CONTRACT DOCUMENTS AND SPECIFICATIONS

FOR THE

BROOKS CITY BASE CONNECTIONS
SOLICITATION #00163
EXHIBIT 3
TECHNICAL SPECIFICATIONS

SAN ANTONIO RIVER AUTHORITY
ENGINEERING DEPARTMENT
100 EAST GUENTHER STREET
SAN ANTONIO, TEXAS  78204

PREPARED BY:

ARCADIS U.S.
1777 NE Loop 410, Suite 625
SAN ANTONIO, TX 78217
TEXAS ENGINEERING FIRM# F-533
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December 2019
BROOKS CITY BASE CONNECTIONS

CONTRACT DOCUMENTS

NOVEMBER 2019

STATE OF TEXAS

JAIME OZUNA, JR.
123130
PROFESSIONAL ENGINEER

Structural Engineering Associates, Inc.

TBPE Firm Reg. No. F-199

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SECTION 01000
SUMMARY OF WORK

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE:

Section 01300: Submittals
Section 01040: Contract Coordination

1.2 WORK COVERED BY CONTRACT DOCUMENTS:

The work to be performed under this Contract shall consist of furnishing all labor, materials, tools, equipment, and incidentals and performing all work required to construct, complete in place and ready to operate, all items of the work described in the Contract Documents.

Items include, but are not necessarily limited to the following:

Concrete Trail Construction, Concrete Retaining Wall Construction, Concrete Slabs on Grade, Drilled Piers, Metal Fabrication, Excavation, Embankment, Grading, Landscaping, and Re-Vegetation

1.3 MEASUREMENT AND PAYMENT:

No direct measurement and payment will be made for this item, measurement and payment is considered subsidiary to other bid items as outlined in Section "Measurement and Payment" of Part 1, General Provisions.

PART 2 PRODUCTS (not applicable)

PART 3 EXECUTION (not applicable)

END OF SECTION
SECTION 01040
CONTRACTOR COORDINATION

PART 1 GENERAL

1.1 DESCRIPTION:

A. COORDINATION WITH OTHER CONTRACTORS:

In the event other Contractors are doing work in the same area simultaneously with this project, the Contractor shall coordinate his proposed construction with that of the other Contractors. Where the Contractors cannot agree, the Project Manager will designate a priority on the work being carried out.

B. COORDINATION WITH UTILITY COMPANIES:

1. The Contractor shall determine and verify the exact locations, both vertically and horizontally, of all existing utilities in the area of construction.

2. The Contractor shall use all safety precautions directed by the Project Manager and utility Owners when crossing such lines with the Work.

C. COORDINATION WITH LOCAL AUTHORITIES:

Due to the nature of this project, the following shall apply:

1. The Contractor shall be responsible for coordinating the work within the local authority's jurisdiction.

2. The Contractor shall notify appropriate local authority's official at least two (2) weeks prior to commencing work within a local authority's jurisdiction.

3. The Contractor shall establish a construction schedule to accommodate the local authority's desires as directed and approved by the Project Manager.

1.2 MEASUREMENT AND PAYMENT:

No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be paid for separately.

PART 2 PRODUCTS (not applicable)
PART 3 EXECUTION (not applicable)

END OF SECTION
SECTION 01050
GRADERS, LINES AND LEVELS

PART 1 GENERAL

1.1 DESCRIPTION:

A. Article 4.4, "Reference Points," of the General Conditions is amended as follows:

1. Construct all Work under this Contract in compliance with the alignments indicated on the Plans.

2. The Contractor shall be responsible for performing the following with competent personnel:

   a. Layout and control of all grades, lines, and levels except as stated in Article 4.4 “Reference Points,” of the General Conditions.
   b. Layout and setting of form lines and grades.
   c. Layout and setting of joint lines.
   d. Layout and setting of embedded items.
   e. Layout and setting pipeline installation, lines, and grades.
   f. Layout blue tops for various courses of materials.
   g. All staking.
   h. Establish offsets and record elevation of staked PI’s.

3. Should the Project Manager determine that the Contractor does not employ competent personnel to provide the above-mentioned surveying functions, the Contractor will be directed to provide a Registered Professional Engineer (Texas Licensed) or a Registered Professional Land Surveyor (Texas Licensed) at no cost to the Owner. Said professional must direct the surveying functions as outlined in Paragraph A.2.

4. The Contractor shall safeguard all points, grade marks, and benchmarks established on the Work; should any of the points be destroyed, the replacement will be at the cost of the Contractor; and shall assume the entire expense of rectifying work improperly constructed due to failure to maintain and protect such established points and marks.

5. The Contractor shall give the Owner forty-eight (48) hours minimum notice
1.2 MEASUREMENT AND PAYMENT:

No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be paid for separately.

PART 2 PRODUCTS (not applicable)

PART 3 EXECUTION (not applicable)

END OF SECTION
SECTION 01060
APPLICABLE CODES

PART 1 GENERAL

1.1 DESCRIPTION:

For work covered under this Contract, the Owner shall provide all rights-of-way designated on the Plans. The Contractor is responsible for obtaining all applicable permits and fees associated therewith.

1.2 MEASUREMENT AND PAYMENT:

No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be paid for separately.

PART 2 PRODUCTS (not applicable)

PART 3 EXECUTION (not applicable)

END OF SECTION
PART 1 GENERAL

1.1 REFERENCE SPECIFICATIONS:
Whenever reference is made to the furnishing of materials or testing thereof to conform to the standards of any technical society, organization, or body, it shall be construed to mean the latest standard, code, specification or tentative specification adopted and published at the time of advertisement for bids, even though reference has been made to an earlier standard, and such standards are made a part hereof to the extent which is indicated or intended.

Common names and abbreviations are listed below, but this list is not intended to be all encompassing:

AASHTO American Association of State Highway and Transportation Officials
ACI American Concrete Institute
AGMA American Gear Manufacturers Association
AISC American Institute of Steel Construction
AISI American Iron and Steel Institute
ANSI American National Standards Institute
ASA American Standards Association
ASAE American Society of Agricultural Engineers
ASCE American Society of Civil Engineers
ASHE American Society of Heating and Ventilating Engineers
ASME American Society of Mechanical Engineers
ASTM American Society for Testing Materials
AWPA American Wood Preservers Association
AWS American Welding Society
AWWA American Water Works Association
CIPRA Cured Iron Pipe Research Association
EPA Environmental Protection Agency
FED. SPEC. Federal Specification
IEEE Institute of Electrical and Electronic Engineers
IES Illuminating Engineering Society
NASSCO National Association of Sewer Service Companies
NAVY SPEC. Navy Department Specification
NEC National Electric Code
NEMA National Electrical Manufacturers Association
OSHA Occupational Safety and Health Administration
SAE Society of Automotive Engineers Standards
SHBI Steel Heating Boiler Institute
TMUTCD Texas Manual on Uniform Traffic Control Devices
TCEQ Texas Commission of Environmental Quality (formerly the Texas Natural Resources Conservation Commission)
Where no reference is made to a code, standard, or specification, the Standard Specification of the ASTM, the ANSI, the ASME, the IEEE, or the NEMA, as appropriate, shall govern. Where reference is made to ASA, it shall be interpreted as referring to ANSI, the successor to ASA.

1.2 TRADE NAMES AND MATERIALS:

Where materials or equipment are specified by a trade or brand name, it is not the intention of the Authority to discriminate against an equal product of another manufacturer, but rather to set a definite standard of quality of performance, and to establish an equal basis for the evaluation of bids. Where the words "APPROVED EQUAL", "EQUIVALENT", "PROPER", or "OR EQUAL TO", are used, they shall be understood to mean that the item referred to shall be proper, the equivalent of, or equal to the item specified by a trade or brand name, in the opinion or judgment of the Project Manager. Unless otherwise specified, all materials shall be the best of their respective kinds and shall be equal to approved samples. Notwithstanding that the words "OR EQUAL TO," or other such expressions, may be used in the Specifications in connection with a material, manufactured article or process, the material, article, or process specifically designated shall be used, unless a substitute is approved in writing by the Project Manager.

1.3 MEASUREMENT AND PAYMENT:

No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be paid for separately.
SECTION 01200
PROJECT MEETINGS

PART 1 GENERAL

1.1 DESCRIPTION:

A. RELATED WORK SPECIFIED ELSEWHERE:

Section 01720: Project Record Documents

B. PROJECT MEETINGS:

The Engineer may request meetings with the Contractor at any time during the life of this project, on matters pertaining to the progress of work being carried out under this Contract. It will be the responsibility of the Contractor to supply whatever information is requested by the Engineer concerning this project throughout its duration. Weekly meetings for review of progress may be required by the Engineer to be held between the Engineer and the Contractor. The Contractor will make himself available for such meetings as requested by the Engineer.

C. PUBLIC MEETINGS AND INFORMATION ACCESS:

The Contractor shall conduct public meetings requested by the Engineer at any time during the life of this Project on progress being carried out under this Contract. It will be the responsibility of the Contractor to notify all affected business and residents one week in advance of the meetings, conduct the meetings outlining anticipated schedule of activities, and provide other current information to the public and coordinate work as required.

Specific information regarding status of past, present, and future street closures and access information for potentially impacted residences, businesses, commuters and others shall be provided to the general public and to authorities as required by the Engineer.

Up to date information shall be consistently provided by mail, fax, voice messages, fliers, or other means, as directed and no less than seven days prior to the proposed impact, unless specified greater than seven days elsewhere in the Contract Documents.

1.2 MEASUREMENT AND PAYMENT:

No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be paid for separately.

PART 2 PRODUCTS (not applicable)
PART 3 EXECUTION (not applicable)
SECTION 01300
SUBMITTALS

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE:

Section 01040: Coordination
Section 01720: Project Record Documents

1.2 COVERSHEET:

A. Cover sheets for the submittals should be submitted electronically to the Project Manager, or designee, unless otherwise communicated by the Project Manager.

B. Contractor to submit sample coversheet form to Project Manager for approval.

C. List every item submitted (e.g. drawings, report, data sheet, or sample) on the coversheet, listing only one item per line.

1.3 SUBMITTALS REQUIRED FOR CONTRACT ADMINISTRATION:

The Contractor shall submit the following during the life of the Contract for each phase of the Project:

A. MONTHLY PROGRESS SCHEDULES:

1. The Contractor shall prepare and maintain a current detailed schedule supporting the Contract performance dates. The Contractor will use the approved project schedule as the baseline schedule and subsequent monthly schedules will be progress schedules.

2. Contractor shall show principal work related submittal requirements, time schedules for coordination, and integration of submittal activity with related work.

3. Contractor shall provide projected schedules (look aheads) in the format requested by the Project Manager.

2. One (1) updated electronic copy of the progress schedule shall be submitted to the Project Manager each month.

3. The progress schedules shall show commencement and completion dates of all major items of work.
4. Other work may be added to the schedule as requested or approved by the Project Manager.

5. The schedule shall show a Gantt chart and be progressed monthly.

6. The baseline schedule shall be submitted to the Project Manager within ten (10) calendar days after the date of the notice to proceed. The progress schedules shall be modified as necessary to reflect additional items or other modifications to the Contract. The second and subsequent progress schedules shall be submitted with the Contractor's monthly pay estimate request.

B. WEEKLY PAYROLLS:

Each week, the Contractor shall submit, to the Project Manager, one (1) electronic copy of all payrolls. The Contractor shall also submit one (1) electronic copy of payrolls of all subcontractors. The Contractor shall indicate that the payrolls are correct and complete, that the wage rates contained therein are not less than those determined by the Secretary of Labor, and that the classifications set forth for each laborer, or mechanic, including apprentices and trainees, conform to the work he performed. Submission of the "weekly statement of compliance" required under this contract and the Copeland Regulations of the Secretary of Labor (29 CER Part 3) shall satisfy the requirement for submission of the above statement. The Contractor shall submit a copy of any fringe benefits approved by the Secretary of Labor that is required by Paragraph C of the clause entitled, "Davis-Bacon Act."

C. MONTHLY MANPOWER UTILIZATION REPORTS:

The Contractor shall submit to the Project Manager on or before the first day of each month a copy of the Monthly Manpower Utilization Report (EPA-Optional Form 66) as submitted to the office of Civil Rights and Urban Affairs, United States Environmental Protection Agency, Region VI, for the previous copies of the Monthly Manpower Utilization Report submitted by all subcontractors performing work of $10,000.00 or more, on or before the first day of the month following the month of the report.

1.4 SUBMITTALS REQUIRED BY PLANS AND SPECIFICATIONS:

A. SUBMITTAL FORMAT:

All material and equipment submitted for review shall meet the following criteria. Each sheet of descriptive literature submitted shall be marked by the Contractor in RED to identify the material or equipment as follows:

1. Submittal sheets or drawings showing more than the particular item under consideration shall have crossed out all but the pertinent description of the
item for which review is requested.

2. Equipment and materials descriptive literature not readily cross-referenced with the drawings or specifications shall be identified by a suitable notation.

3. If the plans or specifications do not indicate specific materials, then the Contractor will be required to provide a submittal on items requested by the Project Manager.

3. Each drawing shall be dated and shall bear the name of the project, names of equipment or materials, and the location where the equipment or materials, are to be installed in the Project. Should dimensions be critical to the submittal, field dimensions shall be verified and clearly marked as such. The Project Manager may decline to consider any submittals that do not contain complete data on the Work, full information on related matters, and/or are not properly collated.

4. Submittals should be numbered in sequence for each section of the specification. Each submittal shall have a separate line on the coversheet with the number and description. The number after the dash indicates the section of the specification, i.e., number of the submittal. For example: 11-03010 would be the eleventh transmittal applicable to section 03010 of the specification, 12-03010 would be the twelfth transmittal applicable to section 03010.

5. Resubmittals (i.e. those replacing or revising previous submittals) should be identified with a letter following the original number. For example: a resubmittal affecting submittal 11-03010 would be number 11A-03010. The number 11-03010 would then be entered in the space "Previous submittal number" which is left blank except on resubmittals. Specifically identify revisions on resubmittals.

6. Every copy of drawings and other items submitted is to be marked with the Contractor's stamp, thus indicating the item has been checked by the General Contractor and approved by him for use. The marking should provide the following information: Name of Contractor, signature of person who checked the item, transmittal number, and date.

7. Contractors and their suppliers must coordinate with the Project Manager for markings indicating changes, corrections, marking or signing drawings to be submitted.

8. Only the General Contractor should submit shop drawings to the Owner. Suppliers and subcontractors should forward their drawings to the General Contractor for review, approval, and submittal.
9. If submittals show departures from the Contract requirements, the Contractor shall make specific mention thereof in the coversheet; otherwise, review of such submittal will not constitute acceptance of the departure. Failure to note any deviation will result in the Project Manager returning the shop drawings for specified processing. The Project Manager and Owner will record all time spent to review improperly processed shop drawings. Such time plus overhead costs will be permanently withheld from payments due to the Contractor. Submittals received by the Project Manager for review without the Contractor's stamp certifying his review will be returned "without action."

10. No work called for by submittal shall be initiated until the said submittals have been reviewed, approved, and accepted by the Project Manager.

B. SUBMITTAL CONTENT:

The submittals shall show that all requirements of the specification section have been met. The submittals shall contain the following information as applicable:

1. Equipment function, normal operating characteristics, and limiting conditions.

2. Assembly, installation, alignment, adjustment and checking instructions. For the reinforcement placement drawings, the Contractor shall show reinforcing steel in plan views and elevations. Showing the reinforcing steel only in section will not be approved.

3. Outline, cross-sections, and assembly drawings; Engineering data; and wiring diagrams.

4. Test data and performance curves, where applicable.

5. The operational and maintenance manual for the equipment item and/or system as designated or as required elsewhere within these specifications shall be submitted in accordance with this section. One (1) original bound volume with one (1) electronic copy of all operation and maintenance manuals is required. Additional hard copies will be provided as requested by the Project Manager.


7. Working Drawings:
   
a. Items for which working drawings are required; included but are not limited to, the non-equipment and installation items as set forth elsewhere within these specifications.
b. The drawings shall be numbered consecutively and shall accurately and distinctly present the following:

1) All working and erection dimensions.
2) Arrangement and sectional views.
3) Necessary details, including complete information for making connections between functional parts.
4) Kinds of materials and finishes.
5) Parts list and description thereof.

c. Where practical, the Contractor should submit original, reproducible drawings for review. Where catalog data is required for submittal, submit original printed matter, not a copy thereof.

d. One (1) electronic copy in the requested file format of all submittals are required for the Project Manager's purpose. At the Project Manager’s discretion hardcopies may be required and will be provided by the Contractor. One (1) electronic of the submittal will be returned to the Contractor marked:

Approved
Approved with Comments
Revise and Resubmit
Rejected

8. Samples include both fabricated and un-fabricated physical examples of materials, products and units of work, both as complete units and as smaller portions of units of work, either for limited visual inspection or (where indicated) for more detailed testing and analysis.

C. SUBMITTAL REJECTION:

The Project Manager will review submittals upon receipt for conformance with the submission requirements for format and content. Submittals not in conformance with the submission requirements will not be reviewed and will be returned for resubmission.

D. COORDINATION OF SUBMITTAL TIMES:

Prepare and transmit each submittal to the Project Manager sufficiently in advance of performing related work or other applicable activities, so the installation will not be delayed or improperly sequenced by processing times, including non-approval and resubmittal (if required). Coordinate with other submittals, testing, purchasing, delivery, and similar sequenced activities. No extension of time will be authorized because of Contractor's failure to transmit submittals to the Project Manager.
sufficiently in advance of the work.

E. SEQUENCING REQUIREMENTS:

As applicable in each instance, do not proceed with a unit of work until submittal procedures have been sequenced with related units of work, in a manner that will ensure that the action will not need to be later modified or rescinded due to a subsequent submittal that should have been processed earlier or concurrently for coordination. Submit all shop drawings pertaining to a functional system together including all related specifications.

F. INDIVIDUAL SECTION REQUIREMENTS:

The individual submittal requirements are specified in other sections of the specifications for each unit of work.

1. Temporary Erosion, Sediment, and Water Pollution Control.
2. Temporary earth retention system.
3. Trench excavation protection.
4. Miscellaneous metals.
5. Reinforcement placement.
6. Forming and concrete placement details.
8. Concrete Mixes
9. Pollution Prevention Plan
11. And other routine submittals as required.

G. HARDCOPY SUBMITTALS:

The Project Manager may request any submittal in hardcopy format. The Project Manager will specify the number of copies. The CONTRACTOR will also be required to submit one (1) electronic copy of the entire submittal to the PROJECT MANAGER.

1.5 DISTRIBUTION:

A. GENERAL DISTRIBUTION (BY THE PROJECT MANAGER):

1. The Project Manager will distribute via e-mail or FTP site depending upon file size.

B. CONTRACTOR DISTRIBUTION:

Provide additional distribution of submittals (not included in foregoing copy
submittal requirements) to subcontractors, suppliers, fabricators, installers, governing authorities, and others as necessary for proper performance of the work. If the Contractor requires additional copies of shop drawings for distribution to subcontractors, he shall prepare them himself at his own expense.

C. REVIEW TIME:

Allow a minimum of four (4) weeks for the Project Manager's initial processing of each submittal requiring review and response, except allow longer periods where processing must be delayed for coordination with subsequent submittals. The Project Manager will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination. Allow four (4) weeks for reprocessing each submittal. Advise the Project Manager on each submittal as to whether processing time is critical to progress of the work, and therefore the work would be expedited if processing time could be foreshortened.

1.6 PROGRESS PHOTOGRAPHS:

A. After construction has started at the site of the work, the Contractor shall have suitable photographs taken on or about the first (1st) and fifteenth (15th) day of each month, showing the general condition of his work. The photographs shall be taken by an established commercial photographer who meets the approval of the Project Manager. The photographer shall coordinate with the Project Manager.

B. Photos views shall be determined by the Project Manager and the Contractor shall be taken on the first (1st) and fifteenth (15th) day of each month for each phase of the project. An electronic copy with a date stamp of each view shall be supplied to the Owner without charge as soon as practicable after the first (1st) and fifteenth (15th) day of each month. Printed photos of the project will be provided as requested by the Project Manager.

1.7 RECORD DRAWINGS:

A. The Contractor shall provide the Project Manager with construction record drawings reflecting items as constructed. Record drawings shall include but not be limited to the following:

1. Miscellaneous metal fabrications and Cured items.
2. All embedment items.
3. All concrete and structural drawings of facilities as constructed.

B. The Contractor shall keep a set of record drawings up to date and current at the job site (used only as a record set) and available for the Project Manager's inspection at all times. A complete set of blueline prints shall be corrected daily with date
notations and shall show every change from the original plans. During the course of construction, red line on a print of all plans, all changes made to the work during installation.

C. Upon Completion of the project the Contractor shall transfer the record data to a clean base drawing and submit to the Project Manager for approval.

1.8 MEASUREMENT AND PAYMENT:

No separate payment will be made for any item of work, materials, parts, equipment, suppliers, or related items required to perform and complete the requirements of this Section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be pair for separately.

PART 2 PRODUCTS (Not applicable)

PART 3 PRODUCTS (Not applicable)

END OF SECTION
SECTION 01400
QUALITY CONTROL

PART 1 GENERAL

1.1 DESCRIPTION:
A. Furnishing the services of a reputable certified independent testing laboratory to determine that materials and workmanship comply with the requirements of these specifications. All testing is paid by the Contractor.

1.2 CODES AND STANDARDS:
Testing shall meet the requirements of all pertinent codes, regulations, and selected standards as specified elsewhere in these specifications.

1.3 PROCESSING AND DISTRIBUTING:
Process required copies of test reports and related instructions and then distribute promptly to ensure all necessary retesting and replacement of materials with the least possible delay in progress of the work.

1.4 PAYMENT FOR TESTING SERVICES:
A. The Contractor will pay for or perform all initial and routine testing services except as otherwise specified.

B. When initial tests indicate non-compliance with the Contract Documents, perform subsequent retesting occasioned by the non-compliance by the same testing laboratory at the sole expense of the Contractor.

C. Inspection or testing performed exclusively for the Contractor's convenience shall be borne by the Contractor.

1.5 COOPERATION WITH TESTING LABORATORY:
Representatives of the testing laboratory shall have access to the work at all times. The Contractor shall provide facilities for such access in order that the laboratory may perform its functions properly.
1.6 TESTING SCHEDULES:

A. The Contractor shall consult the testing laboratory in advance to determine the time required to perform the tests and to issue each of the findings. Include the required time within the construction schedule.

B. When changes of the construction schedule are necessary during construction, the Contractor will coordinate all such changes with the testing laboratory as required.

1.7 TAKING SAMPLES:

All samples for testing will be collected by the independent laboratory staff in accordance with applicable standard guidelines.

1.8 MEASUREMENT AND PAYMENT:

No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be paid for separately.

PART 2 PRODUCTS (not applicable)

PART 3 EXECUTION (not applicable)

END OF SECTION
PART 1 GENERAL

1.1 OVERVIEW:

A. The purpose of this Section is to provide the Owner and the Contractor with an understanding of what constitutes special inspections as defined by the International Building Code (IBC), Chapter 17, “Structural Tests and Special Inspections,” the Contractor’s requirements per IBC and role in enabling the Owner to perform the inspections, and provide the Owner with a Statement of Special Inspection specific to this Project’s Special Inspection requirements.

1. IBC Special Inspections are not a substitute for other quality control testing required elsewhere in the contract documents.

2. IBC Special Inspections may not be performed by the Contractor.

1.2 CONTRACTOR’S RESPONSIBILITIES:

A. Enable the Owner and Owner’s Agent to conduct the required IBC Special Inspections as outlined below in “Special Inspection Activities by the Owner.”

1. Set up pre-construction meeting and coordinate with Owner and Owner’s Agent, prior to beginning construction, regarding the specific inspection needs and requirements that will be performed as part of these Special Inspections.

2. Provide complete access to the Site and make Contract Documents available on-Site.
   a. Provide and pay for all means necessary to enable inspection access at each location requiring inspection. This includes, but is not limited to, ladders, scaffolding, trench boxes/shielding, fall protection, adequate lighting, adequate ventilation, and designated area(s) for storing inspector equipment and test samples.
      1) All required access shall be conducted and constructed in accordance with OSHA.
   b. Protect Special Inspection test specimens of products and construction materials at the Site in accordance with recognized test procedures.
   c. Provide materials needed to perform sampling or field tests.

3. Notify the Owner and Owner’s Agent a minimum of 48 hours in advance of when construction activities requiring testing will be performed or when construction activities will limit and/or prevent inspector(s) from observing construction work already performed.
   a. Provide adequate notice before proceeding with Work that would interfere with sampling, testing, or other required verification.
b. Notify the Owner and Owner’s Agent prior to the time that testing is required. Lead time is to be adequate to allow arrangements to be made for testing.

c. Notify the Owner and Owner’s Agent when schedules change. Be in communication with the Owner as soon as a delay is expected.

4. Provide adequate quantities of representative product to be tested to the laboratory at the designated location.

B. Contractor shall submit the following submittals in accordance with Section 01300 “Submittals” and shall include:

1. A written schedule that establishes the approximate major and/or critical inspection milestones. Submit this schedule as Record Data. Any alterations to the schedule shall be resubmitted under the original Record Data tracking number with revision designation.

2. Maintain a log of times and dates when notification is given for an inspection, delay, re-inspection, etc. and who was notified. Submit this log at the end of the job under the next consecutive revision designation as mentioned above.

C. Special Inspection quality assurance activities are for the purpose of monitoring the results of the Contractor’s Work to see that it is in compliance with the requirements of the Contract Documents.

D. Special Inspection testing requirements mentioned in this Section do not release the Contractor from providing Contractor required testing specified elsewhere in the Contract Documents.

1. Contractor shall provide all testing documentation required in the Contract Documents based solely on Contractor paid testing, which shall be independent of Owner providing testing and testing documentation.

2. As specified in Section 01400, “Quality Control,” provide and pay for any additional testing performed by the Contractor or by the Owner as a result of failed Special Inspection tests.

E. Special Inspection activities or non-performance of Special Inspection activities:

1. Do not relieve the Contractor of its responsibility to perform Work and furnish materials and products and constructed Work conforming to the requirements of the Contract Documents.

2. Do not relieve the Contractor of its responsibility for providing adequate quality control measures.

3. Do not relieve the Contractor of its responsibility for damage to or loss of the material, product or Work before Owner’s acceptance.
4. Do not constitute or imply Owner’s acceptance.

5. Do not affect the continuing rights of the Owner after Owner’s acceptance of the completed Work.

F. All materials and products are subject to Owner’s quality assurance observations or testing at any time during preparation or use. Material or products which have been tested or observed or approved by Owner at a supply source or staging area may be re-observed or re-tested by Owner before or during or after incorporation into the Work, and rejected if they do not comply with the Contract Documents.

1.3 SPECIAL INSPECTION ACTIVITIES BY THE OWNER:

A. According to the 2015 IBC Chapter 17, Structural Tests and Special Inspections, adopted by the City of San Antonio, TX, the Owner shall employ a registered design professional to act as the Owner’s Agent. This registered design professional shall coordinate and fulfill all required IBC Special Inspection requirements, and as required, this registered design professional in responsible charge (RDPIRC) shall employ one or more approved agencies and/or inspectors to perform inspections during construction on the types of work listed below.

1. Unless not required by the building official or authority having jurisdiction (AHJ), the IBC requires that a Statement of Special Inspections be prepared by the RDPIRC for submittal by the applicant to the AHJ.

2. The names of individuals and firms to perform the Special Inspections shall be compiled by the RDPIRC. Prior to beginning the Special Inspections, the RDPIRC shall forward a copy of the inspector qualifications to the AHJ.
   a. Recommended special inspector qualifications for the structural portion of Special Inspection are listed in the Structural Statement of Special Inspection (Attachment A). However, each special inspector shall demonstrate competence, to the satisfaction of the AHJ, for the inspection of the particular type of construction or operation requiring special inspection.
   b. If requested by the AHJ, each special inspector shall provide written documentation to the building official demonstrating his or her competence and relevant experience or training.

3. The RDPIRC shall forward a copy of all reports, tests, and certifications, as a result of the Special Inspections to the AHJ and the Contractor.
   a. Discrepancies shall be brought to the immediate attention of the Contractor and Owner.

