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SECTION 02100

DIVERSION AND CONTROL OF WATER

PART 1 GENERAL

1.1 REQUIREMENT

1.1.1 General

All permanent construction shall be carried on in areas free from water. Water in varying quantities may be flowing in natural washes throughout the length of the project, as a result of rainfall or flow from upstream sources. Storm runoff from watersheds can be rapid and, during periods of rain, intermittent freshets may be expected.

Within 10 days after receipt of Notice to Proceed, the Contractor shall submit a diversion and control of water plan showing the method that he proposes to use to divert water from each working area. In addition, the Contractor shall indicate:

- a) The order of work proposed to provide a contiguous flood drainage system during construction.
- b) Related or conflicting items of work necessarily requiring coordination and/or staged construction, particularly involving maintenance of traffic through the area of channel crossing at Rainbow Blvd., and construction of the parallel detour road.
- c) Items of work (either permanent or temporary) required as part of the subsequently scheduled roadway project that could be placed ahead of schedule, and in coordination with the Contractor's activities for this project, to help satisfy the required drainage carrying capacity of the flood drainage system during construction of the channel.

The responsibility for damage to any part of the permanent work shall be as set forth in the CONTRACT CLAUSE: PERMITS AND RESPONSIBILITIES. Damage to all work (including temporary construction), utilities, materials, equipment, and plant shall be repaired to the satisfaction of the Contracting Officer at the Contractor's expense, regardless of the cause of such damage.

1.1.2 Diversion Requirements

The Contractor is responsible for the diversion and control of all runoff entering the construction area. The runoff will include water originating from upstream, urban runoff, adjacent drainages; and in addition any and all seepage and groundwater originating within the work. The work site may be inundated because of runoff. The Contractor shall be responsible for protection of work site during times of runoff by his own means and shall be approved by the Contracting Officer.

1.1.3 Drainage Ditches

The location and depth of any drainage ditch to be constructed under this contract shall be subject to the approval of the Contracting Officer. Special

precautions shall be taken to avoid impairing the permanent subgrade. Damaged subgrade shall be replaced in accordance with SECTION FILLS AND SUBGRADE PREPARATION by and at the expense of the Contractor.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

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SECTION 02150

CLEAR SITE AND REMOVE OBSTRUCTIONS

PART 1 GENERAL

1.1 ENVIRONMENTAL PROTECTION

All work and Contractor operations shall comply with the requirements of Sections 01130 ENVIRONMENTAL PROTECTION and 02200 EXCAVATION.

1.2 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 REQUIREMENTS

3.1.1 General

Except as otherwise specified, and/or indicated, areas to be cleared will be limited to actual excavation areas, and areas on which fills and/or structures are to be placed. The removal of trees, shrubs, turf, and other vegetation outside of these areas shall be held to a minimum and care shall be exercised not to damage any trees, shrubs, turf, or vegetation which can be left in place.

3.1.2 Existing Structures and Obstructions

The Contractor shall clear and grub the site, fill, and excavation areas, and remove and dispose of all existing structures and obstructions for project construction, except as those structures which are identified to be protected in place as shown on the drawings. Obstructions which are designed or specified to be removed but which are not designated or specified to be removed by others shall be removed by the Contractor. Except as otherwise specified, obstructions designated to be removed by others will be removed in sufficient time to preclude interference with the Contractor's operations.

3.1.3 Clearing

Trees smaller than 1.5 inches in diameter and other vegetation, except as specified, shall be cut off 6 inches below the indicated subgrade or ground level whichever is lower. Other vegetation shall be cut off flush or slightly below the original ground surface. Clearing operations shall be conducted so as to prevent damage to trees, structures, and installations under construction, or to remain in place, and to provide for the safety of employees and others. All rubbish, waste dumps, and debris areas shall be cleared.

3.1.4 Grubbing

Grubbing shall consist of removing all trees, stumps, roots, logs, and other objectionable vegetable matter in the required fills, foundation areas, and all excavation areas. In grubbing out stumps and roots, all roots or other timber more than 1.5 inches in diameter shall be removed to 3 feet below the depth of the required excavation or existing ground level, whichever is lower. Trees and stumps shall be pulled, not cut off.

3.1.5 Trash and Construction Debris

Frequent surface trash and construction debris are present along the beltway and channel alignments, particularly in existing washes. Surface trash and construction debris shall be removed from within the project limits. Surface trash and construction debris to be removed include but not limited to wood, concrete, drywall, roofing materials, wire insulation and other construction debris, chunks of cemented material, grass and vegetation cuttings, tires, car parts and accessories, discarded furniture, foundry slag, drums, containers, and other material.

3.1.6 Environmental Assessment Requirement

The Contractor shall notify the Contracting Officer 14 calendar days prior to the start of clearing and grubbing activities in accordance with SECTION 01200, Paragraph 3.9.5.5.

3.2 DISPOSAL OF CLEARED, GRUBBED, AND REMOVED MATERIAL

All material removed, except material specified and/or indicated to be salvaged, is designated as scrap, shall become the property of the Contractor, and shall be removed from the site. Unsuitable materials from clearing operations may be temporarily used for diversion and control of water. Disposal shall be in accordance with the requirements of Section 01130 ENVIRONMENTAL PROTECTION.

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SECTION 02200

EXCAVATION

1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2487 (1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

U.S. ARMY CORPS OF ENGINEERS (COE)

COE EM 385-1-1 Safety and Health Manual

1.2 GENERAL

Excavation shall consist of the removal of every type of material encountered in the designated areas or from areas directed. The material to be removed may include but is not limited to hardpan, silt, sand, gravel, cobbles and boulders, cemented silt/sand/gravel/cobbles/boulders with various degrees of cementation, caliche, asphalt, vegetation, trash, and other debris. Excavation of temporary slopes, as indicated on the drawings, have been designated per soils report prepared by Kleinfelder, project no. 31-300304, dated November 23, 1998. Unforeseen conditions may dictate that the designated slopes do not necessarily represent the actual slopes to which the excavation must be made to safely perform the work; in such cases, the temporary cut slope shall be made to the actual slope to which the work can be safely performed. Measurement and payment for excavation will be made in accordance with Section 01250, paragraphs 5.1 and 5.2. Excavation for permanent cuts shall be made to the slope lines indicated. Excavation may require ripping or other rock-excavation techniques, including blasting, and shall be performed in a manner which will not impair the subgrade. Rock or cemented material from required excavation to be used in compacted fills and backfills shall be crushed or otherwise reduced in size to meet gradation requirements (Section 02250: FILLS AND SUBGRADE PREPARATION) prior to placement or stockpiling. Except as otherwise specified, the finish surface of subgrades shall be smooth and shall not vary more than 0.1 foot from indicated grade. Prior to commencing excavation, the Contractor shall submit his plan for excavation to the Contracting Officer. All subgrade excavations will be inspected by the Contracting Officer prior to placement of any fill materials.

1.3 BLASTING

Any method used to excavate the channel using explosives shall be subject to the approval by the Contracting Officer.

1.3.1 General Requirements

The drilling and blasting program and methods shall be the minimum necessary to break up the rock (caliche) into bulldozer-manageable sized pieces for removal. Only the minimum strength explosive that will accomplish the fracturing will be allowed. If multiple charges are deemed necessary, they will be sequenced to produce good breakage of the rock and reduce airblast

(sonic impacts) and ground vibrations to minimal levels. In the design of the blasting pattern, no blastholes will be permitted within 200 feet of an active tortoise burrow. A qualified desert tortoise ecologist is required to be present during all blasting operations to ensure that there are no occupied burrows and/or to remove tortoises from the surface or burrows within the 200 foot limit. The desert tortoise ecologist will provide a short report with field notes to the Contracting Officer. The desert tortoise ecologist will be provided by the Contractor at his own expense. Additional restrictions may be imposed during the hibernation period (15 November through 15 March) to protect hibernating tortoises, if necessary and directed by the Contracting Officer. The Contractor shall strictly comply with all State and local regulations regarding construction blasting (e.g., Uniform Standard Specifications for Public Works Construction Off-Site Improvements, Clark County Area, Nevada, Third Edition, subsections 107.10, 203.03.03, and 208.03.01, and Engineer Manual (EM) 1110-2-3800, including all notice and reporting requirements). Under no circumstances shall blasting be performed within 100 feet of concrete that has been placed less than seven days. Blasting within 100 feet of concrete older than seven days will be permitted only if approved by the Contracting Officer.

1.3.2 Blasting

Prior to drilling for each blast, unless excepted by the Contracting Officer, the Contractor shall submit on an approved form the pertinent data on the location, depth and area of the blast; diameter, spacing, depth, overdepth, pattern and inclination of blast holes; the type, strength, amount, distribution and powder factor for the explosives used per hole and per blast; the sequence and pattern of delays, and description and purpose of special methods. The loading of holes shall be done in the presence of a Government inspector. Acceptance by the Contracting Officer of blasting data will not relieve the Contractor of his responsibility to produce satisfactory results as set forth in these specifications. Drilling and blasting shall be done only to the depth, amount, and at such locations, with explosives of such quantity, distribution and density that will not produce unsafe or damaged foundation surfaces or damage material beyond the prescribed excavation limits. When a drilling and blasting program results in damage to the excavation, the Contractor will be required to devise and employ methods which will prevent such damage. The revision may include special methods such as presplit and zone blasting, shallow lifts, reduction in size of individual blasts, small diameter blast holes, closely spaced blast holes, reduction of explosives, greater distribution of explosives by use of decking and primacord or variation in density of explosives.

1.3.3 Overshooting

The Contractor shall control the blasting procedures so as not to overshoot. Any material outside the authorized channel cross section on the side slopes which may be shattered or loosened because of blasting shall be removed and/or re-compacted by the Contractor at his expense. Shattered or loosened material below the bottom limits of the required excavation shall be uniformly distributed and compacted or otherwise disposed of in a manner satisfactory to the Contracting Officer. The Contractor shall discontinue any method of blasting which leads to overshooting or is dangerous to the public, destructive of natural or man-made features, or is injurious to wildlife and habitat.

1.3.4 Equipment

The Contractor shall provide suitable vibration monitoring equipment to measure and record the ground motions associated with each blast. The monitoring equipment will be placed to monitor the effects of the blasting at

the 200 foot distance.

1.3.5 Notifications

The Contractor shall notify each property owner and public utility company having structures or facilities in proximity to the site of the work of his intention to use explosives. Such notice shall be given sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property from injury.

1.3.6 Qualifications

During blasting operations, the Contractor shall have on site, and in immediate charge of the blasting, a licensed blaster acceptable to the Contracting Officer who has had no less than 3 years of experience in controlled blasting and rock excavation operations. Powder handlers shall have had no less than one year continuous experience in preparation and loading of powder charges.

1.3.7 Post-Blast Reports

In addition to the reporting requirements required above, a separate Post-Blast Report of each blast shall be prepared and furnished to the Contracting Officer on an approved form. The report shall indicate the location of the blast by specific stationing, depth of round, pounds of explosives used by type and grade, total number of loaded holes, total pounds per delay, quantity and kind of explosive in each hole, maximum measured blast vibration, and any other blast information directed by the Contracting Officer.

1.3.8 Explosives

1.3.8.1 Safety

The contractor shall fully comply with Section 29, Blasting, U. S. Army Corps of Engineers Safety and Health Requirements Manual, EM 3851-1, dated 3 September 1996.

1.3.8.2 Storage

The Contractor shall submit to the Contracting Officer, for approval, drawings showing the location, access to and type of construction of the proposed storage magazine for explosives, and cap house. The explosives storage magazine and other facilities may be located on project lands if a satisfactory location can be found and is approved by the Contracting Officer. The Contractor shall maintain the explosive storage area at his own expense.

1.4 PRESERVATION OF PROPERTY

All excavation operations shall be conducted in such a manner that concrete structures, embankments, utilities, roads 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, shoring, 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, shoring 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 the proposed method of bracing 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 to the side of the trench by equipment and stored materials. Removal of shoring shall be performed in such a manner as not to disturb or damage the finished concrete or other facility.

1.5 EXCAVATION FOR STRUCTURES

Excavation within the vicinity of existing structures, utilities, roads, and drainage pipes to remain in place shall be performed in a manner to prevent damage to the structure. Earth banks and facilities to remain in place shall be supported as necessary during excavation. Potential for damage resulting from severe vibration may limit the Contractor's operations or choice of equipment. In general, unless otherwise shown or specified, the actual side slopes shall be in accordance with COE EM 385-1-1.

1.6 EXCAVATION CHANNEL

Channel excavation consists of the removal of all materials within the lines and grades indicated.

1.7 REMOVAL OF UNSATISFACTORY SOILS

The removal of soils or materials which are unsatisfactory for the foundation of the channel, or structures may be required in certain areas. Unsatisfactory soils or materials include but are not limited to those materials containing roots and other organic matter, trash, debris and materials classified in ASTM D 2487, as Pt, OH, OL, CH, MH, and materials too wet to support construction equipment. Channel subgrade materials that cannot be brought to 95% compaction after scarification, shall be removed. The Contractor will be required to excavate any such areas to the depth directed and backfill the removal areas with compacted fill conforming to the requirements of SECTION 02250 FILLS AND SUBGRADE PREPARATION.

1.8 DISPOSITION AND DISPOSAL OF EXCAVATED MATERIALS

Excavated materials suitable for required fills shall be placed in temporary stockpiles or used directly in the work. Excess excavated material not utilized as part of the construction, and all unsatisfactory material shall be stockpiled at the disposal site shown on drawing C-2. No excavated material or waste of any kind shall be removed beyond the project limits under this contract without the express written authority of the Contracting Officer. Prior to placing material, the approved stockpile area(s) shall be cleared of trash and vegetation. Vegetation shall be removed by grading the existing ground surface to a depth of 6 inches. Any stockpiles shall be placed in a manner to preclude ponding of water. Natural ground surface soils thus removed will then be designated as either:

- i. materials to be salvaged, or
- ii. scrap or unsatisfactory soils

to be treated as specified above and in SECTION 02150 CLEAR SITE AND REMOVE OBSTRUCTIONS.

1.8.1 Hauled Excavated Material

The Contractor shall have a routing plan for haul within the project limits, including removal of required excavated materials and placing fill materials.

The haul route plan shall be submitted to the Contracting Officer for approval. The Contractor will be responsible for obtaining all permits and licenses necessary to haul material off-site. The Contractor will provide to

the Contracting Officer three copies of the proposed street haul route plan for transport of all excess excavated material.

1.9 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 Section 02250 FILLS AND SUBGRADE PREPARATION, or concrete conforming to the Section 03301 CAST-IN-PLACE STRUCTURAL CONCRETE. The Contractor shall expect to overbuild and trim back the compacted fill required to backfill overcuts made at trapezoidal channel sections. All excavating, backfilling, compacting of backfill, and concreting occasioned thereby shall be by the Contractor at no additional cost to the Government. Any overcut under channel and structures shall be backfilled with concrete.

