EAST MARICOPA Flood Way #2 INLET Repair

EMF #2
INLET REPAIR

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Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

CONSTRUCTION SPECIFICATION

2. CLEARING AND GRUBBING

1. SCOPE

The work shall consist of the clearing and grubbing of designated areas by removal and disposal of trees, snags, logs, stumps, shrubs and rubbish.

2. MARKING

The limits of the areas to be cleared and grubbed will be marked by means of stakes, flags, tree markings or other suitable methods. Trees to be left standing and uninjured will be designated by special markings placed on the trunks at a height of about six feet above the ground surface.

3. REMOVAL

All trees not marked for preservation and all snags, logs, brush, stumps, shrubs and rubbish shall be removed from within the limits of the marked areas. Unless otherwise specified, all stumps, roots and root clusters having a diameter of one inch or larger shall be grubbed out to a depth of at least two feet below subgrade elevation for concrete structures and one foot below the ground surface at embankment sites and other designated areas.

4. DISPOSAL

All materials removed from the cleared and grubbed areas shall be burned or buried at locations shown on the drawings or as specified in Section 6 of this specification.

5. MEASUREMENT AND PAYMENT

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 6 of this specification.

6. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Clearing and Grubbing

(1) This item shall consist of clearing and grubbing the designated areas as shown on the drawings between stations 985+65 and 1066+48.

(2) Refuse material shall be disposed of as described in Specification 3, Structure Removal, Section 7.a.(2).

(3) If material removed from the cleared and grubbed area is to be burned, burning must be carried out in accordance with the Maricopa County Health Department Regulations.

(4) No separate payment will be made for this item. Compensation for this work will be included in the payment for Bid Item 5, Earthfill-O&M Road.

CONSTRUCTION SPECIFICATION

3. STRUCTURE REMOVAL

1. SCOPE

The work shall consist of the removal, salvage and disposal of structures (including fences) from the designated areas.

2. MARKING

The limits of the areas from which structures must be removed will be marked by means of stakes, flags or other suitable methods. Structures to be preserved in place or salvaged will be designated by special markings.

3. REMOVAL

Within the areas so marked all visible structures and attachments and all buried structures located and identified by survey stakes shall be removed to the specified extent and depth.

4. SALVAGE

Structures that are designated to be salvaged shall be carefully removed and neatly placed in the specified storage areas. Salvaged structures that are capable of being disassembled shall be dismantled into individual members or sections. Such structures shall be neatly match marked with paint prior to disassembly. All pins, nuts, bolts, washers, plates and other loose parts shall be marked or tagged to indicate their proper locations in the structure and shall be fastened to the appropriate structural member or packed in suitable containers. Materials from fences designated to be salvaged shall be placed outside the work area on the property from which they were removed. Wire shall be rolled into uniform rolls of convenient size. Posts and rails shall be neatly piled.

5. DISPOSAL OF REFUSE MATERIALS

Refuse materials resulting from structure removal shall be burned or buried at locations shown on the drawings or as specified in Section 7 of the specification.

6. MEASUREMENT AND PAYMENT

For items of work for which specific lump sum prices are established in the contract, payment for structure removal will be made at the contract lump sum price.

Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 2, Structure Removal

(1) This item shall consist of the removal and disposal of Bedding, Loose Rock Riprap, and Grouted Rock Riprap within the limits of the side inlet reconstruction as shown on the drawings.

(2) The refuse materials shall be buried in the area designated in the drawings as Refuse Site. The material shall be no larger than 2-feet in width or diameter nor longer than 2-feet.

Refuse materials shall be buried a minimum of 24-inches below the existing ground surface in the Refuse Site. When disposal is complete, the Refuse Site shall be smoothed and graded to blend into the surrounding terrain.

(3) Damage to existing structures not designated for removal shall be repaired or replaced at the Contractors cost.

(4) In Section 6, Measurement And Payment, Payment shall include compensation for Subsidiary Items Removal of Water and Excavation-Common.

CONSTRUCTION SPECIFICATION

5. POLLUTION CONTROL

1. SCOPE

The work shall consist of installing measures or performing work to control erosion and minimize the production of sediment and other pollutants to water and air during construction operations in accordance with these specifications.

2. MATERIALS

All materials furnished shall meet the requirements of the Material Specifications listed in Section 8 of this specification.

3. EROSION AND SEDIMENT CONTROL MEASURES AND WORKS

The work and measures shall include but not be limited to the following, as shown on the drawings or as specified in Section 8 of this specification.

Staging of Earthwork Activities - The excavation and moving of soil materials shall be scheduled so that the smallest possible areas will be unprotected from erosion for the shortest time feasible.

Seeding - Seedings to protect disturbed areas shall be done as specified on the drawings or in Section 8 of this specification.

Mulching - Mulching shall be used to provide temporary protection to soil surfaces from erosion.

Diversions - Diversions shall be used to divert water away from work areas and/or to collect runoff from work areas for treatment and safe disposition.

Stream Crossings - Culverts or bridges shall be used where equipment must cross streams.

Sediment Basins - Sediment basins shall be used to settle and filter out sediment from eroding areas to protect properties and streams below the construction site.

Straw Bale Filters - Straw bale filters shall be used to trap sediment from areas of limited runoff. Bales are

temporary and shall be removed when permanent measures are installed.

Waterways - Waterways shall be used for the safe disposal of runoff from fields, diversions and other structures or measures.

4. CHEMICAL POLLUTION

The Contractor shall provide watertight tanks or barrels or construct a sump sealed with plastic sheets to be used to dispose of chemical pollutants (such as drained lubricating or transmission oils, greases, soaps, asphalt, etc.) produced as a by-product of the project's work. At the completion of the construction work, sumps shall be voided without causing pollution as specified in Section 8 of this specification.

Sanitary facilities such as pit toilets, chemical toilets, or septic tanks shall not be placed adjacent to live streams, wells, or springs. They shall be located at a distance sufficient to prevent contamination of any water sources. At the completion of construction work, facilities shall be disposed of without causing pollution as specified in Section 8 of this specification.

5. AIR POLLUTION

Local and state regulations concerning the burning of brush or slash or disposal of other materials shall be adhered to.

Fire prevention measures shall be taken to prevent the start or the spreading of fires which result from project work. Fire breaks or guards shall be constructed at locations shown on the drawings.

All public access or haul roads used by the contractor during construction of the project shall be sprinkled or otherwise treated to fully suppress dust.

6. MAINTENANCE, REMOVAL, AND RESTORATION

All pollution control measures and works shall be adequately maintained in a functional condition as long as needed during the construction operation. All temporary measures shall be removed and the site restored to as nearly original conditions as practicable.

7. MEASUREMENT AND PAYMENT

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items, and the items to which they are made subsidiary, are identified in Section 8 of this specification.

8. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Pollution Control

(1) This item shall consist of all measures required to control or reduce pollution.

(2) The Contractor is responsible for maintaining air, water, and vegetative quality within the work area. Responsibilities include establishing turn areas, haul roads, work site access roads, temporary building sites, and equipment yards in approved locations, and staging earthwork activities to prevent contamination of air and water and to minimize erosion.

(3) No separate payment will be made for Pollution Control. Compensation for this work will be included in the payment for Bid Item 6, Water for Construction.

CONSTRUCTION SPECIFICATION

7. ENGINEERING CONSTRUCTION SURVEYS

1. SCOPE

The work consists of performing all surveys required for (1) layout of the work, (2) construction control, and (3) quantity surveys for progress payment estimates from baselines and bench marks established by the Government. It includes furnishing all the necessary equipment, labor, and materials. Not included is work required for making the original and final surveys for computing quantities.

2. EQUIPMENT AND MATERIALS

Equipment used for all construction surveys shall be of a quality and condition that provides the specified accuracy. The equipment shall be maintained in good working order and good adjustment. Records of calibration tests and adjustments shall be maintained and be available for inspection by the Government.

Materials include all the necessary field notebooks, stakes, templates, platforms, equipment, spikes, steel pins, tools, and other accessories required for layout and construction control of all of the work.

3. QUALITY OF WORK

Surveys shall be certified by a Land Surveyor or Engineer licensed by the State. The work shall be performed to the accuracy and detail appropriate for the location and type of job. Daily quantities of earthwork may be estimated from load count or equivalent measurement (within 25 percent $\pm$); measurement for progress payments should be accurate within 10 percent $\pm$.

Notes, sketches, and other data shall be complete, recorded neatly, and organized in a manner that will allow reproduction of copies for job documentation.

Differential leveling shall be third order with such precision that the error of closure (in feet) shall not exceed plus or minus 0.1 times the square root of the distance (in miles). The elevations of bench marks and temporary bench marks shall be determined and recorded to the nearest 0.01 foot.

Transit traverses shall be third order with such precision that: (1) the linear error of closure shall not exceed one foot in 3,000 feet, and (2) the angular error of closure shall not exceed 1.0 minute times the square root of the number of angles turned.

Surveys will be reviewed periodically and randomly checked by the Government to assure that the specified quality is being maintained.

4. PRIMARY CONTROL

The base lines and bench marks for primary control, which are necessary to establish the lines and grades needed for construction, will be established by the Government. They will be shown on the drawings and located on the ground before construction.

The base lines and bench marks shall be used as the origin of all surveys needed to establish lines and grades for construction.

5. CONSTRUCTION SURVEY AND MEASUREMENT RECORDS

All survey data will be recorded in fully identified, bound field notebooks. Pages shall be numbered consecutively. The required books shall be turned over to and become the property of the Government, prior to acceptance of the work or any part of this work. All entries shall be legible, reproducible, and follow the format in Soil Conservation Service TR-62, "Engineering Layout, Notes, Staking and Calculations." The bound field notebooks shall be available at all times during the progress of the work for examination and use by the Government. Copies of field book notes shall be made available to the Contracting Officer upon request. Electronically generated survey data and computations shall be bound, paginated, and referenced in the bound field notebook containing the survey control in a manner that will make all of the information intelligible and permanent. All field notes and printed data shall include the purpose or description of the work, the date the work was performed, the weather (if field work), the individual or individuals who performed and checked the work and sketches and other information pertinent to the work.

6. STAKING

The location and marking of all stakes shall be as shown in Soil Conservation Service TR-62 as supplemented below.

a. Clearing and grubbing - The boundary of the clearing and grubbing areas shall be staked or flagged at 200-foot intervals or less if needed to clearly mark the limits of work.

b. Excavation - Cut stakes shall be placed on the centerline and at the intersection of the planned side slopes and natural ground line. All slope stakes shall be marked with the required cut, horizontal distance, and slope ratio. Offset reference stakes and hubs shall be placed at full stations, on at least one side of the proposed excavation.

c. Earth Fill - Fill stakes shall be placed on the centerline and at the toes of the planned slopes and shall be marked with the fill, horizontal distance, constructed slope ratio, and stationing. Offset reference stakes and hubs shall be provided as a minimum on both sides of tne fill at full stations.

Earthwork slope stakes shall be placed as a minimum at full stations, break in the original ground surface, and at other intermediate stations as necessary to insure accurate location of construction. Slope stakes and cross sections shall be at right angles to the centerline. Distances shall be measured horizontally; rod readings shall be taken vertically and recorded to the nearest 0.1 foot.

7. MEASUREMENT AND PAYMENT

Payment will be made as the work proceeds, after receipt of invoices from the contractor showing (contractor or subcontractor) surveying costs and cost of supplies. If the total of incremental payments is less than the contract lump sum for surveys, the balance will be included in the final contract payment. Total payment will be the contract lump sum price for surveys, regardless of actual cost to the contractor.

