

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
3335 WEST DURANGO STREET
PHOENIX, ARIZONA 85009

LOST DUTCHMAN BOULEVARD/IDAHO ROAD INTERSECTION
AT
APACHE JUNCTION FLOOD RETARDING STRUCTURE

January 1987

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PART I

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
APACHE-BULLDOG FLOOD CONTROL PROJECT

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Ebasco
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PART II

SPECIFICATIONS

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
APACHE-BULLDOG FLOOD CONTROL PROJECT

LIST OF SPECIFICATIONS

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

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Reference Specifications

Uniform Standard Specifications for Public Works Construction, Maricopa
Association of Governments, Arizona 1979, Rev. 1985

SPECIFICATIONS/WORK STATEMENT

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

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

Unless otherwise specified, all materials removed from the cleared and grubbed areas shall be burned or buried at locations approved by the Engineer or otherwise disposed of as approved by the Engineer.

5. MEASUREMENT AND PAYMENT

The cleared and grubbed area will be measured to the nearest 0.1 acre. Payment for clearing and grubbing will be made for the total area within the designated limits at the contract unit 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 6 of this specification.

6. ITEMS OF WORK AND CONSTRUCTION DETAILS

Idaho Road and Lost Dutchman Boulevard Intersection

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

Bid Item 1, Clearing and Grubbing

- (1) This item shall consist of clearing and grubbing of all areas shown on the drawings and staked in the field.
- (2) If waste materials are disposed by burying, they shall be buried a minimum of 18 inches below the existing ground surface in the waste disposal areas shown on Drawing 1-3. When disposal is complete, the waste disposal areas shall be smoothed and graded to blend into the surrounding terrain.
- (3) If materials removed from the cleared and grubbed area are to be burned, burning must be carried out in accordance with Pinal and Maricopa County Health Department regulations.
- (4) Compensation for Subsidiary Item, Structure Removal, will be included in this bid item.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

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

Each structure unit to be removed will be marked by means of stakes, flags, painted markers or other suitable methods.

3. REMOVAL

All structures designated in the contract for removal 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

Unless otherwise specified, refuse materials resulting from structure removal shall be burned or buried at locations approved by the Engineer or otherwise disposed of as specified or as

6. 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 7 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Idaho Road and Lost Dutchman Boulevard Intersection

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

Subsidiary Item, Structure Removal

- (1) This item shall consist of the removal, salvage and disposal, as directed by the Flood Control District of Maricopa County, of the following:
 - (a) Fences,
 - (b) Buildings.
- (2) In Section 3, Removal, items as listed in Section 1 shall be removed with minimal disturbance to soil and vegetation.
- (3) Disposal of materials covered under this item shall be made to Waste Disposal Areas shown on Drawing 1-3, unless otherwise directed by FCD.
- (4) No separate payment will be made for this item. Compensation for this work will be included in Bid Item 1.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

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 - Seeding to protect disturbed areas shall be used 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 - Stream crossings shall be used where fording of streams by equipment is necessary.

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.

(5-2)

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 tanks or barrels or construct a sump sealed with plastic sheets to be used to dispose of chemical pollutants produced as a by-product of the project's work such as drained lubricating or transmission oils, greases, soaps, asphalt, etc. At the completion of the construction work, the sump shall be covered or filled as directed by the Engineer. Storage tanks or barrels shall be removed from the site.

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.

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 as shown on the drawings.

All public access or haul roads used during construction of the project shall be sprinkled with water as required to fully suppress dust.

6. MAINTENANCE REMOVAL AND RESTORATION

All 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 to original conditions as practicable as directed by the Engineer.

7. MEASUREMENT AND PAYMENT

Compensation for 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.

(5-3)

8. ITEMS OF WORK AND CONSTRUCTION DETAILS Idaho Road and Lost Dutchman
Boulevard Intersection

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

Subsidiary Item, Pollution Control

- (1) This item shall consist of all measures required to control dust, erosion, sedimentation or any other form of pollution resulting from the Contractor's activities in constructing the project.
- (2) No separate payment will be made for this item. Compensation for this work will be included in the payment for Bid Item 3.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

7 SURVEYS

1. SCOPE

This work shall consist of performing all surveys required for construction layout and quantity measurements, including the furnishing of equipment and materials.

2. EQUIPMENT AND MATERIALS

Equipment for surveys shall be of sufficient quality and condition to provide the accuracy required. Equipment shall be in good condition and in proper adjustment at all times.

Materials shall include all stakes, spikes, steel pins, tools and other accessories as may be required in laying out any part of the work from the primary control points established by the Government.

3. QUALITY OF WORK

Surveys shall be certified by a Registered Land Surveyor and shall be performed to a degree of accuracy and detail compatible with location and position data, work tolerances, and measurement units for payment specified in the drawing and specifications and in accordance with good engineering practices.

All work shall be performed in a workmanlike manner. Notes, sketches, and other data shall be complete, recorded neatly, and organized in a manner that will allow reproduction of copies and incorporation in reports with a minimum of editing and revision.

Bench level traverses shall be of such precision that the error of closure (in feet) shall not exceed plus or minus 0.1 times the square root of the length of the traverse (in miles). The elevations of points on profiles and cross sections shall be determined and recorded to the nearest 0.1 foot.

Transit traverses shall be of such precision that: (1) the linear error of closure shall not exceed one in 3,000 and (2) the angular error of closure shall not exceed one minute times the square root of the number of stations.

Surveys will be reviewed periodically and be subject to random spot checks by the Government to assure that quality is being maintained.

4. PRIMARY CONTROL

The primary control required to establish the lines and grades needed for construction will be furnished by the Government. The control will consist of bench marks and reference points set at approximately 500-foot intervals.

In case of damage to or destruction of any of the Government's primary control points by the Contractor's forces they will be replaced by the Government at the Contractor's expense. The actual cost to the Government of replacing primary control points will be deducted from the payments due to the Contractor.

Complete information concerning the primary control system will be provided to the Contractor immediately following the receipt of the notice to proceed.

5. CONSTRUCTION SURVEYS AND MEASUREMENTS

Primary control points and bench marks shall be used as the origin of surveys needed to establish lines and grades for construction.

All survey data shall be recorded in bound field notebooks furnished by the Government with consecutively numbered pages. These books shall be turned over to and become the property of the Government upon completion of the work, prior to the preparation of the final pay estimate. All entries shall be legible and follow the format specified in Section 9. The bound field notebooks shall be available at all times during the progress of the work for examination and use by the Government.

Where pay limits are specified, sufficient cross sections shall be taken to verify and document that the works have been completed in accordance with the plans and specifications. Maximum spacing of cross sections for quantity computations shall vary from 200 feet in areas of even topography to 25 feet or less in areas of uneven topography (influenced by hills, washes, ridges, etc.). The surveyor shall submit a list of stations for cross sections to the Government Representative for review and approval.

Surveys (including cross sections) and measurements shall be taken prior to and after construction at each location for each bid item that requires measurement. Sufficient surveys and measurements shall be performed to document the monthly pay estimates. All cross sections are to be taken at the same stations as the original surveys.

Survey information needed for "AS-BUILT" construction drawings and monthly pay estimates and progress reports will be kept current as work progresses and will be made available to the Government by the 25th of each month.

6. STAKING

The location and marking of all stakes shall be as specified in Section 9 and as follows:

- a. Clearing and grubbing - The boundary of the clearing and grubbing areas shall be staked or flagged at 300-foot intervals, or less if needed to clearly mark the work to be done.
- b. Excavation - Cut stakes shall be placed on the centerline and the intersection of the side slopes and natural ground line. All stakes shall have the required cut, distance, slope, and stationing, plus offset reference stakes.
- c. Earth Fill - Fill stakes shall be placed at the toe of the slope and shall have the required fill, distance, slope and stationing, plus offset reference stakes.
- d. Structures - Centerline stakes for location and alignment and elevation offset reference stakes and hubs for apron, sidewalls and upstream headwall.

Cut and fill stakes shall be placed at full stations, breaks in the original ground surface and at other intermediate stations as necessary to insure accurate determination of payment quantities.

Stakes and cross sections shall be at right angles to the centerline. Rod and chain readings shall be taken at all breaks in topography for the full extent of the cross section. Chain distances shall be taken horizontally and rod readings shall be taken vertically and shall be recorded to the nearest 0.1 foot, except that subgrade for structures shall be to the nearest 0.01 foot.

7. AS-BUILT

Cross sections shall be taken on all earth fill and excavation areas before construction begins, after excavation and in advance of placing any earth fill.

Final cross sections of excavation and earth fill shall be taken after finish operations are completed to determine compliance.

8. PAYMENT

Payment will be made as the work proceeds, after presentation of invoices by the contractor showing his surveying costs and evidence of the charges for suppliers, and for subcontractors, for the survey work performed by them. If the total of such payments is less than the contract lump sum for surveys, the unpaid balance will be included in the final contract payment. Total payment will be the lump sum contract 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 residual value, the purchase costs of operating supplies, or for other survey type work such as grade checking which shall be included in the prices bid for the items of work for which such surveys are required.

Payment of the lump sum contract price for surveys will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to 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 or work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 9 of this specification.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

Idaho Road and Lost Dutchman Boulevard Intersection

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

(a) Bid Item 10, 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) The Contractor shall provide the Contracting Officer a statement of qualifications, including specific experience of each of the survey personnel assigned to the job.
- (3) The Contractor shall provide the Contracting Officer a schedule of surveys to be performed each month.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

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.

It shall include the purchase of contract bonds; transportation of personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary facilities at the site, and other preparatory work at the site.

It 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 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 price 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.

(8-2)

3. ITEMS OF WORK AND CONSTRUCTION DETAILS - Idaho Road and Lost Dutchman Boulevard Intersection

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

Bid Item 2, Mobilization

This item shall consist of the mobilization of the Contractor's equipment and forces for construction of all work required under this contract.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

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.

6. MEASUREMENT AND PAYMENT

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

(10-2)

Except as otherwise specified, the measurement for payment will include all water needed at the construction site to perform the work required under this portion of 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 which shall be the price per 1000 gallons shown in the Bid Schedule. 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

Idaho Road and Lost Dutchman Boulevard Intersection

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

Bid Item 3, Water

- (1) This item shall consist of furnishing and applying all water necessary for performance of the work described in this portion of the contract.
- (2) Measurement and payment will be based on metered quantity of water.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

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 drainage way in which its headworks are located.

Unless otherwise specified, the Contractor shall furnish to the Engineer, 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 Engineer, 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.

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 Engineer.

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.

(11-3)

8. ITEMS OF WORK AND CONSTRUCTION DETAILS - Idhao Road and Lost Dutchman Boulevard Intersection

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, ground and construction water or direct rainfall from the construction area as needed.
- (2) The Contractor's plans for control of surface water and any dewatering necessitated by rainfall or runoff into construction areas shall be furnished to the Engineer prior to performance of any excavation or earthfill work.
- (3) No separate payment will be made for the Removal of Water. Compensation for this work will be included in the payment for Bid Items 4.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

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 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. If the drawings or specifications require or the Engineer directs that fill be placed at a higher level in one part of an embankment than another, the top surface of each part shall be maintained as specified above.
- 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 loose material, and shall be scarified, moistened and recompactd 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 in the junction 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 diskling.

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 be scarified and moistened by sprinkling to an acceptable moisture content prior to placement of the next layer of fill.

6. 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.

Fill adjacent to structures shall be compacted to a density equivalent to that of the surrounding fill by means of hand tamping if permitted by the Contracting Officer, 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.

<u>Structure</u>	<u>Time Interval</u>
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
Antiseep collars and 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, 2167, 2922 or 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. Moisture content will be determined by one of the following methods: ASTM Method D-2216, D-3017 unless otherwise specified.

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 the measured surface of the foundation when approved for placement of the fill and the specified neat lines of the fill surface.

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 payment for the item of work to which it is made subsidiary. Such items and the items to which they are identified in Section 10 of this specification.

10. ITEMS OF WORK AND CONSTRUCTION DETAILS

Idaho Road and Lost Dutchman Boulevard Intersection

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

(a) Bid Item 4, Earthfill

- (1) This item consists of all earthfill required to construct the:

Road ramps associated with intersection of Idaho Road and Lost Dutchman Boulevard at the Apache Junction Flood Retarding Structure (FRS) as shown on the drawings.

