			
	TYPE 3 HD		TYPE 6F HD		TYPE 7F HD	
	Design General Limits % Passing	Production Tol. %	Design General Limits % Passing	Production Tol. %	Design General Limits % Passing	Production Tol. %
37.5 mm	100	--				
25.0 mm	95-100	--				
19.0 mm	74-93	±5	100	--		
12.5 mm	58-73	±5	95-100	--	100	--
6.3 mm	38-53	±5	58-72	±5	90-100	--
3.2 mm	26-40	±4	36-54	±4	45-70	±4
850 µm	9-23	±4	15-32	±4	15-40	±4
425 µm	4-18	±4	8-25	±4	8-27	±4
180 µm	3-13	±3	4-16	±3	4-16	±3
75 µm	2-6	±2	2-6	±2	2-6	±2
% Asphalt	4.0-6.0	--	5.0-6.2	--	5.2-7.2	--

**Table 1 - Heavy Duty Mix Composition**

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

“A. **COARSE AGGREGATES.** Top course type 6F and type 7F HD hot mix asphalt mixtures shall be from approved sources and shall meet one of the following requirements:

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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:

For Type 6F HD 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 3.2 mm material) shall be non-carbonate. In addition, not less than 20% of the plus 6.3 mm particles shall be non-carbonate. Non-carbonate particles are defined as those having an acid insoluble residue content not less than 80%.

For Type 7F HD 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 3.2 mm material) shall be non-carbonate. Non-carbonate particles are defined as those having an acid insoluble residue 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.
- C. **MIX PROPERTIES.** The mixtures shall meet the Marshall property criteria appearing in Table 2 - Marshall Mix Property Criteria.

Mix Property	Mix Criteria		
	Type 3HD	Type 6FHD	Type 7FHD
Stability, N, min.	6700	6700	6700
Flow, 0.25 mm., min.	8	8	8
Marshall Quotient, (stability/flow)	670	670	670
Air Voids, percent	3.0 - 5.0	3.0 - 5.0	3.0 - 5.0
Voids in Mineral Agg. (VMA), percent min.	12.0	14.0	16.0
Voids Filled with Asphalt (VFA), percent	65-75	65-75	65-75

**Table 2 - Marshall Mix Property Criteria**

- D. **MIX PREPARATION.** The Marshall specimens shall be prepared, mix properties determined, and completed mix design submitted in accordance with the procedures outlined by Department written instructions with the following modifications:

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1. Compactive effort shall be 75 blows per side.
2. Five point asphalt cement content Marshall design is required prior to production. One point designs are not acceptable.
3. The minimum specified VMA shall be met at each of the five mix design asphalt cement contents.
4. The Marshall quotient is calculated as the corresponding ratio of corrected stability (N) to flow (0.25 mm).
5. The optimum asphalt cement content shall be determined by the "Range" method. Graphs shall be constructed for each of the specified mix design properties (stability, Marshall quotient, air voids, VMA, and VFA) using each property as the vertical axis and percent asphalt cement content as the horizontal axis. The plotted values in each graph shall be fitted with a smooth curve that obtains the "best fit" for all values. A vertical line is drawn at the point where the asphalt cement content provides the acceptable lower and upper limits for the properties of stability, flow, Marshall quotient, and air voids. The mid-point of the common overlap is the optimum asphalt cement content provided it does not fall on the positive slope of the VMA curve. When this occurs the low point of the VMA curve shall be the optimum asphalt cement content provided it falls within the common overlap of the specified stability, flow, Marshall quotient, and air voids ranges."

**CONSTRUCTION DETAILS:**

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

"The compaction equipment shall conform to the requirements of Subsection 401-3.06 Rollers. 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 HMA mixture has been spread, struck off and surface irregularities adjusted, thoroughly and uniformly compact by rolling. 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 each edge and working toward the super-elevated edge. The method of constructing the longitudinal centerline joints will be determined by the Contractor. The types of rollers used, the number of rollers used, and the number of roller passes made will be controlled by the Contractor.

