

TECHNICAL SPECIFICATIONS

FOR

SPEAR INJECTOR

SITE PREPARATION

IS-439-020-01

Prepared by John K. Cosmez Plant Engineering
J. K. Cosmez

Prepared and Approved by Ashley Cunliffe Plant Engineering
A. L. Cunliffe

Reviewed and Approved by Mark N. Obergfell Plant Engineering
M. N. Obergfell

Reviewed and Approved by John M. Voss Stanford Synchr.
J. Voss Radiation Lab.

Plant Engineering Department
Stanford Linear Accelerator Center
Stanford University
Stanford, California

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DIVISION 1

GENERAL REQUIREMENTSSECTION 01100 -- SPECIAL CONDITIONS & STATEMENT OF WORKPART I -- GENERAL1.1 LOCATION

The work as outlined in these specifications shall be performed at the Stanford Linear Accelerator Center, 2575 Sand Hill Road, Menlo Park, CA (San Mateo County). The construction site is located near Building 120.

1.2 STATEMENT OF WORK

The work covered by this specification shall include, but not necessarily be limited to, the following:

1. Demolish and remove asphalt paving and reinforced concrete as required to receive the new work as shown on the Subcontract drawings.
2. Excavate soil as required to indicated subgrade elevations.
3. Excavate for valve box and trenches for storm drain extensions, sewer clean-outs, and other piping as shown. Install items including inlet frames and grates in trenches and backfill to subgrade elevations.
4. Install reinforced concrete to the lines and grades shown on drawings with all indicated dowels.
5. Install asphaltic concrete paved ramps and other paving as shown, including construction repair patching of existing paved areas.

6. Install soldier pile and timber retaining wall in the position shown.

1.3 WORKING HOURS

The Subcontractor will be permitted to work in the construction area during normal working hours, and before 7:30 AM, after 4:30 PM, or on holidays or weekends, when authorized by the University Representative.

1.4 COOPERATION WITH OTHER SUBCONTRACTORS AND UNIVERSITY PERSONNEL

Other Subcontractors and University technicians may be working in areas within or adjacent to the Subcontractor's work area. The Subcontractor shall cooperate with the University in the scheduling of the work to avoid undue inconveniences to all parties.

1.5 DISPOSAL OF WASTE MATERIAL AND EQUIPMENT

Waste material such as lumber, building materials, asphalt paving, concrete, and other debris shall be disposed of by the Subcontractor off the University site. Excess clean material from the excavation shall be disposed of by the Subcontractor in the disposal area, as shown on the drawings. Fill material shall be spread evenly in the location as directed by the University Representative.

1.6 UTILITIES

- A Water is available at the fire hydrant near the work area at no cost to the Subcontractor.
- B 120/208 Volt construction power will be made available at no cost to the Subcontractor.

1.7 UTILITY OUTAGES

- A All required utility outages, including power, water, fire protection, sanitary sewer, air, etc., shall be scheduled 72 hours in advance with the University Representative. Certain electrical outages may require additional notice, and shall be scheduled and coordinated through the University Representative.

1.8 SAFETY REQUIREMENTS

- A Flagmen, signs, barricades, fences, lights and similar precautions are the responsibility of and shall be provided by the Subcontractor to assure public safety and properly guard against personal injury or property damage at no additional expense to the University.
- B Mobile crane safety shall be in accordance with applicable sections of OSHA Construction Safety & Health Regulations, Part 1926, particularly, section 1926.550. However, the following is a list of certain aspects of the safety procedure that are highlighted. This list is to be used as a check before a mobile crane is placed in service. A copy shall be placed in the cab in full view of the operator.
1. The mobile crane operator must be qualified and demonstrate, to the satisfaction of his supervisor, his ability to safely operate the model of equipment which he is asked to operate.
 2. The equipment is to be inspected daily and it shall be determined by the operator that it is safe to operate. Any irregularities found that could adversely affect its safe operation shall be reported to his supervisor and corrected prior to placing it in service.
 3. The mobile crane boom angle indicating device shall be operable, properly calibrated and visible to the operator at all times.
 4. The mobile crane's boom extension length must be known to the operator or physically measured by him, before the pick is made.
 5. The weight of the mobile crane's pick must be accurately known by the operator before the pick is made.
 6. The weight vs. reach chart shall be clearly written and shall be posted in the operator's cab, in clear view of the operator.
 7. The mobile crane shall never be operated in a manner in which an outrigger (or if on rubber, a wheel) lifts or is about to lift off the ground.
 8. The supervisor cannot overrule the mobile crane operator on an unsafe pick refusal. The Subcontractor shall require the operator to demonstrate to his supervisor why he considers the pick unsafe.