2 PRODUCTS (Not Applicable)

3 EXECUTION (Not Applicable)

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GEOTEXTILES USED AS FILTERS

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SECTION 02215

GEOTEXTILES USED AS FILTERS

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 in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 123 (1993) Standard Terminology of Terms Related to Textiles

ASTM D 1683 (1990) Failure in Sewn Seams of Woven Fabrics

ASTM D 3786 (1987) Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics-Diaphragm Bursting Strength Tester Method

ASTM D 3884 (1992) Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method)

ASTM D 4354 (1989) Sampling of Geosynthetic for Testing

ASTM D 4355 (1992) Deterioration of Geotextile from Exposure to Ultraviolet light and Water (Xenon-Arc Type Apparatus)

ASTM D 4491 (1992) Water Permeability of Geotextiles By Permittivity

ASTM D 4533 (1991) Trapezoid Tearing Strength of Geotextile

ASTM D 4632 (1991) Grab Breaking Load and Elongation of Geotextiles

ASTM D 4751 (1993) Determining the Apparent Opening Size of a Geotextile

ASTM D 4833 (1988) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

ASTM D 4873 (1988) Guide for Identification, Storage, and Handling of Geotextiles

ASTM D 4884 (1990) Seam Strength of Sewn Geotextiles

1.2 SHIPMENT AND STORAGE

During all periods of shipment and storage, the geotextile shall be protected from direct sunlight, ultra-violet rays, temperatures greater than 140 degrees F, mud, dirt, dust and debris. To the extent possible, the fabric shall be maintained wrapped in a heavy duty protective covering.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Geotextile

The geotextile shall be a non-woven pervious sheet of plastic yarn as defined by ASTM D 123. The geotextile shall equal or exceed the minimum average roll values listed in TABLE 1, MINIMUM PHYSICAL REQUIREMENTS FOR DRAINAGE GEOTEXTILE. Strength values indicated in the table are for the weaker principal direction.

TABLE 1

MINIMUM PHYSICAL REQUIREMENTS FOR DRAINAGE GEOTEXTILE

Physical Property	Test Procedure	Acceptable Values
Tensile Strength (unaged geotextile)	ASTM D 4632 Grab Test Method using 1 inch square jaws and a 12 inch per minute constant rate of traverse.	200 pound minimum in any principle direction.
Puncture Strength (unaged geotextile)	ASTM D 4833 except polished steel ball replaced with a 5/16-inch diameter solid steel cylinder with a hemispherical tip centered within the ring clamp.	50 pound minimum
Abrasion Resistance	ASTM D 3884 Rubber-base abrasive wheels equal to CS-17?Calibrase? by Taber Instrument Co; 1000 revolutions, determine residual breaking load.	55 pound minimum Residual Breaking Load in any principal direction.
Apparent Opening Size	ASTM 4751 Determining Size of Sieve No. 120 and no coarser a geotextile.	No finer than the U.S Standard Sieve No. 50.
Ultraviolet Degradation of Geotextile	ASTM D 4355 Deterioration of Geotextile from Exposure to Ultraviolet Light and Water	50 at 500 hours.

Note 1: Unaged geotextile is defined as geotextile in the condition received from the manufacturer or distributor.

2.1.1.1 Geotextile Fiber

Fibers used in the manufacturing of the geotextile shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of polyolefins, polyesters, or polamides. Stabilizers and/or inhibitors shall be added to the base polymer if necessary to make the filaments resistant to

deterioration caused by ultraviolet light and heat exposure. Reclaimed or recycled fibers or polymer shall not be added to the formulation. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. The edges of the geotextile shall be finished to prevent the outer fiber from pulling away from the geotextile.

2.1.2 Seams

The seams of the geotextile shall be sewn with thread of a material meeting the chemical requirements given above for geotextile yarn or shall be bonded by cementing or by heat. The sheets of geotextile shall be attached at the factory or another approved location, if necessary, to form sections not less than 12 feet wide. Seams shall be tested in accordance with method ASTM D 1683. The strength of the seam shall be not less than 90 percent of the required grab tensile strength of the unaged geotextile in any principal direction.

2.1.3 Acceptance Requirements

2.1.3.1 All brands of geotextile and all seams to be used shall be accepted on the following basis. The Contractor shall furnish the Contracting Officer, in duplicate, a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the geotextile. The mill certificate or affidavit shall attest that the geotextile meets the chemical, physical and manufacturing requirements stated in this specification. If requested by the Contracting Officer, the Contractor shall provide to the Government geotextile samples for testing to determine compliance with any or all of the requirements in this specification. When samples are to be provided, they shall be submitted a minimum of 60 days prior to the beginning of installation of the same geotextile. All samples provided shall be from the same production lot as will be supplied for the contract, and shall be the full manufactured width of the geotextile by at least 10 feet long, except that samples for seam strength may be a full width sample folded over and the edges stitched for a length of at least 5 feet. Samples submitted for testing shall be identified by manufacturers lot designation.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Following removal of existing riprap and underlying filter material, the subgrade shall be trimmed, dressed, or brought up to grade similar to the lines and grades of the adjacent similar material, and proofrolled with compaction equipment. A tolerance of 1/2 inch shall be allowed from the theoretical slope-lines and grades. The surface on which the geotextile is placed shall be prepared to a relatively smooth surface condition, and shall be free from obstructions, debris, depressions, erosion features, or vegetation. Any irregularities, loose material, soft or low density pockets of material, shall be removed and replaced with approved material and well

compacted. A continuous, intimate contact of the geotextile with all the surface shall be insured. No additional payment shall be made for any material thus required. Immediately prior to placing geotextile, the prepared base shall be inspected by the Contracting Officer, and no geotextile shall be placed thereon, until that area has been approved.

3.2 INSTALLATION OF THE GEOTEXTILE

3.2.1 General

The geotextile shall be placed in the manner and at the locations shown on the drawings. At the time of installation, the geotextile shall be rejected if

it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation or storage.

3.2.2 General

Temporary pinning of the geotextile to help hold it in place until the bedding layer is placed shall be allowed. The temporary pins shall be removed as the bedding is placed to relieve high tensile stress which may occur during placement of material on the geotextile. Design protection of riprap should be in compliance with EM 1110-2-1601. Trimming shall be performed in such a manner that the geotextile shall not be damaged in any way.

3.3 Protection

The geotextile shall be protected at all times during construction from contamination by surface runoff and any geotextile so contaminated shall be removed and replaced with uncontaminated geotextile. Any damage to the geotextile during its installation or during placement of bedding materials or riprap shall be replaced by the Contractor at no cost to the Government. The work shall be scheduled so that the covering of the geotextile with a layer of the specified material is accomplished within 7 calendar days after placement of the geotextile. Failure to comply shall require replacement of geotextile. Before placement of bedding materials or riprap, the Contractor shall demonstrate that the placement technique will not cause damage to the geotextile. In no case shall any type of equipment be allowed on the unprotected geotextile.

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SECTION 02222

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS

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 in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422	(1963; R 1990) Particle-Size Analysis of Soils
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu.ft.(2,700 kN-m/cu.m.))
ASTM D 2487	(1992) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

1.2 DEFINITIONS

1.2.1 Degree of Compaction

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with SECTION: SUBMITTAL DESCRIPTIONS.

1.3.1 SD-09, Reports

Field Density Tests; GA. Testing of Backfill Materials; GA.

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

Satisfactory materials shall consist of any material classified by ASTM D 2487 as GW, GP, GM, GC, SW, SP, SM, SC and CL.

2.1.2 Unsatisfactory Materials

Unsatisfactory materials shall be materials that do not comply with the requirements for satisfactory materials. Unsatisfactory materials include but are not limited to those materials containing roots and other organic matter, trash, debris, frozen materials, cemented chunks of sand and gravel, caliche and stones larger than 3 inches and materials classified in ASTM D 2487, as CH, PT, OH, MH, and OL. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials shall 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.

2.1.4 Rock

Rock shall consist of boulders measuring 1/2 cubic yard or more and materials that cannot be removed without systematic drilling and blasting such as rock material in ledges, bedded deposits, unstratified masses and conglomerate deposits, and below ground concrete or masonry structures, exceeding 1/2 cubic yard in volume, except that pavements will not be considered as rock.

2.1.5 Unyielding Material

Unyielding material shall consist of rock and gravelly soils with stones greater than 3 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller.

2.1.6 Unstable Material

Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.

2.1.7 Select Granular Material

Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall contain not more than 10 percent by weight of material passing a No. 200 mesh sieve and no less than 95 percent by weight passing the 1/2 inch sieve. The maximum allowable aggregate size shall be 1/2 inch, or the maximum size recommended by the pipe manufacturer, whichever is smaller.

2.1.8 Plastic Marking Tape

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 152 mm (6 inches) wide with minimum thickness of 0.102 mm (0.004 inch). Tape shall have a minimum strength of 12.1 MPa (1750 psi) lengthwise and 10.3 MPa (1500 psi) crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in TABLE 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1. Tape Color
Red: Electric

PART 3 EXECUTION

3.1 EXCAVATION

Excavation shall be performed to the lines and grades indicated. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but in no instance closer than 2 feet. Excavated material not required or not satisfactory for backfill shall be removed from the site. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed to maintain the stability of the bottom and sides of the excavation. Unauthorized overexcavation shall be backfilled in accordance with paragraph: BACKFILLING AND COMPACTION at no additional cost to the Government.

3.1.1 Trench Excavation

The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls shall be made vertical. Trench walls more than 5 feet high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Vertical trench walls more than 5 feet high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 600 mm (24 inches) plus pipe outside diameter (O.D.) for pipes of less than 600 mm (24 inches) inside diameter and shall not exceed 900 mm (36 inches) plus pipe outside diameter for sizes larger than 600 mm (24 inches) inside diameter. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Government.

3.1.1.1 Bottom Preparation

The bottoms of trenches shall be accurately graded to provide uniform bearing and support. The trenched subgrade shall not vary more than 0.5 inches from the indicated grade. Stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

3.1.1.2 Removal of Unyielding Material

Where overdepth is not indicated and unyielding material is encountered in the bottom of the trench, such material shall be removed 6 inches below the required grade and replaced with suitable materials as provided in paragraph: BACKFILLING AND COMPACTION.

3.1.1.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced 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 fault or neglect of the Contractor in his performance of the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Government.

3.2 BACKFILLING AND COMPACTION

Backfill material shall consist of satisfactory material or select granular material, as required. Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils, unless otherwise specified.

3.2.1 Trench Backfill

Trenches shall be backfilled to the grade shown.

3.2.1.1 Replacement of Unyielding Material

Unyielding material removed from the bottom of the trench shall be replaced with select granular material.

3.2.1.2 Replacement of Unstable Material

Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 6 inches loose thickness.

3.2.1.3 Bedding and Initial Backfill

Bedding shall be of the type and thickness shown. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

3.2.1.4 Final Backfill

The remainder of the trench shall be filled with satisfactory material. Backfill material shall be placed and compacted as follows:

a. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas:

Backfill shall be deposited in layers of a maximum of 12-inch loose thickness, and compacted to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Compaction by water flooding or jetting will not be permitted. This requirement shall also apply to all other areas not specifically designated above.

3.2.2 Electrical Distribution System

Direct burial cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade, unless otherwise indicated. Special trenching requirements for direct-burial electrical cables and conduits are specified in SECTION: ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

3.2.3 Plastic Marking Tape

Warning tapes shall be installed directly above the pipe, at a depth of 12 inches below finished grade unless otherwise shown.

3.3 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no

additional cost to the Government.

3.3.1 Testing Facilities

Tests shall be performed by an approved commercial testing laboratory or may be tested by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved by the Contracting Officer. The first inspection shall be at the expense of the Government. Cost incurred for any subsequent inspection required because of failure of the first inspection will be charged to the Contractor.

3.3.2 Testing of Backfill Materials

Characteristics of backfill materials shall be determined in accordance with particle size analysis of soils (ASTM D 422) and moisture-density relations of soils (ASTM D 1557). A minimum of one particle size analysis and one moisture-density relation test shall be performed on each different type of material used for bedding and backfill.

3.3.3 Field Density Tests

Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained. A minimum of one field density test per lift of backfill for every 200 feet of installation shall be performed. One moisture density relationship shall be determined for every 1,500 cubic yards of material used or as required due to material change. Field in-place density shall be determined in accordance with ASTM D 1556. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Government.

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SECTION 02241

AGGREGATE BASE COURSE

1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM C 127 (1988; R 1993) Specific Gravity and Absorption of Course Aggregate
- ASTM C 128 (1993) Specific Gravity and Absorption of Fine Aggregate
- ASTM C 131 (1989) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- ASTM C 136 (1995a) Sieve Analysis of Fine and Coarse Aggregates
- ASTM D 75 (1987; R 1992) Sampling Aggregates
- ASTM D 422 (1963; R 1990) Particle-Size Analysis of Soils
- ASTM D 1556 (1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
- ASTM D 1557 (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
- ASTM D 2167 (1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
- ASTM D 2216 (1990) Laboratory Determination of Water Content of Soil and Rock
- ASTM D 2844 (1989) Resistance R-Value and Expansion Pressure of Compacted Soils
- ASTM D 4318 (1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM E 11 (1995) Wire-Cloth Sieves for Testing Purposes

STATE OF NEVADA DEPARTMENT OF TRANSPORTATION (NDOT), MATERIALS TESTING DIVISION

- NDOT T 230C (Rev C) Method of Test for Determining the Percent of Fractured Faces

1.2 DEFINITIONS

1.2.1 Aggregate Base

Aggregate base as used herein is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Degree of Compaction

Degree of compaction required is the ratio of the field density to the maximum dry density expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated hereinafter as percent laboratory maximum density. The field density shall be determined by ASTM D 1556.

1.2.3 Moisture Content

Moisture content is the ratio of the weight of the water to the weight of the solid matter expressed as a percent and it is determined by ASTM D 2216.

1.3 GENERAL

The work specified herein consists of the construction of an aggregate base course. The work shall be performed in accordance with this specification and shall conform to the lines, grades, notes and typical sections shown in the plans. Sources of all materials shall be selected well in advance of the time that materials will be required in the work.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-1 Data

Plant, Equipment, Machines, and Tools; FIO.

List of proposed equipment to be used in performance of construction work including descriptive data.

SD-09 Reports

Sampling and Testing; GA. Field Density; GA.

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within 24 hours after the tests are performed. Certified copies of test results for approval not less than 30 days before material is required for the work.

SD-18 Records

Waybills and Delivery Tickets; GA. Coarse Aggregate; GA.

Copies of waybills and delivery tickets during the progress of the work. Certified waybills and delivery tickets for all materials actually used. A notification stating which type of coarse aggregate is to be used.

1.5 WAYBILLS AND DELIVERY TICKETS

Copies of waybills or delivery tickets shall be submitted during the progress of the work. Before the final payment is allowed, waybills and certified delivery tickets shall be furnished for all aggregates actually used in the construction.

1.6 WEATHER LIMITATIONS

Base shall not be constructed when the atmospheric temperature is less than 35 degrees F. Base shall not be constructed on subgrades that are frozen or contain frost. If the temperature falls below 35 degrees F, completed areas shall be protected against any detrimental effects of freezing.

1.7 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.7.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in satisfactory working condition at all times. Other compacting equipment may be used in lieu of that specified, where it can be demonstrated that the results are equivalent. The equipment shall be adequate and have the capability of producing the results specified.

1.7.2 Steel-Wheeled Rollers

Steel-wheeled rollers shall be the self-propelled type weighing not less than 10 tons, with a minimum weight of 300 pounds per inch width of rear wheel. Wheels of the rollers shall be equipped with adjustable scrapers. The use of vibratory rollers is optional.

1.7.3 Pneumatic-Tired Rollers

Pneumatic-tired rollers shall have four or more tires each loaded to a minimum of 30,000 pounds and inflated to a minimum pressure of 150psi. The loading shall be equally distributed to all wheels, and the tires shall be uniformly inflated. Towing equipment shall also be pneumatic-tired.

1.7.4 Sprinkling Equipment

Sprinkling equipment shall consist of tank trucks, pressure distributors, or other approved equipment designed to apply controlled quantities of water uniformly over variable widths of surface.

1.7.5 Tampers

Tampers shall be of an approved mechanical type, operated by either pneumatic pressure or internal combustion, and shall have sufficient weight and striking power to produce the compaction required.