Compact the pavement sufficiently to achieve densities, expressed as a percentage of the mixture's average daily maximum theoretical density (%MADMTD), in a range of 92% to 97%. Pavement cores, joint cores and mix samples will be tested and analyzed by the Department in accordance with Department written instructions to determine the loose mix sample MADMTD, pavement core bulk density, joint core bulk density and the resultant pavement core and joint core percent of the MADMTD.

If consecutive lots are found to have a Quantity Adjustment Factor equal to or below 0.85 paving operations for this item will be stopped and a new Test Section, constructed as described later in this section, will be required. Paving operations for this item will not be permitted until a new test section meets the acceptance criteria, a minimum Quantity Adjustment Factor of 1.00.

The Quantity Adjustment Factor will not be applied to material placed on ramps with a uniform full width section of less than 400 meters in length, shoulders, maintenance widenings and crossovers, and bridges. Payment for these areas will be based on satisfactory placement and compaction as determined by the Engineer. Placement and compaction

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procedures will be deemed satisfactory by the Engineer when the procedures used in these areas are the same as those used on the main line pavement sections. Also, if a nuclear gauge(s) is used to monitor the main-line paving then the same gauge(s) should be used to monitor the above referenced areas to insure that the pavement density is between 92% to 97% of the MADMTD.

When the rolling operation is complete there should be no visible shallow ruts, ridges, other irregularities, or roller marks in the pavement. If these imperfections are present, correct the imperfections or relay the pavement at no additional cost to the Department as ordered by the Engineer.

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.

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.

Multiple plant production shall not be allowed unless each plant supplies material to a separate paving operation. When multiple paving operations are utilized with material production from a single plant each paving operation will be evaluated as individual paving lots.”

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

**“Sampling.** Take four loose mix samples in accordance with AASHTO T168-91, Standard Test Method for Sampling Bituminous Paving Mixtures. The samples should be taken periodically throughout the day so as to represent the entire days production. When operational conditions cause production to be terminated before the specified number of samples have been taken the following procedures will be used:

- 1) If only three samples are taken, the loose mix MADMTD will be based on the average of the three samples taken.
- 2) If only one or two samples are taken, the days production will be added to the next days production and sublots determined based on the total quantity placed during the two days. Therefore a maximum of six loose mix samples may be used to determine the loose mix MADMTD.

The Engineer will select one pavement core and one longitudinal joint core location for each subplot in accordance with Department written instructions to represent each paving subplot. The Department’s representative shall define a total of eight 150 mm diameter coring locations using an appropriate method. The Department’s core samples must

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come from within the 150 mm diameter circles outlined. Under no circumstances will the Department's representative designate

the coring locations before the rolling operation is complete. The rolling operation will be considered complete when all compaction equipment has moved off the lane to be cored. Obtain the four 150 mm diameter pavement core samples and four 150 mm diameter joint core samples no later than the day following the lot's placement. If coring is performed the same day as placement, cool the pavement so that the core sample is not damaged during coring. Backfill the core holes, with a similar HMA material as was cored, as soon as possible after coring, using a procedure approved by the Engineer.

After procuring the eight paving lot cores, secure them in accordance with Department written instructions for transport to the appropriate Regional Laboratory. Cores arriving at the Regional Laboratory for testing with a damaged or missing security seal will not be tested and new cores will be required from the same locations as the original cores. Take care to insure that the loose mix samples and cores are in an acceptable test condition when delivered to the Regional Laboratory. Damaged cores will require resampling. The Engineer will select the core locations in the same general vicinity,  $\pm 0.5$  meter of the damaged core. Do not intentionally separate the pavement core course from the underlying material if the course does not debond during coring. The Department will separate the pavement core course, required for testing from the remainder of the core by sawing if necessary. Deliver the core samples and the loose mix samples to the Department Regional Laboratory no later than the day following the lot's placement. If, for any reason, a delay occurs in the delivery of the lot samples for three consecutive lots, paving operations for this item will not be permitted to continue until the samples are delivered and tested.

A paving lot is defined as a days production providing a minimum of 1,200 lane-meters or 400 metric tons, whichever is less, are placed (a lane is defined as a travel lane, with a nominal width of 3.6 meters). When paving is continuous within a 24 hour period a new lot will result when a change occurs in the paving crew. If less than the minimum quantity is placed in any day, its placement will be combined with the next paving day to constitute a paving lot. If less than the minimum quantity is placed on the final paving day, the final day shall be evaluated as a paving lot regardless of size. Each paving lot will be equally divided into four sublots in accordance with Department written instructions.