B. Statement of Special Inspections: The Structural Statement of Special Inspections, specific to this Project, is located at the end of this Section (Refer to Attachment A). All other required IBC required Special Inspections shall be determined by the RDPIRC and coordinated with Attachment A prior to submission to the RDPIRC.
PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CONTRACTOR TEST AND INSPECTION LOG:

A. Contractor Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date Owner was notified of impending construction work that requires testing and/or that would interfere with subsequent inspections.

2. Date construction work in question was completed.

3. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project Site. Post changes and revisions as they occur. Provide access to test and inspection log for Owner’s Agent and AHJ reference during normal working hours.

3.2 Contractor REPAIR AND PROTECTION:

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration in adjoining areas with durable seams that are invisible as possible.

B. Protect construction exposed by or for special inspection activities.

C. Repair and protection are Contractor’s responsibility, regardless of the assignment of responsibility for the Special Inspection activities.

END OF SECTION
ATTACHMENT A
STRUCTURAL STATEMENT OF SPECIAL INSPECTIONS

This Statement of Special Inspections has been prepared in accordance with International Building Code 2015 Chapter 17 by the Structural Engineer of Record for the following Project:

Project Name:
Location:
Owner:

Structural Engineer of Record:
Design Professional in Responsible Charge: TBD
Special Inspector for _________________:  TBD
Special Inspector for _________________:  TBD
Special Inspector for _________________:  TBD

Abbreviations

Inspectors

AWS-CWI: An American Welding Society/American Institute of Steel Construction certified welding inspector.
AWS/AISC-SSI: An American Welding Society certified structural steel inspector.
ACI: An American Concrete Institute certified technician, certified in the applicable construction type.
EIT: An Engineer-In-Training, a graduate engineer who has passed the Fundamentals of Engineering exam, and is under the direct supervision of a PE.
NICET: A National Institute for Certification in Engineering Technologies certified technician, certified in the applicable construction type.
PE: A licensed professional engineer and/or a structural engineer (SE) competent in the area of construction being inspected.

Specifications

ACI 318: American Concrete Institute Building Code Requirements for Structural Concrete.
AWS: American Welding Society

Common Words

C: Continuous observation of specified construction activity.
P: Periodic observation of specified construction activity.
CFSF: Cold formed steel framing.
CD: Contract Documents and/or Shop Drawings (if item is performance specified).

Special Inspectors minimum qualifications are listed below for each area of competency.
<table>
<thead>
<tr>
<th>Applicable IBC Section</th>
<th>Minimum Inspector Qualifications</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1704.2.5 Fabricators</td>
<td>N/A</td>
<td>Inspection of a fabrication facility is not required if the fabricator is exempt per IBC. Exemption typically requires a manufacturer is certified by an independent organization (e.g. AISC, IAS, SJI, or NPCA).</td>
</tr>
<tr>
<td>1705.2 Steel Construction</td>
<td>AWS-CWI, AWS/AISC-SSI, PE, or EIT</td>
<td>All welds shall be inspected by an AWS-CWI.</td>
</tr>
<tr>
<td>1705.3 Concrete Construction</td>
<td>ACI or NICET, PE, or EIT, AWS-CWI</td>
<td>All welds shall be inspected by an AWS-CWI.</td>
</tr>
<tr>
<td>1705.3 Post-Installed Concrete Anchors</td>
<td>PE</td>
<td>Professional engineer performing inspection shall have knowledge of post-installed anchor installation requirements and experience in the design and specifying post-installed anchors.</td>
</tr>
<tr>
<td>1705.6 Soils</td>
<td>ACI, NICET, PE, or EIT</td>
<td></td>
</tr>
</tbody>
</table>
Steel Construction

The inspection requirements for this type of construction include structural steel.

<table>
<thead>
<tr>
<th>Verification and Inspection</th>
<th>Frequency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material verification of cold-formed steel deck</strong></td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td><strong>Steel deck installation</strong></td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td><strong>Inspection tasks prior to welding</strong></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Inspection tasks during welding</strong></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Inspection tasks after welding</strong></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Inspection tasks prior to bolting</strong></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Inspection tasks during bolting</strong></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Inspection tasks after bolting</strong></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Steel embedded in concrete</strong></td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td><strong>Connections and framing details</strong></td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td><strong>Cold-formed steel trusses</strong></td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td><strong>Fabrication</strong></td>
<td>-</td>
<td>X</td>
</tr>
</tbody>
</table>
Concrete Construction

The inspection requirements for this type of construction include cast-in-place concrete.

<table>
<thead>
<tr>
<th>Verification and Inspection</th>
<th>Frequency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formwork</td>
<td>- X</td>
<td>Verify formwork for shape, location and dimensions of the concrete member being formed are in conformance with CD.</td>
</tr>
<tr>
<td>Reinforcing steel material and type</td>
<td>- X</td>
<td>Verify size of bars and/or stressing strands, ASTM standard, and grade are in conformance with CD.</td>
</tr>
<tr>
<td>Reinforcing steel position</td>
<td>- X</td>
<td>Verify quantity and spacing of bars and/or stressing strands, concrete clear cover on all sides. Verify lap splice type, location, and size. Verify no welding of reinforcing except where specifically noted.</td>
</tr>
<tr>
<td>Welding of reinforcing steel</td>
<td>X -</td>
<td>Verify material being welded is ASTM A706 and per CD. Verify personnel, equipment, materials, and welds per AWS D1.4. Provide 100% visual inspection of all welds.</td>
</tr>
<tr>
<td>Cast-in-Place anchors</td>
<td>- X</td>
<td>Verify size, type, position, and embedment prior to concrete placement. Verify position after concrete placement.</td>
</tr>
<tr>
<td>Cast-in-Place anchors</td>
<td>X -</td>
<td>Verify placement and consolidation of concrete around anchors.</td>
</tr>
<tr>
<td>Mix design</td>
<td>- X</td>
<td>Verify batch plant tickets’ mix number matches approved mix design for each mix design and application.</td>
</tr>
<tr>
<td>Fresh concrete samples</td>
<td>X -</td>
<td>At the same time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete. Sample per ASTM C31, C143, C231 (or C173), C1064. Frequency shall be per ACI 318: 5.6</td>
</tr>
<tr>
<td>Placement technique</td>
<td>X -</td>
<td>At the time of concrete or shotcrete placement, verify that proper application techniques are being implemented per the CD and ACI 301.</td>
</tr>
<tr>
<td>Curing technique</td>
<td>- X</td>
<td>Verify that approved means of curing and extreme weather protection are implemented in accordance with the CD.</td>
</tr>
</tbody>
</table>
Post-Installed Concrete Anchors

The inspection requirements for this type of construction include adhesive and expansion type anchors installed in hardened concrete and masonry construction.

For each construction personnel, anchor type, diameter, and embedment the inspection of initial anchors placed shall be continuous based on the requirements below. After initial anchor placement inspections have been performed, then inspector may perform quality assurance on a periodic basis.

Any change in personnel or anchor type shall require an initial continuous inspection as indicated here.

<table>
<thead>
<tr>
<th>Verification and Inspection</th>
<th>Frequency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspection tasks prior to anchor hole drilling</td>
<td>C</td>
<td>P</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>Verify contractor has manufacturer’s printed installation instructions (MPII) on site and available for reference by construction personnel.</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>If manufacturer does not have a representative on site, then special inspector shall review MPII with contractor personnel prior to beginning construction.</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>Verify edge distance limitations indicated in CD’s and existing reinforcing locations compared to proposed anchor hole locations.</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>Verify drill bit diameter matches MPII for anchor diameter indicated in CD’s. Special inspector does not need to be present during actual drilling of holes.</td>
</tr>
<tr>
<td>Inspection tasks after drilling prior to anchor placement</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>Verify cleaning operations are in accordance with CD’s and MPII.</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>Verify anchor type, material, diameter, and length.</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>Where adhesive anchors are specified: verify adhesive type is per CD’s, adhesive expiration date, and adhesive dispensing equipment is per MPII.</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>Verify that for horizontal and upwardly inclined adhesive anchors have all MPII required installation items (e.g. piston-plug)</td>
</tr>
<tr>
<td>Inspection tasks during anchor placement</td>
<td>-</td>
<td>X</td>
</tr>
</tbody>
</table>
The inspection requirements for this type of construction include structural fill and compacted fill, and shallow footings and slabs-on-grade.

<table>
<thead>
<tr>
<th>Verification and Inspection</th>
<th>Frequency</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| Subgrade for shallow footings       | -         | X  
  Verify that materials below shallow foundations are adequate to achieve the design bearing capacity, excavations are extended to the proper depth, and have reached the proper material. |
| Backfill materials                   | -         | X  
  Perform classification and testing of compacted fill materials. Test per ASTM D422, D1140, and D698 as required to verify fill materials are in accordance with the CD. |
| Subgrade preparation                 | -         | X  
  Verify the use of proper subgrade preparation per the CD, including but not limited to proof rolling and scarifying. |
| Compaction                          | X         | -  
  Verify proper fill materials, densities, and lift thicknesses during placement and compaction of fill is in accordance with the CD. Test density of each lift per ASTM D698. |

END OF ATTACHMENT A
PART 1 GENERAL

1.1 DESCRIPTION:

A. ENGINEER'S SOIL INVESTIGATION:

If soil investigations have been made by the Project Manager they may be obtained directly from the Project Manager, may be included in Section 700 of the technical specifications, or may already be included in the plans.

B. CONTRACTOR'S SOIL INVESTIGATION:

The Contractor shall visit the site and acquaint himself with site conditions. Prior to bidding, prospective Contractors may make their own site and subsurface investigations to satisfy themselves with site and subsurface conditions. The Contractor must secure permission from the Project Manager prior to making such investigations.

1.2 MEASUREMENT AND PAYMENT:

No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be paid for separately.

PART 2 PRODUCTS (not applicable)

PART 3 EXECUTION (not applicable)

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION:

A. RELATED WORK SPECIFIED ELSEWHERE:
   Section 01200: Project Meetings
   Section 01300: Submittals
   Section 01516: Temporary Sanitary Facilities

B. SCOPE:

This item shall govern the control measures necessary to prevent and control soil erosion, sedimentation, and water pollution that may degrade receiving waters including rivers, streams, lakes, reservoirs, tidal waters, groundwater, and wetlands. The control measures contained herein shall be installed and maintained throughout the construction contract and coordinated with the permanent or existing temporary pollution control features specified elsewhere in the plans and specifications to assure effective and continuous water pollution control throughout the construction and post construction period. These control measures shall not be used as a substitute for the permanent pollution control measures unless otherwise directed by the Project Manager in writing. The controls may include silt fences, baled hay, rock filter dams, rivet mattresses, gabions, dikes, swales, sediment traps and basins, pipe slope drains, paved flumes, construction exits, temporary seeding, sodding, mulching, soil retention blankets or other structural or non-structural water pollution controls.

The items, estimated quantities and locations of the control measures are shown on the plans; however, the Engineer may increase or decrease the quantity of these items as the need arises. The materials will be shown on the plans and in this specification. The Engineer may allow other materials and work as the need arises and as approved in writing. Pollution control measures may be applicable to contractor operations outside the right of way where such work is necessary as a result of roadway related construction such as construction and haul roads, field offices, equipment and supply areas, and materials sources.

Contractor is responsible for complying with all federal, state, and local permits, laws and requirements.

1.2 SUBMITTALS:

Submittals shall be as specified in Section 01300.
Prior to the start of construction, the Contractor shall submit to the Project Manager, for approval, the Storm Water Pollution Prevention Plan (SW3P) and schedules for accomplishment of the pollution control measures. A plan for the disposal of waste materials generated on the project site must be submitted for approval, also. The Contractor shall submit as part of the proposed SW3P, control measures for any industrial activities (such as hot mix plants, concrete batch plants, or material handling areas) in the limits of construction. Work on the project shall not begin until the schedules for implementation of the controls and methods of operations have been reviewed and approved by the Project Manager in writing.

The Contractor shall provide the Project Manager, for information purposes, proposed methods of pollution control for Contractor operations in areas which are outside the limits of construction (such as construction and haul roads, field offices, equipment and supply areas, and material sources) as well as a plan for disposal of waste materials. Pollution control measures for the Contractor's facilities outside the limits of construction are not covered by the plans. The Contractor shall obtain his own Notice of Intent for the off-site operations. These pollution controls will not be measured for payment but shall be performed at the Contractor's expense.

The guidelines and quantities of controls set forth here and in the plans are to be considered minimum requirements. It is the Authority's intent that the pollution prevention plan be dynamic and adaptable to changing conditions in the field, both expected and unexpected. The Authority may require additional or modified controls in order to meet the spirit and legal requirements of the NPDES construction permit

1.3 MEASUREMENT AND PAYMENT:

Measurement and payment will be as outlined in Section "Measurement and Payment" of Part 1, General Provisions.

PART 2 – PRODUCTS – see TXDOT specs – make a note here. Go through and fix for rest of spec.

2.1 BALED HAY:

The hay bales shall weigh a minimum of 80 pounds, be composed entirely of vegetable matter, and measure at least 30 inches in length. The hay bales shall be bound by wire or nylon binding.

2.2 SILT FENCE:

A. Fabric. Fabric materials shall meet the requirements of TxDOT Materials Specification D-9-6230, Silt Fence.
B. Fence Types: Two types of silt fences are identified as follows:

1. Type 1: This system is a self-supported fence, using a woven geotextile fabric.

2. Type 2: This system is a not-reinforced fence, using a non-woven geotextile fabric.

C. Posts: Posts for fence Types 1 and 2 shall be a minimum of 48 inches long, essentially straight, and shall be wood or steel, unless otherwise shown on the plans. Soft wood posts shall be at least 3 inches in diameter or nominal 2 x 4 inches and essentially straight. Hardwood posts shall have a minimum cross section of 1.5 x 1.5 inches. Steel posts shall be "T" or "L" shaped with a minimum weight of 1.3 pounds per linear foot. All T posts to capped with rubber caps.

D. Net Reinforcement: Net reinforcement for the Type 2 fence system shall be galvanized welded wire mesh of a minimum 12.5 gauge wire or equal, as approved by the Project Manager, with a maximum opening size of 4 inches square and shall be at least 24 inches wide.

E. Tension Reinforcement and Staples: Tension reinforcement for the Type 1 fence shall consist of wire or wire cable of at least 12.5 gauge. Staples used to secure reinforcement and fabric to wood posts shall have a crown at least 3/4 inch wide and legs ½ inch long.

When the type of fabric or type of reinforcement system is not specified on the plans, the Contractor may select either of the described types for use in construction of the silt fence.

2.3 STABILIZED STREAM CROSSINGS:

The material used to prevent erosion and vehicular rutting at stream crossings shall be concrete rubble or course graded aggregate. Unless otherwise directed, the rubble or aggregate used in this application shall conform to the requirements of ASTM D448, size #3 (1 to 2 inch) or as directed by the Project Manager.

2.4 STABILIZED CONSTRUCTION EXISTS:

A. TIMBER CONSTRUCTION:

Timber for construction shall consist of treated railroad ties and lumber. The railroad ties and lumber shall be treated to control rot and shall be No. 2 quality or better and free of large and loose knots. Timber shall be fastened with nuts and bolts or lag bolts all of which shall meet or exceed ASTM-A307.
B. FOUNDATION COURSE:

The foundation course shall be flexible base, bituminous concrete, Portland cement concrete, or other material as approved by the Project Manager.

PART 3 – EXECUTION – see TXDOT specs – make a note here. Go through and fix for rest of spec.

B. CONSTRUCTION REQUIREMENTS:

1. The Project Manager has the authority to limit the disturbed surface area exposed by construction operations. The Contractor shall provide control measures to prevent or minimize the impact to receiving waters as required by the plans and/or as directed in writing by the Project Manager.

The Contractor shall effectively prevent and control erosion and sedimentation on the site at the earliest practicable time as outlined in the approved schedule. Control measures, where applicable, shall be implemented prior to the commencement of each construction operation or immediately after the area has been disturbed.

The Contractor shall limit the amount of disturbed earth as directed by the Project Manager. If the Contractor is not able to effectively control soil erosion and sedimentation resulting from construction operations, the Project Manager shall limit the amount of disturbed area to that which the Contractor is able to work in.

Should the control measures fail to function effectively, the Contractor shall act immediately to bring the erosion and sedimentation under control by maintaining existing controls or by providing additional controls as directed by the Project Manager. When in the opinion of the Project Manager the site is adequately stabilized, the Contractor may be required to remove and dispose of the control measures specified by the Project Manager.

All erosion, sediment, and water pollution controls shall be maintained in good working order. A rain gauge shall be located at the project site. Within 24 hours of a rainfall event of 0.5 inch or more as measured by the project rain gauge, the Contractor and Project Manager shall inspect the entire project to determine the condition of the control measures. Sediment will be removed and devices repaired as soon as practicable but no later than 7 days after the surrounding exposed ground has dried sufficiently to prevent further damage from equipment needed for repair operations.

In the event of continuous rainfall over a 24-hour period, or other circumstances that preclude equipment operation in the area, the Contractor
will hand carry and install additional backup devices as determined by the Project Manager. The Contractor shall remove silt accumulations and deposit the spoils in an area approved by the Project Manager as soon as practicable. Any corrective action needed for the control measures shall be accomplished in the sequence directed by the Project Manager however; areas adjacent to water bodies shall generally have priority followed by devices protecting storm sewer inlets.

2. The Contractor shall also conform to the following practices and controls. All labor, tools, equipment, and incidentals to complete the following work will not be paid for directly but shall be considered as subsidiary to this item.

a. Disposal areas, stockpiles, and haul roads shall be constructed in a manner than shall minimize and control the amount of sediment that may enter receiving waters. Disposal areas shall not be located in any wetland, waterbody, or streambed.

b. Construction operations in rivers, streams, lakes, tidal water wetlands and other water bodies shall be restricted to those areas where it is necessary to perform the work shown on the plans. Wherever streams are crossed, temporary stabilized stream crossings shall be used.

c. Protected storage for paints, chemicals, solvents, fertilizers and other potentially toxic materials shall be provided by the Contractor at a location approved by the Project Manager.

d. Construction staging areas and vehicle maintenance areas shall be constructed by the Contractor in a manner to minimize the runoff of pollutants at a location approved by the Project Manager. The Contractor shall prevent pollution of receiving waters with petroleum products or other hazardous or regulated substances. When work areas or material sources are located adjacent to a waterbody, control measures such as dikes, gabions or rock berms, shall be used to keep sediment and other contaminants from entering the adjacent waterbody. Care shall be taken during the construction and removal of such barriers to minimize down-gradient sedimentation.

e. All waterways shall be cleared as soon as practicable of pipe, shoring, formwork or other obstructions placed during construction operations that are not a part of the finished work.

f. Disturbance of vegetation shall be minimized as directed by the
Project Manager.

g. The Contractor shall clean paved surfaces as necessary to remove sediment that has accumulated on the roadway.

3. The project will not be accepted or approved by the Project Manager until the Contractor provides a uniform perennial vegetative cover with a density of 70 percent of adjacent undisturbed areas, or that equivalent permanent stabilization measures supplemented by temporary measures when necessary (such as riprap, gabions, soil retention blankets, mulching) have been employed that will control erosion sedimentation and water pollution until sufficient vegetative cover can be established.

3.2 BALED HAY:

A. CONSTRUCTION METHODS:

The hay bales shall be installed in accordance with the details and at the locations shown in the plans by burial in shallow trenches approximately one half the height of the bale, or as directed by the Project Manager. Gaps between bales shall be filled with hay.

B. MAINTENANCE:

The baled hay installation shall be maintained in good condition by the Contractor. All necessary work and materials to maintain the integrity of the installation shall be provided until permanent erosion control features are in place and/or the disturbed area has been adequately stabilized.

When the accumulated sediment reaches a depth of 6 inches, it shall be removed and deposited at approved sites in a manner that will not contribute to additional siltation. If the installation ceases to function as intended due to washouts, etc., the Project Manager may direct that the installation or portions thereof be replaced. Such replacement shall be subsidiary to this item.

The areas beneath the baled hay and damaged by the removal process shall be stabilized by the Contractor using appropriate methods as approved by the Project Manager.

3.3 SILT FENCE:

A. CONSTRUCTION METHODS:

Silt fence shall be used during construction near the perimeter of a disturbed area to intercept sediment form sheet flow. Silt fence of the self-supported Type 1 shall
be used only at location where the length of overland runoff is less than 100 feet, the embankment is less than 20 feet in height, the slopes are 3:1 or flatter, or the installation will be required for less than 6 months. The silt fence installation methods shall be as specified below, unless otherwise shown on the plans, for the type specified or selected. The physical alignment and location of the fence shall be as shown on the plans or as directed by the Project Manager.

1. Installation of posts: Posts for fence types 1 and 2 shall be embedded 18 inches deep, or adequately anchored if in rock, with a spacing of 6 to 8 feet, and installed on a slight angle toward the anticipated run-off source.

2. Fabric anchoring: Trenches for fence types 1 and 2 shall be dug along the uphill side of the fence to anchor 6 to 8 inches of fabric. The trench shall have a minimum cross section of 6 x 6 inches. The fabric for fence types 1 and 2 shall be installed in the trench such that 4 to 6 inches of fabric is against the side of the trench and approximately 2 inches of fabric is across the bottom in the upstream direction. The trench shall be backfilled and hand tamped as approved by the Project Manager.

3. Fabric Attachment:

   Fence Type 1: The fabric shall be attached to wood posts by staples or locking plastic ties at a maximum spacing of 6 inches. Attachment to steel posts shall be by sewn vertical pockets or locking plastic ties if the posts have suitable projections. The top of the fabric shall be fastened to the tension reinforcement wire or wire cable by hog rings, locking plastic ties, or cord at a maximum spacing of 2 feet.

   Fence Type 2: The reinforcement shall be attached to the end posts, if wood, by staples or locking plastic ties, or if steel, by T-clips, locking plastic ties, or sewn vertical pockets at a minimum of 4 locations. The reinforcement shall be attached to each succeeding post as approved by the Project Manager. Connect the ends of successive reinforcement sheets or rolls at a fence post at least 6 times with hog rings or locking plastic ties. The fabric shall be fastened to the top strand or reinforcement by hog rings, locking plastic ties, or cord at a maximum spacing of 2 feet.

4. Fabric Splices: Splices for fence Types 1 and 2 shall occur at a fence post and shall have a minimum lap of 6 inches attached in at least 6 placed. Splices in concentrated flow areas shall not be permitted.

B. MAINTENANCE:
The silt fence shall be maintained in good condition (including staking, anchoring, tension adjustments, etc.) by the Contractor. All necessary work and materials to maintain the integrity of the fence shall be provided until earthwork construction and permanent erosion control features are in place and/or the disturbed area has been adequately stabilized. This type of routine maintenance shall not be paid for directly but will be considered subsidiary to this item. The areas damaged by the removal process shall be stabilized by the Contractor using appropriate methods as approved by the Project Manager.

3.4 STABILIZED STREAM CROSSING:

A. CONSTRUCTION METHODS:

At all locations where vehicles shall be crossing creeks, a 6” deep and 14’ wide (minimum) rubble or aggregate crossing shall be installed. The crossing length shall be determined by the Project Manager or roughly from toe to toe on the stream bank side slopes.

B. MAINTENANCE:

The crossing will be maintained for the duration of the project. Washouts and rutting shall be repaired within a 48-hour period after damage is noted.

3.5 STABILIZED CONSTRUCTION:

A. CONSTRUCTION METHODS:

When tracking conditions exist, traffic shall not be allowed to cross or leave the construction site and move directly onto a public roadway, alley sidewalk, parking area, or other right of way in areas other than at locations of construction. Construction can be either for long or short-term use. Foundation courses, if needed, shall be used with the long-term construction exits.

The exit shall be placed over a foundation course, if directed by the Project Manager. The foundation course and/or compacted subgrade shall be properly graded to direct runoff from the construction exit to a sediment trap as shown in the plans or as directed by the Project Manager. The exit shall normally be constructed a minimum length of 50 feet. The width shall be at least 14 feet for one-way traffic and 20 feet for two-way traffic but shall not be less than full width of all points of ingress and egress and shall be sufficient for all ingress and egress.

B. MAINTENANCE:

Exits shall be maintained in a condition, which will prevent tracking or flowing of sediment onto public right of way and may require periodic removal and replacement of stone or timber, or other material as conditions demand and repair
and/or clean out of any measures used to trap sediment. Sediment spilled, dropped, washed, or tracked onto public right of way shall be immediately removed by the Contractor and disposed of at an approved site and in a manner that will not contribute to additional siltation.

When necessary, wheels shall be cleaned to remove sediment prior to entrance onto public right of way. When vehicle washing is required, the construction exit shall be graded to drain into a sediment trap or sediment basin. Sediment shall be prevented from leaving the construction site.

The construction exits shall be removed promptly when directed by the Project Manager. Discarded materials shall become the property of the Contractor for his disposal at an approved site. The area beneath the construction exit and area damaged by the removal process shall be stabilized by the Contractor using appropriate methods as approved by the Project Manager.

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION

A. This section covers the preventive measures required for protection of the environment during construction operations, except for those measures set forth in the other sections of these specifications.

B. The Contractor shall provide environmental protection as required to insure the retention of the environment in its natural state to the greatest possible extent during project construction and to enhance the natural appearance in its final condition. Environmental protection shall include consideration of air, water, and land protection and involves solid-waste management as well as other pollutants. For the purpose of this specification environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; affect other species; or degrade the landscape of the area for aesthetic and recreational purposes.

1.2 NOTIFICATION

A. The Project Manager will notify the Contractor in writing of any observed noncompliance with the foregoing provisions. If the Contractor fails or refuses to promptly take corrective action, the Project Manager may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be reason for extension of time or for excess costs or damages unless it is determined that the Contractor was in compliance.

B. Subcontractors: Compliance with the provisions of this section by subcontractors will be the responsibility of the Contractor.

1.3 MEASUREMENT AND PAYMENT:

No direct measurement and payment will be made for this item, measurement and payment is considered subsidiary to other bid items as outlined in Section "Measurement and Payment" of Part 1, General Provisions.

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION

A. The land resources outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction that will appear to be natural and not detract from the appearance of the project. Insofar as possible, the Contractor shall confine his construction activities to areas denoted by the plans or specifications. Waste and borrow areas shall be leveled or trimmed to regular lines and shaped to provide a neat appearance. In all instances the restored area shall be well drained, so as to prevent the accumulation of stagnant water.

B. Prevention of Landscape Defacement: Except in areas shown on the plans or specified to be cleared, the Contractor shall not deface, injure, or destroy trees, shrubs or other vegetation; nor remove or cut them without approval. Where, in the opinion of the Project Manager, landscape may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his blasting, dumping, or other operations, the PM may direct the Contractor to protect adequately landscape.

C. Restoration of Landscape Damage: Any landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor’s expense. The Project Manager will decide what method of restoration shall be used, and whether damaged landscape features shall be treated or removed and disposed of under requirements for clearing and grubbing.

D. Burning: No material shall be burned at the project site.

E. Dust Control: The Contractor will be required to maintain all excavations, embankments, stockpiles, haul roads, permanent access roads, plant sites, waste areas, borrow areas, and all other work areas within or without the project boundaries free from dust which would cause a hazard or nuisance to others. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs.

1.2 MEASUREMENT AND PAYMENT:

No direct measurement and payment will be made for this item, measurement and payment is considered subsidiary to other bid items as outlined in Section "Measurement and Payment" of Part 1, General Provisions.

END OF SECTION
PART 1 GENERAL

1.01 This item shall govern the placing of protection for trees and other landscape plant material or natural areas to be protected during construction. No site preparation work shall begin in areas where tree preservation and treatment measures have not been completed and approved. Where removal of trees is indicated on the drawings, they shall be marked as directed by the engineer or designated representatives. This item shall also govern the excavation, filling, trenching and boring around trees described on the plans, and for furnishing all materials, water, labor, tools, equipment and supplies required as specified by this item or as indicated on the plans.