Payment will not be made under this item for the purchase cost of materials and equipment having a residual value.

Payment of the contract lump sum price for surveys will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to complete of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the item to which they are made subsidiary are identified in Section 8 of this specification.

8. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 9, Surveys

(1) This item shall consist of furnishing personnel, equipment, materials and performing surveys required for:

a) Construction Layout
b) Computation of Quantities
c) "As-Built" Construction Drawings

(2) Section 1, Scope, the last sentence does not apply.

(3) The Contractor shall provide the Contracting Officer a statement of qualifications, including specific experience of each of the survey personnel assigned to the job.

(4) The baseline for primary control will be set at every 500-foot centerline station of the East Maricopa Floodway from station 980+00 to 1085+00.

(5) The Contractor shall provide the Contracting Officer with a schedule of surveys to be performed each month.

CONSTRUCTION SPECIFICATION

8. MOBILIZATION

1. SCOPE

The work shall consist of the mobilization of the Contractor's forces and equipment necessary for performing the work required under the contract. Mobilization will not be considered as work in fulfilling the contract requirement for commencement of work.

Mobilization shall include the cost for transportation of personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary facilities at the site not covered in specific bid items, and other preparatory work at the site. The cost of the entire amount of premiums paid for performance and payment bonds, including coinsurance and reinsurance agreements as applicable shall be paid upon request when evidence of full payment to the surety has been provided to the Contracting Officer.

Work done under this specification shall not include mobilization for any specific item of work for which payment for mobilization is provided elsewhere in the contract.

The specification covers mobilization for work required by the contract at the time of award. If additional mobilization costs are incurred during performance of the contract as a result of changed or added items of work for which the Contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the item or items of work changed or added.

2. PAYMENT

Payment will be made as the work proceeds, after presentation of invoices by the Contractor showing his own mobilization costs and evidence of the charges of suppliers, subcontractors, and others for mobilization work performed by them. If the total of such payments is less than the contract lump sum for mobilization, the unpaid balance will be included in the final contract payment. Total payment will be the lump sum contract price for mobilization, regardless of actual cost to the Contractor.

Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

Payment of the lump sum contract price for mobilization will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to completion of the work.

3. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 1, Mobilization

(1) This item consists of the mobilization of the Contractor's forces and equipment necessary for constructing side inlets and appurtenances.

CONSTRUCTION SPECIFICATION

10. WATER FOR CONSTRUCTION

1. SCOPE

The work shall consist of furnishing, transporting, and using water for construction purposes in accord with the applicable specifications.

2. FACILITIES AND EQUIPMENT

The Contractor shall build and maintain such access and haul roads as are needed, and shall furnish, operate, and maintain all pumps, piping, tanks, and other facilities needed to load, transport, and use the water as specified.

These facilities shall be equipped with meters, tanks, or other devices by which the volume of water supplied can be measured.

3. DUST ABATEMENT AND HAUL ROAD MAINTENANCE

Water for dust abatement and haul road maintenance shall be applied to haul roads and other dust-producing areas as needed to prevent excessive dust and to maintain the roads in good condition for efficient operation while they are in use.

4. EARTHFILL, DRAINFILL, ROCKFILL

Water for earthfill, drainfill, or rockfill shall be used in the fill materials as specified in the applicable construction specifications.

5. CONCRETE, MORTAR, GROUT

Water used in mixing or curing concrete, pneumatically applied mortar, or other portland cement mortar or grout shall meet the requirements of the applicable construction specifications and shall be used in conformance with those specifications. Payment for water used in these items is covered by the applicable concrete, mortar or grout specification.

6. MEASUREMENT AND PAYMENT

For water items for which specific unit prices are established in the contract, the volume of water furnished and used in accordance with the specifications will be measured to the nearest 1000 gallons.

Except as otherwise specified, the measurement for payment will include all water needed at the construction site, except as noted in Section 5, to perform the work required under the contract in accordance with the specifications but will not include water wasted or used in excess of the amount needed. It will not include water used in concrete which is mixed elsewhere and transported to the site.

Payment for water will be made at the contract unit price. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to furnishing, transporting, and using the water.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 6, Water For Construction

(1) This item shall consist of furnishing, transporting, and applying all water necessary for performance of the work described in this contract.

(2) Water may be obtained from the Roosevelt Water Conservation District, Higley, Arizona. Their contact person is Mike Leonard at 963-3414. Other local sources may be available.

(3) In Section 6, Measurement and Payment, Payment shall include compensation for Subsidiary Item, Pollution Control.

CONSTRUCTION SPECIFICATION

11. REMOVAL OF WATER

1. SCOPE

The work shall consist of the removal of surface water and ground water as needed to perform the required construction in accordance with the specifications. It shall include (1) building and maintaining all necessary temporary impounding works, channels, and diversions, (2) furnishing, installing and operating all necessary pumps, piping and other facilities and equipment, and (3) removing all such temporary works and equipment after they have served their purposes.

2. DIVERTING SURFACE WATER

The Contractor shall build, maintain and operate all cofferdams, channels, flumes, sumps, and other temporary diversion and protective works needed to divert streamflow and other surface water through or around the construction site and away from the construction work while construction is in progress. Unless otherwise specified, a diversion must discharge into the same natural drainageway in which its headworks are located.

Unless otherwise specified, the Contractor shall furnish to the Contracting Officer, in writing, his plan for diverting surface water before beginning the construction work for which the diversion is required. Acceptance of this plan will not relieve the Contractor of responsibility for completing the work as specified.

3. DEWATERING THE CONSTRUCTION SITE

Foundations, cutoff trenches and other parts of the construction site shall be dewatered and kept free of standing water or excessively muddy conditions as needed for proper execution of the construction work. The Contractor shall furnish, install, operate and maintain all drains, sumps, pumps, casings, wellpoints, and other equipment needed to perform the dewatering as specified. Dewatering methods that cause a loss of fines from foundation areas will not be permitted.

Unless otherwise specified, the Contractor shall furnish to the Contracting Officer, in writing, his plan for dewatering before beginning the construction work for which the dewatering is required. Acceptance of this

plan will not relieve the Contractor of responsibility for completing the work as specified.

4. DEWATERING BORROW AREAS

Unless otherwise specified in Section 8, the Contractor shall maintain the borrow areas in drainable condition or otherwise provide for timely and effective removal of surface and ground waters that accumulate within the borrow areas from any source. Borrow material shall be processed as necessary to achieve proper and uniform moisture content for placement.

If pumping to dewater borrow areas is included as an item of work in the bid schedule, each pump used for this purpose shall be equipped with a water meter in the discharge line. Accuracy of the meters shall be such that the measured quantity of water is within 3 percent, plus or minus, of the true quantity. Means shall be provided by the Contractor to check the accuracy of the water meters when requested by the Contracting Officer.

5. EROSION AND POLLUTION CONTROL

Removal of water from the construction site, including the borrow areas shall be accomplished in such a manner that erosion and the transmission of sediment and other pollutants are minimized.

6. REMOVAL OF TEMPORARY WORKS

After the temporary works have served their purposes, the Contractor shall remove them or level and grade them to the extent required to present a sightly appearance and to prevent any obstruction of the flow of water or any other interference with the operation of or access to the permanent works.

Except as otherwise specified, pipes and casings shall be removed from temporary wells and the wells shall be filled to ground level with gravel or other material approved by the Contracting Officer.

7. MEASUREMENT AND PAYMENT

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 8 of this specification.

8. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Removal of Water

(1) This item shall consist of the removal or diversion of surface and ground water from the construction areas shown on the drawings.

(2) The diversion or dewatering plans submitted to the Contracting Officer for approval shall be site specific to each structure or section of work. Any diversions or dikes proposed in the existing floodway shall incorporate "fuse" or breakaway sections or otherwise be capable of rapid removal in the event of unusual surface water flows during construction.

(3) No separate payment will be made for the Removal of Water. Compensation for this work will be included in the payment for Bid Item 2, Structure Removal.

CONSTRUCTION SPECIFICATION

21. EXCAVATION

1. SCOPE

The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials.

2. CLASSIFICATION

Excavation will be classified as common excavation or rock excavation in accordance with the following definitions or will be designated as unclassified.

Common excavation shall be defined as the excavation of all materials that can be excavated, transported, and unloaded by the use of heavy ripping equipment and wheel tractor-scrapers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by means of excavators having a rated capacity of one cubic yard and equipped with attachments (such as shovel, bucket, backhoe, dragline or clam shell) appropriate to the character of the materials and the site conditions.

Rock excavation shall be defined as the excavation of all hard, compacted or cemented materials the accomplishment of which requires blasting or the use of excavators larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than one cubic yard in volume encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation.

Excavation will be classified according to the above definitions by the Engineer, based on his judgment of the character of the materials and the site conditions.

The presence of isolated boulders or rock fragments larger than one cubic yard in size will not in itself be sufficient cause to change the classification of the surrounding material.

For the purpose of this classification, the following definitions shall apply:

Heavy ripping equipment shall be defined as a rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a tractor having a power rating of 200-300 net horsepower (at the flywheel).

Wheel tractor-scraper shall be defined as a self-loading (not elevating) and unloading scraper having a struck bowl capacity of 12-20 yards.

Pusher tractor shall be defined as a track type tractor having a power rating of 200-300 net horsepower (at the flywheel) equipped with appropriate attachments.

3. UNCLASSIFIED EXCAVATION

Items designated as "Unclassified Excavation" shall include all materials encountered regardless of their nature or the manner in which they are removed. When excavation is unclassified, none of the definitions or classifications stated in Section 2 of this specification shall apply.

4. BLASTING

The transportation, handling, storage, and use of dynamite and other explosives shall be directed and supervised by a person of proven experience and ability in blasting operations.

Blasting shall be done in such a way as to prevent damage to the work or unnecessary fracturing of the foundation and shall conform to any special requirements in Section 12 of this specification.

5. USE OF EXCAVATED MATERIALS

Suitable materials from the specified excavations may be used in the construction of required earthfill or rockfill. The suitability of materials for specific purposes will be determined by the Engineer.

6. DISPOSAL OF WASTE MATERIALS

All surplus or unsuitable excavated materials will be designated as waste and shall be disposed of at the locations shown on the drawings.

7. BRACING AND SHORING

Excavated surfaces too steep to be safe and stable if unsupported shall be supported as necessary to safeguard the work and workmen, to prevent sliding or settling of the adjacent ground, and to avoid damaging existing improvements. The width of the excavation shall be increased if necessary to provide space for sheeting, bracing, shoring, and other supporting installations. The Contractor shall furnish, place and subsequently remove such supporting installations.

8. STRUCTURE AND TRENCH EXCAVATION

Structure or trench excavation shall be completed to the specified elevations and to sufficient length and width to include allowance for forms, bracing and supports, as necessary, before any concrete or earthfill is placed or any piles are driven within the limits of the excavation.

9. BORROW EXCAVATION

When the quantities of suitable materials obtained from specified excavations are insufficient to construct the specified fills, additional materials shall be obtained from the designated borrow areas. The extent and depth of borrow pits within the limits of the designated borrow areas shall be as directed by the Engineer.

Borrow pits shall be excavated and finally dressed in a manner to eliminate steep or unstable side slopes or other hazardous or unsightly conditions.

