SECTION 321216
BITUMINOUS CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. The work includes furnishing all labor, materials, equipment, and supervision to construct the bituminous concrete paving for walkways, including aggregate base course, new pavement and repairs to existing pavement following curb installation, in accordance with the Drawings and Specifications.

1.3 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:

1. Section 310000, EARTHWORK; Establishment of subgrade elevation; grading; geotextile, and subbase.

1.4 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Association of State Highway and Transportation Officials (AASHTO):
   M 20 Penetration Graded Asphalt Cement
   M 81 Cut-Back Asphalt (Rapid Curing Type)
   M 140 Emulsified Asphalt
   D 979 Sampling Bituminous Paving Mixtures
   D 1557 Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb. (4.54-kg) Rammer and 18-in. (475-mm) Drop
   D 3549 Thickness or Height of Compacted Bituminous Paving Mixture Specimens
   D 1188 Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
D 2041 Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
D 2726 Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
D 2950 Density of Bituminous Concrete in Place by Nuclear Methods

3. Federal Specifications (Fed. Spec.):
   SS-S-1401 Sealing Compound, Hot Applied, for Concrete and Asphalt Pavements

4. Commonwealth of Massachusetts Highway Department (MHD):
   Specifications Standard Specifications for Highways and Bridges

1.5 QUALITY ASSURANCE

A. Unless otherwise specified, work and materials for construction of the asphaltic concrete paving shall conform to the applicable portions of the following:

1. MHD Specifications Section 460 for bituminous pavement for roadways and parking areas, Section 701 for bituminous sidewalks, and Section 405 for aggregate base course.
2. MHD Specifications Section 472 for repairs to existing pavements after installation of new curb.

B. Paving work shall be done only after excavation and construction work which might damage them has been completed. Damage caused during construction shall be repaired before acceptance.

C. Repair and/or replace existing paved areas damaged during this Project. Workmanship and materials for such repair and replacement shall match those employed in existing work, except as otherwise noted.

D. Pavement subbase shall not be placed on a muddy or frozen subgrade.

E. Existing pavement under state or local jurisdiction shall, if damaged or removed during the course of this project, be repaired or replaced under this section of the specification in conformance with applicable codes, standards, and practices.

F. Qualifications:

1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
2. Contractor shall have a minimum 5 years experience installing bituminous concrete pavements and shall have successfully completed at least three projects of comparable scale within the past 3 years.

G. Contractor shall provide and pay for testing procedures specified herein. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, and in accordance with Section 014500, QUALITY REQUIREMENTS.
H. The Owner reserves the right to retain an independent testing laboratory to perform inspection and testing of paving and associated work in accordance with Section 01 45 00, QUALITY REQUIREMENTS.

I. Asphalt-Paving Publication: Comply with Al MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

J. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

C. Shop Drawings: Indicate pavement markings, cross walks, lane separations, and defined parking spaces. Indicate, with international graphics symbol, spaces dedicated to people with disabilities.

D. Qualification Data: For manufacturer.

E. Material Certificates: For each paving material, signed by manufacturers.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
3. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
4. Asphalt Surface Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.

PART 2 – PRODUCTS

2.1 AGGREGATE BASE COURSE

A. Material for aggregate base course shall be Gravel Borrow, as specified in Section 310000, EARTHWORK.

2.2 ASPHALTIC CONCRETE
A. Asphaltic shall be a standard plant-mixed, hot-laid paving material for road work, consisting of clean, crushed rock aggregate, mineral filler, and asphalt equal to Class I, Type-I, in accordance with MHD Specifications Section M3.11.03, except as modified herein. The master range composition tolerances for bituminous concrete materials shall be as follows:

