

**CONSTRUCTION STANDARD SPECIFICATION**

**SECTION 02510**

**ASPHALT CONCRETE PAVEMENT**

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**CONSTRUCTION STANDARD SPECIFICATION**

**SECTION 02510**

**ASPHALT CONCRETE PAVEMENT**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Work provided under this specification shall include the furnishing, placement, and compaction of asphalt concrete pavement.

Job mix formulae and gradations shall meet the criteria as set forth in the most current City of Albuquerque approved asphalt concrete mix designs.

- B. Related Sections: Refer to Section 02232, "Aggregate Base Course (ABC), Recycled Asphalt Base Course (RABC), Crushed Concrete Base Course (CCBC)" for related work.

**1.02 REFERENCES**

- A. American Society for Testing and Materials (ASTM)

C88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

C117 Method for Materials Finer than 75 Micrometers (No. 200) Sieve in Mineral Aggregates by Washing

C131 Test Method for Resistance to Degradation of Small-size Coarse Aggregate by Abrasion and Impact in a Los Angeles Machine

C136 Test Method for Sieve Analysis of Fine and Coarse Aggregate

D5 Test Method for Penetration of Bituminous Materials

D88 Test Method for Saybolt Viscosity

D113 Test Method for Ductility of Bituminous Materials

D242 Specification for Mineral Filler for Bituminous Paving Mixtures

D244 Test Methods for Emulsified Asphalts

- D692 Specification for Coarse Aggregate for Bituminous Paving Mixtures
  - D979 Practice of Sampling Bituminous Paving Mixtures
  - D995 Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
  - D1073 Specification for Fine Aggregate for Bituminous Paving Mixtures
  - D1074 Test Method for Compressive Strength of Bituminous Mixtures
  - D1075 Test Method for Effect of Water on Compression Strength of Compacted Bituminous Mixtures
  - D1559 Test Methods for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
  - D2041 Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
  - D2042 Test Method for Solubility of Asphalt Materials in Trichloroethylene
  - D2172 Quantitative Extraction of Bitumen From Bituminous Paving Mixtures
  - D2493 Viscosity-Temperature Chart for Asphalts
  - D2726 Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
  - D2950 Density of Bituminous Concrete in Place by Nuclear Methods
  - D3203 Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
  - D3515 Standard Specification for Hot Mixed, Hot-Laid Bituminous Paving Mixtures
  - D4125 Asphalt Content of Bituminous Mixtures by the Nuclear Method
- B. City of Albuquerque “Standard Specifications for Public Works Construction”
- Section 112 Paving Asphalt (Asphalt Cement)
  - Section 113 Emulsified Asphalts
  - Section 116 Asphalt Concrete
  - Section 117 Asphalt Rejuvenating Agents
  - Section 118 Hydrated Lime Mineral Filler
  - Section 336 Asphalt Concrete Pavement

### 1.03 DEFINITIONS

- A. Asphalt Cement: A homogeneous bituminous material produced from crude asphaltic petroleum or a mixture of refined liquid asphalt and refined solid asphalt, free from water and residues from distillation of coal, coal tar, or paraffin oil, providing a flexibility to mixtures of mineral aggregates.
- B. Base Course: Placed on prepared surfaces to distribute wheel loads, and provide a non-frost susceptible material on which to support surface courses.
- C. Emulsified Asphalt: A paving asphalt uniformly suspended with water. The emulsion permits the application of paving grade asphalts at normal atmospheric temperatures to obtain workable fluidity. In the emulsifying process, warm asphalt is mechanically milled into minute droplets or globules and dispersed in water treated with a small quantity of emulsifying agent, usually some type of soap. By proper selection of an emulsifying agent, emulsified asphalts are produced in several types and grades. By choice of emulsifying agent, the emulsified asphalt may be:
  - 1. Anionic - Asphalt globules are electro-negatively charged.
  - 2. Cationic - Asphalt globules are electro-positively charged.
- D. Prime Coat: An application of emulsified asphalt to an untreated granular base in preparation for a subsequent asphalt course. The prime coat is designed to waterproof the base surface, and provide adhesion between the base and the next course.
- E. Tack Coat: Thin emulsified cationic emulsified asphalt which provides a bond between an existing pavement and a succeeding paving course.
- F. Mineral Filler: A finely divided mineral product at least 70 percent of which will pass a No. 200 (75  $\mu\text{m}$ ) sieve. Pulverized limestone is the most commonly manufactured filler, although other stone dust, hydrated lime, Portland cement, fly ash and certain natural deposits of finely divided mineral matter are also used.