1.02 REFERENCE STANDARDS

Reference Standards: City of San Antonio Tree Preservation ordinance # 85262

PART 2 PRODUCTS

2.01 MATERIALS

2.02 LEVEL I FENCE PROTECTION:

A. Fabric: Fabric (4 foot height or 1.2 m) shall consist of orange plastic fencing as shown on the plans and shall be woven with 2-inch (50 mm) mesh openings such that in a vertical dimension of 23 inches (584 mm) along the diagonals of the openings there shall be at least seven meshes.

B. Installation Posts: Installation posts shall be a minimum of 72 inches (1.5 m) long and steel “T” shaped with a minimum weight of 1.3 pounds per linear foot (6.3 kg per meter). All T posts to capped with rubber caps.

C. Tie Wire: Wire for attaching the fabric to the t-posts shall be not less than No. 12 gauge galvanized wire. Sufficient fastening material shall be furnished to provide for the securing of the fabric to the “T” line posts.

D. Used Materials: Previously-used materials, meeting the above requirements and when approved by the Engineer, may be used.

2.03 LEVEL IIA FENCE PROTECTION:

Materials same as Level I

-OR-
2.04 LEVEL IIB FENCE PROTECTION:

A. Sleeve: 2x4 lumber to a height of 4 feet above the root crown.
   1. 2x4 shall be utilized as called for on plan.

B. Tie Wire: Wire for securing the 2x4s shall not be less than No. 12 gauge.

2.05 OTHER MATERIALS:

A. Tree Dressing - Asphalitic Tree Wound Paint

PART 3 EXECUTION

3.01 CONSTRUCTION METHODS

A. LEVEL I FENCE PROTECTION:

1. All trees and shrubs in the proximity of the construction site shall be carefully checked for injuries prior to beginning any development activity.

2. Protective fencing shall be erected at locations shown in the plans or as directed by the Inspector and/or City Arborist or in accordance with the details shown on the plans at the drip line of trees (Root Protection Zone, RPZ) and/or landscape plant material including natural areas. Fencing shall be maintained and repaired by the contractor during site construction.

3. Protective fence locations in close proximity to street intersections or drives shall adhere to the City of San Antonio’s site distance criteria.

4. The protective fencing shall be erected before site work commences and shall remain in place during the entire construction phase. Access to fenced areas will be permitted only with the approval of the engineer.

5. The installation posts will be placed every 6 feet (2 m) around the drip line or RPZ and embedded to 18 inches (457 mm) deep. Fabric attachment shall be attached to the installation posts by the use of sufficient wire ties to securely fasten the fabric to the “T” posts as to hold the fabric in a stable and upright position. All T posts to capped with rubber caps.

   a. Do not clear, fill or grade in the RPZ of any tree.

   b. Do not store, stockpile or dump any job material, soil or rubbish under the spread of the tree branches.
c. Do not park or store any equipment or supplies under the spread of the tree branches.

d. Do not set up any construction operations under the spread of the tree branches. (E.g. pipe cutting and threading, mortar mixing, painting or lumber cutting)

e. Do not nail or attach temporary signs, meters, switches, wires, bracing or any other item to the trees.

f. No ropes, cables, or guys shall be fastened to or attached to any existing trees for anchorages.

g. Do not permit runoff from waste materials including solvents, concrete washouts, asphalt tack coats (MC-30 oil), etc. to enter the RPZ. Barriers are to be provided to prevent such runoff substances from entering the RPZ whenever possible, including in an area where rain or surface water could carry such materials to the root system of the tree.

6. The contractor shall avoid cutting roots larger than one inch in diameter when excavation occurs near existing trees. Excavation in the vicinity of trees shall proceed with caution. The contractor shall contact the city inspector.

7. Remove all trees, shrubs or bushes to be cleared from protected root zone areas as directed by engineer by hand.

8. Trees damaged or lost due to contractor’s negligence during construction shall be mitigated at the contractor’s expense and to the engineer’s satisfaction.

9. Any tree removal shall be approved by the city arborist prior to its removal.

10. Cover exposed roots at the end of each day with soil, mulch or wet burlap.

Where, in the opinion of the Project Manager, trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his blasting, dumping, or other operations, he may direct the Contractor to protect adequately such trees by placing boards, planks, or poles around them.

All scars made on trees (not designated on the plans to be removed) by equipment, construction operations, or by the removal of limbs larger than 1 inch in diameter shall be coated as soon as possible with an approved tree wound dressing. All trimming or pruning shall be performed in an approved manner by experienced workmen with saws or pruning shears. Trees that are to remain either within or outside established clearing limits and that are subsequently damaged by the Contractor and are beyond saving in the opinion of the Project Manager, shall be immediately removed and replaced with a nursery-grown tree of the same species and size approved by the Project Manager.
In critical root zone areas that cannot be protected during construction and where heavy traffic is anticipated, cover those areas with (8) inches of organic mulch to minimize soil compaction. This (8) inch depth of mulch shall be maintained throughout construction.

Water all trees, most heavily impacted by construction activities, deeply once a week during periods of hot dry weather. Spray tree crowns with water periodically to reduce dust accumulation on the leaves.

When installing concrete adjacent to the root zone of a tree, use a plastic vapor barrier behind the concrete to prohibit leaching of lime into the soil. See related specifications.

When an excavation or embankment is placed within the dripline of any tree greater than (8) inches in diameter, a Tree well shall be constructed to protect the tree as indicated, when the cut or fill exceeds (8) inches. See related specifications.

Where paving or filling is necessary within the dripline of any tree (8) inches or greater, a permeable pavement and aeration system must be installed as indicated. See related specifications.

B. LEVEL II FENCE PROTECTION

1. Fabric: Fabric (4 foot height or 1.2 m) shall consist of orange plastic fencing as shown on the plans and shall be woven with 2-inch (50 mm) mesh openings such that in a vertical dimension of 23 inches (584 mm) along the diagonals of the openings there shall be at least seven meshes.

2. Installation Posts: Installation posts shall be a minimum of 72 inches (1.5 m) long and steel “T” shaped with a minimum weight of 1.3 pounds per linear foot (6.3 kg per meter). All T posts to capped with rubber caps.

3. Tie Wire: Wire for attaching the fabric to the t-posts shall be not less than No. 12 gauge galvanized wire. Sufficient fastening material shall be furnished to provide for the securing of the fabric to the “T” line posts.

4. Used Materials: Previously-used materials, meeting the above requirements and when approved by the Engineer, may be used.

Tree Maintenance During Construction

5. Providing adequate maintenance can mitigate stressful changes that occur to a tree’s environment during construction. To remain vigorous the tree needs to maintain stored carbohydrates and preserve the effectiveness of its growth regulators. It is recommended that large projects provide:

6. Irrigation providing supplemental irrigation for trees under water stress may be the single most important treatment. Irrigation should be designed to wet the soil within
the Tree Protection Zone to the depth of the root zone and to replace that water once it is depleted. Light, frequent irrigation should be avoided. Create a six-inch berm around trees at the edge of the Tree Protection Zone and fill with no more than six inches of mulch. Fill the basin with water. Irrigation should wet the top two to three feet of soil to replicate similar volumes and normal seasonal distribution.

7. Soil Compaction Mitigation To prevent negligent encroachment into the Tree Protection Zone, trees to be preserved during construction must have the specified type of protection fences in place at all times. Removal of fences, even temporarily, to allow deliveries or equipment access is not allowed unless approved by the Arborist and a root buffer is installed. The root buffer components: mulch, gravel and plywood, must be maintained continually to assure its effectiveness against soil compaction.

8. Dust Control During periods of extended drought, wind or grading, trunks, limbs and foliage should be sprayed with water to remove accumulated construction dust.

Damage to Trees

9. Reporting Injury to Trees any damage or injury to trees shall be reported as soon as possible to the Project Manager or Construction Supervisor, and always to the Park Maintenance Supervisor. The Park Maintenance Supervisor needs to be aware of an injured tree in order to monitor its recovery or progress. Injuries to roots and branches must be repaired immediately.

10. Contractor Subject to Penalties. If a tree designated to remain is removed or irreversibly damaged as determined by the project manager, a contractor may be required to install a replacement tree matching in size, quality and variety, using an contractor designated by the project manager.

3.02 MEASUREMENT

Protective fencing will be measured by the linear foot of accepted work, complete in place for the duration of construction activity.

3.03 PAYMENT:

No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be paid for separately.

END OF SECTION
SECTION 01516
TEMPORARY SANITARY FACILITIES

PART 1 GENERAL

1.1 DESCRIPTION:

A. Approved portable sanitary facilities are acceptable when provided as specified in Article 6.4 of the General Conditions.

B. Clean, deodorize, and disinfect sanitary facilities a minimum of once each day while construction is in progress.

1.2 MEASUREMENT AND PAYMENT:

No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be paid for separately.

PART 2 PRODUCTS (not applicable)

PART 3 EXECUTION (not applicable)

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prevention of erosion due to construction activities.
B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
C. Restoration of areas eroded due to insufficient preventive measures.
D. Compensation of the Owner for fines levied by authorities having jurisdiction due to non-compliance by General Contractor.

1.02 RELATED SECTIONS

A. Section 02110 - Site Clearing: Limits on clearing; disposition of vegetative clearing debris.
B. Section 02310 - Grading: Temporary and permanent grade changes for erosion control.
C. Section 03300 - Cast-in-Place Concrete: Concrete for temporary and permanent erosion control structures indicated on drawings.

1.03 REFERENCES


1.04 PERFORMANCE REQUIREMENTS

A. Comply with all requirements of U.S. Environmental Protection Agency for erosion and sedimentation control, as specified for the National Pollutant Discharge Elimination System (NPDES), Phases I and II, under requirements for the 2003 Construction General Permit (CGP), whether the project is required by law to comply or not.
B. Comply with all requirements of US EPA and Texas Commission for Environmental Quality for erosion and sedimentation control.


F. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.

G. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
   1. The Owner will pay for permits and securities required by authority having jurisdiction.
   2. The Owner will withhold payment to General Contractor equivalent to all fines resulting from non-compliance with applicable regulations.

H. Provide to the Owner a Performance Bond covering erosion and sedimentation preventive measures only, in an amount equal to 100 percent of the cost of erosion and sedimentation control work.

I. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

J. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
   1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
   2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.

K. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
   1. Control movement of sediment and soil from temporary stockpiles of soil.
   2. Prevent development of ruts due to equipment and vehicular traffic.
   3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to the Owner.

L. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
   1. Prevent windblown soil from leaving the project site.
   2. Prevent tracking of mud onto public roads outside site.
   3. Prevent mud and sediment from flowing onto sidewalks and pavements.
   4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to the Owner.

M. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to the Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
   2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

N. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to the Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

O. Open Water: Prevent standing water that could become stagnant.

P. Maintenance: Maintain temporary preventive measures until permanent measures have been established.
A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Erosion and Sedimentation Control Plan:
   1. Submit within 2 weeks after Notice to Proceed.
   2. Include:
      a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
      b. Measurements of existing turbidity of waterways.
      c. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
      d. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
      e. Schedule of temporary preventive measures, in relation to ground disturbing activities.
      f. Other information required by law.
      g. Format required by law is acceptable, provided any additional information specified is also included.
   3. Obtain the approval of the Plan by authorities having jurisdiction.
   4. Obtain the approval of the Plan by the Owner.

C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.

D. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mulch: Use one of the following:
   1. Straw or hay.
   2. Wood waste, chips, or bark.
   3. Erosion control matting or netting.
   4. Polyethylene film, where specifically indicated only.

B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

C. Bales: Air dry, rectangular straw bales.
   1. Cross Section: 14 by 18 inches, minimum.
   2. Bindings: Wire or string, around long dimension.

D. Bale Stakes: One of the following, minimum 3 feet long:
   1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.
   2. Wood, 2 by 2 inches in cross section.

E. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
   1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D 4751.
   2. Permittivity: 0.05 sec^-1, minimum, when tested in accordance with ASTM D 4491.
   3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D 4355 after 500 hours exposure.
   4. Tensile Strength: 100 lb-f, minimum, in cross-machine direction; 124 lb-f, minimum, in machine direction; when tested in accordance with ASTM D 4632.
   5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D 4632.
   6. Tear Strength: 55 lb-f, minimum, when tested in accordance with ASTM D 4533.
7. Color: Manufacturer’s standard, with embedment and fastener lines preprinted.
8. Manufacturers:

F. Silt Fence Posts: One of the following, minimum 5 feet long:
   1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.

G. Gravel: See Section 02200, Paragraph 2.1.3.

H. Concrete: See Section 03300.

PART 3 EXECUTION

3.01 EXAMINATION
A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION
A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES
A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.

B. Construction Entrances: Traffic-bearing aggregate surface.
   1. Width: As required; 20 feet, minimum.
   2. Length: 50 feet, minimum.
   3. Provide at each construction entrance from public right-of-way.
   4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.

C. Linear Sediment Barriers: Made of silt fences.
   1. Provide linear sediment barriers:
      a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
      b. Along the top of the slope or top bank of drainage channels and swales that traverse disturbed areas.
      c. Along the toe of cut slopes and fill slopes.
      d. Perpendicular to flow across the bottom of existing and new drainage channels and swales that traverse disturbed areas or carry runoff from disturbed areas; space at maximum of 200 feet apart.
      e. Across the entrances to culverts that receive runoff from disturbed areas.
   2. Space sediment barriers with the following maximum slope length upslope from barrier:
      a. Slope of Less Than 2 Percent: 100 feet.
      b. Slope Between 2 and 5 Percent: 75 feet.
      c. Slope Between 5 and 10 Percent: 50 feet.
      d. Slope Between 10 and 20 Percent: 25 feet.
      e. Slope Over 20 Percent: 15 feet.

D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
   1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
   2. Straw bale row blocking entire inlet face area; anchor into pavement.

E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.

F. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at
SECTION 01575 - TEMPORARY EROSION AND SEDIMENTATION CONTROL

downspout outlets and storm water outlets.

G. Soil Stockpiles: Protect using one of the following measures:
   1. Cover with polyethylene film, secured by placing soil on outer edges.
   2. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.

H. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.
   1. Wood Waste: Use only on slopes 3:1 or flatter; no anchoring required.

I. Temporary Seeding: Use where temporary vegetated cover is required.

3.04 INSTALLATION

A. Traffic-Bearing Aggregate Surface:
   1. Excavate minimum of 6 inches.
   2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
   3. Place and compact at least 6 inches of 1.5 to 3.5 inch diameter stone.

B. Silt Fences:
   1. Store and handle fabric in accordance with ASTM D 4873.
   2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
   3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
   4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
   5. Install with top of fabric at nominal height and embedment as specified.
   6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
   7. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
   8. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.

C. Straw Bale Rows:
   1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.
   2. Install bales so that bindings are not in contact with the ground.
   3. Embed bales at least 4 inches in the ground.
   4. Anchor bales with at least two stakes per bale, driven at least 18 inches into the ground; drive first stake in each bale toward the previously placed bale to force bales together.
   5. Fill gaps between ends of bales with loose straw wedged tightly.
   6. Place soil excavated for trench against bales on the upslope side of the row, compacted.

D. Mulching Over Large Areas:
   1. Dry Straw and Hay: Apply 2-1/2 tons per acre; anchor using dull disc harrow or emulsified asphalt applied using same spraying machine at 100 gallons of water per ton of mulch.
   2. Wood Waste: Apply 6 to 9 tons per acre.
   3. Erosion Control Matting: Comply with manufacturer's instructions.

E. Mulching Over Small and Medium Areas:
   1. Dry Straw and Hay: Apply 4 to 6 inches depth.
   2. Wood Waste: Apply 2 to 3 inches depth.
   3. Erosion Control Matting: Comply with manufacturer's instructions.

F. Temporary Seeding:
1. When hydraulic seeder is used, seedbed preparation is not required.
2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft.
4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft.
5. Incorporate fertilizer into soil before seeding.
6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch deep deep.
7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
8. Repeat irrigation as required until grass is established.

### 3.05 MAINTENANCE

A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.

B. Repair deficiencies immediately.

C. Silt Fences:
   1. Promptly replace fabric that deteriorates unless need for fence has passed.
   2. Remove silt deposits that exceed one-third of the height of the fence.
   3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Straw Bale Rows:
   1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
   2. Remove silt deposits that exceed one-half of the height of the bales.
   3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

E. Clean out temporary sediment control structures weekly and relocate soil on site.

F. Place sediment in appropriate locations on site; do not remove from site.

### 3.06 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Civil Engineering Consultants.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION
SECTION 01576
CONSTRUCTION IN PUBLIC AND PRIVATE RIGHT-OF-WAY

PART 1 GENERAL

1.1 DESCRIPTION:

This section governs the installation of pipelines or any construction activities along and across the right-of-way of private driveways, City streets, TxDOT, Bexar County, San Antonio River Authority, City Public Service, and other utility right-of-ways.

1.2 MEASUREMENT AND PAYMENT:

No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be paid for separately.

PART 2 PRODUCTS (not applicable)

PART 3 EXECUTION

3.1 CONSTRUCTION:

A. Unless noted otherwise no public or private road shall be closed entirely overnight. The Contractor shall build and maintain all weather bypasses and detours, if required, and to light, barricade, and make all bypasses and detours required on and across the streets involved.

B. All necessary labor, materials, and equipment for the installation of the line shall be available prior to beginning work. Once started, continue the work without delay through completion of this job.

C. A representative of the Authority will be on the job site whenever work is in progress.

D. The Contractor shall notify the inspector not less than forty-eight (48) hours prior to starting construction of the line in order that he may have a representative present.

E. The Contractor, in addition to meeting requirements of this section, shall meet all requirements of the agency having jurisdiction of such public and/or private right-of-way.
3.2 PRIVATE RIGHT-OF-WAY:

A. Pipelines may not be placed along and across private driveways unless indicated otherwise on the Plans. At all times, maintain a sufficient width of the roadway clear of dirt and other materials to allow the free flow of one (1) lane of traffic. Build and maintain all weather bypass and detours and furnish all flagmen, lights, and barricades and mark all bypasses and detours required on and across the roadways involved.

B. The Contractor shall make every effort to complete construction and allow immediate access to adjacent property at all driveway entrances located along the roadways or streets. Notify owners or tenants of improvements where access and entrance drives are located at least forty-eight (48) hours prior to the time the construction will be started at their drive ins or entrances. Inform owners or tenants as to the length of time driveways will be closed, which period shall not exceed six (6) hours.

3.3 MAINTENANCE:

The Contractor shall be responsible for all road and entrance reconstruction, and repairs and maintenance of same for a period of one (1) year from the date of final project acceptance of such reconstruction. In the event the repairs and maintenance are not made immediately and it becomes necessary for the Authority or private owner to make such repairs, the Contractor shall reimburse the Authority or private owner for the cost of such repairs.

3.4 BACKFILL:

Place backfill in trenches within the rights-of-way of City, County, and State streets and private property in compliance with requirements of the agency having jurisdiction of such roads or streets. Comply with the various applicable sections of these specifications, which govern the installation of the pipelines. Before completion of the proposed work, restore all roadway shoulders, slopes, ditches, and berms to their original condition.

3.5 PIPELINE CROSSINGS UNDER ALL ROADWAYS:

A. Do not place excavated material on the roadway shoulders, traffic lanes, or ditches where the drainage will be impaired. In wet weather or when the condition of excavated or backfill material is such (when dropped on the pavement by truck or other means) that it presents a slippery or hazardous driving condition for highway traffic, this material shall be removed at once by the contractor and/or utility company and work suspended if necessary. When excavation is permitted near the roadway where the support of the pavement structure is endangered, sheeting, cribbing, or other measures shall be taken to prevent damage to the roadway or to prevent the creation of a traffic hazard.
B. Backfill excavations in a neat manner. Restore disturbed areas to a condition equal to the original condition. Consolidate backfill material to a density not less than the densities called for on the Plans or in the Specifications. Replace all excavated material except that displaced by the pipe. The degree of compaction shall be such as to prevent future settlement. Dispose of excess material displaced by the pipe. Pipe laying operations shall not be carried on when soil conditions are such that construction equipment will create ruts on the right-of-way.

C. Replace sod and other erosion control measures removed or disturbed by the construction. This includes keeping separate and replacing existing topsoil, importing sod or seeding or a combination of these methods together with fertilizer and water as necessary to reestablish vegetative cover in a healthy and growing condition.

D. The pipe or, if encased, the encasement pipe shall completely fill the bored hole and any voids shall be completely filled with grout under pressure.

E. Restore private and commercial access driveways disturbed by pipe laying operations to a condition equal to that, which existed prior to these operations.

F. Do not cut or trim trees or shrubbery without the approval of the appropriate owner, City, County, State, or private owner or tenant, or authorized representative thereof.

3.6 UTILITY PERMITS:

Various utility permits will not be acquired by the San Antonio River Authority. The Contractor is solely responsible for obtaining and fully complying with all requirements of the permits at no additional cost to Authority. All required permits in addition to the ones provided by the River Authority, must be secured by the Contractor as outlined by Paragraph 6.13 of the General Conditions. Said permits do not relieve the Contractor of his responsibilities for relocation and/or protection of utilities as outlined in the Contract Documents.

END OF SECTION
SECTION 01610
JOB SITE SECURITY

PART 1 GENERAL

1.1 BARRICADES, LIGHTS, AND WATCHMEN:

A. The Contractor shall furnish, erect, and otherwise provide barricades, fences, lights, signals, watchmen, and other precautionary measures for the protection of persons and property. From sunset to sunrise, the Contractor shall furnish and maintain at least one light at each barricade and sufficient numbers of barricades shall be erected to safeguard vehicles from being driven on or into any work under construction. The Contractor, if required, shall furnish watchmen in sufficient numbers to protect the work.

B. The Contractor is responsible for all damages to the work until accepted by the Authority and the Contractor shall remove all damaged portions and replace them at no cost to the Authority. The responsibility of the Contractor for complete job security will not cease until the project is accepted by the Authority.

C. No public, private or park road shall be closed overnight. The Contractor shall build and maintain all-weather bypasses and detours, as necessary, with proper lights, barricades, and markings on and across the roads involved in the work.

1.2 MEASUREMENT AND PAYMENT:

No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be paid for separately.

PART 2 PRODUCTS (not applicable)

PART 3 EXECUTION (not applicable)

END OF SECTION
PART 1 GENERAL

1.1 DURING CONSTRUCTION:

At all times keep the job site free from all materials, debris, and rubbish as is practical and remove same from any portion of the job site, when in the opinion of the Authority it becomes objectionable or interferes with the progress of the work. Furthermore, all streets and affected sidewalks shall be cleaned daily so as not to hamper vehicular or pedestrian traffic.

1.2 FINAL:

A. Upon completion of the work, the Contractor shall remove from the site all plant, materials, tools and equipment belonging to him, and leave the site with an appearance acceptable to the Owner.

B. Thoroughly clean all equipment and materials installed and deliver over such materials and equipment in a bright, clean, polished and new appearing condition.

C. Restore or replace all landscape features scarred or damaged by the Contractor's equipment or operations as nearly as possible to their original condition, at the Contractor's expense. The Owner will decide what method of restoration shall be used. The restoration of landscape shall be in accordance with "Protection of Environmental Resources," Supplementary Conditions, Paragraph 26.

D. The Contractor shall remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other vestiges of construction, as directed by the Authority. It is anticipated that excavation, filling and plowing of roadways will be required to restore the area to near natural conditions, which will permit the growth of vegetation thereon. The restored areas shall be filled, graded, and spread with sufficient topsoil to provide a minimum depth of four (4) inches of suitable soil for the growth of grass, and the entire area shall be seeded or sodded with the original type of grass. Areas shall be restored to original contours as shown on the Plans. If the Plans do not cover the specific areas to be restored, the areas shall be graded to drain and give a smooth transition to the surroundings.

1.3 MEASUREMENT AND PAYMENT:

No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be paid for separately.
PART 2 PRODUCTS (not applicable)

PART 3 EXECUTION (not applicable)

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. Maintain at the site for the Authority's permanent records one copy of:

1. Plans
2. Specifications
3. Addenda
4. Change Orders and other Modifications to the Contract
5. Owner Field Orders or Written Instructions
6. Shop Drawings, Product Data, and Samples
7. Field Test Records
8. Construction Photographs

B. RELATED WORK SPECIFIED ELSEWHERE:

Section 01300: Submittals

1.2 MAINTENANCE OF DOCUMENTS AND SAMPLES:

B. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes. Maintain record drawings as original size, bound set red-lined contract drawings.

B. If the contract does not require a field office, the General Contractor shall maintain the set of as-built Contract Drawings in an accessible location and make them available to a SARA representative for review upon request.

C. Make documents and samples available at all times for inspection by the Owner.

D. The Contractor shall mark all changes and shop drawing modifications on the Record Documents weekly and shall keep them current. Failure to keep Record Documents current will result in the Authority updating Record Documents at the Contractor's expense.

1.3 RECORDING:

A. Label each document "PROJECT RECORD" in neat large printed letters.

B. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.
C. Legibly mark drawings to record actual construction:

1. Depths of various elements of foundation in relation to permanent bench mark datum.
2. Horizontal and vertical locations of underground utilities conduits and appurtenances, referenced to permanent surface improvements.
3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
4. Field changes of dimensions and detail.
5. Changes made by Field Order or by Change Order.
6. Details not on original Contract drawings.
7. Changes to material or equipment for substitutions approved through the SARA submittal process (Section 01300).
8. Changes to Contract Drawings, including those that involve only narrative, shall be clearly and neatly marked in red pen or pencil, and shall be noted on the appropriate drawings.
9. All revisions to a plan sheet will be clouded and include a numbered revision triangle. The triangle will be keyed to a corresponding description of the change located on the revision area of the sheets title block and a notation referencing the source of information (Example: RFI #94, CO #3, or field notes of name) will be included.
10. For major revisions a new sheet can be created and inserted into the plan set with a large “X” being placed over the sheet being replaced. The original outdated sheet should not be discarded.
11. Identify the contractor’s representative(s) responsible for coordinating the verification of the as-built process with SARA to the SARA delegated representative.
12. Ensure that every sheet has been stamped “RECORD DRAWING” and that the cover sheet is signed by the Engineer of Record.
13. Final record drawing deliverables will be a scanned original size color copy saved as a pdf document. These will be provided to the SARA delegated representative for final review and approval.
D. Legibly mark each specification and addenda section to record:

1. Manufacturer, trade name, catalog number and supplier or each product and item of equipment actually installed.

2. Changes made by Field Order or by Change Order.

1.5 SUBMITTALS:

A. At Contract closeout, deliver Record Documents to the Owner.

B. Accompany submittals with transmittal letters in duplicate, containing:

1. Date
2. Project title and number
3. Contractor's name and address
4. Title and number of each Record Document
5. Signature of Contractor or his authorized representative

1.6 MEASUREMENT AND PAYMENT:

No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be paid for separately.

END OF SECTION
SECTION 01740
GUARANTEES AND WARRANTIES

PART 1 GENERAL

1.1 PROJECTION MAINTENANCE AND GUARANTEE:

The Contractor shall maintain and keep in good repair, the improvements covered by these plans and specifications during the life of this Contract.

A. The Contractor shall indemnify the Owner against any repairs which may become necessary to any part of the work performed and to items of equipment, and systems procured for or furnished under this Contract, arising from defective workmanship or materials used therein, for a period of one (1) year from the date of substantial completion for that item of work as indicated by the Owner.

B. The Contractor shall, at his own expense, furnish all labor, materials, tools and equipment required and shall make such repairs and removals, or shall perform such work of reconstruction, as may be necessary by any structural or functional defect or failure resulting from neglect, faulty workmanship, or faulty materials, in any part of the work performed by him.

C. Except as noted on the plans or as otherwise specified, all structures such as embankments, levees, fences, roads, etc., shall be returned to their original condition prior to the completion of the Contract. Any and all damages to any facility, not designated for removal, resulting from the Contractor's operations shall be repaired by the Contractor at no cost to the Owner.

D. The Contractor shall perform all roads and entrance reconstruction required and perform repairs and maintenance of same for a period of one (1) year from the date of such reconstruction. In the event the repairs and maintenance are not made immediately, to the satisfaction of the Project Manager, and it becomes necessary for the Owner of the road to make such repairs, the Contractor shall reimburse the Owner of the roads and entrances for the cost of such repairs and maintenance.

