Congaree National Park
Cowpens National Battlefield
Kings Mountain National Military Park
Ninety-Six National Historic Site

STATE OF SOUTH CAROLINA

SC192 PAVEMENT PRESERVATION (DD-CD'S)

CONG	COWP	KIMO	NISI
334914	334929	334920	334915

PROJECT SPECIFICATIONS

NATIONAL PARK SERVICE (NPS)
DENVER SERVICE CENTER (DSC)

February 2026

NPS DSC Divisions 2 through 49 Specifications
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National Park Service (NPS) - Denver Service Center (DSC) | 1-28-22

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DIVISION 02

EXISTING CONDITIONS

SECTION 02 41 00 – SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for removal of concrete, asphalt pavement, **curbs, curb stops, and signage (including incidental reinforcement, fasteners and foundations)** as indicated on the drawings and in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

C. Work Includes:

1. Demolition and removal of asphalt, concrete, **and miscellaneous curb, curb stops, and signage of roadways and parking lots**.
2. Containment & Removal of debris.

1.2 QUALITY ASSURANCE

A. Conduct work in accordance with OSHA and EPA requirements.

B. National Fire Protection Association (NFPA):

1. NFPA 241 Standards for Safeguarding Construction, Alteration, and Demolition Operations.

C. Design, engineering, and construction of containment system for shotcrete removal, bracing, temporary supports, and debris containment control measures are responsibility of Contractor.

1.3 JOB CONDITIONS

A. Perform preliminary site investigations prior to submitting a bid proposal to ascertain extent of work.

1. Conditions apparent by investigation shall not be allowed as claim for extra cost.

B. Obtain and pay for permits that may be required by authorities having jurisdiction and notify interested utilities companies prior to commencement of activities.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 GENERAL DEMOLITION PROCEDURES

A. **Miscellaneous Demolition**:

1. **Remove timber curb, rubber curb stops, and signage as indicated on plans. All materials shall be removed from the site and disposed in accordance with all local, state and federal regulations**.

B. Demolition Of Pavements, Slabs and Walks:

1. Remove miscellaneous concrete items as shown on plans. Where concrete to be removed abuts concrete to remain, pavement shall be uniformly saw-cut along an existing joint. Jagged or crooked edges will not be acceptable.
2. Remove miscellaneous asphalt items as shown on plans including but not limited to: asphalt paved roads, parking lots, walks, curbs and miscellaneous asphalt. Cuts between pavement to be removed and pavement to remain shall be saw-cut to full depth, straight, smooth, and clean with no jagged edges. Asphalt shall be broken up, hauled, and disposed off-site. All recyclable materials shall be hauled to nearest recycling center and any non-recyclable materials shall be hauled to an approved Disposal Site designated by the CO.

C. Existing Concrete and Asphalt Removal:

1. Existing roadway materials shall be pulverized, maintained on-site for re-use as fill to raise existing grades immediately under the proposed roadway.
2. Asphalt and concrete removed not intended for re-use either for recycled asphalt pavement or pulverized for fill, shall be removed from the site and **disposed in accordance with all local, state and federal regulations**.

D. Conduct operations to ensure minimum interference with roadway and adjacent facilities.

1. Do not obstruct or close roadway, adjacent pullouts and shoulders without CO approval.

E. All demolition activities shall prevent demolition materials and any other debris from entering the waterways.

F. Provide barricades and safety lights as required.

3.2 PROTECTION OF FACILITIES TO REMAIN

A. Protect all site facilities designated to Remain:

1. Conduct operations to prevent damage to roadway and by falling debris or other cause to structures, and other facilities as well as persons. Contractor to submit methods of debris containment for approval

3.3 CLEAN-UP AND DISPOSAL OF DEMOLITION MATERIALS

A. Remove debris, rubbish, and materials resulting from demolition operations.

1. Remove and legally dispose of off-site.
2. Do not burn materials on site.

B. Dispose of items and materials not designated for salvage or reuse.

1. Promptly remove from site.
2. Do not store or sell Contractor salvaged items or materials on site.

C. Clean adjacent improvements of dust, dirt, and debris caused by demolition operations.

D. Return adjacent areas to condition existing prior to start of work.

END OF SECTION 02 41 00

DIVISION 10

SPECIALTIES

SECTION 10 14 53 – TRAFFIC SIGNAGE

PART 1 – GENERAL

1.1 DESCRIPTION

A. This work consists of constructing permanent traffic control signs and removing and resetting permanent traffic control devices.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Aluminum Panels. Conform to ASTM B 209, alloy 6061-T6 or 5052-H38.

Fabricate all temporary panels and those permanent panels that are 30 by 30 inches or smaller from 0.080-inch thick aluminum sheets. Fabricate larger permanent panels from 0.125-inch-thick aluminum sheets.

The blanks shall be free from laminations, blisters, open seams, pits, holes, or other defects that may affect their appearance or use. The thickness shall be uniform, and the blank shall be commercially flat. Perform shearing, cutting, and punching before preparing the blanks for reflective material application.

Clean, degrease, and chromate the blanks, or otherwise properly prepare the panels, according to the methods recommended by the sheeting manufacturer.

B. Signposts. Furnish wood, steel, or aluminum signposts as specified.

1. Wood posts. Furnish posts from dry no. 1 grade Douglas fir, southern or Ponderosa pine, hemlock, spruce, or western larch conforming to AASHTO M 168. Treat the posts with a water-borne preservative, ACA or ACZA, or in accordance with AWPA Standard C14, except that the minimum preservative retention is 0.40 pounds per cubic foot.

C. Hardware. For lag screws, washers, clip angles, wood screws, shear plates, U-bolts, clamps, bolts, nuts, and other fasteners, use galvanized steel or aluminum alloy.

High-strength steel bolts, nuts, and washers conform to AASHTO M 164 or M 253. Galvanize steel hardware in accordance with AASHTO M 232.

For aluminum alloy bolts, nuts, and washers, conform to Specifications for Aluminum Structures.

Furnish oversize bolt heads and oversize neoprene or nylon washers for plastic sign panels.

D. Sign panels are designated as aluminum

Sign retroreflective sheeting type conforms to ASTM D 4956 Supplemental Requirement S1, Fungus Resistance, if specified. For reboundable retroreflective sheeting, conform to ASTM D 4956, including Supplemental Requirement S2, Reboundable Sheeting Requirements.

When an adhesive is used, use ASTM D 4956, backing class 1, 2, or 3

E. New wood signposts in CONG will be painted Terra Brun (SW 6048 or similar), with the backs of the signs painted to match.

F. New signposts in COWP, KIMO, and NISI will be painted in NPS Brown MP63848 (See 10 14 53-5), with the backs of the signs painted to match.

PART 3 – EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. General

1. Furnish traffic control devices according to the MUTCD and Standard Highway Signs published by FHWA. Submit the sign list for approval before ordering.

B. Supports

1. Sign locations may be changed to fit field conditions as approved by the Contracting Officer (CO). Determine sign support lengths at the time of staking. Install supports plumb according to the manufacturer's instructions. Make all supports within the clear zone crashworthy.

2. Drive posts with a suitable driving head or set posts in drilled or punched holes. Replace all damaged posts.

3. Construct concrete footings. Excavate and backfill.

a) Place backfill in horizontal layers that, when compacted, do not exceed 6 inches in depth. Compact each layer according to (b) below.

Bring backfill up evenly on all sides of the structure and extend each layer to the limits of the excavation or to natural ground.

Do not place backfill against concrete less than 7-days-old or until 80 percent of the design strength is achieved.

b) Compact material is placed in all layers to at least 95 percent of the maximum density. Determine the in-place density and moisture content according to AASHTO T 310 or other approved test procedures.

Do not apply density requirements as measured by AASHTO T 310 to material that is incapable of being tested or compacted to maximum values determined by AASHTO T 99. For these materials, fill the voids around the rock in each layer with earth or other fine material. Compact each layer, full width, until there is no visible evidence of further consolidation.

C. Panels

1. Use type III, VII, VIII, or IX retroreflective sheeting. For permanent sign panels, use type L-1 letters, numerals, arrows, symbols, and borders. Cut panels to size and shape and drill or punch all holes. Make panels flat and free of buckles, warp, dents, cockles, burrs, and other defects.

2. Clean and degrease the face of metal panels using methods recommended by the retroreflective sheeting manufacturer. Abrade, clean, and degrease the face of the plywood panels using methods recommended by the retroreflective sheeting manufacturer. Treat the edges of the plywood panel with an approved edge sealant. Apply the retroreflective sheeting material to the panels. Package sign panels in protective material and transport them in a vertical position.

3. Mount sign panels with the legend horizontal. Where multiple panels adjoin, limit the gap between adjacent panels to 1/16 inch. To reduce specular glare (mirror reflection), turn the sign panel 3 degrees away from the road in the direction of travel

4. Use oversized bolt heads and neoprene or nylon washers for fastening plastic sign panels.

5. Do not field drill holes in any part of the panel. Use anti-theft fasteners where possible. Paint all bolt heads, screw heads, and washers that are exposed on the sign face. Match the paint color to the background or message area color at the point where the fitting is exposed.

6. If a sign message is not applicable, completely cover the face of the sign with an opaque material. Maintain the covering in good condition until the message becomes applicable. Do not use adhesive tape on the sign face.

7. Repair or replace damaged parts, including sheeting.

D. Removing and Resetting Permanent Traffic Control Devices

1. Remove and store the existing signs, delineators, and object markers. Replace all devices, posts, and hardware that are damaged during removal, storage, or raising.

E. Acceptance

1. Material (including signs, panels, retroreflective sheeting, supports, delineators, object markers, and hardware) for traffic control devices will be evaluated under Subsections 01 90 00.

2. Installation of traffic control devices will be evaluated under Subsections 01 40 00, 01 90 00, and 34 01 00.

NPS Brown MP63848
PMS Black 4
C41 M57 Y72 K90

END OF SECTION 10 14 53

DIVISION 31

EARTHWORK

SECTION 31 23 10 – EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Earthwork - excavation, backfilling, compaction, disposal of waste and surplus materials, placing structural fill, placing crushed stone, placing surface course, shoring, bracing, and other Earthwork related work.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 31 25 00 – Erosion and Sediment Control.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. C33, Standard Specification for Concrete Aggregates.
   b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 FT-LBF/CU FT).
   c. D1241, Standard Specification for Material for Soil-Aggregate Subbase, Base, and Surface Courses.
   d. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 FT-LBF/CU FT(2,700 kN-m/m)).
   e. D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   f. D3786, Standard Test Method for Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method.
   g. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   h. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   i. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

2. American Association of State Highway and Transportation Officials (AASHTO)
   a. M 43, Standard Specification for Sizes of Aggregate for Road and Bridge Construction.
   b. M 57, Standard Specification for Materials for Embankment and Subgrades.
   c. M 147, Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base, and Surface Courses.

B. Federal Regulations:

1. Occupational Safety and Health Administration (OSHA):

   a. 29 CFR Part 1926.650, Occupational Safety and Health Standards, referred to herein as OSHA Standards.

1.4 DEFINITIONS

A. Contracting Officer (CO): Individual designated and authorized in writing to perform specific technical or Administrative Functions.

B. Excavation:

1. Consists of removal of material encountered to subgrade elevations required or indicated.
2. Includes excavation of soils; pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; boulders; and rock.

C. Foundations: Footings, base slabs, foundation walls, and any other support placed directly on soil or rock.

D. Non-Structural Fill/Backfill: Soil materials placed and compacted to achieve finish grade elevations that do NOT support foundations, slabs, paving, or other flatwork.

E. Structure: Bridges, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

F. Subgrade: The earth or soil layer immediately below foundation bearing elevation, subbase material, fill material, backfill material, or topsoil materials.

G. Unauthorized Excavation:

1. Consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of CO.
   a. Unauthorized excavation, as well as associated remedial work as directed by CO, shall be at Contractor's expense.

H. Unsuitable Soil Materials: Soil materials encountered at or below subgrade elevation of insufficient strength and stiffness to support construction as determined by the CO.

1.5 SUBMITTALS

A. Product Data:

1. Acknowledgement that products submitted meet requirements of standards referenced.
2. Manufacturer's installation instructions.
3. Certifications.
4. Test reports.
   a. Report and certification of materials.
   b. Test reports on borrow material.
   c. Certification that all imported material is weed free.
   d. Verification of suitability of each material, in accordance with specified requirements.
   e. Field reports; in-place soil density and moisture tests.
   f. One optimum moisture-maximum density curve for each type of soil encountered.
   g. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

B. Samples:

1. Coordinate samples and testing for approval of off-site materials with the CO.

1.6 PROJECT CONDITIONS

A. Dispose of waste materials, legally, off site.
   1. Burning and burying, as a means of waste disposal, is not permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill:

1. Selected material approved from site excavation or from off-site borrow. Alternative South Carolina DOT backfill materials that meet the their gradation and property requirements can be submitted to the CO for approval.
2. Backfill:
   a. Structural Backfill
      1) Free of organic matter, frozen material and debris.
      2) Properties:
         a) For material passing the No. 4 sieve, the liquid limit must not exceed 35 (as determined by AASHTO T89), and the plasticity index must not exceed 6.
      3) Gradation:

SIEVE SIZE	% PASSING
2 INCH	100
NO. 4	30-100
NO. 50	10-60
NO. 200	5-20

   b. Surface course aggregate

1) Furnish hard, durable particles or fragments of crushed stone, crushed slag, or crushed gravel conforming to the following:

2) Properties:
   a) Liquid limit must not exceed 35 (as determined by AASHTO T89).
   b) Plasticity index shall be 6 (AASHTO T90).
   c) Los Angeles abrasion must not exceed 50% (AASHTO T96)
   d) Soundness of aggregate using sodium sulfate must not exceed 12% loss
   e) (AASHTO T104, 5 cycles).
   f) Durability index (coarse) must not be less than 35 (AASHTO T210).
   g) Durability index (fine) must not be less than 35 (AASHTO T210).
   Free of organic matter, frozen material and debris.

3) Gradation:

SIEVE SIZE	% PASSING
1 INCH	100
½ INCH	70-80 (5)
NO. 4	40-50 (7)
NO. 10	25-40 (6)
NO. 40	15-25 (5)
NO. 200	8.0-14.0 (4)

() The value in the parentheses is the allowable deviation (+/-) from the target values.

c. Washed Drain Rock
   1) Free of organic matter, frozen material and debris.
   2) Material shall be washed.
   3) Gradation:

SIEVE SIZE	% PASSING
2 INCH	100
NO. 4	30-100
NO. 50	10-60
NO. 200	5-20

B. Filter Material:

1. Free draining sand, gravel, slag, or crushed stone.

PART 3 - EXECUTION

3.1 PROTECTION

A. Erosion Control:

1. See Specification Sections 01 57 23 and 31 25 00.

2. Clean paved roadways daily of any spillage of dirt, rocks or debris from vehicles and equipment entering or leaving site.
3. Conduct work to minimize erosion of site. Remove eroded material washed off site.
   a. If necessary or requested by CO, construct stilling areas to settle and detain eroded material.

B. Protect existing surface and subsurface features on-site and adjacent to site as follows:

1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
2. Protect and maintain bench marks, monuments or other established reference points and property corners.
   a. If disturbed or destroyed, replace at own expense to full satisfaction of CO and controlling agency.
3. Verify location of utilities.
   a. Omission or inclusion of utility items does not constitute nonexistence or definite location.
   b. Secure and examine local utility records for location data.
   c. Take necessary precautions to protect existing utilities from damage due to any construction activity.
      1) If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
      2) Do not interrupt existing utilities serving facilities occupied by CO or others, during occupied hours, except when permitted in writing by CO and then only after acceptable temporary utility services have been provided.
      3) Obtain CO's approval prior to disconnecting any utility service.
   d. Repair damages to utility items at own expense.
   e. In case of damage, notify CO at once so required protective measures may be taken.
4. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
   a. Protect new and existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
   b. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
   c. All repairs to be made and paid for by Contractor.
5. Provide full access to public premises, sidewalks and other points (unless noted otherwise on the plans) as designated by CO to prevent serious interruption of travel.
6. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on-site or on adjoining property.
7. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.

C. Protection of trees to remain:

1. Perform careful excavation within dripline of large trees designated on Drawings to remain. Protect root systems from damage or dry out to the greatest extent possible.
2. Trees **within 10' of Limit of Work (LOW)** to be protected **with temporary fence/snow fence or otherwise as required by the CO**.