10. OVEREXCAVATION

Excavation in rock beyond the specified lines and grades shall be corrected by filling the resulting voids with portland cement concrete made of materials and mix proportions approved by the Engineer. Concrete that will be exposed to the atmosphere when construction is completed shall contain not less than 6 sacks of cement per cubic yard of concrete. Concrete that will be permanently covered shall contain not less than 4-1/2 sacks of cement per cubic yard. The concrete shall be placed and cured as specified by the Engineer.

Excavation in earth beyond the specified lines and grades shall be corrected by filling the resulting voids with approved compacted earthfill, except that, if the earth is to become the subgrade for riprap, rockfill, sand or gravel bedding, or drainfill, the voids may be filled

with material conforming to the specifications for the riprap, rockfill, bedding or drainfill.

11. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of each type and class of excavation within the specified pay limits will be measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Regardless of quantities excavated, the measurement for payment will be made to the specified pay limits, except that excavation outside the specified lines and grades directed by the Engineer to remove unsuitable material will be included. Excavation required because unsuitable conditions result from the Contractor's improper construction operations, as determined by the Contracting Officer, will not be included for measurement and payment.

The pay limits shall be as designated on the drawings.

Payment for each type and class of excavation will be made at the contract unit price for that type and class of excavation. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the performance of the work, except that extra payment for backfilling overexcavation will be made in accordance with the following provisions:

Payment for backfilling overexcavation, as specified in Section 10 of this specification, will be made only if the excavation outside specified lines and grades is directed by the Engineer to remove unsuitable material and if the unsuitable condition is not a result of the Contractor's improper construction operations as determined by the Contracting Officer.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 12 of this specification.

12. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bib Item 3, Excavation-Structure

(1) This item shall consist of the excavation required for installation of the Grade Control Structures and Cutoff Wall for Inlets #13 and #33 as stated on the drawings.

(2) Suitable earthfill materials resulting from excavation and not required for Bid Item 4, Earthfill-Common; Bid Item 5, Earthfill-O&M Road; and Subsidiary Item, Soil Cement shall be disposed in the areas designated on the drawings as Waste Site.

b. Subsidiary Item, Excavation-Soil Cement

(1) This item shall consist of the excavation required for installation of the Soil Cement. The upper, lower, and lateral limits of excavation shall be the neat lines and dimensions of the Soil Cement .

(2) Suitable earthfill materials resulting from excavation and not required for Bid Item 4, Earthfill-Common; Bid Item 5, Earthfill-O&M Road; and Subsidiary Item, Soil Cement shall be disposed in the areas designated on the drawings as Waste Site.

(3) No separate payment will be made for Excavation-Soil Cement. Compensation for this work will be included in the payment for Bid Item 8, Soil Cement.

c. Subsidiary Item, Excavation-Common

(1) This item shall consist of all excavation designated as Excavation-Common required for installation of the Side Inlets, designated Apron replacements, and shaping of the Collector Channel as shown on the drawings.

(2) Suitable earthfill materials resulting from excavation and not required for Bid Item 4, Earthfill-Common; Bid Item 5, Earthfill-O&M Road; and Subsidiary Item, Soil Cement shall be disposed in the areas designated on the drawings as Waste Site.

(3) No separate payment will be made for Excavation-Common. Compensation for this work will be included in the payment for Bid Item 2, Structure Removal.

d. Subsidiary Item, Borrow Excavation

(1) This item shall consist of all excavation required from the designated Borrow Site for obtaining fill material not available from required excavations.

(2) The borrow area shall be excavated uniformly across the entire length and width and shall be smoothed and graded to blend into the surrounding terrain at the completion of the work.

(3) No separate payment will be made for Borrow Excavation. Compensation for this work will be included in the payment for Bid Item 4, Earthfill-Common and Bid Item 5, Earthfill-O&M Road.

CONSTRUCTION SPECIFICATION

23. EARTHFILL

1. SCOPE

The work shall consist of the construction of earth embankments and other earthfills required by the drawings and specifications.

2. MATERIALS

All fill materials shall be obtained from required excavations and designated borrow areas. The selection, blending, routing and disposition of materials in the various fills shall be subject to approval by the Engineer.

Fill materials shall contain no sod, brush, roots or other perishable materials. Rock particles larger than the maximum size specified for each type of fill shall be removed prior to compaction of the fill.

The types of materials used in the various fills shall be as listed and described in the specifications and drawings.

3. FOUNDATION PREPARATION

Foundations for earthfill shall be stripped to remove vegetation and other unsuitable materials or shall be excavated as specified.

Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of 2 inches. The moisture content of the loosened material shall be controlled as specified for the earthfill, and the surface materials of the foundation shall be compacted and bonded with the first layer of earthfill as specified for subsequent layers of earthfill.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of two inches in depth normal to the slope and shall be at such a moisture content that the earthfill can be compacted against them to effect a good bond between the fill and the abutments.

Rock foundation and abutment surfaces shall be cleared of all loose materials by hand or other effective means and shall be free of standing water when fill is placed upon them. Occasional rock outcrops in earth foundations for earthfill, except in dams and other structures designed to restrain the movement of water, shall not require special treatment if they do not interfere with compaction of the foundation and initial layers of the fill or the bond between the foundation and the fill.

Foundation and abutment surfaces shall be not steeper than 1 horizontal to 1 vertical unless otherwise specified. Test pits or other cavities shall be filled with compacted earthfill conforming to the specifications for the earthfill to be placed upon the foundation.

4. PLACEMENT

Fill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the Engineer. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

Fill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed the maximum thickness specified. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness before being compacted. Hand compacted fill, including fill compacted by manually directed power tampers, shall be placed in layers whose thickness before compaction does not exceed the maximum thickness specified for layers of fill compacted by manually directed power tampers.

Adjacent to structures, fill shall be placed in a manner which will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly. The height of the fill adjacent to a structure shall be increased at approximately the same rate on all sides of the structure.

Earthfill in dams, levees and other structures designed to restrain the movement of water shall be placed so as to meet the following additional requirements:

a. The distribution of materials throughout each zone shall be essentially uniform, and the fill shall be free from lenses, pockets, streaks or layers of material differing substantially in texture,

moisture content, or gradation from the surrounding material.

b. If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.

c. The top surfaces of embankments shall be maintained approximately level during construction, except that a crown or cross-slope of approximately 2 percent shall be maintained to insure effective drainage, and except as otherwise specified for drainfill or sectional zones.

d. Dam embankments shall be constructed in continuous layers from abutment to abutment except where openings to facilitate construction or to allow the passage of stream flow during construction are specifically authorized in the contract.

e. Embankments built at different levels as described under (c) or (d) above shall be constructed so that the slope of the bonding surfaces between embankment in place and embankment to be placed is not steeper than 3 feet horizontal to 1 foot vertical. The bonding surface of the embankment in place shall be stripped of all material not meeting the requirements of this specification, and shall be scarified, moistened and recompacted when the new fill is placed against it as needed to insure a good bond with the new fill and to obtain the specified moisture content and density at the contact of the in place and new fills.

5. CONTROL OF MOISTURE CONTENT

During placement and compaction of fill, the moisture content of the materials being placed shall be maintained within the specified range.

The application of water to the fill materials shall be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the materials after placement on the fill, if necessary. Uniform moisture distribution shall be obtained by disking.

Material that is too wet when deposited on the fill shall either be removed or be dried to the specified moisture content prior to compaction.

If the top surface of the preceding layer of compacted fill or a foundation or abutment surface in the zone of contact with the fill becomes too dry to permit suitable bond it shall either be removed or scarified and moistened by sprinkling to an acceptable moisture content prior to placement of the next layer of fill.

6. COMPACTION

Earthfill shall be compacted according to the following requirements for the class of compaction specified:

Class A compaction. Each layer of fill shall be compacted as necessary to make the density of the fill matrix not less than the minimum density specified. The fill matrix is defined as the portion of the fill material finer than the maximum particle size used in the compaction test method specified.

Class B compaction. Each layer of fill shall be compacted to a mass density not less than the minimum density specified.

Class C compaction. Each layer of fill shall be compacted by the specified number of passes of the type and weight of roller or other equipment specified, or by an approved equivalent method. Each pass shall consist of at least one passage of the roller wheel or drum over the entire surface of the layer.

Fill adjacent to structures shall be compacted to a density equivalent to that of the surrounding fill by means of hand tamping or manually directed power tampers or plate vibrators. Unless otherwise specified, heavy equipment including backhoe mounted power tampers, or vibrating compactors and manually directed vibrating rollers, shall not be operated within 2 feet of any structure. Towed or self-propelled vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from a crane or hoist will not be permitted.

The passage of heavy equipment will not be allowed: (1) over cast-in-place conduits prior to 14 days after placement of the concrete; (2) over cradled or bedded precast conduits prior to 7 days after placement of the concrete cradle or bedding; or (3) over any type of conduit until the backfill has been placed above the top surface of the structure to a height equal to one-half the clear span width of the structure or pipe or 2 feet, whichever is greater.

Compacting of fill adjacent to structures shall not be started until the concrete has attained the strength specified in Section 10 for this purpose. The strength will be determined by compression testing of test cylinders cast by the Engineer for this purpose and cured at the work site in the manner specified in ASTM Method C 31 for determining when a structure may be put into service.

When the required strength of the concrete is not specified as described above, compaction of fill adjacent to structures shall not be started until the following time intervals have elapsed after placement of the concrete.

Structure	Time Interval
Retaining walls and counterforts (impact basins)	14 days
Walls backfilled on both sides simultaneously	7 days
Conduits and spillway risers, cast-in-place (with inside forms in place)	7 days
Conduits and spillway risers, cast-in-place (inside forms removed)	14 days
Conduits, precast, cradled	2 days
Conduits, precast, bedded	1 day
Cantilever outlet bents (backfilled both sides simultaneously)	3 days

7. REWORKING OR REMOVAL AND REPLACEMENT OF DEFECTIVE FILL

Fill placed at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the requirements or removed and replaced by acceptable fill. The replacement fill and the foundation, abutment and fill surfaces upon which it is placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control and compaction.

8. TESTING

During the course of the work, the Engineer will perform such tests as are required to identify materials, to determine compaction characteristics, to determine moisture content, and to determine density of fill in place. These tests performed by the Engineer will be used to verify that the fills conform to the requirements of the specifications. Such tests are not intended to provide the Contractor with the information required by him for the proper execution of the work and their performance shall not relieve the Contractor of the necessity to perform tests for that purpose.

Densities of fill requiring Class A compaction will be determined by the Engineer in accordance with ASTM Method D 1556, D 2167, D 2922 or D 2937 except that the volume and moist weight of included rock particles larger than those used in the compaction test method specified for the type of fill will be determined and deducted from the volume and moist weight of the total sample prior to computation of density or if using the nuclear gauge, added to the specified density to bring it to the measure of equivalent composition for comparison. The density so computed will be used to determine the percent compaction of the fill matrix. Unless otherwise specified, moisture content will be determined by one of the following methods: ASTM Method D 2216 or D 3017.

9. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of each type and compaction class of earthfill within the specified zone boundaries and pay limits will be measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Unless otherwise specified, no deduction in volume will be made for embedded conduits and appurtenances.

The pay limits shall be as defined below, with the further provision that earthfill required to fill voids resulting from overexcavation of the foundation, outside the specified lines and grades, will be included in the measurement for payment only where such overexcavation is directed by the Engineer to remove unsuitable material and where the unsuitable condition is not a result of the Contractor's improper construction operations as determined by the Contracting Officer.

The pay limits shall be the specified pay limits for excavation and the specified neat lines of the fill surface.