E. In the event the Contractor fails to remedy the defects of which he has been notified within fifteen (15) days of the dates of such notices, the Owner may cause the required materials to be procured and the work to be done by others, as described in the Notice to the Bidder and the Contractor or the Contractor's Surety shall pay all costs thereof.
1.2 MEASUREMENT AND PAYMENT:

No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be paid for separately.

PART 2 PRODUCTS (not applicable)

PART 3 EXECUTION (not applicable)

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION:

A. Measurement of the Item, "Mobilization," as specified herein will be by the lump sum, as the work progresses.

B. Partial payments of the lump sum bid for "Mobilization" will be as follows. The adjusted contract amount for construction items as used below is defined as the total contract amount less the lump sum bid for "Mobilization."

When 1% of the adjusted contract amount for construction items is earned, 50% of the mobilization lump sum bid or 5% of the total contract amount, whichever is less, will be paid.

When 5% of the adjusted contract amount for construction items is earned, 75% of the mobilization lump sum bid or 10% of the total contract amount, whichever is less, will be paid. Previous payment under this item will be deducted from the above amount.

When 10% of the adjusted contract amount for construction items is earned, 90% of the mobilization lump sum bid or 15% of the total contract amount, whichever is less, will be paid. Previous payment under this item will be deducted from the above amount.

Upon completion of all work under this contract, payment for the remainder of the lump sum bid for "Mobilization" will be made.

C. This item will be paid for at the Contract lump sum price bid for "Mobilization", which price shall be full compensation for work specified, including the furnishing and installation of all materials, equipment, tools, labor and incidentals necessary to complete the work.

D. The amount bid for "Mobilization" plus "Preparation of Right-Of-Way" may not exceed 15% of the adjusted contract amount. The adjusted contract amount is equal to the total amount bid less the amount bid for "Mobilization" plus "Preparation of Right-Of-Way."

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION:

These general site work requirements apply to all site work operations. Refer to Division 2 specification sections for specific product and execution requirements.

1.2 QUALITY ASSURANCE:

A. Comply with all applicable local, state and federal requirements regarding materials, methods of work and disposal of excess and waste materials.

B. Obtain and pay for all required inspections, permits and fees. Provide notices required to governmental authorities.

1.3 PROJECT CONDITIONS:

A. Locate and identify existing underground and overhead services and utilities within contract limit work areas. Provide adequate means of protection of utilities and services designated to remain. Repair utilities damaged during site work operations at Contractor's expense.

B. Arrange for disconnection, disconnect and seal or cap all utilities and services designated to be removed before start of site work operations. Perform all work in accordance with the requirements of the applicable utility company or agency involved.

C. When uncharted or incorrectly charted underground piping or other utilities and services are encountered during site work operations, notify the applicable utility company immediately to obtain procedure directions. Cooperate with the applicable utility company in maintaining active services in operation.

D. Locate, protect and maintain bench marks, monuments, control points and project engineering reference points. Re-establish disturbed or destroyed items at Contractor’s expense.

E. Perform site work operations and the removal of debris and waste materials to assure minimum interference with streets, walks, and other adjacent facilities.

F. Obtain governing authorities written permission when required to close or obstruct street, walks and adjacent facilities. Provide alternate routes around closed or obstructed traffic ways when required by governing authorities.

G. Control dust caused by the work. Dampen surfaces as required. Comply with pollution control regulations of governing authorities.
H. Protect existing buildings, paving and other services or facilities on site and adjacent to the site from damage caused by site work operations. Cost of repair and restoration of damaged items shall be at Contractor's expense.

I. Protect and maintain street lights, utility poles and services, traffic signal control boxes, curb boxes, valves and other services, except items designated for removal. Remove or coordinate the removal of traffic signs, parking meters and postal mail boxes with the applicable governmental agency. Provide for temporary relocation when required to maintain facilities and services in operation during construction work.

1.4 MEASUREMENT AND PAYMENT:

Measurement and Payment will be as outlined in Section "Measurement and Payment" of Part 1, General Provisions.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT:

Materials and Equipment will be as selected by Contractor, unless indicated otherwise in the contract documents.

PART 3 EXECUTION

3.1 PREPARATION:

A. Examine the areas and conditions under which site work is performed. Do not proceed with the work until unsatisfactory conditions are corrected.

B. Consult the records and drawings of adjacent work and of existing services and utilities which may affect site work operations.

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION:

A. RELATED WORK SPECIFIED ELSEWHERE:

Section 02010: Selective Demolition
Section 02005: Site Work
Section 01507: Tree Protection
Section 02221: Structural Excavation, Foundation and Backfill

B. SCOPE:

This section of the specification includes all labor, materials, equipment, and incidentals required to prepare the site for construction operations by protecting all items to remain and by removing and disposing of all obstructions from the construction areas and easements.

Such obstructions shall be considered to include, but not limited to, remains of structures not completely removed by others, foundations, floor slabs, concrete, brick, lumber, plaster, abandoned utility pipes or conduits, fences, retaining walls, and all other debris as well as buried concrete slabs, curbs, driveways and sidewalks.

This item shall also include the removal of trees, stumps, bushes, shrubs, brush, roots, vegetation, logs, rubbish, paved parking areas, miscellaneous stone, brick, drainage structures, manholes, inlets, scrap iron, trees and all debris whether above or below ground except live utility facilities.

As directed by the Engineer, this item shall include the demolition and removal of structures within the project limits either partially or completely.

It is the intent of this specification to provide for the removal and disposal of all obstructions to the new construction together with other objectionable materials not specifically provided for elsewhere by the plans and specifications.

Unless shown otherwise on the plans, all fences, gates and all other improvements along the project limits which are damaged, relocated and/or removed temporarily by the Contractor shall be replaced by the Contractor as directed by the Engineer to an equal or better condition at no additional cost to the Authority.

Precautions to assure protection for adjacent landowners must be taken by the Contractor at the Contractor’s expense. Any and all fencing, whether or not identified on the plans, must be maintained at all times. Where the nature of the work requires fence to be
removed, the Contractor, at his expense, shall replace said fencing to equal or better condition as
approved by the Engineer. Any and all claims directly attributed to the Contractor resulting from
his straying beyond the Construction limits will be settled by the Contractor to the satisfaction of
the Engineer.

1.2 MEASUREMENT AND PAYMENT:

Measurement and Payment will be as outlined in Section "Measurement and Payment" of
Part 1, General Provision.

PART 2 PRODUCTS

2.1 MATERIALS:

Materials and equipment will be as selected by the Contractor, except if otherwise
indicated on the plans.

PART 3 EXECUTION

3.1 CLEARING:

A. Locate and suitably identify trees and improvements indicated to remain.

B. Clear and grub areas within contract limits as required for site access and
execution of the work.

C. Remove undergrowth, other vegetation and debris, except items indicated to
remain.

D. Protect existing specimen trees to remain, as directed by the Engineer, against
injury or damage, including cutting, breaking, or skinning of roots, trunks or branches;
smothering by stockpiled construction materials, excavated materials or vehicular traffic within
branch spread. Tree protection shall be in accordance with Section 02122, "Tree Protection".

E. CONSTRUCTION METHODS:

Areas designated on the plans shall be cleared of all obstructions, vegetation,
abandoned structures, etc., as defined above, except trees or shrubs specifically designated on the
plans or by the Engineer for preservation.

Unless otherwise indicated on the plans, all underground obstructions shall be
removed to the following depths:

1. In areas to receive embankment, two feet (2') below natural ground.

2. In areas to be excavated, two feet (2') below the lower elevation of the
excavation.

3. All other areas, two feet (2') below natural ground.

Holes remaining after removal of all obstructions, objectionable materials, vegetation, etc., shall be backfilled and tamped as directed by the Engineer, and the entire area bladed to prevent ponding of water and to provide drainage. In areas that are to be immediately excavated, backfilling and blading may be eliminated if approved by the Engineer. Areas to be used as borrow sites and material sources shall have all obstructions, objectionable materials, vegetation, etc., removed to the complete extent necessary to prevent such objectionable matter from becoming mixed with the material to be used in the construction.

All "salvageable" material will remain the property of the Owner and will be stored at the site as directed by the Inspector. All "non-salvageable" material and debris removed shall become the property of the Contractor and shall be removed from the site and shall be disposed of properly off property.

3.2 SITE PREPARATION:

Existing Utilities: Protect all pipes, conduits and wires encountered, procure and pay for any necessary permits or certificates required to complete work specified. Make any and all required notifications and comply with all applicable federal, state and local ordinances including City Public Service.

3.3 DISPOSAL OF WASTE MATERIALS:

A. Stockpile, haul from site and legally dispose of waste materials and debris. Accumulation is not permitted.

B. Maintain disposal routes clear, clean and free of debris.

C. On-site burning of combustible cleared materials is not permitted.

D. Channel spoils shall be taken to the landfill as described in Section 02210, “Channel Excavation.”

3.4 CLEANING:

Upon completion of site preparation work, clean areas within the contract limits, remove tools and equipment. Provide site clear, clean and free of materials and debris and suitable for site work operations.

PART 4 SPECIAL REQUIREMENTS

4.1 PROTECTION OF ENVIRONMENTAL RESOURCES:
Comply with all requirements Section 01505, "Environmental Protection" of the Division
1 - General Requirements.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Protection of existing trees.
2. Removal of trees and other vegetation.
3. Topsoil stripping, stockpiling and spreading.
5. Removing above-grade improvements.
6. Removing below-grade improvements.

1.3 PROJECT CONDITIONS

A. Traffic: Conduct site-clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets or other used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protection necessary to prevent damage to existing improvements indicated to remain in place.

C. Protect improvements on adjoining properties and on Owner's property.

D. Restore damaged improvements to their original condition, as acceptable to property owners.

E. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinnning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

F. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.

G. Provide protection for roots over 1-1/2 inch in diameter that are cut during construction operations. Coat cut faces with an emulsified asphalt or other acceptable coating formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.

H. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations in a manner acceptable to Engineer.

I. Salvageable Improvements: Carefully remove items indicated by Project Manager to be salvaged, and store on Owner's premises where indicated or directed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SITE CLEARING
A. General: Remove trees, shrubs, grass and other vegetation, improvements, or obstructions as required to allow installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. “Removal” includes digging out and off-site disposal of stumps and roots. Use necessary means to prevent spread of dust during the duration of the project construction. Moisten surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on site.

B. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

C. Topsoil: Topsoil shall be stripped from the existing surface soil after vegetation and trees have been removed. Where existing trees are indicated to remain, leave existing surface soil in place within drip lines to prevent possible damage to root systems.

D. Stripping of topsoil shall be accomplished by the following procedure: In areas of cut or fill, topsoil may be stripped to whatever depths it is encountered, but not to exceed 12”, in a manner to prevent intermingling with underlying subsoil or other objectionable material. Areas where the topsoil is required for planting with more than 6” of cut, the contractor shall “over excavate” 6” below finish grade and replace with 6” of topsoil. In areas requiring more than 6” of fill where topsoil is required for planting, the top 6” shall be topsoil.

E. Stockpile topsoil in storage piles in areas indicated or as directed by the Engineer or Owner. Construct storage piles to provide free drainage of surface water.

F. Quality topsoil is reasonably free of subsoil, clay lumps or stones larger than 3/4” weeds, roots and other objectionable material and promotes the growth of vegetation.

G. Topsoil shall be placed and spread in the areas required with a depth of not less than 6”. Once the topsoil has been placed and spread, it shall be compacted to 82 - 88% of maximum density as determined by the Texas Department of Transportation (TxDOT) test method, TEX-114E. Final grading of topsoil shall be accomplished by placing grade stakes (blue tops) on a maximum 50’ grid to ensure proper grade control. After proper compaction and final grading the surface shall be tilled with a “landscape rake” to remove rocks, roots, or other objectionable material larger than 3/4”. This machine shall gently till the top 1” of soil, breaking up clumps and clods, leveling uneven ground, and preparing the topsoil surface for turf installation.

H. The “landscape rake” shall consist of Model 5A or 6A attachment equipment manufactured by “Bobcat” to be mounted on traditional “Bobcat” skid-steer loaders. Similar equipment may be used with approval of the Engineer.

I. Dispose of unsuitable or excess topsoil as specified for disposal of waste material.

J. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing by the Project Manager and or adjoining the project site. In the event of damage to any existing objects designated to remain, contractor shall repair or replace at no additional cost to the Owner.

K. Removal of stumps, roots, and other debris shall be required of all areas of excavation to a depth of 18” below the excavation elevation. On areas of embankment, stumps, roots and other debris shall be removed to a depth of 18” below the existing ground surface. The contractor shall accomplish this requirement by root plowing, raking, piling and proper disposal.

L. Use only hand methods for grubbing inside drip line of trees indicated to remain.

M. Fill depressions caused by clearing and grubbing operations with satisfactory soil material,
unless further excavation or earthwork is indicated.

N. Place fill material in horizontal layers not exceeding 6" loose depth, and thoroughly compact to a density equal to adjacent original ground.

O. All areas requiring backfill such as abutting to curbs shall have a minimum 5:1 slope ratio. The backfill material used shall be obtained from approved sources, suitable to support plant growth. It will be fertile loam, easily cultivated, and free from roots, weeds, stones, or other objectionable material.

P. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction. The project drawings do not purport to show all objects existing on the project site. The contractor shall be responsible for verifying all objects to be removed, adjusted or preserved before his start of work.

3.2 DISPOSAL OF WASTE MATERIALS

A. Removal from Owner's property: Remove waste materials from Owner's property. On site burning will not be permitted. All disposal of waste shall be the sole responsibility of the contractor and shall be performed within all legal and applicable laws and regulations.

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION:

A. RELATED WORK SPECIFIED ELSEWHERE:

Section 02221: Structural Excavation, Foundation and Backfill

B. SCOPE:

The work performed under this section of the specification includes furnishing all labor, materials and equipment necessary to remove all surface water and groundwater as needed to construct all permanent work in areas free from water. This includes but is not limited to constructing and maintaining cofferdams, dikes, levees, channels, ditches, pump stations, diversion piping, clean-up and repairs after flood events to permanent and temporary facilities.

1.2 MEASUREMENT AND PAYMENT:

Measurement and Payment will be as outlined in Section "Measurement and Payment" of Part 1, General Provisions.

1.3 SUBMITTALS:

Submittals shall be in accordance with Section 01300, "Submittals", and as stated below:

1.4 DETAILED DESCRIPTION:

A. Construct all permanent work in areas free from water. Design, construct and maintain all dikes, levees, cofferdams, pump and piping systems, diversion structures and drainage channels as necessary to maintain the areas free from water and to protect the areas to be occupied by permanent work from water damage. Remove temporary works after they have served their purpose, unless abandonment in-place is approved in writing by the Engineer.

B. The Contractor shall be responsible for the stability of all temporary and permanent slopes, grades, foundations, materials and structures during the course of the Contract. Repair and replace all slopes, grades, foundations, materials and structures damaged by water, both surface and subsurface, to the lines, grades and conditions existing prior to the damage at no additional cost to the Authority.
C. Remove and replace any system of diversion which does not obtain specified results.

The Contractor may be required at anytime to partially or completely breach the cofferdams, when flood levels are such that the presence of the dams may cause flood damage to adjacent properties, structures, etc. Any damages caused by the required breaching and/or floodwaters to the cofferdams, diversions, etc. will be repaired by the Contractor at his expense.

D. Work in the channel:

The channel is subject to sudden flooding, therefore the Contractor shall not store equipment or materials in the flood way. Also, damage to either permanent work or temporary construction facilities shall be the Contractor’s responsibility to repair, rebuild, or replace at the Contractor’s expense. Numerous floods should be anticipated, budgeted, and planned for by the Contractor. Time extensions due to flooding and flood damage repairs may be considered by the Engineer for approval. Time extensions allowed shall not include delay costs, overhead, or any other associated costs.

E. Physical Data. Information and data furnished or referred to below are furnished for the Contractor's information. However, it is expressly understood that the Authority or Owner will not be responsible for any interpretation or conclusion drawn therefrom by the Contractor.

1. The physical conditions indicated on the plans and in the specifications are the result of previous site investigations, surveys, previous borings, and construction drawings.

2. Weather conditions. The information in the following tables is for Bexar County, Texas, and was compiled from the records for the first order U.S. Weather Bureau Station at San Antonio, Texas.
### PRECIPITATION

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(a) Based on record for the 1941-1970 period.  
(b) Based on record for the 1943-1977 period.  
(c) Based on record for the 1942-1977 period.  
(R) Record for 92 years through 1977.

A rating curve of the San Antonio River at South Alamo Street Bridge, as well as mean daily discharge (typical dry water year 1971), Daily Mean Discharge (based on mean daily discharge) and Hydrographs can be obtained from the U.S. Army Corps of Engineers, Fort Worth District, Fort Worth, Texas.
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(a) Based on record for the 1941-1970 period.
(b) Based on record for the 1943-1977 period.
(c) Based on record for the 1942-1977 period
(R) Record for 92 years through 1977.
### FREQUENCY OF RAIN EVENTS OF 0.5 INCH OR MORE

**SAN ANTONIO, TEXAS (NOAA)**

**1971-1986**

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Note: No known measurement of historic or current streamflows for San Pedro Creek or upstream tributaries of the San Antonio River below Alamo Street. Therefore, a significant increase in frequency distribution for streamflows can be anticipated.

PART 2 PRODUCTS (Not applicable)

PART 3 EXECUTION

3.1 CARE OF WATER:

A. Except where the excavated materials are designated as materials for permanent work, material from required excavation may be used for dikes, levees, cofferdams and other temporary backfill.

B. Install, sequence and coordinate operation of all dikes, levees and other temporary backfill in accordance with Section 01300, "Submittals".

C. Furnish, install, maintain and operate necessary pumping and other equipment, for dewatering the various parts of the work and for maintaining the foundation and other parts free from water as required for constructing each part of the work.

D. Install all drainage ditches, sumps and pumps to control excessive seepage on excavated slopes, to drain isolated zones and perched water tables, and to drain impervious surfaces at final excavation elevation.

E. WATER TABLE:

1. Provide control of seepage until internal drainage systems are in place in each related area. Terminate only when critical uplift pressures are not anticipated.

2. Water all trees and vegetation frequently so as not to stress them due to lowering the water table.

F. After they have served their purpose, remove all temporary protective work at a satisfactory time and in a satisfactory manner. All excavations or other areas where structures will be constructed shall be cleaned out, backfilled and processed under the same specifications as those governing the backfill.

G. When the temporary work will not adversely affect any item of permanent work or the planned usage of the project, the Contractor may be permitted to leave such temporary works in place, if approved by the Engineer.

3.2 DEWATERING:

A. The Contractor shall be fully responsible for the design, furnishing, installation, adequacy, operation, maintenance, monitoring and removal of all (if any) dewatering and (if any)
pressure relief systems, required to dig all excavations and construct all permanent work in the dry. It is of paramount importance that the groundwater level be maintained at all times during construction and until completion of all backfill at a sufficient depth beneath the finished excavated subgrade to prevent softening of the subgrade soils and/or blowouts due to the upward flow of water into the excavation. An interruption in dewatering of only a short interval of time may cause damage to the supporting soils due to softening. If this occurs, the Contractor will be responsible for replacement of the disturbed soil at his expense. The Contractor shall also be responsible for recharging any aquifers if necessary to prevent any settlement of adjacent structures as a result of lowering the groundwater table for other work on the site. All dewatering, pressure relief, and (if any) recharge systems shall be designed, of the design supervised by a Registered Engineer licensed to practice in the State of Texas. A full scale pumping test shall be made on each dewatering system to prove its adequacy prior to the start of any excavation below the groundwater level, more specifically identified as the piezometric water level.

B. All excavations shall be protected from inflow of surface water by means of dikes and ditches, and a sufficient number of pumps shall be provided to promptly remove any rain water falling into the excavation.

C. The Contractor shall also be responsible for disposal of all groundwater and surface water.

END OF SECTION
SECTION 02160

TEMPORARY EXCAVATION SUPPORT SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Design, furnish and install temporary excavation support systems as required to maintain lateral support, prevent loss of ground, limit soil movements to acceptable limits and protect from damage existing and proposed improvements including, but not limited to, pipelines, utilities, structures, roadways, railroads and other facilities.

B. The requirement of sheeting left in place in areas indicated on the drawings does not relieve the Contractor from the responsibility of furnishing and installing proper temporary excavation support systems in other areas.

C. Common types of excavation support system include, but are not limited to, singular or multiple stages comprised of cantilevered or internally braced soldier piles and lagging, steel sheetpile wall, timber sheetpile wall, trench box, or combinations thereof. Trench box temporary excavation support system is only acceptable for pipe or utility trench excavations. Temporary unsupported open cut excavation with stable sloping sides is allowed where applicable.

D. Wherever the word "sheeting" is used in this section or on the contract drawings, it shall be in reference to any type of excavation support system specified except trench box.

E. Construction of the temporary excavation support systems shall not disturb the existing structures or the completed proposed structures. Damage to such structures shall be repaired by the Contractor at no additional cost to the Owner.

F. Adjacent structures are those that are bear upon soils above the proposed excavation depth and within a distance equal to twice the total depth of the excavation away from the closest edge of the excavation. Monitor and protect adjacent structures as specified and indicated.

G. Vibration monitoring for excavation support systems will be performed by Contractor’s vibration consultant and monitoring firm. Vibration due to Contractor’s operations shall not exceed specified limits 1.05 E.

H. Construction operations not to exceed specified noise limits in accordance with Section 01100.

I. The Contractor shall bear the entire cost and responsibility of correcting any failure, damages, subsidence, upheaval or cave-ins as a result of improper installation,
maintenance or design of the temporary excavation support systems. The Contractor shall pay for all claims, costs and damages that arise as a result of the work performed at no additional cost to the Owner.

1.02 RELATED WORK:

A. Section 02140: Dewatering
B. Section 02210: Earth Excavation, Backfill, Fill, and Grading
C. Section 03300: Cast-in-Place Concrete
D. Section 05119: Structural Steel

1.03 REFERENCES:

A. American Society for Testing and Materials (ASTM):
   1. A36: Standard Specification for Structural Steel
   2. A328: Standard Specification for Steel Sheet Piling
   3. A416: Standard Specification for Strand Steel, Uncoated Seven-Wire for Prestressed Concrete
   4. A722: Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete
   5. A615: Standard Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

B. American Wood-Preserves Association (AWPA) Standards.


E. Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29: Subpart P - Excavations, Trenching and Shoring.

F. American Concrete Institute (ACI)
   1. ACI 304: Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
1.04 SUBMITTALS:

A. Submit the following in accordance with Section 01300:

1. Submit the following qualifications four (4) weeks prior to the construction:
   a. Qualifications of independent vibration consulting and monitoring firm as specified in Paragraph 1.05 D.
   b. Qualifications of Contractor’s temporary excavation support system designer as specified in Paragraph 1.05 G.
   c. Qualifications of Contractor’s temporary excavation support system installer as specified in Paragraph 1.05 H.
   d. Qualifications of Contractor’s independent tieback testing laboratory as specified in Paragraph 1.05 I, if a tieback system is utilized.
   e. Qualifications of Contractor’s temporary excavation support system installation supervisor as specified in Paragraph 1.05 J.
   f. Qualifications of vacuum excavation subcontractor as specified in Paragraph 1.05 F, if DMPs for utilities are utilized.

2. Submit a temporary excavation support plan stamped and signed by a Registered Professional Engineer at least two weeks prior to start of the construction. Do not submit design calculations. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include the following items as a minimum:

   a. Proposed temporary excavation support system(s), details, location, layout, depths, extent of different types of support relative to existing features and the permanent structures to be constructed, and methods and sequence of installation and removal.
   b. Certificate of Design: Refer to Section 01300.
   c. A list of all design assumptions, including safety factors used for the temporary excavation support system(s) and all lateral pressures used for each system.
d. If utilizing a tieback system, include tieback installation procedures and criteria for acceptance of tiebacks for performance and proof tests. Submit the tieback testing results to the Engineer for information only.

e. Requirements of dewatering during the construction.

f. Minimum lateral distance from the edge of the excavation support system for use for vehicles, construction equipment, and stockpiled construction and excavated materials.

g. List of equipment used for installing the excavation support systems.

h. Monitoring schedule, installation procedures and location plans for vibration/noise monitoring, geotechnical instrumentation (deformation monitoring points, inclinometers, etc.) and observation wells/piezometers to monitor ground, excavation support system, adjacent structures and groundwater fluctuation during the entire construction period.

3. Submit a Construction Contingency Plan specifying the methods and procedures to maintain temporary excavation support system stability if the allowable movement of the adjacent ground and adjacent structures is exceeded.

4. Monitoring data within one (1) day of data collection from vibration and noise recording equipment, observation wells, deformation monitoring points and offset lines. Data shall include:

a. Horizontal and vertical movements of geotechnical instruments and groundwater readings.

b. New movements since the initial readings of the geotechnical instruments.

c. Weekly summary in tabular and graphic form at the end of each week.

d. A schematic plan of excavation and/or relevant construction activities at the time of monitoring.

5. For excavation support systems left in place, submit the following as-built information prior to backfilling and covering the excavation support systems:

a. Survey locations of the temporary excavation support systems, including coordinates of the ends and points of change in direction.

b. Type of the temporary excavation support system.
c. Elevations of top and bottom of the excavation support systems left in place.

1.05 QUALITY ASSURANCE:

A. Provide in accordance with Section 01400 and as specified.

B. Conform to the requirements of the OSHA Standards and Interpretations: "Part 1926 Subpart P - Excavation, Trenching, and Shoring", and all other applicable laws, regulations, rules, and codes.

C. Construction operations to conform to noise regulations provided in the Noise Control Plan and this Section.

D. Retain the services of an independent vibration consulting firm with the following in-house personnel to conduct the following vibration monitoring requirements:

1. Preparing, reviewing and signing of monitoring plans and daily reports, and overseeing of the monitoring and interpretation of the vibration data shall be performed by personnel with the following qualifications:

   a. Be a (Fill-in State as applicable) Registered Professional Engineer.

   b. Have a minimum of five (5) years experience in the vibration consulting field.

   c. Have successfully completed at least five (5) projects with vibration-inducing construction operations, pile driving, and noise levels equal to or more severe than those to be encountered.

2. Assist Contractor in selecting pile driving equipment which will generate the lowest vibration and noise levels.

3. Installation, monitoring and interpretation of monitoring equipment shall be performed by personnel with the following qualifications:

   a. Have at least three (3) years of experience in the operation of monitoring equipment proposed for use and interpretation of records produced by such equipment.

   b. Have installed, operated, monitored and interpreted equipment and records on at least three (3) projects with vibration-inducing construction operations, pile driving, and noise levels equal to or more severe than
those to be encountered.

E. The peak particle velocity for pile driving, or other vibration-inducing operations, shall not exceed the following:

<table>
<thead>
<tr>
<th>Type of Concrete</th>
<th>Age of Concrete, hrs</th>
<th>Peak Particle Velocity in/sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass Concrete</td>
<td>0-11</td>
<td>1.0</td>
</tr>
<tr>
<td>(footings, mats, slab-on-grade, fill concrete, etc.)</td>
<td>11 and over</td>
<td>2.0</td>
</tr>
<tr>
<td>Concrete Structures</td>
<td>0-11</td>
<td>0.5</td>
</tr>
<tr>
<td>(walls, columns, elevated slabs, etc.)</td>
<td>11-24</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>24 and over</td>
<td>2.0</td>
</tr>
<tr>
<td>Existing Structures, -</td>
<td>-</td>
<td>0.5</td>
</tr>
<tr>
<td>residences or utilities</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F. If utilizing deformation monitoring points (DMPs) for utilities, vacuum excavation shall be performed by subcontractor having five (5) years of experience in non-destructive vacuum excavation methods for utilities.

G. Prepare design, including calculations and drawings, under the direction of a Professional Engineer registered in the state where the project is located and having the following qualifications:

1. Not less than ten (10) years experience in the design of specific temporary excavation support systems to be used.

2. Completed not less than five (5) successful temporary excavation support system projects of equal type, size, and complexity within the last five (5) years.

H. Temporary Excavation Support System Installer's Qualifications:

1. Not less than three (3) year experience in the installation of similar types and equal complexity as the proposed system.

2. Completed not less than three (3) successful excavation support systems of similar type and equal complexity as the proposed system.