9. If the equipment is operated with disregard for any of the above, the Subcontractor shall immediately stop the unsafe operation. Thereafter, operation shall not be permitted to resume until the University's contract administrator is satisfied that the the unsafe practice has been corrected.

C In addition, see GENERAL CONDITIONS, Safety & Health.

1.9 JOB OFFICE

- A No Job Office is required, but subcontractor may provide one at his option.
- B A complete set of building plans and specifications, including general conditions and general provisions, and shop drawings shall be maintained at the job site by the subcontractor at all times.

1.10 TOILET FACILITIES

The Subcontractor may use the toilet facilities in Building 120.

1.11 PROTECTION OF EXISTING FACILITIES

- A Existing facilities, including but not limited to buildings, materials, surfaces, equipment, pipes, conduits and appurtenances not specified for disposal, which are damaged by any operations under this subcontract, shall be replaced or repaired, neatly patched and refinished, all as may be necessary to restore the work to the original condition and to leave the work in a thoroughly complete, operable and finished condition at no extra cost to the University.
- B All damage to existing facilities, as a result of the Subcontractor's activities, shall be repaired to the satisfaction of the University at the Subcontractor's expense.
- C Work, materials, equipment, and existing facilities shall be protected against damage due to construction operations, weather, or other hazards. The Subcontractor shall, at his expense, provide temporary drain lines, surface drainage and suitable covering of all exposed trenches, excavations, equipment, materials, and other work to protect the work and existing facilities from damage.

- D All areas used by the Subcontractor shall be restored to their original condition and the area left in a clean condition. All roads shall be kept clear of haul material and other debris.
- E Storm drains and drainage swale are to be used for clean water only.

1.12 MATERIALS ACCESS AND DELIVERY

- A Access to the work site for delivery of heavy loads and equipment shall be through the Main Gate located at 2575 Sand Hill Road.
- B Delivery of materials or equipment to the work site will be permitted during normal working hours, 7:30 AM to 4:30 PM, Monday through Friday, and at other times when authorized in advance by the University.
- C No material deliveries will be accepted by the University on behalf of Subcontractors. All deliveries shall be properly labeled or identified as follows:
 --- (Subcontractor) ---
 --- (Subcontract Number)---
 c/o SLAC Jobsite, near Bldg. 120.
 2575 Sand Hill Road
 Menlo Park, CA. 94025

1.13 DOSIMETER BADGES

Dosimeter badges that measure exposure to ionizing radiation will be issued by the University to the Subcontractor for all personnel working in the construction area. Although no personal radiation exposure above natural background radiation is anticipated, the badges are required for compliance with Department of Energy regulations and for site security. Subcontractor is responsible for maintaining a current list of badgeholders. A copy of the list shall be submitted to the University Representative whenever a change is made. The Subcontractor is responsible for insuring that all dosimeters are returned to the University upon completion of the work and prior to final payment.

1.14 VISIT TO CONSTRUCTION SITE

All prospective bidders should plan to visit the construction site prior to submission of bids to inspect the site for location, existing conditions, and accessibility of work to be accomplished. See Invitation for Bids for further information regarding a bidders conference. See General Conditions Clause titled "Site Investigations and Representations".

1.15 AS-BUILT DRAWINGS

At the beginning of the work, the University will furnish to the Subcontractor one set of prints for recording as-built conditions. As the work progresses, the Subcontractor shall record on these prints in red pencil the actual locations of all items where there is a variance with the drawings. Approval must be received from the University before any item is relocated. Upon the completion of the work, the Subcontractor shall forward these prints to the University.

1.16 FIELD SURVEYS

The University shall furnish ring slab radius points for subcontractor's use in correctly locating construction.