Payment for each type and compaction class of earthfill will be made at the contract unit price for that type and compaction class of fill. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work, except furnishing, transporting, and applying water to the foundation and fill materials. Water applied to the foundation and fill materials will be measured and payment will be made as specified in Construction Specification 10.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 10 of this specification.

10. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 4, Earthfill-Common

(1) This item shall consist of placing and compacting all earthfill required for the Side Inlets and Apron Replacements as shown on the drawings.

(2) Suitable material shall consist of CL, ML, SC, or SM soils as classified by the Unified Soil Classification System.

(3) Material obtained from the borrow area shall be prewet prior to being brought to the work site for placement.

(4) Earthfill material shall have a minimum of 15 percent passing the #200 sieve when determined on a dry weight basis, in accordance with ASTM D1140.

(5) In Section 6, Compaction, Class A shall apply. The fill matrix shall be compacted to at least 95 percent of the maximum density obtained in compaction tests of the fill materials performed by method A, ASTM D698 (Standard Proctor Test) or Rapid Compaction Test (Test No. S-6) SCS National Engineering Handbook, Section 19.

(6) The maximum size of rock fragments incorporated in the fill shall be 6-inches.

(7) The maximum size of a layer before compaction shall be nine (9) inches.

(8) In Section 8, Testing, densities of fill will be determined in accordance with ASTM 1556. The moisture content of the material incorporated in the fill shall be maintained within the range of the optimum moisture content to three (3) percentage points below the optimum moisture content as determined by ASTM D 2216. The oven-drying temperature shall be 60° ± 5°C.

(9) In Section 9, Measurement and Payment, payment shall include compensation for Subsidiary Item, Borrow Excavation.

b. Bid Item 5, Earthfill-O&M Road

(1) This item shall consist of placing and compacting all earthfill required over the existing O&M Road as shown on the drawings

(2) Suitable material shall consist of CL, ML, SC, or SM soils as classified by the "Unified Soil Classification" system.

(3) Earthfill material shall have a minimum of 15 percent passing the #200 sieve when determined on a dry weight basis, in accordance with ASTM D1140.

(4) In Section 6, Compaction, Class A shall apply. The fill matrix shall be compacted to at least 95 percent of the maximum density obtained in compaction tests of the fill materials performed by method A, ASTM D698 (Standard Proctor Test) or Rapid Compaction Test (Test No. S-6) SCS National Engineering Handbook, Section 19.

(5) The maximum size of rock fragments incorporated in the fill shall be 6-inches.

(6) The maximum size of a layer before compaction shall be nine (9) inches.

(7) In Section 8, Testing, densities of fill will be determined in accordance with ASTM 1556. The moisture content of the material incorporated in the fill shall be maintained within the range of the optimum moisture content to three (3) percentage points below the optimum moisture content as determined by ASTM D 2216. The oven-drying temperature shall be 60° ± 5°C.

(8) In Section 9, Measurement and Payment shall include compensation for Subsidiary Items, Clearing & Grubbing and Borrow Excavation.

CONSTRUCTION SPECIFICATION

33. PNEUMATICALLY APPLIED MORTAR (PAM)

1. SCOPE

The work shall consist of furnishing, mixing, applying and curing pneumatically applied mortar. Except as otherwise specified, a dry mix or wet mix process may be used.

2. MATERIALS

Portland cement shall conform to the requirement of Material Specification 531 for the specified type.

Aggregates shall conform to the requirements of Material Specification 522 unless otherwise specified.

Water used in mixing or curing pneumatically applied mortar shall be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter or other deleterious substances.

Curing compound shall conform to the requirement of Material Specification 534.

3. STRENGTH AND QUALITY

The compressive strength of pneumatically applied mortar at the age of 28 days shall be not less than specified in Section 18 of this specification.

Pneumatically applied mortar shall be uniform and dense, free from "drummy" areas, laminations, voids and sand pockets.

4. CONSISTENCY

The proportion of water added to the mixture shall be accurately controlled to produce thorough and uniform hydration of the mortar. The consistency of the mortar shall be such that the surface of the mortar in place shall have a rich, glossy appearance and that the mortar shall adhere to the supporting surface without flowing, slumping or sloughing. For application to vertical or overhanging surfaces the mix proportions shall be adjusted so that the placed mortar will adhere to a thickness of 3/4 inch without sagging or sloughing. For adjustment of consistency the addition of fly ash or diatomaceous earth conforming to ASTM Specifications C

618 to the mixture in amounts not greater than 3 percent (by weight) of cement in the mixture will be permitted.

5. INSPECTION AND TESTING

The compressive strength of the mortar will be determined in accordance with ASTM Method C 42. The compression test specimens will be cores not less than 3 inches in nominal diameter taken from the test panels described below or from the structure.

Before pneumatically applied mortar is placed, test panels simulating actual job conditions shall be made by shooting the mortar against a back form of plywood or similar material. The panels shall be not less than 30 inches square and not less than 4 inches thick. They shall be made by the mix proportions, air and water pressures, and nozzle settings to be used for the job. A separate panel shall be made for each mix and for each shooting position to be encountered on the job. Not more than 3 representative shooting positions will be required: representing (1) horizontal surfaces, (2) vertical or sloping surfaces, and (3) overhead surfaces.

Similar panels not less than 12 inches square and not less than 4 inches thick shall be made periodically as directed by the Contracting Officer during the progress of the work.

Test panels and cores will be handled and cured according to the requirements of ASTM Method C 31.

For each strength test, 3 cores will be tested in compression. The test result will be the average of the strengths of the 3 specimens, except that if one specimen shows manifest evidence of improper sampling, coring, or testing, it will be discarded and the strengths of the remaining 2 specimens will be averaged. If more than one specimen representing a test shows such defects, the entire test will be discarded.

The Contractor shall furnish the forms and make the required test panels and shall provide such facilities, materials and assistance as may be necessary for curing, handling, and protecting the panels. Test panels shall be cast only when the Engineer is present.

6. MEASURING MATERIALS

The proportions of the mortar mix shall be controlled on the basis of the weight of each component material except that water may be measured by volume.

7. EQUIPMENT

The Contractor shall furnish all equipment necessary for batching, mixing and placing the mortar. Batching and mixing equipment shall include weighing equipment accurate to within 0.4 percent of scale capacity, a power driven mortar mixer capable of thoroughly mixing the materials at a rate adequate to insure uniform feeding of the mixture to the placing equipment, and a feeding apparatus capable of supplying the mixture to the placing equipment at an adequate and uniform rate.

The placing equipment for dry mix mortar shall be designed and equipped to receive the dry mix, introduce it into a stream of compressed air, convey it pneumatically through a delivery hose to a nozzle at the point of discharge, inject water under pressure into the suspended stream of dry sand and cement within the nozzle, and spray the resulting mortar mix onto the surface of the work at a uniform rate and at a controlled velocity. The placing equipment shall be equipped with accurate gauges to indicate the air pressure and water pressure and with devices capable of accurately controlling the air pressure at any level between 50 psi and 80 psi, the water pressure at any level between 50 psi and 100 psi, and the rate of application of water at the nozzle.

The placing equipment for wet mix mortar shall be designed and equipped to receive the mortar from the mixer, convey it through a delivery hose to a nozzle at the point of discharge, accelerate it in the nozzle by means of compressed air, and spray it onto the surface of the work. It shall be capable of delivering mortar to the nozzle uniformly and continuously and discharging it from the nozzle at a uniform rate and at a controlled velocity sufficient for all parts of the work.

The length of the discharge hose shall not exceed 350 feet.

8. MIXING

For dry mix mortar, the cement and sand shall be mixed by at least 25 revolutions of the mixer drum before being

fed into the placing equipment. The dry mix shall be used promptly after mixing and any material that is not placed within 45 minutes after mixing shall be wasted.

For wet mix mortar, the cement, sand, and water shall be thoroughly mixed in the mixer drum sufficiently to produce mortar of the required consistency which is uniform within each batch and uniform from batch to batch when discharged into the placing equipment.

The entire contents of the mixer shall be discharged from the drum before materials for a succeeding batch are placed therein.

9. FORMS

Forms shall be structurally adequate and of such design that rebound or accumulated loose sand can freely escape or be readily removed. Shooting strips shall be used at corners, edges, and on surfaces where necessary to obtain true lines and proper thickness. Where practicable, ground wires shall be installed as guides to accurately establish the specified contour of the finished surface of mortar. Ground wires shall be set and used as guides for templates in forming curved and molded surfaces. When pneumatically applied mortar is to be placed on horizontal or sloping surfaces, headers and ground wires shall be provided to the extent necessary to insure control of slab thickness. Ground wires shall be tightened and kept taut, secure, and true to line and plane during placement of mortar and shall be removed when placement of mortar is completed.

Header boards will be required where the drawings indicate a square edge and at required joints. Form surfaces shall be thoroughly cleaned and oiled before mortar is placed.

10. PREPARATION OF SURFACES TO RECEIVE PAM

All surfaces to receive or support pneumatically applied mortar shall be carefully prepared and conditioned. All such prepared surfaces shall be inspected and approved by the Engineer prior to the application of mortar.

Earth surfaces to which pneumatically applied mortar is to be applied shall be firmly compacted and neatly trimmed to line and grade.

Asphaltic concrete surfaces shall be thoroughly cleaned of any growths, earth, or any other material that would

affect bond, or be detrimental to the pneumatically applied mortar.

Concrete, mortar, or rock surfaces shall be thoroughly cleaned to remove all dirt, laitance, weak or unbonded mortar, loose material, grease or other deleterious substances.

Surfaces on which the pneumatically applied mortar is to be placed shall be sufficiently rough to insure the adherence of the mortar. Offsets which would cause an abrupt and substantial change in thickness of the mortar shall be removed or tapered.

All surfaces shall be maintained in a moistened condition for three hours before application of pneumatically applied mortar. Pneumatically applied mortar shall not be applied to mud, dried earth, uncompacted fill, or surfaces on which free water exists. All ice, snow and frost shall be removed and the temperature of all surfaces, to be in contact with the new mortar shall be no colder than 40oF.

11. PLACING

The Contractor shall have all equipment and materials required for curing available at the site and ready for use before placement of pneumatically applied mortar begins.

No mortar shall be placed except in the presence of the Engineer. The Contractor shall give reasonable notice to the Engineer each time he intends to place mortar. Such notice shall be far enough in advance to give the Engineer adequate time to inspect the surfaces to which the mortar is to be applied, the forms, steel reinforcement, and other preparations for compliance with the specifications before placement is begun.

During placement of the mortar the air pressure shall be adjusted as required to control rebound and density of mortar. For a given application, once the optimum operating pressures have been established they shall be maintained constant throughout the application. For dry mix mortar, the air pressure at the machine shall be not less than 35 psi plus 5 psi for each 50 feet of length of the discharge hose and the water pressure at the nozzle shall be not less than 15 psi greater than the air pressure at the machine.

The placing nozzle shall be held about 3 feet from and approximately normal to the surface of the work. Corners shall be filled first.

When coatings one inch or more in thickness are to be applied to vertical or overhanging surfaces, the pneumatically applied mortar shall be applied in two or more layers not more than 3/4 inch in thickness. On horizontal or slightly sloping surfaces the thickness of a single layer may vary from one inch to a maximum of 3-1/2 inches. When more than a single layer is applied, placement of subsequent layers shall be delayed long enough to prevent sloughing but shall be accomplished before the previously placed mortar has completely set. When pneumatically applied mortar is placed on a vertical surface, application shall be started at the bottom and be completed at the top.