1.7.6 Mechanical Spreader

Mechanical spreader shall be self-propelled or attached to a propelling unit capable of moving the spreader and material truck. The device shall be steerable and shall have variable speeds forward and reverse. The spreader and propelling unit shall be carried on tracks, rubber tires, or drum-type steel rollers that will not disturb the underlying material. The spreader shall contain a hopper, an adjustable screed, and outboard bumper rolls and be designed to have a uniform, steady flow of material from the hopper. The spreader shall be capable of laying material without segregation across the full width of the lane to a uniform thickness and to a uniform loose density so that when compacted, the layer or layers shall conform to thickness and grade requirements indicated. The Contracting Officer may require a demonstration of the spreader prior to approving use in performance of the work.

1.7.7 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 12-foot straightedge for each bituminous paver, for use in the testing of the finished surface. Straightedge shall be made available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to ensure rigidity and accuracy. Straightedges shall have handles to facilitate movement on pavement.

1.8 STOCKPILING MATERIALS

Materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at locations designated. Before stockpiling of material, storage sites shall be cleared, and sloped to drain. Materials obtained from different sources shall be stockpiled separately.

1.9 SAMPLING AND TESTING

1.9.1 General Requirements

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. No work requiring testing shall be permitted until the facilities have been inspected and approved by the Contracting Officer. The first inspection shall be at the expense of the Government. Cost incurred for any subsequent inspection required because of failure of the facilities to pass the first inspection will be charged to the Contractor. Tests shall be performed in sufficient numbers and at the locations and times directed to insure that materials and compaction meet specified requirements. Copies of test results shall be furnished to the Contracting Officer within 24 hours of completion of tests.

1.9.2 Test Results

Results shall verify that materials comply with this specification. When a material source is changed, the new material will be tested for compliance. When deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced or modified as directed by the Contracting Officer.

1.9.3 Sampling

Aggregate samples for laboratory tests shall be taken in accordance with ASTM D 75.

1.9.4 Sieve Analysis

Before starting work, at least one sample of material shall be tested in accordance with ASTM C 136 and ASTM D 422 on sieves conforming to ASTM E 11. After the initial test, a minimum of one analysis shall be performed for each 1000 tons of material placed, with a minimum of three analyses for each day's run until the course is completed.

1.9.5 Liquid Limit and Plasticity Index

One liquid limit and plasticity index shall be performed for each sieve analysis. Liquid limit and plasticity index shall be in accordance with ASTM D 4318.

1.9.6 Laboratory Density

Tests shall provide a moisture-density relationship for the aggregate. Tests

shall be conducted in accordance with ASTM D 1557, Method B or D.

1.9.7 Wear Tests

Wear tests shall be performed in accordance with ASTM C 131. One test shall be run per 1000 square yards of completed base course. A minimum of one test per aggregate source shall be run.

2 PRODUCTS

2.1 MATERIALS

2.1.1 Aggregates

Aggregates shall consist of crushed stone, crushed gravel, angular sand, or other approved material. Aggregates shall be durable and sound, free from lumps of clay, organic matter, objectionable coatings, and other foreign material. Material retained on a No. 4 sieve shall be known as coarse aggregate and that passing the No. 4 sieve shall be known as binder material.

2.1.1.1 Coarse Aggregate

Only one type of coarse aggregate shall be used on the project. Coarse aggregates, consisting of angular fragments of uniform density and quality, shall have a percentage of wear not to exceed 45 percent after 500 revolutions when tested in accordance with ASTM C 131. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3, and an elongated particle is one having a ratio of length to width greater than 3.

2.1.2 Binder Material

Binder material shall consist of screenings, angular sand, or other finely divided mineral matter processed or naturally combined with the coarse aggregate. Liquid-limit and plasticity-index requirements shall apply to any component that is blended to meet the required gradation and shall also apply to the completed course. The portion of any component or of the completed course passing the No. 40 sieve shall be either nonplastic or have a liquid limit not greater than 29 and a plasticity index not greater than 5.

2.1.3 Gradation

Requirements for gradation specified shall apply to the completed base course when tested in accordance with ASTM C 136. The aggregates shall have a 1 inch maximum size and shall be continuously graded within the following limits:

<u>Sieve Designation</u>	<u>Percentage by Weight Passing Square-mesh Sieve</u>
1 inch	100
3/4 inch	90-100
No. 4	35-65
No. 16	15-40
No. 200	2-10

The values are based on aggregates of uniform specific gravity, and the

percentages passing the various sieves are subject to appropriate correction in accordance with ASTM C 127 and ASTM C 128 when aggregates of varying specific gravities are used.

2.1.4 Physical Properties

The minimum R-value of the aggregate when determined in accordance with ASTM D 2844 shall be 78 percent. The percentage fractured faces when determined in accordance with NDOT T230 shall be 50 percent.

3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the base is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 OPERATION OF AGGREGATE SOURCES

Aggregates shall be obtained from off-site sources.

3.3 PREPARATION OF UNDERLYING COURSE

3.3.1 General Requirements

Before constructing aggregate base course, the previously constructed underlying course shall be cleaned of foreign substances. Surface of underlying course shall meet the specified compaction and surface tolerances.

Subgrade shall conform to Section 02250 SUBGRADE PREPARATION. Ruts or soft, yielding spots that may appear in the underlying course, areas having inadequate compaction, and deviations of the surface from requirements specified shall be corrected. For cohesionless underlying materials containing sands, sand gravels, or any other cohesionless material in harmful quantities, the surface shall be mechanically stabilized with aggregate prior to placement of the aggregate course. Stabilization may be accomplished by mixing base course material into the underlying course and compacting by approved methods. Properly compacted material will be considered as part of the underlying course and shall meet all requirements for the underlying course. Preparation of the underlying course shall include scarification of materials to a minimum depth of 6 inches and compaction to 95 percent maximum density in accordance with the requirements of Section 02250 FILLS AND SUBGRADE PREPARATION. Finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until base course is placed.

3.3.2 Grade Control

Underlying material shall be excavated to sufficient depth for the required base course thickness so that the finished base course with the subsequent surface course will meet the fixed grade. Finished and completed area shall conform to the lines, grades, cross section, and dimensions indicated.

3.4 INSTALLATION

3.4.1 Mixing and Placing

Materials shall be mixed by the stationary plant, traveling plant, or road mix method and placed in such a manner as to obtain uniformity of the aggregate base course material and at a uniform optimum water content for compaction. The Contractor shall make such adjustments in mixing or placing procedures or in equipment to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to ensure a satisfactory base course.

3.4.2 Edges of Base Course

Approved material shall be placed along edges of aggregate base course in such quantities as will compact to thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least a 1 foot width of the shoulder to be rolled and compacted simultaneously with rolling and compacting of each layer of base course.

3.4.3 Compaction

Each layer of aggregate base course shall be compacted. Water content shall be maintained at optimum. Density of compacted mixture shall be at least 100 percent of laboratory maximum density. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. Areas inaccessible to the rollers shall be compacted with mechanical tampers, and shall be shaped and finished by hand methods.

3.4.4 Layer Thickness

Compacted thickness of the aggregate course shall be as indicated on the drawings. No layer shall be in excess of 8 inches nor less than 3 inches in compacted thickness.

3.4.5 Finishing

The surface of the top layer shall be finished to grade and cross section shown. Finished surface shall be of uniform texture. Light blading during compaction may be necessary for the finished surface to conform to the lines, grades, and cross sections. Should the surface for any reason become rough, corrugated, uneven in texture, or traffic marked prior to completion, such unsatisfactory portion shall be scarified, reworked, recompacted, or replaced as directed.

3.4.5.1 Smoothness

Surface of each layer shall show no deviations in excess of 3/8 inch when tested with the 12-foot straightedge. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting, as directed.

3.4.5.2 Thickness Control

Compacted thickness of the base course shall be within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course shall be

considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 1/4 inch of the thickness indicated.

3.5 FIELD QUALITY CONTROL

3.5.1 Field Density

Field in-place density shall be determined in accordance with ASTM D 1556 or ASTM D 2167. Calibration curves and calibration test results shall be furnished within 24 hours of the conclusion of the tests. At least one field density test shall be performed for each 250 square yards of each layer of base material.

3.5.2 Smoothness

Measurements for deviation from grade and cross section shown shall be taken in successive positions parallel to the alignment centerline with a 12 foot straightedge. Measurements shall also be taken perpendicular to the alignment centerline at 50 foot intervals.

3.5.3 Thickness

Thickness of the base course shall be measured at intervals in such a manner as to ensure one measurement for each 500 square yards of base course. Measurements shall be made in 3 inch diameter test holes penetrating the base course.

3.6 TRAFFIC

Completed portions of the area may be opened to traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.

3.7 MAINTENANCE

The aggregate base course shall be maintained in a satisfactory condition until accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact.

3.8 DISPOSAL OF UNSATISFACTORY MATERIALS

Removed in-place materials that are unsuitable for the base course material that is removed for the required correction of defective areas, and waste material and debris shall be disposed of as directed at no additional cost to the Government.

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SITE WORK

SECTION 02250

FILLS AND SUBGRADE PREPARATION

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PART 2 PRODUCTS (NOT APPLICABLE)

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SECTION 02250

FILLS AND SUBGRADE PREPARATION

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 in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422 (1963; R 1990) Particle-Size Analysis of Soils

ASTM D 1556 (1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557 (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³)

ASTM D 2216 (1992) Laboratory Determination of Water (Moisture) Content of Soil, and Rock

ASTM D 2487 (1992) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 2922 (1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D 4914 (1994) Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit.

ASTM D 5030 (1994) Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.

1.2 COMPACTION EQUIPMENT

Compaction shall be accomplished by tamping roller, rubber tired roller vibratory compactor or mechanical tampers. All equipment, tools, and machines shall be maintained in satisfactory working condition at all times. Compaction equipment shall be suitable for consistently producing uniform soil densities.

1.3 SUBMITTALS

Government approval is required for submittals with a ?GA? designation; submittals having an ?FIO? designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-09 Reports

Field Density Tests; GA.

Treating of Compacted Fill Materials; GA.

Copies of all laboratory and field test reports shall be submitted to the contracting officer within 24 hours of the completion of the tests.

1.4 GENERAL REQUIREMENTS FOR COMPACTED FILLS AND COMPACTED BACKFILLS

1.4.1 Control

Moisture-density relations shall be established by the Contractor. The soil used for each maximum density test shall be classified in accordance with ASTM D 2487 and shall include a particle size analysis in accordance with ASTM D 422. At least one five point maximum density test shall be made for every 10 field density tests. Field density test shall be performed by the Contractor at the frequency established in paragraph: 1.4.1.2 Field Control, and in such locations to insure that the specified density is being obtained. Moisture-density relations and field densities shall be reported on approved forms. One copy of density data less dry weight determinations shall be provided on the day each test is taken. The completed test reports shall be provided with the Contractor Quality Control Report on the work day following the test.

1.4.1.1 Laboratory Control

Moisture-density relations shall be established by the Contractor. One moisture-density relation shall be made for each classification, blend or change in classification of soil materials encountered. Approval of moisture-density relations shall be obtained prior to the compacting of any material in the work. The moisture-density relations shall be determined in a laboratory in accordance with ASTM D 1557.

a. The desired amount of mixing water will be added for each compaction test specimen, mixed well, and the mixture will be placed in a container with an airtight cover and allowed to cure for 24 hours. A shorter curing time may be allowed where tests show that shortening the curing time will not affect the results.

1.4.1.2 Field Control

Field in-place density shall be determined in accordance with ASTM D 1556. The field moisture content shall be determined in accordance with ASTM D 2216.

Determination of in-place densities using the nuclear method (ASTM D 2922) may be used to supplement the sand cone density tests (ASTM D 1556). When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D 1556. When material contain considerable amount of rock or coarse gravel in-place density test method ASTM D 4914 or ASTM D 5030 shall be used. At least one adjacent sand cone test shall be performed for every five nuclear density tests performed. If field density tests determined by the nuclear method vary by more than 0.5 pounds per cubic foot from comparison sand-cone tests, and are consistently high or low, adjustment of the calibration curve is necessary.

a. In-Place Densities

One test per 1000 cubic yards, for the first 10,000 cubic yards of material and one test for each 2000 cubic yards thereafter, or fraction thereof, shall be made of each lift of fill or backfill areas compacted by other than hand-operated machines. At least one test shall be made in each 2 foot layer of compacted fill or backfill processed as a unit and not less than one test shall be made in each area.

One test per 500 cubic yards, or fraction thereof, shall be made of each lift of fill or backfill areas compacted by hand-operated machines.

The contractor CQC shall maintain a log of all tests which will updated and submitted to the contracting officer on a weekly basis. The test log shall include: Test number (if retest shall include retest number), date, feature of work, station and offset, weight of wet soil, weight of dry soil, percent of compaction, optimum moisture content, maximum dry unit weight, soil classification, in-place density test methods either sand-cone or nuclear

densimeter.

1.4.2 Settling of Fills or Backfills with Water

Settling of fills or backfills with water will not be permitted.

1.4.3 Fill Material

Fill material shall be obtained from the required excavation. Materials considered unsatisfactory for use as compacted fill include but are not limited to those materials containing roots and other organic matter, trash, debris, chunks or clumps of cemented material, and shall contain no stone whose greatest dimension is more than 3/4 the lift thickness. The Contractor shall expect to break-down, crush or otherwise process required excavation for use as fill material due to the cementation of in-situ soils. Materials classified in ASTM D 2487 as MH, CH, Pt, OH, and OL are also considered unsatisfactory for use as compacted fill. Material for compacted fill behind concrete structures shall contain less than 30 percent by weight passing the No. 200 sieve and shall contain no particle larger than 3 inches.

1.4.4 Placement

Fill material shall not be placed against concrete which has not been in place at least 14 days or until the concrete has attained a strength of 2500 PSI when tested in accordance with the Section 03301 CAST-IN-PLACE STRUCTURAL CONCRETE. Heavy equipment shall not be operated over pipes and buried structures until at least 2 feet of fill material have been placed and compacted over them. Material from the top of the pipe or buried structure to 2 feet above pipe or buried structure shall be compacted by mechanical tampers or other equipment approved by the Contracting Officer. Compacted fill shall be placed with suitable equipment in horizontal layers which before compaction, shall not exceed 1 foot in depth for rubber-tired or vibratory rollers, 8 inches in depth for tamping rollers, 4 inches in depth when mechanical tampers are used. The Contractor may vary the layer thickness within these limits for most efficient operations. Material containing stones shall be placed in a manner to prevent the stones from striking the concrete structures and to prevent the formation of voids.

1.4.5 Moisture Content

Material shall have a uniform moisture content while being placed and compacted. Water shall be added at the source, if required, or by sprinkling each layer of material during placement. Uniform distribution of moisture shall be obtained by disking, harrowing, or otherwise manipulating the soil during and after time water is added. Material containing an excess of moisture shall be manipulated with suitable implements to facilitate maximum aeration and shall be permitted to dry to the proper consistency before being compacted. Fill shall have a maximum moisture content of not more than 2 percent above optimum and a minimum moisture content of not less than 2 percent below optimum.

1.4.6 Compaction

No layer of fill shall be compacted before the practicable uniform moisture content has been obtained. Scarified areas shall be compacted as specified for the fill placed thereon. Rollers will not be permitted to operate within 1 foot of channel or structure walls or over buried structures until the compacted fill over the top of the structures has reached a depth of 2 feet. Compaction equipment shall be so operated that structures are not damaged nor overstressed during compaction operations. Mechanical tampers shall be used for compaction of fill material adjacent to structures where rolling equipment is impracticable for use in compaction.

1.5 COMPACTED FILL, CHANNEL

1.5.1 Invert

1.5.1.1 Preparation for Placing

The foundation for the compacted fill to be placed and compacted fill at the channel shall be cleared of all existing obstructions, vegetation and debris.

Any trash or debris shall be removed in accordance with Section 02150 CLEAR SITE AND REMOVE OBSTRUCTIONS and Section 02200 EXCAVATION. Unsatisfactory or unstable (too wet) material not meeting the requirements for fill material shall be removed where directed. The existing surfaces for the compacted fill at the channel site shall be scarified to a depth of 6 inches and proofrolled by four passes of the compaction equipment. The subgrade for the channel shall be prepared in accordance with paragraph: SUBGRADE PREPARATION.

1.5.1.2 Compaction

Each layer of the material shall be compacted to not less than 95 percent of maximum density, per ASTM D 1557.

1.5.2 Behind Channel Walls

1.5.2.1 Limitations on Equipment

The gross weight of any piece of equipment, or the combined weight of any combinations of equipment coupled together, used to place, moisten and/or compact fill behind channel walls and up to 2 feet above the top of covered sections shall not exceed 35,000 pounds, including dynamic forces produced by vibratory equipment. Equipment used to compact the fill behind the channel walls shall be of such size as to be capable of operating in the area between the cut slope and the channel wall. Compaction equipment will not be required to operate at elevations lower than 2 feet above the top of wall footings. This equipment shall be of such size as to be capable of operating in the area between the cut slope and the channel wall at any point 2 feet above the top of the heel of wall footings.

1.5.2.2 Construction Balance

Fills behind wall on one side of the channel shall not exceed by more than 5 feet the high of the fill behind the opposite channel wall at any time during construction.

1.5.2.3 Compaction

Each layer of fill behind channel walls, shall be compacted to not less than 90 percent of maximum density, per ASTM D 1557. The top 3 feet of the maintenance road adjacent to the channel wall shall be compacted to not less than 95% of maximum density per ASTM D 1557.

1.5.2.4 Trimming

The top of fill adjacent to channel walls shall be trimmed to the lines indicated on the drawings with a tolerance of plus or minus 1 inch. Any material loosened by trimming shall be recompacted and the area moistened and compacted with one pass of a smooth-wheeled roller. Tolerances shall apply after rolling. Fill slopes shall be trimmed to a uniform alignment at the top of the berm and reasonably uniform slope at or outside the lines shown on the drawings.

1.5.2.5 Backfill Against Plywood at Ends of Pipe and Sewer Stubs

3/4" plywood shall be braced or otherwise held flush against the end of the pipe during backfilling. The Contractor shall make sure the plywood is of sufficient size to adequately cover the pipe or sewer stub opening. The Contractor shall attach blocks or shims to roughly fit the inside diameter of the pipe to assure that the plywood is not displaced during backfilling.

1.5.3 Compacted Fill Over Covered Channel

1.5.3.1 General

No fill material shall be placed over the top of the covered channel until all voids at the sides of the covered channel have been filled as described below, and until all caved material has been compacted to the specified density to the top of the roof slab.

1.5.3.2 Material

Materials for filling voids shall be clean sand, free of trash, organic materials, debris, and with 100 percent passing the No. 4 sieve and not more than 10 percent passing the No. 100 sieve.

1.5.3.3 Placement

The first layer of fill over the concrete box section shall be 1 foot in thickness and shall be compacted with a rubber-tired or vibratory roller having a maximum weight of 20,000 pounds. The remainder of the fill shall be deposited in 6 inch layers and compacted with rubber-tired or vibratory rollers, or other approved equipment with a maximum weight of 20,000 pounds until the structure has a cover of at least 2 feet. The remainder of the compacted fill shall be placed as specified in paragraph 1.6 - COMPACTED FILL, CHANNEL of this section.

1.5.3.4 Contractors Option

If the Contractor elects to leave the inside forms and shoring in place, permission will be granted to place fill material 48 hours after concrete has been placed.

1.5.3.5 Compaction

Each layer of fill on top of the covered channel shall be compacted to not less than 90 percent of maximum density, per ASTM D 1557. Compacted Fill under streets shall be compacted per paragraph: COMPACTED FILL, STREET.

1.5.4 Compacted Fill, Roadway

1.5.4.1 Location

Compacted roadway fill shall consist of fill placed for all street construction, and all other fill within all street right-of-ways. Street work includes fill and backfill for streets, curbs, and driveways.

1.5.4.2 Compaction

Fill shall be compacted to not less than 95 percent of maximum density per ASTM D 1557 for the width of all traveled ways plus three (3) feet on each side thereof.

1.5.4.3 Trimming

All street shoulders and side slopes shall be trimmed to the lines indicated on the drawings with a tolerance of plus or minus 1 inch. Any material loosened by trimming shall be recompacted and the area moistened and compacted with one pass of a smooth-wheeled roller. Tolerances shall apply after rolling. Fill slopes shall be trimmed to a reasonably uniform slope at or outside the lines shown on the drawings.

1.6 COMPACTED FILL

1.6.1 Preparation for Placing

The foundation for the compacted fill to be placed and compacted as indicated in the drawings shall be cleared of all existing obstructions, vegetation and debris. Any trash or debris shall be removed in accordance with Section 02150 CLEAR SITE AND REMOVE OBSTRUCTIONS and Section 02200 EXCAVATION. Unsatisfactory or unstable (too wet) material not meeting the requirements for fill material shall be removed where directed. The existing surfaces for the compacted fill shall be scarified to a depth of 6 inches and proofrolled by four passes of the compaction equipment.

1.6.2 Fill Material

Fill material shall conform to requirements of paragraph 1.4.3. Fill material shall be placed within the lines and grades indicated in drawings.

1.6.3 Compaction

Each layer of the material shall be compacted to not less than 95 percent of maximum density, per ASTM D 1557.

1.7 BACKFILL

1.7.1 Structural Backfill

1.7.1.1 Location

Backfill shall consist of all fill against and/or around structures.

1.7.1.2 Material

Backfill material shall be obtained from the required excavation as approved by the Contracting Officer. In general, the best material available will be designated as backfill and fill about structures. Backfill may consist of sand, gravelly sand, and silty sands. Organic material, silt, clay, broken concrete or pavement, boulders and other unsatisfactory material shall not be used. Backfill for structures shall not contain any stones larger than 3 inches.

1.7.1.3 Placing

Backfill material shall not be placed against concrete which has not been in place at least 14 days or until the concrete has attained a strength of 2500 PSI when tested in accordance with Section 03301 CAST-IN-PLACE STRUCTURAL CONCRETE. Backfill shall be placed in 4 inch layers.

1.7.1.4 Compaction

Compaction shall be not less than 90 percent of maximum density, per ASTM D 1557 unless noted or shown otherwise.

1.8 SUBGRADE PREPARATION

1.8.1 Subgrade for Channel

Subgrade preparation for channel shall include subgrade preparation for areas to receive concrete, aggregate base course and/or bituminous paving for access roads, maintenance roads, turnarounds, and invert access ramps.

All trash and debris shall be removed in accordance with Section 02150 CLEAR SITE AND REMOVE OBSTRUCTIONS and Section 02200 EXCAVATION. After the channel has been excavated to rough grade, the entire channel invert, invert access ramp, and other area indicated above shall be scarified to a depth of 6 inches, moisture conditioned and proofrolled by 4 passes of the compaction equipment and trimmed to a uniform grade and smoothed with a steel-wheeled roller to make the subgrade ready to receive concrete. If the subgrade is disturbed by the Contractor's operations or is overexcavated, or is soft or yielding, the subgrade shall be restored to grade and compacted to a density of 95 percent of maximum density, per ASTM D 1557. The finished surface of the subgrade shall not be more than 0.5 inch above the indicated grade at any point when tested with a 12 foot straightedge.

Note: Bedding material is not required under the channel invert slabs of box culverts and rectangular channels, neither under the invert and side slope lining of the trapezoidal channels as is erroneously indicated on the drawings.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --

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SECTION 02600

STONE PROTECTION

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 in the text by basic designation only.

American Society for Testing and Materials (ASTM)

ASTM C 33	(1993) Concrete Aggregates
ASTM C 88	(1990) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 127 Absorption of Coarse Aggregate	(1988) Specific Gravity and
ASTM C 131	(1989) Resistance to Degradation of Small-Size Coarse Aggregate Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1995) Sieve Analysis of Fine and Coarse Aggregate
ASTM C 295	(1990) Petrographic Examination of Aggregates for Concrete
ASTM C 535	(1989) Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM D 1141	(1980) Substitute Ocean Water
ASTM D 5519	(1994) Particle Size Analysis of Natural and Man-Made Riprap Materials
ASTM E 548	(1989) General Criteria Used for Evaluating Laboratory Competence

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Definitions

2.1.1.1 Angular Stone. Stone which is obtained from bedrock deposits at a quarry and is angular in shape.

2.1.2 General

The Contractor shall make all arrangements for furnishing and transporting of stone. The Contractor shall vary the loading and placing operations to produce the sizes of stone specified. If the stone being furnished by the Contractor does not fully meet all the requirements of these specifications, the Contractor shall furnish, at no additional cost to the Government, other stone meeting the requirements of these specifications.

2.1.3 Potential Stone Sources

Stone conforming to these specifications will be available from the required excavations and from stone quarries near the project area. The following are sources of stone reasonably near the project area.

<u>Source Name</u>	<u>Location</u>
Hanson Aggregates	El Dorado Quarry, Henderson, NV
WMK Materials	Buffalo Road Pit, Las Vegas, NV
Sloan Quarry	SW of Arden, NV

Listing of a stone source is not to be construed as current or future availability of the source, authorization of all the materials from the source, nor as a waiver of inspection of the source. This is merely a guide for the contractor.

2.1.4 Stone Quality

2.1.4.1 Quality Compliance Testing

Samples for Corps of Engineers testing as specified in paragraph: Source Documentation shall be submitted a minimum of 45 days in advance of the time when the stone will be required in the work. Stone from a proposed source will be tested by the Contractor for quality compliance. The first test shall be at the Contractor's expense, however, if the stone fails the tests, or if the Contractor desires to utilize more than one source, additional testing will be performed by the Government at the Contractor's expense. The cost of additional testing will be deducted from payment due the Contractor in the amount of \$4500 for each sample tested. All test samples (100 pounds minimum) shall be representative of the stone source and shall be obtained by the Contractor under the supervision of the Contracting Officer's Representative and delivered at the Contractor's expense to a testing laboratory approved by the Contracting Officer's Representative.

2.1.4.2 Stone Quality Testing Requirements

Stone shall be subjected to such tests as are necessary to demonstrate to the satisfaction of the Contracting Officer's Representative that the materials are acceptable for use in the work. At a minimum the stone shall meet the following test requirements.

<u>Test</u>	<u>Test Method</u>	<u>Requirement</u>
Specific Gravity (Bulk SSD)	ASTM C 127	2.54 minimum
Absorption	ASTM C 127	2.0% maximum
Wetting and Drying	SPD Test Procedure ⁽¹⁾	No fracturing ⁽³⁾
Sulfate Soundness	ASTM C 88 ⁽²⁾	10% max.loss ⁽⁴⁾
Abrasion Loss	ASTM C 535	50% max. loss ⁽⁴⁾

In addition to the above tests, the stone shall be subjected to a petrographic and X-ray diffraction analysis in accordance with ASTM C 295⁽⁵⁾. The stone must not contain any expansive clays. Stone for grouted stone protection shall not contain excessive amounts of deleterious minerals associated with alkali-silica or alkali-carbonate reactions as described in ASTM C 33.

NOTE: (1): Test procedure for wetting and drying test. The entire sample is carefully examined and representative test specimens are selected. The sample should be large enough to produce two cut slabs, 1 inch thick (+/-1/4 inch) with a minimum surface area of 30 square inches on one side. Two chunks approximately three by four inches are also chosen. The slabs and chunks are carefully examined under a low-power microscope and all visible surface features are noted and recorded. The specimens are then oven dried at 140 degrees F., for eight hours, cooled and weighed to the nearest tenth of a gram. The test specimens are photographed to show all surface features before the test. The chunks and slabs are then subjected to fifteen cycles of wetting and drying. One slab and one chunk are soaked in fresh tap water, the other slab and chunk are soaked in salt water prepared in accordance with ASTM D 1141. Each cycle consists of soaking for sixteen hours at room temperature and then drying in an oven for eight hours at 140 degrees F. After each cycle the specimens are examined with the low-power microscope to check for opening or movement of fractures, flaking along edges, swelling of clays, softening of rock surfaces, heaving of micaceous minerals, breakdown of matrix material and any other evidence of weakness developing in the rock. The cycle in which any of these actions occurs is recorded. After fifteen cycles, the slabs and chunks are again carefully examined and all changes in the rocks are noted and recorded. The test specimens together with all particles broken off during the test are oven dried, weighed and photographed.

NOTE: (2): The test shall be made on 50 particles each weighing 100 grams, +/- 25 grams, in lieu of the gradation given in ASTM C 88.

NOTE: (3): Weakening and loss of individual surface particles is permissible unless bonding of the surface grains softens and causes general disintegration of the surface material.

NOTE: (4): Stone which has a loss greater than the specified limit will be accepted if the Contractor demonstrates that the stone has a satisfactory service record.

NOTE: (5): The test procedure for Petrographic and X-ray Diffraction is performed according to ASTM C 295, except for the following:

(a) A color, microscopic photograph shall be made of each stone type and the individual minerals within the stone shall be identified by labels and arrows upon the photograph.

(b) A very detailed macroscopic and microscopic description shall be made of the stone, to include the entire mineral constituents, individual sizes, their approximate percentages and mineralogical histories. A description of stone hardness, texture, weathering, and durability factors shall also be discussed.

(c) A written summary of the suitability of stone for use as riprap based on the Petrographic and X-ray tests and the results of ASTM C 535 shall be presented in the final laboratory report on stone quality.

2.1.4.3 Stone Acceptance Criteria

Prior to placement, all stone shall be subject to acceptance by the Contracting Officer's Representative. Acceptance of any stone shall not constitute

acceptance of all stone from a source. All accepted stone shall be:

- a. of the same lithology as the original stone from which test results or service records were taken as a basis for authorization of the source;
 - b. sound, durable and hard, and free from laminations, weak cleavages, undesirable weathering, or blasting or handling-induced fractures (or fracture zones which subtend more than 1/3 of the total circumference of the stone along the plane of fracturing);
 - c. of such character that it will not disintegrate from the action of air, water, or the conditions of handling and placing; and,
 - d. clean and free from earth, clay, refuse, or adherent coatings.
- Stone shall not be subjected to any minimum quality or testing requirements for use in this project. Prior to placement, however, all stone shall be subject to acceptance by the Contracting Officer's Representative.

2.1.5 Gradation

2.1.5.1 General

All points on individual grading curves shall be between the boundary limits as defined by smooth curves drawn through specified grading limits plotted on a mechanical analysis diagram. The individual grading curves shall not exhibit abrupt changes in slope denoting skip grading or scalping of certain sizes. Specified grading of all material shall be met both at the source and as delivered to the project. In addition, material not meeting the required grading due to segregation or degradation during placement shall be rejected. If test results show that stone does not meet the required grading, the hauling operation will be stopped immediately and will not resume until processing procedures are adjusted and a gradation test is completed showing gradation requirement are met. All gradation tests shall be at the expense of the Contractor. The relationship between stone size (diameter) and weight in the tables below is based on the volume midway between a sphere and a cube and a specific gravity of 2.54.

2.1.5.2 Gravel Bedding

The bedding layer shall consist of well-graded gravel, crushed gravel, or crushed stone, and shall contain not more than 10 percent by weight of material passing a No. 4 sieve and not less than 95 percent by weight passing the 3-inch sieve.

2.1.5.3 Riprap Stone

Riprap shall be quarried, angular stone reasonably well-graded within the limits specified below, when tested in accordance with ASTM D 5519, Test Method A.

Approximate Average Diameter (in)	Percent Smaller (by weight)
24	100
18	50-85
12	15-30

Approximate Average Diameter (in)	Percent Smaller (by weight)
9	0-15

2.1.5.4 Gradation Sampling and Testing

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Tests shall be performed by an approved testing laboratory on samples selected by the Contracting Officer's Representative. Testing may be done by the Contractor, subject to approval by the Contracting Officer's Representative. If the Contractor elects to establish testing facilities, approval of such facilities shall be based on compliance with ASTM E 548, and no work requiring testing will be permitted, until the Contractor's facilities have been inspected and approved by the Contracting Officer's Representative. Testing shall be supervised by a registered Civil Engineer, experienced in rock-testing. The Government reserves the right to perform check tests and to use the Contractor's sampling and testing facilities to make the tests. One gradation test shall be required at the beginning of production prior to delivery of stone from the source to the project site. A minimum of one additional test shall be required during the placement of the stone, at the discretion of the Contracting Officer's Representative.

2.1.6 Rejected Stone

Stone of unsuitable quality and/or size distribution as required by these specifications shall be rejected. Any rejected stone shall be promptly removed from the project at no expense to the Government. Any portions of the work covered by these specifications containing rejected stone will be considered incomplete.

PART 3 EXECUTION

3.1 FOUNDATION PREPARATION

3.1.1 General

Subgrade preparation for material placement shall conform to the provisions of SECTION: 02250 FILLS AND SUBGRADE PREPARATION and SECTION: 02215 GEOTEXTILES USED AS FILTERS. Areas on which stone is to be placed shall be trimmed and dressed to conform to cross sections indicated or directed, within an allowable tolerance of plus or minus 6 inches from the theoretical slope lines and grades. Immediately prior to placing any stone, the prepared base shall be inspected by the Contracting Officer's Representative and no material shall be placed thereon until that area has been approved.

3.2 PLACEMENT

3.2.1 General

Except as otherwise specified, the limits of stone in place shall follow, with reasonable variation, the indicated lines and slopes, without continuous under- or overbuilding. For all stonework, the Contractor shall submit the method of placement to the Contracting Officer's Representative for approval, before placement begins.

3.2.2 Gravel Bedding

The gravel bedding material shall be placed from the bottom of the slope upward and laterally using light pressure equipment for spreading. Care shall be taken not to damage the geotextile beneath. Sharp turns with equipment shall be avoided.

3.2.3 Riprap Stone

Riprap shall be placed in a reasonably well-graded mass to the lines and grades indicated or directed by the Contracting Officer's Representative. Barring of stone will be required to the extent necessary to secure the results specified.

Hand placing will not be required. A tolerance of 6 inches from the indicated lines and grades will be allowed in the finished surface, but such tolerance shall not be continuous over an area greater than 30 square feet.

-- End of Section --

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SECTION 02710

WEEP HOLE SYSTEM

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SECTION 02710

WEEP HOLE SYSTEMS

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 in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 131	(1996) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1992) Standard Test Method Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(1987; Standard Practice for Method Sampling Aggregates
ASTM D 123	(1996) Terminology Relating to Textile Material
ASTM D 4632	(1991) Grab Breaking Load and Elongation of Geotextile
ASTM D 4833	(1988) Test Method for Index Puncture Resistance of Geotextiles, Geomembrane, and Related Products

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-14 Samples

Filter Material; FIO.

Specimens identified to indicate the manufacturer, type of material, size and quantity of material, and shipment or lot represented. Each sample of filter material shall be a piece not less than 6-inch x 6-inch.

PART 2 PRODUCTS

2.1 DRAIN MATERIAL

Drain material shall be durable, hard, tough, and free from adherent coatings.

The material shall not contain corrosive agents, organic matter, or soft, friable, thin or elongated particles in quantities considered deleterious by the Contracting Officer. Drain material shall consist of gravel, crushed stone, or processed crushed concrete, and shall show a loss in weight of not more than 50 percent when tested in accordance with ASTM C 131, and shall be reasonably well graded within the following limits:

<u>Sieve Size (millimeters)</u>	<u>Percent by Weight Passing</u>
63 mm	100
50 mm	95-100
37.5 mm	35-70
25 mm	0-15
12.5 mm	0- 5

2.2 FILTER FABRIC

Filter fabric shall be a nonwoven needle punch pervious sheet of plastic yarn. The filter fabric shall provide an apparent opening size no finer than the No. 100 sieve and no coarser than the No. 50 sieve. The filter fabric shall have a minimum tensile strength of 100 pounds in any principal direction when tested in accordance with ASTM D 4632 grab test method using one inch square jaws and a one foot per minute constant rate of traverse. The filter fabric shall have a 15 percent minimum breaking elongation in any principal direction when tested in accordance with ASTM D 4632. The filter fabric shall have a 50 pound minimum puncture strength when tested in accordance with ASTM D 4833. The filter fabric shall have no seams.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Drain Material

Drain material for weep holes shall be wrapped completely in filter fabric and placed immediately against the wall, covering the opening of the weep hole.

3.1.2 Installation of the Filter Fabric

The filter fabric shall be placed in the manner and at the location indicated. The Contractor shall submit a plan for installation of filter fabric in front of channel weep holes for approval by the Contracting Officer. At the time of installation, the filter fabric shall be rejected if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation or storage. The surface to receive the filter fabric shall be prepared to a relatively smooth condition free of obstruction, depressions, debris and soft or low density pockets of material. The filter fabric shall be placed smooth and free of tension, stress, or wrinkles. The filter fabric shall be placed to provide a minimum overlap of 12 inches at each joint. Temporary pinning of the textile to help hold it in place shall be allowed. The temporary pins shall be removed during placement of materials on the filter fabric to relieve high tensile stress. The filter fabric shall be protected at all times during construction from contamination by surface runoff and any filter fabric so contaminated shall be removed and replaced with uncontaminated filter fabric. Any damage to the filter fabric during its installation or during placement of

drain material or compacted fill shall be replaced by the Contractor at no cost to the Government. The work shall be scheduled so that the covering of the filter fiber with a layer of the specified material is accomplished within 7 days after placement of the filter fabric. Failure to comply shall require replacement of filter fabric. The filter fabric shall be protected from damage prior to and during the placement of drain material or compacted fill by limiting the height of drop to less than 1 foot. Before placement of drain material or compacted fill, the Contractor shall demonstrate that the placement technique will prevent damage to the filter fabric. In no case shall any type of equipment be allowed on the unprotected filter fabric.

3.1.3 Shipment and Storage

During all period of shipment and storage, the filter fabric shall be protected from direct sunlight, ultra-violet rays, temperatures greater than 140 degrees Fahrenheit, mud, dirt, dust and debris. To the extent possible shall be maintained wrapped in a heavy duty protective covering.

3.2 TESTS

3.2.1 Drain Material

3.2.1.1 Points

Points on the individual grading curves obtained from representative samples of the drain material not only shall lie between the boundary limits as defined by smooth curves drawn through the tabulated grading limits plotted on a mechanical-analysis diagram but also shall exhibit no abrupt changes in slope denoting skip grading, scalping of certain sizes, or other irregularities which would be detrimental to the proper functioning of the drain.

3.2.1.2 Sampling and Testing

Sampling and testing of the drain material shall be performed by the Contractor to determine compliance of the installed materials with specified requirements in conformance with ASTM C 131, ASTM C 136, and ASTM D 75. Sampling and testing shall be performed at regular intervals with at least three tests being made for drain materials. The location of after placement tests shall be as directed.

3.3 PROTECTION

The Contractor shall take all necessary precautions to avoid damage to the completed subdrainage system from the movement of equipment during placing and compacting operations of fill material.

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REINFORCED CONCRETE PIPE STUBOUTS

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SECTION 02720

REINFORCED CONCRETE PIPE STUBOUTS

PART 1 GENERAL

1.1 APPLICABLE PUBLICATIONS

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 76 (1995) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

PART 2 PRODUCTS

2.1 GENERAL.

The reinforced concrete pipe conduit shall be constructed as shown and as specified. Concrete shall conform to the applicable requirements of the section: CAST-IN-PLACE STRUCTURAL CONCRETE. Where pipe is embedded in concrete, the pipe shall be supported in such a manner to hold it rigidly in position while concrete is placed. Earthwork about the conduit shall conform to the applicable requirements of the section: EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Specified and/or indicated D-loading is the minimum acceptable, and heavier pipe may be furnished at the option of the Contractor.

2.2 CONCRETE PIPE.

2.2.1 MATERIALS.

Reinforced Concrete Pipe shall conform to the requirements of ASTM C 76, CLASS III. The following additional markings shall be clearly stenciled on the pipe:

Permissible D-load to produce a 0.01-inch crack
Internal diameter in inches

2.3 TESTS FOR PIPE.

Certified copies of test reports, demonstrating conformance to the applicable pipe specifications, shall be furnished the Contracting Officer before installation of the pipe. Strength tests for concrete pipe, as required in the applicable specifications, shall be the three-edge bearing tests.

2.4 MORTAR.

2.4.1 COMPOSITION.

Mortar for joints shall be composed of cement, sand, and water proportioned at the approximate ratio of one part cement to not more

than two parts sand. The materials shall conform to the applicable requirements of the section: CAST-IN-PLACE STRUCTURAL CONCRETE.

2.4.2 MIXING.

The mortar shall be mixed in a concrete mixer in the manner specified for concrete, or in a watertight mixing box. If mixed in a box, the box shall first be filled with the required amount of sand, the volume of which shall be determined with a one-cubic-foot measuring box. The requisite amount of cement shall then be added and the material dry mixed by turning at least three times with a mortar hoe. Sufficient water shall then be added and the mixing continued until the batch is uniform in color and consistency. Mortar shall show no visible signs of setting and shall be used within a period of 30 minutes after mixing with water. No retempering will be permitted.

PART 3 EXECUTION

3.1 INSTALLATION.

3.1.1 PLACING.

Each pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. All pipe in place shall have been inspected before encasing in concrete. Laying shall proceed upgrade with the tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Circular concrete pipe with elliptical reinforcing shall be so placed that the reference lines designating the top of the pipes will be not more than 5 degrees from the vertical plane through the longitudinal axis of the pipe. In encasing the pipe in concrete, care shall be taken to prevent damage to or misalignment of the pipe.

3.1.2 MORTAR JOINTS.

All joint areas shall be cleaned and moistened with a wet brush immediately before caulking. The interior surface of the lower portion of the groove of the tongue-and-groove pipe shall have a layer of soft mortar applied. The tongue end of the second section, while in a horizontal position, shall have a layer of soft mortar applied to the upper half of the tongue. The tongue shall then be inserted in the groove. The joint shall then be caulked with mortar, completely filling the annular space between the pipe sections. The inside of the joint shall then be wiped and finished smooth. The outside of the joint shall be immediately protected from the air and sun with continuously moist burlap or earth until the mortar is cured.

-- End of Section --

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 in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 94	(1990) Ready-Mixed Concrete
ASTM C 150	(1989) Portland Cement
ASTM C 478	(1990b) Precast Reinforced Concrete Manhole Sections
ASTM C 924	(1989) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM D 2751	(1991) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 3034	(1989) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1989) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F 477	(1990) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

FEDERAL SPECIFICATIONS (FS)

FS QQ-C-40	(Basic; Am 2: Notice 1) Caulking: Lead Wool and Lead Pig
FS RR-F-621 (Rev E)	Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 49	(1975) Hazardous Chemicals Data
NFPA 325M	(1991) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids

1.2 GENERAL REQUIREMENTS

The construction required herein shall include precast concrete manhole. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Excavation and backfilling is specified in Section 02222: EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Backfilling shall be accomplished after inspection by the Contracting Officer.

1.2.1 Protection of Materials

Before, during, and after installation, fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300: SUBMITTAL DESCRIPTIONS:

SD-13 Certificates

Portland Cement; GA; CD/OD.

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes.

PART 2 PRODUCTS

2.1 JOINTS

Joints installation shall comply with the manufacturer's instructions.

2.2 FRAMES AND COVERS

Frames and covers shall be cast iron, ductile iron or reinforced concrete. Cast iron frames and covers shall be as indicated or shall conform to FS RR-F-621, type as suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 400 pounds. Reinforced concrete frames and covers shall be as indicated. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.3 STEEL LADDER

A steel ladder shall be provided where the depth of a manhole exceeds 12 feet. The ladder shall not be less than 16 inches in width, with 3/4 inch diameter rungs spaced 12 inches apart. The two stringers shall be a minimum 3/8 inch thick and 2 inches wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123.

2.4 CEMENT MORTAR

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.4.1 Portland Cement

Portland cement shall conform to ASTM C 150, Type II for concrete used in manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking.

2.4.2 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

2.5 STRUCTURES

2.5.1 Precast Reinforced Concrete Manhole Sections

Precast reinforced concrete manhole sections shall conform to ASTM C 478, except that portland cement shall be as specified herein. Joints shall be cement mortar, or an approved mastic or rubber gasket, or an approved combination of these types.

PART 3 EXECUTION

3.1 MANHOLES

3.1.1 General

Manholes shall be constructed of precast concrete manhole sections. The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be built up with brick and mortar, or shall be half tile laid in concrete, or shall be constructed by laying full section sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. Pipe connections shall be made to manhole using water stops, standard 0-ring joints, special manhole coupling, or shall be made in accordance with the manufacturer's recommendation. The Contractor's proposed method of connection, list of materials selected, and specials required, shall be approved prior to installation. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 1 inch per foot nor more than 2 inches per foot. Free drop inside the manholes shall not exceed 1 foot 6 inches, measured from the invert of the inlet pipe to the top of the floor of the manhole outside the channels, and drop manholes shall be constructed whenever the free drop would otherwise be greater than 1 foot 6 inches.

3.1.2 Steel Ladder

Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 6 feet apart vertically, and shall be installed to provide at least 6 inches of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

3.1.3 Jointing and Plastering

Mortar joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of the manhole. Mortar and mastic joints between precast rings shall be full-bedded in jointing compound and shall be smoothed to a uniform surface on both the interior and exterior of the manhole. Installation of rubber gasket joints between precast rings shall be in accordance with the recommendations of the manufacturer.

3.1.4 Frames and Covers

Unless otherwise indicated, tops of frames and covers shall be set flush with finished grade in paved areas or 2 inches higher than finished grade in unpaved areas.

3.2 CONNECTION TO EXISTING GRAVITY SEWER LINE

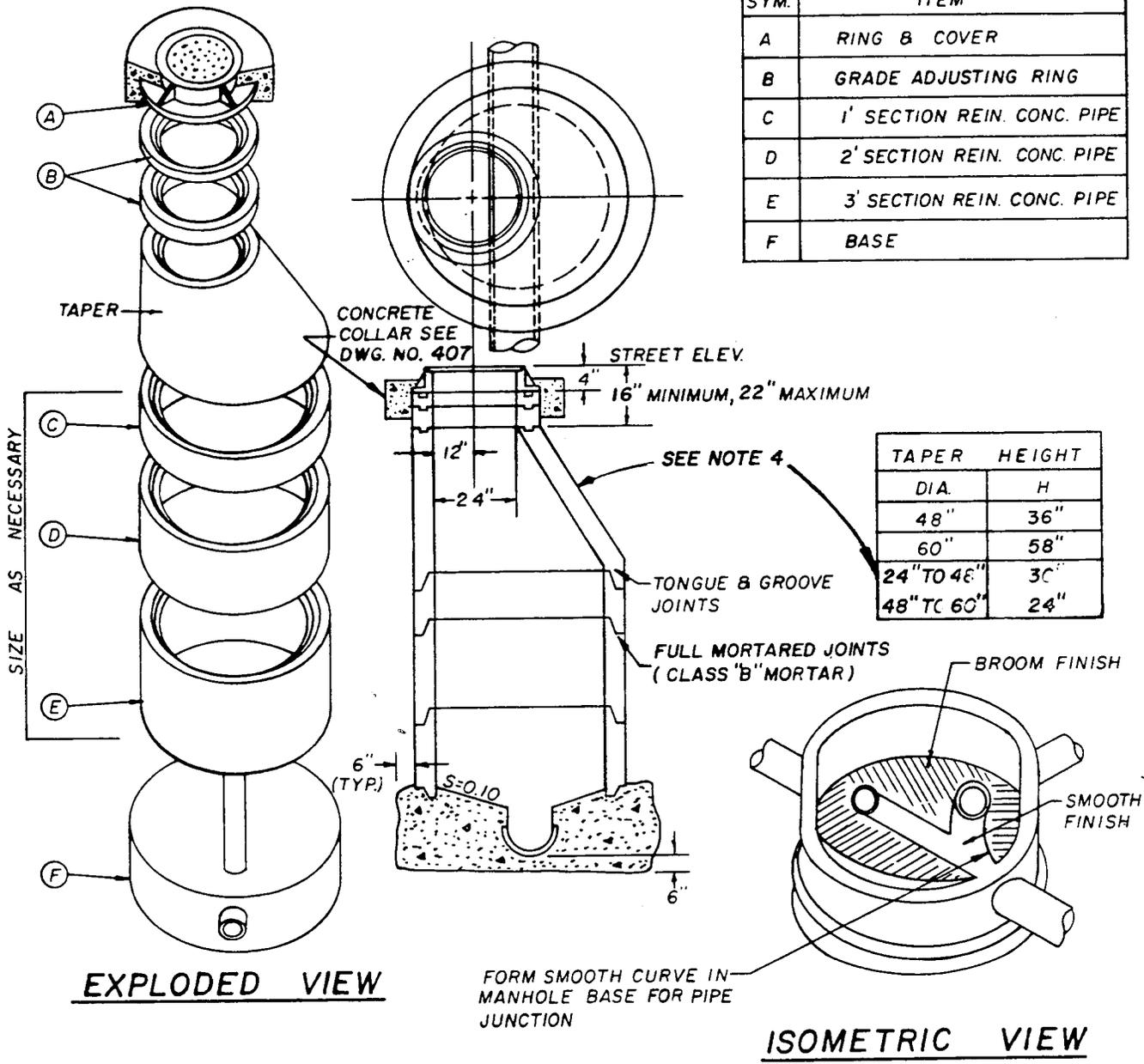
Pipe connection to existing gravity sewer line shall be made in such manner that the finish work will conform as nearly as practicable to the essential applicable requirements specified for new gravity sewer lines, including all necessary concrete work, cutting, and shaping.

3.3 CLEANOUTS AND OTHER APPURTENANCES

Cleanouts and other appurtenances shall be installed where shown on the drawings or as directed by the Contracting officer, and shall conform to the detail of the drawings.

--End of Section--

SYM.	ITEM
A	RING & COVER
B	GRADE ADJUSTING RING
C	1' SECTION REIN. CONC. PIPE
D	2' SECTION REIN. CONC. PIPE
E	3' SECTION REIN. CONC. PIPE
F	BASE



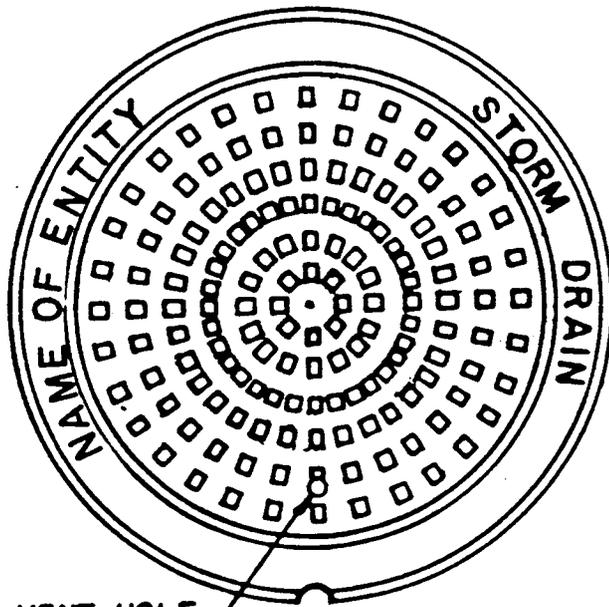
EXPLODED VIEW

ISOMETRIC VIEW

NOTES:

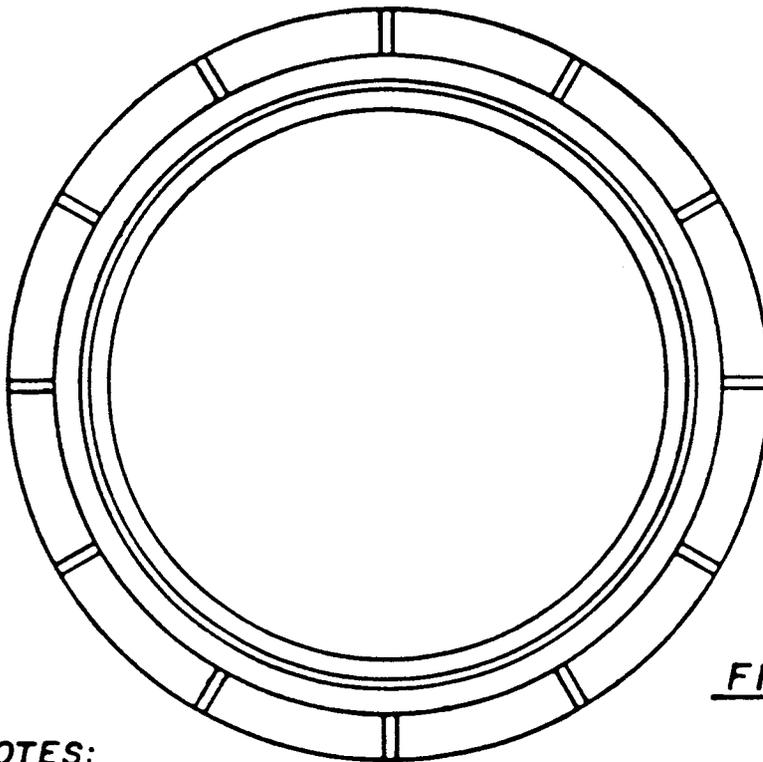
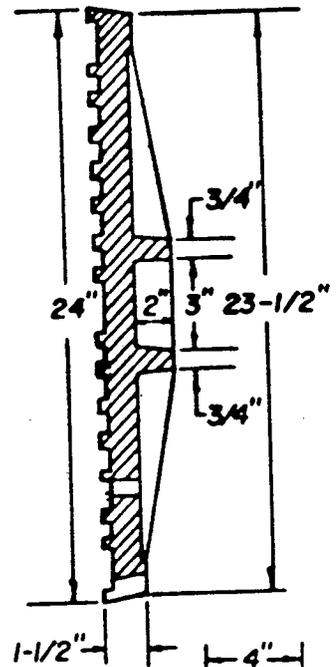
1. IN UNIMPROVED NON-TRAFFIC AREAS, TOP OF MANHOLE SHALL BE 6" TO 9" ABOVE GRADE.
2. PIPES SHALL NOT PROTRUDE MORE THAN 3" INSIDE OF MANHOLE SECTION. CONSTRUCT WATER TIGHT CONNECTION TO MANHOLE.
3. PIPE SECTION LENGTHS ARRANGED TO FIT DEPTH.
4. AN OPTIONAL TWO PIECE 24" TO 48" AND 48" TO 60" CONE MAY BE USED.

SPECIFICATION REFERENCE		UNIFORM STANDARD DRAWINGS CLARK COUNTY AREA		
501	CONCRETE & MORTAR			
609	CATCH BASINS, MANHOLES & INLETS	TYPE I MANHOLE		
		DATE	DWG. NO. 403	PAGE NO. 103

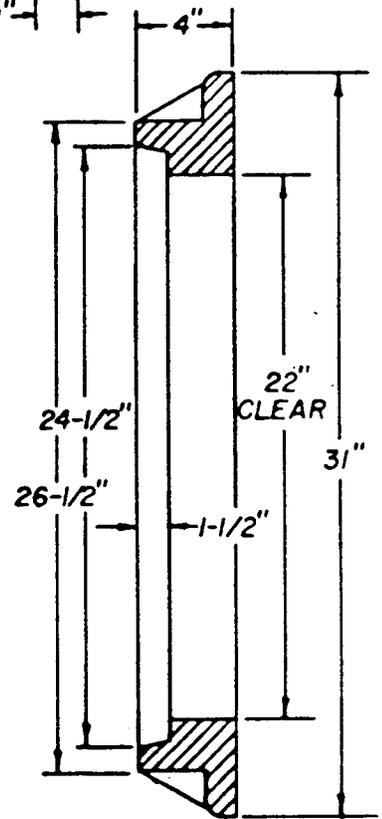


1" DIA. VENT HOLE

COVER



FRAME



NOTES:

1. FRAME AND COVER TO BE ALHAMBRA FOUNDRY COMPANY TYPE A1310 IN ACCORDANCE WITH ASTM A-48, CLASS 30, OR APPROVED EQUAL.
2. CAST IRON SHALL HAVE MINIMUM TENSILE STRENGTH OF 30,000 P.S.I.
3. FRAME AND COVER MACHINED TO FIT.
4. WEIGHT OF FRAME AND COVER 330 LBS. MINIMUM.

SPECIFICATION REFERENCE		UNIFORM STANDARD DRAWINGS CLARK COUNTY AREA		
712	MISCELLANEOUS METALS			
		STANDARD MANHOLE COVER AND RING		
		DATE	DWG. NO. 409	PAGE NO. 109

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ASTM D 1856	(1995a) Recovery of Asphalt from Solution by Abson Method
ASTM D 2041	(1995) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D 2172	(1995) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 2216	(1992) Laboratory Determination of Water (Moisture) Content of Soil and Rock
ASTM D 3381	(1992) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 3515	(1996) Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
ASTM D 4318	(1995) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

STATE OF NEVADA DEPARTMENT OF TRANSPORTATION MATERIALS TESTING
DIVISION (NDOT)

NDOT T 230C	(Rev C) Method of Test for Determining the Percent of Fractured Faces
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1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Asphaltic Cement; GA.

Copies of test results.

Gradation and Physical Properties of Aggregates GA.

Copies of test results.

Bituminous Pavement Mix Design; GA.

Copy of mix design selected. Report to be submitted and signed by a Civil Engineer licensed to practice in State of Nevada.

Properties of Bituminous Pavement Mixture GA.

Copies of test results. Report to be submitted and signed by a Civil Engineer licensed to practice in State of Nevada.

Report of Density, Asphalt Content, and Gradation GA.

Copies of test results. Report to be submitted and signed by a Civil Engineer licensed to practice in State of Nevada.

Report of Grade Conformance and Surface Smoothness GA.

Copies of test results. Report to be submitted and signed by a Civil Engineer licensed to practice in State of Nevada.

SD-18 Records

Waybills and Delivery Tickets; GA.

Waybills and delivery tickets, during progress of the work.

1.3 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.3.1 General

The bituminous plant shall be of such capacity to produce the quantities of bituminous mixtures required. Hauling equipment, paving machines, rollers, miscellaneous equipment, and tools shall be provided in sufficient numbers and capacity and in proper working condition to place the bituminous paving mixtures at a rate equal to the plant output.

1.3.2 Mixing Plants

The mixing plant shall be an automatic or semiautomatic controlled commercially manufactured unit designed and operated to consistently produce a mixture within the job-mix formula (JMF). The plant shall have a minimum capacity of 100 tons per hour. Drum mixers shall be prequalified at the production rate to be used during actual mix production. The prequalification tests will include extraction and recovery of the asphalt cement in accordance with ASTM D 2172 and ASTM D 1856. The penetration of the recovered asphalt binder shall not be less than 60 percent of the original penetration, as measured in accordance with ASTM D 5.

1.3.3 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 12-foot straightedge for each bituminous paver. Straightedges shall be made available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to ensure rigidity and accuracy. Straightedges shall have handles to facilitate movement on pavement.

1.4 WEATHER LIMITATIONS

Unless otherwise directed, bituminous courses shall not be constructed when temperature of the surface of the existing pavement or base course is below 40 degrees F.

1.5 PROTECTION OF PAVEMENT

After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until the pavement has cooled to 140 degrees F.

1.6 GRADE AND SURFACE-SMOOTHNESS REQUIREMENTS

Finished surface of bituminous courses, when tested as specified below, shall conform to gradeline and elevations shown and to surface-smoothness requirements specified.

1.6.1 Plan Grade

The grade of the completed surface shall not deviate more than 0.05 foot from the plan grade.

1.6.2 Surface Smoothness

When a 12-foot straightedge is laid on the surface parallel with the centerline of the paved area or transverse from crown to pavement edge, the surface shall vary not more than 1/4 inch from the straightedge.

1.7 GRADE CONTROL

Lines and grades shall be established and maintained by means of line and grade stakes placed at site of work in accordance with the Special Contract Requirements. Elevations of bench marks used by the Contractor for controlling pavement operations at the site of work will be determined, established, and maintained by the Government. Finished pavement elevations shall be established and controlled at the site of work by the Contractor in accordance with bench mark elevations furnished by the Contracting Officer.

1.8 SAMPLING AND TESTING

1.8.1 Aggregates

1.8.1.1 General

Samples of aggregates shall be furnished by the Contractor for approval of aggregate sources and stockpiles prior to the start of production and at times during production of the bituminous mixtures. Times and points of sampling will be designated by the Contracting Officer. Samples will be the basis of approval of specific sources or stockpiles of aggregates for aggregate requirements. Unless otherwise directed, ASTM D 75 shall be used in sampling coarse and fine aggregate, and ASTM C 183 shall be used in sampling mineral filler. All tests necessary to determine compliance with requirements specified herein will be performed by the Contractor.

1.8.1.2 Sources

Sources of aggregates shall be selected well in advance of the time the materials are required in the work. If a previously developed source is selected, evidence shall be submitted 15 days before starting production, indicating that the central-plant hot-mix bituminous pavements constructed with the aggregates have had a satisfactory service record of at least five years under similar climatic and traffic conditions. The Contractor will make such tests and other investigations as necessary to determine whether aggregates meeting requirements specified herein can be produced from proposed sources. If a sample of material from a new source fails to meet specification requirements, the material represented by the sample shall be replaced, and the Contractor will be required to submit new test data on the submitted materials. Approval of the source of aggregate does not relieve

the Contractor of responsibility for delivery at the jobsite of aggregates that meet the requirements specified herein.

1.8.2 Bituminous Materials

Bituminous materials shall be sampled in accordance with ASTM D 140. Tests necessary to determine conformance with requirements specified herein will be performed by the Contractor. Sources where bituminous materials are obtained shall be selected in advance of the time when materials will be required in the work. In addition to initial qualification testing of bituminous materials, samples shall be taken before and during construction when shipments of bituminous materials are received or when necessary to assure some condition of handling or storage has not been detrimental to the bituminous material.

1.8.3 Bituminous Mixtures

Sampling and testing of bituminous mixtures will be performed by the Contractor.

1.9 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

1.9.1 Mineral Aggregates

Mineral aggregates shall be delivered to the site of the bituminous mixing plant and stockpiled in such manner as to preclude fracturing of aggregate particles, segregation, contamination, or intermingling of different materials in the stockpiles or cold-feed hoppers. Mineral filler shall be delivered, stored, and introduced into the mixing plant in a manner to preclude exposure to moisture or other detrimental conditions.

1.9.2 Bituminous Materials

Bituminous materials shall be maintained at appropriate temperature during storage but shall not be heated by application of direct flame to walls of storage tanks or transfer lines. Storage tanks, transfer lines, and weigh buckets shall be thoroughly cleaned before a different type or grade of bitumen is introduced into the system. The asphalt cement shall be heated sufficiently to allow satisfactory pumping of the material; however, the storage temperature shall be maintained below 300 degrees F.

1.10 ACCESS TO PLANT AND EQUIPMENT

The Contracting Officer shall have access at all times to all parts of the paving plant for checking adequacy of the equipment in use; inspecting operation of the plant; verifying weights, proportions, and character of materials; and checking temperatures maintained in preparation of the mixtures.

1.11 WAYBILLS AND DELIVERY TICKETS

Before the final statement is allowed, the Contractor shall file with the Contracting Officer certified waybills and certified delivery tickets for all aggregates and bituminous materials actually used in construction.

2 PRODUCTS

2.1 BITUMINOUS HOT MIX

Bituminous hot mix shall consist of coarse aggregate, fine aggregate, mineral filler, bituminous material, and approved additives, if required, of the qualities and in the proportions specified and shall conform to the requirements contained in paragraph PROPORTIONING OF MIXTURE.

2.1.1 Aggregates

Aggregates shall consist of stone, crushed stone, crushed gravel, screening, sand, and mineral filler, as required. The portion of materials retained on the No. 4 sieve shall be known as coarse aggregate, the portion passing the No. 4 sieve and retained on the No. 200 sieve as fine aggregate, and the portion passing the No. 200 sieve as mineral filler. Aggregate gradation as determined by ASTM C 117 and ASTM C 136 shall conform to the following:

<u>Sieve Size</u>	<u>General Paving Percent Passing (by weight)</u>	<u>Bike Paths Paving Percent Passing (by weight)</u>
1 inch	100	--
3/4 inch	90-100	--
1/2 inch	78-94	100
3/8 inch	68-84	90-100
No. 4	50-65	55-85
No. 8	30-49	32-67
No. 50	7-25	7-27
No. 200	2-9	2-10

2.1.1.1 Coarse Aggregate

Coarse aggregate shall consist of clean, sound, durable particles meeting the following requirements.

- a. Portion of the material larger than 3/8 inch screen shall contain at least 50 percent of particles having fractured faces when determined in accordance with NDOT T 230C.
- b. Percentage of loss shall not exceed 45 after 500 revolutions, as determined in accordance with ASTM C 131.

2.1.1.2 Fine Aggregate

Fine aggregate shall have a plasticity index of 6 percent or less and liquid limit of 35 percent or less when tested in accordance with ASTM D 4318.

2.1.1.3 Mineral Filler

Mineral filler shall consist of portland cement conforming to ASTM C 150 or shall be mechanically reduced rock with the following gradation:

<u>Grain size in mm</u>	<u>Percent Finer</u>
0.75	75-100
0.05	65-100
0.02	35-65

0.01	26-35
0.005	10-22

Grain size shall be determined in accordance with ASTM D 422.

2.1.2 Bituminous Material

Asphalt cement for use in general paving shall conform to ASTM D 3381, Table 2, Grade AC-40. Asphalt cement for use in bike paths paving shall conform to AASHTO MP1, PG 70-16.

2.1.3 Additives

The use of additives such as antistripping and antifoaming agents is subject to approval.

2.2 PROPORTIONING OF MIXTURE

2.2.1 Job Mix Formula

The JMF for the bituminous mixture will be prepared by the Contractor and approved by the Contracting Officer. The formula will indicate the percentage of each stockpile and mineral filler, the percentage of each size aggregate, the percentage of bitumen, and the temperature of the completed mixture when discharged from the mixer. Tolerances are given in TABLE I for asphalt content, temperature, and aggregate grading for tests conducted on the mix as discharged from the mixing plant. Bituminous mix that deviates more than 25 degrees F from the JMF shall be rejected. The JMF may be adjusted during construction to improve paving mixtures. Adjustments to the JMF are subject to the approval of the Contracting Officer.

TABLE I. JOB-MIX TOLERANCES

<u>Material</u>	<u>Tolerance, Plus or Minus</u>
Aggregate passing No. 4 sieve or larger	5 percent
Aggregate passing Nos. 8, 16, 30, and 50 sieves	4 percent
Aggregate passing Nos. 100 and 200 sieves	2 percent
Bitumen	0.25 percent
Temperature of mixing	25 degrees F

2.2.2 Test Properties of Bituminous Mixtures

Finished mixture shall meet requirements described below when tested in accordance with ASTM D 1559. All samples will be compacted with 50 blows of specified hammer on each side of sample. When bituminous mixture fails to meet the requirements specified below, the paving operation shall be stopped until the cause of noncompliance is determined and corrected.

2.2.2.1 Stability, Flow, and Voids

Requirements for stability, flow, and voids are shown in TABLES II and III for nonabsorptive and absorptive aggregates, respectively.

TABLE II. NONABSORPTIVE-AGGREGATE MIXTURE

	<u>Wearing Course</u>	<u>Intermediate course</u>
Stability minimum, pounds	500	500
Flow maximum, 1/100-inch units	20	20
Voids total mix, percent (1)	3-5	3-5
Voids filled with bitumen, percent (2)	75-85	65-75

(1) The Contracting Officer may permit deviations from limits specified when gyratory method of design is used to develop the JMF.

(2) The Contracting Officer may permit deviation from limits specified for voids filled with bitumen in the intermediate course in order to stay within limits for percent voids total mix.

TABLE III. ABSORPTIVE-AGGREGATE MIXTURE

	<u>Wearing Course</u>	<u>Intermediate Course</u>
Stability minimum, pounds	500	500
Flow maximum, 1/100-inch units	20	20
Voids total mix, percent (1)	3-5	3-5
Voids filled with bitumen, percent (2)	80-90	70-80

(1) The Contracting Officer may permit deviations from limits specified when gyratory method of design is used to develop the JMF.

(2) The Contracting Officer may permit deviation from limits specified for voids filled with bitumen in the intermediate course in order to stay within limits for percent voids total mix.

a. When the water-absorption value of the entire blend of aggregate does not exceed 2.5 percent as determined in accordance with ASTM C 127 and ASTM C 128, the aggregate is designated as nonabsorptive. The theoretical specific gravity computed from the apparent specific gravity or ASTM D 2041 will be used in computing voids total mix and voids filled with bitumen, and the mixture shall meet requirements in TABLE II.

b. When the water-absorption value of the entire blend of aggregate exceeds 2.5 percent as determined in accordance with ASTM C 127 and ASTM C 128, the aggregate is designated as absorptive. The theoretical specific gravity computed from the bulk-impregnated specific gravity method contained in ASTM D 2041 shall be used in computing percentages of voids total mix and voids filled with bitumen; the mixture shall meet requirements in TABLE III.

2.2.2.2 Stability

The index of retained stability must be greater than 75 percent as determined by ASTM D 1559. When the index of retained stability is less than 75, the aggregate stripping tendencies may be countered by the use of hydrated lime or by treating the bitumen with an approved antistripping agent. The hydrated lime is considered as mineral filler and should be considered in the gradation requirements. The amount of hydrated lime or antistripping agent added to bitumen shall be sufficient, as approved, to

produce an index of retained stability of not less than 75 percent. No additional payment will be made to the Contractor for addition of antistripping agent required.

3 EXECUTION

3.1 BASE COURSE CONDITIONING

The surface of the base course will be inspected for adequate compaction and surface tolerances specified in paragraph GRADE AND SURFACE-SMOOTHNESS REQUIREMENTS. Unsatisfactory areas shall be corrected.

3.2 PREPARATION OF BITUMINOUS MIXTURES

Rates of feed of aggregates shall be regulated so that the moisture content and temperature of aggregates will be within specified tolerances. Aggregates, mineral filler, and bitumen shall be conveyed into the mixer in proportionate quantities required to meet the JMF. Mixing time shall be as required to obtain a uniform coating of the aggregate with the bituminous material. Temperature of bitumen at time of mixing shall not exceed 150 degrees C. Temperature of aggregate and mineral filler in the mixer shall not exceed 300 degrees F when bitumen is added. Overheated and carbonized mixtures or mixtures that foam shall not be used.

3.3 WATER CONTENT OF AGGREGATES

Drying operations shall reduce the water content of mixture to less than 0.75 percent. The water content test will be conducted in accordance with ASTM D 2216; the weight of the sample shall be at least 500 grams. If the water content is determined on hot bin samples, the water content will be a weighted average based on composition of blend.

3.4 STORAGE OF BITUMINOUS PAVING MIXTURE

Storage shall conform to the applicable requirements of ASTM D 3515; however, in no case shall the mixture be stored for more than 4 hours.

3.5 TRANSPORTATION OF BITUMINOUS MIXTURE

Transportation from paving plant to site shall be in trucks having tight, clean, smooth beds lightly coated with an approved releasing agent to prevent adhesion of the mixture to the truck bodies. Excessive releasing agent shall be drained prior to loading. Each load shall be covered with canvas or other approved material of ample size to protect mixture from weather and to prevent loss of heat. Loads that have crusts of cold, unworkable material or that have become wet will be rejected. Hauling over freshly placed material will not be permitted.

3.6 SURFACE PREPARATION OF UNDERLYING COURSE

Prior to placing of asphaltic pavement, the underlying course shall be cleaned of all foreign or objectionable matter with power brooms and hand brooms.

3.7 PRIME COATING

Surfaces of previously constructed base course shall be sprayed with a coat of bituminous material conforming to Section 02748 BITUMINOUS TACK AND PRIME COATS.

3.8 TACK COATING

Contact surfaces of previously constructed pavement, curbs, manholes, and other structures shall be sprayed with a thin coat of bituminous material conforming to Section 02748 BITUMINOUS TACK AND PRIME COATS.

3.9 PLACING

Bituminous courses shall be constructed only when the base course or existing pavement has no free water on the surface. Bituminous mixtures shall not be placed without ample time to complete spreading and rolling during daylight hours, unless approved satisfactory artificial lighting is provided.

3.9.1 Offsetting Joints

The wearing course shall be placed so that transverse joints in the wearing course shall be offset by at least 2 feet from transverse joints in the underlying course.

3.9.2 General Requirements for Use of Mechanical Spreader

Range of temperatures of mixtures, when dumped into the mechanical spreader, shall be as determined by the Contracting Officer. Mixtures having temperatures less than 225 degrees F when dumped into the mechanical spreader shall not be used. The mechanical spreader shall be adjusted and the speed regulated so that the surface of the course being laid will be smooth and continuous without tears and pulls, and of such depth that, when compacted, the surface will conform to the cross section indicated. Placing with respect to high side with one-way slope shall be as directed. Placing of the mixture shall be as nearly continuous as possible, and speed of placing shall be adjusted, as directed, to permit proper rolling. When segregation occurs in the mixture during placing, the spreading operation shall be suspended until the cause is determined and corrected.

3.9.3 Placing Strips Succeeding Initial Strips

In placing each succeeding strip after initial strip has been spread and compacted as specified below, the screed of the mechanical spreader shall overlap the previously placed strip 2 to 3 inches and be sufficiently high so that compaction produces a smooth dense joint. Mixture placed on the edge of a previously placed strip by the mechanical spreader shall be pushed back to the edge of the strip by use of a lute. Excess mixture shall be removed and wasted.

3.9.4 Handspreading in Lieu of Machine Spreading

In areas where the use of machine spreading is impractical, the mixture shall be spread by hand. Spreading shall be in a manner to prevent segregation. The mixture shall be spread uniformly with hot rakes in a

loose layer of thickness that, when compacted, will conform to required grade, density, and thickness.

3.10 COMPACTION OF MIXTURE

Rolling shall begin as soon after placing as the mixture will bear a roller without undue displacement. Delays in rolling freshly spread mixture will not be permitted. After initial rolling, preliminary tests of grade and smoothness shall be made by the Contractor. Deficiencies shall be corrected so that the finished course will conform to requirements for grade and smoothness specified herein. Grade and smoothness will be checked in each section of completed pavement by the Contracting Officer for compliance. After the Contractor is assured of meeting grade and smoothness requirements, rolling shall be continued until all roller marks are eliminated and at least 95 percent of the density of a laboratory-compacted specimen of the same mixture has been obtained. Places inaccessible to rollers shall be thoroughly compacted with hot hand tampers.

3.10.1 Correcting Deficient Areas

Mixtures that become contaminated or are defective shall be removed to the full thickness of the course. Edges of the area to be removed shall be cut so that sides are perpendicular and parallel to the direction of traffic and so that the edges are vertical. Edges shall be sprayed with bituminous materials conforming to Section 02748 BITUMINOUS TACK AND PRIME COATS. Fresh paving mixture shall be placed in the excavated areas in sufficient quantity so that the finished surface will conform to grade and smoothness requirements. Paving mixture shall be compacted to the density specified herein. Skin patching of an area that has been rolled shall not be permitted.

3.11 JOINTS

3.11.1 General

Joints between old and new pavements, between successive work days, or joints that have become cold (less than 175 degrees F) shall be made to ensure continuous bond between the old and new sections of the course. All joints shall have the same texture and smoothness as other sections of the course. Contact surfaces of previously constructed pavements coated by dust, sand, or other objectionable material shall be cleaned by brushing or shall be cut back as directed. When directed by the Contracting Officer, the surface against which new material is placed shall be sprayed with a thin, uniform coat of bituminous material conforming to Section 02748 BITUMINOUS TACK AND PRIME COATS. Material shall be applied far enough in advance of placement of a fresh mixture to ensure adequate curing. Care shall be taken to prevent damage or contamination of the sprayed surface.

3.11.2 Transverse Joints

The roller shall pass over the unprotected end of a strip of freshly placed material only when placing is discontinued or delivery of the mixture is interrupted to the extent that the material in place may become cold. In all cases, prior to continuing placement, the edge of previously placed pavement shall be cut back to expose an even vertical surface for full thickness of the course. In continuing placement of a strip, the mechanical spreader shall be positioned on the transverse joint so that sufficient hot

mixture will be spread to obtain a joint after rolling that conforms to the required density and smoothness specified herein.

3.12 QUALITY CONTROL

3.12.1 General

Quality Control Testing shall be the responsibility of the Contractor. Testing shall be performed by an acceptable commercial testing laboratory or by the Contractor on approval of the Contracting Officer. Materials shall be tested to establish compliance with the specified requirements. Samples of Bituminous material, unless otherwise specified, shall be in accordance with ASTM D 140. Certificates of compliance shall be furnished. All core holes from which specimens are taken will be patched by the contractor with fresh bituminous mixture, conforming to the specified JMF.

3.12.2 Inspection Details and Frequency of Testing

In addition to other tests specified elsewhere, the Contractor shall perform the following tests on materials as specified hereinafter. At least one set of tests, as described below, shall be completed for each days placement of asphalt.

3.12.2.1 Aggregate Gradation

A test for aggregate gradation for each 500 tons of aggregate produced.

3.12.2.2 Aggregate Moisture Content

A test of aggregate moisture content for each day's production.

3.12.2.3 Asphalt Properties

One determination each for stability, flow, voids total mix, and voids filled with bitumen for every 1000 tons of asphaltic concrete produced.

3.12.2.4 Asphalt Content

One determination of actual asphalt content per 1000 tons of asphaltic concrete produced.

3.12.2.5 Temperature

At least one measurement of asphaltic concrete temperature each hour, in which paving operations are being conducted. Additional tests may be taken as required by the Contracting Officer.

3.12.2.6 Density

At least three cores will be recovered and tested for every 10,000 square feet of pavement, or one day's production, whichever is smaller. Additional tests may be taken as required by the Contracting Officer.

3.12.2.7 Thickness

At least three cores will be recovered and tested for every 10,000 square feet of pavement, or one day's production, whichever is smaller. Additional tests may be taken as required by the Contracting Officer.

3.12.3 Action Required

3.12.3.1 Aggregate Gradation

When the amount passing any sieve is outside the specification limits, the aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall immediately be reported to the Contracting Officer, and immediate steps shall be taken to rectify the situation.

3.12.3.2 Aggregate Moisture Content

When the moisture content of the aggregates is outside specification requirements the aggregates shall be immediately resampled and retested. If there is another failure, the fact shall immediately be reported to the Contracting Officer, and immediate steps shall be taken to rectify the situation.