### 1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract documents and Section 01330, "Submittals Procedures."
- B. Product Data: Submit product data for all material used in asphalt concrete, including supplier and design mix identification number.
- C. Certification of Compliance: Provide certification that mix design complies with the requirements specified in 2.04 "Mixes" of this specification.
- D. Test Reports: Provide laboratory test reports to show that materials comply with requirements specified in 2.02 "Materials" of this specification.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Contractor shall provide to the Sandia Delegated Representative (SDR) with each load of batched material delivered to the job site, before unloading at the site, a copy of the delivery ticket on which is printed, stamped or written, the information defined in TABLE 02510.A.

<b>DELIVERY TICKET INFORMATION</b>	
<b>TABLE 02510.A</b>	
A.	Name of Supplier
B.	Date of Delivery
C.	Delivery Ticket Number
D.	Name of Contractor
E.	Project Name (optional)
F.	Job Mix Formula Identification Number
G.	Weight of Load
H.	Time Loaded

- B. Protection: When hauling time from the mixing plant to the job site exceeds two hours or when inclement weather prevails, bituminous mixtures shall be covered with tarpaulins while being hauled. The tarpaulins shall completely cover the load and be firmly tied down.

Mixtures shall be delivered to site of the work without segregation of the ingredients and within the temperature range specified in the authorized job mix formula.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements, manufacturers of products include, but are not limited to the following:

- Western Mobile, Inc.
- Calmat Co. of New Mexico

2.02 MATERIALS

- A. Asphalt Cement: Comply with the requirements of TABLE 02510.B.

<b>ASPHALT CEMENT GRADE</b>			<b>TABLE</b>
<b>02510.B</b>			
Road Classification	Standard Penetration	Viscosity Grade	
Parking Lot	60-70	AC-20	
Primary	60-70	AC-20	

- B. Aggregate: Aggregates shall be crushed particles of stone, gravel, asphalt concrete pavement, Portland cement concrete, and natural or manufactured sand conforming to the quality and crushed particle requirements of this specification.
1. Coarse aggregates shall comply with the requirements of ASTM D692.
  2. Fine aggregates shall comply with the requirements of ASTM D1073 and as specified in TABLE 02510.C.

<b>ENGINEERING REQUIREMENTS</b>		
<b>TABLE 02510.C</b>		
CHARACTERISTIC	Fine	Coarse
Los Angeles Abrasion Wear (ASTM C131)		40% max.
Soundness (5 cycles ASTM C88)	15%	15% max.
Crushed Aggregate (% Material Retained on No. 4 (4.75 mm) sieve by wt., having at least two (2) fractured faces)		85% max.
Fineness Modulus Variation (ASTM D1073)	± 0.25	
Plasticity Index (Material finer than No. 40 sieve) (425 µm)	4.0 max.	

- C. Mineral Filler: Mineral Filler shall comply with the requirements of ASTM D242 and as specified herein.
- D. Anti-Stripping Admixtures: Anti-stripping admixtures shall be used in asphalt concrete provided under this specification. Anti-strip admixtures shall be either hydrated limes, Portland cement, a liquid admixture or modified asphalt approved by the SDR. Anti-strip admixture shall be proportioned to provide a minimum of 85% retained strength as determined by ASTM D1075 and not less than 100% of the strength of the reference sample when tested dry in accordance with ASTM D1074.
- E. Emulsified Asphalt: Shall be classified as rapid-setting (RS), or slow-setting (SS) type in anionic emulsions and shall conform to the requirements of TABLE 02510.D.