In any case when the placing of pneumatically applied mortar is interrupted for more than one hour, the edge of the layer shall be sloped off at an angle of approximately 45 degrees to the surface being shot, and the sloped portion shall be covered with a double layer of seven-ounce burlap and kept continuously moist until the application of mortar is resumed. Before applying new material, the sloped portion shall be thoroughly cleaned and wetted by means of an air and water blast or equally effective method approved by the Engineer.

Material that rebounds and accumulates on forms, subgrade surfaces or reinforcing steel ahead of the mortar being placed shall be removed.

In no case shall mortar be applied over rebound debris. Rebound debris shall not be reused in mortar on any portion of the work and shall be disposed of as the work progresses.

12. FINISHING

Rebound material shall be carefully swept off the finished mortar surface before it becomes too hard for removal.

Pneumatically applied mortar shall not be screeded. After the mortar has been placed to the depth required the surface shall be checked with a straightedge or template and any low spot shall be brought up to specified grade by placing additional pneumatically applied mortar. Finishing of mortar surfaces by means of floats or trowels will not be permitted.

13. CURING

Pneumatically applied mortar shall be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period or until curing compound is applied as specified below. Moisture shall be maintained by sprinkling, flooding or fog spraying, or by covering with continuously moistened canvas, cloth mats, straw, sand or other approved material. Wood forms left in place during the curing period shall be kept wet. Formed surfaces shall be thoroughly wetted immediately after forms are removed and shall be kept wet until patching and repairs are completed. Water or covering shall be applied in such a way that the mortar surface is not eroded or otherwise damaged.

Water for curing shall be clean and free from any substances that will cause discoloration of the mortar where finished surfaces will be exposed to view.

Except as otherwise specified in Section 16, and except for surfaces to which additional mortar is to be applied, pneumatically applied mortar may be coated with curing compound in lieu of the continued application of moisture.

The compound shall be sprayed on the moist mortar surfaces as soon as rebound has been removed and any required repairs are completed, or as soon as water curing is discontinued.

The curing compound shall be thoroughly mixed immediately before applied and continuously agitated during application. It shall be applied at a uniform rate of not less than one gallon per 150 square feet of surface. It shall not check, crack or peel, and shall be free from pin holes or other imperfections.

Curing compound shall not be applied to subgrade surfaces or other surfaces requiring bond with subsequently placed mortar, such as construction joints, reinforcing steel and other embedded items.

Surfaces subjected to heavy rainfall or running water within 3 hours after the compound has been applied, or surfaces damaged by subsequent construction operations during the curing period shall be resprayed in the same manner as for the original applications. Surfaces covered by the membrane shall not be trafficked unless protected from wear.

14. REPLACEMENT OR REPAIR

When pneumatically applied mortar has "drummy" areas, voids, sand pockets, or is damaged or otherwise defective, the Contractor shall remove and replace the portion of the structure containing the defective mortar, or correct or repair the defective parts. The Contracting Officer will determine the required extent of removal, replacement or repair.

Prior to starting repair work the Contractor shall obtain the Contracting Officer's approval of his plan for making the repair. Such approval shall not be considered a waiver of the Contracting Officer's right to require complete removal of defective work if the completed repair does not produce mortar of the required quality and appearance.

Repair work shall be performed only when the Engineer is present.

Repair shall be made with pneumatically applied mortar conforming to this specification. When removal of defective mortar is required, reinforcement damaged or destroyed shall be replaced prior to replacement of the mortar. At the edges of removed sections the sound mortar shall be carefully trimmed to the extent required to expose sufficient reinforcement for effecting competent splices. The sound mortar at the edges of removed sections shall be trimmed to a slope of approximately 45 degrees with the surface of the work and shall be thoroughly moistened prior to placement of the new mortar.

Any portions of the work having thicknesses less than those specified may be repaired by the placement of additional layers of pneumatically applied mortar, provided that such repair is expressly authorized.

Surfaces of the work to which additional pneumatically applied mortar is to be applied shall be prepared as required by Section 10 of this specification.

Curing as specified in Section 13 shall be applied to repaired areas immediately after the repairs are completed.

15. PLACING IN COLD WEATHER

When the atmospheric temperature may be expected to drop below 40oF at the time pneumatically applied mortar is

placed, or at any time during the curing period, the following provisions also shall apply:

a. The temperature of the mortar at time of placing shall not be less than 50oF nor more than 90oF. The temperature of neither aggregates nor mixing water shall be more than 100oF just prior to mixing with the cement.

b. When the daily minimum temperature is less than 40oF, mortar shall be insulated or housed and heated after placement. The temperature of the mortar and air adjacent to the mortar shall be maintained at not less than 50oF nor more than 90oF for the duration of the curing period.

c. Methods of insulating, housing and heating the structure shall conform to "Recommended Practice for Cold Weather Concreting," ACI Standard 306.

d. The use of accelerators or antifreeze compounds will not be allowed.

e. When dry heat is used to protect mortar, means of maintaining an ambient humidity of at least 40 percent shall be provided unless the mortar has been coated with curing compound as specified in Section 13 or is covered tightly with an approved impervious material.

16. PLACING IN HOT WEATHER

When climatic or other conditions are such that the temperature of pneumatically applied mortar may reasonably be expected to exceed 90oF at the time of placement, or during the first 24 hours after placement, the following provisions also shall apply:

a. The Contractor shall maintain the temperature of the mortar below 90oF during mixing, conveying, and placing. Methods used shall conform to "Recommended Practice for Hot Weather Concreting," ACI Standard 305.

b. Exposed mortar surfaces which tend to dry or set too rapidly shall be continuously moistened by means of fog sprays or otherwise protected from drying immediately after placement.

c. Mortar surfaces exposed to the air shall be covered as soon as the mortar has hardened sufficiently and shall be kept continuously wet for at least the first 24 hours of the curing period, and for the entire curing period unless curing compound is applied as specified in Subsection d, below.

d. If moist curing is discontinued before the end of the curing period, white pigmented curing compound shall be applied immediately, following the procedures specified in Section 13.

17. MEASUREMENT AND PAYMENT

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 18 of this specification.

18. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 7, Pneumatically Applied Mortar (PAM)

(1) This item shall consist of furnishing, mixing, applying, and curing of Pneumatically Applied Mortar for installation of Side Inlet Structures, Grade Control Structures, designated Apron Replacements, Test Panels, Inlets #13 and #33, and to the limits shown on the drawings.

(2) The PAM mortar shall have a 28-day compressive strength of 4000psi.

(3) The Cement shall be Type V.

(4) The I. Joint Sealant and Materials, and II. Installation shall be:

I. Joint Sealant and Materials:

(a) Type S, Grade NS, Use NT or T, low-modulus silicone conforming to the requirements of ASTM C-920 that can tolerate submergence by intermittent flood flows.

(b) Capable of withstanding without failure, an increase of 100 percent, and a decrease of at least 50 percent of the joint width as measured at the time of application when tested in accordance with ASTM C-719.

(c) The elongation shall be a minimum of 800 percent without failure when tested in accordance with ASTM D-412, and 500 percent without adhesion failure when tested in accordance with ASTM C-719.

(d) The backer-rod material shall be compatible with the sealant and conform to the sealant manufacture's requirements.

II. Installation:

(e) Cleaning Each joint face shall be sand-blasted. The sand-blasting nozzle must be held at an angle or fitted with deflectors to direct the sand against the joint face within one or two inches of the surface. A minimum of one pass shall be made for each joint face.

After sand-blasting, the joint cavity shall be cleaned, removing all sand or other debris that would interfere with joint closure. Just prior to priming, the joints shall be air-blasted to remove sand and dust. Air compressors used for sand-blasting and air-blasting shall be equipped with traps to remove moisture and oil from the air. Air-blasting shall be done in one direction only.

The joint is considered to be clean when no residue is evident after rubbing your finger or dark lint free cloth along the cleaned dry joint face. The joint shall be completely clean and air dried as determined by the Engineer, for a minimum of 24-hours under natural drying conditions before proceeding with the application of primer or sealant.

Sealant Installation The primer coat shall be applied to the clean, dry joint surfaces by brushing or spraying to the full depth of the sealant contact area. Equipment used for the application of primer shall be solvent resistant to prevent gel formation and plugged lines. The primer shall be allowed to dry in accordance with the manufacturer's recommendations.

Joints must be clean and dry when the sealant is installed. Drying of the joint surfaces may only occur from natural weather conditions.

During the sealant placement the nozzle of the sealant applicator shall be moved steadily along the joint, pushing the sealant ahead to form the required cross section.

Immediately after placement and before a skin forms, the sealant shall be tooled, forcing it onto the backer-rod and joint surfaces as

detailed on the drawings. Excess sealant on the concrete surface shall be removed.

Delivery and Storage The sealant material shall be delivered in original, tightly sealed containers, clearly labeled with the manufacture's name, product identification, and lot numbers where applicable.

The unopened sealant materials shall be stored out of the weather in their original containers as recommended by the manufacture. Storage temperature shall bot exceed 90 degrees fahrenheit.

The Contractor shall furnish both certifications showing that each lot of sealant meets the requirements and a letter of assurance from the manufacturer stating that the sealant will tolerate submergence by intermittent flood flows.

(5) In Section 17, Measurement and Payment, the following method shall apply.

For items of work for which specific unit prices are established in the contract, pneumatically applied mortar will be measured to the neat lines and dimensions shown on the drawings and the volume of pneumatically applied mortar will be computed to the nearest 0.1 cubic yard. Payment will be made at the contract unit prices for pneumatically applied mortar. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the work, including making and handling test panels but not including other items listed for payment elsewhere in the contract.

Pneumatically applied mortar required to fill voids resulting from overexcavation of the foundation, outside the dimension lines and grades of the structures, will be included in the measurement for payment *only* where such overexcavation is directed by the Engineer.

Payment shall include compensation for Joint Sealant and Installation and Subsidiary Items, Welded Wire Fabric and Pneumatically Applied Mortar-Grouted Rock.

b. Subsidiary Item, Pneumatically Applied Mortar-Grouted Rock

(1) This item shall consist of furnishing, mixing, applying, and curing of Pneumatically Applied Mortar required to fill voids in the existing loose rock riprap along both sides of the inlets (5, 6, 33, and 13). The void area to be filled is a 2' x 2' cross-section sloping 3H:1V and varying in height from 8.5 to 9.5-feet.

(2) The pneumatically applied mortar shall have a range of 4 to 6-inch slump.

(3) No separate payment will be made for Pneumatically Applied Mortar-Grouted Rock. Compensation for this work will be included in the payment for Bid Item 7, Pneumatically Applied Mortar.

CONSTRUCTION SPECIFICATION

34. STEEL REINFORCEMENT

1. SCOPE

The work shall consist of furnishing and placing steel reinforcement for reinforced concrete or pneumatically applied mortar.

2. MATERIALS

Steel reinforcement shall conform to the requirements of Material Specification 539. Before reinforcement is placed, the surfaces of the bars and fabric and any metal supports shall be cleaned to remove any loose, flaky rust, mill scale, oil, grease or other coatings or foreign substances. After placement, the reinforcement shall be maintained in a clean condition until it is completey embedded in the concrete.

3. BAR SCHEDULE, LISTS AND DIAGRAMS

Any supplemental bar schedules, bar lists or bar-bending diagrams required to accomplish the fabrication and placement of reinforcement shall be provided by the Contractor. Prior to placement of reinforcement, the Contractor shall furnish four prints or copies of any such lists or diagrams to the Contracting Officer. Acceptance of the reinforcement will not be based on approval of these lists or diagrams but will be based on inspection of the reinforcement after it has been placed.