- (2) All earthfill shall be obtained from the required excavations and the borrow area and shall meet the following gradation requirements:

Sieve Size	% Passing By Weight
6"	100
#4	75-100
#200	15-60

Gradations will be determined by ASTM C-136. For per cent of fines greater than size 200, they will be determined by ASTM C-117.

- (3) The maximum thickness of layer prior to compaction shall be nine (9) inches.
- (4) The moisture content of the fill material at the time of compaction shall not be less than 2% below nor more than 2% above optimum moisture content as determined by ASTM D2216-80 with the drying oven controlled at 110 plus or minus 5 degrees Celsius.
- (5) Compaction shall be as specified in Section 6. The fill matrix shall be compacted to at least 95 percent of the maximum density obtained from compaction tests performed by Method C, ASTM D698 or the rapid compaction test (Test No. S-6, SCS Reference NEH Section 19).
- (6) Measurement and payment will be as specified in Section 9 and will include Compensation for Subsidiary Items, Removal of Water, Borrow Excavation and Pollution Control.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

24. DRAINFILL/BEDDING

1. SCOPE

The work shall consist of furnishing, placing and compacting drainfill required in the construction of structure drainage systems.

2. MATERIALS

Drainfill materials shall conform to the requirements of Material Specification 521. At least 30 days prior to the delivery of the materials to the site the Contractor shall inform the Contracting Officer in writing of the source from which he intends to obtain them. The Contractor shall provide the Engineer free access to the source for the purpose of obtaining samples for testing.

3. BASE PREPARATION

Foundation surfaces and trenches shall be clean and free of organic matter, loose soil, foreign substance, and standing water when the drainfill is placed. Earth surfaces upon or against which drainfill will be placed shall not be scarified.

4. PLACEMENT

Drainfill shall not be placed until the subgrade has been inspected and approved by the Engineer. Drainfill shall not be placed over or around pipe or drain tile until the installation of the pipe or tile has been inspected and approved.

Drainfill shall be placed uniformly in layers not more than 12 inches deep before compaction. When compaction is accomplished by manually controlled equipment, the layers shall be not more than 8 inches deep. The material shall be placed in a manner to avoid segregation of particle sizes and to insure the continuity and integrity of all zones. No foreign materials shall be allowed to become intermixed with or otherwise contaminate the drainfill.

Traffic shall not be allowed to cross over drains at random. Equipment crossovers shall be maintained, and the number and location of such crossovers shall be established and approved prior to the beginning of drainfill placement. Each crossover shall be cleaned of all contaminating materials and shall be inspected and approved by the Engineer before additional drainfill is placed.

The upper surface of drainfill constructed concurrently with adjacent zones of earthfill shall be maintained at an elevation at least one foot above the upper surface of the adjacent fill.

5. CONTROL OF MOISTURE

The moisture content of drainfill materials shall be controlled as specified in Section 9. When the addition of water is required, it shall be applied in such a way as to avoid excessive wetting to adjacent earth fill. Except as specified in Section 9, control of moisture content will not be required.

The upper surface of drainfill constructed concurrently with adjacent zones of earthfill shall be maintained at an elevation at least one foot above the upper surface of the adjacent fill.

6. COMPACTION

Drainfill shall be compacted as specified in Section 9.

Heavy equipment shall not be operated within 2 feet of any structure. Vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from cranes or hoists will not be permitted.

7. TESTING

The Engineer will perform such tests as are required to verify that the drainfill materials and the drainfill in place meet the requirements of the specifications. These tests are not intended to provide the Contractor with information he needs to assure that the materials and workmanship meet the requirements of the specifications, and their performance will not relieve the Contractor of the responsibility of performing his own tests for that purpose.

8. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of drainfill within the neat lines shown on the drawings or limits established by the Engineer will be measured and computed to the nearest cubic yard. Where the Engineer directs placement of drainfill outside the neat lines to replace unsuitable foundation material, the volume of such drainfill will be included, but only to the extent that the unsuitable condition is not a result of the Contractor's operations.

Payment for drainfill will be made at the contract unit price for each type of drainfill, complete in place. Except as otherwise specified in Section 9, such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance 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. Such items and the items to which they are made subsidiary are identified in Section 9 of this specification.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

Idaho Road and Lost Dutchman Boulevard Intersection

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

(b) Bid Item 5, Drainfill/Bedding

- (1) This item consists of furnishing and installing the Drainfill material necessary to construct the:

Drainfill portion of the drainage and bedding systems under the corrugated steel pipe culverts, as shown on the drawings.

- (2) The Drainfill material shall be well graded within the following limits of gradation:

Sieve Size	% Passing By Weight
2"	100
3/4"	90-100
1/2"	60-100
3/8"	40-80
#4	5-25
#10	0-8
#20	0-5

- (3) The Drainfill material shall contain sufficient moisture to permit placing with minimum segregation.
- (4) No compaction is required beyond that resulting from the placing and spreading operations.
- (5) Measurement and payment will be as specified in Section 8.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

31. CONCRETE

1. SCOPE

The work shall consist of furnishing, forming, placing, finishing and curing portland cement concrete as required to build the structures designated in Section 26 of this specification.

2. MATERIALS

Portland cement shall conform to the requirements of Material Specification 531 for the specified type. One brand only of any type of cement shall be used in any single structure as defined in Section 26.

Aggregates shall conform to the requirements of Material Specification 522 unless otherwise specified. The grading of coarse aggregates shall be as specified in Section 26.

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

Air entraining admixtures shall conform to the requirements of Material Specification 532. If air-entraining cement is used, any additional air-entraining admixture shall be of the same type as that in the cement.

Pozzolan shall conform to ASTM C618, Class F except the loss of ignition shall not exceed 3.0 percent.

Water-reducing, set-retarding admixture shall conform to the requirements of Material Specification 533.

Shear plates shall conform to the requirements of Material Specification 581 for structural quality or commercial or merchant quality steel. Structural quality shall be used if specifically designated in the drawings or specifications.

Preformed expansion joint filler shall conform to the requirements of Material Specification 535.

Waterstops shall conform to the requirements of Material Specifications 537 and 538 for the specified kinds.

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

3. Concrete shall be classified as follows:

<u>Class of Concrete</u>	<u>Water Content (gallons/bag)</u>	<u>Cement Content (bag/cu. yd.)</u>
5000X	5	7
4000X	6	6
3000X	7	5
2500X	8	4-1/2

4. AIR CONTENT AND CONSISTENCY

The air content (by volume) of the concrete at the time of placement shall be:

<u>Maximum Size Aggregate</u>	<u>Air Content (%)</u>
3/8 inch to 1/2 inch	6 to 9
Over 1/2 inch to 1 inch	5 to 8
Over 1 inch to 2-1/2 inches	4 to 7

The consistency of the concrete shall be such as to allow it to be worked into place without segregation or excessive laitance. Unless otherwise specified, the slump shall be:

<u>Type of Structure</u>	<u>Slump (inches)</u>
Massive sections, pavements, footings	2 ± 1/2
Heavy beams, thick slabs, thick walls (over 12 in.)	3 ± 1/2
Columns, light beams, thin slabs, thin walls (12 in. or less)	4 ± 1

5. DESIGN OF THE CONCRETE MIX

At least 35 days prior to any placement of concrete the Contractor shall inform the Contracting Officer in writing of the source and grading of aggregates and the brand and type of cement and the brand and type of admixture, if any, he proposes to use for each class of concrete, and shall

furnish certifications or other evidence satisfactory to the Engineer that the proposed materials meet the requirements of the specifications.

When acceptable sources, types and gradings of aggregates are designated in the contract, certification for such aggregates will not be required.

Job mix proportions and batch weights will be determined by the Engineer. During the course of the work, the Engineer will adjust the job mix proportions and batch weights whenever necessary.

After the job mix has been designated, neither the source, character or grading of the aggregates nor the type or brand of cement or admixture shall be changed without prior notice to the Engineer.

If such changes are necessary, no concrete containing such new or altered materials shall be placed until the Engineer has designated a revised job mix.

When specified, a water-reducing, set-retarding admixture shall be used. When conditions are such that the temperature of the concrete at the time of placement is consistently above 75°F, a water-reducing, set-retarding admixture may be used, at the option of the Contractor. The cement content shall be the same as that required in the mix without the admixture.

The use of calcium chloride or other accelerators or antifreeze compounds will not be allowed.

When it is anticipated that a water-reducing, set-retarding admixture will be used, the Contractor shall furnish to the Engineer a sample of the admixture he proposes to use sufficient for the tests required by Material Specification 533, Section 4. Concrete containing the admixture shall not be placed until test results have been obtained showing that its performance in the job mix meets the requirements of Material Specification 533, Section 4.

6. INSPECTING AND TESTING

The following tests will be performed by the methods indicated:

<u>Test</u>	<u>Method (ASTM) Designation)</u>
Sampling	172 ¹
Slump Test	C 143 ¹
Air Content	C 231 ¹ or C 713 ¹
Compression Test Specimens	C 31 ¹ or C 42
Compressive Strength	C 39 ² , C 42 or C 684 ²
Unit Weight	C 138

1 Test of a portion of a batch may be made on samples representative of that portion for any of the following purposes:

- (1) Determining uniformity of the batch.
- (2) Checking compliance with requirements for slump and air content when the batch is discharged over an extended period of time.
- (3) Checking compliance of the concrete with the specifications when the whole amount being placed in a small structure, or a distinct portion of a larger structure, is less than a full batch.

For each strength test of specimens made according to ASTM Designation C 39, 3 standard test specimens shall be made. The test result shall be the average of the strength of the 3 specimens, except that if one specimen in the test shows manifest evidence of improper sampling, molding or testing, it shall be discarded and the strengths of the remaining 2 specimens shall be averaged. Should more than one specimen representing a test show such defects, the entire test shall be discarded.

The Engineer shall have free entry to the plant and equipment furnishing concrete under the contract. Proper facilities shall be provided for the

Engineer to inspect materials, equipment and processes, to obtain samples of the concrete. All tests and inspections will be conducted so as not to interfere unnecessarily with the manufacture and delivery of the concrete.

7. HANDLING AND MEASUREMENT OF MATERIALS

Aggregates shall be stored or stockpiled in such a manner that separation of coarse and fine particles of each size will be avoided and that various sizes will not become intermixed before proportioning. Methods of handling and transporting aggregates shall be such as to avoid contamination, excessive breakage, segregation or degradation, or intermingling of various sizes.

Scales for weighing aggregates and cement shall be beam type or springless dial type. They shall be accurate within 1 percent under operating conditions. All exposed fulcrums, clevises and similar working parts of scales shall be kept clean.

The quantities of cement and aggregates in each batch of concrete, as indicated by the scales, shall be within the following percentage of the required batch weights:

Cement	plus or minus 1.0 percent
Aggregates	plus or minus 2.0 percent

Measuring tanks for mixing water shall be of adequate capacity to furnish the maximum amount of mixing water required per batch and shall be equipped with outside taps and valves to provide for checking their calibration unless other means are provided for readily and accurately determining the amount of water in the tank.

Except as otherwise provided in Section 8, cement and aggregates shall be measured as follows:

Cement shall be measured by weight or in bags of 94 lbs. each. When cement is measured by weight, it shall be weighed on a scale separate from that used for other materials, and in a hopper entirely free and independent of the hopper used for weighing the aggregates. When cement is measured in bags, no fraction of a bag shall be used unless weighed.

Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weights. The batch weight of each aggregate shall be the required saturated, surface-dry weight corrected by the weight of surface moisture it contains.

Mixing water shall consist of water added to the batch, ice added to the batch, water occurring as surface moisture on the aggregates and water introduced in the form of admixtures. The added water shall be measured by weight or volume to an accuracy of 1 percent of the required total mixing water. Added ice shall be measured by weight. Wash water shall not be used as a portion of the mixing water for succeeding batches.

Dry admixtures shall be measured by weight, and paste or liquid admixtures by weight or volume, within a limit of accuracy of 3 percent.

8. MIXERS AND MIXING

Mixers and mixing shall be in accordance with recommended standards set forth in ACI 304, some specific interpretations of which are stated below.

Concrete may be furnished by batch mixing at the site of the work or by ready-mix methods.