**Test Section.** Prior to paving operations for this item, construct a test section on the project site at a location approved by the Engineer. The amount of mixture prepared according to the job mix formula should be sufficient to construct a test section at least 50 meters long and full width of pavement and shall be of the same depth specified for the construction of the course which it represents. The maximum test section length is 500 centerline-meters long on roadways subject to Quantity Adjustment Factors, otherwise there is no maximum length. Use equipment in the construction of the test section that is of the same type and weight to be used on the remainder of the course represented by the test section. If the test section is located on a roadway subject to Quantity Adjustment Factors Table 3 - Quantity Schedule shall apply. The test section will be paid for at 1.5 times the actual quantity paved, up to 200 actual paved metric tons per test section, for no more than two test sections for each item. The 1.5 Test Section Adjustment does not apply to any additional required test sections.

Testing as described above will be performed on the test section to determine if it meets the mat acceptance criteria. Paving operations for this item will not be permitted until a test section meets the mat acceptance criteria, a minimum Quantity Adjustment Factor of 1.00. Only one test section per item per day may be placed.

If the Quantity Adjustment Factor for a test section is less than 1.00, make the necessary adjustments to the mix design, plant operation, and/or rolling procedures. Construct an additional test section as required above. This test section will be evaluated to determine if the mat acceptance criteria is met."

**METHOD OF MEASUREMENT:**

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

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

This Specification  
has been  
disapproved  
as a result  
of the  
issuance of  
EP 98-21

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 determine the paving lot's Percent Within Limits (PWL) in accordance with Department written instructions. In order to receive a Quantity Adjustment Factor of 1.00, pavement and joint cores representing the paving lot must achieve statistically a minimum of 94% of the lot within the prescribed limits. If the above requirement is not met, the lot's quantities will be adjusted in accordance with Table 3 - Quantity Schedule. The quantity of the lot subject to possible adjustment will be determined based on an estimate of tonnage placed, determined from the typical sections shown in the plans.

Percent Within Limits(PWL)	Quantity Adjustment Factor	
	Pavement	Joints
>93	1.05	1.02
5 ≤ PWL ≤ 93	0.00449(PWL) + 0.578	1.00
<5	*	1.00

\* The lot shall be removed and replaced to meet specification requirements as ordered by the Engineer.

**Table 3 - Quantity Schedule**

A combined Quantity Adjustment Factor shall be computed as follows:

$$QAF_{\text{COMBINED}} = QAF_{\text{PAVEMENT}} + QAF_{\text{JOINT}} - 1.00$$

When the quantity Adjustment Factor is over 1.00, the additional tonnage will be calculated and paid for on a daily basis.

The total tonnage paid for under this item will not exceed 1.07 times the actual tons of materials placed. The individual Quantity Adjustment Factors listed in Table 3 will be calculated for the PWL from the pavement core results and the PWL from the joint core results. The pavement QAF and joint QAF will be combined and applied to the actual tons of material placed in each paving lot to determine the percentage of that production received at the unit bid price. The combined Quantity Adjustment Factor will not be applied to material placed on ramps with a uniform full width section of less than 400 meters in length, shoulders, maintenance widenings and crossovers, and bridges. Payment in these areas will be based on satisfactory placement and compaction as determined by the Engineer. Placement and compaction procedures will be deemed satisfactory by the Engineer when the procedures used in these areas are the same as those used on the main line pavement sections.”

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**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 asphalt cement 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 obtaining the pavement cores, filling all core holes with HMA and compacting these core holes satisfactorily to the Engineer.

Payment will be made under:

<b><u>ITEM NO.</u></b>	<b><u>ITEM DESCRIPTION</u></b>	<b><u>PAY UNIT</u></b>
01403.1318M	Heavy Duty Asphalt Concrete, Type 3 HD	Metric Ton
01403.1718M	Heavy Duty Asphalt Concrete, Type 6F HD	Metric Ton
01403.1918M	Heavy Duty Asphalt Concrete, Type 7F HD	Metric Ton