3.2 EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES

A. General:

1. In general, work includes, but is not necessarily limited to, excavation for structures and retaining walls, removal of underground obstructions and undesirable material, backfilling, filling, and fill, backfill, and subgrade compaction.
2. Obtain fill and backfill material necessary to produce grades required.
   a. Materials and source to be approved by the CO.
   b. Excavated material approved by CO may also be used for fill and backfill.
3. In the paragraphs of this Specification Section, the word "soil" also includes any type of rock subgrade that may be present at or below existing subgrade levels.

B. Excavation Requirements for Structures:

1. General:
   a. Do not commence excavation for foundations for structures until CO approves:
      1) The removal of topsoil and other unsuitable and undesirable material from existing subgrade.
      2) Density and moisture content of site area compacted fill material meets requirements of specifications.
   b. CO grants approval to begin excavations.
2. Dimensions:
   a. Excavate to elevations and dimensions indicated or specified.
   b. Allow additional space as required for construction operations and inspection of foundations.
   c. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction.
   d. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
3. Removal of obstructions and undesirable materials in excavation includes, but is not necessarily limited to, removal of old foundations, existing construction, unsuitable subgrade soils, expansive type soils, and any other materials which may be concealed beneath present grade, as required to execute work indicated on Contract Drawings.
   a. If undesirable material and obstructions are encountered during excavation, remove material and replace as directed by the CO.
   b. Remove unsuitable subgrade soils located below foundations. The bottom of the over excavation shall be located outside the exterior limits of foundations around the perimeter of structure the following horizontal distance, whichever is greater:
      1) Distance equal to depth of over excavation below bottom of foundations.
      2) 5 FT.
      3) As directed by CO.
   c. When excavation has reached required subgrade elevations, notify CO, who will make an inspection of conditions.
      1) If CO determines that bearing materials at required subgrade elevations are unsuitable, provide Subgrade Stabilization as specified herein.
4. Construction traffic:
   a. Construction traffic not allowed on native soils to avoid soil disturbance unless approved by the CO.
   b. Repair disturbed subgrade soils prior to placing fill or construction work as directed by CO.

5. Proof-roll all subgrades to receive fill or concrete placement after subgrade has been scarified and compacted.
   a. Proof-roll in the presence of CO with a fully-loaded tandem axle dump truck or other equipment with a minimum gross weight of 25 tons as approved by the CO.
6. Install working surface over approved subgrade (if applicable).
   a. Minimum thickness 12 in.
7. Level off bottoms of excavations to receive foundations, pavement, or compacted fill (if applicable).
   a. Remove loose materials and bring excavations into approved condition to receive hot mixed asphalt, concrete, or fill material.
   b. Where compacted fill material must be placed to bring subgrade elevation up to underside of construction, scarify existing subgrade upon which fill material is to be placed to a depth of 6-inches and then compact to density stated in this Specification Section before fill material can be placed thereon.
   c. Do not carry excavations lower than shown for foundations except as directed by the CO.
   d. If any part of excavations is carried below required depth without authorization, notify CO and correct unauthorized excavation as directed. Corrections may include:
      1) Under soil supported footings, foundation bases, or retaining walls, fill unauthorized excavation as approved by the CO.
         a) Concrete fill may be used to bring elevations to proper position.
      2) In locations other than those above, including slabs on grade, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by CO.
      3) No extra compensation will be made to Contractor for correcting unauthorized excavations.
8. Make excavations large enough for working space, forms, and inspection.
9. Notify CO as soon as excavation is completed in order that subgrades may be inspected. a. Do not commence further construction until subgrade under compacted fill material, under foundations, under floor slabs-on-grade, and under retaining wall footings has been inspected and approved by the CO as being free of undesirable material, being of compaction density required by this specification, and being capable of supporting the allowable foundation design bearing pressures and superimposed foundation, fill, and building loads to be placed thereon.
   b. CO shall be given the opportunity to inspect subgrade below fill material both prior to and after subgrade compaction.
   c. Place fill material, foundations, retaining wall footings, slabs-on-grade, as soon as weather conditions permit after excavation is completed, inspected, and approved and after forms and reinforcing are inspected and approved.
   d. Before concrete or fill material is placed, protect approved subgrade from becoming loose, wet, frozen, or soft due to weather, construction operations, or other reasons.
10. Subgrade stabilization:
   a. If subgrade under foundations, fill material, slabs-on-grade, in a frozen, loose, wet, or soft condition before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved compacted material as directed by CO.
   b. Provide compaction density of replacement material as stated in this Specification Section.
   c. Loose, wet, or soft materials, when approved by CO, may be stabilized by a compacted working mat of well graded crushed stone.

d. Compact stone mat thoroughly into subgrade to avoid future migration of fines into the stone voids.
e. Remove and replace frozen materials as directed by CO.
f. Method of stabilization shall be performed as directed by CO.
g. Do not place further construction on the repaired subgrades, until the subgrades have
been approved by the CO.

11. Protection of structures:
    a. Prevent new and existing structures from becoming damaged due to construction operations or other reasons.
    b. Prevent subgrade under new and existing foundations from becoming wet and undermined during construction due to presence of surface or subsurface water or due to construction operations.
12. Shoring:
    a. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA standards 29 CFR Part 1926.650 Subpart P, and state requirements.
    b. Shore, slope, or brace excavations as required to prevent them from collapsing.
    c. Remove shoring as backfilling progresses but only when banks are stable and safe from caving or collapse.
13. Drainage:
    a. Control grading around structures so that ground is pitched to prevent water from running into excavated areas or damaging structures.
    b. Maintain excavations where fill materials are to be placed free of water.
    c. Provide pumping required to keep excavated spaces clear of water during construction.
    d. Should any water be encountered in the excavation, notify CO.
    e. Provide free discharge of water by trenches, pumps, wells, well points, or other means as necessary and drain to point of disposal that will not damage existing or new construction or interfere with construction operations.
14. Frost protection:
    a. Do not place foundations, slabs-on-grade, equipment support pads, or fill material on frozen ground.
    b. When freezing temperatures may be expected, do not excavate to full depth indicated, unless foundations, slabs, or fill material can be placed immediately after excavation has been completed and approved.
    c. Protect excavation from frost if placing of concrete or fill is delayed.

C. Filling and Backfilling Outside of Structures.
1. This paragraph of this Specification applies to fill and backfill placed outside of structures above bottom level of both foundations and piping but not under paving.
2. Provide material as approved by CO for filling and backfilling outside of structures.
3. Fill and backfill placement:
    a. Prior to placing fill and backfill material, obtain optimum moisture and maximum density properties for proposed material from CO.
    b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.
    c. Compact material with equipment of proper type and size to obtain density specified.
    d. Use hand operated equipment for filling and backfilling within 5 FT of walls and less than 3 FT above pipes.
        1) Compaction equipment exceeding 3000 LBS dead weight shall not be used within 5 FT of the wall as a minimum.

2) Contractor is responsible for method of compaction so as not to damage walls or buried commodities.

e. Use only hand operated equipment for filling and backfilling next to walls and retaining walls.

f. Do not place fill or backfill material when temperature is less than 40 DEGF and when subgrade to receive material is frozen, wet, loose, or soft.

g. Use vibratory equipment for compacting granular material; do not use water.

4. Backfilling against walls:

a. Do not backfill around any part of structures until each part has reached specified 28-day compressive strength and backfill material has been approved.

b. Do not start backfilling until concrete forms have been removed, trash removed from excavations, have been completed.

c. Bring backfill and fill up uniformly around the structures.

D. Backfilling Outside of Structures Under Piping or Paving:

1. When backfilling outside of structures requires placing backfill material under piping or paving, the material shall be placed from bottom of excavation to underside of piping or paving at the density required for fill under piping or paving as indicated in this Specification Section.

2. This compacted material shall extend transversely to the centerline of piping or paving a horizontal distance each side of the exterior edges of piping or paving equal to the depth of backfill measured from bottom of excavation to underside of piping or paving.

3. Provide special compacted bedding or compacted subgrade material under piping or paving as required by other Specification Sections for the Project.

3.3 USE OF EXPLOSIVES

A. Blasting with any type of explosive is prohibited.

3.4 COMPACTION DENSITY REQUIREMENTS

A. Obtain approval from COR with regard to suitability of soils and acceptable subgrade prior to subsequent operations.

B. Provide dewatering system necessary to successfully complete compaction and construction requirements.

C. Remove frozen, loose, wet, or soft material and replace with approved material as directed by the COR.

D. ~~Assure by results of testing that compaction densities comply with the following requirements:~~

~~LOCATION~~	~~COMPACTION DENSITY~~	~~MOISTURE CONTENT~~
~~Inside of structures under foundations, under equipment support pads, under slabs-on-grade and scarified existing subgrade under fill material~~	~~[98% per ASTM D698] [95% per ASTM D698]~~	~~-2 to +3% of optimum~~
~~Outside structures next to walls, piers, columns and any other structure exterior member~~	~~[92% per ASTM D698] [90% per ASTM D698]~~	~~-2 to +3% of optimum~~

3.5 SUBGRADE PROTECTION

A. Obtain approval from CO with regard to suitability of soils and acceptable subgrade prior to subsequent operations.

B. Provide dewatering system necessary to successfully complete compaction and construction requirements.

C. Remove frozen, loose, wet, or soft material and replace with approved material as directed by CO.

D. Stabilize subgrade with well graded granular materials as directed by CO.

3.6 FIELD QUALITY CONTROL

A. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA standards 29 CFR Part 1926.650 Subpart P, and state requirements. Where conflict between OSHA and state regulations exists, the more stringent requirements shall apply.

B. Responsibilities of Contractor:

1. Review proposed materials for fill and backfill around structures.
2. All testing, observation and work indicated as being performed by the Material Testing Firm in this Specification Section.
3. Services will include verification and documentation of satisfactory soil materials, subgrade quality, sampling, placement, moisture conditioning, compaction and testing of proposed soil materials, and field testing for quality control.
4. Moisture density relations, to be established by the Geotechnical Engineer required for all materials to be compacted.
5. Extent of compaction testing will be as necessary to assure compliance with
6. specifications. Prepare and submit inspection and test reports to CO.
7. Test reports to include the following:
    a. Report and certification of aggregate fill and drainage fill.
    b. Test reports on borrow material.
    c. Verification of suitability of each footing subgrade material, in accordance with specified requirements.
    d. Field reports; in-place soil density and moisture tests.
    e. One optimum moisture-maximum density curve for each type of soil encountered.
    f. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.
    g. Other documentation necessary for CO to approve earthwork.
    h. Assist CO to determine corrective measures necessary for defective work.
8. Give minimum of 24 HR advance notice to Material Testing Firm when ready for compaction or subgrade testing and inspection.
9. Should any compaction density test or subgrade inspection fail to meet specification requirements, perform corrective work as necessary.

C. Responsibilities of Testing Agency for Excavation and Backfilling:

1. All required soil testing, observation, and work indicated in this Specification.
2. Services will include verification and documentation of satisfactory soil materials, subgrade quality, sampling, placement, moisture conditioning, compaction and testing of proposed soil materials, and field testing for quality control.
3. Moisture density relations, to be established by the CO required for all materials to be compacted.
4. Extent of compaction testing will be as necessary to assure compliance with specifications.

END OF SECTION 31 23 10

DIVISION 32

EXTERIOR IMPROVEMENTS

SECTION 32 01 11.53 REMOVAL OF EXISTING PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies requirements for removal of existing pavement markings.

PART 2 – PRODUCTS

2.1 MATERIAL

A. Repair material, if necessary, shall be specifically designed to repair medium to large cracks, smooth out rough spots and fill minor depressions. The material shall be a two component liquid consisting of a polymer base with carbon black and an activator. The material when mixed with a fine aggregate and a black topping aggregate forms a repair compound having a compressive strength between 1500 and 3000 psi, flexural strength between 700 and 1025 psi and bond strength between 200 and 360 psi.

PART 3 – EXECUTION

3.1 REMOVAL OF EXISTING PAVEMENT MARKINGS

A. Existing pavement markings shall be removed prior to application of asphalt surface course.

1. Any depression left by pavement marking removal shall be filled to within a 1/16” of the existing pavement surface at no additional cost to the NPS.

2. In no case shall the depression created by the removal operations be greater than ½”.

B. Approved methods of pavement markings removal include:

1. High pressure water.

2. Steam or superheated water.

3. Mechanical devices such as grinders, sanders, scrapers, scarifiers and wire brushers.

C. Painting or paving over a pavement marking line or symbol with asphaltic liquids or paints will not be allowed unless approved by the Contracting Officer.

D. Material deposited on the pavement from removal operations shall be removed as the work progresses. Accumulations of sand or other material which might interfere with drainage or could constitute a hazard to traffic will not be permitted.

3.2 REPAIR OF DEPRESSIONS

A. Repair material, if necessary, shall be placed when the weather is dry, rain is not forecast for 24 hours, and the ambient temperature is above 550F. Repair material shall be protected from traffic until the material has cured and will not track. Additional applications of the patching material may be made after a 24 hour cure.

B. Any depressions created during the removal operations that are greater than ½" shall not be repaired with a troweling material but shall be repaired by milling to 1" depth and repaired with hot mix asphalt.

C. Acceptance

1. Removal of existing pavement markings will be evaluated under Section 01 90 00.

END OF SECTION 32 01 11.53

SECTION 32 01 16.71 – COLD MILLING ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. This work consists of removal of hot mix asphalt (HMA) including cold mix, and/or surface treatment pavement by cold milling; hauling of cuttings; cleaning of asphaltic concrete pavement and concrete pavements (if applicable) in preparation for an overlay in conformity with these specifications, and to the lines, grades, and cross sections shown on the plans or drawings or as established by the National Park Service (NPS) or the Contracting Officer (CO). This work includes milling of intersecting streets to the limits shown on the plans or drawings or as ordered by the CO.

B. All salvaged pavement shall become the property of the Contractor and shall be removed from the site unless otherwise negotiated by the NPS.

C. The Contractor shall visit the site of the proposed work and fully acquaint themselves with the existing conditions relating to construction, labor, and traffic. The Contractor shall be fully informed as to the facilities involved and the difficulties and restrictions regarding the performance of the contract.

D. Areas shall not be left in a milled condition for more than ten (10) calendar days prior to paving, unless otherwise approved by the NPS. The NPS may further restrict the time limits when conditions warrant.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Pavement Profilers: The Contractor shall furnish one (1) or more machine(s) operated by experienced operators. The equipment for removing the pavement surface shall be a cold plaining (milling) machine specifically designed for automatically controlled profiling and adequate to perform the work according to the lines, grades, and tolerances.

1. The Equipment shall be maintained in a satisfactory working condition so as not to cause delays, and the machine must be equipped with taillights, headlights, and necessary reflectors so that it can be operated in traffic with complete safety.

2. Pavement profilers shall have a means of loading by an integral loading belt, and it shall have the ability to cold mill concrete patches when encountered in the pavement.

B. Restrictions: Track-mounted cold milling equipment will be required for primary operations on HMA surfaces in which the Contractor anticipates pavement milling down to within three quarters (3/4) of an inch of an unbound base course. Either track or conventional wheeled milling machines will be acceptable on work requiring only partial-depth milling of the bound

C. materials such that sufficient pavement materials exist after removal to support the cold milling operation. Wheeled machines of sufficient size will be permitted for trimming operations.

Grade Control: The automatic controls on the milling machine shall provide accurately established profile grades at each edge of the machine by referencing from the existing pavement or an independent grade reference, where required, or be capable of automatically maintaining a designated cross slope from a single reference.

1. The milling machine shall be equipped with a built-in automatic grade control system that can control the longitudinal profile and the transverse cross-slope to produce the specified results. The longitudinal controls shall be capable of operating from any longitudinal grade reference, including string line, ski (30 foot minimum), mobile string line (30 foot minimum), or matching shoe. The transverse controls shall have an automatic system for controlling cross-slope at a given rate.

2. The rotary drum of the machine shall utilize carbide tip tools spaced not more than 5/8 inches apart.

3. The milling machine shall be self-propelled and shall have sufficient power, traction, and stability to maintain an accurate depth of cut.

D. Documentation: The Contractor shall provide to the CO at the Pre-Construction meeting full details concerning the machine to be used, including type, weight, milling width (sixty (60) inch minimum for primary operations), milling depth per pass (two (2) inch minimum), operating speeds, air pollution control, and dust suppression.