I. If utilizing a tieback system, employ an independent testing laboratory to test the tieback system with the following qualifications:
1. Be accredited by the American Association of State Highway and Transportation Officials (AASHTO) Accreditation Program.

2. Employ personnel conducting testing who are trained in the methods and procedures to test and monitor tieback systems of similar type and equal complexity, as the proposed system.

3. Have not less than five (5) years experience in testing of tieback systems of similar type and equal complexity as the proposed system.

4. Have successfully tested at least three (3) tieback systems of similar type and equal complexity as the proposed system.

J. Install all temporary excavation support systems under the supervision of a supervisor having the following qualifications:

1. Not less than five (5) years experience in installation of systems of similar type and equal complexity as the proposed system.

2. Completed at least five (5) successful temporary excavation support systems of similar type and equal complexity as the proposed system.

K. All welding shall be performed in accordance with AWS D1.1.

1.06 DESIGN CRITERIA:

A. Design of temporary excavation support systems shall meet the following minimum requirements:

1. Support systems shall be designed for earth pressures, hydrostatic pressure, equipment, temporary stockpiles, construction loads, roadways, railroads, and other surcharge loads.

2. Design a bracing system to provide sufficient reaction to maintain stability.

3. Limit movement of ground adjacent to the excavation support system to be within the allowable ground deformation as specified.

4. Design the embedment depth below bottom of excavation to minimize lateral and vertical earth movements and provide bottom stability. Toe of braced temporary excavation support systems shall not be less than 5 feet [1.5 m] below the bottom of the excavation.
5. Design temporary excavation support systems to withstand an additional 2 feet [60 cm] of excavation below proposed bottom of excavation without redesign except for the addition of lagging and/or bracing.

6. Maximum width of pipe trench excavation shall be as indicated on the drawings.

7. Do not cast permanent structure walls directly against excavation support walls.

8. The design location of the excavation support wall shall be determined such that the installed wall and bracing system components are all located outside the limits of the permanent structure. Construction tolerances (e.g. wall verticality) shall be considered in determining the plan location.

1.07 DELIVERY, STORAGE AND HANDLING:

   A. Provide in accordance with Sections 01610 and as specified.

   B. Store sheeting and bracing materials to prevent sagging which would produce permanent deformation. Keep concentrated loads which occur during stacking or lifting below the level which would produce permanent deformation of the material.

1.08 PROJECT/SITE CONDITIONS:

   A. Subsurface Conditions: Refer to Section 01420.

PART 2 - PRODUCTS

2.01 MATERIALS:

   A. Structural Steel: All soldier piles, wales, rakers, struts, wedges, plates, waterstop and accessory steel shapes shall conform to ASTM A36.

   B. Steel Sheet Piling: ASTM A328, continuous interlocking type.

   C. Timber Lagging Left in Place: Pressured treated per appropriate AWPA standards.

   D. Tieback Tendons: Tieback tendons shall be high strength steel wire strand cables conforming to ASTM A416, or bars conforming to ASTM A722. Splicing of individual cables shall not be permitted.

   E. Raker Ties: ASTM A615 Grade 60.

   F. Cement Grout Materials And Admixtures For Tieback Anchorages: Grout cube strength shall be a minimum 3500 psi at 7 days and 5000 psi at 28 days.
G. Concrete: Section 03300.

H. Tamping tools adapted for backfilling voids after removal of the excavation support system.

I. Provide specific trench box sizes for each pipe and utility excavation with structural capacity of retaining soil types as described in OSHA's 29 CFR Part 1926 Subpart P.

2.02 EQUIPMENT:

A. A vibratory hammer shall be utilized for driving the temporary sheet piling providing that such operations do not exceed vibration/noise requirements of the specifications. Impact hammer shall be utilized when vibratory hammer is unable to drive temporary sheet piling to required depth and/or unable to meet vibration requirements. Impact hammer shall also meet noise requirement.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Installation of the temporary excavation support systems shall not commence until the related earth excavation and dewatering submittals have been reviewed by the Engineer with all Engineer’s comments satisfactorily addressed.

B. Install excavation support systems in accordance with the temporary excavation support plan.

C. If utilizing a tieback system, all performance and proof tests shall be conducted in the presence of the Engineer. Testing performed without the Engineer present will not be accepted. Repeat testing in the Engineer's presence at no additional cost to the Owner.

D. Do not drive sheeting within 100 feet [30 m] of concrete less than seven (7) days old.

E. Carry out program of temporary excavation support in such a manner as to prevent undermining or disturbing foundations of existing structures of work ongoing or previously completed.

F. Bottom of the trench box excavation support system shall be above the pipe invert prior to installing the pipe.

G. Install and read geotechnical instrumentation in accordance with the temporary excavation support plan. Notify the Engineer immediately if any geotechnical instrumentation is damaged. Repair or replace damaged geotechnical instrumentation at the sole option of the Engineer and at no additional cost to the Owner.
H. Continuously monitor movements of the ground adjacent to excavation support systems and adjacent structures. In events of the measured movements approaching or exceeding the allowable movements, take immediate steps to arrest further movement by revising procedures such as providing supplementary bracing, filling voids behind the trench box, supporting utilities or other measures (Construction Contingency Plan) as required.

I. Notify utility owners if existing utilities interfere with the temporary excavation support system. Modify the existing utility with the utility owners permission or have the utility owner make the modifications at no additional cost to Owner.

3.02 GROUND DEFORMATION ADJACENT TO EXCAVATION SUPPORT SYSTEMS:

A. Allowable Vertical (heave/settlement) and Lateral Movements: 2 inches [5 cm] maximum for the trench box excavation support system, and 1 inch [2.5 cm] maximum for other types of excavation support systems at any location behind the excavation support system.

B. Monitoring personnel shall use a procedure for reading and recording geotechnical instrumentation data which compares the current reading to the last reading during data collection to eliminate spurious readings.

C. Plot the observed ground deformation readings versus time. Annotate the plots with construction loading and excavation events having an impact on the readings. Evaluate plots by means of secondary rate-of-change plots to provide early warning of accelerating ground movements.

D. Notify the Engineer when the allowable ground deformation is exceeded.

E. Implement Construction Contingency Plan under direction of the temporary excavation support system designer and the Engineer.

3.03 REMOVAL OF EARTH RETENTION SYSTEM:

A. Sheeting shall be left in place unless otherwise indicated or approved in writing by the Engineer.

B. When indicated or approved by the Engineer, remove the temporary excavation support system without endangering the constructed or adjacent structures, utilities, or property. Immediately backfill all voids left or caused by withdrawal of temporary excavation support systems with bank-run gravel, screened gravel or select borrow by tamping with tools specifically adapted for that purpose.

C. When tiebacks are used, release tension in tiebacks as the excavation is backfilled. Do not leave tensioned tieback in place at the completion of the work.
D. The excavation support system left-in-place shall be cut-off a minimum of 2 feet [60 cm] below the bottom of the next higher foundation level or a minimum of 5 feet [152 cm] below finished grade.

E. Conduct survey of the locations and final cut-off elevations of the excavation support systems left in place.

3.04 MEASUREMENT AND PAYMENT:

Measurement and Payment will be as outlined in Section "Measurement and Payment" of Part 1, General Provisions.

END OF SECTION
PART 1 GENERAL

1.01 DESCRIPTION:

A. Perform earthwork as shown and specified. The work includes:
   1. Site grading and filling to indicated elevations, profiles and contours.
   2. Excavating and backfilling structure footings and foundations.
   4. Topsoil distribution and finish grading.

B. Related Work:
   1. Section 02050: Site Preparation.
   2. Section 02400: Site Drainage.
   3. Section 02487: Sodding.
   4. Section 02490: Trees, Plants and Ground Covers.
   5. Section 02513: Asphaltic Concrete Paving.
   6. Section 02515: Concrete Curbs, Walks and Paving.

1.02 QUALITY ASSURANCE:

A. Comply with Section 01400 requirements.

B. Materials and methods of construction shall comply with applicable requirements of:
   1. Local governing authorities having jurisdiction.
3. American Association of State Highway and Transportation Officials (AASHTO).

1.03 PROJECT CONDITIONS:

A. Known underground and surface utility lines are indicated on the plans, but it is the contractor’s responsibility to verify all horizontal & vertical locations of utility prior to commencing work.

B. Protect existing trees and other features designated to remain as part of the landscaping work.

C. Protect excavation by shoring, bracing, sheeting, underpinning, or other methods, as required to prevent cave-ins or loose dirt from entering excavations. Barricade open excavations and post warning lights at work adjacent to public streets and walks.

D. Promptly repair damage to adjacent facilities caused by earthwork operations. Cost of repair at Contractor’s expense.

E. Promptly notify the Engineer of unexpected subsurface conditions. The contractor does however, have the opportunity and responsibility to satisfy himself of any subsurface conditions not shown clearly on plans by performing subsurface investigations prior to bid opening. All exploration are at the expense of the contractor and must have approval from the engineer.

F. Protect bottoms of excavations and soil beneath and around foundation from frost and freezing.

G. Grade at excavations to prevent surface water draining into excavated areas.

1.04 MEASUREMENT AND PAYMENT:

Measurement and payment will be as outlined in Section "Measurement and Payment" of Part I, General Provisions.

PART 2 PRODUCTS

2.01 MATERIALS:

A. Fill Material: Earth similar to the earth existing in the areas free from rubbish, batts, lumber, rocks larger than 3" in their greatest dimension or other debris.

B. Granular Base: AASHTO Soil Classification A-1-a for granular materials, washed sand.

C. Granular Fill or Backfill: AASHTO M43, #6 (3/8" to 3/4") clean, washed
uniformly graded stone or gravel.

D. Topsoil: Natural, friable, fertile soil characteristic of productive soil in the vicinity, free of stones, clay lumps, roots, and other foreign matter.

1. Provide imported topsoil material as required to complete the work. Obtain rights and pay all costs for imported materials.

2. Proposed topsoil material shall be acceptable to the Engineer.

PART 3 EXECUTION

3.01 PREPARATION:

A. Establish extent of grading and excavation by area and elevation. Designate and identify datum elevation and project engineering reference points. Set required lines, levels and elevations.

B. Do not cover or enclose work of this section before obtaining required inspections, tests, approvals and location recording.

3.02 EXISTING UTILITIES:

A. Before starting grading and excavation, establish the location and extent of underground utilities in the work area. Exercise care to protect existing utilities during earthwork operations. Perform excavation work near utilities by hand and provide necessary shoring, sheeting and supports as the work progresses.

B. Maintain, protect, relocate or extend as required existing utility lines to remain which pass through the work area. Pay costs for this work, except as covered by the applicable utility companies.

C. Protect active utility services uncovered by excavation.

D. Remove abandoned utility service lines from areas of excavation. Cap, plug or seal abandoned lines and identify termination points at grade level with markers.

E. Accurately locate and record abandoned and active utility lines re-routed or extended on project record documents.

3.03 SITE GRADING:

A. Perform grading within contract limits, including adjacent transition areas, to new elevations, levels, profiles and contours indicated. Provide subgrade surfaces parallel to finished surface grades. Provide uniform levels and slopes between new elevations and existing grades.
B. Grade surfaces to assure areas drain away from structures and to prevent ponding and pockets of surface drainage. Provide subgrade surfaces free from irregular surface changes and as follows:

1. Rough Grading: Plus or minus 0.10 ft. subgrade tolerance. Finish required will be that ordinarily obtained from either blade-grader or scraper operations.

2. Provide subgrade surface free of exposed boulders or stones exceeding 4" in greatest dimension in paved areas; 2" in greatest dimension in lawn and planting areas.

3. Lawn and Planting Areas: Allow for 6" average depth of topsoil at lawn and planting areas, except as otherwise indicated on the plans.

4. Paved Areas: Shape surface of subgrade areas to line, grade and cross-section indicated. Provide compacted subgrade suitable to receive paving base materials. Subgrade tolerance plus 0, minus 1/2".

5. Granular Base: Grade subgrade surface smooth and even, free of voids to the required subgrade elevation. Provide compacted subgrade suitable to receive granular base materials. Tolerance 1/2" in 10'-0".

C. Grading at existing trees to remain:

1. Perform grading, within branch spread of existing trees to remain, by hand methods to elevations indicated.

2. Cut roots cleanly to depth 3" below proposed finish grade. Coat cut roots with Engineer approved tree paint.

3.04 EXCAVATING:

A. Excavate for structures to elevations and dimensions shown. Extend excavation a sufficient distance from foundations to permit placing and removal of formwork, installation of materials, services and inspection. Hand trim foundation excavations to final grade just before concrete is placed. Remove loose, soft materials, and all organic matter. Footings shall bear on approved undisturbed bearing soil.

B. Obtain inspection and testing of foundation excavations by Engineer before concrete is placed.

C. Excavate for curbs, walks and paving to cross sections, elevations, and grades indicated. Allow for base material.
D. Earth excavation shall include the satisfactory removal and disposal of all materials encountered, regardless of the nature of the materials, the condition of the materials at the time they are excavated, or the manner in which they were excavated, except materials classified as rock excavation.

E. Extra Excavation: Excavate unsatisfactory soil materials extending below required elevations to depth as directed. Such extra excavation will be paid for as a change in work. Obtain Engineer's written authorization before performing extra excavation work.

F. Unauthorized Excavation: Backfill and fill any over excavation to proper grades. Fill over excavation at footings with 1,500 psi concrete. Additional labor and material for unauthorized excavation and remedial work at Contractor's expense.

G. Shore, sheet, or brace excavations as required to maintain them secure. Remove shoring and bracing as backfilling progresses, when banks are safe against caving.

H. Do not excavate footings or slabs to the full depth when freezing temperature may be expected, unless footings or slabs are placed immediately after the excavation has been completed. Protect excavation bottoms from freezing when the placing of concrete is delayed.

3.05 SITE DRAINAGE AND UTILITIES EXCAVATING AND BACKFILLING:

Performed under Site Drainage, Section 02400.

3.06 DRAINAGE:

A. Provide necessary pumps and drainage lines and maintain excavations, including footings and pits, free from water, ice and snow during excavating and subsequent work operations.

B. Provide drainage of the working area at all times.

3.07 FILLING, BACKFILLING AND COMPACTING:

A. Filling:

1. Suspend fill operations when satisfactory results can not be obtained because of environmental or other unsatisfactory site conditions. Do not use muddy or frozen fill materials. Do not place fill material on muddy or frozen subgrade surface.

2. Maintain surface conditions which permit adequate drainage of rain water and prevent ponding of surface water in pockets. When fill placement is interrupted by rain, remove wet surface materials or permit to dry before placing additional fill material.

B. Place backfill materials in uniform layers not greater than 8" loose thickness over entire backfill area.
1. Use hand tampers or vibrating compactors at foundation walls, retaining walls and similar locations. Do not use large rolling equipment adjacent to foundation walls and retaining walls.

2. Do not backfill against foundation walls or retaining walls until walls for bearing surfaces have reached design strength or are properly braced, and backfilling operations approved. Provide clean backfill materials, except where granular materials are indicated. Compact in maximum 8" layers loose thickness.

C. Fill all areas of settlement to proper grade before subsequent construction operations are performed.

D. Compaction: Tamp to 98% standard proctor density (SPD), but not more than 100% SPD. Where compaction is authorized beneath slabs and foundation the subgrade shall be compacted to at least 98% SPD. Subgrade beneath sidewalks shall be scarified to a depth of 6" and compacted to 98% SPD. Moisture content shall be between -1% and +3% optimum moisture content as determined by the third party testing laboratory.

3.08 FINISH GRADING:

A. After the subsoil has been prepared, required topsoil as specified below shall be evenly spread thereon to a minimum 6" depth and light compacted. No topsoil shall be spread in a frozen or muddy condition. Allowance for settlement shall be made and the finish grade of topsoil shall be 1 1/2" below finish grade of walls and paving.

B. If the quantity of excavated topsoil is inadequate, sufficient additional topsoil shall be furnished. Topsoil furnished shall be a natural, fertile, friable soil, possessing characteristics of representative productive soils in the vicinity. It shall be obtained from naturally well drained areas. Topsoil shall be without admixture of subsoil and free from Bermuda grass, nut grass (Cyperus rotundus) and other objectionable grass, weeds, and toxic substances. Topsoil to be approved by the Engineer. Any areas that become compacted during construction shall be tilled to a minimum 4" depth prior to final placement of topsoil or before planting operations are begun.

C. Manually install topsoil at trees to remain. Avoid damage to root systems.

D. Rip-rap:

1. Provide rip-rap work as and where indicated on the plans.

2. Prepare subgrade as required in Section 03420 of the specifications.

3. Install rip-rap as detailed and in accordance with Section 03420 of the specifications.
E. Maintenance:

1. Protect finish graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded and damaged areas.

2. Where completed areas are disturbed by construction operations or adverse weather, scarify, re-shape and compact to required density.

3.09 DISPOSAL OF WASTE MATERIALS:

A. Stockpile, haul from site and legally dispose of waste materials, including excess excavated materials, rock, trash and debris.

B. Maintain disposal route clear, clean and free of debris.

3.10 CLEANING:

Upon completion of earthwork operations, clean areas within contract limits, remove tools and equipment. Provide site clear, clean, free of debris and suitable for site work operations.

END OF SECTION
SECTION 02221
STRUCTURAL EXCAVATION, FOUNDATIONS AND BACKFILL

PART 1 GENERAL

1.1 DESCRIPTION:

A. RELATED WORK SPECIFIED ELSEWHERE:

Section 01300: Submittals
Section 01400: Quality Control and Testing
Section 02050: Site Preparation
Section 02140: Temporary Earth Retention Systems
Section 02150: Dewatering and Care of Water
Section 02415: Subsurface Drainage System
Section 02700: Trench Excavation Protection
Section 03300: Cast-in-Place Concrete

B. SCOPE:

Under this section of the specifications, the Contractor shall furnish all labor, tools, equipment and related items required to perform all excavations to remove all earth, rock, water and other materials to the extent required for the construction of such facilities as shown on the plans: to prepare the subgrade and/or sub-base for the foundation of the facilities; and backfill around the facilities to the lines and grades established on the plans.

Pipe Excavation, Trenching and Backfill: Refer to Specification Section 02210 for excavation, trenching, and backfill in conjunction with underground pipelines; not work of this section.

Excavation for Mechanical/Electrical Work: Refer to Divisions 13 and 16 sections for excavation and backfill required in conjunction with underground mechanical and electrical utilities, and buried mechanical and electrical appurtenances; not work of this section.

C. DEFINITION:

"Excavation" consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

1.2 QUALITY ASSURANCE:

A. CODES AND STANDARDS:

Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
B. TESTING AND INSPECTION:

Inspection and testing will be performed in accordance with "Quality Control and Testing", Section 01410 of these specifications.

1.3 MEASUREMENT AND PAYMENT:

Measurement and payment will be as outlined in Section “Measurement and Payment” of Part 1 General Provisions.

The additional excavation, authorized in writing by the Engineer, shall be considered additional work and shall be considered subsidiary to Bid Items of authorized additional work. Work shall include all items of cost related to the additional excavation or select subbase placement.

1.4 SUBMITTALS:

A. TEST REPORTS-EXCAVATING: Contractor to submit following reports directly to the San Antonio River Authority from the Contractor hired testing services, with copy to Contractor:

   Test reports on borrow material.

   Verification of each footing subgrade.

   Field density test reports.

   One optimum moisture-maximum density curve for each type of soil encountered.

   Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

1.5 JOB CONDITIONS:

A. SITE INFORMATION:

Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor. The Geotechnical Engineering Report was prepared for design purposes and is not intended for determining construction means and methods. Data are made available for convenience of Contractor.

Additional test borings and other exploratory operations may be made by Contractor at no cost to Owner. Contractor shall coordinate with the Authority prior to any such operations.
B. EXISTING UTILITIES:

Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by Owner's Representative and then only after acceptable temporary utility services have been provided.

Provide minimum of 48-hour notice to Owner's Representative, and receive written notice to proceed before interrupting any utility.

Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

C. USE OF EXPLOSIVES:

The use of explosives is not permitted.

D. PROTECTION OF PERSONS AND PROPERTY:

Barricade open excavations occurring as part of this work and post with warning lights. Comply with regulations of authorities having jurisdiction. See Section 02700, "Trench Excavation Protection", for other requirements.

Operate warning lights as recommended by authorities having jurisdiction.

Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

Perform excavation within drip-line of large trees to remain by hand, and protect the root system from damage or dry out to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1 inch diameter and larger with emulsified asphalt tree paint.

PART 2 PRODUCTS

2.1 SOIL MATERIALS:

A. BACKFILL AND FILL MATERIALS:
The on-site excavated clays shall not be used as structural fill materials under grade-supported structures except as otherwise indicated on the plans. Any on-site materials authorized for use as fill shall be free of organic and other deleterious materials, and shall contain no cobbles larger than 4 inch in nominal diameter.

All backfill shall be gravel backfill, drainage gravel, or select fill to limits as specified herein. Backfill beyond limits as specified may be backfilled with on-site excavated materials. Geotextile fabric Mirafi 140N or equivalent must be installed between the different backfill materials. Backfill using on-site excavated materials must be compacted to at least 95% of the maximum density as determined by TxDOT TEX-113E compaction test at a moisture content between optimum and optimum plus 3 percent. Compaction of other materials shall be as specified in Paragraph 3.8-B. These materials shall be free of organic and other deleterious materials, and shall contain no cobbles larger than 4 inch in nominal diameter.

B. SELECT FILL:

This materials is to be used under concrete structures and other locations as shown on the plans. Materials used as select fill shall meet the TxDOT 1995 Standard Specification for Construction of Highways, Streets and Bridges, Item 247, Flexible Base, Type A, Type B, or Type C, Grades 1 through 5.

C. GRAVEL BACKFILL:

This materials shall be a well-graded, washed, crushed angular gravel meeting the requirements of ASTM C33, size 56, 57 or 467.

D. MUD SLAB:

This shall consist of a low strength (1500 psi concrete), non-reinforced, 2 inch slab to directly support all structural slabs and retaining wall footings where shown on the drawings or as required due to existing conditions. If the Contractor requests to use a mud slab to expedite construction due to ground water or frequent rains, he may do so at his own expense, if authorized by the Engineer.

E. Filter fabric and impermeable geomembrane Mirafai 140N or Engineer approved equal shall be used as the filter fabric over the top of the drainage gravel and where specified or shown on the plans. An impermeable 30 mil PVC membrane shall be used under the drainage gravel between the drainage gravel and select fill.

PART 3 EXECUTION

3.1 SITE PREPARATION:

A. Establish extent of excavation by area and elevation; designate and identify datum elevation.
B. Set required lines and levels.

C. Maintain bench marks, monuments and other references points. Re-establish if disturbed or destroyed at no cost to the Owner.

3.2 SITE PROTECTION:

A. Protect bench marks and existing neighboring fences, roads, and other structures against damage from equipment and vehicular traffic.

B. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions, other structures in vicinity or stability of material excavated.

C. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods, as required to prevent cave-ins or loose dirt from falling into excavations.

D. Notify Engineer of unexpected subsurface conditions and discontinue work in area until Engineer provides notification to resume work.

E. Provide temporary berms and diversion ditches around foundation excavations to divert surface run-off away from these areas. The berms shall be constructed away from the edge of the excavations to reduce the risk of sudden collapse of the embankment walls.

3.3 CLEARING:

Clear areas as required for access to site excavation and performance of work.

3.4 FILL SITE:

A fill site is not available on site for excavated material. Excavated materials is the complete responsibility of the Contractor and will not be paid for separately.

3.5 EXCAVATION:

A. GENERAL:

Excavations shall be of such dimensions as to permit the construction of the work in the manner, shape and size shown on the plans.

B. DEPTH OF EXCAVATION:

1. In excavating for slabs cut surface to required elevations and take care to leave subgrade surface undisturbed and free of ruts or soft spots.
2. The final one (1) foot of excavation for any given structure shall be accomplished in the same day so as not to expose the subgrade for more than 48 hours.

C. AUTHORIZED ADDITIONAL EXCAVATION:

Where the proposed subgrade material on which the foundations, footings or slab is to be placed is deemed unsatisfactory by the Engineer, the excavation shall be carried to an additional depth specified by the Engineer and the excavated space filled with 2500 psi concrete, select fill, or drainage gravel, as specified by the Engineer and compacted as specified by the Engineer. The additional authorized excavation and concrete or select base material shall not be done at the Contractor's expense; it shall be considered as additional or extra work, and will be paid for under appropriate bid items.

D. APPROVED ADDITIONAL EXCAVATION:

Upon written request by the Contractor, the Engineer may approve in writing additional excavation. The excavation shall be carried to the approved depth and the excavated spaced filled with material as specified. Such work shall be done at the Contractor's expense; it shall not be considered as additional or extra work.

E. UNAUTHORIZED EXCAVATION:

Whenever the excavation is carried beyond or below the lines or grades shown on the drawings through negligence on the part of the Contractor, all such excavated space below the structure foundation shall be refilled with 2500 psi concrete or select fill material compacted as specified. Such work shall be done at the Contractor's expense; it shall not be considered as additional or extra work.

F. STABILITY OF EXCAVATIONS:

Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

Maintain sides and slopes of excavations in safe condition until completion of backfilling. Any such designs and safety plans shall be developed in accordance with current OSHA guidelines and other applicable industry standards.

G. SHORING AND BRACING:

Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition. Design of temporary earth retention systems shall be the responsibility of the Contractor, in accordance with Section 02140.

Establish requirements for trench shoring and bracing to comply with local, state and federal codes and authorities having jurisdiction. Maintain shoring and bracing in
excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

H. DEWATERING:

Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

Establish and maintain temporary berms and diversion ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

Water removed from the excavation shall be disposed of in such a manner as to prevent damage to adjacent property or other work under construction. Damage of whatever nature caused by dewatering the work or failure to dewater the work satisfactorily shall be promptly repaired or remedied by the Contractor at his own expense. This shall include the cleaning and flushing of existing drainage pipelines where such are used. Design of temporary site dewatering systems as may be required shall be the responsibility of the Contractor, in accordance with Section 02150.

3.6 MATERIAL STORAGE:

Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

Dispose of excess soil material and waste materials as herein specified.

3.7 COLD WEATHER PROTECTION:

Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degree F (1 degree C).

3.8 SUBGRADE PREPARATION COMPACTION AND BACKFILLING:

A. PREPARATION:

Excavate to lines indicated being careful not to over-excavate. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than 1
vertical to 4 horizontal so that fill material will bond with existing surface.

The exposed subgrade shall be thoroughly proofrolled in order to locate and identify any weak and compressible zones. A minimum of 5 passes of an 18 ton pneumatic roller should be used for planning purposes. Weak, loose areas or existing pits identified during the proofrolling operations shall be over-excavated and backfilled with select fill material or 2500 psi concrete.

B. COMPACTATION:

Control soil and fill material compaction during construction providing minimum percentage of density specified for each area classification as indicated below. Moisture content of the materials shall be maintained at optimum to 3 percent above the optimum moisture until permanently covered.

Percentage of Maximum Density Requirements: Compact soil and fill materials to not less than the following percentages of maximum density determined in accordance with TxDOT TEX-113-E.

Subgrade for concrete structures, steps and other grade supported structures: Upon completion of proofrolling operations, the subgrade shall be moisture conditioned (if necessary) and compacted to a minimum of 95% of the maximum density.

Select fill should be placed in loose lifts not exceeding 8 inch thickness and compacted to at least 98 percent of maximum density.

Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

Place backfill and fill materials evenly adjacent to structures, piping or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

For a 5 foot zone behind below grade walls, the gravel backfill shall be compacted using hand guided vibratory rollers or vibratory plate compactors, having a maximum weight not greater than 3,000 lbs. and a frequency no greater than 2,500 rpm (50 hz), over each lift of gravel backfill. The lift thickness should not exceed 12 inches and the compaction equipment should be capable of achieving the maximum density in a series of at least 3, but not more than 5 passes. For backfilling operations greater than 5 feet from the wall, heavier vibratory compaction equipment can be considered, as approved by the Engineer.

Drainage gravel shall be compacted using same procedures as specified for gravel backfill.
Backfill or fill at slabs on grade, roadways, and similar use areas: Compact each layer at 95% maximum optimum density.

Backfill at lawn or unpaved areas: Compact each layer at 90% maximum density.