1.17 SHOP DRAWINGS AND SUBMITTALS

Shop drawings and submittals shall be submitted to the University for review as required by the various sections of this specification and shall conform to the requirements of General Conditions. Submittals are required for specified items, as well as "or equal" items proposed by the Subcontractor.

1.18 MATERIALS AND SUBSTITUTIONS

A In any section of these specifications or drawings where reference is made to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and not as limiting competition. An approved equal may be accepted whether specifically stated or not. If substitutions are offered, the list shall be accompanied by drawings and other data, giving adequate information to enable the University to determine the quality of the suggested materials to those specified, without recourse to other information.

- B This implies no right of the Subcontractor to use other materials or methods unless approved in writing by the University. The decision of the University shall govern as to whether the proposed material may be used. The burden of proof that the proposed material is equivalent to that specified shall be upon the Subcontractor.

1.19 TESTING, INSPECTION, AND APPROVALS

Testing, inspection, approvals, and other actions by the University, other than changes issued in writing by the Contract Administrator, do not relieve the Subcontractor of any Subcontract requirement or otherwise change the Subcontract. Any approval of the work or of substitutions is based on representations made by the Subcontractor. The Subcontractor remains responsible for costs of correction of any work that is not in conformance with the Subcontract requirements, regardless of any testing, inspection, or approvals performed by the University. The Subcontractor expressly agrees that testing, inspection, and approvals performed by the University are for the benefit of the University and are not for the benefit of Subcontractor; that any reliance by the Subcontractor on any such testing, inspection, and approvals is at the Subcontractor's risk; that the performance by the Subcontractor of work not in conformance with contract requirements constitutes a material cause of any resulting costs of correction, and that any unintentional failure on the part of the University to discover or notify the Subcontractor of a deficiency constitutes an immaterial cause of any resulting costs of correction.

1.20 HISTORICAL AND SCIENTIFIC SPECIMENS

All articles of historical or scientific value, including but not limited to fossils and archaeological artifacts which may be uncovered by the Subcontractor during the progress of the work, shall become the property of the University. Such findings shall be reported immediately to the University Representative who will determine the method of removal, where necessary, and the final disposition thereof.

1.21 DRAWINGS AND WORKMANSHIP

The drawings are diagrammatic and indicate the general arrangement of the work. All work shall be done in a workmanlike manner. Drawings shall not be scaled for dimensions. All dimensions shall be verified in the field. Only quality workmanship will be accepted. Haphazard or poor construction practice will be cause for rejection of the work by the University.

1.22 DRAWING LIST

All work covered by this specification shall be in strict accordance with the following subcontract drawings:

<u>Number</u>	<u>Sheet</u>	<u>Title</u>
ID-439-020-01-C0	C-1	SPEAR Injector Project Site Preparation Plot & Location Plan
ID-439-020-02-C0	C-2	SPEAR Injector Project Site Preparation Sections & Details
ID-439-020-03-C0	C-3	SPEAR Injector Project Site Preparation Sections & Details
ID-439-420-01-C0	M-1	SPEAR Injector Project Site Preparation Mechanical Utilities Site Utilities Plan
ID-439-420-02-C0	M-2	SPEAR Injector Project Site Preparation Mechanical Utilities Details

1.23 CONSTRUCTION SCHEDULE

Prior to commencement of work, a construction schedule shall be submitted showing individual work items, and expected starting and completion dates.

1.24 HAZARD COMMUNICATION STANDARD

The Subcontractor's attention is specifically directed to the Federal O.S.H.A. "Hazard Communications" Standard (29 Code of Federal Regulations 1910.1200).

The Subcontractor is required to comply with this STANDARD in all respects, including, but not limited to the furnishing to the University and the appropriate posting at the job site, of copies of the Material Safety Data Sheets (MSDS) for all hazardous materials brought onto the University premises. Copies of the Material Safety Data Sheets shall be furnished to the Contract Administrator and approved prior to any such materials being brought to the job site.

DIVISION 2

SITE WORKSECTION 02200 -- EARTHWORKPART I -- GENERAL2.1 DESCRIPTION

This section covers the requirements for excavation, fill, back-fill, and grading, complete. Excavation, trenching and back-filling for utility systems shall be performed under the respective sections of these specifications, but shall conform to the requirements specified herein.