ANIONIC EMULSIFIED ASPHALT TABLE 02510.D									
Test	ASTM Test Method	Rapid Setting				Slow Setting			
		RS-1		RS-2		SS-1		SS-1h	
		Min	Max	Min	Max	Min	Max	Min	Max
<u>Test on Emulsions:</u>									
Viscosity SSF @ 77° F (25° C)	D88	20	100	-	-	20	100	20	100
Viscosity SSF @ 122° F (50° C)	D88	-	-	75	400	-	-	-	-
Settlement 5 days, % [1]	D244	-	-	-	5	-	5	-	5
Storage Stability 1 day [2]		-	1	-	1	-	1	-	1
Demulsibility 35 ml. 0.02N Calcium Chloride [3]		60	-	60	-				
Cement Mixing Test, %				-		-	2.0		2.0
Sieve Test, %		-	0.10	-	0.10	-	0.10	-	0.10
Residue by Distillation, %		55	-	63	-	57	-	57	-
<u>Tests on Residue From Distillation Test:</u>									
Penetration @ 77° F (25° C)	D5	100	200	100	200	100	200	40	90
Ductility @ 77° F (25° C)	D113	40	-	40	-	40	-	40	-
Solubility in trichlorethylene, %	D2042	97.5	-	97.5	-	97.5	-	97.5	-
<p>[1] Test requirement for settlement may be waived when the emulsified asphalt is used in less than 5 days time; or the SDR may require the settlement test be run from the time the sample is received until it is used, if the elapsed time is less than 5 days.</p> <p>[2] 24 hour (1 day) storage stability test may be used instead of the 5 day settlement test.</p> <p>[3] Demulsibility test shall be made within 30 days from date of shipment.</p> <p>[4] A harder base asphalt meeting current paving asphalt specifications may be specified with the provision that the test requirements on the Residue from Distillation be waived.</p>									

## 2.03 EQUIPMENT

- A. Spreading: Depositing and spreading of the asphaltic concrete shall be accomplished by means of a bituminous paver.
1. Bituminous pavers shall be self-contained, power-propelled units, provided with an activated screed or a strike-off assembly, heated if necessary, and capable of spreading and finishing courses of bituminous plant mix material in lane widths applicable to the specified typical section and thickness shown in the contract documents.
  2. Paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed.
  3. Screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving or gouging the mixture.
  4. When laying mixtures, the paver shall be capable of being operated at forward speeds consistent with satisfactory laying of the mixture.
  5. The bituminous paver shall be equipped with an automatic leveling device controlled from either a string line that has been set as the grade reference, or from a short or long ski grade follower, riding on an adjacent lane, curb, or gutter.
  6. Subsequent passes shall utilize a matching device of one foot (305 mm) minimum length riding on the adjacent lay.
- B. Rolling: Rollers shall be of the steel wheel and/or pneumatic-tire type and shall be in good condition, capable of reversing without backlash, and shall be operated at speeds slow enough to avoid displacement of the bituminous mixture.
1. The number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition.
  2. Vibratory rollers with separate controls for energy and propulsion and especially designed for bituminous mixture compaction may be used.
  3. Use of equipment which results in excessive crushing of the aggregate will not be permitted.
- C. Pressure Distributor: Used for applying prime coat and tack coat material, designed and operated as to distribute the prime material in a uniform spray without atomization, in the amount and between the limits of temperature specified by the supplier. Equipped with a speed tachometer registering feet per minute and so located as to be visible to the truck driver to maintain the constant speed required for application at the specified rate.
1. Pressure distributor shall be equipped with a tachometer registering the pump speed, pressure gauge, and a volume gauge. The rates of application shall not vary from the rates specified by more than 10 percent.

2. An accurate measurement of the prime coat material temperature shall be available at all times. The thermometer well shall be so placed as not to be in contact with a heating tube.
3. Distributor shall be so designed that the normal width of application shall be not less than 6 feet (1.8 m), with provisions for the application of lesser width when necessary.
4. Distributor shall be so equipped and operated that the prime material shall be circulated or agitated throughout the entire heating process.