E. Sweepers: The textured surface shall be left clean and dust free by the use of self-propelled power sweepers with spray bar, vacuums, hand sweepers, or other methods approved by the CO. All equipment shall be equipped with or provide a means of effectively limiting the amount of dust escaping during the milling and removal operation.

F. All equipment must meet the current standards set by the Air Quality Act of noise and air pollution as well as any additional local, state, or federal pollution laws and regulations.

G. Dust Control: Wet suppression equipment shall consist of sprinkler pipelines, tanks, tank trucks, or other devices capable of providing regulated flow, uniform spray, and positive shut- off.

PART 3 - EXECUTION

3.1 TRANSPORTATION OF MATERIALS

A. Caution shall be taken to ensure that any vehicle used to transport milled material intended for use in any recycled asphalt concrete will be free from any foreign matter (such as dirt, debris, leaves, solvents, etc). Disposal of the sweepings or oversized pieces of pavement will not be permitted near the cold milling stockpiles of a HMA production plant.

3.2 CONSTRUCTION METHODS

A. Pavement Milling: Remove HMA to a depth as noted in the plans or exhibits and indicated by the CO. Variable milling depths may be required to improve drainage and cross slope.

1. The cutting tools on the revolving cutting drum must be continually maintained and shall be replaced as warranted to provide a uniform pavement texture. A test strip may be ordered by the CO which shall be a maximum length of 500 feet and shall meet the criteria for surface tolerance and cross slope as noted in this specification.

2. The Contractor shall be responsible for the maintenance of the milled roadway. Exposed granular material shall be compacted to proper lines and grades. The exposed granular material shall be patched with HMA in accordance with procedures outlined in the Partial Depth Specification prior to paving. Included in this item will be all labor, equipment, materials, and maintenance necessary to provide a satisfactory surface for paving.

3. Where a surface delamination between HMA layers or a surface delamination of HMA on Portland cement concrete causes a non-uniform texture to occur, the depth of milling shall be adjusted +/- ½ inch or until delamination is eliminated under the direction of the CO and at no additional cost to NPS.

4. Care shall be utilized by the Contractor to ensure that the milling operation does not disturb or damage pavement areas to remain. If milling operations begin to displace or damage pavement to remain, then the Contractor shall cease milling operations and make adjustments as required and as approved by the CO. Any damage caused by the milling operations shall be repaired at the Contractor's expense and as directed by the CO.

5. Asphalt concrete that cannot be removed by cold planning equipment shall be removed by other methods acceptable to the CO.

B. Transition Milling: Where the milling area terminates and abuts the existing adjacent pavement, a neat straight line shall be cut with suitable power-driven equipment before commencing the pavement removal with a milling machine. It is the intention of this operation and the obligation of the Contractor to produce a uniform straight line at the joint. The resulting joint shall be filled with cold patch material and maintained by the Contractor as necessary to provide a safe transition from the milled surface to the adjacent pavement for the traveling public at all times.

C. Structures: Care shall be utilized by the Contractor to ensure that no damage occurs to curbing, median barriers, bridge scuppers, parapets, manholes, utility valve boxes, loop detectors, traffic counters, and/or similar structures installed in or adjacent to the street. The Contractor shall, at no additional cost to the NPS, repair or replace any structures damaged.

1. If concrete pavement base is present within the construction limits, the Contractor shall inform the CO of the location. Milling of the various asphaltic pavement overlays on the concrete base shall be performed where directed by the CO in a manner that does not damage the concrete base. This work shall be included in the various milling items and no additional payment or compensation shall be made for work necessary due to the concrete pavement base.

D. Joints: All butt joints created by the milling operation at driveways which are greater than two (2) inches in depth shall be filled with millings or cold patch material and maintained by the Contractor to allow a safe egress and ingress for the traveling public at all times. All butt joints created by the milling operation at intersecting streets which are greater than one-and-one-half (11/2) inches in depth shall be filled with cold patch material and maintained by the Contractor to allow a safe egress and ingress for the traveling public at all times.

E. Safety: The Contractor will provide all necessary labor, materials, and equipment for protection of motorists and pedestrians from any protruding structures that may result from the milling operation. The Contractor shall also be responsible for the protection of motorists and pedestrians from any irregularities and pavement drop-offs that may result from the milling operation.

1. In the event of rain or inclement weather, the Contractor shall suspend milling operations. The Contractor shall make necessary allowances such as for drainage of water that may pond in areas where the milling was completed, and the paving has not been completed. Those areas that are to be opened to traffic shall have drainage outlets cut through the shoulder at locations designated by the CO. The Contractor shall plan and prosecute the milling operation to avoid the trapping of water on the roadway. Drainage outlets shall be restored to original grade, unless otherwise directed by the CO. Cost for cutting and restoring the drainage slots in the roadway shoulder shall be included in the price bid for other items of work.

2. The Contractor shall provide a means to effectively limit the amount of airborne dust created during trafficking. The use of self-propelled sweepers may be necessary during the time in which the street is left in a milled state.

3. The milling operation shall not proceed until the Contractor is prepared to overlay the milled section with its intended wearing or surface course. A street may be left in a milled condition for no more than ten (10) calendar days, unless otherwise approved by the CO.

F. Sweeping: The Contractor shall sweep and remove loose cuttings, dust, or other objectionable material from the roadway at the end of each working day using power brooms, power vacuums or both; and ancillary equipment, tools, and labor necessary to properly prepare the road for subsequent tack coat and paving.

G. Patching: During the cold-milling operation, any localized areas of exposed base materials will be repaired by the Contractor at no additional cost to the NPS. The area of base exposure shall be repaired by placing a minimum of 1 inch of compacted HMA, or as otherwise directed by the CO. Any patching required shall be repaired before the end of the working day, and in a manner satisfactory to the CO.

H. Pollution Control: All equipment will be operated such that it will effectively control dust generated by cutting, loading, and/or cleaning operations. To prevent the infiltration of milled materials into any storm water system the Contractor shall take special care to prevent the milled material from falling through structures. Any material that has fallen through the structures shall be removed at the Contractor's expense.

I. Dust Control: The Contractor is responsible for controlling dust at all times, including nonworking hours, weekends, nights, and holidays. Dust control procedures shall be conducted

when particulate matter concentrations exceed the National Air Quality Standard of 150 micro-grams/m3 on a 24-hour average basis or when ordered by the CO.

3.3 ACCEPTANCE

A. Grades: Any deviations in the profile or cross-slope that exceed 3/8 inch under a 10-foot stringline or straightedge placed parallel or transversely to the centerline will be corrected to the satisfaction of the CO.

B. Surface Texture: The milled surface shall provide a riding surface with a uniform textured appearance. The milled surface shall be free from gouges, longitudinal grooves and ridges, oil film, and other imperfections that are a result of defective equipment, improper use of equipment, or poor workmanship. The variation of the top of two ridges from the testing edge of the straightedge, between any two ridge contact points, shall not exceed 3/8 inch. The variation of the top of any ridge to the bottom of the groove adjacent to that ridge shall not exceed 3/8 inch. Any unsatisfactory surfaces produced are the responsibility of the Contractor and shall be corrected at the Contractor's expense and to the satisfaction of the CO.

C. Depth: The depth of removal will be verified by taking a measurement every 250 feet per each pass of the milling machine, or as directed by the CO. These depth measurements shall be used to monitor the average depth of removal.

D. The CO may require re-milling of any area where a non-uniform surface has resulted from the Contractor's operations; these areas will be corrected at no additional expense to the NPS. All corrections will be made with approved methods and materials. Any areas that require corrective measures will be subject to the same acceptance tolerances. Excess material that becomes bonded to the milled surface will be removed to the NPS's satisfaction before the area is accepted.

END OF SECTION 32 01 16.71

SECTION 32 01 17.61 - SEALING CRACKS IN ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes routing, cleaning, sealing, and filling cracks in asphalt pavement surfaces.

B. Related Sections.

1. 32 12 16 – Minor Asphalt Pavement
2. 32 17 23 – Pavement Markings

C. Measurement Procedures

1. Surface preparation will not be measured separately for payment.

2. Contract lump sum will include all work required to complete cracks averaging more than ¼ inch.

D. Payment Procedures. The accepted work will be paid at the contract lump sum price listed in Section 01 27 00, Article 3.1 List of Contract Line Items.

1.2 REFERENCES

A. ASTM - ASTM International, formerly known as American Society for Testing and Materials

1. ASTM C920 – Standard Specification for Elastomeric Joint Sealant
2. ASTM D1056 – Standard Specification for Flexible Cellular Materials
3. ASTM D5078 – Standard Specification for Crack Filler, Hot-Applied, for Asphalt
4. ASTM D6690 – Standard Specification for Joint and Crack Sealants, Hot Applied

B. SHRP – Strategic Highway Research Program

1. Materials and Procedures for Sealing and Filling Cracks in Asphalt-Surfaced Pavements Manual of Practice

C. FAR - Federal Acquisition Regulations

1. FAR 46.105 Contractor responsibilities
2. FAR 52.246-12 Inspection of Construction

1.3 SUBMITTALS

A. Joint Sealants and crack sealant – ASTM D6690 Type II or Type III

B. Crack filler, hot applied – ASTM D5078

C. Submit the flowing information for all materials

1. Certificate of Compliance
2. Source and grade
3. Type of modifier if any
4. Quantity of asphalt modifier and percentage
5. Other additives
6. Heating and application temperatures
7. Manufacturer's recommended application procedures

1.4 QUALITY ASSURANCE

A. The provisions of FAR 52.246-12 Inspection of Construction shall apply.

B. Provide and implement a Quality Control Plan (QCP) that will ensure all materials and workmanship meet contract requirements for the project.

C. The Contractor is responsible for controlling the quality of materials and workmanship during production and placement of the surface treatment provided for by this section.

D. The CO will monitor the adequacy of the Contractor's QC activities during production.

1.5 PROJECT SITE CONDITIONS

A. Do not seal or fill cracks when the pavement surface temperature is below 35 degrees F (2 degrees C)

B. Do not seal or fill cracks when the weather conditions are rainy or foggy.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Joint and Crack Sealant, hot applied, for concrete and asphalt concrete pavements shall be ASTM D6690 Type II or Type III

B. Crack Filler, hot applied for concrete and asphalt concrete pavements shall be ASTM D5078

C. Proprietary asphalt-rubber products may be approved based on the submittal information.

2.2 EQUIPMENT

A. Router. A power rotary impact router or vertical spindle router capable of creating a reservoir to the required depth and width without damaging adjacent pavement.

B. Air Lance. A hot compressed air lance capable of providing clean, oil-free compressed air at a volume of 100 cubic feet (2.8 cubic meters) per minute, a pressure of 120 pounds per square inch (830 kilopascals), and a temperature of 1000 degrees F (1100 degrees C).

C. Application wand. A wand attached to a heated hose attached to a heated material chamber that maintains material temperature within manufacturer's tolerances. Supply proper wand tips for desired applications.

D. Heating kettle. An indirect-heating double boiler capable of constant and effective agitation. Fill the space between the inner and outer shells with oil or other heat transfer medium. Provide an accurate and calibrated thermometer with a range from 200 to 600 degrees F in 5 degrees F graduations (90 to 320o C in 2o C graduations) located so the material temperature can be safely checked.

E. Squeegee or screed. A hand-held squeegee or screed of appropriate configuration for filling cracks flush with the surface, underfilling cracks to recess below the surface, or overfilling cracks to an overband shape.

F. Compressor. A compressor capable of producing oil-and water-free air at a minimum rate of 100 cubic feet (2.8 cubic meters) per minute with a minimum continuous line pressure of 125 pounds per square inch (860 kilopascals).

PART 3 - EXECUTION

3.1 PREPARATION

A. Route, clean and seal cracks in a continuous operation. Do not allow traffic to close or damage routed cracks.

1. Routing. Route 1/8 to ½ inch (3 to 13 millimeter) wide cracks to produce vertical, intact walls and a flat bottom with a reservoir centered over the crack. Make the reservoir two to three times the width of the crack. Rout cracks to a depth of ½ to ¾ inches (13 to 19 millimeters). **Routing is not necessary for cracks over 1/2" wide.**

2. Cleaning. Prevent debris from entering waterways, travel lanes open to public traffic, or areas designated not to be disturbed. Remove dirt, dust, and other deleterious material from the crack walls and cavity using a stream of air or other approved methods. Blow or brush dry material off the pavement surface.

3. Drying. Dry the crack surfaces with the hot air lance before sealing or filling. Warm and dry the crack surfaces using a hot-compressed air lance if the pavement temperature is below 50° F (10° C) or moisture is present. Keep the lance moving to prevent burning the pavement surface.

3.2 APPLICATION

A. Sealing routed cracks averaging ¼ to 1 inch (6 to 25 millimeters) wide.

1. Heat the material to pouring temperature in a heating kettle and continuously agitate the material. Place and finish the material within 5 minutes after heating the pavement surface with the lance.

2. Use an application wand to place material in each crack from the bottom up. Insulate the wand to maintain pouring temperature while placing material. Return the wand to the heating kettle immediately after sealing each crack. Use a squeegee or screed to strike off the material.

3. Discard sealant when:

   a. Heated above the safe heating temperature recommended by the manufacturer;
   b. Held at pouring temperature for more than 12 hours;
   c. Reheated more than once; or
   d. Not consistent or uniform in appearance.

B. Filling cracks averaging more than 1 inch (25 millimeters) wide. Fill each crack with either an asphalt mix according to Section 32 12 16 or the crack filler submitted as part of this section. Use a squeegee, screed, or other suitable equipment to force the mix into the crack. Fill each crack flush with the pavement surface and compact.

C. Do not allow traffic on sealed or filled cracks until the sealant or filler has cured or is treated with debonding material recommended by the manufacturer and approved by the CO.

3.3 FIELD QUALITY CONTROL

A. The CO will monitor the adequacy of the Contractor's QC activities during production and placement and may perform inspection, sampling and testing to verify conformance with contract requirements.

3.4 ADJUSTING

A. Resealing Cracks. Reseal cracks exhibiting adhesion failure, damage, incomplete filling, foreign objects in the sealant, or otherwise rejected by the CO.

END OF SECTION 32 01 17.61

SECTION 32 11 23 – AGGREGATE BASE AND SUBBASE COURSE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes production, construction, and compaction of an aggregate base course used for pavements, shoulders, and incidental construction.

B. Quality control and acceptance:

1. The Contractor is responsible for controlling the quality of materials and work during production and placement.
2. The CO will monitor the adequacy of the Contractor's QC activities during production and placement and may perform inspection, sampling and testing to verify conformance with contract requirements.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. AASHTO T 11: Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
2. AASHTO T 19: Bulk Density ("Unit Weight") and Voids in Aggregate
3. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates
4. AASHTO T 89: Determining the Liquid Limit of Soils
5. AASHTO T 90: Determining the Plastic Limit and Plasticity Index of Soils
6. AASHTO T 96: Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
7. AASHTO T 180: Moisture-Density Relations of Soils Using a 4.54 kg (10 lb) Rammer and 457 mm (18 in) Drop
8. AASHTO T 193: The California Bearing Ratio
9. AASHTO T 255: Total Evaporable Moisture Content of Aggregate by Drying
10. AASHTO T 335: Determining the Percent of Fracture in Coarse Aggregate

1.3 DEFINITION

A. Completed Course: Compacted, unyielding, free from irregularities, with smooth, tight, even surface, true to grade, line, and cross-section.

B. Completed Lift: Compacted with uniform cross-section thickness.

C. Base Course: Crushed aggregate or similar as specified placed and compacted on prepared subgrade or subbase course.

D. Gravel Surfacing: Aggregate used for construction of low-volume access and staging area that can be easily graded and compacted.

E. Leveling Course: Crushed aggregate placed and compacted on base course to be used for finish grading.

F. Subbase Course: Sandy, gravelly material placed and compacted on prepared subgrade.

1.4 SUBMITTALS

A. Written report for approval for each aggregate class and source, a minimum of five working days before placement. Include the following:

1. Aggregate suitability. Refer to this Section, Part 2.
2. Name of supplier and location of source.
3. Maximum Dry Density and Optimum Moisture Content and associated test result data. Refer to AASHTO T 180, Method D.
4. Job mix gradation including single values for each sieve size, No. 4 and finer. The target values must be within the gradation limits of Table 2

PART 2 - PRODUCTS

2.1 SUBBASE COURSE

A. Clean granular material, free of clay, graded from coarse to fine, having a maximum aggregate size of 3 inches conforming to the requirements of AASHTO M 147 Sections 3 and 4.