Mixers shall be capable of thoroughly mixing the concrete ingredients into a uniform mass within the specified mixing time and of discharging the mix without segregation. Each mixer or agitator shall bear a manufacturer's rating plate indicating the rated capacity and recommended speeds of rotation, and shall be operated in accordance with these recommendations.

Concrete shall be uniform and thoroughly mixed when delivered to the forms. Variations in slump of more than 1 inch within a batch will be considered evidence of inadequate mixing and shall be corrected by changing batching procedures, increasing mixing time, changing mixers or other means. Mixing time shall be within the limits specified below unless the Contractor demonstrates by mixer performance tests that adequate uniformity is obtained by different times of mixing.

No mixing water in excess of the amount called for by the job mix shall be added to the concrete during mixing or hauling or after arrival at the delivery point. If less water than the design maximum water-cement ratio has been incorporated in the batch, water to compensate for up to 1-inch loss in slump may be added, up to the design maximum water cement ratio. Withholding some of the mixing water until the concrete arrives on the job, then adding the remaining water and turning the mixer 30 revolutions at mixing speed may overcome transporting conditions. When loss of slump or workability cannot be offset by these measures, complete mixing shall be performed on the job using centrally dry batched materials, or by on site batching and mixing.

Batch mixing at the site. For concrete mixed at the site of the work with paving mixers or stationary construction mixers, the time of mixing after all cement and aggregates are in the mixer drum shall be not less than 1-1/2 minutes. The batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates and all mixing water shall be introduced into the drum before one-fourth of the mixing time has elapsed.

Control shall be provided to insure that the batch cannot be discharged until the required time has elapsed.

If truck mixers are used, the requirements below for truck mixers and truck-mixed concrete shall apply

Volumetric batching and continuous mixing at the site. Volumetric batching and continuous mixing at the construction site will be permitted if approved by the Contracting Officer. The batching and mixing equipment shall conform to the requirements of ASTM Specification C 685 and shall be demonstrated prior to placement of concrete, by tests with the job mix, to produce concrete meeting the specified proportioning and uniformity requirements. Concrete made by this method shall be produced, inspected, and certified in conformance with Sections 6, 7, 8, 13, and 14 of ASTM Specification C 685.

Ready-mixed concrete. Ready-mixed concrete shall be mixed and delivered to the site of the work by one of the following methods:

- a. Truck-mixed concrete--Mixed completely in a truck mixer.
- b. Shrinked-mixed concrete.--Mixed partially in a stationary mixer, and the mixing completed in a truck mixer.
- c. Central-mixed concrete.--Completely in a stationary mixer and the mixed concrete transported to the point of delivery in a truck agitator or in a truck mixer operating at agitating speed or in nonagitating equipment.

Truck mixers and agitators shall be equipped with revolution counters by which the number of revolutions of the drum or blades may be readily verified.

When ready-mixed concrete is furnished, the Contractor shall furnish the Engineer a statement-of-delivery ticket showing the time of loading, the revolution counter reading at the time of loading and the quantities of materials used for each load of concrete.

Truck-mixed concrete. When concrete is mixed in a truck mixer loaded to its maximum capacity, the number of revolutions of the drum or blades at mixing speed shall be not less than 70 nor more than 100. If the batch is at least 1/2 cubic yard less than maximum capacity, the number of revolutions at mixing speed may be reduced to not less than 50. Mixing in excess of 100 revolutions shall be at the speed designated by the manufacturer of the equipment as agitating speed. The mixing operation shall begin within 30 minutes after the cement has been added to the aggregates and the water shall be added during mixing. When mixing is begun during or immediately after charging, a portion of the mixing water shall be added ahead of, or with, the other ingredients.

Shrink-mixed concrete. When concrete is partially mixed at a central plant and the mixing is completed in a truck mixer, the mixing time in the central plant mixer shall be the minimum required to intermingle the ingredients and shall be not less than 30 seconds. The mixing shall be completed in a truck mixer and the number of revolutions of the drum or blades at mixing speed shall be not less than 50 nor more than 100. Mixing in excess of 100 revolutions shall be at the speed designated by the manufacturer of the equipment as agitating speed.

Central-mixed concrete. For central-mixed concrete, mixing in the stationary mixer shall meet the same requirements as batch mixing at the site.

When an agitator, or truck mixer used as an agitator, transports concrete that has been completely mixed in a stationary mixer, mixing during transportation shall be at the speed designated by the manufacturer of the equipment as agitating speed.

The use of nonagitating equipment to transport concrete to the site of the work will be permitted only if the consistency and uniformity of the concrete as

discharged at the point of delivery meet the requirements of this specification. Bodies of nonagitating hauling equipment shall be so constructed that leakage of the concrete mix, or any part thereof will not occur. Concrete hauled in open-top vehicles shall be protected from rain, and from more than 20 minutes exposure to the sun when the air temperature is above 75°F.

9. FORMS

Forms shall be of wood, plywood, steel or other approved material and shall be mortar tight. The forms and associated falsework shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Form surfaces shall be smooth and free from holes, dents, sags or other irregularities. Forms shall be coated with a nonstaining form oil before being set into place.

Metal ties or anchorages within the forms shall be equipped with cones, she-bolts or other devices that permit their removal to a depth of at least one inch without injury to the concrete. Ties designed to break off below the surface of the concrete shall not be used without cones.

All edges that will be exposed shall be chamfered, unless finished with molding tools as specified in Section 20.

10. PREPARATION OF FORMS AND SUBGRADE

Prior to placement of concrete, the forms and subgrade shall be free of chips, sawdust, debris, water, ice, snow, extraneous oil, mortar, or other harmful substances or coatings. Any oil on the reinforcing steel or other surfaces required to be bonded to the concrete shall be removed.

Rock surfaces shall be cleaned by air-water cutting, wet sand blasting or wire brush scrubbing, as necessary, and shall be wetted immediately prior to placement of concrete. Earth surfaces shall be firm and damp. Placement of concrete on mud, dried earth, uncompacted fill or frozen subgrade will not be permitted. All ice, snow and frost shall be removed and the temperature of all surfaces to be in contact with the new concrete shall be no colder than 40°F.

Items to be embedded in the concrete shall be positioned accurately and anchored firmly.

Weepholes in walls or slabs shall be formed with nonferrous materials.

11. CONVEYING

Concrete shall be delivered to the site and discharged into the forms within

1-1/2 hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85°F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes.

The Engineer may allow a longer time, provided the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case, concrete shall be conveyed from the mixer to the forms as rapidly as practicable, by methods that will prevent segregation of the aggregates or loss of mortar.

12. PLACING

Concrete shall not be placed until the subgrade, forms and steel reinforcement have been inspected and approved.

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

No concrete 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 concrete. Such notice shall be far enough in advance to give the Engineer adequate time to inspect the subgrade, forms, steel reinforcement and other preparations for compliance with specifications. Other preparations include but are not limited to the concrete batching plant, mixing and delivery equipment and system, placing and finishing equipment and system, schedule of work, work force and heating or cooling facilities as applicable. All deficiencies are to be corrected before concrete is delivered for placing.

The concrete shall be deposited as closely as possible to its final position in the forms and shall be worked into the corners and angles of the forms and around all reinforcement and embedded items in a manner to prevent segregation of aggregates or excessive laitance. The depositing of concrete shall be regulated so that the concrete can be consolidated with a minimum of lateral movement.

Concrete shall not be dropped more than 5 feet vertically unless suitable equipment is used to prevent segregation.

13. LAYERS

Unless otherwise specified, slab concrete shall be placed to design thickness in one continuous layer. Formed concrete shall be placed in horizontal layers not more than 20 inches thick. Hoppers and chutes, pipes

or "elephant trunks" shall be used as necessary to prevent splashing of mortar on the forms and reinforcing steel above the layer being placed.

Successive layers shall be placed at a fast enough rate to prevent the formation of "cold joints". If the surface of a layer of concrete in place sets to the degree that it will not flow and merge with the succeeding layer when vibrated, the Contractor shall discontinue placing concrete and shall make a construction joint according to the procedure specified in Section 15.

If placing is discontinued when an incomplete layer is in place, the unfinished end of the layer shall be formed by a vertical bulkhead.

14. CONSOLIDATING

Unless otherwise specified, concrete shall be consolidated with internal type mechanical vibrators capable of transmitting vibration to the concrete at frequencies not less than 6000 impulses per minute.

The location, manner and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete without causing segregation of the mortar and coarse aggregate, and without causing water or cement paste to flush to the surface.

The Contractor shall provide a sufficient number of vibrators to properly consolidate the concrete immediately after it is placed in the work. Vibration shall be applied to the freshly deposited concrete by slowly inserting and removing the vibrator at points uniformly spaced and not farther apart than twice the radius over which the vibration is visibly effective. The vibrator shall extend into the previously placed layer of fresh concrete, at all points, to insure effective bond between layers.

Vibration shall not be applied directly to the reinforcement steel or the forms nor to concrete that has hardened to the degree that it does not become plastic when vibrated.

The use of vibrators to transport concrete in the forms or conveying equipment will not be permitted.

Vibration shall be supplemented by spading and hand tamping as necessary to insure smooth and dense concrete along form surfaces, in corners and around embedded items.

15. CONSTRUCTION JOINTS

Construction joints shall be made at the locations shown on the drawings.

If construction joints are needed which are not shown on the drawings, they shall be placed in locations approved by the Engineer.

Where a feather edge would be produced at a construction joint, as in the top surface of a sloping wall, an insert form shall be used so that the resulting edge thickness on either side of the joint is not less than 6 inches.

In walls and columns as each lift is completed, the top surfaces shall be immediately and carefully protected from any condition that might adversely affect the hardening of the concrete.

Steel tying and form construction adjacent to concrete in place shall not be started until the concrete has cured at least 12 hours. Before new concrete is deposited on or against concrete that has hardened, the forms shall be retightened. New concrete shall not be placed until the hardened concrete has cured at least 12 hours.

Surfaces of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coatings, stains or debris by either wet sandblasting after the concrete has gained sufficient strength to resist excessive cutting, or air-water cutting as soon as the concrete has hardened sufficiently to prevent the jet from displacing the coarse aggregates, or both. The surface of the concrete in place shall be cut to expose clean, sound aggregate but not so deep as to undercut the edges of larger particles of the aggregate. After cutting, the surface shall be thoroughly washed to remove all loose material. If the surface is congested by reinforcing steel, is relatively inaccessible, or it is considered undesirable to disturb the concrete before it is hardened, cleaning of the joint by air-waterjets will not be permitted and the wet sandblasting method will be required after the concrete has hardened.

The surfaces shall be kept moist for at least one hour prior to placement of new concrete. The new concrete shall be placed directly on the cleaned and washed surface.

Method 2 Surfaces of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coatings, stains, or debris by washing and scrubbing with a wire brush or wire broom or by other means approved by the Engineer. The surfaces shall be kept moist for at least one hour prior to placement of new concrete. The new concrete shall be placed directly on the cleaned and washed surface.

16. EXPANSION AND CONTRACTION JOINTS

Expansion and contraction joints shall be made only at locations shown on the drawings.

Exposed concrete edges at expansion and contraction joints shall be carefully tooled or chamfered, and the joints shall be free of mortar and concrete. Joint filler shall be left exposed for its full length with clean and true edges.

When open joints or weakened plane "dummy" joints are specified, the joints shall be constructed by the insertion and subsequent removal of a wood strip, metal plate or other suitable template in such a manner that the corners of the concrete will not be chipped or broken. The edges of the concrete at the joints shall be finished with an edging tool prior to removal of the joint strips.

Preformed expansion joint filler shall be held firmly in the correct position as the concrete is placed.

17. WATERSTOPS

Waterstops shall be held firmly in the correct position as the concrete is placed. Joints in metal waterstops shall be brazed or welded. Joints in rubber or plastic waterstops shall be cemented, welded or vulcanized as recommended by the manufacturer.

18. REMOVAL OF FORMS

Forms shall be removed only when the Engineer is present and shall not be removed without his approval. Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that will permit the concrete to take the stresses due to its own weight uniformly and gradually.

Method 1 Forms shall not be removed sooner than the following minimum times after the concrete is placed. These periods represent the cumulative number of days and fractions of days, not necessarily consecutive, during which the temperature of the air adjacent to the concrete is above 50°F.