4. BENDING

Reinforcement shall be cut and bent in compliance with the requirements of the American Concrete Institute Standard 315. Bars shall not be bent or straightened in a manner that will injure the material. Bars with kinks, cracks or improper bends will be rejected.

5. SPLICING BAR REINFORCEMENT

Splices of reinforcement shall be limited to those locations shown on the drawings. Splice lengths shall be determined prior to fabrication and meet the requirements of ACI Standard 318 "Building Code Requirements for Reinforced Concrete" based upon design information contained in Section 10 of this specification. Bar placement drawings and schedules shall be provided for

approval prior to fabrication. The drawings shall show all splice locations, layouts, and lap distances.

6. SPLICING WELDED WIRE FABRIC

Unless otherwise specified, welded wire fabric shall be spliced in the following manner:

a. Adjacent sections shall be spliced end to end (longitudinal lap) by overlapping a minimum of one full mesh plus 2 inches plus the length of the two end overhangs. The splice length is measured from the end of the longitudinal wires in one piece of fabric to the end of the longitudinal wires in the lapped piece of fabric.

b. Adjacent sections shall be spliced side to side (transverse lap) a minimum of one full mesh plus 2 inches. The splice length shall be measured from the centerline of the first longitudinal wire in one piece of fabric to the centerline of the first longitudinal wire in the lapped piece of fabric.

7. PLACING

Reinforcement shall be accurately placed and secured in position in a manner that will prevent its displacement during the placement of concrete. Tack welding of bars will not be permitted. Metal chairs, metal hangers, metal spacers and concrete chairs may be used to support the reinforcement. Metal hangers, spacers and ties shall be placed in such a manner that they will not be exposed in the finished concrete surface. The legs of metal chairs or side form spacers that may be exposed on any face of slabs, walls, beams or other concrete surfaces shall have a protective coating or finish by means of hot dip galvanizing, epoxy coating, plastic coating, or be stainless steel. Metal chairs and spacers not fully covered by a protective coating or finish shall have a minimum cover of 3/4 inch of concrete over the unprotected metal portion except for those with plastic coatings may have a minimun cover of 1/2 inch of concrete over the unprotected metal portion. Precast concrete chairs shall be manufactured of the same class of concrete as that specified for the structure and shall have tie wires securely anchored in the chair or a V-shaped groove at least 3/4 inch in depth molded into the upper surface to receive the steel bar at the point of support. Precast concrete chairs shall be moist at the time concrete is placed.

High density or structural plastic rebar accessories, designed to insure maximum concrete bond, may be substituted for metal or concrete accessories in spacer applications as approved by the Contracting Officer. Exposure of plastic rebar accessories at the finished concrete surface shall be kept to a minimum. Plastic rebar accessories, if used, shall be staggered along adjacent parallel bars and shall be placed at intervals no closer than 12 inches. Plastic rebar accessories shall not be used in concrete sections 6 inches or less in thickness.

Reinforcement shall not be placed until the prepared site has been inspected and approved by the Engineer. After placement of the reinforcement, concrete shall not be placed until the reinforcement has been inspected and approved by the Engineer.

8. STORAGE

Steel reinforcement stored at the work site shall be placed above the ground surface on platforms, skids or other supports and protected from mechanical damage or corrosion.

9. MEASUREMENT AND PAYMENT

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items to which they are made subsidiary are identified in Section 10 of this specification.

TABLE 34-1. STANDARD REINFORCING BARS

Bar Size No.	Wt. (lb./ft.)
3	0.376
4	0.668
5	1.043
6	1.502
7	2.044
8	2.670
9	3.400
10	4.303
11	5.313
14	7.65
18	13.60

TABLE 34-2. RECTANGULAR WELDED WIRE FABRIC1/

Style Designation By Steel Wire Gauge	Style Designation By W-Number	Weight, lb. Per 100 Sq. Ft.
6 x 6 - 10 x 10	6 x 6 - W1.4 x W1.4	21
6 x 6 - 8 x 8	6 x 6 - W2.1 x W2.1	30
6 x 6 - 6 x 6	6 x 6 - W2.9 x W2.9	42
6 x 6 - 4 x 4	6 x 6 - W4.0 x W4.0	58
4 x 4 - 10 x 10	4 x 4 - W1.4 x W1.4	31
4 x 4 - 8 x 8	4 x 4 - W2.1 x W2.1	44
4 x 4 - 6 x 6	4 x 4 - W2.9 x W2.9	62
4 x 4 - 4 x 4	4 x 4 - W4.0 x W4.0	85
4 x 12 - 8 x 12	4 x 12 - W2.1 x W0.92/	25
4 x 12 - 7 x 11	4 x 12 - W2.5 x W1.12/	31

1/ Style designation is defined in ACI Standard 315 of the American Concrete Institute.

2/ Welded smooth wire fabric with wires smaller than Size W1.4 is manufactured from galvanized wire.

10. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Welded Wire Fabric

(1) This item shall consist of furnishing and installing all Welded Wire Fabric required to construct the Pneumatically Applied Mortar Side Inlets, Grade Control Structures, Apron Replacements, and Inlets #13 and #33.

(2) In Section 6, Splicing Welded Wire Fabric, the minimum overlapping shall be two (2) full meshes.

(3) No separate payment will be made for Wire Fabric. Compensation for this item will be included in Bid Item 7, Pneumatically Applied Mortar.

CONSTRUCTION SPECIFICATION

94. CONTRACTOR INSPECTION

1. Scope

The work shall consist of providing all equipment, materials, labor and services necessary to ensure that the specified quality is maintained on all work performed. The Contractor shall be responsible for the day-to-day quality control.

2. Equipment and Materials

Equipment for materials testing shall be of the quality and condition required to meet the test specifications cited in the contract references. Equipment shall be in good condition and properly adjusted. Calibration of equipment shall be done at the frequency specified in Section 8. Records of equipment calibration tests shall be available to the government at all times. Nuclear devices shall be operated and maintained by qualified operators and as prescribed by applicable state and federal regulations.

Materials include but shall not be limited to: sand for density tests, bound field books and forms for record-keeping, concrete specimen molds, and all other equipment and materials prescribed by the test procedures referenced in the contract.

The quality of materials used in quality control testing and the equipment employed shall: meet the appropriate standards specified and the standards of the industry, be appropriate for its intended use, and provide the accuracy specified by the contract requirements unless otherwise specified in Section 8 of this specification.

3. Inspection Personnel

Inspections and materials testing shall be accomplished by qualified personnel: a licensed engineering firm, testing laboratory, certified inspection technicians, or licensed and experienced personnel from the contractor's organization. The contractor's written inspection plan shall identify the names and qualifications, training, and experience of all quality control personnel who will actually be performing the inspection and quality control work.

4. Inspection System

The Contractor shall develop and conduct an inspection system adequate to maintain quality control of all work performed and materials and equipment used. The inspection system established shall be based upon a plan and implemented by the necessary mobilization of personnel, equipment and materials. Inspection shall include the initial work needed to verify

adequacy of completed work and provide controls for any corrective work. The inspection system and records to substantiate daily conduct of the system shall be kept by the Contractor and are subject to review by the Contracting Officer, at any time.

The Contrctor's inspection system shall cover all aspects of quality control and shall specifically address any testing and inspection requirements detailed in Section 8 of this specification. The planned inspection system shall also identify the Contractor's primary quality control manager and provide an organizational listing of the individual quality control personnel and their specific duties, experience and qualifications.

If the government's quality assurance inspections indicate that the contractor's inspection system is not adequate or is not producing the desired results, corrective actions shall be taken by the Contractor in both the inspection system, its plan and the work. The Contracting Officer may direct that changes be made in the inspection system including, but not limited to, the removal of unsatisfactory quality control personnel.

5. Pre-Construction Conference

After the contract is awarded and before construction operations are started the Contractor shall meet with the Contracting Officer and discuss the contractor's inspection plan. The meeting shall develop a mutual understanding regarding inspection details including the form of documentation to be used for recording the quality control operations, inspections, management procedures and the interrelationship of Contractor and government inspection efforts. The finalized plan will be approved by the Contracting Officer and it shall become a part of the contract.

6. Records

The inspection records shall be kept daily and shall document both acceptable and deficient features of the work. They shall include complete records of required material tests, submittal and approval of shop drawings, manufacturer's recommendation and certifications, and a complete record of materials delivery, quality examination, certification and storage. Tests performed by the Contractor (including sub contractors) shall be a part of the record. All records shall be on forms acceptable to the Contracting Officer and shall be legible, properly dated and identified as to the responsible tester, the material or item tested, and its location of placement in the structure. In addition, these records shall include factual evidence that required activities or tests have been performed, including but not limited to the following:

1. Type and number of control activities and tests involved and the location (elevation, station and offset) of the work tested.

2. Result of control activities or tests.

3. Method of testing used (e.g. citation of reference specification).

4. Nature of defects, cause for rejection, etc.

5. Proposed remedial action.

6. Corrective actions taken and quality control testing.

7. Measurement and Payment

For items of work for which lump sum prices are established in the contract, payment for contractor inspection will be made at the contract lump sum price. Such payment shall constitute full compensation for all labor, materials, equipment, transportation and all other items necessary and incidental to completion of the work. Progress estimates for payment of this bid item will be based on the percent completion of all contract items (dollar value) used in preparing the regular progress payments.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary are identified in Section 8 of this specification.

8. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 10, Contractor Inspection

1. This item shall consist of furnishing the personnel, equipment and material required to perform the testing and inspection necessary to implement and inspection system to insure the specified quality is being maintained for:

   (a) Excavation - Structure
   (b) Earthfill - Common and Earthfill - O&M Road
   (c) Pneumatically Applied Mortar (PAM)
   (d) Soil Cement

2. The mositure - density determinations required for the quality control of Earthfill - Common and Earthfill - O&M Road shall be performed in accordance with method A ASTM D 698 (Standard Procter Test) or Test No. S-6 (Rapid Compaction Control Method) as described in Section 19 of the SCS National Engineering Handbook.

3. The moisture content and in-place density of the compacted fill shall be determined in accordance with ASTM D 2216 and D 1556.

4. Prior to establishing fill production operations, it shall be demonstrated and verified by test results that the proposed equipment fleet is capable of producing fill of the quality specified.

5. For production operations the initial moisture-density test frequency shall be one (1) test per 2,000 cubic yards of compacted Earthfill - O&M Road and one (1) test per structure or each 500 cubic yards, whichever occur's first, of compacted Earthfill - Common. When approved by the Contracting Officer, the testing frequency may be modified as the job progresses, provided the quality of the fill is consistant or when the testing frequency is not compatible with the daily production.

6. The plasticity and classification of the fill material shall be determined during the initial placing operation and whenever a significant difference in fill material is encoutered or 5,000 cubic yards, whichever occurs first.

7. The quality control for Pneumatically Applied Mortar shall include making and testing the initial test panels specified in Section 5 of Construction Specification 33 and one (1) set for every 100 c.y. placed thereafter and monitoring the placing operation.

8. The mixing and placing of Soil Cement shall be monitored by quality control personnel for the proper soil type, cement and moisture content, and layer depth. Prior to commencing placing operation, the foundation shall be in spected and certified to the Contracting Officer that it has been properly shaped, compacted and wetted.

9. Testing equipment shall be calibrated after it is delivered to the site and whenever erratic or unreasonable test results are being obtained. The sand used for testing fill densities shall be calibrated whenever there is a changed in the humidity or lot of sand.