3.12.3.3 Asphalt Properties

If there is a failure in any of the asphalt properties production will cease and the Contracting Officer will be immediately notified. No additional paving will occur until adjustments to the plant and test results confirm that the specified properties are being achieved.

3.12.3.4 Asphalt Content

If there is a failure to meet the specified asphalt content production will cease and the Contracting Officer will be immediately notified. No additional paving will occur until adjustments to the plant and test results confirm that the specified asphalt is being supplied.

3.12.3.5 Temperature

When the temperature of the bituminous mixture is outside specification requirements the mixture shall be immediately resampled and retested. If there is another failure, the fact shall immediately be reported to the Contracting Officer, and immediate steps shall be taken to rectify the situation. In no case will overheated or carbonized mixtures be allowed.

3.12.3.6 Density

When test results indicate lack of compaction additional specimens will be obtained as directed by the Contracting Officer. Based on the test results the Contractor will remove and replace the affected areas of pavement.

3.12.3.7 Thickness

When test results indicate that the finished pavement is 1/4 inch less than the thickness shown on the drawings, additional samples will be taken to determine the extent of defective thickness. The area determined will be

removed and replaced or may be overlaid. The overlay will be a minimum of 1 inch thick and will be placed to duplicate slopes and drainages of the original pavement. No skin patching will be allowed.

3.12.4 Reports

All results of tests conducted at the project site shall be reported as required. During periods requiring protection from weather, reports of pertinent temperatures or other relevant values shall be made daily. These requirements do not relieve the contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all Contractor Quality Control records.

-- End of Section --

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SECTION 02748

BITUMINOUS TACK AND PRIME COATS

1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

ASTM D 140	(1993) Sampling Bituminous Materials
ASTM D 977	(1991) Emulsified Asphalt
ASTM D 2027	(1976; R 1992) Cutback Asphalt (Medium-Curing Type)
ASTM D 2995	(1993) Determining Application Rate of Bituminous Distributors

1.2 WAYBILLS AND DELIVERY TICKETS

Before the final statement is allowed, the Contractor shall file with the Contracting Officer certified waybills and certified delivery tickets for all bituminous materials used in the construction of the pavement covered by the contract. The Contractor shall not remove bituminous material from storage until the initial outage and temperature measurements have been taken. The delivery or storage units will not be released until the final outage has been taken by the Contracting Officer; nor shall the Contractor release the car or storage tank taken until the final outage has been taken by the Contracting Officer.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Sampling and Tests; FIO.

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. Copies of all test results for bituminous materials shall be submitted within 24 hours of completion of tests. Certified copies of the manufacturer's test reports indicating compliance with applicable specified requirements shall be submitted not less than 30 days before the material is required in the work.

SD-18 Records

Waybills and Delivery Tickets; GA.

Waybills and delivery tickets shall be submitted during progress of the work.

1.4 PLANT, EQUIPMENT, MACHINES AND TOOLS

1.4.1 General Requirements

Plant, equipment, machines and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the results specified.

1.4.2 Bituminous Distributor

The distributor shall have pneumatic tires of such size and number to prevent rutting, shoving or otherwise damaging the base surface or other layers in the pavement structure. The distributor shall be designed and equipped to spray the bituminous material in a uniform double or triple lap at the specified temperature, at readily determined and controlled rates with an allowable variation from the specified rate of not more than plus or minus 5 percent, and at variable widths. Distributor equipment shall include a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. The distributor shall be equipped to circulate and agitate the bituminous material during the heating process.

1.4.3 Power Brooms and Power Blowers

Power brooms and power blowers shall be suitable for cleaning the surfaces to which the bituminous coat is to be applied.

1.4.4 Storage Tanks

Tanks shall be capable of heating the bituminous material, under effective and positive control at all times to the required temperature. Heating shall be accomplished by steam coils, hot oil, or electricity. An armored thermometer shall be affixed to the tank so that the temperature of the bituminous material may be read at all times.

1.5 WEATHER LIMITATIONS

Bituminous coat shall be applied only when the surface to receive the bituminous coat is dry. Bituminous coat shall be applied 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.

2 PRODUCTS

2.1 TACK COAT

Emulsified asphalt shall conform to ASTM D 977, Type SS-1h.

2.2 PRIME COAT

Cutback asphalt shall conform to ASTM D 2027, Grade MC-70.

3 EXECUTION

3.1 PREPARATION OF SURFACE

Immediately before applying the bituminous coat, all loose material, dirt, clay, or other objectionable material shall be removed from the surface to be treated. To assure a uniform spread of the bituminous coat, the portion of the subgrade, subbase, or base course prepared for treatment, if excessively dry, shall be lightly sprinkled with water immediately before the application as directed by the Contracting Officer. For previously constructed pavement, the contact surface shall be dry and clean at the time of treatment. Prior to application of the tack coat, an inspection of the area to be treated shall be made by the Contracting Officer to determine fitness of the area to receive the bituminous coating.

3.2 APPLICATION RATE

The exact quantities within the range specified, which may be varied to suit field conditions, will be determined by the Contracting Officer based on trials made by Contractor.

3.2.1 Tack Coat

Bituminous material for the tack coat shall be applied in quantities of not less than 0.05 gallons nor more than 0.18 gallons per square yard of pavement surface.

3.2.2 Prime Coat

Bituminous material for the prime coat shall be applied in quantities of not less than 0.18 gallons nor more than 0.40 gallons per square yard of pavement surface.

3.3 APPLICATION TEMPERATURE

3.3.1 Viscosity Relationship

Asphalt application temperature shall provide an application viscosity between 20 and 120 centistokes, (20 and 120 square mm/sec) kinematic. The temperature viscosity relation shall be furnished to the Contracting Officer.

3.3.2 Temperature Ranges

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

<u>Bituminous Material</u>	<u>Application Temperature</u>
Liquid Asphalts MC-70	120-220 degrees F

Emulsions
SS-1h

70-160 degrees F

3.4 APPLICATION

Following preparation and subsequent inspection of the surface, the bituminous coat shall be applied at the specified rate with uniform distribution over the surface to be treated. All areas and spots missed by the distributor shall be properly treated with the hand spray. Until the succeeding layer of pavement is placed, the surface shall be maintained by protecting the surface against damage and by repairing deficient areas at no additional cost to the Government. If required, clean dry sand shall be spread to effectively blot up any excess bituminous material. No smoking, fires, or flames other than those from the heaters that are a part of the equipment shall be permitted within 8 meters of heating, distributing, and transferring operations of bituminous material other than bituminous emulsions. To obtain uniform application of the prime coat on the surface treated at the junction of previous and subsequent applications, building paper shall be spread on the surface for a sufficient distance back from the ends of each application to start and stop the prime coat on the paper. Immediately after application, the building paper shall be removed and destroyed.

3.5 CURING PERIOD

Following application of the bituminous material and prior to application of the succeeding layer of pavement, the bituminous coat shall be allowed to cure and to obtain evaporation of any volatiles or moisture. Prime coat shall be allowed to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course.

3.6 FIELD QUALITY CONTROL

Samples of the bituminous material shall be tested for compliance with the applicable specified requirements. A sample shall be obtained and tested by the Contractor for every 1900 tons of bituminous material used.

3.7 SAMPLING AND TESTING

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved.

3.7.1 Sampling

The samples of bituminous material, unless otherwise specified, shall be in accordance with ASTM D 140. Sources from which bituminous materials are to be obtained shall be selected and notification furnished to the Contracting Officer within 15 days after the award of the contract.

3.7.2 Calibration Test

The Contractor shall furnish all equipment, materials, and labor necessary to calibrate the bituminous distributor. Calibration shall be made with the approved job material and prior to applying the bituminous coat material to

the prepared surface. Calibration of the bituminous distributor shall be in accordance with ASTM D 2995.

3.7.3 Trial Applications

Before providing the complete bituminous coat, three lengths of at least 30 meters for the full width of the distributor bar shall be applied to evaluate the amount of bituminous material that can be satisfactorily applied.

3.7.3.1 Tack Coat Trial Application Rate

Unless otherwise authorized, the trial application rate of bituminous tack coat materials shall be applied in the amount of 0.05 gallons per square yard. Other trial applications shall be made using various amounts of material as may be deemed necessary.

3.7.3.2 Prime Coat Trial Application Rate

Unless otherwise authorized, the trial application rate of bituminous materials shall be applied in the amount of 0.25 gallons per square yard. Other trial applications shall be made using various amounts of material as may be deemed necessary.

3.7.4 Sampling and Testing During Construction

Quality control sampling and testing shall be performed as required in paragraph FIELD QUALITY CONTROL.

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SECTION 02831

FENCE, CHAIN-LINK

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 in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 121	(1992a) Zinc-Coated (Galvanized) Steel Barbed Wire
ASTM A 153	(1996) Zinc-Coated (Hot Dip) on Iron and Steel Hardware
ASTM A 176	(1994) Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
ASTM A 392	(1996) Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A 478	(1995a) Chromium-Nickel Stainless and Heat-Resisting Steel Weaving and Knitting Wire
ASTM A 491	(1996) Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A 585	(1992) Aluminum-Coated Steel Barbed Wire
ASTM A 666	(1994) Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
ASTM A 780	(1993a) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
ASTM A 824	(1992) Metallic-Coated Steel Marcellled Tension Wire for Use With Chain Link Fence
ASTM C 94	(1996) Ready-Mixed Concrete
ASTM F 626	(1996) Fence Fittings
ASTM F 883	(1990) Padlocks
ASTM F 900	(1994) Industrial and Commercial Swing Gates
ASTM F 1043	(1995) Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework
ASTM F 1083	(1996) Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

ASTM F 1184	(1994) Industrial and Commercial Horizontal Slide Gates
ASTM G 23	(1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
ASTM G 26	(1995) Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
ASTM G 53	(1996) Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330: SUBMITTAL PROCEDURES:

SD-13 Certificates

Chain Link Fence; GA.

Statement signed by an official authorized to certify on behalf of the manufacturer attesting that the chain link fence and component materials meet the specified requirements.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall conform to the following.

2.1.1 Chain Link Fence

2.1.1.1 Fabric

ASTM A 392, Class 2, zinc-coated steel wire with minimum coating weight of 2.0 ounces of zinc per square foot of coated surface, or ASTM A 491, Type I, aluminum-coated steel wire. Fabric shall be fabricated of 9-gauge wire woven in 2-inch mesh. Fabric height shall be as indicated. The fabric shall be knuckled at both selvages.

2.1.2 Posts

ASTM F 1083, zinc-coated. Group IA, with external coating Type A steel pipe. Group IC steel pipe, zinc-coated with external coating Type A or Type B and Group II, formed steel sections, shall meet the strength and coating requirements of ASTM F 1043. Group III, ASTM F 1043 steel H-section may be used for line posts in lieu of line post shapes specified for the other classes. Sizes shall be as shown on the drawings. Line posts and terminal (corner, gate, and pull) posts selected shall be of the same designation throughout the fence. Gate post shall be for the gate type specified subject to the limitation specified in ASTM F 900 and/or ASTM F 1184.

2.1.3 Rails and Braces

ASTM F 1083, zinc-coated, Group IA, steel pipe, size NPS 1-1/4. Group IC steel pipe, zinc-coated, shall meet the strength and coating requirements of ASTM F 1043. Group II, formed steel sections, size 42.16 mm (1.66 inch), 1.66 inch, conforming to ASTM F 1043, may be used as braces and rails if Group II line posts are furnished.

2.1.4 Accessories

ASTM F 626. Ferrous accessories shall be zinc or aluminum coated. Truss rods shall be furnished for each terminal post. Truss rods shall be provided with turnbuckles or other equivalent provisions for adjustment. Tie wire for attaching fabric to rails, braces, and posts shall be 9 gauge steel wire and match the coating of the fence fabric. Miscellaneous hardware coatings shall conform to ASTM A 153 unless modified herein.

2.1.5 Collapsible Fence Panel

Collapsible fence panel shall be the type shown on the drawing. Fence panel frames shall be constructed of Class 1 Grade A or B, steel pipe, sizes as shown on the drawing, as specified in FS RR-F-191/3. Fence panel fabric shall be as specified for chain-link fabric and shall be attached to the panel by method standard with the manufacturer except that welding will not be permitted. Material for hinge assembly (bolts, nuts, and steel plates) shall be as indicated on the drawing and as specified in SECTION: MISCELLANEOUS METAL.

2.1.6 Concrete

ASTM C 94, using 19 mm maximum size aggregate, and having minimum compressive strength of 3000 psi at 28 days. Grout shall consist of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.

PART 3 EXECUTION

3.1 FENCE INSTALLATION

Fence shall be installed per manufacturers instructions and to the lines and grades indicated. The area on either side of the fence line shall be cleared to the extent indicated. Line post shall be spaced equidistant at intervals not exceeding 10 feet. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Fabric shall be continuous between terminal posts; however, runs between terminal posts shall not exceed 500 feet.

3.2 RAILS, BRACES AND TRUSS RODS

3.2.1 Top Rail

Top rail shall be supported at each post to form a continuous brace between terminal posts. Where required, sections of top rail shall be joined using sleeves or couplings that will allow expansion or contraction of the rail. Bottom rail, if required for high security fence, shall be installed as indicated on the drawings.

3.2.2 Bottom Rail

The bottom rail shall be bolted to double rail ends and double rail ends shall be securely fastened to the posts. Bolts shall be peened to prevent easy removal. Bottom rail shall be installed before chain link fabric.

3.2.3 Braces and Truss Rods

Braces and truss rods shall be installed as indicated and in conformance with the standard practice for the fence furnished. Horizontal (compression) braces and diagonal truss (tension) rods shall be installed on fences over 6 feet in height. A center brace or 2 diagonal truss rods shall be installed on 12-foot fences. Braces and truss rods shall extend from terminal posts to line posts. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal. No bracing is required on fences 6 feet high or less if a top rail is installed.

3.3 TENSION WIRES

Tension wires shall be installed along the top and bottom of the fence line and attached to the terminal posts of each stretch of the fence. Top tension wires shall be installed within the top 1 foot of the installed fabric. Bottom tension wire shall be installed within the bottom 6 inches of the installed fabric. Tension wire shall be pulled taut and shall be free of sag.

3.4 CHAIN-LINK FABRIC

Chain-link fabric shall be installed on the side of the post indicated. Fabric shall be attached to terminal posts with stretcher bars and tension bands. Bands shall be spaced at approximately 15-inch intervals. The fabric shall be installed and pulled taut to provide a smooth uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fabric shall be fastened to line posts at approximately 15-inch intervals and fastened to tension wires at approximately 24-inch intervals. Fabric shall be cut by untwisting and removing pickets. Splicing shall be accomplished by weaving a single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be 2 inches (plus or minus 1/2-inch) above the ground.

3.5 GATES

Gates shall be installed at the location shown. Hinged gates shall be mounted to swing as indicated. Latches, stops, and keepers shall be installed as required.

3.6 GROUNDING

Fences crossed by power lines of 600 volts or more shall be grounded at or near the point of crossing and at distances not exceeding 150 feet on each side of crossing. Ground conductor shall consist of No. 8 AWG solid copper wire. Grounding electrodes shall be 3/4-inch by 10-foot long copper-clad steel rod. Electrodes shall be driven into the earth so that the top of the electrode is at least 6 inches below the grade. Where driving is impracticable electrodes shall be buried a minimum of 12 inches deep and radially from the fence. Top of electrode shall be not less than 2 feet or more than 8 feet from the fence. Ground conductor shall be clamped to the fence and electrodes with bronze grounding clamps so as to create electrical continuity between fence posts, fence fabric, and ground rods. After installation the total resistance of fence to ground shall not be greater than 25 ohms.

-- End of Section --