<u>Element</u>	<u>Time</u>
Beams, arches - supporting forms and shoring	14 days
Conduits, deck slabs - supporting (inside) forms and shoring	7 days
Conduits (outside forms), sides of beams, small structures	24 hours
Columns, walls, spillway riser - with side or	

vertical load	7 days
Columns, walls, spillway riser - with no side or vertical load.	7 days
Concrete supporting more than 30 feet of wall in place above it	7 days
Concrete supporting 20 to 30 feet of wall in place above it ¹	3 days
Concrete supporting not more than 20 feet of wall in place above it ¹	24 hours

¹ Age of stripped concrete shall be at least 7 days before any load is applied other than the weight of the column or wall, forms and scaffolds for succeeding lifts.

Method 2 Forms, supports and housings shall not be removed until the concrete has attained the strength specified in Section 26 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 form removal time.

19. FINISHING FORMED SURFACES

All concrete surfaces shall be true and even, and shall be free from open or rough spaces, depressions or projections.

Immediately after the removal of forms:

All bulges, fins, form marks or other irregularities which in the judgment of the Engineer will adversely affect the appearance or function of the structure shall be removed. All form bolts and ties shall be removed to a depth at least 1 inch below the surface of the concrete. The cavities produced by form ties and all other holes of similar size and depth shall be thoroughly cleaned and, after the interior surfaces have been kept continuously wet for at least 3 hours, shall be carefully packed with a dry patching mortar mixed not richer than 1 part cement to 3 parts sand. Patching mortar shall be mixed in advance and allowed to stand without addition of water until it has reached the stiffest consistency that will permit placing. Manipulation of the mortar with a trowel during this period shall be performed as required to insure the proper consistency.

Holes left by form bolts or straps which pass through the wall shall be filled solid with mortar.

Patching mortar shall be thoroughly compacted into place to form a dense, well-bonded unit, and the in-place mortar shall be sound and free from shrinkage cracks.

All repaired areas shall be cured as specified in Section 21.

20. FINISHING UNFORMED SURFACES

All exposed surfaces of the concrete shall be accurately screeded to grade and then float finished.

After placing and consolidating the concrete, all exposed surfaces shall be accurately struck off to grade. Following strike-off, the surfaces shall be immediately smoothed by darbying or bull floating before any free water has bled to the surface. The concrete will then be allowed to rest until the bleed water and water sheen has left the surface and the concrete has stiffened to where it will sustain foot pressure with only about 1/4 inch (6 mm) indentation. At this time all joints and edges that will be exposed to view that are not chamfered shall be finished with edging and/or molding tools. After edging and hand-jointing is complete, all exposed surfaces shall be floated with wood or magnesium floats. The floating should work the concrete no more than necessary to remove screed, edger and jointer marks and produce a compact surface, uniform in texture.

Joints and edges on unformed surfaces shall be chamfered or finished with molding tools.

21. CURING

Concrete shall be cured in accordance with the recommended practice of ACI 308, of which some specific interpretations are set forth below.

Concrete shall be prevented from drying for a period of at least 7 days after it is placed. Exposed surfaces and concrete formed in absorbtive wood forms shall be kept continually wet during the entire curing period or until the forms have been removed. After forms have been removed, the exposed surface shall be kept continuously wet until patching and repair are complete and until the curing period is completed or until a curing compound is applied.

Moisture can be maintained by sprinkling, flooding or fog spraying or by covering with continuously moistened canvas, cloth mats, straw, sand or an

approved material. Water and/or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

Curing compound may be used for exposed surfaces or formed surfaces after patching and repair have been completed. Unless otherwise specified, the curing compound shall be white pigmented and conform to ASTM C 309 Type 2, Class A or B. If surface coatings are to be applied to concrete where curing compound is used, Type 2, Class B shall be used and allowed to age a minimum of 30 days prior to the application of the coating. Clear curing compound (Type 1) or clear with fugitive dye (Type 1-D) may only be used when specified in Section 26.

Curing compound shall be thoroughly mixed before applying and 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 form a uniform continuous, adherent film that shall not check, crack or peel and shall be free from pinholes or other imperfections.

All surfaces covered with curing compound shall be continuously protected from damage to the protective film during the required curing period.

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 application.

Unless otherwise specified in Section 26, curing compound shall not be applied to construction joints or other areas that are to receive additional concrete, paint or other material that require a positive bond.

Water for curing shall be clean and free from any substances that will cause discoloration of the concrete.

22. REMOVAL OR REPAIR

When concrete is honeycombed, damaged or otherwise defective, the Contractor shall remove and replace the structure or structural member containing the defective concrete, or correct or repair the defective parts. The Engineer will determine the required extent of removal, replacement or repair.

Prior to starting repair work the Contractor shall obtain the Engineer'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 concrete of the required quality and appearance.

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

Repair of formed surfaces shall be started within 24 hours after removal of the forms.

Except as otherwise approved by the Engineer, the appropriate methods described in Chapter VII of the Concrete Manual, Bureau of Reclamation, U.S. Department of the Interior, shall be used. If approved in writing by the Contracting Officer, proprietary compounds for adhesion or as patching ingredients may be used. Such compounds shall be used in accordance with the manufacturer's recommendations.

Curing as specified in Section 21 shall be applied to repaired areas immediately after the repairs are completed.

23. CONCRETING IN COLD WEATHER

Concreting in cold weather shall be performed in accordance with ACI 306 Recommended Practice for Cold Weather Concreting, of which some specific interpretations are set forth below.

When the atmospheric temperature may be expected to drop below 40°F at the time concrete is delivered to the work site, during placement, or at any time during the curing period, the following provisions also shall apply:

- a. The temperature of the concrete at time of placing shall not be less than 50°F nor more than 90°F. The temperature of neither aggregates nor mixing water shall be more than 140°F just prior to mixing with the cement.
- b. When the daily minimum temperature is less than 40°F, concrete structures shall be insulated or housed and heated after placement. The temperature of the concrete and air adjacent to the concrete shall be maintained at not less than 50°F nor more than 90°F 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. When dry heat is used to protect concrete, means of maintaining an ambient humidity of at least 40 percent shall be provided unless the concrete has been coated with curing compound as specified in Section 21 or is covered tightly with an approved impervious material.

24. CONCRETING IN HOT WEATHER

Concreting in Hot Weather shall be in accordance with the recommended practice of ACI 305, of which some specific interpretations are set forth below.

For the purpose of the specification, hot weather is defined as any combination of high temperature, low relative humidity and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise resulting in abnormal properties.

When climatic or other conditions are such that the temperature of the concrete may reasonably be expected to exceed 90°F at the time of delivery at the work site, during placement, or during the first 24 hours after placement, the following provisions shall apply;

- a. The Contractor shall maintain the temperature of the concrete below 90°F during mixing, conveying, and placing.
- b. The concrete shall be placed in the work immediately after mixing. Truck mixing shall be delayed until only time enough remains to accomplish it before the concrete is placed.
- c. Exposed concrete surfaces which tend to dry or set too rapidly shall be continuously moistened by means of fog sprays or other means acceptable to the Engineer to maintain adequate moisture during the time between placement and finishing, and after finishing.
- d. Finishing of slabs and other exposed surfaces shall be started as soon as the condition of the concrete allows and shall be completed without delay. The subgrade shall be prewetted or sealed with a vapor barrier and either wet cure or a white pigmented curing compound ASTM C 309 Type 2 applied promptly to the fresh concrete.
- e. Formed surfaces shall be kept completely and continuously wet for the duration of curing period (prior to, during and after form removal) or until curing compound is applied as specified in subsection g, below.
- f. Concrete surfaces, especially flatwork placed with large areas of surface, shall be covered as soon as the concrete has sufficiently hardened and shall be kept continuously wet for at least 72 hours of the curing period. This protective method may be continued for the required curing period or until curing compound as specified in (g) below is applied:

- g. Moist curing may be discontinued before the end of the curing period if white pigmented curing compound is applied immediately, following the procedures specified in Section 21.
- h. In extreme conditions it may be necessary to (1) restrict placement to late afternoon or evening (2) restrict the depth of layers to assure coverage of the previous layer while it will still respond readily to vibration, (3) suspend placement until conditions improve, and (4) remove forms, repair, patch and reapply wet curing by small areas at a time.

25. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, concrete will be measured to the neat lines of pay limits shown on the drawings, and the volume of concrete will be computed to the nearest 0.1 cubic yard. No deduction in volume will be made for chamfers, rounded or beveled edges, or for any void or embedded item that is less than five cubic feet in volume. Where concrete is placed against the sides or bottom of an excavation without intervening forms, drainfill, or bedding, the volume of concrete required to fill voids resulting from 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 each item of concrete will be made at the contract unit price for that item. The payment for concrete will constitute full compensation for all labor, materials, equipment, transportation, tools, forms, falsework, bracing and all other items necessary and incidental to completion of the concrete work, such as joint fillers, waterstops, dowels or other assemblies, and shear plates, but not including furnishing and placing reinforcing steel or furnishing and handling cement or other items listed for payment elsewhere in the contract.

Measurement and payment for furnishing and placing reinforcing steel will be made as specified in Construction Specification 34.

Cement will be measured by dividing the volume of concrete accepted for payment by the yield of the applicable job mix. The yield will be determined by the procedure specified in ASTM Designation C 137. If the amount of cement actually used per batch exceeds the amount in the job mix specified by the Engineer, the measurement will be based on the latter. One barrel of cement will be considered equal to 4 bags or 376 pounds. Payment for each type of cement will be made at the contract

unit price for furnishing and handling that type of cement and such payment will constitute full compensation for all materials, labor, equipment, storage, transportation and all other items necessary and incidental to furnishing and handling the cement.

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 26 of this specification.

26. ITEMS OF WORK AND CONSTRUCTION DETAILS

Idaho Road and Lost Dutchman Boulevard Intersection

(a) Bid Item 6, Concrete, Class 4000X

- (1) This item shall consist of furnishing, forming and placing all concrete required to construct the headwalls for the pipe culverts underneath the road fill for Idaho Road and Lost Dutchman Boulevard, as shown on the drawings and described in the specifications.
- (2) Concrete shall be Class 4000X as described in Section 3.
- (3) Cement shall be Type II or IIA
- (4) Coarse aggregate shall be sized number 57 in accordance with ASTM C-33.
- (5) Curing compound shall meet the requirements of ASTM C309-81 for Type ID, Class B. If concrete is placed during hot weather (Section 24), treated surfaces shall be shaded for at least the first three days after application. The curing compound shall be continuously stirred or agitated during application.
- (6) Concrete for Bid Item 6 shall be integrally colored. The concrete color shall blend with the natural earth tones at the site and can be produced using Davis Colors' Omaha Tan additive or similar quality products produced by Colorful Admixtures or L.M. Scofield. The Contractor shall construct an unexposed footing or a sample slab or verify color.

Color matching of concrete patching materials shall also be established by the Contractor in the trial sample. The color tone of finished concrete and patching materials shall be approved by the Engineer prior to full production.

(b) Bid Item 7, Cement

- (1) This item shall consist of furnishing the cement for all the concrete required to construct the structures described in Bid Item 6(a)(1).
- (2) Cement shall be Type II or IIA as described in this specification.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

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 completely 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 three 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 made only at locations shown on the drawings and provided by the steel schedule. Placement of bars at the lap splice locations shown, when not in contact, shall not be farther apart than one-fifth the shown lap length and in any case no greater than 6 inches.

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 handers, metal spacers and concrete chairs may be used to support the reinforcement. Metal handers, 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 by 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 minimum 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.

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

For items of work for which specific unit prices are established in the contract, the weight of reinforcement placed in the concrete in accordance with the drawings will be determined to the nearest pound by computation from the placing drawings. Measurement of hooks and bends will be based on the requirements of ACI Standard 315. Computation of weights of reinforcement will be based on the unit weights established in Tables 34-1 and 34-2. Computation of weights for welded wire fabric not shown in Table 34-2 shall be based on ACI Standard 315. The area of welded wire fabric reinforcement placed in the concrete in accordance with the drawings will be determined to the nearest square foot by computation from the placing drawings with no allowance for laps. The weight of steel reinforcing in extra splices of extra-length splices approved for the convenience of the Contractor or the weight of supports and ties will not be included in the measurement for payment.

Payment for furnishing and placing reinforcing steel 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 the completion of the work including preparing and furnishing bar schedules, lists or diagrams; furnishing and attaching ties and supports; and furnishing, transporting, storing, cutting, bending, cleaning and securing all reinforcements.

