

SECTION 321000

BASES, BALLASTS, AND PAVING

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
  - 1. Bituminous Concrete Pavements.
  - 2. Cold-planing of pavements.
  - 3. Installing Pavement Markings.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
  - 1. Section 312000, Earth Moving.

1.3 SUBMITTALS

- A. Refer to Section 013300 - Submittals for submittal provisions and procedures.
  - 1. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.
  - 2. Submit shop drawings for curbing items.

1.4 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this Section to the extent referenced herein:
  - 1. ASTM: American Society for Testing and Materials.
  - 2. AASHTO: American Association of State Highway and Transportation Officials.
  - 3. ACI: American Concrete Institute.
  - 4. MUTCD: Manual on Uniform Traffic Control Devices.

5. Reference is made herein to the Commonwealth of Massachusetts, Department of Transportation (MassDOT), formerly Massachusetts Highway Department (MHD) *Standard Specifications for Highways and Bridges*, latest edition, hereinafter referred to as the "Standard Specifications". All references to method of measurement, basis of payment, and payment items in the "Standard Specifications" are hereby deleted. References made to particular sections or paragraphs in the "Standard Specifications" shall include all related articles mentioned therein.
6. Commonwealth of Massachusetts, Massachusetts Highway Department, Construction Standards, latest Edition with amendments, hereinafter referred to as the "Construction Standards."
7. City of Lowell Regulations.

#### 1.5 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.
- B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

#### 1.6 WEATHER CONDITIONS

- A. Weather Limitations: Apply prime and tack coats when ambient temperature is above 50° F (10° C), and when temperature has not been below 35° F (1° C) for 12 hours immediately prior to application. Do not apply when base surface is wet or contains an excess of moisture.
- B. Spread asphalt concrete courses when atmospheric temperature is above 40° F (4° C), and when base surface is dry. Base course may be placed when air temperature is above 30° F (-1° C) and rising.

### PART 2 – PRODUCTS

#### 2.1 MATERIALS

- A. Subgrade base course material shall conform to the applicable subsections of Section 312000, Earth Moving of this Specification.
- B. Bituminous Concrete Base Course shall conform to the applicable subsections of Section 420, Class I Bituminous Concrete Base Course, Type I-1 of the "Standard Specifications".
- C. Bituminous Concrete Pavement shall conform to the applicable subsections of Section 460, Class I Bituminous Concrete Pavement, Type I-1 of the "Standard Specifications."

- D. Cement Concrete Pavement shall achieve a 28 day minimum compressive strength of 4,000 psi, and conform to the applicable subsections of Section M4 of the "Standard Specifications".
- E. Lane Marking Paint: Fast Drying White Water-borne Traffic Paint and Fast Drying Yellow Water-borne Traffic Paint as specified in the "Standard Specifications" under Sections M7.01.23, and M7.01.24, respectively.

## 2.2 RECLAIMED BASE COURSE

- A. The work under this item shall consist of scarifying and pulverizing in place the existing asphalt pavement and underlying material, mixing and blending the material, and spreading and compacting the mixture to the lines and grades shown on the Contract Drawings.
- B. Equipment such as rear-mounted ripper crushers and cold planing/milling equipment will not be permitted to perform the work under this item.
- C. Prior to scarifying and pulverizing the pavement, the Contractor shall locate, protect, or remove all drainage and utility structure castings. All lowered structures shall be protected and covered by a steel plate and all watergates shall be covered as well to prevent any materials from falling into the bottom sections. All materials that fall into any structures as a result of the Contractor's operations shall be removed by the Contractor at no additional cost.
- D. The existing full bituminous pavement structure and underlying base materials shall be simultaneously crushed, pulverized, and blended into a homogenous material to create the following gradation (M1.09.0):

<u>Sieve Designation</u>	<u>Percent Passing</u>
3-inch	100
1½-inch	70-100
¾-inch	50-85
No. 4	30-60
No. 50	8-24
No. 200	0-10

- E. The construction operation shall be performed in such a manner as to allow for continuous vehicular access as required by the project schedule. Emergency vehicular access shall be maintained at all times.

## 2.3 GRANITE CURB

- A. Granite curb shall be light gray in color, free of seams and other imperfections, which would affect its structural integrity. The front face of the stone shall be at right angles to the plane of the top and the ends and shall have a smooth surface. The ends of the stones shall be square with the planes of the top and front face to provide flush joints. Top surface shall be sawn cut with a split front face.
- B. Granite curb inlet shall be 6 feet in length, ± ½ inch, from 17 to 19-inches in depth, 6 inches wide at the top and at least 6 inches wide at the bottom.

- C. A gutter mouth at least 3 inches in depth and at least 2 feet in length shall be cut in the front face of the stone as shown on the plans.

## 2.6 EXPANSION JOINT FILLER AND SEALANT

- A. Expansion joint filler strips shall conform to the requirements of AASHTO M-33.
- B. Joint sealant shall be a self-leveling, gun-grade, non-staining, polyurethane-based material which cures at ambient temperature to a firm flexible tear resistant rubber made specifically for its intended use. The color shall be concrete gray.

## 2.7 AUXILIARY MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1752, cork or self-expanding cork.
- B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- C. Pavement-Marking Paint: Acrylic/latex type, low VOC, water-borne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes.
  - 1. Color: As indicated.

## PART 3 – EXECUTION

### 3.1 GENERAL

- A. Subbase under paving shall be compacted as described in Section 312000, Earth Moving. Add material meeting the requirements of ordinary borrow to bring the subgrade to the required grade as necessary before placing base course.
- B. The gravel base course shall be spread in layers upon the prepared subgrade conforming to the required line and grade. Gravel shall be placed in compacted layers not more than 4 inches thick compacted to not less than 95 percent of the maximum dry density of the material. Any stone greater than 3 inches in size shall be removed. Compaction shall continue until the surface is even and true to line and grade.
- C. Gravel base course shall be placed on backfilled and compacted trenches to proper grade before placement of pavement.
- D. The edges of existing pavement that is to remain shall be saw cut to an even, straight edge using a power-driver rotary saw; use of a jackhammer is unacceptable. This includes road, parking lot, sidewalk, and utility trench edges.
- E. Bituminous concrete courses shall be spread and compacted to the finished thicknesses as shown on the Contract Drawings. A smooth even surface shall be produced.

- F. Any joints at junctions of old and new pavements shall be sealed with a hot poured rubber asphalt sealer and covered with sand.

### 3.2 COLD-PLANING

- A. This work consists of removing bituminous or cement concrete pavements by use of a cold planer in areas designed on the Contract Drawings. The cold planer must be equipped with an elevating device capable of loading planed material directly into dump trucks while operative. It shall have all the necessary safety devices, such as reflectors, headlights, taillights, flashing lights, and backup signals so as to operate safely in traffic both day and/or night.
- B. The cold planer shall be designed and built for planing flexible pavements and possess the ability to plane cement concrete patches when encountered in bituminous pavement. It shall be self-propelled and have the means for planing without tearing or gouging the underlying surface. Variable lacing patterns shall be provided to permit a rough grooved or smooth surface as directed.
- C. The cold planer shall be able to make up to a 3 inch cut or any specified lesser depth may be required in one pass. The minimum width of pavement planed in each pass shall be 6 feet, except in areas to be trimmed and edged. The machine shall be adjustable as to crown and depth and meet the standards set by the Air Quality Act for noise and air pollution.
- D. The planed surface shall conform to the grade and cross-slope required. The surface shall not be torn, gouged, shoved, broken, or excessively grooved. It shall be free of imperfections in workmanship that prevent resurfacing after this operation. Surface texture shall be as specified by the Engineer and excess material shall be removed so the surface is acceptable to traffic if required.

### 3.3 CURBING

- A. Construct curbing of the type (M9.04.5) and at the locations shown on the Contract Drawings.
- B. Construct curbing in accordance with the details shown on the Contract Drawings.
  - 1. The foundation for curb shall consist of gravel spread upon the subgrade and after being thoroughly compacted shall be 6 inches in depth. The bottom of the curbstones shall be fully seated and supported on the compacted subgrade.
  - 2. The joints between curbstones shall be carefully filled with cement mortar and neatly pointed on all exposed surfaces.
  - 3. After pointing, the curbstones shall be cleaned of all excess mortar.
- C. After curbing is in place at the line and grade shown on the Contract Drawings backfill and compact equally on both sides with subbase course material as specified in Section 312000, Earth Moving. Compaction shall be by vibratory, hand-operated equipment and shall achieve the same density as specified for subbase course in Section 312000, Earth Moving.

### 3.4 SURFACE PREPARATION

- A. Proof Roll the prepared subbase. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving.