When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

C. MOISTURE CONTROL:

Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

Placement of concrete shall be accomplished as soon as possible after excavation to reduce changes in the moisture content or the state of stress of the foundation materials.

D. BACKFILL AND FILL:

Backfill limits of select fill, drainage gravel and gravel backfill are as shown on the structural drawings. The drainage gravel should extend the full width and length of the bottom of the excavation and should be a minimum of 1 foot deep. In the areas of subsurface drain lines the section shall widen to a minimum of 18 inches deep to allow a minimum of 6 inches of drainage gravel above and below the sub-surface drain lines. Excavations below grade walls shall be backfilled with gravel backfill to extend a minimum horizontal distance of 5 feet from outside face of wall and wall footings. Gravel backfill may be used for the full extent of backfill behind walls at Contractor’s option. Should the Contractor elect to backfill behind the walls using a combination of gravel backfill and on-site excavated materials the two different materials must be separated by Mirafi 140N filter fabric or equal.

Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.

In excavations, under grassed areas, use satisfactory excavated or borrow material.

Under steps, grade-supported slabs, use specified fill material.
Behind retaining walls and other below-grade concrete walls, use specified backfill material.

Backfill excavations as promptly as work permits, but not until completion of the following:

Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing and structure hydrostatic testing.

Removal of concrete formwork.

Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.

Removal of trash and debris.

Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.9 GRADING:

A. GENERAL:

Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

B. GRADING OUTSIDE BUILDING LINES:

Grade areas adjacent to structure to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:

Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10' above or below required subgrade elevations.

Parking Areas, Drives and Roadways: Shape surface of areas under roadway to line, grade and cross-section, with finish surface not more than ½" above or below required subgrade elevation.

Grading Surface of Fill under Grade-Supported Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of ½" when tested with a 10' straightedge.
After grading, compact surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.10 PAVEMENT SUBBASE COURSE:

A. GENERAL:

Subbase course consists of placing subbase material, in layers of specified thickness.

B. GRADE CONTROL:

During construction, maintain lines and grades including crown and cross-slope of subbase course.

C. PLACING:

Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicate cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.

When a compacted subbase course is shown to be 6" thick or less, place material in a single layer. When shown to be more than 6" thick, place material in equal layers, except no single layer more than 6" or less than 3" in thickness when compacted.

3.11 MAINTENANCE:

A. PROTECTION OF GRADED AREAS:

Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. RECONDITIONING COMPACTED AREAS:

Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

C. SETTLING:

Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or
finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.12 DISPOSAL OF EXCESS AND WASTE MATERIALS:

Excavated material shall be hauled off site. All costs and responsibilities for properly disposing materials off site is Contractor's responsibility.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Removal of topsoil.
   B. Rough grading the site for site structures, building pads, and pavements.
   C. Finish grading.

1.02 RELATED SECTIONS
   A. Section 02315 - Excavation.
   B. Section 02316 - Fill and Backfill: Filling and compaction.
   C. Section 02317 - Trenching for Site Utilities: Trenching and backfilling for utilities.
   D. Section 02923 - Sodding: Finish ground cover.

1.03 SUBMITTALS
   A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.04 QUALITY ASSURANCE
   A. Perform Work in accordance with Texas Department of Transportation standards.

1.05 PROJECT CONDITIONS
   A. Protect above- and below-grade utilities that remain.
   B. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.
   C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from grading equipment and vehicular traffic.

PART 2 PRODUCTS

2.01 MATERIALS
   A. Earthwork: 02200.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.02 PREPARATION
   A. Identify required lines, levels, contours, and datum.
   B. Stake and flag locations of known utilities.
   C. Locate, identify, and protect utilities that remain, from damage.

3.03 ROUGH GRADING
   A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
   B. Do not remove topsoil when wet.
   C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
   D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.
E. When excavating through roots, perform work by hand and cut roots with sharp axe.
F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 SOIL REMOVAL
A. Remove excavated topsoil from site.

3.05 FINISH GRADING
A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.
B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.
C. Where topsoil is to be placed, scarify surface to depth of 3 inches.
D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.
E. Place topsoil in areas where seeding are indicated.
F. Place topsoil to the following compacted thicknesses:
   1. Areas to be Sodded: 4 inches.
G. Place topsoil during dry weather.
H. Remove roots, weeds, rocks, and foreign material while spreading.
I. Near plants spread topsoil manually to prevent damage.
J. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
K. Lightly compact placed topsoil.

3.06 FIELD QUALITY CONTROL
A. See Section 02316 for compaction density testing.

3.07 CLEANING AND PROTECTION
A. Remove unused stockpiled topsoil. Grade stockpile area to prevent standing water.
B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION
SECTION 02315
EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating for slabs-on-grade, paving, site structures, utilities within the building, and to meet grading requirements.
B. Trenching for utilities outside the building to utility main connections.

1.02 RELATED SECTIONS

A. Section 02310 - Grading: Grading.
B. Section 02316 - Fill and Backfill: Fill materials, filling, and compacting.
C. Section 02317 - Trenching for Site Utilities: Excavating for utility trenches outside the building to utility main connections.

1.03 PROJECT CONDITIONS

A. Verify that survey bench mark and intended elevations for the Work are as indicated.
B. Protect plants, lawns, rock outcroppings, and other features to remain.
C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum locations.
B. See Section 02310 for additional requirements.

3.02 EXCAVATING

A. All excavation is unclassified and there are no rock payment provisions. Contractor to remove all rock encountered needed to complete the work.
B. Excavate to accommodate new structures and construction operations.
C. Notify Civil Engineering Consultants of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
D. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
E. Do not interfere with 45 degree bearing splay of foundations.
F. Cut utility trenches wide enough to allow inspection of installed utilities.
G. Hand trim excavations. Remove loose matter.
H. Remove all lumped subsoil, boulders, and rock. For rock up to 1/3 cu yd use rubber tire loader.
I. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 02316.
J. Grade top perimeter of excavation to prevent surface water from draining into excavation.
K. Remove excavated material that is unsuitable for re-use from site.
L. Remove excess excavated material from site.

3.03 FIELD QUALITY CONTROL
   A. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

3.04 PROTECTION
   A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
   B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for building volume below grade.
B. Backfilling and compacting for utilities outside the building to utility main connections.
C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED SECTIONS

A. Document: Geotechnical report; bore hole locations and findings of subsurface materials, available upon request.
B. Section 02310 - Grading: Site grading.
C. Section 02317 - Trenching for Site Utilities: Excavating for utility trenches outside the building to utility main connections.
D. Section 03300 - Cast-in-Place Concrete.

1.03 UNIT PRICES

A. Structural Fill:
   1. Includes: Excavating existing soil, scarifying substrate surface, placing where required, and compacting.

B. Granular Fill:
   1. Includes: Excavating existing material, scarifying substrate surface, placing where required, and compacting.

1.04 REFERENCES

B. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2000a.
D. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2002.
F. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2000.
G. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
H. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

1.05 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.
B. Subgrade Elevations: Indicated on drawings.

1.06 SUBMITTALS
A. Materials Sources: Submit name of imported materials source.
B. Compaction Density Test Reports.

1.07 PROJECT CONDITIONS
A. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary, store materials on site in advance of need.
B. Verify that survey bench marks and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

2.01 FILL MATERIALS
A. General Fill: Conforming to State of Texas Highway Department standard.
B. Structural Engineered Fill - Fill Type Type A - Crushed Limestone Aggregate: Conforming to State of Texas Highway Department standard.
C. Granular Fill: Coarse aggregate, conforming to State of Texas Highway Department standard.
D. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
   1. Grade in accordance with ASTM D 2487 Group Symbol SW.
E. Topsoil - Fill that meets the requirements shown below.
   1. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
   2. Acidity range (pH) of 5.5 to 7.0.
   3. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.
   4. Conforming to ASTM D2487 Group Symbol OH.
      If topsoil from the site meeting these specifications, it can be used for the projects.

2.02 ACCESSORIES
A. Geotextile Fabric: Non-biodegradable, woven.

2.03 SOURCE QUALITY CONTROL
A. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.01 EXAMINATION
A. Identify required lines, levels, contours, and datum locations.

3.02 PREPARATION
A. Scarify subgrade surface to a depth of 6 inches to identify soft spots.
B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING
A. Fill to contours and elevations indicated using unfrozen materials.
B. Employ a placement method that does not disturb or damage other work.
C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
D. Maintain optimum moisture content of fill materials to attain required compaction density.
E. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
F. Correct areas that are over-excavated.
   1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.
G. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under paving, slabs-on-grade, and similar construction: 97 percent of maximum dry density.
   2. At other locations: 95 percent of maximum dry density.
H. Reshape and re-compact fills subjected to vehicular traffic.

3.04 FILL AT SPECIFIC LOCATIONS
A. Use general fill unless otherwise specified or indicated.
B. Over Buried Utility Piping, Conduits, and Duct Bank in Trenches:
   2. Cover with general fill.
   3. Fill up to subgrade elevation.
   4. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.
C. At Lawn Areas:
   1. Use general fill.
   2. Fill up to subgrade elevations.
   3. Compact to 95 percent of maximum dry density.
   4. See Section 02310 for topsoil placement.
D. At Planting Areas Other Than Lawns:
   1. Use general fill.
   2. Compact to 95 percent of maximum dry density.
   3. See Section 02310 for topsoil placement.

3.05 TOLERANCES
A. Top Surface of General Filling: Plus or minus 1/2 inch from required elevations.
B. Top Surface of Filling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.06 FIELD QUALITY CONTROL
A. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.
C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.07 CLEAN-UP
A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to
prevent standing surface water.
SECTION 02470
TOPSOIL

PART I GENERAL

1.1 DESCRIPTION:

A. RELATED WORK SPECIFIED ELSEWHERE:

   Section 01710: Cleaning
   Section 02100: Site Work
   Section 02500: Vegetative Cover Restoration, Seeding and
                  Hydromulching

B. SCOPE:

   This item shall consist of furnishing, placing and spreading approved selected
   topsoil to the lines, grades and at locations shown on the plans or as directed by the Engineer and
   in conformity with these specifications.

1.2 MEASUREMENT AND PAYMENT:

   No separate payment will be made for any items of work, materials, parts, labor,
   equipment, supplies, or related items required to perform and complete the requirements of this
   section. Cost shall be subsidiary to all other bid items.

PART 2 PRODUCTS

2.1 MATERIALS:

A. GENERAL:

   The topsoil shall be fertile loam, easily cultivated and free from objectionable
   material (i.e. roots, weeds or stones) and shall have a relatively high erosion resistance and be
   readily able to support the growth of the planting, seeding or sodding specified on the plans.

B. SOURCES:

   Some topsoil material may be obtained from within the limits of the excavation in
   areas that support grass when indicated on the plans or designated by the Engineer; or, it may be
   obtained from sources outside the excavation area secured by the Contractor which meet the
   approval of the Engineer.
PART 3 EXECUTION

3.1 RIGHT OF WAY SOURCES:

The existing topsoil shall be moved from within the limits of construction as indicated on the plans and stockpiled in a windrow along the right of way line, or at designated locations, or spread over an area that is ready for topsoil application in accordance with the plans or as directed by the Engineer.

3.2 CONTRACTOR OBTAINED SOURCES:

The Engineer shall be notified sufficiently in advance of the opening of any material source to permit inspection and to prepare for necessary checking and measurement. Only material which meets the approval of the Engineer shall be removed from the source for use on the project.

Trash, wood, brush, stumps and other objectionable materials encountered shall be removed and disposed of as directed by the Engineer prior to beginning of work required by this item. The source and stockpile areas shall be kept drained, insofar as practicable, during the period of removal of the topsoil material, and the source areas and stockpile areas shall be left in a neat and presentable condition upon completion of the removal of all material required.

The selected topsoil material shall be used to improve designated areas for planting, seeding or sodding purposes as directed by the Engineer. Payment will not be allowed for any material which is used for purposes other than those designated.

The spreading of the topsoil shall be undertaken as soon as the grading operations have been completed or at such time as specified by the Engineer. The topsoil shall be spread so as to form a cover of uniform thickness as shown on the plans or as directed by the Engineer. After topsoil has been placed and shaped, it shall be sprinkled and/or rolled if directed by the Engineer.

END OF SECTION
SECTION 02487
SODDING

PART 1 GENERAL

1.01 DESCRIPTION:

A. Provide sodded lawns as shown and specified. The work includes:

2. Sodding indicated areas.

B. Related Work:

1. Section 02200: Earthwork.
2. Section 02441: Irrigation System.
4. Section 02495: Landscape Accessories.

1.02 QUALITY ASSURANCE:

A. Comply with Section 02000 requirements.

B. Sod: Comply with The American Sod Producers Association (ASPA) classes of sod materials.

1.03 SUBMITTALS:

Submit sod growers certification of grass species. Identify source location.

1.04 DELIVERY, STORAGE AND HANDLING:

A. Cut, deliver and install sod within a twenty four (24) hour period.

1. Do not harvest or transport sod when moisture content may adversely affect sod survival.
2. Protect sod from sun, wind and dehydration prior to installation.
3. Do not tear, stretch or drop sod during handling and installation.
1.05 PROJECT CONDITIONS:

A. Work notification: Notify Engineer at least seven (7) working days prior to start of sodding operations.

B. Protect existing utilities, paving, walks and other facilities from damage caused by sodding operations.

C. Perform sodding work only after planting and other work affecting ground surface has been completed.

D. Restrict traffic from lawn areas until grass is established. Erect signs and barriers as required.

E. Provide hose and lawn watering equipment as required.

F. The irrigation system if required will be installed prior to sodding. Locate, protect and maintain the irrigation system during sodding operations. Repair irrigation system components damaged during sodding operations at the Contractor's expense.

1.06 WARRANTY:

Provide a uniform stand of grass by watering, mowing and maintaining lawn areas until final acceptance. Resod areas, with specified materials, which fail to provide a uniform stand of grass until all affected areas are accepted by the Engineer.

1.07 MEASUREMENT AND PAYMENT:

Measurement and payment will be as outlined in Section "Measurement and Payment" of Part I, General Provisions.

PART 2 PRODUCTS

2.01 MATERIALS:

A. Sod: Bladerunner Farms HABITURF grass sod shall be healthy living grass with adhering soil of uniform thickness obtained from approved sources where the sod is heavy and thickly matted. The presence of nut grass (Cyperus rotundus), bermuda grass of other objectionable grass or weeds or other material which might be detrimental to the development of turf will be cause for rejection of sod.

B. Provide well-rooted, healthy sod, free of diseases, nematodes and soil borne insects. Provide sod uniform in color, leaf texture, density and free of weeds, undesirable grasses, stones, roots, thatch and extraneous material; viable and capable of growth and development when planted.
1. Furnish sod machine stripped in square pads or strips not more than 3'-0" long; uniformly 1" to 1-1/2" thick with clean cut edges. Mow sod before stripping.

C. Four (4) inches of topsoil shall be furnished in all planting and grassed areas as called for on the plans. If the quantity of excavated topsoil is inadequate for planting purposes, sufficient additional topsoil shall be furnished. Topsoil furnished shall be natural, fertile, friable soil, possessing characteristics of representative productive soils in the vicinity. It shall be obtained from naturally well drained areas. Topsoil shall be without admixture of sub-soil and free from Bermuda grass, nut grass (Cyperus rotundus), and other objectionable grass, weeds and toxic substances. Topsoil shall be approved by the Engineer.

D. Fertilizer: Shall be Carefree, Vertagreen, or Engineer approved equal, organic fertilizer containing the following minimum percentages of available plant food by weight: 15-5-5 or 16-8-8 Nitrogen-Phosphorus. Mixed Nitrogen, not less than 50% from organic source. Inorganic chemical nitrogen shall not be derived from the sodium form of nitrate or from the ammonia nitrate. It shall be delivered to the site in unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, will not be accepted.

E. Water: Free of substance harmful to sod growth. Hoses or other methods of transportation furnished by Contractor.

PART 3 EXECUTION

3.01 INSPECTION:

Examine finished surfaces, grades, topsoil quality and depth. Do not start sodding work until unsatisfactory conditions are corrected.

3.02 PREPARATION:

A. Limit preparation to areas which will be immediately sodded.

B. Loosen topsoil of lawn areas to minimum depth of 4". Remove stones over 1" in any dimension and sticks, roots, rubbish and extraneous matter.

C. Grade lawn areas to smooth, free draining and even surface with a loose, uniformly fine texture. Roll and rake; remove ridges and fill depressions as required to drain.

D. Apply fertilizer at the rate equal to 40.00 lb. per 1,000 square foot. Apply fertilizer by mechanical rotary or drop type distributor, thoroughly and evenly incorporated with the soil to a depth of 3" by discing or other approved methods. Fertilize areas inaccessible to power equipment with hand tools and incorporate it into soil.

E. Dampen dry soil prior to sodding.
F. Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to sodding.

3.03 INSTALLATION:

A. Sodding:

1. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips. Do not overlay edges. Stagger strips to offset joints in adjacent courses. Remove excess sod to avoid smothering of adjacent grass. Provide sod pad top flush with adjacent curbs, sidewalks, drains and seeded areas.

2. Do not lay dormant sod or install sod on saturated or frozen soil.

3. Install initial row of sod in a straight line, beginning at bottom of slopes, perpendicular to direction of the sloped area. Place subsequent rows parallel to and lightly against previously installed row.

B. Sod indicated areas within contract limits and areas adjoining contract limits disturbed as a result of construction operations.

3.04 MAINTENANCE:

A. Maintain sodded lawns until completion and acceptance of the entire project.

B. Maintain sodded lawn areas, including watering, spot weeding, mowing, application of herbicides, fungicides, insecticides and resodding until a full, uniform stand of grass free of weed, undesirable grass species, disease and insects is achieved and accepted by the Engineer.

1. Water sod thoroughly every 2 to 3 days, as required to establish proper rooting.

2. Repair, rework and resod all areas that have washed out or are eroded. Replace undesirable or dead areas with new sod.

3. Mow lawn areas as soon as lawn top growth reaches a 3” height. Cut back to 2” height. Repeat mowing as required to maintain specified height. Not more than 40% of grass leaf shall be removed at any single mowing.

3.05 ACCEPTANCE:

A. Inspection to determine acceptance of sodded lawns will be made by the Engineer, upon Contractor's request. Provide notification at least ten (10) working days before requested inspection date.
1. Sodded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, even colored viable lawn is established, free of weeds, undesirable grass species, disease and insects.

   B. Upon acceptance, the Authority will assume lawn maintenance.

3.06 CLEANING:

   Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris and equipment. Repair damage resulting from sodding operations.

END OF SECTION
SECTION 02500
VEGETATIVE COVER RESTORATION, SEEDING AND HYDROMULCHING

PART I GENERAL

1.1 DESCRIPTION:

A. RELATED WORK SPECIFIED ELSEWHERE:

Section 01710: Cleaning
Section 02005: Site Work
Section 02470: Topsoil

B. SCOPE: The Contractor shall furnish, install and maintain the vegetative cover restoration and/or seeding as specified in the establishment of turf requirements paragraphs of the section and as indicated on the plans.

1.2 MAINTENANCE: The Contractor shall maintain all plant materials during the Guarantee Period. Such maintenance shall include spraying, weeding, cultivating, fertilizing, disease and insect control, replenishment to levels specified of any topsoil that has been lost from erosion or settling, replacement of any and all unacceptable materials, plus any procedures consistent with good horticultural practice necessary to insure normal, vigorous, and healthy growth.

1.3 GUARANTEE:

A. GENERAL: The guarantee for all vegetative cover restoration and seeding work shall follow the completion of the planting and shall start with the provisional acceptance and end with the final acceptance.

B. PROVISIONAL ACCEPTANCE: Upon completion of planting and written request of Contractor, the Engineer will inspect all the vegetative cover restoration and seeding work for provisional acceptance.

C. GUARANTEE PERIOD: The guarantee period shall begin upon completion of the provisional acceptance. All plant materials shall be guaranteed by the Contractor for a period of one year from the date of provisional acceptance, to be in good, healthy, and nourishing condition. The exceptions are damages resulting from neglect by the Authority, abuse or damage by others, or unusual phenomena or incidents which are beyond the Contractor's control.
D. REPLACEMENT: The Contractor shall replace, without cost to the Authority, and as soon as weather conditions permit, all dead grassed areas not in a vigorous, thriving condition, as determined by the Engineer during and at the end of the guarantee period. Replacements shall be subject to all requirements stated in this specification. The Contractor shall make all necessary repairs to grades, grassed areas, and terrace paving required because of grass replacement at no cost to the Authority.

E. FINAL INSPECTION AND ACCEPTANCE: At the end of the guarantee period and upon written request of the Contractor, the Engineer will inspect all guaranteed work for final acceptance. The written request shall be submitted to the Authority ten (10) days prior to the anticipated date of inspection. Upon completion by the Contractor of all repairs or renewals which may appear at that time to be necessary in the judgment of the Authority or his authorized representative, the final acceptance of the seeding will be issued.

1.4 MEASUREMENT AND PAYMENT: Measurement and payment will be as outlined in Section "Measurement and Payment" of Part 1, General Provisions.

PART 2 PRODUCTS

2.1 MATERIALS OTHER THAN PLANTS:

A. FERTILIZER: All fertilizer shall be delivered in bags or containers with labels showing the analysis. The fertilizer will be subject to testing by the State Chemist in accordance with the Texas Fertilizer Law at no expense to the Contractor. A pelleted or granulated fertilizer shall be used with an analysis of either 16-20-0 or 16-18-8 unless otherwise indicated on the plans. The figures in the analysis represent the percent of nitrogen, phosphoric acid, and potash nutrients, respectively, as determined by the methods of the Association of Official Agricultural Chemists. In the event it is necessary to substitute a fertilizer of a different analysis, it shall be a pelleted or granulated fertilizer with a lower concentration. The total amount of each nutrient furnished and applied per acre shall equal or exceed that required by the rate of application specified in paragraph 3.1.J.

B. WATER: Water shall be fresh and free from injurious amounts of oil, acid, alkali, salts, or other materials harmful to the growth of plants.

C. HYDROMULCHING FOR GRASS-SEEDED AREAS: Hydromulching will not be allowed on this project.

D. TOPSOIL: The topsoil shall be 4” of fertile loam, easily cultivated and free of objectionable material. It shall also be at least ninety (90) percent weed free and shall have a relatively high erosion resistance and be readily able to support the growth of the planting and seeding as specified.
2.2 PLANT MATERIALS:

A. GRASS SEED: All seed shall meet the requirements of the Texas Seed Law including the labeling requirements for showing purity, germination, name and type of seed. Seed furnished shall be of the previous season's crop and the date of analysis shown on each bag shall be within nine months of the time of delivery to the project. Each variety of seed shall be furnished and delivered in separate bags or containers. A sample of each variety of seed shall be furnished for analysis and testing. The amount of seed planted per acre shall be of the type specified below and shall equal or exceed the following percentages for purity and germination.

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SCIENTIFIC NAME</th>
<th>PURITY</th>
<th>GERMINATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native American Grasses</td>
<td>N/A</td>
<td>95%</td>
<td>90%</td>
</tr>
<tr>
<td>Midway Mix</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The seeds planted per acre shall be of the type specified with the mixture, rate and planting date as follows except as otherwise indicated on the plans.

<table>
<thead>
<tr>
<th>PLANTING DATES</th>
<th>TYPE</th>
<th>RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Jan. - 1 June</td>
<td>Native American Grasses (Midway Mix)</td>
<td>1 lb./1000 sq. ft.</td>
</tr>
</tbody>
</table>

B. SUBSTITUTIONS: Substitutions of seeding material will be considered only if adequate proof is submitted to and approved by the Authority that specific seeds are unobtainable. All substitutions shall be equivalent or better seeding material than originally required at no additional cost to the Authority.

C. VEGETATIVE COVER RESTORATION: Materials to be utilized for vegetation restoration shall be as mutually established by the Contractor and Engineer. Vegetative cover must be such to restore areas disturbed by construction to a condition that is equal or better than what existed prior to construction.

PART 3 EXECUTION

3.1 ESTABLISHMENT OF TURF:

A. GENERAL: The work covered consists of the tilling, smoothing, fertilizing, seeding and watering of the applicable areas indicated on the plans. The Contractor shall furnish all labor, equipment, and material, and perform all operations necessary to accomplish the work.

B. CLEARING: Prior to grading and tilling, vegetation that interferes with operations shall be mowed, grubbed, and raked; the collected material shall be removed.
from the site. The surface shall be cleared of stumps, stones larger than two (2) inches in diameter, roots, cable, wire, and other materials that might hinder the work or subsequent maintenance.

C. GRADING: Finished grade shall be such that after repeated treatments, i.e., tillage, topsoiling, and planting, the planted grades will join level with adjacent surface grades and one (1) inch below adjacent surface grades of walks, drives, curbs and parking lots.

D. CONSTRUCTION METHODS: After the designated areas have been completed to the lines, grades and cross-sections shown on the plans and as provided for in other items of this contract, select topsoil material shall be used to improve designated areas for planting and seeding purposes as directed by the Engineer. The spreading of topsoil to a minimum of six (6) inches shall be undertaken as soon as grading operations have been completed or at such time as specified by the Engineer. The topsoil shall be spread, as directed by the Engineer, so as to form a cover of uniform thickness as shown on the Plans. After the topsoil has been placed and shaped, it shall be sprinkled and/or rolled if directed by the Engineer.

E. SEEDING: Seeding shall be spread uniformly over the areas indicated on the plans. Seeding shall be done by the broadcast method only during periods when satisfactory results are likely to be obtained. When conditions are such by reason of drought, excessive moisture, or other factors, that results are not likely to be satisfactory, the seeding work shall not be performed. The seed or seed mixture in the quantity specified shall be distributed uniformly over the designated areas using a Cyclone seeder, or an equivalent type seeder which spreads the seed on the surface of the ground. The grass seed shall be planted and followed by compaction and water. Where a cyclone seeder is used, the seed shall be covered by a light harrowing or by rolling with a corrugated roller of the Cultipacker type. All rolling of sloped areas shall be on the contours. Seeded areas shall not be fertilized before, during or immediately following planting. Fertilizing of grassed areas shall be done within three (3) months after planting.

F. HYDROMULCHING: Hydomulching will not be allowed on this project.

G. WATERING AND MAINTENANCE:

1. Watering. Upon completion of the seeding, all grass-seeded area shall be given thorough watering sufficient to provide an established uniform stand of grass. Rate of application must be as approved by the Engineer and may be required daily. All watering shall be sprinkled on lightly and shall be done in a manner that will provide uniform coverage, but not cause erosion or damage to the finished surface. The Contractor shall furnish all pumps, hoses, pipelines, water trucks, and sprinkling equipment required.

2. Maintenance. The Contractor shall maintain the seeded areas until the provisional
acceptance is accomplished. The Contractor shall continue all other maintenance, such as, replacing topsoil and reseeding eroded areas until runners are produced on all of the landscaped areas. These activities shall continue until all work or designated portions thereof have been completed and final acceptance accomplished. Any damages and mulch material that has been removed by wind or other causes shall be repaired or replaced prior to acceptance.

H. RESEEDING: Areas requiring reseeding shall be reseeded in the same manner as required for the original seeding with the same kind of seed as originally required until all affected areas are accepted by the Engineer. The reseeding shall be performed in a manner that will cause minimum disturbance to existing stands of grass.

I. REPAIR: When any portion of the surface becomes gullied or otherwise damaged or treatment is destroyed, the affected portion shall be repaired to reestablish condition and grade of soil and treatment prior to injury, as directed. Repair work required because of faulty operations or negligence on the part of the Contractor shall be performed without cost to the Authority.

J. FERTILIZING: Pelleted or granulated fertilizer shall be applied uniformly over the areas designated to be fertilized. The fertilizer shall be dry and in good physical condition. Fertilizer that is powdered or caked will be rejected. Unless otherwise indicated on the plans, fertilizer shall be applied uniformly at the average rate of 300 pounds per acre on all existing cultivated lands. Newly cleared and root plowed areas shall not be fertilized.

3.2 EMBANKMENT AND OTHER DISTURBED AREA SEEDING: Any embankment and/or other disturbed area, whether or not within or outside the construction easement, that is damaged by the Contractor shall be seeded as described under paragraphs 2.1.C and 3.1.E at the discretion of the Engineer.