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.

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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

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TABLE 34-2. RECTANGULAR WELDED WIRE FABRIC¹

Style Designation By Steel Wire Gauge	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
24 x 12 - 8 x 12	4 x 12 - W2.1 x W0.9	25
24 x 12 - 7 x 11	4 x 12 - W2.5 x W1.1	31

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

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

10. ITEMS OF WORK AND CONSTRUCTION DETAILS

Idaho Road and Lost Dutchman Boulevard Intersection

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

(a) Bid Item 8, Steel Reinforcement

- (1) This item consists of furnishing and installing all steel reinforcement required in the construction of:

The headwalls for the pipe culverts under the road ramps

- (2) All steel bars shall be ASTM 615 Grade 40. Contractor may substitute Grade 60 for Grade 40.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

51. CORRUGATED STEEL PIPE CONDUITS

1. SCOPE

The work shall consist of furnishing and placing circular, arched or elliptical corrugated metal pipe and the necessary fittings. Pipe shall be zinc-coated steel plus a full bituminous coating on the outside surface. No bituminous coating shall be applied to the inside surface of the pipe.

2. MATERIALS

Pipe and fittings shall conform to the requirements of Material Specification 551.

3. LAYING AND BEDDING THE PIPE

Unless otherwise specified, the pipe shall be installed in accordance with the manufacturer's recommendations. The pipe shall be laid with the outside laps of circumferential joints pointing upstream and with longitudinal laps at the sides at the about the vertical midheight of the pipe. Field welding of corrugated galvanized iron or steel pipe will not be permitted. Unless otherwise specified, the pipe sections shall be joined with standard coupling bands. The pipe shall be firmly and uniformly bedded throughout its entire length to the depth and in the manner specified on the drawings.

Perforated pipe shall be laid with the perforations down and oriented symmetrically about a vertical center line. Perforations shall be clear of any obstructions at the time the pipe is laid.

The pipe shall be loaded sufficiently during backfilling around the sides to prevent its being lifted from the bedding.

4. STRUTTING

When required, struts or horizontal ties shall be installed in the manner specified on the drawings. Struts and ties shall remain in place until the backfill has been placed to a height of 5 feet above the top of the pipe, or has been completed if the finished height is less than 5 feet above the top of the pipe, at which time they shall be removed by the Contractor.

5. HANDLING THE PIPE

The Contractor shall furnish such equipment as is necessary to place the pipe without damaging the pipe or coatings. The pipe shall be transported and handled in such a manner as to prevent bruising, scaling, or breaking of the spelter coating or bituminous coating.

6. REPAIR OF DAMAGED COATINGS

Any damage to the zinc coating shall be repaired by thoroughly wire brushing the damaged area, removing all loose and cracked coating, removing all dirt and greasy material with solvent, and painting with two coats of zinc dust-zinc oxide primer conforming to the requirements of Federal Specification TT-P-641, Type III, or zinc dust paint conforming to the requirements of Military Specification MIL-P-21035. If the coating is damaged in any individual area larger than 12 square inches, or if more than 0.2 percent of a total surface area of a length of pipe is damaged, the length will be rejected.

Breaks or scuffs in bituminous coatings that are less than 36 square inches in area shall be repaired by the application of two coats of hot asphaltic paint or a coating of cold-applied bituminous mastic. The repair coating shall be at least 0.05 inches thick after hardening and shall bond securely and permanently to the pipe. The material shall meet the physical requirements for bituminous coatings contained in the references cited in Material Specification 551. Whenever individual breaks exceed 36 square inches in area or when the total area of breaks exceeds 0.5 percent of the total surface area of the pipe, the pipe will be rejected.

Bituminous coating damaged by welding of coated pipe or pipe fittings shall be repaired as specified in this Section for breaks and scuffs in bituminous coatings.

7. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract the quantity of each type, class, size and gauge of pipe will be determined to the nearest 0.1 foot by measurement of the laid length of pipe along the centerline of the pipe. Payment for each type, class, size and gauge of pipe will be made at the contract unit price for that type, class, size and gauge of pipe. Such payment will constitute full compensation for furnishing, transporting and installing the pipe and fittings 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 8 of this specification.

8. ITEMS OF WORK AND CONSTRUCTION DETAILS - Idaho Road and Lost Dutchman Boulevard Intersection

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

Bid Item 9, Corrugated Steel Pipe - Ellipse (9'-1"H, 10'-0"V)

- (1) This item shall consist of furnishing and installing two multi-plate galvanized corrugated steel pipe culverts, No. 10 gage (thickness = 0.138 in.), 6-in. by 2-in. corrugations, bolted fabrication. Each culvert shall be an ellipse, with a horizontal axis of 109 in. (9 ft. 1 in.) and a vertical axis of 120 in. (10 ft.) as shown on the drawings.
- (2) Pipe and fittings shall conform to the requirements of Material Specification 551.
- (3) The pipe shall be loaded sufficiently during backfilling around the sides to prevent its being lifted from the bedding.
- (4) Bedding materials and compaction bedding material shall be accomplished in accordance with Construction Specification 24.
- (5) Backfill shall be placed and brought up evenly on both sides of the pipe for its full length. Backfill material shall be selected, material placed and compacted in accordance with Construction Specification 23. No heavy equipment shall be allowed to travel over the pipe backfill until three (3) feet of compacted fill have been placed over the pipe, unless otherwise permitted by the Engineer.
- (6) Payment for bedding/drainfill material where called for under this specification is made under Construction Specification 24, "Drainfill."

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

401. RELOCATION OF UTILITIES

1. SCOPE

The work shall consist of cooperation and/or relocation of all utilities as described in Section 3 of these specifications.

2. MAG - 105

The provisions of Sections 105, "Control of Work", of the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction dated 1979 and current revisions thereto, together with the Maricopa County Highway Department Supplement to the Uniform Standard Specifications apply to this specification and the construction details contained herein.

3. COORDINATION WITH UTILITIES

The Contractor shall protect from damage all existing improvements and utilities (1) at or near the work site and (2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

An attempt has been made to determine the location of all underground utilities. It shall be the Contractor's responsibility to cooperate with the pertinent utility companies so that any obstructing utility installation may be adjusted. The Contractor shall exercise care to prevent damage to any existing facilities and shall coordinate his work with that of the Mountain Bell Telephone Company, Arizona Water Company, City of Apache Junction and Salt River Project in such a manner as will cause the least possible interference with their work. The Contractor shall make all arrangements that may be necessary for the construction and any financial agreement shall be solely between the Contractor and the utility owner.

4. 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 of 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 5 of this specification.

5. ITEMS OF WORK AND CONSTRUCTION DETAILS

Idaho Road and Lost Dutchman Boulevard Intersection

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

Subsidiary Item, Relocation of Utilities

(1) This item shall consist of the relocation of the following utility lines:

- (a) The existing 4-in. temporary water line shall be relocated as shown on drawings in accordance with the requirements of the City of Apache Junction and Section 610 of the Maricopa Association of Governments (MAG-610). In order to provide leakage protection for the FRS, provision shall be made to provide a pipe enclosure for the water line where it crosses FRS, between Sta (-)3+00K and Sta 2+00L, as shown on Dwg. 1-35. An electronically controlled valve shall be installed that will be activated when there is a loss of pressure caused by a leak or break in the water supply pipe.

Contractor shall perform work according to the detail drawing(s) prepared by the City of Apache Junction and approved by the Flood Control District. Drawing(s) shall include details of water pipe, enclosure pipe, automatic shutoff valve and sensor, and blocking between four-inch and twelve-inch pipes as required for intermediate guides and for braces at pipe bends.

- (b) Contractor shall contact the Mountain Bell Telephone Company to determine the disposition of the existing underground telephone lines.
- (c) The existing overhead power line shall be relocated as required by the Salt River Project.
- (d) The underground AT&T cable remains in its present location and must not be disturbed.
- (2) No separate payment will be made for this item. Compensation for this work will be included in Bid Item 4.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

402. SUBGRADE PREPARATION

1. SCOPE

The work shall consist of the preparation of roadways and bridge approaches prior to the placement of sub-base material and pavement.

2. MAG - 301

The provisions of Section 301, "Subgrade Preparation," of the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction dated 1979 and current revisions thereto, together with the Maricopa County Highway Department Supplement to the Uniform Standard Specifications apply to this specification and the construction details contained herein.

3. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the quantity of work will be determined to the nearest 0.05 mile by measurement along the centerline of road.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment of 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 4 of this specification.

4. ITEMS OF WORK AND CONSTRUCTION DETAILS

Idaho Road and Lost Dutchman Boulevard Intersection

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

Bid Item 11, Subgrade Preparation

- (1) This item shall consist of the preparation of subgrade to the required line and grade for the full width pavement as shown on the drawings for the Idaho Road and Lost Dutchman Boulevard crossings at the Apache Junction FRS.
- (2) Subgrade Preparation shall also include the preparation of subgrade to the required line and grade for the portion of the project located beyond the full width pavement at the intersection of the Idaho Road and Lost Dutchman Boulevard where the untreated base course is required in accordance with the plans or as directed by the Engineer.
- (3) Measurement and payment will be in accordance with Section 3.

IDAHO AND ROAD LOST DUTCHMAN BOULEVARD INTERSECTION

403. UNTREATED BASE

1. SCOPE

The work shall consist of furnishing, placing and compacting the untreated base material required for the construction of the bridge approaches and roads.

2. MAG SECTION 310

The provisions of Section 310, "Untreated Base" of the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction dated 1979 and current revisions thereto, together with the Maricopa County Highway Department Supplement to the Uniform Standard Specifications apply to this specification and the construction details contained herein.

3. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the quantity of work will be determined by actual weight. The Contractor will be required to furnish the Engineer certified weight tickets covering all of the Untreated Base placed on the project. Final pay quantities will be base upon the scale tickets accepted by the Engineer.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment of 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 4 of this specification.

4. ITEMS OF WORK AND CONSTRUCTION DETAILS

Idaho Road and Lost Dutchman Boulevard Intersection

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

Bid Item 12, Untreated Base

- (1) This item shall consist of the placing of the Untreated Base to the required line and grade as shown on the drawings for the Idaho Road and Lost Dutchman Boulevard road crossings at the Apache Junction FRS.
- (2) Placement of the Untreated Base shall also include the placement of the Untreated Base to the required line and grade for the portion of the project located beyond the full width payment at the intersection of Idaho Road and Lost Dutchman Boulevard where Untreated Base course is required in accordance with the plans or as directed by the Engineer.
- (3) Measurement and payment will be in accordance with Section 3.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

404. BITUMINOUS PRIME COAT (CONTINGENT ITEM)

1. SCOPE

The work shall consist of furnishing and applying the bituminous prime coat to the aggregate base.

2. MAG 315

The provisions of Section 315, "Bituminous Prime Coat," of the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction dated 1979 and current revisions thereto, together with the Maricopa County Highway Department Supplement to the Uniform Standard Specifications apply to this specification and the construction details contained herein.

3. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the quantity of work will be determined by actual weight. The Contractor will be required to furnish the Engineer certified weight slips for the undiluted bituminous material used.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment of 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 4 of this specification.

4. ITEMS OF WORK AND CONSTRUCTION DETAILS

Idaho Road and Lost Dutchman Boulevard Intersection

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

Bid Item 13, Bituminous Prime Coat (Contingent Item)

- (1) This item shall consist of the application of the bituminous prime coat to the aggregate base course, as shown on the drawings for the Idaho Road and Lost Dutchman Boulevard Road crossing at the Apache Junction FRS.
- (2) Application of the prime coats shall also include the portion of the project located beyond the full width payment at the intersection of Idaho Road and Lost Dutchman Boulevard required in accordance with the plans or as directed by the Engineer.
- (3) Measurement and payment will be in accordance with Section 3.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

405. ASPHALT CONCRETE PAVEMENT

1. SCOPE

The work shall consist of furnishing all materials, mixing at a plant, hauling and placing a mixture of an aggregate material and a bituminous material to form a pavement course to the specified depth as shown on the drawings.

2. MAG SECTION 321

The provisions of Section 321, "Asphalt Concrete Pavement", of the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction dated 1979 and current revisions thereto, together with the Maricopa County Highway Department Supplement to the Uniform Standard Specifications apply to this specification and the construction details contained herein.