10. Suitable lab facilities will be set up at the site and will be used exclusively for testing and quality control purposes.

11. The Contractor shall designate and experienced quality control manager and inspection staff whose primary reponsibility will be implementing the inspection system. The manager shall be on site during major construction activities and will not be involved in directing production oriented activities unless it pertains to achieving the specified quality for the work being performed.

12. The names and qualifications of proposed quality control personnel shall be submitted to the Contracting Officer for review and approval prior to the pre-construction conference. Any changes in quality control personnel will require the approval of the Contracting Officer.

13. Copies of all test results and inspection reports (visual inspections of earthwork and concrete form works, steel placement verifications, concrete placement, etc.), required by the approved inspection plan shall be submitted to the Contracting Officer within 24 hours of when the test or inspection report is completed and certified.

CONSTRUCTION SPECIFICATION

206 SOIL-CEMENT

1. SCOPE

The work shall consist of the furnishing, placing, compacting, and curing a mixture of soil material, Portland cement and water. The mixture shall be uniformly mixed, blended, compacted, finished and cured as specified. It shall conform to the lines, grades, thicknesses, and cross section(s) shown on the plans.

2. MATERIALS

Soil materials shall be obtained from the required excavations or designated borrow locations and shall meet the requirements stated below.

Deleterious materials such as sod, brush, or roots shall be separated from soil materials during the selection, blending, and routing operations. Maximum size of rock particles shall be 2 inches. Soil materials, cement content, and moisture content other than those specified in Section 15 may be used as approved by the Engineer. Proposed alternatives must meet one of the following requirements to be considered:

(a) If the soil material to be used has similar gradation and Atterberg limits as the soils specified, the same cement content and water content shall be used. The Contractor shall provide gradation and Atterberg test data from a reputable commercial soil testing laboratory verifying gradation and Atterberg limits.

(b) If the soil materials do not have the same gradation and Atterberg limits as the soils specified, the Contractor shall provide soil-cement durability tests, moisture-density relations data, Atterberg limits and gradation tests from a reputable commercial soil testing laboratory. The soil-cement mix ratio and water content shall also be provided by the lab. As a minimum, the following durability tests shall be provided; ASTM D 559 and ASTM D 560. The moisture-density relations are to be in accordance with ASTM D 558. The tests must indicate a soil-cement of a quality equal to or exceeding the quality specified.

Portland cement shall conform to the requirements of Material Specification 531 for the specified type. Mixing of different brands or types of cement will not be allowed.

Portland cement shall be furnished in sacks, barrels, or bulk. Sacked cement that is stored at the job site shall be used in the same order as the deliveries to the site. Each shipment of sacked cement shall be stored so that it may be readily distinguished from other shipments. Emptied cement sacks shall be burned or buried in accordance with Construction Specification 5 unless otherwise specified.

Water used in mixing or curing soil-cement shall be clean and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances and shall meet the requirements for water as specified in ASTM C 94.

Pozzolanic Materials, if used, shall comply with requirements of ASTM C 618 Class F, Specifications for Fly Ash, and Raw or Calcined Natural Pozzolan, except the loss of ignition shall not exceed 3.0 percent.

Curing compounds shall conform to the requirements of Material Specification 534 for the type of curing compound specified. A liquid petroleum asphalt curing material may be used as specified in Section 15. Application of the curing compound shall be in accordance with Section 12 of this specification and the manufacturer's recommendations.

3. OPERATIONS OF PITS OR STOCKPILES OF SOIL MATERIALS

All work involved in the opening and operation of borrow pits or stockpiles shall be performed by the Contractor. The pits or stockpiles shall be opened in such a manner as to expose a near vertical face of the soil material for a suitable working depth. The face should not exceed five feet in height without benching back if it poses a threat to workers.

Material shall be excavated in successive vertical cuts extending across the pit or stockpile. When approved by the Engineer, successive horizontal cuts on a horizontal oriented working face may be permitted in homogeneous soils. All pockets or strata of unsuitable materials not meeting the quality requirements specified in Section 2 shall be wasted. The method of operating the pit or stockpile and the blending of materials shall be changed when such action is necessary to obtain material conforming to the specifications. Upon completion of the work, the pits shall be graded and dressed to minimize erosion and drain freely.

4. FOUNDATION PREPARATION

Before soil-cement processing begins, the subgrade placement area shall be graded, shaped, and compacted in conformance with the lines and grades shown on the plans. The subgrade shall firmly support the construction equipment. Immediately prior to the placement of the soil-cement, the compacted subgrade surface shall be moistened to approximately the same moisture content as specified for the soil-cement, and shall be kept moist until the soil-cement is placed.

5. DESIGN OF SOIL-CEMENT MIXTURE

General The materials and proportion of the soil-cement mixture shall constitute the "job-mix". After a job-mix has been approved, neither the source, character or grading of the soil nor the type, brand, or quantity of cement or pozzolanic material shall be changed without prior approval of the Engineer. A change in materials or proportions requires the establishment of a new job-mix supported by evidence, as required for the

initial job-mix, that the proposed new materials and mix proportions will produce soil-cement of the strength specified.

The use of calcium chloride or other accelerators or antifreeze compounds will not be allowed unless approved by the Engineer.

The Contractor shall use the soil, fly ash, cement, and moisture content as determined by the Engineer in accordance with laboratory tests. During the course of the work, the Engineer shall adjust the job-mix proportions as needed to achieve the specified compressive strength.

The percent of cement to be used in the mix will be determined by dividing the weight of cement by the oven dry weight of the soil material.

6. MIXING

The mixing plant shall be capable of producing a uniform mixture of soil, cement, and water. The plant shall be equipped with measurement devices that will proportion the mix in the specified quantities. Prior to use, all measurement devices shall be calibrated and certified by a technician approved by the Engineer. The actual quantities of the mix shall not vary more than 2 percent from the specified quantities, unless otherwise specified. The water content shall be percentage of moisture in the mixture at the time of compaction.

The Engineer shall have free access to the mixing plant at all times for inspection of the plant's operation and for sampling the soil-cement mixture and its components.

Method 1 Mixing of the soil, cement, and water shall be accomplished in a stationary mixing plant. The plant may be either a batch type or a continous flow type design. The plant may use either weight or volume proportioning. The scale or metering devices shall be sensitive to one percent (1%) of the maximum load that may be required or imposed. The mixer shall be a pugmill, revolving-blade or rotary-drum system.

Facilities for efficiently storing, handling and proportioning unmixed materials shall be provided at the plant.

Method 2 Mixing of the soil, cement, and water shall be accomplished in a truck mixer. The mixer shall meet the requirements for truck mixers contained in ASTM C 94.

Method 3 Mixing of the soil-cement shall be accomplished in place. Mixing of the soil, cement, and water shall be accomplished by a single or multiple transverse shaft mixer, a traveling pugmill, or similar equipment approved by the Engineer. A motor grader or similar equipment will not be acceptable in lieu of the mixing equipment specified.

Soil material to be mixed in place shall be formed into windrows or divided into known grid areas. If windrows are used, they shall be prepared to a known size with a sizing device. The tops of the windrows shall be flattened or slightly trenched to receive the cement.

The mixing operation shall be accomplished in such a manner that there are no unmixed seams of soil between layers. Excessive striking of the soil-cement below the layer being mixed will not be allowed.

All Methods The following provisions apply to all methods of mixing. The mixing time shall be controlled so that all ingredients shall be mixed for at least 30 seconds or longer as may be necessary to insure a thorough, uniform and homogeneous mixture of soil, cement, pozzolanic materials (if used) and water. Mixing time may be adjusted based on tests and field determinations. The mixing time shall be considered as the interval between the time the cement contacts the soil and water and the time the mixture leaves the mixing unit or when the mixer speed is reduced to the agitating speed. The soil and cement shall be mixed sufficiently to prevent cement balls from forming before the water is added. The water may be applied through the mixing machine or separately by approved pressure distributing equipment.

Soils containing plastic silt or clay lumps larger than 1-inch shall be pulverized or screened out of the raw soil prior to mixing.

7. TRANSPORTING

The soil-cement mixture shall be transported from the mixing plant to the site of placement in vehicles having tight, clean and smooth beds or mixer trucks. Haul time shall not exceed 30 minutes. Haul time shall be the elapsed time from when the water and cement are mixed together and the mixture is spread onto the foundation or soil-cement surface.

The Contractor shall protect the soil-cement mixture if transported during unfavorable weather. Any material excessively wet by precipitation will be subject to rejection.

Equipment shall not be operated on a finshed and compacted layer of the soil-cement, except where specifically permitted. Any damage resulting to the finished surfaces of the soil-cement from such operation shall be repaired by the Contractor at no cost to the Government.

Earth ramps crossing over completed soil-cement must have a minimum compacted thickness of two (2) feet. Where ramps are constructed over soil-cement that is not to finished grade, all foreign materials and the uppermost one (1) inch of the top layer of soil-cement must be removed prior to the continuation of the soil-cement construction.

8. PLACEMENT

Soil-cement shall not be placed until the required excavations and preparation of the foundation are completed and the foundation has been inspected and approved by the Engineer.

Equipment for spreading the soil-cement mixture shall be suitable for the purpose and shall be operated in such a manner as to produce a reasonably smooth, uniform surface. The equipment shall be controllable so as to produce uniform layers not more than the specified maximum thickness. The layer of soil-cement, or each successive lift when layering is required, shall be spread and compacted as soon as possible after the preceding layer is completed and approved. Soil-cement shall be placed in horizontal layers or layers conforming to the plane of the subgrade.

If the time elapsed between completion of compaction on a layer and start of placement of the next layer is greater than two (2) hours, the Contractor shall scarify the surface to a depth of one (1) inch. The Contractor shall clean off the scarified surface thoroughly by power brooming or other approved methods prior to proceeding. The broomed surface shall then be thoroughly moistened over its entire surface before the next layer of soil-cement is placed.

Soil-cement shall not be mixed or placed when the air temperature is below 45 degrees Fahrenheit (F). Soil-cement shall not be placed on a frozen foundation, or if the soil to be processed is frozen, or if weather conditions are such that the material being processed cannot be completely compacted and protected before the onset of damaging weather (such as overnight lows below 40 degrees F, cold fronts, rainstorms, etc.). The use of accelerators or antifreeze compounds will not be allowed, unless otherwise specified. The temperature of fresh soil-cement shall not be allowed to drop below 32 degrees F for a period of 7 days. If temperatures are expected to be below 45 degrees F, the Contractor's method for protection shall be approved by the Engineer prior to placement of any soil-cement.

9. COMPACTION

(a) Equipment The Contractor may use any type of compaction equipment to obtain the specified density of the soil-cement mixture, provided such equipment does not have any projections or tamping feet which penetrate to previously compacted layers. Wheel rolling with only the hauling equipment shall not be an acceptable method of compaction.

(b) Compaction Requirements Soil-cement shall be uniformly compacted to a density not less than the minimum density specified. Optimum moisture and maximum density shall be determined by ASTM D 558. Soil Conservation Service Test No. S-6 (USBR Test E-25), Rapid Compaction Control Method, as referenced in NEH-19, may be used as equivalent to ASTM D 558. The compaction shall begin on all areas within 30 minutes after the addition of water to the soil-cement mixture. The compaction shall proceed in such a manner that the length of time

between spreading of the soil-cement mixture and completion of compaction shall not exceed 1 hour for each layer.