#### 2.04 MIXES

- A. Job mix formula gradation shall comply with the requirements for gradation ranges and tolerances shown in TABLE 02510.E.
- B. Job mix formulas required in this specification are the same as those required by the City of Albuquerque's Public Works Department. Job mix formulas pre-approved by the City of Albuquerque Materials Engineer are on file with the manufacturers listed in 2.01 "Manufacturers" and shall comply with the latest edition of the City of Albuquerque Standard Specification for Public Works Construction, Section 116 - "Asphalt Concrete."
  1. Asphalt concrete shall be proportioned in accordance with the requirements of ASTM D1559 for dense graded asphalt concretes and this specification.
  2. Each job mix formula submitted and approved for use under this specification shall be identified by a number, unique to that job mix formula. The materials specified in a job mix formula shall be the same source and type for all asphalt concrete batched and delivered under the identification number defined in the approved job mix formula.
  3. If either a change in material(s) or material supplier(s) from that specified in the job mix formula occur during a project, the Contractor shall submit a new job mix formula to include the changed materials for approval by the SDR.
- C. Aggregates and Mineral Filler: Job mix formulae aggregates and mineral filler shall be proportioned to provide a combined gradation that complies with the requirements specified in TABLE 02510.E.
  1. Proportions of either natural sand, or crushed asphalt concrete, or Portland cement concrete shall not exceed twenty percent (20%) by weight of total aggregates for 1 inch (25.4 mm), 3/4 inch (19.1 mm), and 1/2 inch (12.7 mm) aggregates.
  2. Proportions of either crushed asphalt concrete or crushed Portland cement concrete shall not exceed twenty percent (20%) by weight of total aggregates for grading 1/8 inch (1.25 mm) aggregate.

GRADATION RANGE - PERCENT (%) PASSING TABLE 02510.E					
SIEVE	SIZE	NOMINAL AGGREGATE SIZE			
		1 inch (25.4 mm) Min - Max [2]	3/4 inch (19.1 mm) Min - Max [2]	1/2 inch (12.7 mm) Min - Max [2]	3/8 inch (9.5 mm) [1] Min - Max [2]
1-1/2 inch (38.1 mm)		100			
1 inch (25.4 mm)		93 - 100 (8)	100		
3/4 inch (19.1 mm)		-	93 - 100 (8)	100	
1/2 inch (12.7 mm)		69 - 83 (8)	-	93 - 100 (8)	100
3/8 inch (9.5 mm)		-	70 - 80 (8)	-	93 - 100 (8)
No. 4 (4.75 mm)		45 - 57 (7)	52 - 65 (7)	59 - 75 (7)	69 - 85 (7) [3]
No. 8 (2.36 mm)		36 - 46 (6)	40 - 50 (6)	44 - 54 (6)	55 - 67 (6)
No. 16 (1.18 mm)		29 - 38 (6)	33 - 43 (6)	37 - 47 (6)	43 - 53 (6)
No. 30 (600 µm)		23 - 33 (5)	26 - 35 (5)	28 - 37 (5)	30 - 40 (5)
No. 50 (300 µm)		15 - 24 (5)	19 - 27 (5)	21 - 29 (5)	15 - 25 (5)
No. 200 (75 µm)		3 - 8 (3)	3 - 8 (3)	3 - 10 (3)	3 - 10 (3)
<p>[1] Gradation used for skin patches.</p> <p>[2] Maximum variation in grading of % passing the respective sieve.</p> <p>[3] Variation for asphalt concrete using recycled asphalt concrete and/or Portland cement concrete, (±)8%.</p>					

- D. Asphalt Content: Job mix formulae for asphalt content shall be proportioned to comply with the requirements defined in TABLE 02510.F. The asphalt content shall be selected, based on laboratory testing such that the job mix formula physical properties do not exceed the tabulated limits for a maximum deviation from the target asphalt content of plus (+) or minus (-) 0.5 percent.

<b>JOB MIX FORMULA STRENGTH PROPERTIES TABLE 02510.F [1], [2]</b>		
Application	Parking Lot	Primary
Marshall Blows/face	50	75
Stability lb (kg)	1500 (680) min.	1800 (816) min.
Flow 0.01 in. (0.25 mm)	10 - 18 (250 - 450)	8 - 16 (200 - 400)
Voids in Asphalt Concrete %	4 [3]	4 [3]
Voids Filled %	70 - 80	65 - 80
Nominal Size Aggregate	Minimum Voids In Mineral Aggregate - VMA %	
1 inch (25 mm)	14	
3/4 inch (19.1 mm)	15	
1/2 inch (12.7 mm)	16	
3/8 inch (9.5 mm)	18	
<p>[1] A job mix formula shall be determined by design/development analysis of a minimum of five (5) asphalt contents, with test results for a single asphalt defined by the average of the test results of three (3) briquettes, containing only that portion of a mix that passes a one-inch (25.4 mm) sieve. The recommended target asphalt content shall be bracketed between two laboratory test points. Job mix formula submittals shall include all information required to verify the proposed job mix formula complies with the production ranges and/or variations specified.</p> <p>[2] Maximum job mix formula asphalt content shall not exceed the asphalt content at a minimum VMA.</p> <p>[3] Maximum deviation shall be plus (+) or minus (-) 1.0 percent.</p>		

## 2.05 BATCHING

- A. Asphalt Concrete: Batched in accordance with the requirements of ASTM D3515 and the requirements of this specification.
- B. Batching Facilities: Comply with the requirements of ASTM D995.
- C. Batch Plant: Calibrated annually with calibration standards traceable to the National Bureau of Standards.
- D. Certificates: Calibration and production certifications shall be maintained at the asphalt batching plant.

**PART 3 - EXECUTION****3.01 PREPARATION**

- A. Emulsified Asphalt: Heat in such a manner that steam or hot oils will not be introduced directly into the emulsified asphalt during heating.
1. Contractor shall furnish and keep on the site at all times an accurate thermometer suitable for determining the temperature of the emulsified asphalt.
  2. Various grades of emulsified asphalt shall be applied at temperatures within the limits specified in TABLE 02510.G.

<b>APPLICATION TEMPERATURE OF EMULSIFIED ASPHALT TABLE 02510.G</b>		
<b>Emulsion Asphalt Grade</b>	<b>Mixing</b>	<b>Spraying</b>
RS-1	Not Used	70-140°F (21-60°C)
RS-2	Not Used	125-185°F (52-85°C)
SS-1	50-160°F (10-71°C)	70-140°F (21-60°C)
SS-1h	50-160°F (10-71°C)	70-140°F (21-60°C)

3. Emulsified asphalt shall be reheated, if necessary, but at no time after loading into a tank car or truck for transportation from the refinery to the purchaser shall the temperature of the emulsion be raised above 185 degree F (85 degrees C).
  4. During all reheating operations the emulsified asphalt shall be agitated to prevent localized overheating. Emulsified asphalt shall not be permitted to cool to a temperature of less than 40 degrees F (4 degrees C).
- B. Prime Coat: For asphalt concrete pavement constructed directly upon an aggregate base course, an emulsified asphalt prime coat shall be applied to surfaces of bases at least 12 hours prior to placing the asphalt cement unless otherwise directed by the SDR.
1. Immediately prior to application of the asphalt prime, an inspection will be made to verify that the base course has been constructed as specified. Also, all loose and foreign material shall be removed by light sweeping. Material so removed shall not be mixed with other aggregate.
  2. Surface to be primed shall be in a smooth and well-compacted condition, true to grade and cross section, and free from ruts and inequalities.
  3. Asphalt prime shall be applied uniformly at the rate of 0.10 to 0.30 gallon per square yard (0.45 to 1.36 liter per square meter). It shall be applied only when permitted by the SDR and when the air temperature is not less than 40 degrees F (4 degrees C).

4. Contractor shall protect the prime coat against all damage and markings, both from foot and other traffic.
  5. Barricades shall be placed where necessary to protect the prime coat. If, after the prime coat is disturbed after application, it shall be restored to its condition at the time of acceptance.
- C. Tack Coat: For asphalt concrete pavement constructed directly upon an existing hard-surfaced pavement, a tack coat shall be evenly and uniformly applied to such existing pavement preceding the placing of the asphalt concrete.
1. Surface shall be free of water, all foreign material, or dust when the tack coat is applied. No greater area shall be treated in any one day than will be covered by the asphalt concrete during the same day. Traffic will not be permitted over tack coating.
  2. Tack coat shall consist of an emulsified asphalt. Application rate shall be no more than 0.10 gallon per square yard (0.45 liter per square meter).
  3. A similar tack coat shall be applied to the surface of any course if the surface is such that a satisfactory bond cannot be obtained between it and the succeeding course.
  4. Contact surfaces of all cold pavement joints, curbs, gutters, manholes, and the like shall be painted with a tack coat immediately before the adjoining asphalt concrete is placed.
- D. Sand Cover: If the asphalt prime coat has not been completely absorbed by the base course prior to the start of placing the asphalt concrete mixture, sufficient sand shall be spread over the surface to blot up the excess liquid asphalt.
1. Sand shall also be used at intersections and such areas where traffic may pass over the prime coat.
  2. Prior to placing the asphalt concrete, loose or excess sand shall be swept from the base.
  3. If a sand cover is specified on the drawings to cover asphalt prime, it shall be applied within 4 hours after the application of prime coat.

### 3.02 INSTALLATION

- A. General: Asphalt concrete shall be placed in uniform layers/lifts at least equal to two times (2x's) the nominal size aggregate of the job mix formula used but not greater than 3 inches (76 mm). Pavement lift thickness shall be selected to use the maximum size aggregate defined in this specification.
- B. Placement: Asphalt concrete may be placed when the temperature is 40 degrees F (4 degrees C) and rising, and the weather is favorable as determined by the SDR. No asphalt concrete shall be placed on material which is significantly over optimum moisture, causing deterioration of compacted grade.

1. Asphalt concrete shall be evenly spread upon the subgrade or base to such a depth that after rolling, the pavement will be of the specified cross section and grade of the course being constructed.
  2. All joints shall be completely bonded.
  3. Placing, once commenced, must be continued without interruption. No greater amount of the mixture shall be delivered in any one day than can be properly distributed and rolled during that day.
  4. In narrow, deep, or irregular sections, intersections, turnouts, or driveways, where it is impractical to spread and finish the base and level the surface mixtures by machine methods, the Contractor may use spreading equipment or acceptable hand methods approved by the SDR.
  5. Pavement cuts of 8 feet (2.4 m) or more in width and 100 feet (30.5 m) or more in length must be paved with an approved bituminous paving machine.
- C. Compaction: Asphalt concrete compaction shall begin when the asphalt concrete temperature is in the range specified in the authorized job mix formula by the asphalt cement supplier's temperature viscosity curve.
1. Temperature of the asphalt concrete in the paver's receiving hopper shall not be less than 225 degrees F (107 degrees C) prior to placement.
  2. Compaction shall not be allowed on material with a material temperature equal to or less than 185 degrees F (85 degrees C).
  3. Materials shall be compacted to a density of at least 93% but not greater than 97% of the theoretical maximum density as determined by ASTM D2041.
  4. Diesel fuel or other petroleum based solvents shall not be used as a release agent to clean equipment used to place and compact asphalt concrete.
  5. Rolling of both the base course and surface course shall be continued until all roller marks are eliminated.
  6. In areas not accessible to the roller, the mixture shall be thoroughly compacted with hand-operated mechanical tampers.
  7. Any mixture that becomes mixed with foreign material or in any way is defective shall be removed, replaced with fresh mixture, and compacted to the density of the surrounding pavement.
  8. Unless waived by the SDR, a test strip of a minimum of 10 feet (3 m) wide and 250 feet (76 m) long shall be placed to establish the rolling pattern to be used on each asphalt mix and thickness to be placed on the project. If authorized by the SDR the test strip may be incorporated into the project pavement.
- D. Rolling: Commenced with a steel wheel roller along the lower edge of the area to be rolled and be continued until the edge is thoroughly compacted, after which the roller shall be gradually advanced to the crown point, both sides being rolled in a like manner.

1. Rolling shall be continued with steel and pneumatic wheel rollers until the layer has become thoroughly compacted throughout and is true to grade and cross section.
  2. Rollers shall be maintained in good mechanical condition, and those that cannot be operated without jerking or driven along a straight path shall not be used.
  3. No leakage from any roller shall be allowed to come in contact with the pavement being constructed nor shall any roller be permitted to stand motionless on any portion of the work before it has been properly compacted.
  4. Steel roller wheels shall be treated with water or oil to prevent the adherence of the asphalt concrete, and water or oil may be used on pneumatic-tired rollers but the quantity used must not be such as to be detrimental to the surface being rolled.
  5. If the vibratory rollers cause surface cracking, use pneumatic-tired rollers following rolling with vibratory rollers.
- E. Joints: Care shall be exercised in connection with the construction of joints to insure that the surface of the pavement is true to grade and cross section.
1. In making the joint along any adjoining edge such as a curb, gutter, or an adjoining pavement and after the hot mixture is placed by the finishing machine, sufficient hot material shall be carried back to fill any space left open. This joint shall be properly "set up" with the back of a rake at proper height and level to receive the maximum compression under rolling. The work of "setting up" this joint shall be performed by competent workmen who are capable of making a correct, clean, and neat joint.
  2. Longitudinal and transverse joints shall be made in a careful manner to ensure well-bonded and sealed joints. Joints between old and new pavements or between successive days' work shall be carefully made in such a manner as to insure a thorough and continuous bond between the old and new surfaces.
  3. In the case of surface course, the edge of the old surface course shall be cut back for its full depth so as to expose a fresh surface and, if necessary to obtain a well-bonded joint, shall be painted with a tack coat after which the hot surface mixture shall be placed in contact with it and raked to a proper depth and grade.
  4. Before placing mixture against contact surfaces of curbs, gutters, headers, manholes, etc., they shall be painted with a tack coat.
- F. Tolerances: When a 10 foot (3 m) straight edge is laid on the finished surface parallel to the centerline of the roadway, the surface shall not vary from the edge of the straightedge more than 3/16 inch (4.76 mm), except at intersections or any changes of grade. Areas that are not within this tolerance shall be brought to grade immediately following the initial rolling.

After the completion of final rolling, the smoothness of the course shall be checked, and the irregularities that exceed the specified tolerances or that retain water on the surface shall be corrected by removing the defective work and replacing with new material as directed at the expense of the Contractor.

3.03 FIELD QUALITY CONTROL

- A. Sampling Prior to Placement: An asphalt concrete sample will be taken in accordance with the requirements of ASTM D979 for up to each 250 tons (230 metric tons) delivered per day to a project, for each job mix delivered.
1. Sample will be of such size to provide material for all tests specified in TABLE 02510.H and retainage to perform verification tests if required.
  2. Asphalt concrete sample will be tested for, but not limited to the properties specified in TABLE 02510.H.

<b>ASPHALT CONCRETE SAMPLE TESTS TABLE 02510.H [1]</b>	
1. Marshall Properties [2]	
a. Stability	ASTM D1559 [3]
b. Flow	ASTM D1559
2. Physical Properties	
a. Asphalt Content [6]	ASTM D2172 [4], or D4125
b. Bulk Density	ASTM D2726
c. Air Voids in Asphalt Concrete	ASTM D3203
d. Voids in Mineral Aggregate - VMA Calculations	Standard Marshall
e. Voids Filled	Standard Marshall Calculations
f. Extracted Aggregate Gradation [7]	ASTM C136, ASTM C117, [4]
g. Maximum Theoretical Density	ASTM D2041
[1] Material used for an individual test will be split from the same sample.	
[2] Asphalt concrete material to be compacted for Marshall Properties, shall be compacted at the MEDIAN TEMPERATURE of the compaction temperature range ( $\pm 5$ degrees F), ( $\pm 3$ degrees C), recommended by the asphalt cement supplier in the viscosity temperature relationship curve of the asphalt cement, specified for a respective job mix formula. The MEDIAN TEMPERATURE shall be defined as the temperature halfway between the minimum and maximum compaction temperatures recommended.	
[3] A minimum of three (3) standard briquettes shall be molded.	
[4] Corrected for mineral material extracted with the asphalt.	
[5] The laboratory may retain the unused portion of the split sample for testing as required until the lot that the sample represents is accepted by the SDR.	
[6] Asphalt content test results shall be corrected for extracted mineral material, if applicable.	
[7] Aggregate gradation shall be adjusted for extracted mineral material, if applicable.	

- B. Sampling Pavement After Placement: Samples of the compacted asphalt pavement will be taken and tested to determine conformance of the finished pavement with the specified requirements. Contractor shall replace the pavement at his expense where samples are removed. The number of samples including rings and cores to be taken will be as required herein.

1. Minimum test requirements for the pavement shall consist of a test for:
    - a. Gradation of extracted aggregates.
    - b. Density of compacted pavement.
    - c. Asphalt content by extraction (if not previously controlled and verified by tank strap test).
  2. Frequency for these tests shall not be less than one (1) test in each of the three (3) categories for each 500 tons (450 metric tons) or fraction thereof of asphalt concrete placed and for asphalt concrete less than 500 tons (450 metric tons) placed during one day's run.
- C. Field Testing: In-place field compaction tests will be conducted in accordance with the requirements of ASTM D 2950 at the minimum rate of one test per lift per 500 square yards (420 m<sup>2</sup>) of asphalt material placed, or one (1) test per day if less than 500 square yards (420 m<sup>2</sup>) is placed.
1. Compaction tests shall measure the density of the fresh constructed asphalt concrete roadway lift only.
  2. Compaction test of the subgrade or base course material for the asphalt concrete roadway lift to be constructed, shall be taken prior to the placement of the fresh asphalt concrete lift. The density of the subgrade or base course material determined by the compaction test shall be used as reference in performing the compaction test of the fresh asphalt material.
  3. Compaction test of the subgrade or base course material shall be taken at the rate of one (1) test for each 500 square yards (420 m<sup>2</sup>) of surface or less to be paved over in a day.
  4. Density of the subgrade or base course material will be reported as "reference support material density" in the compaction test report of the constructed asphalt concrete pavement over the area represented by the subgrade or base course material compaction test.
  5. In place field compaction tests shall be taken at various locations on the asphalt being placed. The exact location of each test shall be directed by the SDR.
    - a. The three (3) general areas in which tests are to be taken are the edge of the mat, mat interior, and the joints. The number of tests taken in each area will vary but the total number of tests taken on any project shall be in the approximate proportions shown in TABLE 02510.I.
    - b. If core samples are required or requested by the Contractor, four (4) inch (102 mm) diameter cores shall be taken and tested in accordance with the requirements of ASTM D2726.

<b>FIELD COMPACTION TESTS</b>		<b>TABLE</b>
<b>02510.I</b>		
Location	% of Total Compaction Tests	
Edge of Mat [1]	20% to 30%	
Mat Interior	40% to 60%	
Joints [2]	20% to 30%	
<p>[1] Edge of Mat tests will be taken in the area between one (1) foot (305 mm) and two (2) feet (610 mm) in from a free edge and/or an edge adjacent to a curb or structure, or longitudinal or transverse abutting joints.</p> <p>[2] Joints will include the longitudinal and transverse butt joints between adjacent lifts of asphalt having the same final elevation.</p>		

- D. Test Reports: Test reports will include but not be limited to the requirements of TABLE 02510.J.

<b>TEST REPORT INFORMATION</b>
<b>TABLE 02510.J</b>
<b>FIELD DATA</b>
Date of Sampling/Test
Project Title
Asphalt Concrete Supplier
Delivery Ticket Number (asphalt concrete sample only)
Job Mix Formula Number
Location of sample/test as defined by the project plans and specifications
Time of sampling/testing
Material temperature at time of sampling, degree F (degree C)
Ambient temperature at time of sampling, degree F (degree C)
Field test results with reference specification limits

1. Test results shall be reported to the SDR and supplier in writing within 4 working days of completion of the sampling of the asphalt and/or the field testing.
2. Non-complying tests shall be reported to the SDR and supplier within one (1) working day of completion of the test.

3.04 CLEANING

Contractor shall keep the premises free from accumulations of waste materials, rubbish, and other debris resulting from the Work.

- A. Remove all waste materials, rubbish, and debris from and about the premises.
- B. Remove all tools, construction equipment and machinery, and surplus materials.
- C. Contractor shall restore to their original condition those portions of the site not designated for alterations by the Contract Documents.

END OF SECTION