3. MEASUREMENT AND PAYMENT

For items of work for which specific unit specific prices are established in the contract, the quantity of work will be determined by actual weight. The Contractor will be required to furnish the Engineer certified weight slips of the asphalt concrete pavement.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment of 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 4 of this specification.

4. ITEMS OF WORK AND CONSTRUCTION DETAILS

Idaho Road and Lost Dutchman Boulevard Intersection

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

Bid Item 14, Asphalt Concrete Pavement

- (1) This item shall consist of the placement of the asphalt concrete pavement upon the previously prepared base to the required line and grade as shown on the drawings for the Idaho Road and Lost Dutchman Boulevard road crossing at the Apache Junction FRS.
- (2) Placement of the asphalt concrete pavement shall also include that portion of the project located beyond the full width pavement at the intersection of Idaho Road and Lost Dutchman Boulevard where untreated base course is required in accordance with the plans or as directed by the Engineer.
- (3) Measurement and payment will be in accordance with Section 3.

(b) Subsidiary Item, Tack Coat and Preservative Seal

- (1) Payment for application of the tack coat and preservative seal are subsidiary to this item. No separate payment will be made for this item. Compensation for this work will be included in Bid Item 14.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

406. INSTALLATION OF FLEXIBLE METAL GUARD RAIL

1. SCOPE

The work shall consist of furnishing all materials and constructing the metal beam guardrail at the locations shown on the drawings.

2. MAG SECTION 415

The provisions of Section 415 "Flexible Metal Guardrail" of the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction dated 1979 and current revisions thereto, together with the Maricopa County Highway Department Supplement to the Uniform Standard Specifications apply to this specification and the construction details contained herein.

3. SPECIAL PROVISIONS

Guard rail details shall be in accordance Standard Details 135-1, 135-2, 135-3 and 135-4 of Uniform Standard Details for Public Works Construction issued by MAG.

Limits of guard rail construction are shown on drawings, Sheet 1-35.

4. 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 of 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 5 of this specification.

5. ITEMS OF WORK AND CONSTRUCTION DETAILS

Idaho Road and Lost Dutchman Boulevard Intersection

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

Subsidiary Item, Installation of Flexible Metal Guard Rails

- (1) This item shall consist of the installation of the metal guard rail as shown on the drawings.
- (2) No separate payment will be made for this item. Compensation for this work will be included in Bid Item 14.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

407. PAVEMENT MATCHING AND SURFACING REPLACEMENT

1. SCOPE

The work shall consist of replacement of pavement and surfacing removed by construction activities or to be matched in connection with the improved roadway.

2. MAG SECTION 336

The provisions of Section 336 "Pavement Matching and Surfacing Replacement" of the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction dated 1979 and current revisions thereto, together with the Maricopa County Highway Department Supplement to the Uniform Standard Specifications apply to this specification and the construction details contained herein.

3. 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 of 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 4 of this specification.

4. ITEMS OF WORK AND CONSTRUCTION DETAILS

Idaho Road and Lost Dutchman Boulevard Intersection

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

Subsidiary Item, Pavement Matching and Surfacing Replacement

- (1) This item shall consist of the replacement of pavement and surfacing removed as directed by the Contracting Officer.
- (2) No separate payment will be made for this item. Compensation for this work will be included in Bid Item 14.

IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

408. TRAFFIC CONTROL

1. SCOPE

The work shall consist of furnishing, installing, maintaining, moving and removing all traffic control devices, including flagging service, required to provide safe and efficient passage through and/or around the work.

2. MAG SECTION 401

The provisions of Section 401 "Traffic Control" of the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction dated 1979 and current revisions thereto, together with the Maricopa County Highway Department Supplement to the Uniform Standard Specifications apply to this specification and the construction details contained herein.

3. MEASUREMENT AND PAYMENT

Compensation for any item of work described in the contact but not listed in the bid schedule will be included in the payment of 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 4 of this specification.

4. ITEMS OF WORK AND CONSTRUCTION DETAILS

Idaho Road and Lost Dutchman Boulevard Intersection

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

Subsidiary Item, Traffic Control

- (1) This item shall consist of supplying the necessary men and equipment to provide safe and efficient passage through and/or around the work.
- (2) No separate payment will be made for this item. Compensation for this work will be included in Bid Item 4.

MATERIAL SPECIFICATIONS

MATERIAL SPECIFICATION

521. AGGREGATES FOR DRAINFILL AND FILTERS

1. SCOPE

This specification covers the quality of mineral aggregates for the construction of drainfill and filters.

2. QUALITY

Drainfill and filter aggregates shall be sand, gravel or crushed stone or mixtures thereof. They shall be composed of clean, hard, durable mineral particles free from organic matter, clayballs, soft particles or other substances that would interfere with their free-draining properties.

Aggregates of crushed limestone shall be thoroughly washed and screened. Coarse aggregate containing crushed limestone shall have not more than 3 percent by weight of particles finer than the No. 4 sieve. Crushed limestone shall not be used for fine aggregates except in combination with other materials such that not more than 5 percent of the portion finer than the No. 4 sieve shall be crushed limestone.

Aggregates shall be tested for soundness according to ASTM Method C 88, and shall have a weighted average loss in five cycles of not more than 12 percent when sodium sulfate is used or 18 percent when magnesium sulfate is used.

3. GRADING

Drainfill and filter aggregates shall conform to the specified grading limits after being placed in the work, and after being compacted if compaction is specified. Grading shall be determined by ASTM Method C 136, but the percentage of material finer than a No. 200 sieve shall be not more than 5 percent when determined by ASTM Method C 117.

4. STORING AND HANDLING

Drainfill and filter aggregates shall be stored and handled by methods that prevent segregation of particle sizes or contamination by mixing with other materials.

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 alkalis 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 alkalis 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.

Aggregates 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" cement, containing less than 0.60 percent alkalis expressed as sodium oxide.

MATERIAL SPECIFICATION

523. ROCK FOR RIPRAP

1. SCOPE

This specification covers the quality of rock to be used in the construction of rock riprap.

2. QUALITY

Individual rock fragments shall be dense, sound and free from cracks, seams and other defects conducive to accelerated weathering. The rock fragments shall be angular to subrounded in shape. The least dimension of an individual rock fragment shall be not less than one-third the greatest dimension of the fragment.

Except as provided below, the rock shall have the following properties:

- a. Bulk specific gravity (saturated surface-dry basis) not less than 2.5.
- b. Absorption not more than 2 percent.
- c. Soundness: Weight loss in 5 cycles not more than 10 percent when sodium sulfate is used or 15 percent when magnesium sulfate is used.

The bulk specific gravity and absorption shall be determined by ASTM Method C 127. The test for soundness shall be performed by ASTM Method C 88 for coarse aggregate modified as follows:

The test sample shall not be separated into fractions. It shall consist of 5000 ± 300 grams of rock fragments, reasonably uniform in size and shape and weighing approximately 100 grams each, obtained by breaking the rock and selecting fragments of the required size.

After the sample has been dried, following completion of the final test cycle and washing to remove the sodium sulfate or magnesium sulfate, the loss of weight shall be determined by subtracting from the original weight of the sample the final weight of all fragments which have not broken into three or more pieces.

The report shall show the percentage loss of weight and the results of the qualitative examination.

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

532. AIR-ENTRAINING ADMIXTURES
(FOR CONCRETE)

1. SCOPE

This specification covers the quality of air-entraining admixtures for concrete.

2. QUALITY

Air-entraining admixtures shall conform to the requirements of ASTM Specification C 260, except that the relative durability factor in the freezing and thawing test shall be not less than 95.

MATERIAL SPECIFICATION

533. WATER-REDUCING AND SET-RETARDING ADMIXTURES FOR PORTLAND CEMENT CONCRETE

1. SCOPE

This specification covers the quality of water-reducing and set-retarding admixtures for portland cement concrete.

2. QUALITY

Water-reducing and set-retarding admixtures shall conform to the requirements of ASTM Specification C 494, except that resistance to freezing and thawing shall be determined in all cases, and the minimum relative durability factor shall be 95.

3. TYPES

Admixtures shall be Type A, Water-Reducing or Type D, Water-Reducing and Retarding, as defined in ASTM Specification C 494.

4. PERFORMANCE IN THE JOB MIX

When added in the manner and amount recommended by the manufacturer to the concrete used on the job, with no change in the cement content or proportions of the aggregates, admixtures shall have the following effects:

Type A or Type D: The water content at the required slump shall be at least 5 percent less with the admixture than without. The air content shall remain within the range specified, but shall not exceed 8 percent in any case.

Type D: The time of initial setting, determined as prescribed in ASTM C 494, shall be from 1 to 3 hours longer with the admixture than without.

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.

MATERIAL SPECIFICATION

551. ZINC-COATED IRON OR STEEL CORRUGATED PIPE

1. SCOPE

This specification covers the quality of zinc-coated iron or steel corrugated pipe and fittings.

2. PIPE

Zinc-coated iron or steel corrugated pipe and fittings shall conform to the requirements of Federal Specification WW-P-405 for the specified classes and shapes of pipe, and to the following additional requirements:

- a. Unless otherwise specified, circumferential shop riveted seams shall have a maximum rivet spacing of 6 inches, except that 6 rivets will be sufficient for 12-inch diameter pipe;
- b. When close riveted pipe is specified: (1) the pipe shall be fabricated so that the rivet spacing in the circumferential seams shall not exceed 3 inches, except that 12 rivets will be sufficient to secure the circumferential seams in 12-inch pipe, and (2) in those portions of the longitudinal seams that will be covered by the coupling bands the rivets shall have finished flat heads or the rivets and holes shall be omitted and the seams shall be connected by welding to provide a minimum of obstruction to the seating of the coupling bands.
- c. Double riveting or double spot welding or pipe less than 42 inches in diameter may be required. When double riveting or double spot welding is specified, the riveting or welding shall be done in the manner specified for pipe 42 inches or greater in diameter.

3. COATINGS

Coatings shall conform to the requirements of Federal Specification WW-P-405 for the specified types of coatings.



PART III

BID SCHEDULE

III. BID SCHEDULE

The Bid Schedule follows the pattern established for other project units of the Buckhorn-Mesa Watershed. All items will be bid on a unit price basis except surveys. Certain small items and required procedures are included as a subsidiary to other bid categories.

BID SCHEDULE
IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

Item No.	Work or Material	Spec. No.	Quantity	Unit	Unit Price	Amount
1.	Clearing & Grubbing	2	14.6	Acres	\$ _____	\$ _____
2.	Mobilization	8	1	Lump Sum	\$ _____	\$ _____
3.	Water	10	900	M.G.*	\$ _____	\$ _____
4.	Earth Fill	23	241,700	Cu. Yd	\$ _____	\$ _____
5.	Drain Fill/Bedding	24	1,390	Cu. Yd.	\$ _____	\$ _____
6.	Concrete, Class 4000X (colored)	31	60	Cu. Yd	\$ _____	\$ _____
7.	Cement	31	17	Ton	\$ _____	_____
8.	Steel Reinforcement	34	6,000	Lbs.	\$ _____	\$ _____
9.	109" x 120" C.S.P. Ellipse	51	292	Lin. Ft.	\$ _____	\$ _____
10.	Surveys	7	1	Lump Sum	\$ _____	\$ _____
11.	Subgrade Preparation	402	0.82	Mile	\$ _____	\$ _____
12.	Untreated Base	403	4,850	Ton	\$ _____	\$ _____
13.	Bituminous Prime Coat (Contingent Item)	404	10	Ton	\$ _____	\$ _____
14.	Asphalt Concrete	405	900	Ton	\$ _____	\$ _____
			TOTAL		\$ _____

* M.G. denotes 1,000 gallons



PART IV

CONSTRUCTION COST ESTIMATE

IV. COST ESTIMATE

Good cost estimates for the type of construction involved in this Project are available as a result of recently contracted work of a similar nature. This includes other project units of the Buckhorn-Mesa Watershed.

Cost estimates are based upon contract conditions which can be met by small to medium-sized contractors.

CONSTRUCTION COST ESTIMATE
IDAHO ROAD AND LOST DUTCHMAN BOULEVARD INTERSECTION

Item No.	Work or Material	Spec. No.	Quantity	Unit	Unit Price	Amount
1.	Clearing & Grubbing	2	14.6	Acres	\$ 389.00	\$ 5,680.00
2.	Mobilization	8	1	Lump Sum	N/A	\$ 12,000.00
3.	Water	10	900	M.G.*	\$ 7.70	\$ 6,930.00
4.	Earth Fill	23	241,700	Cu. Yd	\$ 1.46	\$352,880.00
5.	Drain Fill/Bedding	24	1,390	Cu. Yd.	\$ 21.84	\$ 30,360.00
6.	Concrete, Class 4000X (colored)	31	60	Cu. Yd	\$ 208.00	\$ 12,480.00
7.	Cement	31	17	Ton	\$ 84.70	\$ 1,440.00
8.	Steel Reinforcement	34	6,000	Lbs.	\$ 0.48	\$ 2,880.00
9.	109" x 120" C.S.P. Ellipse	51	292	Lin. Ft.	\$ 200.00	\$ 58,400.00
10.	Surveys	7	1	Lump Sum	N/A	\$ 5,500.00
11.	Subgrade Preparation	402	0.82	Mile	\$28,300.00	\$ 23,210.00
12.	Untreated Base	403	4,850	Ton	\$ 6.40	\$ 31,040.00
13.	Bituminous Prime Coat (Contingent Item)	404	10	Ton	\$ 270.00	\$ 2,700.00
14.	Asphalt Concrete Pavement	405	900	Ton	28.00	\$ 25,200.00
SUBTOTAL						\$570,700.00
10% CONTINGENCY						\$ 57,070.00
TOTAL						\$627,770.00

* M.G. denotes 1,000 gallons



PART V

SUPPLEMENTAL CALCULATIONS

EBASCO SERVICES INCORPORATED

BY DG DATE 11-24-88

SHEET _____ OF _____

CHKD. BY NH DATE 1/14/87

OFS NO. ECOM 4452.00 DEPT. NO. _____

CLIENT USDA SOIL CONSERVATION SERVICE

PROJECT APACHE-BULLDOG FLOOD CONTROL PROJECT

SUBJECT Design Review of C.S. Pipe

CULVERT - Ellipse-Hor. 9'-1 (109") x Vert. 10'-0 (120")
- #10 ga. - t = 0.138"
- Cor. - 2" x 6"

<u>LOADING</u> A'	<u>Rd</u>	<u>Ht of</u> <u>cover</u>	<u>DL</u> (W. 130 pcf) (W. 120 pcf)	<u>LL</u> H-20 Ldg (psf)	<u>DL+LL</u> (psf)	<u>Design</u> DL+0.75 LL (psf)
	<u>Lost Dutchman</u>	<u>4'-0</u>	<u>520</u>	<u>400</u>	<u>920</u>	<u>820</u>
	<u>Idaho</u>	<u>10'-0</u>	<u>1,300</u>	<u><100</u>	<u>1300</u>	<u>1300</u>

RING COMPRESSION "C"

$$C = P \times S/2 = 1300 \times 4.54 = 5,902 \text{ P/ft.}$$



ALLOWABLE WALL STRESS f_a

$$D/r = 114 (\text{AVE. D}) / 0.684 = 167''$$

$$\text{For } D/r < 294, f_a = 33,000 / 2K = 33,000 / 1.30 = 25,385 \text{ psi}$$

(K = 0.65 for 95% Std. Density)

$$\text{Seam stress } f_a = 15,500 \text{ psi}$$

$$\text{Wall thickness} = A = C/f_a = \frac{5,902}{15,500} = 0.38 \text{ in} < 2.003 \text{ in} \text{ (OK)}$$

HANDLING STIFFNESS

FF = Flexibility Factor

$$FF = \frac{D^3}{EI} = \frac{114^3}{30 \cdot 10^6 \cdot 938} = 0.0005 < 0.02 \text{ (OK)}$$

EBASCO SERVICES INCORPORATED

BY DG DATE 9.3.88

SHEET _____ OF _____

CHKD. BY N.H DATE 1/4/87

OFS NO. 4452-001 DEPT. NO. _____

CLIENT USDA SOIL CONSERVATION SERVICE

PROJECT APACHE-BULLDOG FLOOD CONTROL PROJECT

SUBJECT BORROW AREA DRAINAGE DITCH & CULVERT LENGTHS

CRITERIA

1. Est. Depth of Borrow is 5'-0".
2. Apache Floodway Earth Channel Outlet = EL. 1795 (Sh 1-5)
3. Invert EL. P.S. Inlet = EL. 1783.50 (Sh 1-20)
4. Scaled Length of Dr. Ditch = 5,300 (Sh 1-2)

• Bottom of U/S Borrow Area 1795 - 5. = EL 1790.
 • Start Ditch at Surface EL 1790.00

Ave Slope = $1790 - 1783.50 / 5,300 = .00122/1$ or $1.22/1000$
 Use .001% for setting culvert els.

LOST DUTCHMAN L

Scale Dist to Lost D. Culvert = 2500'

D.E. = $2500 \times .001 = 2.5$

Scaled Ht 4' Use 15'

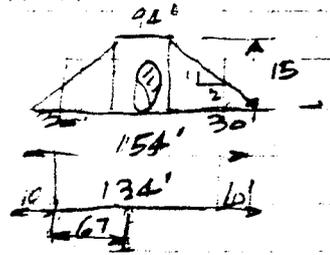
[1] Culv's Inv EL = $1790 - 2.5 = \underline{EL 1787.5}$

± Rd Sta. of Culvert = STA (-) 4+80 L

D/S Inv. $1787.5 - 134' \times .003 = \underline{EL 1787.1}$

St.A = D/S 68' longer than U/S ∴ U/S 66.6' & S 67.4'

IDAHO "K"



Scale dist. of connecting ditch = 470'; D.E. = $470 \times .001 = .47'$

[2] Culv U/S Inv = $1787.1 - .47 = \underline{EL 1786.63}$

Remaining Dist = 2,100' @ .001 D.E. = 2.1'

± Rd Sta. of Culvert = STA (-) 4+20 K

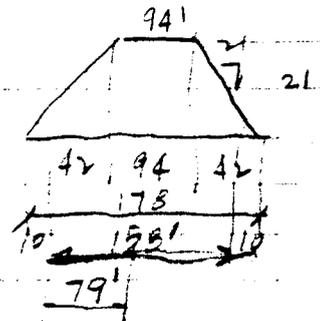
Scale Ht = 20' Use 21'

D/S Inv EL $1786.63 - (158 \times .003) = \underline{EL 1786.15}$

3x48 D/S 0.96' longer than U/S 78.5', D/S 79.5'

Slope to P.S. Inlet = $\frac{1786.15 - 1783.50}{2,100} = .0013/1$

OK



EBASCO SERVICES INCORPORATED

BY Mel. Chalco DATE 8/27/86

SHEET 1 OF 3

CHKD. BY N. G. DATE 8/27/86

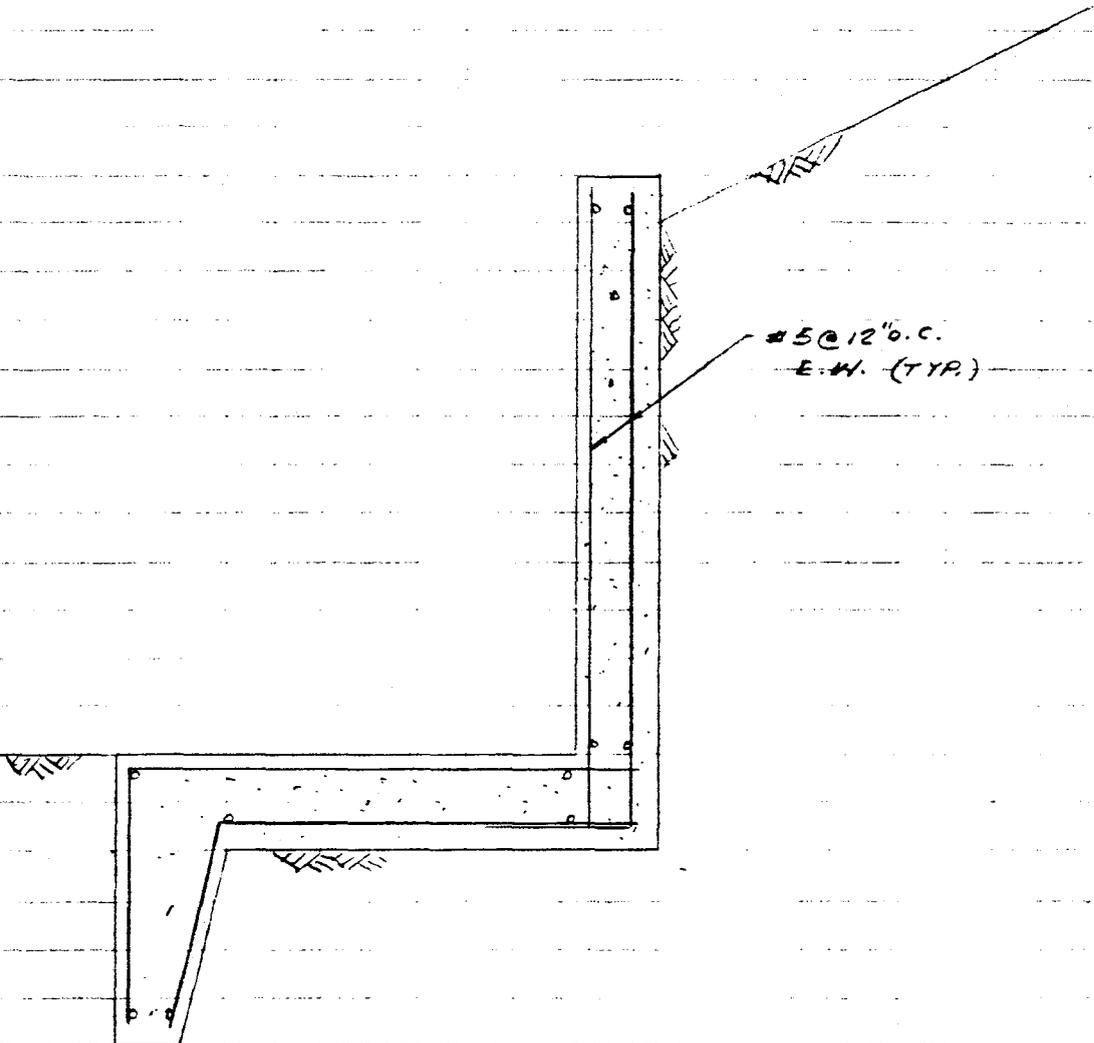
OFS NO. FCDM 4452 001 DEPT. 521
NO. 521

CLIENT FCDMC

PROJECT ROAD RAMP

SUBJECT LAYOUT OF CMP HEADWALL

TYPICAL WALLS & SLAB REINFORCEMENT



SECTION C

V-3

EBASCO SERVICES INCORPORATED

BY Mel. Chalko DATE 8/27/86
 CHKD. BY N. Id DATE 8/27/86
 CLIENT FCDMC

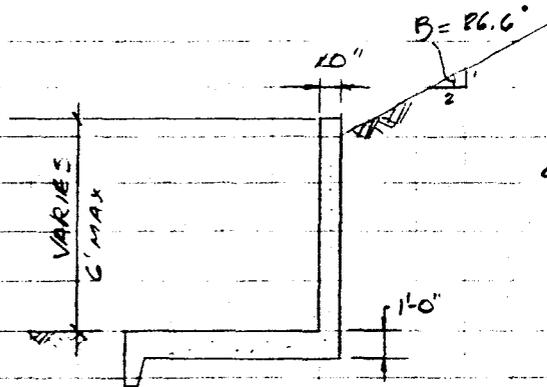
SHEET 2 OF 3
 OFS NO. FCDM4452 DEPT. NO. 521
001

PROJECT ROAD RAMP
 SUBJECT LAYOUT OF CMP HEADWALL

RETAINING WALL DESIGN

LOADS:

LATERAL PRESSURE = 100 PCF + E' OF SOIL SURCHARGE



USE H = 5.0' TO DESIGN RETAINING WALL

FIND LATERAL FORCE (P_{01}) DUE TO LATERAL PRESSURE

$$P_{01} = (100 \frac{\text{pcf}}{\text{ft}^3} \times 5' \times \frac{1}{2}) (1')$$

$$= 1250 \text{ ft}$$

FIND LATERAL FORCE (P_{02}) DUE TO SURCHARGE LOAD

$$P_{02} = (100 \frac{\text{pcf}}{\text{ft}^3} \times 2') (5') (1')$$

$$= 1000 \text{ ft}$$

CONSERVATIVELY, DESIGN WALL AS A CANTILIVER WALL

$$M_b = 1250 \frac{\text{ft}}{\text{ft}} \times 5' / 3 + 1000 \frac{\text{ft}}{\text{ft}} \times 5' \times \frac{1}{2}$$

$$\approx 5.0 \text{ ft} \text{ (MOMENT @ BASE OF WALL)}$$

EBASCO SERVICES INCORPORATED

BY Mel. Chalco DATE 8/27/86

SHEET 3 OF 3

CHKD. BY N.L.A. DATE 8/30/86

OFS NO. ECDM 4459.001 DEPT. NO. 521

CLIENT ECDMC

PROJECT ROAD RAMPS

SUBJECT LAYOUT OF CMP HEADWALL

RETAINING WALL DESIGN CONT'D.