3.3 VEGETATIVE COVER RESTORATION: Unless otherwise noted on the plans, vegetative cover shall be restored in all areas disturbed by construction. Plant materials and a planting plan shall be mutually established by the Contractor and Engineer. Said plan must restore the area to a vegetative cover condition that is equal or better than what existed prior to construction. Topsoil available on site shall be moved and/or stored and be readily available for final use in vegetative cover re-establishment.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes exterior Portland cement concrete paving for the following:

1. Roadways.
2. Parking lots.
3. Curbs and gutters.
4. Walkways.
5. Slope protection.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 02200 "Earthwork" for subgrade preparation, grading and base course.
2. Section 02578 "Pavement Markings"

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract:

2. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect/Engineer.

1.4 QUALITY ASSURANCE

A. Concrete Standards: Comply with provisions of the following standards, except where more stringent requirements are indicated.

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
2. ACI 318, "Building Code Requirements for Reinforced Concrete."
4. Concrete Manufacturer Qualifications: Manufacturer of ready- mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
5. Concrete Testing Service: The Owner will engage a qualified independent testing agency to perform materials evaluation tests and review design concrete mixes.

1.5 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

B. Use flexible or curved forms for curves of a 100-foot or less radius.

C. Form Release Agent: Provide commercial formulation form-release agent with a maximum of 350 mg/l volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars and Tie Bars: ASTM A 615, Grade 60, deformed.

B. Plain, Cold-Drawn Steel Wire: ASTM A 82.

C. Welded Steel Wire Fabric: ASTM A 185. Furnish in flat sheets, not rolls.


E. Fabricated Bar Mats: Welded or clip-assembled steel bar mats, ASTM A 184. Use ASTM A 615, Grade 60 steel bars, unless otherwise indicated.

F. Supports for Reinforcement: Chairs, spacers, dowel bar supports and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Use wire bar-type supports complying with CRSI specifications.

G. Use supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I.

B. Use one brand of cement throughout Project unless otherwise acceptable to Architect/Engineer.

C. Fly Ash: ASTM C 618, Type F.

D. Normal-Weight Aggregates: ASTM C 33, Class 4, and as follows. Provide aggregates from a single source.

E. Maximum Aggregate Size: 1-1/2 inches.

F. Do not use fine or coarse aggregates that contain substances that cause spalling.

G. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect/Engineer.

H. Water: Potable.
2.4 ADMIXTURES

A. Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

B. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.5 CURING MATERIALS

A. Clear Solvent-Borne Liquid Membrane-Forming Curing Compound: ASTM C 309, Type I, Class A or B, wax free. Moisture loss not less than 0.055 gr./sq.cm when applied at 200 sq.ft./gal.

B. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B.

C. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

2.6 RELATED MATERIALS

A. Boiled Linseed Oil Mixture: Combination of boiled linseed oil and mineral spirits, complying with AASHTO M-233.

B. Joint Sealing Compound: Use Dow Corning 890-SL Silicone Joint Sealant or approved equivalent.

2.7 CONCRETE MIX

A. Prepare design mixes for each type and strength of normal-weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.

B. Limit use of fly ash to 25 percent of cement content by weight.

C. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:

   1. Compressive Strength (28-Day): 3000 psi for sidewalks and flatwork, 4000 psi for driveways and parking.
   2. Maximum Water-Cement Ratio at Point of Placement: 0.45.
   3. Slump Limits at Point of Placement: 3 - 5 inches.

D. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows with a tolerance of plus or minus 1-1/2 percent:

E. Air Content: 5.5 percent for 1-1/2-inch maximum aggregate.

2.8 CONCRETE MIXING
A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.

B. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Proof-roll prepared base surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

B. Remove loose material from compacted base surface immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork and screeds for grade and alignment to following tolerances:
   1. Top of Forms: Not more than 1/8 inch in 10 feet.
   2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.3 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute’s recommended practice for “Placing Reinforcing Bars” for placing and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.4 JOINTS

A. General: Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise.

B. When joining existing paving, place transverse joints to align with previously placed joints, unless
indicated otherwise.

C. Contraction Joints: Provide weakened-plane contraction joints, sectioning concrete into areas as noted on the plans. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness, as follows: equal to width of sidewalk or flatwork or maximum of 10' spacing.

D. Tooled Joints: Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radiused jointer tool.

E. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into hardened concrete when cutting action will not tear, abrade, or otherwise damage surface and before development of random contraction cracks.

F. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than ½ hour, unless paving terminates at isolation joints.

G. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless indicated otherwise. Embed keys at least 1-1/2 inches into concrete.

H. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.

I. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

J. Isolation Joints: Form isolation joints of preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

K. Locate expansion joints at intervals of 50 feet, unless indicated otherwise.

L. Extend joint fillers full width and depth of joint, not less than ½ inch or more than 1 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.

M. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.

N. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

O. Provide joint sealant in all isolation joints abutting structures, all roadway pavements, all courtyard pavements, all site flatwork excluding typical sidewalks, and as indicated in the plans or details.

3.5 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from base surface and reinforcing before placing concrete. Do not place concrete on surfaces that are frozen.

C. Moisten base to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing
E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

F. When concrete placing is interrupted for more than ½ hour, place a construction joint.

G. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

H. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.

I. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.

J. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.

K. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

L. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect/Engineer.

M. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.

N. Slip-Form Pavers: When automatic machine placement is used for paving, submit revised mix design and laboratory test results that meet or exceed requirements. Produce paving to required thickness, lines, grades, finish, and jointing as required for formed paving.

O. Cold-Weather Placement: Comply with provisions of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

P. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

Q. Do not use frozen materials or materials containing ice or snow.

R. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

S. Hot-Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.
T. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

U. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

V. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 CONCRETE FINISHING

A. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.

B. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across concrete surface perpendicular to line of traffic to provide a uniform fine line texture finish. (Sidewalks, curbs, drainage structures).

C. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic. (Medium Paving).

D. Final Tooling: Tool edges of paving, gutters, curbs, and joints formed in fresh concrete with a jointing tool to the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.

E. Radius: 3/8 inch.

F. After final floating, apply a light hand-trowel finish followed by a broom finish to concrete. Cure concrete with a curing compound recommended by the dry-shake material manufacturer. Apply the curing compound immediately after final finishing.

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.

B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture- retaining-cover curing, curing compound, or a combination of these as follows:

E. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following
materials:

F. Water.

G. Continuous water-fog spray.

H. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with a 12-inch lap over adjacent absorptive covers.

I. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

J. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 FIELD QUALITY CONTROL TESTING

A. The Owner will employ a qualified independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement as follows:

B. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

C. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.

D. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test but no less than one test for each day's pour of each type of air-entrained concrete.

E. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.

F. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless directed otherwise.

G. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 25 cu. yd. Test one specimen at 7 days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.

H. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

I. When total quantity of a given class of concrete is less than 25 cu. yd., Architect/Engineer may waive strength testing if adequate evidence of satisfactory strength is provided.

J. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

K. Test results will be reported in writing to Architect/Engineer, concrete manufacturer, and
Contractor within 24 hours of testing. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in paving, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.

L. Additional Tests: The testing agency will make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect/Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.9 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this Section.

B. Drill test cores where directed by Architect/Engineer when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK

A. The work covered by this section consists of furnishing all paint, labor, equipment, and materials and in performing all operations in connection with paint striping and marking, complete in accordance with the specifications and the applicable plans, and subject to the terms and conditions of the contract. The work included under this section shall not be commenced until areas to be painted are in proper condition to receive the striping and marking paint.

1.3 JOB CONDITIONS

A. Weather Limitations: The painting shall be performed only when the existing surface is dry and clean, when the atmospheric temperature is above 40 degrees F, and when the weather is not excessively windy, dusty, or foggy.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Traffic Paint: Traffic paint shall be Chlorinated Rubber Traffic Marking Paint of the color noted in the plans and shall conform to Federal Specifications TTP-115E, Type III: TTP-115F, Type II and TTP-85.

B. Thinner: Paint is formulated to be applied as packaged and ordinarily, thinning will not be allowed. Should thinning becomes necessary because of the type of application equipment, no more than one quart of toluene per five gallons of paint may be used.

C. Technical Data:

<table>
<thead>
<tr>
<th></th>
<th>White</th>
<th>Yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent solids by weight</td>
<td>41.2</td>
<td>41.2</td>
</tr>
<tr>
<td>Percent pigment by weight</td>
<td>57.3</td>
<td>57.3</td>
</tr>
<tr>
<td>Percent solvent by weight</td>
<td>28.9</td>
<td>28.9</td>
</tr>
<tr>
<td>Viscosity</td>
<td>70-80</td>
<td>70-80</td>
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<tr>
<td>Weight per gallon</td>
<td>12.15</td>
<td>12.15</td>
</tr>
<tr>
<td>Flash point</td>
<td>25° F</td>
<td>25° F</td>
</tr>
<tr>
<td>Reflectance</td>
<td>87</td>
<td>54</td>
</tr>
</tbody>
</table>

PART 3 - EXECUTION

3.1 GENERAL

A. The work of striping and marking shall be performed by experienced personnel in a neat and workmanlike manner. All work shall be carried out under favorable weather conditions and no work shall be done unless the paving surfaces are clean and dry in all respects satisfactory for striping work.

B. All work shall be carefully laid out by the Contractor and all lines shall be of the width, length and pattern shown on the drawings. All lines shall be straight and accurate regarding the
angles and shall be snapped with a chalk line or other approved method.

C. All traffic paint shall be delivered on the job in new unbroken sealed containers and applied in accordance with the manufacturer’s specifications.

D. In the carrying out of these operations, care shall be taken to avoid spilling paint or otherwise disfiguring surfaces not required to be painted. Any paint spilled or completed striping not satisfactory to the Engineer shall be removed. Waste paint and residue from cleaning and maintenance of the equipment shall be disposed of at a point and a manner satisfactory to the Engineer.

E. The Contractor shall schedule his operations and conduct his work in accordance with a predetermined program that shall be approved by the Engineer.

3.2 EQUIPMENT

A. The striping machine shall be of a type and manufacture regularly used in the striping of pavements. It shall be the self propelled type, shall apply paint by means of a compressor or actuator spray gun and shall be provided with controls to accurately regulate the amount of pain to be applied to the finished stripe. The design of the machine shall be such as to produce sharp edged stripes of uniform density with square cut beginnings and endings. The machine shall further be equipped with hand-spray attachments for use where required.

3.3 APPLICATION OF PAINT

A. Paint for striping shall be applied in two applications. The first coat shall be applied as a primer and the second coat applied to achieve the specified thickness of 15 mil. The second coat may be applied at any time after the first.

3.4 CLEANING

A. During progress of the work, remove from project site all discarded materials, rubbish, and debris resulting from the work. Upon completion, clean all surfaces which have become soiled or coated as a result of work of this section, using proper methods which will not scratch or otherwise damage finished surfaces.

END OF SECTION
PART 1 - GENERAL

1.1 SCOPE

A. This item shall govern for trench excavation protection required for the construction of all trench excavation protection systems to be utilized in the project and including all additional excavation and backfill necessitated by the protection systems.

1.2 CONSTRUCTION METHODS

A. Trench excavation protection shall be accomplished as required by the provisions of Part 1926, Subpart P - Excavations, Trenching, and Shoring of the Occupational Safety and Health Administration Standards and Interpretations.

OSHA Regulations (Standards - 29 CFR)
Table of Contents for - Part 1926 Subpart P – Excavations

  1926.650 - Scope, application, and definitions applicable to this subpart.
  1926.651 - Specific Excavation Requirements.
  1926.652 - Requirements for protective systems.
  1926 Subpart P - Authority for 1926 Subpart P
  1926 Subpart P App A - Soil Classification
  1926 Subpart P App B - Sloping and Benching
  1926 Subpart P App C - Timber Shoring for Trenches
  1926 Subpart P App D - Aluminum Hydraulic Shoring for Trenches
  1926 Subpart P App E - Alternatives to Timber Shoring
  1926 Subpart P App F - Selection of Protective Systems

END OF SECTION
SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Provide and remove all formwork to produce cast-in-place concrete structures as indicated and specified. The use of stay in place forms is expressly prohibited.

B. Use formwork to cast all concrete structures including foundation mats, base slabs, footings, slabs on grade, grade beams and pile caps.

1.02 RELATED WORK:

A. Section 03200: Concrete Reinforcement

B. Section 03250: Construction and Expansion Joints

C. Section 03255: Polyvinyl Chloride Waterstops

D. Section 03256: Hydrophilic Rubber Waterstops

E. Section 03300: Cast-In-Place Concrete

F. Section 13530: Filter Underdrain System

1.03 REFERENCES:

A. American Concrete Institute (ACI):

1. ACI 117: Standard Tolerances for Concrete Construction and Materials

2. ACI 301: Standard Specifications for Structural Concrete

3. ACI 347R: Guide to Formwork for Concrete

B. Department of Commerce (DOC):
1. **DOC PS 1: Construction and Industrial Plywood**

C. National Sanitation Foundation (NSF):

1. ANSI/NSF 61: Drinking Water System Components – Health Effects

1.04 SUBMITTALS:

A. Shop Drawings: Submit the following manufacturer's data and literature in accordance with Section 01300:

1. Form ties.

2. Form releasing agents.

3. Tubular fiber forms.

B. ANSI/NSF 61 Certification that form release agents and curing compounds proposed for use in structures to contain potable water are non-toxic and have no adverse effect on the quality or appearance of potable water.

1.05 QUALITY ASSURANCE:

A. Provide in accordance with Section 01400 and as specified herein.

B. Produce shop drawings indicating details of form type, methods of form construction and erection and the location of form joints, pipe penetrations, form ties and shoring. Maintain a copy of the drawings in the field office during form erection.

C. Design and construct formwork in conformance with methodology of ACI 347R and as specified herein. Provide the following minimum surface finishes as defined in ACI 347:

1. Surfaces exposed to view or exposed to liquids shall have a Class A formed surface with a maximum irregularity of 1/8” [3 mm] in 5 feet [1.5 meters].

2. Surfaces to receive plaster, stucco or shotcrete shall have a Class B formed surface with a maximum irregularity of 1/4” [6 mm] in 5 feet [1.5 meters].

3. All other surfaces shall have a Class C formed surface with a maximum irregularity of 1/2” [13 mm] in 5 feet [1.5 meters].

4. Class D surfaces are unacceptable for any concrete work.

D. Comply with the requirements in ACI 117 for tolerances for formed surfaces except as specified in Table 03100-1.
E. Check vertical and horizontal alignment of formwork before placing concrete. Adjust formwork to maintain the concrete tolerances specified.

F. Notify the Engineer a minimum of forty-eight (48) hours before the closure of forms that would hinder subsequent inspection to enable the engineer to inspect the Work.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Formwork Design Requirements:

1. Design formwork in conformance with methodology of ACI 347R for anticipated loads, lateral pressures, depth of concrete placement and rate of concrete placement.

2. Locate bracing and shoring to maintain form stability and comply with finish tolerances specified.

3. Provide temporary openings in wall and column forms to facilitate cleaning, inspection and concrete placement.

4. Provide drop chutes and/or drop pipes to prevent accumulation of hardened concrete on forms and reinforcement above fresh concrete and to prevent concrete segregation.

5. Construct forms with regard for construction and expansion joint locations and architectural lines.

6. Use panels as large as practical to minimize form seam lines.

7. Construct forms to minimize fines leakage during concrete placement at construction joints, bulkheads, base of wall/slab intersections and other areas where fines may migrate from the concrete surface during placement. The level of acceptable fine leakage from the formed surface shall be determined by the Engineer as evidenced by the lack of rock pockets formed during placement of the concrete.

B. Formwork Construction:

1. Provide material for forms that is not reactive with concrete. Formwork of aluminum is not acceptable.

2. Expandable metal mesh shall not be used in formwork.
3. Provide material which will produce surfaces equivalent in smoothness and appearance to that produced by new plywood panels conforming to DOC PS 1, Exterior Type, Grade B-B.

4. Provide forms which will not deflect beyond finish tolerances specified.

C. Tubular Fiber Forms:

1. Provide forms with spirally constructed laminated plies of fiber

2. Provide forms with wall thickness as recommended by the manufacturer to meet load requirements of the various uses and sizes.

3. Provide forms with wax coated outside surfaces for moisture resistance.

4. Provide forms with inside surface coated with bond-breaker compound.

D. Form Ties:

1. Provide factory fabricated, metal ties that will prevent form deflection beyond finish tolerances specified and will not spall concrete upon tie removal. Provide solid backing at each tie.

2. Provide ties fitted with devices that will form cone shape holes in concrete surface not less than 3/8 inch [10 mm] interior diameter or more than 1-1/4 inch [32 mm] in exterior surface diameter and at least 1-1/2 inch [38 mm] deep such that the portion of the tie remaining in the concrete will be at least 1-1/2 [38 mm] inch back from concrete surface

3. Provide ties with waterstop devices to break surface continuity around ties and inhibit water seepage.

E. Form Releasing Agents:

1. Provide form releasing agents of commercial formulations that will not bond with, stain or adversely affect concrete surfaces.

2. Form releasing agents must not impair subsequent treatment of concrete surfaces that depend upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

3. Volatile organic compound emissions of form releasing agents shall not exceed 2.09 pounds per gallon [250 grams per liter] or that as acceptable in the State, County, or District of their intended use, whichever is more stringent.
4. Form releasing agents shall be certified as meeting the requirements of ANSI/NSF 61 for contact with potable water.

F. Chamfer Strips:
   1. Provide three-quarter inch triangular fillets to form all exposed concrete corners.
   2. Material shall be milled clear straight-grain pine, surfaced each side or extruded vinyl.

PART 3 - EXECUTION

3.01 COATING:
   A. Coat forms with a form releasing agent before the forms and reinforcement are placed in their final position. Do not allow coating to come in contact with reinforcement, waterstops, construction or expansion joints. Apply coating as recommended in the manufacturer's printed instructions.
   B. Remove surplus coating on form surfaces before placing concrete.
   C. Do not allow excess coating material to stand in puddles in the forms or come in contact with concrete against which fresh concrete is to be placed.

3.02 INSTALLATION:
   A. Erect forms as designed and in accordance with the shop drawings.
   B. Erect forms butted tightly together to prevent mortar leakage.
   C. Where forms for continuous surfaces are placed in successive units, fit the forms over the existing surface so as to obtain accurate alignment of the surface and to prevent mortar leakage.
   D. Arrange joints between formwork panels vertically and horizontally to match construction and expansion joint locations and architectural lines.
   E. Set forms true to the indicated line and grade and to obtain the specified tolerances for formed surfaces. Correct deviations before concrete placement.
   F. Correct deviations in lines and grades after concrete placement to the extent of demolishing and rebuilding concrete structures at no additional cost to the Owner.
   G. Control grade of finished surfaces and horizontal construction and expansion joints by setting chamfer strips or grading strips true to grade.
H. Inspect forms, embedded items and foundation preparation before placing concrete. Remove all snow, ice, water, dirt, debris and foreign matter from excavation and within formwork before placing concrete.

I. Protect materials in construction and expansion joints from damage during construction.

J. Key groove construction joints as specified in Section 03250 whether shown as keyed on the drawings or not. Horizontal construction joints in walls and the joint between the base of walls and the foundation need not be keyed unless indicated as such on the drawings.

3.03 REMOVAL:

A. Remove forms and falsework in a manner that will prevent damage to the concrete and not impair the safety of the structure.

B. Do not use pinch bars or similar tools to pry against concrete surfaces.

C. Do not remove forms until concrete has aged as follows:

1. Elevated slabs and beams: 7 days minimum.

2. Grade beams, columns, walls, construction and expansion joint bulkheads and other vertical surfaces: 24 hours minimum.

D. Elevated slabs and beams shall have attained at least 70 percent of the specified 28 day strength before form removal. Concrete shall also have sufficient strength to safely support its own weight and construction loads. Determine concrete strength for form removal in conformance with ACI 301.

E. Remove tubular fiber forms in accordance with requirements for columns above.

F. Reshore elevated concrete elements immediately upon form removal. Shoring shall remain in place until the concrete has attained the specified 28 day design strength.

G. Maintain shoring of elevated concrete elements which support subsequent construction when the subsequent construction loads exceed the design live load of the elements.

3.04 REUSE:

A. Clean and repair the surfaces of forms that are to be reused to obtain the specified concrete finish. Withdraw all projecting nails and fill holes before reusing form material.

B. Do not reuse forms if there is any evidence of surface wear and tear, splits, fraying, delaminating or other damage which would impair the quality of the concrete surface or
prevent obtaining the specified concrete finish.

C. When forms are extended for successive concrete placements, thoroughly clean form surfaces of mortar from previous concreting and of all other foreign material before reuse.

D. Apply new form releasing agent to all form areas which will be in contact with concrete.

3.05 TOLERANCES:

A. Comply with the requirements of ACI 117 for tolerances for formed surfaces except as specified in Table 03100-1.

<table>
<thead>
<tr>
<th>TABLE 03100-1</th>
<th>TOLERANCES FOR FORMED SURFACES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Vertical alignment (plumbness)</td>
<td>1/4&quot; [6 mm] in any 10 [3 meters] feet and 1&quot; [25 mm] maximum for entire length</td>
</tr>
<tr>
<td>2. Variation in the lines and surfaces of foundation mats, base slabs and walls</td>
<td>1/4&quot; [6 mm] in any 10 [3 meters] feet and 1&quot; [25 mm] max. for entire length</td>
</tr>
<tr>
<td>3. Variation from the level or from the grades indicated on the drawings</td>
<td>1/4&quot; [6 mm] in any 10 [3 meters] feet</td>
</tr>
<tr>
<td>4. Variation of the linear building lines from established position in plan</td>
<td>1/2&quot; [13 mm] in any 20 feet [6 meters] and 1&quot; [25 mm] maximum for entire length</td>
</tr>
<tr>
<td>5. Variation of distance between walls</td>
<td>1/4&quot; [6 mm] in any 10 [3 meters] feet and 1&quot; [25 mm] maximum for entire length and height</td>
</tr>
<tr>
<td>6. Variation in the sizes and locations of sleeves, floor openings and wall openings</td>
<td>Minus 1/4&quot; [6 mm]. Plus 1/2&quot; [13 mm].</td>
</tr>
<tr>
<td>7. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls</td>
<td>Minus 1/4&quot; [6 mm]. Plus 1/2&quot; [13 mm].</td>
</tr>
<tr>
<td>8. Offset between adjacent panels of formwork facing material</td>
<td>1/2&quot; [13 mm] (ACI 117 Class C finish).</td>
</tr>
<tr>
<td>9. Offset between adjacent panels of formwork facing material for exposed surfaces where appearance is of importance</td>
<td>1/8&quot; [13 mm] (ACI 117 Class A finish).</td>
</tr>
</tbody>
</table>

NOTE: Tolerances are not cumulative.
3.06 MEASUREMENT AND PAYMENT:

Measurement and Payment will be as outlined in Section "Measurement and Payment" of Part 1, General Provisions.

END OF SECTION
SECTION 03163

DRILLED CONCRETE PIERS AND SHAFTS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes installed drilled piers.

1.2 UNIT PRICES

A. Unit prices are included in Division 01 Section "Unit Prices."

B. Drilled Piers: Actual net volume of drilled piers in place and approved. Actual length, shaft diameter, may vary, to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments will be made on net variation of total quantities, based on design dimensions for shafts.

1. Base bids on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft and the diameter of shaft.

2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, permanent and temporary casings, dewatering, reinforcement, concrete fill, testing, inspecting, and other items for complete drilled-pier installation.

C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed outside dimensions of drilled piers cast against rock. Unit prices for rock excavation include replacement with approved materials.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture.

C. Shop Drawings: For location of concrete piers, pier dimensions (diameter and depth), and concrete reinforcement.

D. Welding certificates.

E. Material certificates and/or test reports.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
SECTION 03163

DRILLED CONCRETE PIERS AND SHAFTS

1. AWS D1.1, "Structural Welding Code - Steel."

2. AWS D1.4, "Structural Welding Code - Reinforcing Steel."

B. Drilled-Pier Standard: Comply with ACI 336.1 unless modified in this Section.

C. Pre-installation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Project-Site Information: A geotechnical report is being utilized for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for drilled piers.

2. The geotechnical report is included elsewhere in the Project Manual.

B. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.

1. Record and maintain information pertinent to each drilled pier and cooperate with Owner's testing and inspecting agency to provide data for required reports.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A82, as drawn.

2.2 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source, throughout Project:
SECTION 03163

DRILLED CONCRETE PIERS AND SHAFTS

1. Portland Cement: ASTM C150, Type I. Supplement with the following in an amount equal to or greater than 25% of the weight of all cementitious materials:
   a. Fly Ash: ASTM C618, Class C or Class F.

B. Normal-Weight Aggregate: ASTM C33, graded, 3/4-inch nominal maximum coarse-aggregate size.
   1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C94 and potable.

D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C494/, Type A.
   2. Water-Reducing and Retarding Admixture: ASTM C494, Type D.
   3. High-Range, Water-Reducing and Retarding Admixture: ASTM C494, Type G.
   4. Plasticizing and Retarding Admixture: ASTM C1017, Type II.

2.3 STEEL CASINGS (TEMPORARY AND PERMANENT)

A. Temporary Steel Pipe Casings: ASTM A283, Grade C, or ASTM A36, carbon-steel plate, with joints full penetration welded according to AWS D1.1/D1.1M.

B. Permanent Steel Pipe Casings: ASTM A252, Grade 3, carbon-steel plate, with joints full penetration welded according to AWS D1.1/D1.1M.

2.4 CONCRETE MIXTURES AND MIXING

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 limits as if concrete were exposed to deicing chemicals.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Proportion normal-weight concrete mixture as follows:
   1. Compressive Strength (28 Days): 4,000 psi minimum or as indicated on plans.
SECTION 03163

DRILLED CONCRETE PIERS AND SHAFTS

2.  Air Content: Do not air entrain concrete.

E.  Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

PART 3 - EXECUTION

3.1  EXCAVATION

A.  Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered.

B.  Classified Excavation: Excavation is classified as standard excavation, special excavation, and obstruction removal and includes excavation to bearing elevations as follows:

1.  Standard excavation includes excavation accomplished with conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work.

2.  Special excavation includes excavation that requires special equipment or procedures above or below indicated depth of drilled piers where drilled-pier excavation equipment used in standard excavation, operating at maximum power, torque, and downthrust, cannot advance the shaft.

3.  Obstructions: Payment for removing unanticipated boulders, concrete, masonry, or other subsurface obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work will be according to Contract provisions for changes in the Work.

C.  Excavate shafts for drilled piers to indicated elevations. Remove loose material and water from bottom of excavation before concreting.

D.  Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Engineer and Geotechnical Engineer.

1.  Do not excavate shafts deeper than elevations indicated unless approved by Engineer and Geotechnical Engineer.

2.  Payment for additional authorized excavation will be according to Contract provisions for changes in the Work.

E.  Temporary and Permanent Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.
SECTION 03163

DRILLED CONCRETE PIERS AND SHAFTS

1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete.

F. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.

3.2 INSTALLATION

A. When required, install steel casings of diameter not less than diameter of drilled pier. Use casing strong enough to withstand handling stresses and pressures of concrete and of surrounding earth or water, and that is water tight, smooth, clean, and free of accumulations and hardened concrete.

B. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

C. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by Owner's independent testing and inspecting agency. Do not leave excavation open overnight.

D. Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement. Provide a hopper with a minimum 3 ft. long drop-tube at the top of the shaft to direct concrete vertically down the center of the shaft. Vibrate top 60 inches of concrete.

E. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing. Vibrate top 60 inches of concrete after withdrawal of temporary casing.

F. Provide at least one standby vibrator for emergency use.

3.3 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Drilled piers.
2. Excavation.
3. Concrete.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
SECTION 03163

DRILLED CONCRETE PIERS AND SHAFTS

C. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.

   1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-pier lengths and bearing capacities will be determined by testing and inspecting agency. Final evaluations and approval of data will be determined by Engineer and Geotechnical Engineer.

D. Concrete Tests and Inspections: ACI 301.

END OF
SECTION
SECTION 03200
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Provide reinforcement and accessories as indicated and specified.