### 3.5 PLACING MIX

- A. General: Spread bituminous concrete mixture on prepared surface, spread and strike-off. Spread mixture at minimum temperature of 225°F (107°C). Place inaccessible and small areas by hand. Place each course to required grade, cross-section, and compacted thickness. Protect all adjacent construction from staining with mix or damage by mechanical equipment. Clean, repair or replace any construction stained or damaged at no additional cost to the Owner.
- B. Paver Operation: Spread bituminous in strips not less than 10-feet wide, unless otherwise acceptable to Engineer. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for a section before placing surface course.
- C. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density and smoothness as other sections of bituminous concrete course. Clean contact surfaces and apply Hot Poured Rubberized Asphalt Sealer.
- D. Coat surfaces of watergate covers, gas gate covers, manhole covers and catch basin grates with a release agent to prevent bond with asphalt pavement.
- E. The equipment for spreading bituminous concrete shall be mechanical, self-powered pavers capable of spreading and finishing the mixture true to line, grade, width, and crown by means of fully automated controls for both longitudinal and transverse slope.
- F. The pavers shall operate while bituminous mixture is being spread at a speed that will produce a uniform surface texture free of any rippling or unevenness.
- G. The mixtures shall be placed and compacted only at such times as to permit the proper inspection and checking by the Engineer or Owner's Representative.
- H. The mixtures shall only be placed in the work when they can be efficiently and satisfactorily placed by the methods stipulated herein. Unless otherwise permitted by the Engineer or Owner's Representative for special conditions, only machine methods of placing shall be used.
- I. No mixture shall be placed unless the breakdown and intermediate rolling can be completed by the time the material has cooled to 170°F and provided that the density of the completed pavement attains at least 95 percent of the laboratory compacted density.
- J. The mixtures shall be placed only upon approved surfaces that are clean from foreign materials and dry and when weather conditions are suitable. The Engineer or Owner's Representative may, however, at the entire responsibility of the Contractor, permit work to continue when overtaken by sudden rain, but only with material that may be in transit from the plant at the time and then only when the temperature of the mixture is within the temperature limits specified and the existing surface on the

roadway is not excessively wet.

- K. The bituminous concrete shall be placed in course depths as shown in the Contract Drawings, as specified and as directed by the Engineer.
- L. When an existing surface or new base upon which the bottom course is to be placed contains unsatisfactory irregularities, in the Engineer's or Owner's Representative's judgment, such irregularities shall be eliminated by an adequate placing and compaction of mixture so as to furnish a surface with true contour and grade before placing any specified course of mixture.
- M. Special attention shall be given to proper testing of the surface of each course with a straightedge. The finished surfaces shall be even and uniform throughout.
- N. Any mixture that becomes loose or broken, mixed with dirt, or in any way defective shall be removed and replaced with new mixture that shall be compacted to conform to the surrounding area. Areas of one square foot or more showing an excess of bitumen shall be removed and replaced.
- O. Immediately after any course is screened and before roller compaction is started, the surface shall be checked, any irregularities adjusted, any accumulation from the screed removed by rake or lute, and all fat spots in any course removed and replaced with satisfactory material. Irregularities in alignment and grade along outside edges shall be corrected by the addition or removal of mixture before the edges are rolled. Indiscriminate casting of mix on the new screened surface, where irregularities are not evident, shall not be permitted.
- P. Spreading by hand methods will be permitted only for particular locations in the work that, because of irregularity, inaccessibility, or other unavoidable obstacles, do not allow mechanical spreading and finishing.

### 3.6 ROLLING

- A. General: Begin rolling when mixture will bear roller weight without excessive displacement.
- B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
- C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.
- D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.
- E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.
- F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut-out such areas and fill with fresh, hot bituminous concrete. Compact by rolling to match the surrounding surface density and smoothness.

- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked by wheel traffic.
- I. After the paving mixture has been properly spread, initial compaction shall be obtained by the use of power rollers. The rollers shall be steel wheeled supplemented with pneumatic-tired rollers where required or where permitted by the specifications, vibratory rollers.
- J. Steel wheel rollers for initial and intermediate rolling shall have a weight of not less than 240 pounds per inch width of tread.
- K. Each roller shall be operated by a competent, experienced roller operator and shall be kept in as nearly continuous operation as practicable while work is underway. The mixture shall be rolled longitudinally, diagonally, and transversely as may be necessary to produce the required contour for surface. Longitudinal rolling shall start at the side and proceed toward the center of the pavement, except on superelevated pavements where the rolling shall begin on the low side and progress to the high side, overlapping on successive trips by at least 12 inches. The rolling shall be continued and so executed that all roller marks, ridges, porous spots, and impressions are eliminated and the resulting surface has the required grade and contour. The motion of the rollers shall at all times be slow enough to avoid any displacement of the hot mixture. Any displacement or marring of the surface occurring as a result of reversing the direction of the rollers, or from any other cause, shall be corrected. To prevent adhesion with the mixture, the wheels of the steel rollers shall be kept lightly moistened with water, but excess water will not be permitted. The use of oil for this purpose will not be allowed.
- L. Along curbs, structures, and all places not accessible with a roller, the mixture shall be thoroughly compacted with mechanical tamping devices. The surface of the mixture after compaction shall be smooth and true to the established line and grade.
- M. Placing of the mixture shall be as nearly continuous as possible and the roller shall pass over the unprotected end of the newly placed mixture only when the placing of the course is to be discontinued for such length of time as would permit the mixture to attain initial stability. In all such cases, including the formation of joints, provision shall be made for proper bond with the new surface for the full specified depths of the courses.
- N. The maximum length of longitudinal joint shall be such that the temperature of the mixture of the joint shall be not less than 200°F when abutting mixture is placed.
- O. If the paving sequence or other conditions cause the joint temperature to fall below 200°F, the joint shall be treated prior to laying the next lane of bituminous concrete as follows:
  - 1. The joint shall be coated with a hot poured rubberized asphalt sealant meeting the requirements of Federal Specification SS-S-1401 or SS-S-164.
- P. Longitudinal and transverse joints shall be made in a careful manner, well bonded and sealed, and true to line and grade.

- Q. In making joints along any adjoining edge, such as curb, gutter, or an adjoining pavement, and after the mixture is placed by the mechanical spreader, just enough of the hot material shall be placed by hand method to fill any space left open. These joints shall be properly “set-up” with the back of a rake at the proper height and level to receive the maximum compaction. The work of “setting-up” these joints shall be performed only by competent workmen.
- R. Where and as directed, the first width of any course shall be placed not less than 1 foot wider than the first width of top course and successive widths of top and as any other courses shall be so placed that there will be at least a 1-foot overlap between the joints in the top course and the other course.
- S. The rolling of the successive widths of courses shall overlap and shall be performed so as to leave smooth, uniform joints and cross-sections.

### 3.7 PAVEMENT MARKINGS

- A. The work under this Item shall be in conformance with Section 860 of the Standard Specifications and the Manual on Uniform Traffic Control Devices (MUTCD), current edition.
- B. Cleaning: Sweep and clean surface thoroughly to remove loose material and dust. Markings shall be placed no earlier than 48 hours after the placement of the bituminous concrete top course and at temperatures above 45° F.
- C. Apply paint with mechanical equipment to produce uniform straight edges. Lines to be applied at the width and color designated in the Contract Drawings. The Contractor shall establish reference lines for the proper layout of all markings. Apply in two coats at manufacturer's recommended rates. Furnish and place all barricades necessary to prevent tracking of wet paint by vehicles and pedestrians.
- D. While the paint is still wet reflectorized glass beads shall be evenly applied at the rate of 6 pounds per gallon of paint.

### 3.8 FIELD QUALITY CONTROL

- A. Test in-place asphalt and cement concrete courses for compliance with tolerance requirements. Repair or remove and replace unacceptable paving as directed by Engineer or Owner's Representative. In-place surfaces will not be acceptable if exceeding the allowable variation from the following required tolerances:
  - 1. Thickness: Plus ¼-inch.
  - 2. Sidewalk Elevation: ⅛-inch, plus or minus.
  - 3. Roadway Elevation: ¼-inch, plus or minus.
  - 4. Expansion Joint Width: Plus ⅛-inch.
  - 5. Surface: Gap below 10-foot-long straightedge, ⅛-inch.

B. Compaction

1. The bituminous mixture shall be compacted to at least 95% of the density achieved on the laboratory testing of the design mix for the project.
2. Density will be checked by the Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods, ASTM 2950 at the Contractor's expense.

- C. Guarantee: During the one year guarantee period, the Contractor shall maintain the surfacing and shall promptly fill with similar material in compliance with the above specifications, any depressions and holes that may occur so as to keep the surfacing in a safe and satisfactory condition for traffic.

END OF SECTION 321000