2.2 BASE COURSE

A. Well-graded, clean, hard, tough, durable, and sound mineral aggregates consisting of crushed stone, crushed gravel, or crushed slag, free of organic matter and contamination from chemical or petroleum products, according to Table 2-1.

1. Material not meeting the gradation requirements may be allowed to remain in-place at the discretion of the COR provided density requirements are met.
2. Additional lots may not be placed until the deficiencies are addressed and corrected.
3. Correct material that does not meet the specified criteria by scarifying, placing additional material, re-mixing, reshaping, and re-compacting when determined by the COR.
4. Do not place additional material on any unaccepted layer.

Table 2-1

Aggregate Properties			
	Aggregate Class		
	A	B	
Dry Rodded Unit Weight	Not less than 75 lb/ft^3		AASHTO T 19
Liquid Limit/Plastic Index	Non-plastic	PI ≤ 6	AASHTO T 89 AASHTO 90
Aggregate Wear	Not to exceed 50 percent		AASHTO T 96
Gradation	Table 2-2		AASHTO T 11 AASHTO T 27
CBR with a 10 lb surcharge measured at 0.20 inch penetration	70% Minimum	N/A	AASHTO T 193
Two Fractured Faces	50% Min	N/A	AASHTO T 335

B. Establish the job mix (target) gradation for the 3⁄4 inch sieve and finer within the gradation limits.

1. The Job Mix Gradation Tolerance, Table 2-2, is the allowable deviation from the job mix (target) gradation on the applicable sieves.
2. All other percent passing shall be within the gradation limits. Refer to AASHTO T 11 and AASHTO T 27.
3. Percent passing based on total aggregate (dry weight) and fine and coarse aggregate with approximately the same bulk specific gravities.

Table 2-2

Gradation Limits		
Sieve Size	**Job Mix Gradation Target Blend**	**Job Mix Gradation Tolerance**
1 ½ inch	100	
1 inch	90 – 100	±9.0
¾ inch	70 – 85	±9.0
½ inch	65 – 80	±9.0
3/8 inch	55 – 75	±9.0
No. 4	40 – 65	±6.0
No. 16	25 – 40	±5.0
No. 200	7 - 11	±3.0

C. Pavement

1. Use Class A aggregate, Table 2-1. Random samples may be taken from the grade and tests for moisture, gradation, and laboratory density and performs in-place density determinations. Meet gradation limits and applicable tolerances of Table 2-2 for each gradation test. Meet minimum density test average of 95 percent of maximum laboratory density with no test less than 94 percent.

D. Curb, curb & gutter, ABA ramps, sidewalks, paved ditches, waterway, and other flatwork

1. Use Class A aggregate, Table 2-1. Random samples may be taken from the grade and tests for moisture, gradation, and laboratory density and performs in-place density determinations. Meet gradation limits and applicable tolerances of Table 2-2 for each gradation test. Meet minimum density test average of 95 percent of maximum laboratory density with no test less than 92 percent.

E. Shouldering

1. Use Class A or B aggregate, Table 2-1. Adjust moisture content before compaction

2.3 SOURCE QUALITY CONTROL

A. Perform tests necessary to locate acceptable source of materials meeting specified requirements.

B. Final approval of aggregate material will be based on test results of installed materials.

C. Should separation of coarse from fine materials occur during processing or stockpiling, immediately change methods of handling materials to correct uniformity in grading.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

A. Obtain COR's acceptance of subgrade before placing base course or surfacing material.

B. Do not place base course or surfacing materials in snow or on soft, muddy, or frozen subgrade.

3.2 EQUIPMENT

A. Compaction Equipment: Adequate in design and number to provide compaction and to obtain specified density for each layer.

3.3 HAULING AND SPREADING

A. Hauling Material:

1. Do not haul over surfacing in process of construction.
2. Loads: Of uniform capacity.
3. Maintain consistent gradation of material delivered; loads of widely varying gradations will be cause for rejection

B. Spreading Material:

1. Distribute material to provide required density, depth, grade, and dimensions with allowance for subsequent lifts.
2. Produce even distribution of material upon roadway or prepared surface without segregation.
3. Should segregation of coarse from fine materials occur during placing, immediately change methods of handling materials to correct uniformity in grading.

3.4 CONSTRUCTION OF COURSES

A. Subbase Course:

1. Maximum Completed Lift Thickness: 6 inches.
2. Completed Course Total Thickness: As shown.
3. Spread lift on prepared subgrade to required cross-section.
4. Water, grade, and roll surface until thoroughly compacted.
5. Blade or broom surface to maintain true line, grade, and cross-section.

B. Base Course:

1. Provide moisture content of ± 2 percent of optimum at the time of placement. Refer to AASHTO T 180, Method D and AASHTO T 255.
2. Place in layers of uniform thickness and compact each layer to a thickness not to exceed a 6 inch depth.
3. Finish to a uniform line and grade with surface deviations no more than 3⁄8 inch in 10 ft in any direction.
4. Correct any profile deviations greater than 3⁄8 inch.
5. Rework minimum of 4 inch lift to achieve homogeneous density.
6. Determine limits of correction based on extent of deviation.
7. Continue finishing until existing deviation is less than 3⁄8 inch.
8. Maintain optimum moisture content ± 2 percent during compaction.
9. Use appropriate compaction equipment adjacent to abutments, backwalls, approach slabs, wing walls, retaining walls, and other structures
10. Use a minimum of two passes with a roller for Type III placement or as directed by the COR
11. Finished surface shall be true to grade and crown before proceeding with surfacing.

3.5 FIELD QUALITY CONTROL

A. In-Place Density Tests:

1. Provide testing laboratory at least 4 hours' advance notification prior to testing.
2. Show proof that areas meet specified requirements before identifying density test locations.
3. Refer to Table 3-1 for minimum sampling and testing requirements for aggregate base course and surfacing.

Table 3-1

Minimum Sampling and Testing Requirements			
Property	**Test Method**	**Frequency**	**Sampling Point**
Gradation	ASTM C117and ASTM C183	One sample every **500** tons but at least every 4 hours of production	Roadbed after processing
Moisture Density (Maximum Density)	ASTM **D1557**, Method D	One test for every aggregate grading produced	Production output or stockpile
In-Place Density and Moisture Content	ASTM D5195, ASTM D6938, and ASTM D2216 for moisture content	One for each 500 ton but at least every 10,000 sq ft of area	In-place completed, compacted area

3.6 CLEANING

A. Remove excess material from the Work area. Clean stockpile and staging areas of all excess aggregate.

END OF SECTION 32 11 23

SECTION 32 12 13.13 – ASPHALT TACK COAT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work consists of applying an emulsified asphalt tack coat. Tack coat emulsified asphalt grade is designated as shown in AASHTO M 140 or M 208.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Emulsified Asphalt: When specified for tack coat, an equivalent anionic grade emulsion may be substituted for a cationic grade and vice versa. The sieve test in AASHTO M 140 and M 208 is not required.

1. Anionic emulsions. Conform to AASHTO M 140. For RS-1h and RS-2h, conform to AASHTO M 140 for RS-1 and RS-2, except conform the following for the penetration on the residue.

a. Ductility, 77 ºF, 2 inches/min, AASHTO T 51 40 mm (min.)

2. Cationic emulsions. Conform to AASHTO M 208. For CRS-1h and CRS-2h, conform to AASHTO M 208 for CRS-1 and CRS-2, except conform to the following for the penetration on the residue.

a. Ductility, 77 ºF, 2 inches/min, AASHTO T 51 40 mm (min.)

3. Quick-setting emulsions. Conform to AASHTO M 208.

4. Polymer modified emulsions. For micro-surfacing, mill or blend the polymer material into the asphalt or emulsifier solution before the emulsification process. Use a polymer quick set emulsified asphalt conforming to AASHTO M 208, ISSA 143, and the following:

a. Residue by distillation, AASHTO T 59 62 % (min.)
b. Softening point, AASHTO T 53 135 degrees F (min.)
c. Penetration at 77 degrees F, ASTM D 2397 40-90

PART 3 – EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Equipment

1. Asphalt distributor.

   a. Capable of heating asphalt evenly
   b. Adjustable full circulation spray bar to 15-foot width
   c. Positive controls including tachometer, pressure gauge, volume measuring device, or calibrated tank to uniformly deposit asphalt over the full width within 0.02 gallons per square yard of the required rate
   d. Thermometer for measuring the asphalt temperature in the tank

2. Rotary power broom.

   a. Self-propelled
   b. Capable of controlling the vertical broom pressure

3. Pneumatic-tire rollers. Furnish a minimum of two pneumatic-tire rollers both with the following capabilities:

   a. Self-propelled
   b. Minimum compacting width – 5 feet
   c. Gross weight adjustable within the range of 200 to 360 pounds per inch of compaction width

4. Aggregate spreader

   a. Self-propelled
   b. Minimum of 4 pneumatic tires on 2 axles
   c. Positive controls to uniformly deposit the aggregate over the full width of asphalt within 10 percent by mass of the required rates

B. Surface Preparation. Clean the existing surface of all loose material, dirt, or other deleterious substances by approved methods. When the surface is concrete, remove excess joint and crack filler.

C. Weather Limitations. Apply asphalt tack coat on a dry, unfrozen surface when the air temperature in the shade is above 35 ºF and rising.

D. Asphalt Application

1. Calibrate the asphalt distributor spray bar height, nozzle angle, and pump pressure and check longitudinal and transverse spread rates weekly according to ASTM D 2995. If different asphalt distributors are used, calibrate each before use on the project. Ensure that the length of the spread is no more than can be covered with aggregate immediately after application.

   Protect the surfaces of nearby objects to prevent spattering or marring. Spread building paper on the surface for a sufficient distance from the beginning and end of each application so the flow through the distributor nozzles may be started and stopped on the paper.

   The Contracting Officer (CO) will approve the exact application rate, temperature, and area to be treated before application and may make adjustments for variations in field

conditions. Apply the asphalt uniformly with an asphalt distributor. Move distributor forward at the proper application speed at the time the spray bar is opened. Use care not to apply excess asphalt at the junction of spreads.

Correct skipped areas or deficiencies. Remove and dispose of paper or other material used.

2. Apply the asphalt at a rate of 0.03 - 0.05 gallons per square yard for newly paved surfaces, 0.05 - 0.06 gallons per square yard for existing hot mix asphalt surfaces, and 0.75 – 1.0 gallons per square yard for milled surfaces.

   When a tack coat cannot be applied with an asphalt distributor spray bar, apply the tack coat uniformly and completely by fogging with a hand spray attachment or by another approved method.

   If excess asphalt material is applied, squeegee the excess from the surface. Allow the tacked surfaces to completely cure before placing the covering course. Place the covering course within 4 hours of placing the tack coat.

3. Pressurized asphalt distributor with a spray bar must be capable of applying a triple overlap spray pattern.

END OF SECTION 32 12 13.13

SECTION 32 12 16 – ASPHALT PAVEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Work under this Section includes constructing one or more courses of asphalt pavement. Furnish all labor, material, equipment, tools, transportation and supplies necessary to complete the work according to the contract.

B. Furnish asphalt pavement (pavement) composed of mineral aggregate, performance-graded asphalt binder, recycled asphalt, mineral filler, anti-strip additives and placed on a prepared surface in accordance with these specifications and in conformance to the lines, grades, compacted thicknesses and typical cross sections shown on the contract drawings or as directed by the Contract Officer.

C. Measurement Procedures

1. Asphalt emulsion for Tack Coat, as required by the plans or these specifications, will not be measured separately for payment. It will be included in the price of the Asphalt Pavement in place.
2. Asphalt Pavement will be measured by the lump sum for all work required. Work constructed outside of the planned lines and grades, or exceeding the dimensions as detailed in the contract, will not be measured for payment. The lump sum contract bid price for Asphalt Pavement will include:
   a. Cost of the Performance-Graded Asphalt Binder (including any binder modifiers)
   b. Anti-strip additive (if required by the job mix formula)
   c. Warm mix additives and technologies, if used
   d. Pre-construction conference
   e. Construction of control strip(s)
   f. Development and implementation of the Quality Control Plan, including revisions or modification as may be required
   g. Joint treatments
   h. Removal of cores and filling voids left by cores
   i. Tack coat material and application
   j. All sampling and testing required by the contract
   k. All materials, labor, and equipment required to construct the asphalt pavement course(s)

D. Payment Procedures

1. The accepted work will be paid at the contract lump sum price for all work described in this section if all test parameters fall within the upper and lower specification limits.

1.2 REFERENCES

A. AASHTO - American Association of State Highway and Transportation Officials

1. AASHTO M 320 - Standard Specification for Performance-Graded Asphalt Binder 2. AASHTO R 26 - Standard Practice for Certifying Suppliers of Performance-Graded Asphalt Binders

B. ASTM - ASTM International, formerly known as American Society for Testing and Materials

C. FAR - Federal Acquisition Regulations
   1. FAR 46.105 Contractor responsibilities
   2. FAR 52.236-9 Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements
   3. FAR 52.246-12 Inspection of Construction

1.3 SUBMITTALS

A. Job Mix Formula (JMF): No pavement shall be placed on the project site until a JMF has been submitted by the Contractor, approved by the Contracting Officer, and a pre-paving meeting conducted. The job mix formula shall be submitted in writing by the Contractor at least thirty (30) days prior to the start of paving operations. The submittal shall be a signed statement prepared by the Contractor's testing laboratory that certifies the proposed JMF meets the requirements of the contract and can be placed and compacted in the field during production. The submittal shall be based on a JMF that has been produced and tested within 12 months of scheduled paving operations. For each JMF submit the following:
   1. Individual bin/stockpile percentages including average percent passing each specified sieve size, resulting blend gradations and proposed designated sieve Target Values (TV) for specified gradation. Gradation shall be performed using AASHTO T 11 procedure B.
   2. Percent of performance-graded asphalt binder (PGAB) required by the JMF to meet the specified design parameters.
   3. PGAB production Certificate of Compliance (COC) certifying the specified binder grade and properties are in accordance with AASHTO M 320 and R 26. State the type of modification, if applicable.
   4. Mixing temperature: Conform to recommendations of PGAB supplier. Do not heat above 350F.
   5. Compaction temperature requirements for the asphalt binder grade specified for hot mix asphalt (HMA).
   6. Percent and type of anti-stripping additive, if required.
   7. At the time of JMF submittal, if requested by the Contracting Officer, the Contractor shall provide samples of aggregates, binder, mineral filler, bag house fines (if used in the submitted JMF), and antistrip additive (if used in the submitted JMF). Provide sufficient quantity of each component for JMF verification by the Contracting Officer. This may require up to 800 pounds of aggregates, proportioned according to individual bin combinations, five individual gallons of PGAB, and proportionate amounts of the other components necessary to complete JMF verification. Confirm with the Contracting Officer the actual quantities required before delivering samples for JMF verification. Allow the Contracting Officer the opportunity to witness sampling and splitting of JMF submittal samples.
   8. The JMF shall identify the specific part of the work for which it is intended to be used (i.e. base course, intermediate course, surface course, etc.). And shall indicate minimum criteria listed above for each JMF. If multiple mixing plants are proposed to be used, submit a separate JMF for each plant.
   9. Submit a list of materials proposed for use in the work under this sub- section including the name and address of the materials producers and the locations from which the materials are to be obtained.

10. Submit aggregate quality test results and furnish certificates of compliance signed by the materials producers or subcontractors and suppliers, stating that materials when tested according to specified test method(s) meet or exceed the specified contract requirements.

B. Laboratory facility accreditations/certification.

C. Qualifications for inspection and testing personnel.

D. Sample copies of all forms to be used for reporting data and information as required by the contract.

1.4 QUALITY ASSURANCE & CONTROL

A. The FAR clause 52.246-12 Inspection of Construction shall apply, in addition to the provisions of Section 01 40 00 - Quality Requirements and this sub-section. Provide and implement a Quality Control Plan (QCP) that will ensure all asphalt pavement materials and workmanship meet contract requirements for the project. Provide qualified personnel and laboratory facilities to support the QCP. The QCP shall, at a minimum, include and address the following elements:

1. Scope and Applicable Specifications
2. Submittal Requirements
3. Quality Control Organization
   a. QC Organizational Chart
   b. QC Personnel
4. Quality Control Laboratories
   a. Primary QC Laboratory, with qualification documents
   b. Alternate QC Laboratories
5. Materials Control, as applicable for each item of work
   a. Material Types and Source(s)
   b. Material Properties & Mix Designs
   c. Processing of Materials at the Production Site
   d. Material Storage and Handling
   e. Materials Certifications
6. Quality Control Sampling and Testing
   a. Frequency of sampling
   b. Testing procedures
   c. Random Sampling Plan
   d. Sample Identification System and numbering
   e. Quality Control Sampling & Testing
   f. Split Sample procedures
   g. Reporting
   h. Sample Storage and Retention
7. Production Facilities
   a. Production Facilities & Equipment lists with calibration records
   b. Production Facility QC Activities, sampling and testing
   c. Production Facility Control Chart(s)
   d. Evaluation of test data from the production facility
   e. Reporting
8. Field Operations

a. Placement Equipment and Procedures
b. Placement QC Sampling, Testing process
c. Evaluation of test data from placement operations
d. Reporting

B. Personnel Requirements - The Contractor's organization shall, at a minimum, include the personnel outlined below that meet the described minimum qualifications. Include personnel by name in the QCP. If changes in QC personnel occur, submit personnel qualifications for review and approval to the Contracting Officer.

1. Quality Control Manager - The Contractor's Quality Control activities shall be administered by a qualified Quality Control Manager (QCM). The QCM must be a full-time employee of the Contractor with full authority to exercise any and all actions necessary for the successful implementation of the QCP, including the authority to stop or to reject work. The QCM shall be available to communicate with the Contracting Officer at all times. Principal responsibilities of the QC Manager shall include managing the activities of all QC personnel, communicating on quality issues within the Contractor's organization and with the Contracting Officer, and ensuring that all requirements outlined in the QCP are met.
2. Quality Control Technician(s) - All Contractor QC sampling, testing, and inspections performed at the production facility or at the project site shall be performed by qualified Quality Control Technicians (QCTs).

C. Laboratory Facility Requirements

1. All Contractor testing shall be performed in certified laboratories either accredited through the AASHTO Accreditation Program (AAP), or meeting the requirements of ASTM D 3666 or state DOT approved facilities. Laboratory facilities shall be kept clean and all equipment shall be maintained in proper working condition. This includes providing required AASHTO and ASTM and agency reference documents and ensuring that all required equipment, sampling platforms, and tools are properly functioning, calibrated, and certified. Provide evidence of all certifications, accreditations and calibrations to the Contracting Officer.
2. The Contracting Officer shall be permitted unrestricted access to inspect and review the Contractor's laboratory facility. The Contracting Officer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. Deficiencies shall be grounds for the Contracting Officer to order an immediate stop to incorporating materials into the work until deficiencies are corrected.

D. Inspection

1. The Contractor shall perform inspection of all work required by this contract. At a minimum, schedule pre-work meetings with the Contracting Officer, production and placement personnel, and subcontractors and suppliers at the following phases of the work: Preparatory - at least seven (7) days prior to beginning any work element: Start-Up - at beginning of each work type; Production and Placement - periodically throughout the work.
2. The minimum frequency for inspections shall be as shown in the approved QCP. The results and findings of QC inspections shall be documented on Inspector Daily Reports (IDRs).

E. Sampling and Testing Requirements

1. Perform sampling and testing at both the production facility and at the site of field placement. Take samples and test per Table 3-2 for quality assurance acceptance testing, verification (correlation), or other purposes and deliver to the Contracting Officer immediately after sampling and splitting. All sampling and testing shall be in accordance with applicable AASHTO, ASTM, or agency procedures as designated in the contract. Furnish industry standard containers for all material samples. Provide the Contracting Officer the opportunity to monitor and witness all sampling, splitting and testing. Complete QC and QA tests on production and deliver test results to the Contracting Officer within twenty-four (24) hours of taking each sample, but preferably before the next day's paving operation begins.

F. Documentation and Reporting

1. Document all inspection, sampling and testing activities on Inspectors Daily Report (IDR) forms and/or Test Report Forms (TRF), as appropriate. Deliver to the Contracting Officer within one working day of those activities occurring. The QC Manager shall review and evaluate IDRs and TRFs on a daily basis to assure that all work conforms to contract requirements. Include, at a minimum, the following information:
   a. Daily weather or environmental conditions
   b. A summary of production or placement activities completed, including equipment used and hours worked
   c. Any non-conforming material or workmanship identified.
   d. Any corrective actions recommended or taken
   e. Discussions with subcontractors or Contracting Officer personnel
   f. Visitors to the production facility or project site
2. Use Control Charts as part of the QCP. Include examples of the Control Charts to be used in the QCP. Plot test results for each sublot tested. Control charts during placement shall at a minimum include: gradations, density, VMA, air voids, VFA, and binder content. Update Control Charts within 24 hours of completing tests for each sublot. Post Control Charts in an accessible location and submit to the Contracting Officer on a daily basis.
3. Corrective Action: Describe in the QCP what action will be taken when inspection or test results indicate that non-conforming work is being produced. Correct all areas of unacceptable pavement at no additional cost to the Government. Submit corrective plan to the Contracting Officer for approval.

G. Plan Review and Modifications

1. Review of the QCP will be based on the inclusion of the required information. Revisions to the QCP may be required prior to work startup for any part of the QCP that is determined by the Contracting Officer to be insufficient. Review of the QCP does not imply any warranty by the Contracting Officer that the QCP will result in completed work that complies with the specifications. It remains the responsibility of the Contractor to demonstrate such compliance. The Contractor shall modify the QCP as work progresses when circumstances necessitate changes in Quality Control personnel, laboratories, or procedures. In such case, the Contractor shall submit an amended QCP to the Contracting Officer for review a minimum of three (3) calendar days prior to the proposed changes being implemented. The Contracting Officer may require changes or

improvements to the QCP for initial review, or if during the progress of the work it becomes evident that the QCP is not resulting in work that conforms to contract requirements; work may be suspended on affected items if the Contracting Officer determines that the QCP is not adequately being implemented for specification compliance.

1.5 DELIVERY & HANDLING

A. Asphalt mixture deliveries shall be scheduled so that placing and compacting is continuous, with minimal stopping and starting of the paver.

B. Coordinate trucks dispatched from the plant to ensure that all asphalt mixture delivered to the project is placed in accordance with these specifications. Provide for reliable two-way radio or cellular phone communication between the project site and the plant.

C. Do not use or combine asphalt mixes produced from different plants unless they are produced using the same JMF, are materials from the same sources, and have been approved by the Contracting Officer.

D. The temperature range of the asphalt mixture when delivered to the project site will be established in the Contractor Quality Control Plan utilizing the approved JMF. Monitor the temperature of the mixture for each load, in the haul vehicles, in the paver hopper, and behind the laydown. Use approved methods and instruments for measuring temperature. Record results on Inspector's Daily Reports. Visually inspect the delivered asphalt mixture for crusting or segregation. Reject material that is crusted, segregated, or which is not within the delivery temperature range established in the Contractor Quality Control Plan.

1.6 PROJECT SITE CONDITIONS

A. Place HMA on a dry, unfrozen surface when the air temperature in the shade is above 35 ºF and rising and the temperature of the road surface in the shade conforms to Table 1-1.

Table 1-1

HMA Placement Temperatures

HMA Placement Temperature Compacted Lift Thickness Road Surface Temperature ºF	**<2 Inches**	**2.1-3 Inches**	**>3.1 Inches**
	Minimum Lay-Down Temperature (1) ºF		
< 35	(2)	(2)	(2)
35 - 39.9	(2)	(2)	280
40 - 49.9	(2)	285	275
50 - 59.9	295	280	270
60 - 69.9	285	275	265
70 - 79.9	280	270	265
80 – 89.9	270	265	260
≥ 90	265	260	255

(1) Never heat the asphalt concrete mix above the temperature specified in the approved mix design.

(2) Paving not allowed.

B. Rain and Surface Conditions: Immediately cease transportation of asphalt mixtures from the plant when rain begins at the project. Do not place pavement while rain is falling, or when there is water on the surface. Placing pavement may continue, when the rain has stopped and water has been removed from the tacked surface to the satisfaction of the Contracting Officer and if the temperature of the asphalt mixture meets the specification requirements.

C. Information regarding the air temperature, average wind speed, overcast conditions, mix delivery temperature, and existing moisture conditions shall be evaluated by the Contractor prior to placement. The Contractor is responsible for constructing the pavement to meet compaction, bonding and all specification requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. Performance Graded Asphalt Binders: The asphalt binder shall be a Performance-Graded Asphalt Binder (PGAB) which meets the specification requirements of AASHTO M320 or M332 and AASHTO R26. The PG binder for hot mix asphalt shall be achieved by the use of Neat Asphalt with elastomer polymer modification if needed. The grade for the PGAB will be as designated in the contract. Acceptance of the PGAB will be in accordance with AASHTO R26. PGAB shall be provided by an Approved Supplier (AS). Provide a Certification of Compliance (COC) for the specified PGAB with each bulk delivery to the mixing plant during the production of asphalt.

1. Date and place of manufacture
2. Lot number or other means of cross-referencing to the manufacturer's inspection and testing system
3. Substantiating evidence that the material conforms to the contract quality requirements as required by FAR 46.105(a)(4), including all of the following:
   a. Test results on material from the same lot and documentation of the inspection and testing system
   b. A statement from the manufacturer that the material complies with all contract requirements
   c. Manufacturer's signature or other means of demonstrating accountability for the certification

All other manufactured, non-project produced materials shall require Commercial Certification such as mineral filler, antistrip additives.

B. Recycled Asphalt Pavement (RAP) Material

1. General Requirements: RAP may be used as a component of the asphalt mixture if approved by the Contracting Officer. Usage of RAP is subject to the following requirements: a maximum of twenty percent (20%) for surface courses; and a maximum of twenty-five percent (25%) for all other courses. Percent RAP is computed by mass.

C. Tack Coat

3. Use an Emulsified Asphalt. An equivalent anionic grade emulsion may be substituted for a cationic grade and vice versa. The sieve test in AASHTO M 140 and M 208 is not required.

Anionic emulsions: Conform to AASHTO M 140. For RS-1h and RS-2h, conform to AASHTO M 140 for RS-1 and RS-2, except conform to the following for the penetration on the residue: Ductility, 77 ºF, 2 inches/min, AASHTO T 51 40 mm min.

Cationic emulsions: Conform to AASHTO M 208. For CRS-1h and CRS-2h, conform to AASHTO M 208 for CRS-1 and CRS-2, except conform to the following for the penetration on the residue: Ductility, 77 ºF, 2 inches/min, AASHTO T 51 40 mm min.

D. When required by the mix design (job mix formula) furnish lime conforming to AASHTO 303.

E. Aggregates shall conform to the requirements of these specifications for the designated grading.

2.2 EQUIPMENT

A. Mixing Plant: Use mixing plants conforming to AASHTO M 156 supplemented as follows:

1. All plants
   a. Automated controls: Control the proportioning, mixing, and discharging of the mix automatically.
   b. Dust collector: AASHTO M 156, Requirements for All Plants, Emission Controls is amended as follows: Equip the plant with a dust collector. Dispose of the collected material. In the case of bag house dust collectors, dispose of the collected material or return the collected material uniformly. Use of bag house fines in asphalt concrete mixes requires approval unless included as part of the approved job-mix formula.
   c. Recycled asphalt pavement: When recycled asphalt pavement material is incorporated into the mixture, modify plants according to the plant manufacturer's recommendations to process reclaimed material, and according to any state specific specifications related to processing RAP.
2. Drum dryer-mixer plants
   a. Bins: Provide a separate bin in the cold aggregate feeder for each individual aggregate stockpile in the mix. Use bins of sufficient size to keep the plant in continuous operation and of proper design to prevent overflow of material from one bin to another.
   b. Stockpiling procedures: Separate aggregate into at least 2 stockpiles with different gradations. As a minimum, stockpile mostly coarse material in one stockpile and mostly fine material in another.
3. Batch and continuous mix plants
   a. Hot aggregate bin: Provide a bin with 3 or more separate compartments for storage of the screened aggregate fractions to be combined for the mix. Make the partitions between the compartments tight and of sufficient height to prevent spillage of aggregate from one compartment into another.
   b. Load cells: Calibrated load cells may be used in batch plants instead of scales.
   c. Recycled asphalt pavement: Modify batch plants so the recycled asphalt pavement is introduced into the mix after bypassing the dryer. Design the cold feed bin, conveyor system, and special bin adjacent to the weigh hopper, if used, to avoid

segregation and sticking of the recycled asphalt pavement material. Heat aggregate to a temperature that will transfer sufficient heat to the recycled asphalt pavement material to produce a mix of uniform temperature within the range specified in the approved job-mix formula.

B. Hauling Equipment

1. Use vehicles with tight, clean, and smooth metal beds for hauling asphalt mixture. Thinly coat the beds with an approved material to prevent the mix from adhering to the beds. Do not use petroleum derivatives or other coating material that contaminates or alters the characteristics of the mix. Drain the bed before loading. Equip each truck with a canvas cover or other suitable material of sufficient size to protect the mix from the weather and thermal segregation and during hauling on public roads. When necessary to maintain temperature, use insulated truck beds and securely fastened covers. Provide access ports or holes for checking temperature of asphalt mix in the truck.

C. Pavers

1. Self-contained, power-propelled units with adjustable vibratory screeds with full width screw augers.
2. Heated for the full width of the screed.
3. Capable of spreading and finishing courses of asphalt mix in widths at least twelve inches (12”) more than the width of one lane.
4. Equipped with a receiving hopper having sufficient capacity to ensure a uniform spreading operation.
5. Equipped with automatic feed controls, which are properly adjusted to maintain a uniform depth of material ahead of the screed.
6. Operable at forward speeds consistent with satisfactory mix lay down.
7. Capable of producing a finished surface of the required smoothness and texture without segregating, tearing, shoving, or gouging the mix.
8. Equipped with automatic screed controls with sensors capable of sensing grade from an outside reference line, sensing the transverse slope of the screed, and providing the automatic signals that operate the screed to maintain grade and transverse slope.
9. Do not use diesel during paving operations as release agent on any parts that come in contact with the mix.

D. Rollers

1. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. They shall be in good condition, capable of reversing direction without backlash, and shall be operated at speeds and vibration amplitudes and frequencies which avoid detrimental displacement of the pavement.
2. The Contractor shall exercise caution when using vibratory rollers so as not to cause damage to buried infrastructure or adjacent infrastructure. Damage to buried or adjacent infrastructure will be the responsibility of the Contractor. Oscillation type rollers are acceptable for use for compaction rolling. Oscillation rolling is allowed on bridge decks with a low frequency setting.

2.3 MIXES

A. Composition of Asphalt Mixture (Job Mix Formula): Furnish mixes of aggregate, asphalt binder, recycled asphalt pavement, and additives that meet applicable material specifications and the design requirements as designated in Table 2-1. Volumetric mix properties will be determined and approved at Ndes according to AASHTO T 312 and R 35 after all additives/technologies have been incorporated. This includes meeting PGAB specification requirements. The assumed traffic loading used for the JMF pavement design is estimated 0.04 million Equivalent Single Axle Loads (ESALs) per the Geotechnical investigation.

Table 2-1

Asphalt Pavement Design Requirements

Design ESAL (Million)	**Gyratory Compaction Level (% Theoretical Maximum Specific Gravity, G_{mm}) AASHTO T 312[4]**			**Minimum Voids-in-the Mineral Aggregate (VMA), % [1]**				**Voids Filled with Asphalt (VFA), %**	**Dust-to-Binder Ratio [3]**	**Minimum Tensile Strength Ratio, AASHTO T 283[4]**
				Nominal Maximum Size Aggregate [2]						
	$N_{initial}$	**N_{design}**	**N_{max}**	**1 inch (25 mm)**	**¾ inch (19 mm)**	**½ inch (12.5 mm)**	**⅜ inch (9.5 mm)**			
< 0.3	6 (≤91.5%)	50 (96.0%)	75 (≤98.0%)	12.0	13.0	14.0	15.0	70.0 - 80.0	0.8 -1.6	0.80
0.3 to < 3	7 (≤90.5%)	75 (96.0%)	115 (≤98.0%)					65.0 - 78.0		
3 to 30	8 (≤89.0%)	100 (96.0%)	160 (≤98.0%)					65.0 - 78.0		

(1) When mineral filler or hydrated lime is used, include in the calculation for compliance with the VMA.

(2) The nominal maximum size aggregate is one size greater than the first sieve to retain more than ten percent (10%) of the combined aggregate.