(c) Other Requirements If the surface of a layer of soil-cement has been rutted or compacted unduly by hauling or other equipment, the Contractor shall scarify and recompact such surfaces. When required to maintain uniformity of the layer surface, blading in connection with compaction operations shall be employed. If blading is required, raw unmixed soil shall not be bladed onto the mixed soil-cement.

10. CONSTRUCTION JOINTS

At the end of each workday, or when the adjacent placing operation is shut down for a period longer than 2 hours, a vertical construction joint shall be made along all unfinished edges of the thoroughly compacted soil-cement. Just before placing operations are resumed, the construction joint shall be shaved to remove all dry soil-cement and all curing compound from the face of the joint.

11. REMOVAL AND REPLACEMENT

Rejected or defective soil-cement shall be removed and replaced in accordance with these specifications, when:

(a) Compaction operations are interrupted for any reason prior to the completion of compaction and the soil-cement mixture is left undisturbed for more than thirty (30) minutes.

(b) The soil-cement mixture, prior to completion of compaction, becomes excessively wet so that the moisture content exceeds the specified limits.

(c) The compacted soil-cement does not meet the density and moisture requirements; except that when the moisture is lower than required, the soil-cement mixture may be reworked, thoroughly mixed and compacted within the one (1) hour time limit as stated in Section 9. (b)., Compaction Requirements.

(d) The finished surface is rough or below grade such that a thin "scab" section would be required to smooth the surface or bring the surface to grade.

12. PROTECTING AND CURING

(a) Moistening Bonding Surfaces Compacted surfaces of soil-cement that are to receive an overlying layer of soil-cement or concrete shall be kept moist, until placement of the overlying or adjacent layer of soil-cement or concrete. The Contractor will not be required to keep such surfaces moistened for longer than seven (7) days.

(b) Curing Finished Exposed Surfaces

Concrete curing compound conforming to ASTM C 309 of the type specified shall be applied at a rate of not less than one (1) gallon per 150 square feet of surface using constantly agitating, pressure spray equipment. It shall form a uniform, continous, adherent film that shall not check, crack, or peel.

Any curing membrane that is removed from the surface or damaged within seven (7) days after application shall be repaired immediately. The surfaces of each section of soil-cement to be treated with curing compound shall be moistened with a light spray or water immediately after the section has been compacted. As soon as the surface film of moisture disappears, but while the surface still has a damp appearance, the curing compound shall be applied. Special care shall be taken to insure ample coverage with the compound at edges, corners and around rough spots. After application of the curing compound has been completed and the coating is dry to the touch, any required repair of the soil-cement surfaces shall be performed. Each repair, after being finished, shall be moistened and coated with curing compound in accordance with foregoing equipments. The Contractor shall have all equipment and materials required for curing at the site ready for use before placement of soil-cement begins.

13. INSPECTION AND TESTING

The Engineer shall make such inspections and tests as necessary to verify that the soil cement materials and soil-cement in place meet the specified requirements.

All testing of soil-cement or its individual components, unless otherwise specified, will be in accordance with the latest applicable ASTM specifications. These tests are not intended to provide the Contractor with information he needs to assure that the material and workmanship meets the requirements of the specifications and their performance will not relieve the Contractor of the responsibility of performing tests for that purpose.

Tests for density and moisture will be performed at any location chosen by the Engineer. If the soil-cement does not pass the minimum moisture and density requirements specified, it shall be reworked or removed at the Contractor's expense. The Contractor shall not place any additional soil-cement until the rejected material has been removed, or reworked, and meets the density requirements specified.

14. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the quantity of soil-cement will be measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas. The quantity of soil-cement required

to fill voids resulting from overexcavation outside the neat lines or pay limits will be included in the measurement for payment where such overexcavation is directed by the Engineer to remove unsuitable foundation material, but only to the extent that the unsuitable condition is not a result of the Contractor's improper construction operations, as determined by the Engineer.

Payment for soil-cement will be made at the contract unit price per cubic yard. The payment will constitute full compensation for all labor, materials, equipment, transportation, tools and all other items necessary and incidental to completion of the work, but not including other items listed for payment elsewhere in the contract.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for items of work to which it is made subsidiary. Such payment and the items to which they are made subsidiary are identified in Section 15 of this specification.

15. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 8, Soil Cement

(1) This item shall consist of furnishing, placing, compacting, and curing an 8-inch thick section of Soil Cement as shown on the drawings.

(2) In Section 9, Compaction, the following shall apply. There shall be a minimum of three (3) passes per layer of Soil Cement of a smooth wheel or plate vibrating compactor capable of exerting a minimum dynamic force of 7000-lbs. at a rate of at least 3,500 vibratons per minute. The soil cement shall be uniformly compacted.

(3) In Section 6, Mixing, Mixing shall be performed by either method one, two, or three. The Contractor shall notify the Contracting Officer five (5) working days prior to placement of the Soil Cement, which method he proposes to use for mixing.

(4) The Contractor shall use a cement content of 10.0 percent by weight and shall verify by weight tickets to the Engineers satisfaction, that the required percentage of cement is being applied.

(5) The Contractor shall take all necessary precautions to avoid damage to the soil-cement by equipment and avoid the deposition of raw earth or other unsuitable materials between layers or within the soil-cement.

(6) Trimming and shaping of the face of the soil-cement bank protection, above the grade of the proposed dimensions, shall be conducted daily, and at the completion of each day's production, utilizing a smooth blade. As necessary or as directed by the Engineer, the surface shall be lightly scarified to prevent compaction planes.

(7) The soil-cement plating layer shall be spread evenly on the slopes by proceeding up and down the slopes and not parallel to the prevailing slope.

(8) When it is necessary to replace any soil-cement, the replacement shall be for the full depth, with vertical cuts, using either soil-cement or concrete. No skin patches will be permitted.

(9) In Section 2, Materials, The maximum rock size shall be 1-1/2". The material shall contain no more than 30 percent nor have less than 5 percent passing the No. 200 (0.075mm) sieve.

The distribution and gradation of material used for the soil cement shall be uniform and not result in lenses, pockets, streaks, or layers of material differing in texture or gradation.

(10) Portland cement shall be Type V.

(11) At the time of compaction, the moisture content shall not be more than 2 percentage points above or below optimum.

(12) The compacted layers of soil cement shall not exceed eight (8) inches nor be less than four (4) inches in thickness.

(13) In Section 12, Protecting and Curing, The curing compound shall conform to ASTM C-309 Type 1-D.

(14) In Section 14, Measurement and Payment, Payment shall include compensation for subsidiary item Excavation-Soil Cement.

MATERIAL SPECIFICATION

522. AGGREGATE FOR PORTLAND CEMENT CONCRETE

1. SCOPE

This specification covers the quality of fine aggregate and coarse aggregate for use in the manufacture of portland cement concrete.

2. QUALITY

Aggregate shall conform to the requirements of ASTM Specification C-33 for the specified sizes. Aggregates that fail to meet any requirement may be accepted only when: (1) the specified alternate conditions of acceptance can be proved prior to the use of the aggregates on the job and within a period of time such that no work under the contract will be delayed by the requirements of such proof; or, (2) the specification for concrete expressly contains a provision of special mix requirements to compensate for the effects of the deficiencies.

3. REACTIVITY WITH ALKALIES

The potential reactivity of aggregates with the alkalies in cement shall be evaluated by petrographic examination and, where applicable, the chemical method of test, ASTM Designation C 289, or by the results of previous tests or service records of concrete made from similar aggregates from the same source. The standards for evaluating potential reactivity shall be as described in ASTM Specification C 33, Appendix A1.

Aggregates indicated by any of the above to be potentially reactive shall not be used, except under one of the following conditions:

a. Applicable test results of mortar bar tests, made according to ASTM Method C 227, are available which indicate an expansion of less than 0.10 percent at six months in mortar bars made with cement containing not less than 0.8 percent alkalies expressed as sodium oxide; or

b. Concrete made from similar aggregates from the same source has been demonstrated to be sound after 3 years or more of service under conditions of exposure to moisture and weather similar to those anticipated for the concrete under these specifications.

Agregates indicated to be potentially reactive, but within acceptable limits as determined by mortar bar test results or service records, shall be used only with 'low alkali" cements, containing less than 0.60 percent alkalies expressed as sodium oxide.

4. STORING AND HANDLING

Aggregate of each class and size shall be stored and handled by methods that prevent segregation of particles sizes or contamination by intermixing with other materials.

MATERIAL SPECIFICATION

531. PORTLAND CEMENT

1. SCOPE

This specification covers the quality of portland cements.

2. QUALITY

Portland cement shall conform to the requirements of ASTM Specification C 150 for the specified types of cement, except that, when Type I portland cement is specified, Type IS portland blast-furnace slag cement or Type IP portland-pozzolan cement conforming to the requirements of ASTM Specification C 595 may be used unless prohibited in the specifications.

If air-entraining cement is to be used, the Contractor shall furnish the manufacturer's written statement giving the source, amount and brand name of the air-entraining addition.

3. STORAGE AT THE CONSTRUCTION SITE

Cement shall be stored in such a manner as to be protected from weather, dampness or other destructive agencies. Cement that is partially hydrated or otherwise damaged will be rejected.

MATERIAL SPECIFICATION

534. CURING COMPOUND (FOR CONCRETE)

1. SCOPE

This specification covers the quality of liquid membrane-forming compounds suitable for spraying on concrete surfaces to retard the loss of water during the curing process.

2. QUALITY

The curing compound shall meet the requirements of ASTM Specification C 309.

Unless otherwise specified the compound shall be Type 2.

3. DELIVERY AND STORAGE

All curing compound shall be delivered to the site of the work in the original container bearing the name of the manufacturer and the brand name. The compound shall be stored in a manner to prevent damage to the containers and to protect water-emulsion types from freezing.

MATERIAL SPECIFICATION

539. STEEL REINFORCEMENT (FOR CONCRETE)

1. SCOPE

This specification covers the quality of steel reinforcement for reinforced concrete.

2. QUALITY

All reinforcement shall be free from rust, oil, grease, paint or other deleterious matter.

Steel bars for concrete reinforcement requiring bends shall be deformed billet-steel bars conforming to ASTM Specification A 615, Grade 40 or Grade 60.

Straight steel bars shall be deformed bars conforming to one of the following specifications:

Deformed Billet-Steel Bars for Concrete Reinforcement (Grade 40 or Grade 60) - ASTM Designation A 615.

Rail-Steel Deformed Bars for Concrete Reinforcement (Grade 50 or Grade 60) - ASTM Designation A 616.

Axle-Steel Deformed Bars for Concrete Reinforcement (Grade 40 or Grade 60) - ASTM Designation A 617.

Fabricated steel bar mats shall conform to the requirements of ASTM Specification A 184.

Welded steel wire fabric reinforcement shall conform to the requirements of ASTM Specification A 185.

Welded deformed steel wire fabric for concrete reinforcement shall conform to the requirements of ASTM Specification A 497.

Cold-drawn steel wire reinforcement shall conform to the requirements of ASTM Specification A 82.

Deformed steel wire for concrete reinforcement shall conform to the requirements of ASTM Specification A 496.

3. DIMENSIONS OF WELDED WIRE FABRIC

Gauges, spacing and arrangement of wires in welded steel wire fabric shall be as defined in ACI Standard 315 of the American Concrete Institute for the specified style designations.

4. STORAGE

Steel reinforcement stored at the site of the work shall be stored above the ground surface on platforms, skids or other supports and shall be protected from mechanical injury and corrosion.