- FIND WALL REINFORCEMENT

$$M_u = (5.0^{kl}) 1.7 = 8.5^{kl}$$

$$d = 10" - 3\frac{5}{8}" = 6.375", \quad b = 12" \quad f'_c = 3.0 \text{ KSF}$$

$$F = \frac{12" \times 6.375^2}{12,000} = 0.041, \quad K_u = \frac{8.5^{kl}}{0.041} = 207, \quad \alpha_u = 4.29$$

$$A_s = \frac{8.5^{kl}}{4.29 \times 6.375"} = 0.31 \text{ in}^2 \quad \therefore \underline{\# 5 @ 12" O.C.} \quad A_s = 0.31 \text{ in}^2$$

- FIND SLAB REINFORCEMENT (12" THICK)

BY INSPECTION, USE MINIMUM REINFORCEMENT.

$$A_{smin} = 0.0018 \times 12" \times 12" = 0.26 \text{ in}^2 \quad \therefore \underline{\text{USE } \# 5 @ 12" O.C.} \quad A_s = 0.31 \text{ in}^2$$

V.5

EBASCO SERVICES INCORPORATED

BY Mel. Chalco DATE 9/2/86

CHKD. BY N.H. DATE 9/2/86

CLIENT FCDMC

PROJECT ROAD RAMPS

SUBJECT LAYOUT OF CMP HEADWALL

SHEET _____ OF _____

OFS NO. FCRM 4452001 DEPT. NO. 521

VOLUME OF CONCRETE

$$V_1 = (10\frac{1}{2}) [(23.56 \times 5)\frac{1}{2} + (2 \times 23.56)] = 88 \text{ ft}^3$$

$$V_2 = (10\frac{1}{2}) [(4 \times 5)\frac{1}{2} + (2 \times 4)] = 15 \text{ ft}^3$$

$$V_3 = 10\frac{1}{2} [(11 \times 7) - (\pi \times \frac{3^2}{4}) \times \frac{1}{2}] = 56 \text{ ft}^3$$

APPROXIMATE

} 10"
WALLS

$$V_4 = 1' [(4' + 11\frac{1}{2}) (28.2' - 11\frac{1}{2})] \frac{1}{2} = 120 \text{ ft}^3$$

$$V_5 = 1' [(4' \times 11\frac{1}{2}) + (11\frac{1}{2})^2 \frac{1}{2}] = 61 \text{ ft}^3$$

} 1 1/2"
SLAB

$$V_6 = (8\frac{1}{2}) (2') (28.2') + (6\frac{1}{2}) (2') (28.2') \frac{1}{2} = 52 \text{ ft}^3$$

} GRADE
BEAM

$$V_T = (88 \text{ ft}^3 + 15 \text{ ft}^3 + 56 \text{ ft}^3) + (120 \text{ ft}^3 + 61 \text{ ft}^3) + 52 \text{ ft}^3$$

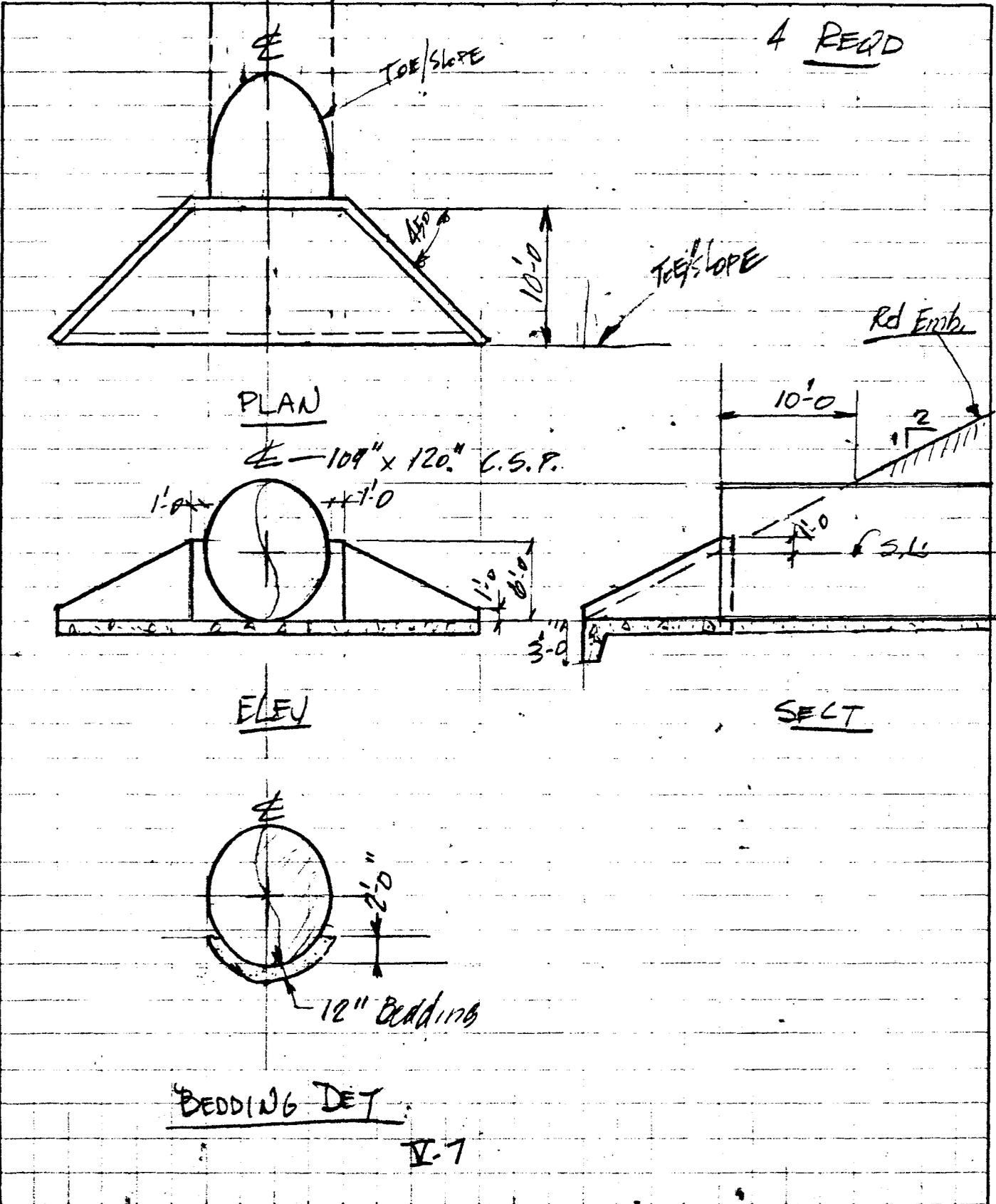
$$= 392 \text{ ft}^3 \approx 15 \text{ yd}^3$$

EBASCO SERVICES INCORPORATED

BY DL DATE 6/11/86
CHKD. BY NH DATE 7/14/87

SHEET _____ OF _____
FCDM 4452.001 DEPT. NO. _____
OFS NO. _____

CLIENT _____
PROJECT USDA-SOIL CONSERVATION SERVICE
ADACUE DILL DOG FLOOD CONTROL PROJECT
SUBJECT ROAD INT. CULVERTS BEDDING & 1/2 HEADWALL DETS 11/10'



EBASCO SERVICES INCORPORATED

BY DE DATE 4/21/86
 CHKD. BY NH DATE 1/14/87

SHEET 1 OF
 OFS NO. 4452.00 DEPT. NO.

CLIENT USDA-SOIL CONSERVATION SERVICE
 PROJECT APACHE BULLDOG FLOOD CONTROL PROJECT
 SUBJECT Vertical Curves at Road Crossing

$$\text{Min. } L = 3 \times V_{max} = 3 \times 35 = 105'$$

40mph stopping speed sight dist $S = 275'$

SUMMIT SCL: $S = 3.82 \sqrt{\frac{L}{A}} \therefore L = \frac{S^2 A}{3.82^2}$
 $= \frac{275^2 \cdot .04}{3.82^2} = 205'$

$$S > L \quad S = 7.28/A + 4\frac{1}{2} \therefore L = 2(S - 7.28/A)$$

$$L = 2(275 - 7.28/.04) = 186'$$

USE 200' V.C.

SAG SCL $L = \frac{AS^2}{500 + 3.5S} =$

$$\frac{4 \cdot 275^2}{500 + 3.5 \cdot 275} = 206.8$$

$$S > L \quad L = 2S - \frac{(500 + 3.5S)}{A} =$$

$$\frac{2 \cdot 275 - 1462.5}{4} = 184.4$$

USE 200' V.C.

EBASCO SERVICES INCORPORATED

BY DB DATE 12-29-86

SHEET _____ OF _____

CHKD. BY WJ DATE 1/4/87

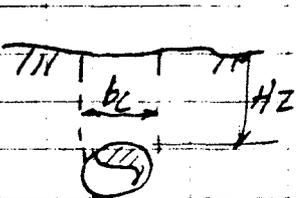
OFS NO. 4452.00 DEPT. NO. _____

CLIENT USDA SOIL CONSERVATION SERVICE

PROJECT APACHE-BULLDOG FLOOD CONTROL PROJECT

SUBJECT PVC Enclosure Pipe Design

Design according to SCS AZ. BULL. NO. AZ 210-6-47

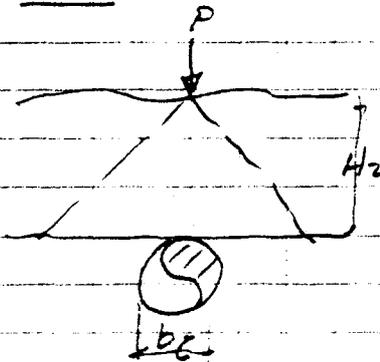


$bc = 12.750''$ $1.06'$
 $H_z = 2'$
 $\rho = 130 \text{ p.c.f.}$

1. DL

$W_d = \rho H_z bc = 130 \cdot 2 \cdot 1.06 = 275.6 \#$

2. LL



$W_L = \frac{0.48 I_p P b_c^2 (2.67 H_z - 0.5)}{2.67 H_z^3}$
 $= \frac{0.48 \cdot 1.2 \cdot 10 \cdot 10^3 \cdot 1.06^2 (2.67 \cdot 2 - 0.5)}{2.67 \cdot 2^3}$
 $= 302.99 (4.54)$
 $= 1,364 \#/1$

$W_L = 1364 + 276 = 1,640 \#/1$
Sch 40

3. Pipe Δ Sch 80

$\Delta y = \frac{K D_1 W_L r^3}{12 (EI + 0.061 E' I^3)}$

$I = t^3/12 = 0.687^3/12 = .027 \text{ m}^4$ $I = .406^3/12 = .006$

$\Delta y = \frac{(6.10)(1.25)(1,640) 6^3}{12 (290,000 \cdot .027 + .061 \cdot 1000 \cdot 6^3)}$ $\frac{4480}{12 (290 \cdot 10^3 \cdot .006 + 13176)}$

$\Delta y = 0.18$ 0.25

$\% \delta = \frac{.18}{12.75} \cdot 100 = 1.45\% < 5\%$

$.25/12.75 \cdot 100 = 2.0\% < 5\%$

V-10

Sch. 40 ok