1.02 RELATED WORK:

A. Section 03100: Concrete Formwork
B. Section 03250: Construction and Expansion Joints
C. Section 03255: Polyvinyl Chloride Waterstops
D. Section 03256: Hydrophilic Rubber Waterstops
E. Section 03300: Cast-in-Place Concrete
F. Section 04200: Unit Masonry and Accessories
G. Section 13530: Filter Underdrain System

1.03 REFERENCES:

A. American Society for Testing and Materials (ASTM) Publications:

1. A 185: Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
2. A 497: Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement

3. A 615/A 615M: Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

4. A 706/A 706M: Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement

B. American Concrete Institute (ACI):


2. ACI 318: Building Code Requirements for Structural Concrete and Commentary

C. American Welding Society (AWS):

1. AWS D1.4: American Welding Society, Structural Welding Code, Reinforcing Steel

1.04 SUBMITTALS:

A. Shop Drawings: Submit the following in accordance with Section 01300:

1. Mill test reports for each shipment of reinforcement. Identify reports with specific lots in shipment and submit prior to use of reinforcement in work.

2. Chemical composition of reinforcement steel. Ladle analysis indicating percentage of carbon, phosphorous, manganese and sulfur present in steel.

3. Current welder's certification in conformance with AWS D1.4 for the appropriate electrode and class of material, when welding is indicated or specified. Testing shall be conducted and witnessed by an independent testing laboratory prior to welding reinforcement in work. Maintain qualification and certification records at the job site, readily available for examination of test results.

4. Shop and placement drawings for all reinforced concrete and masonry structures shall be approved by Engineer prior to fabrication which indicate:

   a. Wall reinforcing shall be shown in elevation.

   b. Slab reinforcing shall be shown in plan view.

   c. Show location and size of all penetrations greater than 12-inches in diameter or least dimension of the opening with the corresponding added reinforcing around the penetrations.
d. All construction and expansion joints.

e. Reinforcement detailed in conformance with ACI SP-66.

f. Support bars and details of reinforcing bar supports including type, size and spacing.

g. Marking for each reinforcement item.

5. Locations of reinforcing bar cut-offs, splices and development lengths.

1.05 QUALITY ASSURANCE:

A. Provide in accordance with Section 01400 and as specified herein.

B. Do not fabricate reinforcement until shop and placement drawings have been approved by the Engineer.

C. Remove reinforcement with kinks or bends not shown on approved shop or placement drawings. Remove all such reinforcement from job site and replace with new fabricated steel. Field bending of reinforcement is prohibited unless reinforcement is indicated or specified to be field bent.

D. Set reinforcement to tolerances specified in ACI 318, except the tolerance on minimum concrete cover shall be minus 1/4 inch.

E. Perform welding indicated or specified in conformance with the requirements of AWS D1.4 for procedures and welding.

F. All welding shall be performed by qualified operators in conformance with requirements of AWS D1.4. Welders shall be certified by test to perform type of work required within the 12 months immediately prior to welding.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Provide in conformance with Section 01610 and as specified herein.

B. Deliver reinforcement and accessories to work site with items of same size and shape fastened in bundles that are clearly marked with identification tags indicating size and mark.

C. Store reinforcement and accessories off the ground on a platform or skids and protect from snow, rain and ground splatter.
D. Protect reinforcement from rusting, deforming, bending, kinking and other injury. In-place reinforcing which has rusted, or been splattered with concrete shall be cleaned via sand or water blasting to the satisfaction of the Engineer prior to incorporation into the Work.

PART 2 - PRODUCTS

2.01 STEEL REINFORCING BARS:

A. Provide newly rolled deformed billet-steel reinforcement bars conforming to ASTM A 615, Grade 60.

B. Provide weldable deformed reinforcement conforming to ASTM A 706, Grade 60, when welding is indicated or specified.

2.02 TIE WIRE:

A. Provide minimum 16 gage mild steel or annealed iron tie wire for uncoated reinforcement.

2.03 REINFORCING BAR SUPPORTS:

A. Provide minimum size number 5 support bars.

B. Provide plastic protected reinforcing bar supports in contact with exposed surfaces in conformance with ACI SP-66.

C. Provide 3-in. [75 mm] by 3-in. [75 mm] plain precast concrete blocks, precast concrete doweled blocks or concrete brick for support of bottom reinforcing in foundation mats, base slabs, footings, pile caps, grade beams and slabs on grade. Provide block thickness to produce concrete cover of reinforcement as indicated.

2.04 WELDED WIRE FABRIC:

A. Provide welded wire fabric reinforcement conforming to ASTM A 185.

B. Provide welded wire fabric in flat sheets.

C. Provide support bars and reinforcing bar supports as specified herein to obtain the concrete cover indicated.

D. Provide flat sheets of deformed welded wire fabric reinforcement conforming to ASTM A 497 when deformed welded wire fabric is indicated or specified.

PART 3 - EXECUTION
3.01 PLACEMENT:

A. Clean all reinforcement and accessories of mortar, oil, dirt, loose mill scale, loose or thick rust and coatings of any character which will reduce bond with concrete before setting in forms to the satisfaction of the Engineer.

B. Set reinforcing bars and welded wire fabric to tolerances specified in ACI 318, except tolerance for minimum concrete cover shall be minus $\frac{1}{4}$ inch. Secure reinforcing in position using tie wire with ends pointed away from forms and finished grade lines and is subjected to the same clearance tolerances as the reinforcing bars.

C. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits or embedded items providing the same reinforcing coverage is maintained. Bars moved more than three inches, or bars moved to a greater or lesser depth of coverage are subject to approval of the Engineer.

D. Position dowels accurately. Rigidly support, align and securely tie dowels normal to the concrete surface before concrete placement. Setting dowels into wet concrete is prohibited.

E. Provide and place safety caps on all exposed ends of vertical reinforcement that pose a danger to life safety.

F. Use chairs, bolsters and spacers of sufficient strength to resist crushing under load to hold reinforcing bars and welded wire fabric in place in conformance with ACI SP-66.

G. Do not use metal chairs, ferrous clips, nails, etc. which extend to the surfaces of the concrete. Do not use stones, brick or wood block supports.

H. Use precast concrete reinforcing bar support blocks or concrete brick for foundation mats, base slabs, footings, pile caps, grade beams and slabs on grade.

I. Setting bars and welded wire fabric reinforcement on layers of fresh concrete as the work progresses or adjusting reinforcement during the placement of concrete is prohibited.

J. Set bars in contact and tie securely at reinforcement lap splices or space transversely apart to permit embedment of entire surface of each bar in concrete. Length of lap splices for reinforcement shall conform to the requirements of ACI 318, unless otherwise indicated or specified.

K. Tie a minimum of 25 percent of all intersecting bars in foundation mats, base slabs, footings, pile caps, slabs on grade and elevated slabs.

L. Do not splice reinforcement steel in foundation mats, base slabs, beams, girders, slabs and walls at points of maximum stress unless otherwise indicated. The Engineer shall be consulted on all bar splice locations not shown on the drawings. Shop drawings shall
specifically flag splice locations that do not show on the drawings.

M. Lap splice welded wire fabric reinforcement at least two full meshes. Stagger splices to avoid continuous laps in either direction and wire tightly together.

N. Provide continuous reinforcement through construction joints.

O. Do not use continuous reinforcement or other fixed metal items through expansion joints. Provide two-inch reinforcement clearance from each face of expansion joint.

P. Do not use heat to bend or straighten reinforcing steel.

Q. Welding of reinforcing bars is permitted only where indicated or specified. Perform all welding in accordance with AWS D1.4.

R. Welding of reinforcing steel shall be performed only by operators certified by test in conformance with AWS D1.4 and as specified herein.

S. Tack welding reinforcement is prohibited.

3.02 MEASUREMENT AND PAYMENT:

Measurement and Payment will be as outlined in Section "Measurement and Payment" of Part 1, General Provisions.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION:

A. Provide construction and expansion joints as indicated and specified.

1.02 RELATED SECTIONS:

A. Section 03100: Concrete Formwork
B. Section 03200: Concrete Reinforcement
C. Section 03255: Polyvinyl Chloride Waterstops
D. Section 03256: Hydrophilic Rubber Waterstops
E. Section 03300: Cast-in-Place Concrete

1.03 REFERENCES:

A. American Society for Testing and Materials (ASTM) Publications:
   2. C 1193: Guide for Use of Joint Sealants

B. National Sanitation Foundation (NSF):
   1. ANSI/NSF 61: Drinking Water System Components – Health Effects
1.04 SUBMITTALS:

A. Shop Drawings: Submit the following in accordance with Section 01300:

1. Manufacturer's printed data and application instructions all specified materials and locations where materials are to be used.

2. Manufacturer's printed instructions for:
   a. Treatment of cut surfaces of premolded expansion joint filler.
   b. Preparation of concrete for expansion joint compound.

B. ANSI/NSF 61 certification that joint materials proposed for use in structures to contain potable water are non-toxic and have no adverse effect on the quality or appearance of potable water.

1.05 QUALITY ASSURANCE:

A. Provide in accordance with Section 01400 and as specified herein.

B. Do not omit construction or expansion joints without written authorization from the Engineer.

C. Do not add or relocate construction or expansion joints.

D. Cast slabs and beams monolithically without horizontal joints unless specifically indicated on the drawings.

E. Do not use horizontal joints within foundation mats, base slabs, footings, pile caps, slabs on grade or elevated beams and slabs.

F. Provide construction and expansion joints in concrete fills and toppings at the same location as the construction and expansion joints in the supporting concrete.

G. Reject material exceeding expiration date for use.

H. Clean concrete surfaces to receive expansion joint compound in accordance with the printed instructions of the joint compound manufacturer.

I. In structures to contain potable water, use joint materials that are non-toxic and have no adverse effect on the quality or appearance of potable water. Materials shall be ANSI/NSF 61 approved for contact with potable water.

1.06 DELIVERY, STORAGE AND HANDLING:
A. Provide in conformance with Section 01610 and as specified herein.

B. Transport, handle and deliver materials to the job site in the manufacturer's sealed bags, unopened containers or banded pallets.

C. Store materials off the ground on a platform or skids and protect with covers from snow, rain and ground splatter.

D. Store expansion joint compounds in a dry warm location to prevent freezing.

E. Store plastic products under cover in a dry cool location, out of direct sunlight.

PART 2 - PRODUCTS

2.01 PREMOLDED-JOINT FILLER:

A. Provide premolded-joint filler conforming to ASTM D1752, Type I or Type II. Provide Type III self-expanding cork where specifically indicated.

B. Provide joint filler of same thickness as expansion joint width indicated.

C. Provide maximum length filler to minimize field splicing.

2.02 JOINT COMPOUNDS:

A. Provide joint compound for expansion joints in horizontal surfaces and surfaces inclined less than 30 degrees from the horizontal conforming to ASTM C920, Type S or M, Grade P, Class 25. Use T in pedestrian and vehicular traffic areas and use NT in non-vehicular areas.

B. Provide joint compound for expansion joints in walls and surfaces inclined greater than 30 degrees from the horizontal conforming to ASTM C920, Type S or M, Grade NS, Class 25.

C. Provide compatible joint compounds as recommended by manufacturer when they abut each other.

D. Provide compound intended for continuous submergence in liquid containing structures.

2.03 BOND BREAKER FOR JOINT COMPOUNDS:

A. Provide polyethylene tape.

2.04 BACK-UP MATERIAL FOR JOINT COMPOUNDS:
A. Provide polyethylene foam or polychloroprene foam rubber.

B. Do not use material impregnated with oil, bitumen or similar substances.

C. Provide back-up material as recommended by joint compound manufacturer which is compatible with the joint compound and has the same expansion/contraction characteristics as the joint compound.

PART 3 - EXECUTION

3.01 CONSTRUCTION JOINTS:

A. Key groove construction joints whether shown as keyed on the drawings or not. Horizontal construction joints in walls and the joint between the base of walls and the foundation need not be keyed unless indicated as such on the drawings. Roughen all horizontal joints to $\frac{1}{4}$” [6 mm] amplitude.

B. Key grooves shall be one-third the thickness of the thinner member and 1-1/2-in. [38 mm] deep unless otherwise indicated.

C. Use tapered key groove forms to permit form removal without damage to the groove. Taper not to exceed 2 inches per foot [150 mm per meter].

D. Center waterstops in construction joints unless otherwise indicated.

E. Consolidate concrete during placement in vicinity of key grooves and waterstops without damaging or dislodging the key or waterstop.

F. Remove all key groove forms.

G. Clean joint of laitance, curing compound, foreign materials and protrusions of hardened concrete. Blow out debris and dust with oil-free compressed air.

H. Protect exposed key groove and waterstop from damage.

3.02 EXPANSION JOINTS:

A. Install expansion joints in accordance with the manufacturer's printed instructions and as indicated.

B. Center waterstops in expansion joints unless otherwise indicated.

C. Consolidate concrete during placement in vicinity of expansion joint without damaging premolded joint filler and waterstop.
3.03 PREMOLDED JOINT FILLER:

A. Treat cut surface of premolded joint filler in conformance with manufacturer's printed instructions.

B. Prevent disturbance of or damage to premolded joint filler.

C. Fill expansion joint completely with premolded joint filler.

D. Secure wood strips to expansion joint surfaces that are to receive joint compound.

E. Use tapered wood strips with the smaller width being the same width as the expansion joint and of depth necessary to install the joint compound and back-up materials.

F. Use materials to secure the premolded joint filler and wood strips that will not harm concrete or affect the joint compound bond to concrete.

G. Do not remove wood strips until forms are removed as specified in Section 03100.

H. Clean joint of laitance, curing compound, foreign materials and protrusions of hardened concrete. Blow out debris and dust with oil-free compressed air.

3.04 JOINT COMPOUND:

A. Seal the dry clean concrete in expansion joints in conformance with manufacturer's printed instruction.

B. Install back-up and bond breaker materials.

C. Prime concrete, fill flush with joint compound of required thickness, tool to concave shape and seal in conformance with manufacturer's printed instructions and ASTM C1193.

D. Prevent spilling joint compound over adjoining surfaces. Use tape adjacent to joint as required. Remove all tape completely from concrete surface after installing joint compound.

E. Do not prime concrete or install joint compound when compound, air or concrete temperature is less than 40 deg. F. or as prescribed by manufacturer.
3.05 MEASUREMENT AND PAYMENT:

Measurement and Payment will be as outlined in Section "Measurement and Payment" of Part 1, General Provisions.

END OF SECTION
SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Provide, finish, protect, and cure cast-in-place concrete as indicated and specified.

1.02 RELATED WORK:

A. Section 03100: Concrete Formwork

B. Section 03200: Concrete Reinforcement

C. Section 03250: Construction and Expansion Joints

1.03 REFERENCES:

A. American Concrete Institute (ACI):

1. ACI 211.1: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

2. ACI 214: Recommended Practice for Evaluation of Strength Test Results of Concrete

3. ACI 301: Standard Specifications for Structural Concrete

4. ACI 304R: Guide for Measuring, Mixing, Transporting and Placing Concrete

5. ACI 305R: Hot Weather Concreting
6. ACI 306R: Cold Weather Concreting
7. ACI 308: Standard Practice for Curing Concrete
8. ACI 309R: Guide for Consolidation of Concrete
9. ACI 311.4R: Guide for Concrete Inspection
10. ACI 318: Building Code Requirements for Structural Concrete
11. ACI 350: Code Requirements For Environmental Engineering Concrete Structures

B. American Society for Testing and Materials (ASTM) Publications:

3. C 31: Standard Practice for Making and Curing Concrete Test Specimens in the Field
7. C 42: Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
9. C 88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
14. C 138: Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
15. C 143: Standard Test Method for Slump of Hydraulic Cement Concrete
19. C 172: Standard Practice for Sampling Freshly Mixed Concrete
20. C 192: Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
24. C 295: Standard Guide for Petrographic Examination of Aggregates for Concrete
27. C 494: Standard Specification for Chemical Admixtures for Concrete
29. C 618: Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
30. C 882: Standard Test Method for Bond Strength of Epoxy Resin Systems Used with Concrete by Slant Shear
34. C 1116: Standard Specification for Fiber Reinforced Concrete
36. D 75: Standard Practice for Sampling Aggregates
37. E 154: Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

C. American Association of State Highway and Transportation Officials (AASTO):
   1. AASHTO M182:

D. National Sanitation Foundation (NSF):
   1. ANSI/NSF 61: Drinking Water System Components – Health Effects

1.04 SUBMITTALS:

A. Shop Drawings: Submit the following in accordance with Section 01300:

1. Name and address of proposed Contractor's testing laboratory firm and a brief description of prior work which is similar to that proposed for this project. Provide prior work owner's full name, address and telephone number. ASTM E 329 will also be used as one of the basis for evaluating the testing laboratory firm.

2. Concrete design mixes and results of strength tests from trial concrete mixes by the Contractor's testing laboratory firm.

3. Concrete design mixes and results of drying shrinkage tests from trial concrete mixes by the Contractor's testing laboratory firm.
4. Material test results by the Contractor's testing laboratory:
   a. Fineness modulus of fine aggregate per ASTM C 136.
   b. Fine aggregate organic impurities per ASTM C 40.
   c. Fine aggregate mortar strength per ASTM C 87 and ASTM C 109.
   d. Quality of fine and coarse aggregates per ASTM C 33.
   e. Quality of the cement per ASTM C150.

B. Mill test reports for each shipment of cement, regardless of quantity, prior to incorporation into the work.

C. Manufacturer's specifications and instructions for all admixtures, curing materials, adjustable inserts and non-shrink non-metallic grout. Manufacturer’s certification of compatibility of all admixtures.

D. Manufacturer's fly ash or pozzolan chemical analysis and results of physical test reports in conformance with ASTM C 311 and as specified herein for each shipment of fly ash or pozzolan, prior to incorporation into the work.

1.05 QUALITY ASSURANCE:

A. Provide in accordance with Section 01065 and Section 01400 and as specified herein.

B. Concrete not meeting the minimum specified 28-day design strength shall be cause for rejection and removal from the work.

C. Perform concrete work in conformance with ACI-301 unless otherwise indicated or specified.

D. Do not use admixtures, including calcium chloride, which will cause accelerated setting of cement in concrete.

E. Do not place concrete until design mix, material tests and trial concrete batch mix compression test results are approved by the Engineer. Approvals are required at least 30 days before placing any production concrete.

F. The Contractor shall employ an independent testing laboratory, acceptable to the Engineer, to test conformity of materials to specifications and to design concrete mixes. Concrete testing shall be performed by and an ACI Concrete Field Technician, Grade I or equivalent.
G. Furnish, pay for and deliver representative samples of sufficient quantity of cement, aggregates and admixtures required for trial concrete batch mixes to the testing laboratory. Obtain materials from the concrete batching plant that will be supplying production concrete in conformance with ASTM D 75.

H. Testing laboratory shall furnish trial concrete design mixes having proportions, admixtures and slump proposed for use, based upon ACI 211.1. Furnish at least three different water-cement ratios that will produce a range of strengths, aggregate sizes and admixture combinations encompassing those required for the work. Report design mixes for maximum permitted air, slump and temperature of concrete used in trial batches.

I. Produce new concrete design mixes at no additional cost to the Owner when job site concrete is not of required strength. Provide additional testing when original sample materials produce unsatisfactory results or new material sources are to be used. All additional testing shall be done by the same testing laboratory and paid for by the Contractor.

J. Measure all materials for concrete, including water, with equipment and facilities suitable for accurate measurement and capable of being adjusted in conformance with ASTM C 94. Use scales certified by local Sealer of Weights and Measures within one year of use and accurate when static load tested to plus or minus 0.4 percent of total capacity of scale. Batch all materials by weight except admixtures that may be batched by volume.

K. Once the mix design is approved, the contents of the mix ingredients shall not be altered from the approved materials (volume, location, type, size, etc...). Batch tickets shall indicate the amount of material batched for each material. Material batched that is not within the allowable tolerances shall be cause for rejection.

L. The Contractor’s testing laboratory shall conduct drying shrinkage tests for the trial batches as specified herein. Drying shrinkage specimens shall be fabricated, cured, dried and measured in accordance with ASTM C 157 modified as follows.

1. Measurement to determine expansion expressed as a percentage of original length shall be made at age 7 days. This length at age 7 days shall be the base length for drying shrinkage calculations (“0” days drying age).

2. Specimens then shall be stored immediately in a humidity control room maintained at 73 degrees F +/- 3 degrees F and 50 percent +/- 4 percent relative humidity for the remainder of the test.

3. Measurements to determine shrinkage, expressed as percentage of base length, shall be made and reported separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.
a. The drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at “0” days drying age) and the length after drying at each test age.
b. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001 inch at each test age.
c. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004-inch, the results obtained from that specimen shall be disregarded.
d. Results of the shrinkage test shall be reported to the nearest 0.001 percent of shrinkage.

M. Compression test specimens shall be taken in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered a part of the normal compression tests for the project. Allowable shrinkage limitation shall be as specified herein.

N. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age shall be 0.039 percent or 0.045 percent, respectively.

1. Shrinkage limitations apply only to 4,000 psi or higher concrete strengths.
2. Use only mix designs for construction that have first met the trial batch shrinkage requirements.
3. If the trial batch results fail to meet the shrinkage limitation, the Contractor shall redesign the mix to reduce shrinkage. Such redesigns may include the usage of a high range water reducing admixture in addition to lowering the water/cement ratio.

O. The Owner’s testing agency will take control test specimens; conduct slump tests and measure air content and temperature in the field.

P. Methods of Sampling and Testing:

1. Fresh Concrete Sampling: ASTM C 172
2. Specimen Preparation: ASTM C 31
3. Compressive Strength: ASTM C 39
4. Air Content: ASTM C 231
5. Slump: ASTM C 143
6. Temperature: ASTM C 1064
7. Unit Weight: ASTM C 138

8. Obtaining Drilled Cores: ASTM C 42


Q. Acceptance of Structure: Acceptance of completed concrete work requires conformance with dimensional tolerances, appearance and strength as indicated or specified.

R. Hot weather concrete to conform to ACI 305R and as specified herein.

S. Cold weather concrete to conform to ACI 306R and as specified herein.

T. Reject concrete delivered to job site that exceeds the time limit specified.

U. Reject concrete delivered to job site that exceeds the concrete temperature limitations specified.

V. Do not place concrete in water or on frozen or uncompacted ground.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Provide in conformance with Section 01610 and as specified herein.

B. Order concrete from batching plant so that trucks arrive at discharge locations when concrete is required. Avoid excessive mixing of concrete or delays in placing successive layers of concrete in forms. Re-tempering of concrete is strictly prohibited.

C. Deliver concrete to discharge locations in watertight agitator or mixer trucks without altering the specified properties of water-cement ratio, slump, air entrainment, temperature and homogeneity.

D. Reject concrete not conforming to specification, unsuitable for placement, exceeding the time or temperature limitations or not having a complete delivery batch ticket.

1.07 JOBSITE CONDITIONS:

A. Do not place concrete until conditions and facilities for making and curing control test specimens are in compliance with ASTM C 31 and as specified herein.
PART 2 - PRODUCTS

2.01 MATERIALS:

A. All materials used in concrete or the curing and repair of concrete, which can contact potable water, shall be certified as meeting requirements of ANSI/NSF 61 for contact with potable water when in the finished concrete.

B. Furnish Portland cement conforming to ASTM C 150. Use one approved brand from one mill throughout the contract term unless otherwise approved by the Engineer. Use cement of uniform color.
   1. Use Type II for all work, unless otherwise indicated or specified.
   2. Reject the entire shipment when cement is lumpy, wetted, partially or wholly set.

C. Water:
   1. Use water for concrete that is potable and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances, conforms to the requirements for water in ASTM C 94, and as specified herein.
   2. The maximum water-soluble chloride ion in the water shall not exceed 0.060 percent by weight of cement.
   3. Heat or cool water to obtain concrete temperatures indicated or specified, and in conformance with ACI 305R and ACI 306R.

D. Aggregates:
   1. Use fine aggregates for normal weight concrete consisting of well graded natural sand from a single source conforming to ASTM C 33 and to the following requirements:
      a. Fineness modulus: 2.50 to 3.10
      c. Soundness: Maximum of 10 percent weighted average loss after 5 cycles of magnesium sulfate soundness test as determined by ASTM C 88.

E. Use coarse aggregates from a single source for normal weight concrete consisting of washed, well graded gravel or crushed stone conforming to ASTM C 33 and to the following requirements:
1. Soundness: Maximum of 14 percent weighted average loss after 5 cycles of magnesium sulfate soundness test as determined by ASTM C 88.

2. Test aggregates for chert in conformance with ASTM C 33 as determined by ASTM C 123.

3. Test conformity of aggregate and confirm that aggregates intended for use in concrete are potentially non-reactive when tested in conformance with ASTM C 289.

F. Admixtures:

1. General Requirements:
   a. Maintain compressive strength and maximum water-cement ratios indicated in Table 03300-1 when using admixtures. Include all admixtures in solution form in the water-cement ratio calculations.
   b. Do not use calcium chloride, admixtures containing chloride ions or other admixtures causing accelerated setting of cement. Do not use combinations of admixtures and cements producing erratic or otherwise undesirable results with aggregates.
   c. Reject admixtures that have been in storage for longer than manufacturer’s recommendations or which have been subjected to freezing.
   d. Do not use admixtures in greater dosages than recommended by manufacturer.
   e. The strength of concrete with proposed admixtures after 48 hours shall not be less than the strength of similar concrete without admixture.
   f. All admixtures shall be obtained from one manufacturer. The manufacturer shall be capable of providing qualified field service representation.
   g. Admixtures shall be used in compliance with the manufacturer’s printed instructions. The manufacturer shall certify the compatibility of multiple admixtures used in the same mix.
2. Air-Entrainment:
   b. Provide total air content by volume in field mixtures of normal weight concrete:
      
      $5 \pm 1\frac{1}{2}$ percent for concrete using 1-1/2 inch [38 mm] maximum aggregate size.
      
      $6 \pm 1\frac{1}{2}$ percent for concrete using 3/4 inch [19 mm] maximum aggregate size.
   c. Measure air content in accordance with ASTM C 231.
   d. Adjust the admixture content to accommodate the fly ash or pozzolan requirements, and other admixtures when used, in order to obtain the specified air content.

3. Mid-Range Water Reducer: Use admixture conforming to ASTM C 494, Type A.


G. Curing Compound: Liquid form, which will form impervious membrane over, exposed surface of concrete when applied to fresh concrete by means of spray gun. Compound shall not inhibit future bond of floor covering or concrete floor treatment. Use Type I-D compound with red fugitive dye, Class B, having 18 percent minimum solids conforming to ASTM C 309.

H. Evaporation Retardant shall be:
   1. Confilm as manufactured by Master Builders.
   2. Eucobar as manufactured by Euclid Chemical Company
   3. SikaFilm as manufactured by Sika Corporation
   4. Or equal.

I. Waterproof Curing Sheet: Waterproof paper polyethylene film or white burlap-polyethylene film conforming to ASTM C 171.

J. Cloth, Burlap, Jute or Kenaf: Curing materials conforming to AASHTO M182.
K. Curing mats shall be heavy carpets or cotton mats, quilted at 4 inches on center. Curing mats shall weight a minimum of 12 ounces per square yard when dry.

L. Dovetail Anchor Slots: Provide 24-gage [0.70 mm], foam-filled, hot-dip galvanized steel dovetail anchor slots. Dovetail anchor slots shall be compatible with dovetail anchors specified in Section 04200. Dovetail anchor slots shall be manufactured by:

1. The Dayton Sure-Grip & Shore Co.
2. Heckmann Building Products, Inc.
3. Hohmann & Barnard Inc.
4. Or equal.

M. Adjustable Inserts: Adjustable inserts shall be hot-dip galvanized in conformance with ASTM A 123 and A 153. Adjustable inserts shall be:

1. Ductile iron wedge inserts, Type F-7 manufactured by The Dayton Sure-Grip & Shore Co.
2. Malleable iron wedge inserts, Type HW manufactured by Hohmann & Barnard Inc.
3. Malleable iron peerless wedge inserts manufactured by Richmond Screw Anchor Co., Inc.
4. Or equal.

N. