2010P042

HNTB

#F – 420

Tres Rios Environmental Restoration Phase 3B

Grading Specifications

Final Submittal
November 2011

US Army Corps of Engineers®
Los Angeles District

Kiewit

City of Phoenix

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PHASE 3A SPECIFICATIONS SHALL APPLY TO PHASE 3B EXCEPT AS LISTED BELOW. FOR CONSTRUCTION OF PHASE 3B, THE SPECIFICATIONS LISTED BELOW SHALL REPLACE THE RESPECTIVE PHASE 3A SPECIFICATIONS.

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SECTION 31 00 00

EARTHWORK
10/04

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D 1140	(2000; R 2006) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 2487	(2006e1) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D 4318	(2005) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 DEFINITIONS

1.2.1 Satisfactory Materials

Satisfactory materials for grading shall be comprised of in-situ material and river cobbles/stones less than 3 to 4 inches in diameter.

1.2.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter. The Contracting Officer's Representative shall be notified of any contaminated materials.

1.2.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Testing required for classifying materials shall be in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

1.2.4 Hard/Unyielding Materials

Weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than 3 to 4 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.2.5 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.2.6 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than 25 when tested in accordance with ASTM D 4318.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Dewatering Work Plan; G RE

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Controlled Low Strength Materials (CLSM)

CLSM shall have a minimum 28-day compressive strength of 1000 psi. The CLSM shall be non-segregating and shall have high flowability as described in ACI 229 It shall be flowable and capable of filling the voids as indicated on the drawings. The CLSM may contain coarse aggregates to a 3/4-inch nominal maximum coarse aggregate size. The precise mix proportions are the responsibility of the contractor and will be prepared to meet the placing requirements specified.

PART 3 EXECUTION

3.1 GENERAL EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with

the typical sections and contours shown and the tolerances specified in paragraph FINISHING. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times.

3.1.1 Ditches, Corridors, and Channel Changes

Finish excavation of ditches, corridors, and channel changes by cutting accurately to the grades and elevations shown on the drawings. Do not excavate features below grades shown. Backfill the excessive open ditch or excavation with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Dispose excavated material as shown or as directed, except in no case allow material be deposited a maximum 4 feet from edge of a ditch. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.1.2 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. The Contractor shall establish/construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to facilitate construction activities. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.2.5 Trench Excavation Requirements

Excavate the trench as provided in Section 33 40 00, Paragraph TRENCHING.

3.1.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, remove such material to the depth directed and replace it to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost to the Government.

3.2 PRESERVATION OF PROPERTY

All excavation operations shall be conducted in such a manner that concrete structures, embankments, utilities, or other facilities and improvements which are to remain in place permanently will not be subjected to settlement or horizontal movement. The Contractor shall furnish and install sheet piling, cribbing, bulkheads, shores, or whatever means may be necessary to adequately support material carrying such improvements or to support the improvements themselves and shall maintain such means in position until they are no longer needed. Temporary sheet piling, cribbing, bulkheads, shores or other protective means shall remain the property of the Contractor and when no longer needed shall be removed from the site.

The Contractor shall submit for approval shop drawings showing proposed method of bracing which he intends to use. All shoring and bracing shall be designed so that it is effective to the bottom of the excavation, and shall be based upon calculation of pressures exerted by (and the condition and nature of) the materials to be retained, including surcharge imparted to the side of the trench by equipment and stored materials. Removal of shoring shall be performed in such manner as not to disturb or damage the finished concrete or other facility.

3.3 EXCAVATION OF THE COLLECTOR CHANNELS

Channel excavation consists of the removal of all materials within the channel footprint, to lines and grades indicated. Channels shall not be excavated below grades shown. Excessive excavation shall be backfilled with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Material excavated shall be disposed of as shown or as directed, except that in no case shall material be deposited less than 4 feet from the edge of a ditch. The Contractor shall maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris. Side slopes shall be uniform for the entire length of any one side, unless otherwise directed.

3.4 DISPOSITION AND DISPOSAL OF EXCAVATED MATERIALS

Excavated materials suitable for required fills shall be placed in temporary stockpiles or used directly in the work. Satisfactory excess excavated natural ground and surface material and soils not utilized as part of the construction shall become the property of the Contractor, and disposed off project site at the Contractor's expense.

3.5 OVERCUT

Except as otherwise specified or specifically ordered in writing, any overcut or excavation beyond the lines and grades indicated in the plans (or as directed) shall be backfilled with compacted fill conforming to the Paragraph EMBANKMENTS. Subgrades shall be prepared in accordance with Paragraph SUBGRADE PREPARATION. All excavating, backfilling, compacting of backfill, and concreting occasioned thereby shall be by the Contractor at no additional cost to the Government.

3.6 STOCKPILE SITES

Stockpiles of satisfactory and unsatisfactory and wasted materials shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources.

3.7 GROUND SURFACE PREPARATION

3.7.1 General Requirements

Unsatisfactory material in surfaces to receive fill or in excavated areas

shall be removed and replaced with satisfactory materials as directed by the Contracting Officer's Representative. The surface shall be scarified to a depth of 12 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 3 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 12 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill.

3.8 BACKFILLING

3.8.1 Controlled Low Strength Material (CLSM)

CLSM material shall be brought up uniformly to the lines or limits shown on the plans.

CLSM shall be placed directly into the trench and consolidated by its own mass. If the trench contains water, CLSM may be used to displace the water provided measures are taken to prevent segregation of the CLSM during placement. Temporary bulkheads are permitted to control required placement quantities.

3.9 EMBANKMENTS

3.9.1 General Embankment

Construct embankments from in-situ material placed in successive horizontal layers of loose material not more than 12 inches in depth. Do not use pieces of rock larger than 4 inches in the greatest dimension. Spread each layer of material uniformly, completely saturate, and compact with tracked dozer weighing at least 4 tons, vibratory compactors weighing at least 4 tons, or steel-wheeled rollers weighing at least 4 tons.

Compaction using the above-referenced equipment shall be observed daily and visual opservations recorded in a report provided to the Contracting Officer. A minimum of 4 passes of tracked dozer, vibratory compators, or steel-wheel rollers at each lift is required. The number of passes shall be increased where movement of the rock is occuring during compaction.

In areas where embankments are required in water, bring fill material up two feet above the localized water surface elevation prior to compaction.

3.10 SUBGRADE PREPARATION

3.10.1 Construction

Subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with, satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 6 inches below finished grade for the subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as

specified.

3.11 FINISHING

The surface of excavations and subgrades shall be finished to a smooth and compact surface in accordance with the general notes, lines, grades, and cross sections or elevations shown. Gutters and ditches shall be finished in a manner that will result in effective drainage. Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work, shall be repaired and grades re-established to the required elevations and slopes.

The Contractor may dispose of excess excavated material on-site by creating pseudo-natural terrain features such as "humps," "bumps," and "mounds" so long as doing so does not interfere with the design intent of the project or create an un-desirable aesthetic effect in conflict with project stakeholder intentions.

3.11.1 Subgrade and Embankments

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until subbase, or concrete is placed. The storage or stock piling of materials on the finished subgrade will not be permitted. No gravel shall be laid until the subgrade has been checked and approved, and in no case shall gravel be placed on a muddy or spongy subgrade.

3.12 PLACING EMBANKMENT

a. Place embankment material to uniform thickness.

b. Intermix different sizes of pieces to eliminate segregation and to fill voids between larger pieces with smaller pieces and work surface free from irregularities.

c. Use placement and intermixing methods that avoid disturbing or damaging existing facilities, completed work, or adjacent property.

3.13 DISPOSITION OF SURPLUS MATERIAL

Surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber shall be removed from Government property as directed by the Contracting Officer 's Representative.

3.14 EXCAVATION OF WASTE

The Contractor shall immediately notify the Contracting Officer's Representative if waste as defined in Article 1.2.8 of Section 01 57 20.00 10 ENVIRONMENTAL PROTECTION is encountered during excavation. Excavation and disposal will be in accordance with requirements in Section 01 57 20.00 10, ENVIRONMENTAL PROTECTION. Should waste extend below bottom or beyond the sides of the planned excavation the Contractor shall over excavate within the influence area to the following depth and distances, as shown on plans, or as directed.

Facility	Distance of Over Excavation (feet)	
	Inert Material or Construction Debris	Mixed, Household Waste, or Tires
Structures	5	Depth equal to twice foundation width
Roads	3	5
Overbank Canals	2	3
Wet lands	4	5
Pipelines	2	3

All overexcavations at inert material, construction debris, or mixed waste locations shall be backfilled as specified for earth embankments fill unless otherwise directed by the Contracting Officer's Representative. Overexcavations at household waste locations shall be backfilled with liner material as specified in Section 01 57 20.00 10 ENVIRONMENTAL PROTECTION, unless otherwise directed by the Contracting Officer's Representative.

3.15 TIRE REMOVAL

All tires and pieces of tires greater than 6 inches in size shall be removed from within the excavation limits and disposed offsite.

All tires removed during excavation activities or recovered from the ground surface shall be handled, stored, transported, and disposed of in accordance with applicable federal, state, and local regulations. Applicable state regulations include: Arizona Revised Statues (ARS) SS44-1301 et seq: S44-1301; S44-1302; S44-1303; S44-1304.01; S44-1305; S44-1306; S44-1307.

Tires shall be cleaned of all soil and other debris prior to removal from site.

3.16 SPECIAL OR HAZARDOUS WASTE

Special or Hazardous Waste: In the event that the Contractor encounters any suspected special or hazardous waste, the Contractor will immediately notify the Contracting Officer's Representative. The Contracting Officer will direct the Contractor to implement the Special and Hazardous Waste Contingency Plan as specified in Section 01 57 20.00 10 ENVIRONMENTAL PROTECTION.

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BITUMINOUS TACK AND PRIME COATS

08/08

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SECTION 32 12 10

BITUMINOUS TACK AND PRIME COATS
08/08

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 33/C 33M	(2011) Standard Specification for Concrete Aggregates

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Waybills and Delivery Tickets

Waybills and delivery tickets, during progress of the work.

SD-06 Test Reports

Sampling and Testing

Copies of all test results for emulsified asphalt, and bituminous materials, within 24 hours of completion of tests. Certified copies of the manufacturer's test reports indicating temperature viscosity relationship for cutback asphalt, compliance with applicable specified requirements, not less than 30 days before the material is required in the work.

1.3 DELIVERY, STORAGE, AND HANDLING

Inspect the materials delivered to the site for contamination and damage. Unload and store the materials with a minimum of handling.

1.4 ENVIRONMENTAL REQUIREMENTS

Apply bituminous coat only when the surface to receive the bituminous coat is dry. Apply bituminous coat only when the atmospheric temperature in the shade is 50 degrees F or above and when the temperature has not been below 35 degrees F for the 12 hours prior to application, unless otherwise directed.

PART 2 PRODUCTS

2.1 PRIME COAT

Prime coat (liquid asphalt) shall consist of either natural crude or refined asphalt petroleum, or a residual product thereof.

The liquid asphalt shall be medium curing product designed by the letters MC, and shall consist of a paving asphalt conforming to the provisions in Section 32 12 16 HOT-MIX ASPHALT (HMA) FOR ROADS, fluxed or blended with a kerosene type solvent.

The asphalt shall not be heated during the process of its manufacture or during construction so as to cause injury as evidence by the formation of carbonized particles.

AASHTO 82										
	MC-30		MC-70		MC-250		MC-800		MC-3000	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
KINEMATIC VISCOSITY AT 60 DEG C (140 DEG F) CENTISTOKES	30	60	70	140	250	500	800	1600	3000	6000
FLASH POINT (TAB. OPEN-CUP), DEG C (F)	38 (100	---	38 (100	---	66 (150	---	66 (150	---	66 (150	---
WATER PERCENT	---	0.2	---	0.2	---	0.2	---	0.2	---	0.2
DISTILLATION TEST: DISTILLATE PERCENTAGE BY VOLUME OF TOTAL DISTILLATE TO 360 DEG C (680 DEG F)										
TO 225 DEG C (437 DEG F)	---	25	0	20	0	10	---	---	---	---
TO 260 DEG C (500 DEG F)	40	70	20	60	15	55	0	35	0	15
TO 315 DEG C (600 DEG F)	75	93	65	90	60	87	45	80	15	75
RESIDUE FROM DISTILLATION TO 360 DEG C (680 DEG F) VOLUME PERCENTAGE OF SAMPLE DIFFERENCE	50	---	55	---	67	---	75	---	80	---

TESTS ON RESIDUE FROM DISTILLATION										
ABSOLUTE VISCOSITY AT 60 DEG C (140 DEG F) POISES	300	1200	300	1200	300	1200	300	1200	300	1200
DUCTILITY, 5 CM/MIN, CM	100	---	100	---	100	---	100	---	100	---
SOLUBILITY IN TRICHLOROETHYLENE, PERCENT	99	---	99	---	99	---	99	---	99	---

2.2 TACK COAT

Tack coat (emulsified asphalt) shall be composed of a paving asphalt base uniformly emulsified with water and an emulsifying or stabilizing agent. It shall be homogeneous throughout and if stored, shall show no separation of ingredients within 30 days after delivery. Emulsified asphalt shall be classified as quick setting, rapid setting, medium setting or slow setting type in either anionic or cationic emulsions.

REQUIREMENTS FOR ANIONIC EMULSIFIED ASPHALT														
TYPE	RAPID-SETTING				MEDIUM-SETTING						SLOW-SETTING			
GRADE	RS-1		RS-2h		MS-1		MS-2		MS-2h		SS-1		SS-1h	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
TESTS ON EMULSIONS VISCOSITY, SAYBOLT FUROL AT 77 DEG F, SEC	20	100			20	100	100		100		20	100	20	100
VISCOSITY, SAYBOLT FUROL AT 122 DEG F, SEC			75	400										
SETTLEMENT, 24 HOUR DAY, PERCENT		1		1		1		1		1		1		1
DEMULSIBILITY 35 ml 0.02 N CaCl2,	60		60											
COATING ABILITY AND WATER RESISTANCE														
COATING, DRY AND AGGREGATE					GOOD		GOOD		GOOD					
COATING, AFTER					FAIR		FAIR		FAIR					

COATING, WET AGGREGATE					FAIR		FAIR		FAIR					
COATING, AFTER					FAIR		FAIR		FAIR					
CEMENT MIXING TEST,												2		2
SIEVE TEST, PERCENT		0.1		0.1		0.1		0.1		0.1		0.1		0.1
RESIDUE BY DISTILLATION, PERCENT	55		63		55		65		65		57		57	
TESTS ON RESIDUE FROM DISTILLATION TEST:														
PENETRATION 77 DEG F, 100g, 5s	100	200	40	90	100	200	100	200	40	90	100	200	40	90
DUCTILITY, 77 DEG F, 5 cm/min cm	40		40		40		40		40		40		40	
SOLUBILITY IN TRICHLOROETHY	97.		97.		97.		97.		97.		97.		97.	

REQUIREMENTS FOR ANIONIC/CATIONIC EMULSIFIED ASPHALT																
TYPE	QUICK SETTING				RAPID SETTING				MEDIUM SETTING				SLOW SETTING			
GRADE	QSH		CQSH		CRS-1		CRS-2h		CMS-2		CMS-2h		CSS-1		CSS-1h	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
TESTS ON EMULSIONS:																
VISC., SAYBOLT FUROL AT 77 DEG F, SEC	20	10											20	10	20	100
VISC., SAYBOLT FUROL AT 122 DEG F, SEC					20	10	10	40	50	45	50	45				
SETTLEMENT, 24 HOUR DAY, PERCENT						1		1		1		1		1		1

DEMULSIBILITY 35 ml 0.8% SODIUM DIOCTYL SULFOSUCINATE %					40		40									
COATING ABILITY AND WATER RESISTANCE:																
DRY AGGREGATE									GOOD		GOOD					
AFTER SPRAYING									FAIR		FAIR					
WET AGGREGATE									FAIR		FAIR					
AFTER SPRAYING									FAIR		FAIR					
PARTICLE CHARGE TEST	NEGAT		POSITI		POSITI		POSITI		POSITI		POSITI		POSITI		POSITIVE	
SIEVE TEST, %	0.1		0.10		0.10		0.10		0.10		0.10		0.10		0.10	
CEMENT MIXING TEST														2.0		2.0
DISTILLATION:																
OIL DISTILLATE, BY VOLUME OF						3		3		12		12				
RESIDUE, %	57		57		60		65		65		65		57		57	
TEST ON RESIDUE FROM DISTILLATION																
PENETRATION, 77 DEG F, 100g, 5s	40	11	40	11	100	250	40	90	100	250	40	90	100	250	40	90
DUCTILITY, 77 DEG F, 5cm per min, cm	40		40		40		40		40		40		40		40	
SOLUBILITY IN TRICHLOROETHY %	98		98		98		98		98		98		97		97	
STORAGE STABILITY TEST, 1 DAY, %	1		1													

PART 3 EXECUTION

3.1 PREPARATION OF SURFACE

3.1.1 Prime Coat

The surface on which the bituminous prime coat is to be placed shall be uniformly smooth and firm and reasonably true to grades and cross-sections as shown on the plans, and shall be so maintained throughout the period of placing the prime coat. In no event shall a prime coat be placed on a soft, uneven base. Any holes, depressions or irregularities shall be repaired by the removal of all loose and unsuitable material and replacement by suitable material, which shall be compacted to produce a dense surface conforming to the adjacent area. Uniformity of surface texture is of the utmost importance. When required, the surface on which the prime coat is to be placed shall be lightly bladed and rolled immediately prior to the application of bituminous material.

3.1.2 Tack Coat

Immediately before applying the bituminous material, the area to be surfaced shall be cleaned of dirt and other objectionable material. In urban areas, the surface shall be cleaned with a self-propelled pickup sweeper. In rural areas, power brooms may be used. When necessary, cleaning shall be supplemented by hand brooms.

The bituminous material shall not be applied until an inspection of the surface has been made by the Contracting Officer's Representative and he has determined that it is suitable.

3.2 APPLICATION

3.2.1 Prime Coat

Bituminous material shall be applied only when the surface is either slightly damp or dry. For extremely dry areas, a light application of water may be required prior to the application of bituminous material.

The approximate quantity of bituminous material to be used will be between the range of 0.20 and 0.40 gallons per square yard; however, the exact amount used will be determined by the Contracting Officer's Representative at the time of application. The bituminous material shall be uniformly applied to the prepared surface at the rate so designated and in one application.

Upon application of the prime coat, broadcast or spread a thin layer of fine aggregate or sand to serve as a bond-breaker between the CLSM and asphalt pavement. Fine aggregate or sand shall be ASTM C 33/C 33M

When so directed, the surface of the complete prime coat shall be rolled with a pneumatic-tired roller.

Traffic shall be kept off the bituminous material until it has penetrated the base or subgrade and cured sufficiently.

The integrity of the prime coat shall be maintained at all times until the next course is placed or until the final acceptance. In the event traffic has caused holes or breaks in the surface, such holes or breaks shall be satisfactorily repaired by the Contractor.

3.2.2 Tack Coat

The bituminous material shall be applied as soon as possible after preparation of surfaces.

Tack coat shall be diluted in the proportion of 50 percent water and 50 percent emulsion and applied at the rate of 0.05 to 0.10 gallons per square yard. Application shall be made in advance of subsequent construction as ordered by the Contracting Officer's Representative.

3.3 APPLICATION TEMPERATURE

3.3.1 Temperature Ranges

The viscosity requirements determine the application temperature to be used. The following is a normal range of application temperatures:

Liquid Asphalts (Prime Coat)

70	105-175 degrees F
250	140-225 degrees F
800	175-255 degrees F
3000	215-290 degrees F

Emulsions (Tack Coat)

RS-1	70-140 degrees F
MS-1	70-140 degrees F
SS-1	70-140 degrees F
SS-1h	70-140 degrees F
CSS-1	70-140 degrees F
CSS-1h	70-140 degrees F
RS-2	125-185 degrees F
MS-2	125-185 degrees F
MS-2h	125-185 degrees F
CRS-1	125-185 degrees F
CRS-1h	125-185 degrees F
CRS-2h	125-185 degrees F
CMS-2	125-185 degrees F
CMS-2h	125-185 degrees F
QSH	125-185 degrees F
CQSH	125-185 degrees F

These temperature ranges exceed the flash point of the material and care should be taken in their heating.

3.4 DISTRIBUTING EQUIPMENT

Distributor trucks shall be of the pressure type with insulated tanks. Gravity distributors will not be permitted.

Spray bars and extensions shall be of the full circulating type. The spray bar shall be adjustable to permit varying height above the surface to be treated.

The nozzle spacings, center to center, shall not exceed 6 inches. The

valves shall be operated so that one or all valves may be quickly opened or closed in one operation. The valves which control the flow from the nozzles shall be of a positive acting design so as to provide a uniform, unbroken spread of bituminous material on the surface.

The distributor shall be equipped with devices and charts to provide for accurate, rapid determination and control of the amount of bituminous material being applied. The distributor shall be equipped with a tachometer of the auxiliary wheel type registering speed in feet per minute. The distributor shall also be equipped with pressure gauges and an accurate thermometer for determination of the temperature of bituminous material. The spreading equipment shall be designed so that uniform application of a bituminous material can be applied in controlled amounts ranging from 0.05 to 2.0 gallons per square yard. Transverse variation rate shall not exceed ten (10) percent of the specified application rate. The distributor shall be equipped with a hose and nozzle attachment to be used for spotting skipped areas and areas inaccessible to the distributor. Distributor and booster tanks shall be maintained as to prevent dripping of bituminous material from any part of the equipment.

Hand spray by means of hose or bar through a gear pump or air tank shall be acceptable for resurface work, corners or tacking of vertical edges. Care shall be taken to provide uniform coverage.Equipment that fails to perform satisfactorily shall be removed from the job.

3.5 TRAFFIC CONTROLS

Keep traffic off surfaces freshly treated with bituminous material. Provide sufficient warning signs and barricades so that traffic will not travel over freshly treated surfaces.

-- End of Section --

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SECTION 32 12 16

HOT-MIX ASPHALT (HMA) FOR ROADS
08/09

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 96	(2002) Standard Method of Test for Resistance to Degredation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
AASHTO T 180	(2010) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
AASHTO T 283	(2003) Standard Method of Test for Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage.
AASHTO M 17	(2011) Standard Specification for Mineral Filler for Bituminous Paving Mixtures
AASHTO T 245	(1997; R 2009) Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
AASHTO T 90	(2008) Determining the Plastic Limit and Plasticity Index of Soils
AASHTO T 269	(2003) Standard Method of Test for Percent Air Voids in Compacted Dense and Open Asphalt Mixtures
AASHTO T 27	(2006) Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
AASHTO T 304	(2008) Uncompacted Void Content of Fine Aggregate

ASPHALT INSTITUTE (AI)

AI MS-02	(1997 6th Ed) Mix Design Methods
AI SP-2	(2001; 3rd Ed) Superpave Mix Design

ASTM INTERNATIONAL (ASTM)

ASTM C 1089	(2006) Standard Specification for Spun Cast Prestressed Concrete Poles
ASTM C 150	(2009) Standard Specification for Portland Cement
ASTM C 595/C 595M	(2010) Standard Specification for Blended Hydraulic Cements
ASTM D 3549	(2003) Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens
ASTM D 4791	(2010) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D 5361	(2011) Sampling Compacted Bituminous Mixtures for Laboratory Testing

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Mix Design; G

Submit proposed job mix formula for approval prior to preparing and placing the bituminous mixture.

Contractor Quality Control; G

Quality control plan.

Material Acceptance; G

Acceptance test results.

SD-06 Test Reports

Aggregates; G
QC Monitoring

Aggregate and QC test results.

SD-07 Certificates

Asphalt Cement Binder; G

Copies of certified test data.

Amount, type and description of any modifiers blended into the asphalt cement binder

Testing Laboratory

Certification of compliance.

Plant Scale Calibration Certification

1.3 WEATHER AND MOISTURE CONDITIONS

Asphalt concrete shall be placed only when the surface is dry, and when the atmospheric temperature in the shade is 40 degrees F (50 degrees F for Asphalt Concrete lift less than 2 inch thick) or above. No asphalt concrete shall be placed when the weather is foggy or rainy, or when the base or sub base on which the material is to be placed is unstable. Asphalt concrete shall be placed only when the Contracting Officer's Representative determines that weather conditions are suitable.

PART 2 PRODUCTS

2.1 AGGREGATES

Coarse and Fine aggregates shall conform to the applicable requirements of this section. Coarse mineral aggregate shall consist of crushed gravel, crushed rock, or other approved invert material with similar characteristics, or a combination therof, conforming to the requirements of these specifications.

Coarse aggregate for hot mix asphalt is material retained on or above the No. 4 sieve and Fine aggregate is material passing the No. 4 sieve. Aggregates shall be relatively free of deleterious materials, clay balls, and adhering films or other material that pervent coating with the asphalt binder. Coarse and Fine aggregates shall conform to the following requirements when tested in accordance with the applicable test methods.

COARSE/FINE AGGREGATE REQUIREMENTS		
CHARACTERISTICS	TEST METHOD	HIGH TRAFFIC
FRACTURED FACES, % (COARSE ONLY)	ARIZONA 212	85, 1 OR MORE 80, 2 OR MORE
UNCOMPACTED VOIDS, % MIN	AASHTO T 304	45
FLAT & ELONGATED PIECES, % 5:1 RATIO	ASTM D 4791	10.0 MAX
SAND EQUIVALENT, %	AASHTO T 180	50 MIN
PLASTICITY INDEX	AASHTO T 90	NON-PLASTIC
LA ABRASION, % LOSS	AASHTO T 96	9 MAX @ 100 REV 40 MAX @ 500 REV
COMBINED BULK SPECIFIC GRAVITY	AI MS-02 / AI SP-2	2.35 - 2.85

COMBINED WATER ABSORPTION	AI MS-02 / AI SP-2	0 - 2.5%

Tests on aggregates used in asphalt concrete outlined above, shall be performed on materials furnished for mix design purposes and composited to the mix design gradation.

Blend sand (naturally occurring or crushed fines) shall be clean, hard and sound material which will readily accept asphalt binder coating. The blend sand grading shall be such taht, when it is mixed with the other mineral aggregates, the combined product shall meet the requirements of the above table.

The natural sand shall not exceed 20 percent for the Marshall mixes.

2.1.1 Mineral Admixture

Mineral admixture when used as an anti-stripping agent in asphalt concrete shall conform to the requirements of AASHTO M 17. Mineral admixture used in asphalt concrete shall be dry hydrated lime, conforming to the requirements of ASTM C 1089 or Portland cement conforming to ASTM C 150 Type II or ASTM C 595/C 595M Type IP. The amount of hydrated lime or Portland cement used shall be determined by the mix design. The minimum Mineral admixture content within a mix will be 1.00 percent, by weight of total aggregate.

2.2 ASPHALT CEMENT BINDER

The asphalt binder shall be Performance Grade Asphalt PG 70-10.

Asphalt paving temperature shall be according to the following:

GRADE OF MATERIAL	PUG MILL MIXING ASPHALT, TEMPERATURE DEGREES F		DISTRIBUTOR APPLICATION, TEMPERATURE DEGREES F	
	MIN	MAX	MIN	MAX
PG 70-10	275	325	300	390

At no time, after loading into a tank car or truck for transportation from the refinery to the purchaser, shall the temperature of the paving asphalt be raised above 400 degrees F.

Paving asphalt shall be heated in such a manner that steam or hot oils will not be introduced directly into the paving asphalt during heating.

2.3 MIX DESIGN

The Marshall Mix Design shall be performed in accordance with the requirements of the latest edition of the AI MS-02 "Mix Design Methods for Asphalt Concrete." The mix shall utilize the compactive effort of 75 blows per specimen. The mix shall comply with the criteria in the table below:

MARSHALL MIX DESIGN CRITERIA

CRITERIA	1/2" MIX	3/4" MIX	DESIGNATED TEST METHOD
1. VOIDS IN MINERAL AGGREGATE: %, MIN	14	13	AI MS-02
2. EFFECTIVE VOIDS: %, RANGE	4.0 +/- 0.2	4.0 +/- 0.2	AI MS-02
3. ABSORBED ASPHALT: %, RANGE*	0 - 1.0	0 - 1.0	AI MS-02
4. DUST TO EFF ASPHALT RATIO, RANGE**	0.6 - 1.4	0.6 - 1.4	AI MS-02
5. TENSILE STRENGTH RATIO: %, MIN	65	65	AASHTO T 283
6. DRY TENSILE STRENGTH: PSI, MIN	100	100	AASHTO T 283
7. STABILITY: LBS, MIN	2500	2500	AASHTO T 245
8. FLOW: 0.01-INCH, RANGE	8 - 16	8 - 16	AASHTO T 245
9. MINERAL AGGREGATE GRADING LIMITS			AASHTO T 27
PERCENT PASSING WITH ADMIX			
SIEVE SIZE	1/2" MIX	3/4" MIX	N/A
1-1/4"			N/A
1"		100	N/A
3/4"	100	90 - 100	N/A
1/2"	85 - 100	---	N/A
3/8"	62 - 85	62 - 77	N/A
No. 8	40 - 50	35 - 47	N/A
No. 40	10 - 20	10 - 20	N/A
No. 200	2.0 - 10.0	2.0 - 8.0	N/A

*Unless otherwise approved by the Contracting Officer's Representative.

** The ratio of the mix design composite gradation target for the No. 200 sieve, including admixture, to the effective asphalt content shall be within the indicated range.

PART 3 EXECUTION

3.1 PAVEMENT TO BE REMOVED

Existing asphalt pavement to be removed for trenches or for other underground construction or repairs shall be cut by a device capable of making a neat, straight and smooth cut without damaging adjacent pavement that is not to be removed. The Contracting Officer's Representative's decision as to the acceptability of the cutting device and manner of operation shall be final. In lieu of cutting trenches across driveways, curbs and gutters, sidewalks, alley entrances, and other types of pavements, the Contractor may, when approved by the Contracting Officer's Representative, elect to tunnel or bore under such structures and pavements.

3.2 PERMANENT PAVEMENT REPLACEMENT

All pavement replacement shall match gradation and thickness of the existing pavement.

Unless otherwise noted, pavement replacement shall comply with the following:

Pavement replacement shall consist of a 2.5 inch-thick base course of 3/4" mix and a 1.5 inch-thick surface course of 1/2" mix.

Where the base course is to be placed with non-compactive equipment, it shall be immediately rolled with a pneumatic-tired roller.

Where the trench is 6 feet or more in width, all courses shall be placed with self-propelled spreading and compacting equipment. When the trench is from 6 to 8 feet in width, self-propelled spreading and compacting equipment shall not be wider than 8 feet.

Placement of the surface course is to be by means which will result in a surface flush with the existing pavement.

A tack coat shall be applied to all existing and to each new course of asphalt prior to the placing of a succeeding lift of asphalt concrete.

The pavement replacement surface shall not vary more than 1/4 inch from the lower edge of a straightedge placed across the replacement pavement surface between edges of the existing matched surfaces.

3.2.1 Density

Achieving the required compaction is the responsibility of the contractor. The number and types of rollers is the contractor's responsibility and shall be sufficient to meet these requirements.

In-place air voids shall be determined in accordance with AASHTO T 269 utilizing cores taken from the finished pavement. The Contracting Officer's Representative will designate two random test locations for each sublot and the acceptance laboratory will obtain two cores from each location. The two cores will be averaged for acceptance. The outside one foot of each pass of the pavement course or any unconfined edge will be

excluded from testing. The Contracting Officer's Representative may exclude areas from the compaction lot that are not accessible by normal compaction equipment.

Pavement with in-place voids of 4.0% to 8.0% shall be accepted. Pavement with in-place densities of less than 4.0% or greater than 8.0% shall be deficient and removed and replaced at the no cost to the Government.

3.2.2 Thickness

Asphalt Pavement thickness will be determined from cores secured from each sublot for this purpose. Such cores will be taken and measured by the Asphalt Core Method.

If the pavement is deficient from the target thickness by 0.25 inches or less, it shall be accepted. Pavement deficient from the target thickness by greater than 0.25 inches shall be removed and replaced at no cost to the Government.

3.2.3 Asphalt Core Method

3.2.3.1 Scope

This method is to establish a consistent method of the use of a diamond bit core to recover specimens of 4 or 6 inch diameter for laboratory analysis and testing. The method will require the use of: water, ice (bagged or other suitable type), dry ice, and a water-soap solution to be utilized when coring asphalt rubber concrete. Individuals doing the specimen recovery should be observing all safety regulations from the equipment manufacturer as well as the required job site safety requirements for actions, and required personal protective equipment.

3.2.3.2 Core Drilling Device

The core drilling device will be powered by an electrical motor, or by an acceptable gasoline engine. Either device used shall be capable of applying enough effective rotational velocity to secure a drilled specimen. The specimen shall be cored perpendicularly to the surface of pavement, and that the sides of the core are cut in a manner to minimize sample distortion or damage. The machinery utilized for the procedure shall be on a mounted base, have a geared column and carriage that will permit the application of variable pressure to the core head and carriage throughout the entire drilling operation. The carriage and column apparatus shall be securely attached to the base of the apparatus; and the base will be secured with a mechanical fastener or held in place by the body weight of the operator. The core drilling apparatus shall be equipped with a water spindle to allow water to be introduced inside of the drill stem while operating. The cutting edge of the core drill bit shall be of hardened steel or other suitable material with embedded diamond chips in the cutting surface. The core barrel shall be of sufficient diameter to secure a specimen that is a minimum of four or six inches or whichever is prescribed for necessary testing. The core barrel shall not be missing more than one of the teeth used for cutting; if so it shall be discarded and another barrel shall be used. The core barrel shall also be a minimum of two inches longer than the anticipated depth of pavement in accordance with project paving plans.

3.2.3.3 Accessory Equipment

A sufficient supply of ice and dry ice shall be provided to sufficiently cool the pavement prior to securing the samples from the designated areas in the pavement. The ice should also be used to adjust the temperature of the water used to cool the core bit. A water supply (usually a plastic 35 - 55 gal drum) with sufficient hose to introduce the water into and through the spindle of the coring device by gravity feed. The drum should be white or light in color to minimize excessive thermal heating of the water (for coring of asphalt rubber cores see Note 1). At no time shall the water utilized in the coring operation exceed 65 degrees F during the coring operation. Ice shall be utilized o ensure the temperature control of the water being introduced during the cutting operation. An ice chest or other suitably insulated container that can maintain a temperature of less than 70o F shall be used to secure the specimens during transport. The container will be equipped with flat shelving that will support the drilled cores throughout the entire specimen dimension during transport back to the testing facility.

Miscellaneous hand tools to remove the drilled specimen from the drill hole or the core barrel taking great care in not disturbing the specimen more than necessary (refer to fig. 1 in ASTM D 5361).

3.2.3.4 Process

The pavement surface at the time of coring shall not exceed a temperature of 90 degrees F, the pavement shall be conditioned with ice or dry ice to ensure that this requirement is met. Immediately after it has been ensured that the pavement has dropped to the required temperature, core drilling shall begin. The operator will then apply an even and continuous pressure to penetrate through the full depth of the pavement. The operator will concurrently ensure that enough water is moving over the core surface as to adequately remove any and all cuttings that could damage the drilled core. After the pavement thickness has been penetrated the core shall be carefully removed from either the drill hole or the core barrel and be immediately transferred to an ice chest or other suitable container. Each individual core shall be placed on a shelf in the cooler with the exposed side of the specimen facing down, or the "top side" down. If the specimen is a two lift core, the only acceptable means of separating lifts is with a power or other acceptable wet saw type of equipment (conforming to ASTM D 5361); however, at no time shall cores be split using a mallet and screwdriver or metal straight edge when being tested for bulk density. Perpendicularity of the specimen shall be checked in the field after the specimen has been extracted from the surface. The core operator shall hold the core up to eye level and place the core top side down in a "speed square" or small carpenters square. The specimen placed in the square shall not depart from perpendicular to the axis more than 0.5 degrees (approximately equivalent to 1/16 of an inch in 6 inches). If the specimen is outside of this distance from square it shall be discarded in the field and another sample cored that falls within tolerance. The cores upon arriving at the laboratory for testing shall be carefully cleaned and measured for thickness in accordance with ASTM D 3549. A speed square shall be utilized to measure squareness as compared to a 90 degree angle and shall not depart from perpendicular to the axis more than 0.5 degree (approximately equivalent to 1/16 of an inch in 6 inches). All remaining testing shall be done within the parameters of the current project and / or agency required specification.

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04/08

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PAVEMENT MARKINGS
04/08

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 247	(2009) Standard Specification for Glass Beads Used in Pavement Markings

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-B-1325	(Rev D) Beads (Glass Spheres) Retro-Reflective (Metric)
FS TT-P-1952	(Rev E) Paint, Traffic and Airfield Markings, Waterborne

1.2 SYSTEM DESCRIPTION

All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Equipment operating on roads and runways shall display low speed traffic markings and traffic warning lights.

1.2.1 Paint Application Equipment

1.2.1.1 Self-Propelled or Mobile-Drawn Pneumatic Spraying Machines

The equipment to apply paint to pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall have a speed during application not less than 5 mph, and shall be capable of applying the stripe widths indicated, at the paint coverage rate specified in paragraph APPLICATION, and of even uniform thickness with clear-cut edges. The paint applicator shall have paint reservoirs or tanks of sufficient capacity and suitable gauges to apply paint in accordance with requirements specified. Tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gauges in full view and reach of the operator. Paint strainers shall be installed in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

1.2.1.2 Hand-Operated, Push-Type Machines

All machines, tools, and equipment used in performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces will be acceptable for marking small streets and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Sandblasting equipment shall be provided as required for cleaning surfaces to be painted. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

1.2.2 Reflective Media Dispenser

The dispenser for applying the reflective media shall be attached to the paint dispenser and shall operate automatically and simultaneously with the applicator through the same control mechanism. The dispenser shall be capable of adjustment and designed to provide uniform flow of reflective media over the full length and width of the stripe at the rate of coverage specified in paragraph APPLICATION, at all operating speeds of the applicator to which it is attached.

1.2.3 Surface Preparation Equipment

1.2.3.1 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 150 cfm of air at a pressure of not less than 90 psi at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.

1.2.3.2 Waterblast Equipment

The water pressure shall be specified at 2600 psi at 140 degrees F in order to adequately clean the surfaces to be marked.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment

Lists of proposed equipment, including descriptive data, and notifications of proposed Contractor actions as specified in this section. List of removal equipment shall include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation.

Composition Requirements

Manufacturer's current printed product description and Material Safety Data Sheets (MSDS) for each type paint/color proposed for use.

Qualifications

Documentation on personnel qualifications, as specified.

SD-06 Test Reports

Sampling and Testing; G

Certified copies of the test reports, prior to the use of the materials at the jobsite. Testing shall be performed in an approved independent laboratory.

SD-07 Certificates

Volatile Organic Compound (VOC); G

Certificate stating that the proposed pavement marking paint meets the VOC regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

Submit documentation certifying that pertinent personnel are qualified for equipment operation and handling of chemicals.

1.4.2 Traffic Controls

Suitable warning signs shall be placed near the beginning of the worksite and well ahead of the worksite for alerting approaching traffic from both directions. Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers. Painting equipment shall be marked with large warning signs indicating slow-moving painting equipment in operation.

1.4.3 Maintenance of Traffic

1.4.3.1 Roads, Streets, and Parking Areas

When traffic must be rerouted or controlled to accomplish the work, the necessary warning signs, flagpersons, and related equipment for the safe passage of vehicles shall be provided.

1.5 DELIVERY, STORAGE, AND HANDLING

All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

1.6 ENVIRONMENTAL REQUIREMENTS

Surface temperature shall be at least 40 degrees F and rising at the beginning of operations, except those involving shot or sand blasting. Operation shall cease during thunderstorms. Operation shall cease during rainfall, except for waterblasting and removal of previously applied chemicals. Waterblasting shall cease where surface water accumulation alters the effectiveness of material removal.

PART 2 PRODUCTS

2.1 PAINT

The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paints for airfields, roads, parking areas, and streets shall conform to FS TT-P-1952, color as selected. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

2.2 REFLECTIVE MEDIA

Reflective media for roads and streets shall conform to FS TT-B-1325, Type I, Gradation A or AASHTO M 247, Type I. Pavement marking shall match the existing pavement markings at El Mirage Road. Match color, size, and reflectivity of existing pavement markings.

2.3 SAMPLING AND TESTING

Materials proposed for use shall be stored on the project site in sealed and labeled containers, or segregated at source of supply, sufficiently in advance of needs to allow 60 days for testing. Upon notification by the Contractor that the material is at the site or source of supply, a sample shall be taken by random selection from sealed containers in the presence of the Contracting Officer. Samples shall be clearly identified by designated name, specification number, batch number, manufacturer's formulation number, project contract number, intended use, and quantity involved. Testing shall be performed in an approved independent laboratory. If materials are approved based on reports furnished by the Contractor, samples will be retained by the Government for possible future testing should the material appear defective during or after application.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Thoroughly clean surfaces to be marked before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion as directed. Areas of old pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed

to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be recleaned, when work has been stopped due to rain.

3.2 APPLICATION

All pavement markings and patterns shall match the existing markings.

3.2.1 Paint

Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 40 degrees F and less than 95 degrees F. Paint temperature shall be maintained within these same limits. New asphalt pavement surfaces and new Portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint. Paint shall be applied pneumatically with approved equipment at rate of coverage specified. Provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

3.2.1.1 Rate of Application

a. Reflective Markings: Pigmented binder shall be applied evenly to the pavement area to be coated at a rate of 105 plus or minus 5 square feet/gallon. Glass spheres shall be applied uniformly to the wet paint on road and street pavement at a rate of 6 plus or minus 0.5 pounds of glass spheres per gallon of paint. Pavement marking shall match the existing pavement markings at El Mirage Road. Match color, size, and reflectivity of existing pavement markings.

3.2.1.2 Drying

The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

3.2.2 Reflective Media

Application of reflective media shall immediately follow application of pigmented binder. Drop-on application of glass spheres shall be accomplished to insure that reflective media is evenly distributed at the specified rate of coverage. Should there be malfunction of either paint applicator or reflective media dispenser, operations shall be discontinued immediately until deficiency is corrected.

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STORM DRAINAGE UTILITIES

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SECTION 33 40 00

STORM DRAINAGE UTILITIES
02/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 190	(2004; R 2008) Standard Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches
AASHTO M 243	(1996; R 2008) Standard Specification for Field-Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches

ASTM INTERNATIONAL (ASTM)

ASTM A 742	(2003; R 2008) Standard Specification for Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe
ASTM A 762	(2008) Standard Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM A 798	(2007) Standard Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
ASTM D 3035	(2010) Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D 3350	(2010) Standard Specification forPolyethylene Plastics Pipe and Fittings Materials
ASTM F 2620	(2009) Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

PLASTICS PIPE INSTITUTE (PPI)

PPI TR-33	(2006) Generic Butt Fusion Join Procedure for Field Joining of Polyethylene Pipe

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Pipe

Certified copies of test reports demonstrating conformance to applicable pipe specifications shall be delivered to the Contracting Officer's Representative before pipe is installed.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Do not store materials directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris.

1.3.2 Handling

Materials shall be handled in such a manner as to insure delivery to the trench in sound undamaged condition. Pipe shall be carried to the trench not dragged. Gasket materials and plastic materials that are not to be installed immediately shall not be stored in the direct sunlight.

PART 2 PRODUCTS

2.1 GENERAL

Controlled Low Strength Material (CLSM) shall conform to Section 31 00 00 EARTHWORK. Where pipe is embedded in CLSM, the pipe shall be supported in such a manner to hold it rigidly in position while CLSM is placed. Earthwork about the drains and structures shall conform to the applicable requirements of Section 31 00 00 EARTHWORK. Specified and/or indicated pipe thickness, D-loading, weight, or gage are the minimum acceptable and heavier pipe may be furnished at the option of the Contractor.

2.1.1 Manufacturers Recommendations

Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Contracting Officer's Representative prior to installation. Installation of the item will not be allowed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

2.2 TESTS FOR PIPE

Certified copies of test reports demonstrating conformance to applicable pipe specifications shall be delivered to the Contracting Officer's Representative before pipe is installed.

2.3 PIPE

Pipe shall be as indicated and shall conform to the requirements for the following pertinent types. Proposed cross-road pipe culverts at El Mirage Road shall be 42-inch diameter corrugated steel pipe. Temporary pipe culverts for maintenance roads shall be PE pipe.

2.3.1 Corrugated Steel Pipe

2.3.1.1 Polymer Precoated

ASTM A 762 corrugated steel Type I pipe with helical 2-2/3 by 1/2 inch corrugations fabricated from ASTM A 742 Grade 10/10 polymer precoated sheet.

2.3.2 PE Pipe

High Density Polyethylne (PE) plastic pipe shall be manufactured in conformance with ASTM D 3035 from pressure rated polyethylene compound that meets or exceeds ASTM D 3350 Cell Classification PE345464C and meets or exceeds material designation codes PE3608 and PE3408. Pipe shall have the following properties:

Nominal Size (in.)	Minimum Wall Thickness (square inches)
24	1.412

2.4 JOINTS

2.4.1 For Corrugated Steel Pipe

At each joint, provide semi-corrugated (Hugger) standard couplers with bar and strap connectors in accordance with the National Corrugated Steel Pipe Association Installation Manual for Corrugated Steel Pipe.

2.4.2 For PE Pipe

PE pipe shall be joined by leak-proof heat fusion or by electrofusion techniques. Butt fusion joints to be made on grade before placing the pipe in the trench.

High density polyethylene plastic pipe and fittings shall conform to the requirements of ASTM F 2620 and PPI TR-33.

PART 3 EXECUTION

3.1 INSTALLATION

Special care shall be taken in the handling and installation pipe and fittings to prevent damage and to assure that proper line and pipe grade are maintained throughout the backfilling operation.

Unless otherwise permitted by the Contracting Officer's Representative, the installing of the pipe shall begin at the downstream end. Any pipe which is not in true alignment or which shows undue settlement after laying or is

damaged shall be removed. The trench shall be prepared as hereinbefore specified and the pipe shall be installed again. Any pipe which, in the opinion of the Contracting Officer's Representative, is damaged so that it cannot be used shall be replaced.

Pipes and joining materials shall be protected from the sun, blowing dust, and other deleterious agents at all times. Pipes and joints shall be inspected before installing the pipe; any loose or defective joint shall be remade. If during installation, the joint should come loose or broken, the pipe shall be removed and the joint remade. The interior of all pipes shall be free of dirt and foreign material as the work progresses and all pipes shall be left clean at the time of final acceptance.

3.2 EXCAVATION AND TRENCHING

Excavation of trenches and backfill all be in accordance with the applicable portions of Section 31 00 00 EARTHWORK and the following requirements.