2.2 RELATED WORK SPECIFIED ELSEWHERE

Asphaltic Concrete Paving: Section 02600

2.3 APPLICABLE DOCUMENTS

The latest issue of the following standards form a part of this specification to the extent indicated by the reference thereto:

1. ASTM Standards

C33	Specification for Concrete Aggregates
D1556	Standard Method of Test for Density of Soil in Place by the Sand-Cone Method
D1557	Standard Method of Test for Moisture-Density Relations of Soil Using 10-lb (4.5 kg) Rammer and 18 inch (457 mm) Drop

D2992 Standard Methods of Test for Density of Soil and
and Soil-Aggregate in Place by Nuclear Methods

D3017 Standard Methods of Test for Moisture Content of
Soil and Soil-Aggregate in Place by Nuclear
Methods

2. State of California CALTRANS Standard Specifications, dated 1984.

2.4 QUALITY ASSURANCE

A Backfilling operations may be subject to inspection by a soil testing laboratory employed by the University under another contract. Authorized personnel shall have unrestricted access to the work.

B Laboratory Analysis and Testing
The soil testing laboratory will:

1. Make mechanical analysis and consistency tests of fill materials to determine the amount of non-durable and organic material therein, and if necessary, determine the plasticity index, gradation and moisture content.
2. Make moisture-density tests in accordance with ASTM D1557:

C Field Control Testing

1. The soil testing laboratory will, if deemed necessary:
 - a. Determine the density and moisture content of soil in place in accordance with ASTM D1556 or D2992, and D3017, where and as directed by the University.
 - b. Make other tests as directed by the University.
2. When, in the judgment of the University, there is reasonable doubt that a backfill material exhibits characteristics necessary for the specified compaction, a field-conducted moisture-density one-point test will be performed. If the moisture-density one-point test does not fall on the curve which has been established, a sample of that material in question will be tested in the laboratory for compaction recommendations.

D Testing performed by the University does not relieve the Subcontractor of the responsibility for insuring that the backfill meets the requirements of this specification.

2.5 JOB CONDITIONS

- A Blasting is not expected to be necessary and will not be permitted.
- B Material shall not be placed during rain or other unfavorable weather conditions. After rain or other unfavorable weather condition, the moisture content of existing fill shall be checked by the Subcontractor and moisture content corrected, if necessary, before continuing with the placement of fill.
- C Adequate dust control shall be employed throughout the course of the subcontract. Subcontractor shall keep roads free of haul material at all times.

2.6 PROTECTION

- A Surface drainage shall be provided to prevent standing water in any part of the work. Excavation shall be kept free of water at all times.
- B Excavations shall be adequately supported or sloped to prevent cave-in or other damage. The Subcontractor shall support excavations in accordance with the applicable requirements of Federal construction standards. If excavation is performed without support, slopes shall be stable and shall be within the limits of excavation specified in OSHA 1926.652 Table P-1.

PART II -- PRODUCTS

2.7 MATERIALS

- A Structural fill material, except where shown on the drawings as drainage rock, shall be select native material.
- B Sand for bedding under concrete slabs shall be Santa Cruz County, Olympia sand and shall be free of deleterious materials and injurious amounts of organic matter. Sand shall conform to the applicable requirements of ASTM C33.
- C Drainage rock shall be gravel or broken stone, well washed and free from dirt or other deleterious substances.

PART III -- EXECUTION2.8 EXCAVATIONA General

1. Excavations shall be cut to the lines, grades and cross sections indicated on the drawings.
2. Bottoms of excavations shall be soil, cut to the elevations indicated on the drawings. Excavations in soil under concrete which are cut below the indicated level shall be filled to the indicated elevation and compacted as specified for the backfill, at no additional expense to the University.
3. Limits of the excavation shall allow for adequate working space for installing forms and as required for safety of personnel.
4. All unstable bottom material, large stones, debris and compressible soils shall be removed from excavation bottoms to a minimum depth of 12".
5. Care shall be exercised to preserve the material below and beyond the lines of all excavation. Where excavation is carried below the required grade or to indicated invert grade, overexcavation shall be filled as specified in this article.
6. Excavated material shall be placed at sufficient distance from edge of excavation so as not to cause cave-in or bank slides, but in no case closer than 3' from the edge of excavations.
7. In paved areas, pavement shall be removed as required to accomplish the work. After compacting the backfill, pavement shall be restored to a condition equivalent to or better than that existing at the start of construction. Damaged pavement shall be restored at no additional expense to the University.