(3) Dust to binder ratio is the effective asphalt content divided by the total percent of material passing the No. 200 (75 µm) sieve. Dust includes lime, bag house fines, and other mineral matter. Use washed sieve analysis.

(4) Prepare specimens in accordance with AASHTO T 312. AASHTO T 283 specimens shall be four inches (4") in diameter for freeze thaw. Use AASHTO T 166 regardless of the volume of water absorbed.

B. Aggregate Gradation: Furnish nominal maximum size aggregate gradation(s) as specified in the contract, consistent with Table 2-2 Mixtures for Superpave Asphalt, and that conform to AASHTO M 323, Superpave Volumetric Mix Design, Table 3.

Table 2-2

Mixtures for Superpave Asphalt

Sieve Size[a]	Percent by Weight Passing Square Mesh Sieves				
	Grading S6	**Grading S5/RIL**	**Grading S4**	**Grading S3**	**Grading S2**
37.5 mm (1.5”)				-	100
25.0 mm (1”)				100	90 – 100
19.0 mm (¾”)			100	90 – 100	≤90
12.5 mm (½”)		100	90 – 100	≤90	-
9.5 mm (⅜”)	100	90 – 100	≤90	-	-
4.75 mm (#4)	80 – 100	≤90	-	-	≥40
2.36 mm (#8)	54-90	37 –67	34 – 58	31 – 49	29 – 45
1.18 mm (#16)	-	-	-	-	-
600 ∝m (#30)				-	-
300 ∝m (#50)	-	-	-	-	-
150 ∝m (#100)	-	-	-	-	-
75 ∝m (#200)	5.0 – 15.0	2.0 – 10.0[b]	2.0 – 10.0[b]	2.0 – 8.0[b]	1 – 7[b]
Other Mixture Requirements					
NMAS[c]	1 in [25 mm)	¾ in [19 mm]	½ in [12.5 mm]	3/8 in [9.5 mm]	No. 4 [4.75 mm]
Asphalt Cement[d], % of Mix Max	≥3.7	≥4.1	≥4.6	≥5.1	≥5.6
Performance Grade Asphalt Cement	c	c	c	c	c

[a] Table 2-2 reflects the sieve size boundaries for design and JMF purposes. After the design is established, the JMF will designate combined aggregate sieve requirements with tolerances in Table 3-1.

[b] Ensure the ratio of the percent passing the No. 200 [75µm] sieve to the percent effective asphalt cement is from 0.6 to 1.6.

[c] Nominal Maximum Size (NMS) is defined as one size larger than the first sieve to retain more than 10 percent.

[d] The Contracting Officer may adjust the lower limit if the effective specific gravity of the combined aggregates is greater than 2.65. The Contracting Officer may allow adjustments if a theoretical lab molded specimen at the JMF asphalt content meets the VMA requirements at 4% air voids.

[E] The Contractor may substitute a higher grade of asphalt than that shown on the Plans at no additional cost to the Government.

C. Fractured Faces Coarse Aggregate, Uncompacted Void Content of Fine Aggregate (% min), Sand Equivalent (% min), and Flat and Elongated (% min) shall meet requirements specified in AASHTO M 323, Superpave Volumetric Mix Design, Table 5.

D. Furnish hard durable particles or fragments of crushed stone, crushed slag or crushed gravel conforming to the following:

1. Los Angles abrasion, AASHTO T 96 — 35% max.
2. Sodium sulfate soundness loss, AASHTO T 104 (5-cycles):
   a. Coarse Aggregate — 12% max.
   b. Fine aggregate — 12% max.

E. For the surface course, do not use aggregates known to polish or carbonate aggregates containing less than 25 percent by mass of insoluble residue when tested according to ASTM D3040.

PART 3 EXECUTION

3.1 PREPARATION

A. Notification: Notify the Contracting Officer at least fourteen (14) days prior to beginning paving work. A pre-paving conference will be scheduled at least seven (7) days prior to starting placement. The Contracting Officer, Contractor, and supplier representatives critical to the paving operation will be required to attend this meeting. At this meeting be prepared to discuss work schedule, traffic control, proposed equipment to be used, control strip construction and acceptance, production and placement, quality control, final acceptance procedures and requirements, and any other elements critical to the successful execution of paving operations.

B. The Contractor shall place pavement at the locations, widths, thickness shown on the Drawings. The Contractor shall furnish, set, and maintain all line and grade stakes, string lines, or other controls necessary to guide and control the paving equipment.

C. Maintain all equipment in safe and satisfactory operating condition.

D. Protection and Restoration of Property and Landscape: Follow the requirements of FAR 52.236-9 Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements. If damage occurs, repairs shall be made to the satisfaction of the Contracting Officer at no additional cost to the Government. In addition:

1. Protect adjacent work from contamination by paving materials and placement activities. Remove any stains or damage from adjacent work, structures, curbing, or other facilities, resulting from such contamination. Remove and dispose of all waste and spillage.

3. Do not damage or disturb existing improvements, facilities, features, or vegetation. Provide suitable protection where required before starting work and maintain protection throughout the course of the work.

Check frames, covers, grates, water valve boxes, and other miscellaneous tings that are located in the proposed pavement areas to ensure that they have been correctly positioned and set to the proper slope and elevation. Adjust frames to ¼-inch maximum and ½-inch maximum below final grade surface of adjacent pavement.

E. Preparation of the Underlying Surface

1. The underlying course shall be thoroughly cleaned of all dust and debris by a self-propelled sweeper immediately before placing pavement. Areas inaccessible by power sweepers shall be broom swept manually until the surface is clean. Ensure that the surface to receive the pavement has been approved by the Contracting Officer, is properly compacted and free from soft areas or other deficiencies that might affect the quality of the final pavement course.
2. On bridge decks or concrete pavement, remove excess crack and joint material by trimming the excess material flush with the pavement surface prior to placing pavement. Remove all excess joint or crack material on any pavement surface in excess of one-sixteenth inch (1/16”) in depth prior to placing new pavement courses.

3.2 CONTROL TEST SECTION

A. After the JMF has been approved a Control Test Section (CTS) shall be placed, and accepted, prior to beginning full production. The purpose of the CTS is to demonstrate the Contractor’s ability to produce, place and compact the mixture as designed, specified, and approved. Confirm the mix proportions and additive rates through field tests performed during production. If necessary, during this time, adjustments to the mix design may be made according to these specifications. Target value adjustments to the JMF greater than those designated in Table 3-1 may require a completely new mix design submittal and verification, if requested by the Contracting Officer.

Table 3-1

Allowable JMF Revision Limits

Test Property	**Verification and Adjustment Limits, %**
Asphalt Binder Content	+/- 0.4
Gradation: 2.36mm & Larger 600um & 300um	+/- 3.0 +/- 2.0
Gradation: 0.075mm	+/- 1.0
Voids in Mineral Aggregate, VMA,	Min. per Table 2-1
Voids Filled with Asphalt, VFA,	Range per table 2-1

B. The CTS will be a minimum of five-hundred feet (500’) long and two lanes wide. If the design thickness is one and a half inches (1½”) or greater include a Longitudinal Joint-Wedge as described in these specifications. It shall be of the same depth, and placed on the same

underlying material, as the work that it represents. The equipment used in construction of the CTS shall be the same type and weight(s) to be used on the remainder of the work.

C. Take three (3) random one-hundred (100) pound samples from behind the laydown machine. The samples shall be fifty (50) pound split and the split portion shall be delivered to the Contracting Officer for verification testing. Testing shall include: VMA, VFA, VTM, TSR, aggregate gradation, and asphalt binder content. The contractor shall test its portion of the samples and report data to the Contracting Officer. Test samples according to contract specified testing methods. PGAB shall be verified using approved documentation production COC meeting the specified grade.

D. Take five (5) randomly selected cores from the finished pavement mat and five (5) randomly selected cores from the longitudinal joint in the CTS. Provide splits to the Contracting Officer for evaluation. Test samples according to contract specified testing methods. Correlation of density equipment with cores will be as described in the QCP and approved by the Contracting Officer. Provide correlation data between the density gauge and the cores to the Contracting Officer.

All density gauges shall be calibrated in accordance with manufacturer's recommendations prior to use on the project. Provide calibration record to the Contracting Officer.

E. The Control Test Section shall be considered acceptable and allowed to remain in place if:
1. Mixture and Density: The mix is acceptable if all test results are within specification limits for gradation, asphalt content, air voids, VMA, and density.
2. Smoothness: Pavement mat is uniform in texture and smoothness, with no surface deviations in excess of ¼-inch in 10-feet.

F. If the initial CTS is unacceptable as described above, adjust the JMF, plant operations, or placing and compacting procedures as necessary and construct another CTS.

G. Additional CTS, as required, shall be constructed and evaluated until an acceptable CTS is constructed. All unacceptable CTS shall be removed at the Contractor's expense. Costs incurred by the Government, if any, for additional sampling, testing and inspection required due to unacceptable CTS will be deducted from payments owed the contractor.

H. Full production shall not begin until an acceptable CTS has been constructed.

3.3 APPLICATION

A. Production

Do not heat asphalt binder above 350F unless approved by the manufacturer.

Weigh or meter aggregates, additives, and asphalt binder material and introduce into the mixer in the proportions specified by the JMF. Take corrective action as outlined in the QCP when testing results indicate the material is not in compliance with the requirements of the contract and the approved JMF and when the test results fall outside of the action limits noted in these specifications.

Mix the combined materials until all aggregate particles are uniformly coated with asphalt binder and thoroughly distributed throughout the mixture.

The temperature of the mixture shall be in accordance with the Performance-Graded Asphalt Binder (PGAB). The temperature of the mixture when discharged from the mixer or silo shall

be + 25°F from the value stated in the JMF. Mixtures exceeding these limits shall be subject to rejection.

B. Aggregate Preparation

For batch plants, heat, dry, and deliver aggregate for pug mill mixing at a temperature sufficient to produce an asphalt concrete mix temperature within the approved range. Adjust flames used for drying and heating to prevent damage to and contamination of the aggregate.

Control plant operations so the moisture content of the asphalt concrete mix behind the paver is zero point five percent (0.5%) or less according to AASHTO T 329.

Before starting asphalt concrete mix production, obtain approval of synchronized metering and weighing devices used to introduce a constant rate of lime and water.

When lime is used as an anti-strip, adjust the aggregate moisture to at least four percent (4%) by mass of aggregate. Mix the lime uniformly with the aggregate before introducing the aggregate into the dryer or dryer drum. Use calibrated weighing or metering devices to measure the amount of lime added to the aggregate.

Add lime to the aggregate by one of the following methods:

Method A: Add lime to the combined cold feed aggregate using an enclosed in-line cold feed mechanical pug mill mixer. Use a twin-shaft, continuous mixing pug mill with adjustable mixing paddles. Adjust the retention time of the mixture in the pug mill so no unmixed lime is visible after the lime and aggregate exit the pug mill.

Method B: Add lime to the produced aggregates during stockpiling using a pug mill. Distribute the lime per the stockpile ratios stated in the asphalt concrete mix design.

A minimum moisture content of two percent (2%) by dry weight for coarse aggregate and four percent (4%) by dry weight for fine aggregate is required at the time the aggregates and lime are mixed. Marinate treated aggregate in stockpiles from twenty-four (24) hours to sixty (60) days before using in asphalt concrete mix. Do not use aggregate marinated longer than sixty (60) days.
Method C: Add lime to the combined cold feed aggregate by introducing the lime between aggregate layers as the aggregate flows from the cold feed bins. Mix the lime and aggregate on the conveyor belt by placing a minimum of six paddles over the conveyor belt. Make the paddles protrude into the aggregate flow and direct the aggregate to fold over itself causing the material to migrate from one side of the conveyor belt to the other. Space the paddles to provide complete mixing. Provide a water spray over the conveyor belt as necessary to control dust and to maintain minimum moisture content.

C. Mix Design Revisions

During production, the Contractor may request target value revisions to the approved JMF. Proposed changes are subject to meeting the following requirements: (1) the changed target value(s) must be within the limits defined in Table 3-1, test results from the new mixture indicate that the proposed JMF changes will produce asphalt mixtures with the specified VTM, VMA, VFA and F/A ratio, and the resulting gradations are within the grading band for the specified nominal maximum size grading.

Proposed changes must include new and revised maximum unit weights (AASHTO T 209) for controlling mat density.

Any proposed changes to the approved JMF, along with supporting documentation, shall be submitted in writing to the Contracting Officer for approval prior to placement on the project. Changes to the approved JMF may necessitate and require additional evaluation and verification of the mix by the Contracting Officer prior to final approval.

D. Tack Coat

Apply a uniform tack coat of asphalt emulsion to the contact surfaces of manholes, structures, existing pavement edges and surfaces and other abutting surfaces immediately prior to placing new pavement. This includes freshly placed layers if one day has elapsed since placement, or if dust or debris has contaminated the fresh surface, or if traffic has been allowed on the surface to be paved. Tack coat shall be applied in accordance with specification section 32 12 13.13. Tack coat will not be paid separately but shall be included in the lump sum cost for asphalt pavement.

E. Transportation, Placing, and Finishing

Set string line or other fixed controls to ensure proper alignment of pavement centerline, joints, and edges.

Verify the depth of each layer at frequent intervals behind the laydown machine and adjust if the compacted thickness does not meet the specified thickness. The average compacted depth will be verified by calculating yield using known bulk specific gravity values from the acceptance tests. Furnish daily calculated yields to Contracting Officer at the end of each day for the day's production. The final paved thickness will be confirmed by cores taken after the final lift has been completed.

The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least six inches (6"). The joint in the top layer shall be at the designed centerline of the pavement. Transverse joints in one layer shall be offset by at least two feet (2') from transverse joints in the previous layer.

Unless otherwise permitted by the Contracting Officer for special conditions and circumstances, only machine methods of placement shall be used. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be placed using hand tools. Luting shall be performed in such a manner as to prevent segregation.

Immediately after placement, and before the initial roller pass, the surface shall be checked and any irregularities corrected. Irregularities in alignment and grade along outside edges shall be corrected by the addition or removal of mixture before the edges are rolled.

The newly placed pavement surface shall be free of visible segregation or other irregularities. Inspect the uncompacted mat behind the paver for longitudinal streaks, segregation, or other irregularities. Correct as necessary before initial compaction.

If material segregation or irregularities in the mat behind the paver are noted, the Contractor shall review the production, transportation, and placement operations and take corrective action. The Contractor's Quality Control Plan shall fully outline procedures for inspecting the mat during placement, identifying and troubleshooting material segregation or temperature related segregation, and implementing corrective action.

1. Joints, Edges, and Cleanup

a. Transverse Joints: The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse paving joint. When necessary to form a temporary transverse paving joint, it shall be made by means of placing a bulkhead or by temporarily tapering the course, in which case the edge shall be cut back to its full depth and width on a straight line to expose a vertical face. In both methods, all contact surfaces shall be given a tack coat of asphaltic material before placing any fresh mixture against the joint.

b. Longitudinal Joints-Wedge: For placement depths greater than or equal to one and a half inches (1½”), use a Notched Wedge plate attachment on the screed such as the Trans Tech notch wedge, or approved equal. The attachment must provide, for the first paver pass, a half inch (½”) notch at the top of the wedge, followed by a diagonal slope down to the underlying surface where a step is formed equal to the nominal maximum aggregate size. The width of the joint shall be a minimum of six inches (6”). The attachment will include a mechanism to provide compaction of the sloped surface of the notched wedge. If no mechanism exists in the attachment, the diagonal shall be compacted by other means satisfactory to the Contracting Officer. The subsequent paver pass will place mix at a depth equal to the lane being matched, plus the appropriate roll-down, to result in a fully compacted joint meeting the smoothness requirement of these specifications.

c. Longitudinal Joints-Confined Edge: For pavement depths less than one and a half inches (1½”), use a confined-edge longitudinal joint. This is the most typically constructed longitudinal joint which attempts to confine the outside edge of the first paver pass of the mat as much as possible to create a near vertical edge.

F. Asphalt Pavement Compaction

1. Thoroughly and uniformly compact the asphalt surface by rolling. In places inaccessible to rollers, use alternate equipment approved by the Contracting Officer. Do not cause cracking, shoving, or undue displacement.
2. Monitor the compaction process with nuclear density gauges calibrate according to the ASTM D2950 calibration section within six (6) months before use. Check the standard and reference on each day of use according to the ASTM D2950 standardization and reference check sections. Compact to at least ninety-one percent (91%) of the maximum specific gravity (density) determined in the asphalt pavement design requirements.
3. Continue compaction until surface marks are eliminated and cracks are sealed.

G. Pavement Uniformity and Roughness: The finished mat and surfaces of the pavement shall be smooth, dense and uniform in appearance, free from irregularities in contour and texture and shall present a smooth-riding surface. Construct all pavement surfaces to meet the requirements of these specifications.

H. Opening to Traffic: No vehicular traffic or construction loads shall be permitted on the newly completed pavement until the material has cooled to a temperature of 140F or less.

3.4 FIELD QUALITY CONTROL

A. General: In addition to performing QC testing during production and placement of asphalt pavement the Contractor shall perform acceptance testing as specified in Table 3-2. Contractor QC test results may be used by the Contracting Officer for acceptance if through verification (correlation) and validation, the Contractor QC test results are deemed acceptable

by the Contracting Officer. The Contracting Officer has sole discretion to include Contractor QC test results in the acceptance determination or to use only results from tests performed by the Contracting Officer or the Contracting Officer's agent. The Contracting Officer shall have access at any time to all parts of the production and material storage facilities and to all parts of the project site, to perform inspections and tests, as deemed necessary to ensure the quality of the final product.

B. Utilize stratified random sampling of each lot produced and placed to assure that all material within the lot has an equal probability of being selected for testing. The Contracting Officer will provide random numbers as required for each day's sampling, based on the anticipated production for that day. Adjustments in sampling locations and times necessary due to differences between anticipated and actual production quantities will be made by the Contracting Officer. The Contracting Officer may at any time, notwithstanding previous plant acceptance, reject and require the Contractor to dispose of any batch of asphalt mixture and/or pavement which is deemed unfit for use due to contamination, segregation, incomplete coating of aggregate, non-specification temperature, or other indication of defective material. Such rejection may be based on only visual inspection or temperature measurements. Similarly, the Contracting Officer may at any time, notwithstanding field acceptance for mat or longitudinal joint density, reject and require the Contractor to correct any asphalt pavement that was placed with unacceptable mat uniformity or paving joints, due to low density, lack of bond, segregation, improper elevation, tearing or other material or workmanship defects. In the event of such rejection, the Contractor and Contracting Officer may take split samples of the area(s), and if it can be demonstrated by testing that such material or constructed pavement was erroneously rejected, payment will be made for the material at the contract unit price.

C. All samples of PGAB, asphalt mixture, and pavement cores shall be split samples and the split portion delivered to the Contracting Officer. Samples shall be split in accordance with applicable AASHTO or ASTM procedures. Deliver to the Contracting Officer all core samples taken from the compacted pavement after testing. Protect cores from damage before delivering to the Contracting Officer.

D. Lots and Sublots: The entire quantity of production for each asphalt mixture type will be considered one lot and an individual sublot will be considered 700 tons.

E. Selective Sampling: The Contracting Officer may sample the work at any time to verify the quality of the work being performed. Work represented by these samples will be removed and replaced at no cost to the Government if, through further evaluation, the tests indicate that the represented work does not conform to contract requirements.

F. Independent Assurance Sampling: The Contracting Officer or their authorized agent may sample the work at any time to verify the quality of the sampling and testing and equipment used in the Acceptance determination. This will include the Contractor's quality of the sampling and testing and equipment calibrations if Contractor QC tests are used in the Agency Acceptance.

Table 3-2

Sampling, Testing, and Acceptance Requirements during placement

Material or Product	Type of Acceptance (Subsection)	Characteristic		Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time	Remarks
Asphalt concrete pavement	Action/Suspension	Asphalt Content[1]		AASHTO T 308	1 per 700 tons	Behind the paver before compaction	Yes	6 hours	—
		Air voids		AASHTO T 312 & T 166	"	"	"	"	—
		VMA		AASHTO R 35	"	"	"	"	—
		Core density[2]		AASHTO T 166	"	In-place after Compacting	"	24 hours	—
		Core density Long. Joint[5]		AASHTO T166	"	"	"	"	"
		Core thickness[6]		ASTM D 3549	"	"	Yes	24 hours	
Asphalt concrete pavement	Measured and tested for conformance	Placement Temperature		—	First load and as determined by Contracting Officer thereafter	Hauling vehicle prior to dumping, or windrow before pickup	—	Immediately upon completion of measurement	—
		Maximum specific gravity[3][4]		AASHTO T 209	Minimum 1 per day	Behind the paver before compaction	Yes	24 hours	—
Asphalt Binder	Measured and tested for conformance	Quality		AASHTO M 320 or M332	After each delivery and mixing	In line between tank and mixing plant	2 – 1 quart (1 liter) samples	See remarks	Test by Government
Asphalt concrete pavement	Measured and tested for Conformance, information and control	Gradation		AASHTO T 30	1 per 500 tons of mix	Behind the paver before compaction	"	"	—

(1) Use AASHTO T 308, Method A. Calculate the asphalt binder content by weighing the sample before and after the burn using a calibrated external balance.

(2) Side by side cores will be obtained for core density testing. Submit one core to the Contracting Officer for verification testing and the other to the Contractor for acceptance testing. Perform specific gravity and thickness tests on the cores and deliver to the Contracting Officer after testing is completed. Use AASHTO T 166 regardless of the volume of water absorbed. Care should be taken to dry cores to constant mass at 125 ± 5°F, before testing.

(3) After production paving has begun, use the average maximum specific gravity value (AASHTO T 209) for each day to adjust the percent compaction for the cores that represent that day's paving.

(4) Do not use the supplemental procedure for mixtures containing porous aggregate (dry back method) of AASHTO T 209).

(5) The six-inch diameter core shall be taken on the centerline of the longitudinal joint. For the notched-wedge joint, the lower specification limit is ninety-two percent (92%) of the maximum specific gravity with the cores taken on the wedge portion of the joint with the core centered on the diagonal.

(6) The core density samples may be used to determine core thickness, minimizing the number of total cores taken.

G. Smoothness: Measure the completed paved surface after the final lift is placed and compacted, and prior to any surface seal is placed.

1. Straightedge Measurement: Use a 10-foot metal straight edge to measure at right angles and parallel to the centerline. Defective areas are deviations between the surface and the bottom of the straightedge in excess of one quarter inch (1/4") measured between any two contacts of the straightedge, or deviations in excess of one quarter inch (1/4") measured at the end of the straightedge.

H. Thickness: Measure the full depth thickness, as specified in Table 3-2, after the final lift of pavement has been constructed. In addition, obtain cores randomly in parking areas, approach roads and pullouts as directed by the Contracting Officer.

3.5 ADJUSTING

A. Smoothness: Correct defective areas at no additional cost to the Government. Either grind, mill a minimum of one half (1/2) the pavement depth and fill with an approved asphalt mix, or cut and remove the pavement and repave with an approved asphalt mix. When correction by any other method is proposed, submit a proposal to the Contracting Officer for approval.

1. If grinding is proposed, use a diamond blade machine and specify the manufacturer and model of the equipment to be used. Identify the beginning and ending station of each grind location, the grinding depth and lateral extent of grinding. Specify the type of seal to be placed after grinding is completed. Place all seals in a manner acceptable to the Contracting Officer. The Contracting Officer may take up to seven (7) days to approve, modify, or reject the proposal. Do not begin corrective work until Contracting Officer approval is obtained.
2. After corrections are made, re-measure the pavement surface according to these specifications. The final pavement thickness after any corrective work shall be no less than ninety percent (90%) of the design pavement thickness.

B. Thickness: Correct all areas where the final pavement surface, prior to placement of any corrective layers, is less than ninety percent (90%) of the design pavement thickness. The method of correction will meet or exceed the structural and roughness requirements for the contract. Obtain approval, in writing, from the Contracting Officer for the proposed method of correction.

3.6 FINAL ACCEPTANCE

A. General: Test results from random sampling will be used to determine acceptance as provided for in this subsection. Contractor QC test results may be included in this evaluation, if the Contracting Officer has determined that they will be used for acceptance, as provided for in this subsection. The materials acceptance parameters and characteristics as noted in Table 3-2 will be accepted based on the conformance tests, materials certifications and by visual acceptance for workmanship and material quality as provided in the contract.

B. Acceptability of materials and workmanship will be according to the following Specification Limits. If test results fall outside of the Specification Limits described herein, make corrections as necessary to bring the applicable mix or pavement characteristic back into specification. If any individual test result falls outside of the Limits described herein, the material represented by that test result will be subject to rejection and replacement, at no additional cost to the government.

Acceptance will be based upon the average of test results for the Lot for each quality characteristic.

1. Asphalt Content: The upper and lower specification limits are the approved JMF target value plus or minus zero point four percent (0.4%). No single test value shall be beyond plus or minus zero point six percent (0.6%) of the JMF target value.
2. VMA: The lower specification limit is the value specified for the nominal maximum size aggregate designated. After the JMF has been verified the Contractor's combined coarse and fine bulk specific gravity of aggregate Gsb values shall be used to calculate VMA on field produced HMA.
3. Mat Density and Notched Wedge Longitudinal Joint Density: The lower specification limit is ninety-two percent (92%) and the upper specification limit is ninety-seven and a half percent (97.5%) of the maximum specific gravity (density) determined according to AASHTO T 166 and T 209. No single test value shall be below ninety percent (90.0%) nor above ninety-eight percent (98%). The percent compaction will be determined using the average maximum specific gravity (AASHTO T 209) from all samples tested each day. The longitudinal joint cores shall be taken on the wedge portion of the joint with the core centered on the diagonal.
4. Confined Edge Longitudinal Joint Density: For the confined edge joint, the lower specification limit is ninety percent (90%) and the upper specification limit is ninety-seven and a half percent (97.5%) of the maximum specific gravity (density) determined according to AASHTO T 166 and T 209. No single core test value shall be below eighty-nine percent (89.0%) nor above ninety-eight percent (98%) of the maximum density. The percent compaction will be determined using the average maximum specific gravity (AASHTO T 209) from all samples tested each day. The six-inch (6") diameter core shall be taken on the centerline of the longitudinal joint.
5. Air Voids: The upper and lower specification limits are five percent (5%) and three percent (3%) respectively. No single test value shall be above six and a half percent (6.5%) nor below one and a half percent (1.5%). Air voids are determined by AASHTO T 269, AASHTO T 209, and AASHTO T 166 of the compacted specimen.
6. Asphalt Binder Grading: Contracting Officer will determine acceptability based upon sampling and conformance to specification limits for each test property. The Contracting Officer may test split liquid asphalt samples taken as part of the contractor's required QC sampling and use those results as part of the final acceptance process.
7. Pavement Thickness Allowable Deviations: The lower specification limits (LSL) will be the design pavement thickness for asphalt concrete pavement minus the allowable

deviation. The allowable deviation will be ten percent (10%) of the designed pavement thickness. No single sample shall be beyond twenty percent (20%) of the designed pavement thickness.

END OF SECTION 32 12 16

SECTION 32 12 36 – SEAL COAT

PART 1 - GENERAL

1.1. DESCRIPTION

A. This work shall consist of the installation and application of SealMaster® Polymer Modified MasterSeal (PMM) or equivalent that helps to seal fine cracks in the pavement surface and provide protection from the process of oxidation in accordance with the manufacturer's recommendations.

B. The seal coat shall consist of a squeegee (first application) and spray (second application) of the existing pavement with 0.10 to 0.15 gallons per square yard of diluted asphalt emulsion from a distributor. To help improve skid resistance, a fine cover aggregate can also be applied by the distributor in a one-step process in the same pass as the spray application. In preparation for the application, the road surface should be swept clean of any debris. Following the placement of the treatment, traffic should remain off the surface until the emulsion has fully cured (up to 2-4 hours depending on road and weather conditions).

C. The work also includes pavement sweeping. Pavement patching, crack sealing and pavement markings will be performed under separate tasks.

1.2. EQUIPMENT

A. The equipment used by the Contractor shall include, but not be limited to, the following:

1. Asphalt distributor:

a. Capable of heating asphalt evenly;

b. Adjustable full circulation spray bar to 15-foot width;

c. Positive controls including tachometer, pressure gauge, volume measuring device, or calibrated tank to uniformly deposit asphalt over the full width within 0.02 gallons per square yard of the required rate; and

d. Thermometer for measuring the asphalt temperature in the tank.

PART 2 - MATERIALS

2.1. BLOTTER

A. Furnish sound, durable particles of gravel or crushed stone conforming to the following:

1. Material passing 3/8 inch sieve, AASHTO T 27 100%

2. Liquid limit, AASHTO T 89 25 max.

3. Free of organic matter and clay balls

2.2. POLYMER MODIFIED SEALANT

A. SealMaster® Polymer Modified MasterSeal (PMM) or equivalent to provide a high performance mineral reinforced asphalt emulsion seal coat blended with polymers and special surfactants for superior adhesion, flexibility, and durability.

2.3. WATER

A. Conform to the following:

1. Water for earthwork, pavement courses, dust control, and incidental construction. Furnish water free of substances detrimental to the work.

PART 3 - EXECUTION

3.1. SURFACE PREPARATION

A. All surface preparations shall be completed by the Contractor prior to applying the seal coat. Cover all manhole covers, water boxes, catch basins and other such utility structures with plastic or building felt. Reference each location for masking removal.

B. Surface preparation includes a combination of power sweeping, hand sweeping, and air blowing of the existing pavement surface to remove all surface debris and dust.

C. All pavement markings shall be removed or masked by approved methods which include:

1. High pressure water.
2. Steam or superheated water.
3. Mechanical devices such as grinders, sanders, scrapers, scarifiers and wire brushers.
4. Felt roofing paper and masking tape.
5. Black out paint.

D. Temporary Markings, if applicable, shall be installed using Temporary Preformed Retro Reflective Pavement Marking Tape and shall be removed by the Contractor immediately prior to seal coat application.

3.2. WEATHER LIMITATIONS

A. The minimum pavement surface temperature for application of the seal coat is 40°F in the shade, although it is recommended that the surface temperature be above 50°F. No freezing conditions are allowed in the first 24 hours, as the emulsion-based products require about one-day to fully cure.

3.3. SEAL COAT APPLICATION

A. Apply sealant diluted with water onto an existing asphalt surface. Provide a uniform application across the entire width of the diluted emulsified asphalt at a rate of 0.10 to 0.15 gallons per square yard depending on the condition of the existing surface. Overlapping at the joints shall be

approximately 6 inches. Continuously monitor the rate of squeegee/spray. The applicator shall be capable of providing digital outputs and a control strip shall be performed during the first day to ensure that the readout is accurate. The spray bar should be calibrated and able to be adjusted to within ± 10% of the design application rate. Coverage of the pavement must be even and uniform and, as such, it is important that there are no plugged nozzles on the spray bar.

B. Calibrate the asphalt distributor spray bar height, nozzle angle, and pump pressure and check longitudinal and transverse spread rates weekly according to ASTM D 2995. If different asphalt distributors are used, calibrate each before use on the project. Ensure that the length of the spread is no more than can be covered with aggregate immediately after application.

C. Protect the surfaces of nearby objects to prevent spattering or marring. Spread building paper on the surface for a sufficient distance from the beginning and end of each application so the flow through the distributor nozzles may be started and stopped on the paper.

D. The CO will approve the exact application rate, temperature, and area to be treated before application and may make adjustments for variations in field conditions. Apply the asphalt uniformly with an asphalt distributor. Move distributor forward at the proper application speed at the time the spray bar is opened. Use care to avoid excess application of asphalt at the junction of spreads.

E. Correct skipped areas or deficiencies. Remove and dispose of paper or other material used.

1. Spraying Temperature 70 - 160 degrees F

2. Mixing Temperature 70 - 160 degrees F

F. Repeat the application to produce a double seal coat after allowing the initial application of seal coat to penetrate undisturbed for at least 2 hours.

3.4. OPENING TO TRAFFIC

A. Allow each application of seal coat to penetrate undisturbed for at least 2 hours or until the emulsified asphalt breaks and is substantially absorbed into the existing surface. Then, lightly cover remaining spots of excess asphalt with blotter before opening the surface to traffic.

3.5. MAINTENANCE OF TRAFFIC

A. Traffic Control will be provided by the Contractor. The Contractor shall maintain access at all times in accordance with the Staging Plans. Traffic Control shall conform to the latest edition of the MUTCD.

END OF SECTION 32 12 36

SECTION 32 17 23 – PAVEMENT MARKINGS

PART 1 – GENERAL

1.1 DESCRIPTION

A. This work consists of applying permanent pavement markings and raised pavement markers on the completed pavement.

1. Pavement markings included in this project are limited to the following:

Type B – Waterborne Traffic Paint with Type 1 Glass Beads.
Type H – Thermoplastic Pavement Markings with Type 1 Glass Beads.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Waterborne Traffic Paint (Type B). Furnish an acrylic water-based, ready-mixed paint for use on asphalt and rigid pavements conforming to the following:

1. Composition. Furnish a paint composed of resin solids of 100 percent acrylic polymer with the exact formulation determined by the manufacturer. Conform to the following:

a	Pigment, % by mass, ASTM D 3723	45 to 55%
b	Lead, chromium, cadmium, or barium, ASTM D 3335 & D3718	0%
c	Volatile organic compounds, ASTM D 2369	20.0 ounces per gallon (max)
d	Mass of paint, ASTM D 1475	12. pounds per gallon (min)

2. Viscosity: ASTM D 562 — 75-90 Krebs units

3. Drying time

a	Dry to no pickup, ASTM D 711	10 minutes (max.)
b	Drying to no track, 6 pounds per gallon, type 1 waterproofed glass beads	90 seconds (max.)
c	15±1 mil wet film thickness at 130 ºF	

4.	Flexibility, ASTM D 522, using the 1/4-inch cylindrical mandrel	No cracking or flaking
5.	Dry opacity, ASTM D 2805, contrast ratio at 319 square feet per gallon spreading rate	0.96 (min)
6.	Color	
	a White, ASTM D 1729, highway white	Match FHWA standard
	b Yellow, ASTM D 1729, highway yellow	Match FHWA standard
7.	Daylight reflectance. (Without glass beads)	
	a White, FTMS 141 method 6121, ASTM E 1347	84% relative to magnesium oxide standard
	b Yellow, FTMS 141 method 6121, ASTM E 1347	55% relative to magnesium oxide standard
8.	Bleeding ratio, ASTM 969	0.96 (min)

Determine reflectance according to ASTM D 1347 immediately after drying. Divide the average of 3 reflectance readings of the paint over the bleeding surface by the average of 3 readings over the non-bleeding surface to determine the bleeding ratio

9.	Scrub resistance, ASTM D 2486	300 cycles (min)
10.	Freeze-thaw stability. ASTM D 2243	
	a Change in viscosity	±5 Krebs units (max)
	b Decrease in scrub resistance	-10% (max.)

11. Storage stability. During a 12-month storage period, conform to the following:

    a No excessive setting, caking, or increase in viscosity; and Readily stirred to a consistency for use in the striping equipment

B. Thermoplastic Markings, Conform to AASHTO M 249

C. Glass Beads. Conform to AASHTO M 247 for the type specified.

D. Raised Pavement Markers

1. Non-plowable, extended life, retroreflective, pavement markers. Conform to ASTM D 4280

2. Plowable, retroreflective, pavement markers. Conform to ASTM D 4383

PART 3 – EXECUTION

3.1 PAVEMENT MARKINGS

A. General: Before opening a pavement surface to traffic, remove all conflicting pavement markings by sandblasting or other methods that do not damage the surface or texture of the pavement. Make the removal pattern uneven so it does not perpetuate the outline of the removed pavement markings. Lightly coat sandblasted or removal areas on asphalt surfaces with emulsified asphalt.

Where existing and final pavement marking locations are identical, stake the limits of all existing pavement markings (no-passing zones, edge stripes, etc.) before any pavement work.

Upon completion of the final surface course, establish line limits for the new pavement for approval before marking. Provide temporary layout or marking of final striping limits for review and approval by the cor prior to application of permanent markings. Establish markings according to the MUTCD. In curve widening areas, apply the pavement edge markings at the edge of the traveled way and the centerline markings midway between the pavement lines.

Remove loose particles, dirt, tar, grease, and other deleterious material from the surface to be marked. Where markings are placed on rigid pavement less than 1 year old, clean the pavement of all residue and curing compounds. Remove temporary pavement markings the same day permanent pavement markings are applied. Apply markings to a clean, dry surface according to the MUTCD.

At least 7 days before applying pavement markings, furnish a written copy of the marking manufacturer's recommendations for use. A field demonstration may be required to verify the adequacy of recommendations.

Legends and symbols shall be installed per the dimensions shown on the exhibits or the latest edition of the Manual of Uniform Traffic Control Devices (MUTCD).

Ship marking material in appropriate containers plainly marked with the following information, as appropriate, for the material being furnished:

1. Manufacturer's name and address
2. Name of product
3. Lot/batch numbers
4. Color
5. Net mass and volume of contents

6. Date of manufacture
7. Date of expiration
8. Statement of contents (if mixing of components is required)
9. Mixing proportions and instructions
10. Safety information

Prior to full production, provide a minimum 500 linear foot control strip for each type of marking material for review and acceptance by the COR.

Apply pavement markings in the direction of traffic according to the manufacturer's recommendations. Apply all markings to provide a clean-cut, uniform, and workmanlike appearance by day and night. Striping shall be straight and true to line. Misaligned, wavy, or irregular markings will not be accepted and shall be removed and replaced.

Maintain striping equipment in proper working condition. Clean and maintain nozzles and application equipment to ensure uniform distribution of marking material. Make lines 4 inches wide. Make broken lines 10 feet long with 30-foot gaps. Make dotted lines 2 feet long with 4-foot gaps. Separate double lines with a 4-inch space.

Protect marked areas from traffic until the markings are dried to no-tracking condition. Remove all tracking marks, spilled marking material, markings in unauthorized areas, and defective markings.

B. Waterborne Traffic Paint (Type B). Apply paint when the pavement and air temperatures are above 50 ºF. Spray paint at 15 mil minimum wet film thickness before glass beads or at a rate of 107 square feet per gallon. Immediately apply Type 1 glass beads on the paint at a minimum rate of 6 pounds per gallon of paint.

C. Thermoplastic Markings (Type H). On areas to be marked on rigid pavements and old asphalt pavements, apply an epoxy resin primer/sealer according to the thermoplastic manufacturer's recommendations. Allow the primer/sealer to dry.

Apply thermoplastic when the pavement and air temperatures are above 50 ºF. Spray or extrude the thermoplastic at 430±5 ºF. For centerlines and lane lines, spray or extrude 90 mil minimum dry film thickness or at a rate of 17.8 square feet per gallon. For edge lines, spray or extrude 60 mil minimum dry film thickness or at a rate of 26.7 square feet per gallon.

Immediately apply Type 1 glass beads on the thermoplastic at a minimum rate of 12 pounds per 100 square feet. Thermoplastic markings shall produce a smooth, uniform finish free of excessive buildup, overlapping edges, or surface irregularities

D. Raised Pavement Markers (RPM). Install raised pavement markers when the pavement and air temperatures are above 50 ºF. Apply raised pavement markers with epoxy resin or asphalt adhesive.

Heat epoxy components A and B separately with indirect heat, mix, and apply at 70±10ºF. Discard all material heated over 120 ºF or stiffened by polymerization.

Heat and apply asphalt adhesives at 412±12 ºF. Discard all material heated over 450 ºF.

Space and align the markers to within 1/2 inch of the required location. Do not place raised pavement markers over pavement joints.

The minimum bond strength will be 1.75 pounds per square inch or a total tensile strength of 25 pounds.

E. Acceptance.

1. Material will be evaluated under Sections 01 90 00.

2. Placement of permanent pavement markings will be evaluated under Section 01 90 00.

END OF SECTION 32 17 23

SECTION 32 21 11 – TRAFFIC LOOPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work consists of installing traffic loops.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Electrical material

(a) Wire and cable.

(1) Lighting. Furnish either ozone resistant cross-linked polyethylene (XLP) or polyvinyl chloride (PVC) insulated cable, with or without a nylon jacket conforming to the following:

(a) Polyethylene (XLP). Insulated Cable Engineers Association (ICEA) S-66-524, ICEA S-95-658/NEMA WC70, *Non-Shielded Power Cables Rated 2000 V or Less*, ICEA S-96-659/NEMA WC71, *Non-Shielded Power Cables Rated 2001-5000 V*, ICEA S-93-639/NEMA WC74, *Shielded Power Cable 5,000-46,000 V*; or

(b) Polyvinyl chloride (PVC). Conform to UL 83, *Thermoplastic-Insulated Wires and Cables*.

(2) Electrical. Furnish soft drawn or annealed copper conductors conforming to ASTM B3 and stranding conforming to ASTM B8.

Furnish 7 strand for #10 AWG through #2 AWG (5.3 square millimeters through 33.6 square millimeters), and 17 strand for #1 AWG through #4/0 AWG (42.4 square millimeters through 107 square millimeters). Furnish #6 AWG (13.3 square millimeters) minimum solid copper ground wires.

PART 3 - EXECUTION

3.1 REGULATIONS AND CODES

A. Furnish material and workmanship conforming to the standards of the National Electrical Code, local safety code, UL, and the National Electrical Manufacturers Association (NEMA).

B. Obtain permits, arrange for inspections, and pay fees necessary to obtain electrical service.

C. Notify the CO, local traffic enforcement agency, utility companies, or railroad company at least 7 days before operational shutdown to coordinate connections or disconnections to an existing utility or system.

3.2 GENERAL

A. Submit a list of proposed equipment and material 14 days before installation. Include the manufacturer's name, size, and identification number of each item. Supplement the list with scale drawings and wiring diagrams showing locations and details of equipment and wiring.

B. The CO will approve the exact locations of the systems.

C. Salvage material acceptable for reuse in the work.

D. Where roadways are to remain open to traffic and existing systems will be modified, maintain the existing systems in operation until final connection to the modified circuit to minimize traffic disruptions.

3.3 TRAFFIC LOOPS

A. Do not install loops when the pavement is wet.

B. Loops shall be installed between lifts of new pavement or on milled surface.

C. Install the loop wire in one continuous length at the approved location. Install without kinks, curls, or other damage to the wire or its insulation. Replace damaged wires.

D. Where the loop wire crosses a crack or joint, use a plastic sleeve that extends 4 inches (100 millimeters) on each side of the crack or joint. Provide extra loop wire in the sleeve for joint expansion and contraction.

E. Twist the loop lead-in wires 5 turns per foot (16.5 turns per meter) from the loop to the pull box. Color code the wires of each loop for identification of separate loops. Coil 36 inches (900 millimeters) of lead-in pair slack in the pull box for each loop.

F. Before applying pavement on top of loops, test the loop and lead-in for continuity and resistance by applying a 1000-volt megohmmeter between each end of the loop lead-in and the nearest reliable electrical ground. If no available ground exists, establish a ground for the measurement. Record the location and megohmmeter readings and submit readings and test equipment data. Replace the loop if the megohmmeter reading is less than 10 megohms or the inductance is less than 60 microhenries or more than 100 microhenries.

H. Repeat the resistance and continuity test after pavement is applied. Report the second test for comparison with the first test report.

PART 4 – TESTING AND ACCEPTANCE

4.1 TESTING AND DEMONSTRATION PERIOD

A. Before energizing portions of the system, demonstrate that the conductor system is clear and free of short circuits, open circuits, and unintentional grounds. Repair or replace faulty circuits.

B. After energizing the system, demonstrate that all electrical components work properly. Repair or replace faulty electrical components.

C. After completing electrical component tests, conduct a demonstration test for 30 continuous days. Adjust and correct deficiencies in the system during the 30-day demonstration period. If part of the system is replaced or repaired, retest that part of the system for an additional 30 days.

4.2 WARRANTIES, GUARANTEES, AND INSTRUCTION SHEETS

A. When installations are permanent, deliver manufacturer's warranties, guarantees, instruction sheets, and parts lists at the final inspection.

4.3 ACCEPTANCE

A. Material for traffic loops will be evaluated under 01 90 00, Acceptance of Work.

B. Installation of traffic loops will be evaluated under 01 90 00, Acceptance of Work.

END OF SECTION 32 31 11.

SECTION 32 91 19.14 – AGGREGATE TOPSOIL COURSE

PART 1 – GENERAL

1.1 DESCRIPTION

A. This work consists of furnishing and placing an aggregate, topsoil, cellulose fiber mulch, and seed mixture on a prepared shoulder or other surface.

1.2 SUBMITTALS

A. Seed shall be certified as to mixture, germination, purity, and live seed.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Aggregate for Aggregate-Topsoil Course. Conform to the following:

1. Gradation AASHTO M 43, size number 57
2. Quality AASHTO M 80, class E

B. Furnished Topsoil – Furnish fertile, friable, free draining, sandy loam soil that is free of subsoil, refuse, stumps, roots, brush, weeds, rocks larger than 1 inch, or other substances detrimental to the development of vegetative growth. Demonstrate that the soil can sustain healthy crops of grass, shrubs, or other plant growth. Conform to the following:

1. Texture
   a. Organic matter, AASHTO T 267 3 to 10%
   b. Sand, AASHTO T 88 20 to 70%
   c. Silt, AASHTO T 88 10 to 60%
   d. Clay, AASHTO T 88 5 to 30%
2. pH, AASHTO T 289 6 to 8.

C. Conserved Topsoil – Excavated material conserved from the roadway excavation and embankment foundation areas that is suitable for growth of grass, cover crops, or native vegetation.

D. Seed

1. For COWP, KIMO, and NISI, seed shall consist of a turf-type tall fescue blend containing a minimum of three (3) cultivars suitable for the South Carolina Piedmont region. Mix shall contain not less than 90 percent turf-type tall fescue and not more than 10 percent annual rye for temporary cover.

2. Seed shall be certified and applied at the manufacturer's recommended rate for new turf establishment

3. For CONG, no seeding is required. Shoulder areas shall be graded and stabilized with an aggregate/topsoil mix only.

E. Water. Conform to the following:

1. Water for mixing or curing cement concrete, mortar, or grout. Conform to AASHTO M 157. Potable water of known quality may be used without testing according to AASHTO T 26. Potable water is safe for human consumption as defined by the public health authority having jurisdiction.

2. Water for planting or care of vegetation. Furnish water that is free of substances injurious to plant life such as oils, acids, alkalies, or salts.

3. Water for earthwork, pavement courses, dust control, and incidental construction. Furnish water free of substances detrimental to the work.

PART 3 – EXECUTION

3.1 AGGREGATE TOPSOIL COURSE

A. Preparing Surface: Complete the adjoining pavement before placing an aggregate-topsoil mixture on the shoulder. Scarify the area where the mixture is to be placed to a depth of 2 inches. Reduce all clods and sod to a maximum size of 4 inches.

B. Mixing, Placing, and Compacting: Furnish a mixture of 50±10 percent aggregate and 50±10 percent topsoil by volume with sufficient water for compaction.
Mix the components into a uniform mixture. Spread the mixture on the prepared surface in a uniform layer. Shape the mixture to the line, grade, and cross-section. Remove all clods and stones greater than 2 inches in diameter.

Uniformly compact the mixture so that it does not exhibit heaving, pumping, rutting, or shearing. Seeding shall be performed in accordance with part 2.1.D. Seed shall be uniformly distributed at the manufacturer's recommended rate for new turf establishment.

C. Cellulose fiber mulch may be applied where directed by the COR for erosion control.

D. Acceptance.

1. Material will be evaluated under Sections 01 90 00.

END OF SECTION 32 91 19.14

DIVISION 34

TRANSPORTATION

SECTION 34 01 00 – MAINTENANCE OF TRAFFIC

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work of this section shall consist of preparing, submitting for review, and implementing a maintenance of traffic plan for the work of this project. All requirements for maintenance of traffic shall be in accordance with the latest edition of the Manual of Uniform Traffic Control Devices and all reference documents.

PART 2 – PRODUCTS

2.1 MATERIALS

A. All materials and products used for maintenance of traffic on this project shall be in accordance with the latest edition of the Manual of Uniform Traffic Control Devices and all reference documents.

PART 3 – EXECUTION

3.1 MAINTENANCE OF TRAFFIC

A. Prior to the start of construction, the Contractor shall develop and submit to the COR for approval a proposed sequence of construction and maintenance of traffic plan. Maintenance of traffic shall conform to the work zone traffic control requirements of the latest edition of the Manual of Uniform Traffic Control Devices for Streets and Highways (MUTCD) published by the Federal Highway Administration. The maintenance of traffic plan submittal shall include plans for each work zone traffic control situation anticipated during construction.

B. All construction signing and maintenance of traffic measures required shall be in place prior to the start of work.

C. Acceptance:

1. Maintenance of traffic work will be evaluated under subsection 01 90 00 1.2.

END OF SECTION 34 01 00