3.2.1 Trenching

The width of trenches at any point below the top of the pipe shall not be greater than the outside diameter of the pipe plus 36 inches to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheeting and bracing where required shall be placed within the trench width as specified. Care shall be taken not to over excavate. Give special attention to slopes which may be adversely affected by weather or moisture content. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures shall be necessary. Cost of this redesign and increased cost of stronger pipe or special installation procedures shall be borne by the Contractor without additional cost to the Government.

3.3 PLACING PIPE

Each pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used. Pipe shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. All pipe in place shall be inspected before backfilling, and those damaged during placement shall be removed and replaced at no additional cost to the Government.

3.3.1 Corrugated Steel Pipe

Laying shall be with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides. Any unprotected metal in the joints shall be coated with bituminous material as specified in AASHTO M 190 or AASHTO M 243. Interior coating shall be protected against damage from insertion or removal of struts or tie wires. Lifting lugs or nylon slings shall be used to facilitate moving pipe without damage to exterior or interior coatings. During transportation and installation, pipe or pipe arch and coupling bands shall be handled with care to preclude damage to the coating. Damaged coatings shall be repaired in accordance with the manufacturer's recommendations prior to placing backfill. Pipe on which coating has been damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced.

3.3.2 PE Pipe

High density polyethylene plastic pipe shall be assembled and installed in accordance with the manufacturer's installations. PE pipe sections shall be joined together before placement.

3.4 JOINTING

3.4.1 Corrugated Metal Pipe

3.4.1.1 Field Joints

Transverse field joints shall be designed so that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. In addition, the joints shall meet the general performance requirements described in ASTM A 798. The space between the pipe and connecting bands shall be kept free from dirt and grit so that corrugations fit snugly. The connecting band, while being tightened, shall be tapped with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. The type, size, and sheet thickness of the band and the size of angles or lugs and bolts shall be as indicated or where not indicated, shall be as specified in the applicable standards or specifications for the pipe.

3.5 BACKFILLING

3.5.1 Backfilling Pipe in Trenches

After the bedding has been prepared and the pipe installed, CLSM shall be used for pipe backfill and carefully placed around pipe until water surface elevation is reached. Voids must be eliminated by knifing under and around pipe or by some other technique. Precautions should be taken to prevent flotation or misalignment such as anchoring the pipe and pouring the fill in lifts as indicated up to the water surface elevation. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe.

CLSM shall effectively displace volume of water and not substantially dilute or segregate durings submerged placement. Precautions shall be taken to ensure CLSM does not segregate during submerged placement. Directed localized placement of CLSM with the use of plywood ramps may be required if submerged placment becomes difficult to acheive without material segregation.

3.5.3 Movement of Construction Machinery

Operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert at any stage of the construction shall be at the Contractor's risk. Any pipe damaged thereby shall be repaired or replaced at the expense of the Contractor.

-- End of Section --

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DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION

SECTION 35 31 19

STONE PROTECTION

09/04

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-- End of Section Table of Contents --

SECTION 35 31 19

STONE PROTECTION
09/04

PART 1 GENERAL

This specification shall address only the gradation requirements for stone materials used for construction of Phase 3B. Refer to Phase 3A section 35 31 19 STONE PROTECTION for all other requirements.

No additional stone material testing is required for construction of Phase 3B. If stone materials used for construction of Phase 3B are from the same supplier and geomorphic region (ledge) as those tested, approved, and used for construction of Phase 3A, no additional testing or submittals will be required for stone materials. If stone materials delivered to the site for construction of Phase 3B features, upon visual inspection by the Contracting Officer's Representative, differ from those previously approved and used for construction of Phase 3A, the Contractor shall be responsible for testing stone materials and all associated costs according to the requirements as outlined in section 35 31 19 STONE PROTECTION issued for construction of Phase 3A.

1.1 RIPRAP

All stone shall be within specified gradation shown below. If the stone is delivered by the truckload, each truckload shall be representative of the gradation requirements.

RipRap (D50=27")		
STONE DIAMETER IN INCHES (UPPER AND LOWER LIMITS) 46 41	STONE WEIGHT IN POUNDS (UPPER AND LOWER LIMITS)	PERCENT PASSING BY SIZE
42 TO 37	4600 TO 3200	100
31 TO 27 ✓	1900 TO 1300	50
16 TO 11 ✓	250 TO 80	15

RipRap (D50=12")		
STONE DIAMETER IN INCHES (UPPER AND LOWER LIMITS)	STONE WEIGHT IN POUNDS (UPPER AND LOWER LIMITS)	PERCENT PASSING BY SIZE

RipRap (D50=12")		
20 TO 18	520 TO 400	100
14 TO 12	150 TO 100	50
12 TO 9	100 TO 50	15

3 5

1.2 BEDDING STONE

Bedding Stone shall be reasonably graded, within the limits specified below, when tested, in accordance with ASTM D 5519, Test Method A.:

RIPRAP FILTER GRADATION A, 6" THICK	
STONE DIAMETER IN INCHES	PERCENT PASSING BY SIZE
6.00	90 - 100
4.24	70 - 85
3.00	30 - 50
2.00	5 - 15
1.00	0 - 5

RIPRAP FILTER GRADATION C, 6" THICK	
STONE DIAMETER IN INCHES	PERCENT PASSING BY SIZE
3.00	100
2.5	85
2.00	50 - 75
1.00	10 - 20

STRUCTURE BACKFILL, 6" THICK	
STONE DIAMETER IN INCHES	PERCENT PASSING BY SIZE
3.00	100
0.75	60 - 100
0.0937	35 - 80
0.0029	0 - 12

PART 2 PRODUCTS (MATERIALS)

NOT USED

RipRap (D50=12")		
20 TO 18	520 TO 400	100
14 TO 12	150 TO 100	50
12 TO 9	100 TO 50	15

3 5

1.2 BEDDING STONE

Bedding Stone shall be reasonably graded, within the limits specified below, when tested, in accordance with ASTM D 5519, Test Method A.:

RIPRAP FILTER GRADATION A, 6" THICK	
STONE DIAMETER IN INCHES	PERCENT PASSING BY SIZE
6.00	90 - 100
4.24	70 - 85
3.00	30 - 50
2.00	5 - 15
1.00	0 - 5

RIPRAP FILTER GRADATION C, 6" THICK	
STONE DIAMETER IN INCHES	PERCENT PASSING BY SIZE
3.00	100
2.5	85
2.00	50 - 75
1.00	10 - 20

STRUCTURE BACKFILL, 6" THICK	
STONE DIAMETER IN INCHES	PERCENT PASSING BY SIZE
3.00	100
0.75	60 - 100
0.0937	35 - 80
0.0029	0 - 12

PART 2 PRODUCTS (MATERIALS)

NOT USED

PART 3 EXECUTION

NOT USED

-- End of Section --