B Disposal

1. Clean, excavated material in excess of backfill requirements shall be spread in the disposal area as shown on the drawings.
2. Material to be re-used as backfill shall be placed in temporary stockpiles adjacent to the construction site as approved.

C Excavation, Trenching & Backfill for Utility Lines

All excavated materials not required or suitable for backfill shall be removed and disposed of as hereinbefore specified. Such grading shall be done as may be necessary to prevent surface water from flowing into trench or other excavations, and any water accumulating therein shall be removed by pumping or by other approved methods. The trenches shall not be backfilled until all required pressure tests are performed and approved and until systems as installed conform to the requirements specified in the various sections of these specifications covering the installation of utilities. The trenches shall be carefully backfilled with imported material, deposited in 8" layers and each layer thoroughly and carefully compacted. Trenches shall be compacted to 95% of max. density in paved areas and 90% of max. density in non-paved areas.

DIVISION 2

SITE WORK

SECTION 02500 -- STORM DRAINAGE SYSTEM

PART I -- GENERAL

2.1 DESCRIPTION

This section describes the requirements for the materials and relocation of inlets, drains and appurtenances for the diversion of surface water.

2.2 RELATED WORK SPECIFIED ELSEWHERE

Earthwork: Section 02200
Concrete Work: Section 03300

2.3 CITED REFERENCES

- A Standard Specifications, CALTRANS, dated 1984.
 Section 66, Corrugated Metal Pipe.
 Section 75, Miscellaneous Metal.
- B ASTM - American Society for Testing and Materials
 1. A 36: Standard Specification for Structural Steel
 2. A 123: Standard Specification for zinc (hot galvanized)
 Coatings
 3. A 576: Standard Specification for Steel Bars, Hot-Wrought,
 Special Quality

PART II -- PRODUCTS

2.4 MATERIALS

- A Corrugated metal pipe, couplers and other accessories shall conform to Section 66 of CALTRANS Standard Specifications.
- B Cast-in-place concrete shall conform to Section 03300 of these specifications.
- C Inlet frames and grates shall be fabricated from structural steel conforming to ASTM A36 or ASTM A576, Grade 1021, 1022, 1026, 1029, or 1030. Frames and grates shall be welded steel, galvanized, conforming to CALTRANS Standard Specifications.

PART III -- EXECUTION

2.5 INSTALLATION

- A Corrugated metal pipe shall be installed and anchored in accordance with CALTRANS Standard Specifications, Section 66.
- B Excavation, structural backfill, and bedding for drainage structure and pipe shall be as specified in Section 02200 of these specifications.
- C Concrete and reinforcement shall be installed in accordance with Section 03300 of these specifications.

DIVISION 2

SITE WORK

SECTION 02600 -- ASPHALTIC CONCRETE PAVING

PART I -- GENERAL

2.1 DESCRIPTION

- A Work included:
Provide asphaltic concrete paving and aggregate base where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

2.2 QUALITY ASSURANCE

- A Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B Operations may be subject to inspection by a testing laboratory employed by the University under another contract. Subcontractor shall cooperate with the University and testing laboratory in obtaining the necessary tests. Authorized personnel shall have unrestricted access to the work. The testing laboratory will, if deemed necessary:
1. Determine the density of material in place in accordance with ASTM D2992, where and as directed by the University.
 2. Make other tests as directed by the University.

- C Testing performed by the University does not relieve the Subcontractor of the responsibility for insuring that the material meets the requirements of this specification.

2.3 SUBMITTALS

None required.

2.4 PRODUCT HANDLING

Comply with pertinent provisions as stated below. Delivered asphalt must be covered with a tarpaulin to preserve the temperature of the mix.

PART II - PRODUCTS

2.5 AGGREGATE BASE COURSE AND PAVING

Materials used for new paving and restoration of existing paved surfaces shall conform to the applicable requirements of the State of California Standard Specifications (CALTRANS), dated July 1984, and as stated below.

PART III - EXECUTION

2.6 EXISTING PAVED AREAS

Restoration of existing paved surfaces removed or damaged during these construction operations shall be accomplished using materials and methods to match the existing adjacent paved surfaces and shall conform to the applicable sections of the CALTRANS Specifications.

2.7 NEW PAVING

- A Clear and excavate areas as required, grade and compact to required subgrade elevation.

- B Place a 6" thick aggregate base with 95% compaction at locations indicated on drawings. Base material shall be Class 2 in conformance with Section 26.
- C Directly above the aggregate base, apply a prime coat at the rate of 0.20 to 0.50 gallons per square yard, in accordance with Section 93. Apply a paint binder to all vertical surfaces of existing pavement, curbs, etc. against which additional material is to be placed, in accordance with Section 94, SS1 grade.
- D Apply 2" (minimum) thickness of asphaltic concrete in accordance with Section 39, Type B, using Section 92 steam refined asphalts. Asphalt shall not be placed when the atmospheric temperature is less than 50 degrees F, nor when the asphalt temperature is less than 250 degrees F.
- E After placement of asphaltic concrete, apply a fog seal coat in accordance with Section 37, using Section 94 SS1 grade asphaltic emulsion at a rate of 0.05 to 0.10 gallons per square yard. Protect area from traffic until fog seal has set and cured.
- F Protection of Utilities:
Any existing utility lines that are to remain in service but which are disturbed by the work required, shall be restored or repaired to the satisfaction of the University at no additional cost.

DIVISION 3

CONCRETE

SECTION 03300 -- CONCRETE WORK

PART I -- GENERAL

3.1 DESCRIPTION

- A Furnish all labor, materials, and equipment necessary to complete the work of this Section.
- B Produce concrete which will present an appearance satisfactory to the University when finished as specified in this section of the specifications.
- C Examine all drawings and other sections of these specifications for extent and detail of all items required to be inserted in the forms for attachment of other work.

3.2 RELATED WORK SPECIFIED ELSEWHERE

Structural Steel: Section 05100

3.3 COOPERATION

- A Obtain information and instruction from all trades and suppliers in ample time to schedule and coordinate the installation of items furnished by them to be embedded in concrete under this section so that provisions for their work can be made without delaying the project.
- B Take all precautions to maintain alignment and prevent damage to such items during placement of concrete.

- C Cutting and/or patching made necessary by failure or delay in complying with these requirements shall be at the expense of the Subcontractor.

3.4 APPLICABLE DOCUMENTS

- A The documents listed below form a part of this specification to the extent indicated by the reference thereto.

1. ASTM Standards

A615-82	Specification for Deformed Billet-Steel Bars for Reinforcement
A185-79	Specification for Welded Steel Wire Fabric for Concrete Reinforcement
C31-81	Method of Making and Curing Concrete Compression and Flexure Test Specimens in the field
C33-82	Specification for Concrete Aggregates
C39-81	Method of Test for Compressive Strength of Molded Concrete Cylinders
C94-81	Specifications for Ready-Mix Concrete
C150-81	Specification for Portland Cement
C260-77	Specification for Air-Entraining Admixtures for Concrete
C309-81	Specification for Liquid Membrane-Forming Compounds for Curing Concrete
C494-80	Specification for Chemical Admixtures

2. ACI Standard

ACI 318-83	Building Code Requirements for Reinforced Concrete
ACI 315	Manual of Standard Practice for Detailing Reinforced Concrete Structures.

B General

Full cooperation shall be coordinated for all trades for installation of embedded items. Suitable templates or instructions, or both, shall be provided for setting items not placed in the forms. Embedded items shall have been inspected and approved by the University before concrete is placed. All concrete shall comply with the ACI standard "Building Code Requirements for Reinforced Concrete (ACI 318-83)."

C Submittals

Shop drawings and data shall be submitted to the University for the reinforcing steel, detailed in conformance with ACI 315, showing material sizes, cutting and bending dimensions, and placement details. Shop drawings shall be reviewed by the University prior to commencement of fabrication. Concrete mix

design shall be submitted to the University in accordance with paragraph 3.10.