Table A (As modified)
Percent by Weight Passing Square Opening Sieves

<table>
<thead>
<tr>
<th>Standard Sieve Size</th>
<th>Base Course</th>
<th>Binder Course</th>
<th>Surface Course</th>
<th>Dense Mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 in.</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 in.</td>
<td>55-80</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/4 in.</td>
<td>80-100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5/8 in.</td>
<td></td>
<td>100</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>1/2 in.</td>
<td>40-65</td>
<td>55-75</td>
<td>95-100</td>
<td>100</td>
</tr>
<tr>
<td>3/8 in.</td>
<td></td>
<td>80-100</td>
<td>80-100*</td>
<td></td>
</tr>
<tr>
<td>No. 4</td>
<td>20-45</td>
<td>28-50</td>
<td>50-76</td>
<td>55-80</td>
</tr>
<tr>
<td>No. 8</td>
<td>15-33</td>
<td>20-38</td>
<td>37-54</td>
<td>48-63</td>
</tr>
<tr>
<td>No. 16</td>
<td></td>
<td>26-40</td>
<td></td>
<td>36-49</td>
</tr>
<tr>
<td>No. 30</td>
<td>8-17</td>
<td>8-22</td>
<td>17-29</td>
<td>24-38</td>
</tr>
<tr>
<td>No. 50</td>
<td>4-12</td>
<td>5-15</td>
<td>10-21</td>
<td>14-27</td>
</tr>
<tr>
<td>No. 100</td>
<td></td>
<td>5-16</td>
<td></td>
<td>6-18</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-4</td>
<td>0-5</td>
<td>2-7</td>
<td>4-8</td>
</tr>
<tr>
<td>Bitumen</td>
<td>4-5</td>
<td>4.5-5.5</td>
<td>5.5-7.0</td>
<td>7-8</td>
</tr>
</tbody>
</table>

* For dense mix the maximum aggregate size allowable shall be 3/8 in. AASHTO M20.

1. Base or bottom course paving for roadways and parking lots shall have maximum aggregate size passing 2 in. sieve, and bitumen content of 4.5% ± 1/2% by weight.
2. Binder course paving for roadways and parking lots shall have maximum aggregate size passing 1 in. sieve, and bitumen content of 5% ± 1/2% by weight.
3. Top or wearing course paving for roadways and parking lots shall have maximum aggregate size passing 5/8 in. sieve, and bitumen content of 6-1/2% ± 1/2 % by weight.
4. Surface or wearing course paving for sidewalks and shall conform to composition for "Dense Mix".

B. Complete job mix formula, listing quantities and pertinent ingredient properties, shall be submitted to and approved by ENGINEER at least two weeks before work is scheduled to begin.

2.3 BITUMINOUS MATERIALS

A. Bituminous material for prime coat shall be one of the following:
1. Cut-back asphalt (rapid-curing type) conforming to AASHTO M 81, Grade RC-70 or RC-250.
2. Emulsified asphalt rapid-setting type conforming to AASHTO M 140, Grade RS-1.

B. Bituminous material for tack coat shall be emulsified asphalt rapid-setting type conforming to AASHTO M 140, Grade RS-1.

C. Bitumen shall be a rapid-setting type emulsified asphalt conforming to AASHTO M 140, Grade RS-1.

D. Bituminous crack sealer shall be a hot-applied bituminous sealer conforming to Fed. Spec. SS-S-1401.

PART 3 - EXECUTION

3.1 GRADING

A. Areas to be paved will be compacted and brought approximately to subgrade elevation under Section 310000, EARTHWORK before work of this section is performed. Final fine grading, filling, and compaction of subgrade to receive paving to form a firm, uniform, accurate, and unyielding subgrade at required elevations and to required lines, shall be done under this Section.

B. Existing subgrade material which will not readily compact shall be removed and replaced with satisfactory materials. Additional materials needed to bring subgrade to required line and grade and to replace unsuitable material removed shall be material conforming to Section 310000, EARTHWORK.

C. Subgrade of areas to be paved shall be recompacted to bring top 8 in. of material immediately below gravel base course to a compaction of at least 90% of maximum density, as determined by ASTM D 1557, Method D. Subgrade compaction shall extend for a distance of at least 1 ft. beyond pavement edge.

D. Excavation required in pavement subgrade shall be completed before fine grading and final compaction of subgrade are performed. Where excavation must be performed in completed subgrade or subbase, subsequent backfill and compaction shall be performed as directed by the ENGINEER as specified in Section 310000, EARTHWORK. Completed subgrade after filling such areas shall be uniformly and properly graded.

E. Areas being graded or compacted shall be kept shaped and drained during construction. Ruts greater than or equal to 2 in. deep in subgrade, shall be graded out, reshaped, and recompacted before placing pavement.

F. Materials shall not be stored or stockpiled on subgrade.
G. Disposal of debris and other material excavated and/or stripped under this section, and material unsuitable for or in excess of requirements for completing work of this Section shall conform to the following:

1. Material shall be legally disposed of off-site.

H. Prepared subgrade will be inspected and tested by an independent testing agency, provided and paid for by the Contractor, prior to installation of paving base course. Disturbance to subgrade caused by inspection procedures shall be repaired under this Section of the specification.

1. Contractor shall submit a minimum of six (6) Proctor compaction test results indicating conformance to compaction density requirements specified herein.

3.2 AGGREGATE BASE COURSE

A. Aggregate base course for paving and the spreading, grading, and compaction methods employed shall conform to Section 310000, EARTHWORK.

B. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel. Materials spilled outside pavement lines shall be removed and area repaired.

C. Portions of subgrade or of construction above which become contaminated, softened, or dislodged by passing of traffic, or otherwise damaged, shall be cleaned, replaced, and otherwise repaired to conform to the requirements of Section 310000, EARTHWORK before proceeding with next operation.

3.3 SURFACE PREPARATION

A. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

2. Protect primed substrate from damage until ready to receive paving.

3.4 ASPHALTIC PAVING

A. Asphaltic paving mixture, equipment, methods of mixing and placing, and precautions to be observed as to weather, condition of base, and other factors shall conform to MHD Specifications Section 460 Class I Bituminous Concrete Pavement for roadway and parking areas and Section 701 Sidewalks, Wheelchair Ramps, and Driveways for sidewalks.
B. Complete job mix formula, listing quantities and pertinent ingredient properties, shall be submitted to and approved by Architect at least two weeks before work is scheduled to begin.

C. Asphaltic base, binder, and wearing courses shall each be applied individually, in single lifts of full thickness indicated on the Drawings.

D. Work shall not be performed during rainy weather or when temperature is less than 40o F. or 60o F. as indicated in Paragraph 1.06.

E. Adjacent work shall be protected from stain and damage during entire operation. Damaged and stained areas shall be replaced or repaired to equal their original condition.

F. Existing paved surfaces to be resurfaced shall be cleaned of foreign and objectionable matter with blowers, power brooms, or hand brooms immediately before applying bituminous pavement. Cracks shall be cleaned and bituminous crack sealer applied to fully seal pavement.

G. The surface of the pavement to be resurfaced shall receive a bituminous prime coat before laying asphaltic binder course. Prime coat shall be applied at rate which will leave asphaltic residue of 5 to 7 gal./100 sq. yd. after evaporation of vehicle. Base surface shall be dry and clean when prime coat is applied. Asphaltic paving material shall not be placed until vehicle has completely evaporated from prime coat. Adjoining new paving shall be placed before prime coat has dried or dusted over.

H. Deliveries shall be timed to permit spreading and rolling all material during daylight hours, unless artificial light, satisfactory to Architect, is provided. Loads which have been wet by rain or otherwise will not be accepted. Hauling over freshly laid or rolled material will not be permitted.

I. Placing and rolling of mixture shall be as nearly continuous as possible. Rolling shall begin as soon after placing as mixture will bear the operation without undue displacement. Delays in rolling freshly spread mixture will not be permitted. Rolling shall proceed longitudinally, starting at edge of newly placed material and proceeding toward previously rolled areas. Rolling overlap on successive strips shall be greater than or equal to 1/2 width of roller rear wheel. Alternate trips of roller shall be of slightly different lengths. Corrections required in surface shall be made by removing or adding materials before rolling is completed. Skin patching of areas where rolling has been completed will not be permitted. Course shall be subjected to diagonal rolling, crossing lines of the first rolling while mixture is hot and in compactable condition. Displacement of mixture or other fault shall be corrected at once by use of rakes and application of fresh mixture or removal of mixture. Rolling of each course shall be continued until roller marks are eliminated.
Roller shall pass over unprotected edge of course only when paving is to be discontinued for sufficient time to permit mixture to become cold.

J. In places not accessible to roller, mixture shall be compacted with hand tampers. Hand tampers shall weigh at least 50 lb. and shall have a tamping face less than or equal to 100 sq. in. Mechanical tampers capable of equal compaction will be acceptable in areas in which they can be employed effectively.

K. Portions of pavement courses which become mixed with foreign material or are in any way defective shall be removed, replaced with fresh mixture, and compacted to density of surrounding areas. Asphaltic material spilled outside lines of finished pavement shall be immediately and completely removed. Such material shall not be employed in the work.

L. Joints shall present same texture, density, and smoothness as other sections of the course. Continuous bond shall be obtained between portions of existing and new pavements and between successive placements of new pavement. New material at joints shall be thick enough to allow for compaction when rolling. Compaction of pavement, base, and subgrade at joints shall be such that there is no yielding of new pavement relative to existing pavement when subjected to traffic.

M. Contact surfaces of previously constructed pavement (if greater than or equal to seven days since binder placed), manholes, and similar structures shall be thoroughly cleaned and painted with a thin uniform coating of bitumen immediately before fresh mixture is placed. Tack coat shall be applied at rate which will leave asphaltic residue of 5 to 7 gal./100 yd.2 after evaporation of vehicle. Base surface shall be dry and clean when tack coat is applied. Asphaltic paving material shall not be placed until vehicle has completely evaporated from tack coat. Adjoining new paving shall be placed before tack coat has dried or dusted over.

N. Earth or other approved material shall be placed along pavement edges in such quantity as will compact to thickness of course being constructed, allowing at least 1 ft. of shoulder width to be rolled and compacted simultaneously with rolling and compacting surface. Pavement edge shall be trimmed neatly to line before placing earth or other approved material along edge.

1. After final rolling, vehicular traffic shall not be permitted on pavement until it has cooled and hardened, and in no case less than six hours.

O. Variations in smoothness of finished surface shall be less than or equal to the following tolerances when tested with a 10 ft. straightedge, applied both parallel to and at right angles to centerline of paved area.

1. For roadway and parking pavement surface course - 1/4 in. in 10 ft.
2. For sidewalk pavement surface course - 1/4 in. in 10 ft.
3. At joint with existing pavement, and at other locations where an essentially flush transition is required, pavement elevation tolerance shall not exceed 0.01 ft.
4. At other areas pavement elevation tolerance shall not exceed ± 0.05 ft.
5. Irregularities exceeding these amounts or which retain water on surface shall be corrected by removing defective work and replacing with new material conforming to this Section.

3.5 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.6 REPAIRS TO EXISTING PAVEMENT

A. Subgrade shall be done in strict accordance with Paragraph 3.01, above.

B. Aggregate base course shall be replaced in strict conformance with Paragraph 3.02, above.

C. Asphaltic concrete paving mixture, equipment, and methods of mixing and placing shall conform to MHD Specifications Section 472 for Bituminous Concrete for Patching, and Paragraph 3.03, above.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
   1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.
   1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
   2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
      a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than 3 cores taken.
      b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION 321216