PART II -- PRODUCTS

3.5 FORMWORK

A Materials

1. APA "Plyform" for all vertical concrete surfaces, except for footings or keyways placed in earth trenches.
2. W.J. Burke Co. "Burke Form Release Oil," or approved equal.
3. Richmond "Snap-Type," or approved equal, for ties.

B Construction

Furnish and erect to profiles, lines and levels as required and shore and brace against movement or bellying. Coat all forms with release oil before placing concrete.

C Inserts

All inserts, sleeves and other embedments as shown on the drawings shall be set into the formwork where required, prior to requesting approval of forms by the University.

3.6 VAPOR BARRIER

Vapor barrier shall be polyethylene sheeting of .004" thickness and shall be "Visqueen" or other University approved equal. Vapor barrier shall be carefully installed to avoid puncture or tear. Punctures and tears occurring during subsequent operations shall be patched. Edges shall be lapped not less than 4" and end joints shall be lapped not less than 6". Patches and lapped joints shall be sealed with a pressure-sensitive adhesive or pressure-sensitive tape not less than 2" wide. Adhesive or tape shall be compatible with the membrane, and as recommended by the manufacturer of the membrane.

3.7 REINFORCING STEEL

A Materials shall be as follows:

1. Bars: ASTM A615, Billet-Steel - Grade 60.
2. Welded wire fabric: ASTM A185.
3. Minimum concrete covering for steel shall be 3" when placed against earth. Reinforcing shall be kept clear of the ground by 3" cubes of concrete or plastic chairs tied to steel with wire.

B Fabrication and Erection

Furnish and place to details and locations shown, securely tie and anchor against displacement. Use concrete blocks to support work above grade. Provide bends and hooks as detailed, cold-bent. Laps shall be 32 diameters minimum, or as shown on the drawings. Clean all bars free from dirt, scale, rust, etc., just prior to placing concrete. Clean all formwork of debris and other deleterious substances prior to placement of concrete. All reinforcement and embedded items shall be inspected and approved by the University prior to placing of concrete. Fabrication and erection shall comply with ACI 318-83.

3.8 SOURCES OF CONCRETE

Ready-mixed concrete shall be used. Except for materials herein specified, ready-mix concrete shall conform to ASTM C94. Water shall not be added to the mix at the site without the approval of the University representative.

3.9 CONCRETE MATERIALS

- A Portland cement shall conform to the requirements of ASTM C150, Type II, unless otherwise directed by the University representative.
- B Aggregate shall conform to ASTM C33 and shall be granite or limestone.
- C Admixtures shall be used in all concrete as follows: Water reducing admixture conforming to all requirements of ASTM C494. Air entraining admixtures complying with ASTM C260 shall be used. Air content of freshly mixed concrete shall not exceed four (4) percent or be less than two (2) percent.
- D Water used in concrete shall be clean, domestic water.

- E Curing Materials
Concrete shall be cured as follows:

Concrete shall be cured with a membrane curing compound conforming to the requirements of ASTM C309, Type I, with fugitive dye, provided that where the surfaces are exposed to the direct rays of the sun, Type 2 white pigment shall be used.

- F Concrete for encasement of underground electrical ducts (where shown on drawings) shall be colored a distinctive red by adding 10 pounds of Miller's Red pigment per cubic yard, or other approved equal.

3.10 MIX DESIGN

Minimum design compressive strength shall be 4000 psi at 28 days, except for post anchors and duct bank, which shall have a compressive strength of 3000 psi at 28 days.

3.11 TESTING

Three test cylinders (empty cylinders provided by the University) shall be provided by the Subcontractor for each 50 cubic yards, or fraction thereof, of concrete placed each day. Testing will be performed by a certified testing laboratory, employed by the University under another subcontract. Compression tests will be made at seven days and 28 days in accordance with ASTM C39.

PART III -- EXECUTION

3.12 CONCRETE PLACEMENT

- A Two working days advance notice of any concrete placement is required.
- B Concrete shall be placed within 90 minutes after the cement has been intermingled with the aggregate and/or 45 minutes after addition of water and admixture.
- C Concrete shall be consolidated to the maximum practicable density, using vibrators. Vibrators shall be electric or pneumatic, power-driven, immersion type.
- D When depositing concrete at freezing or near-freezing temperature, the concrete shall have a temperature of at least 50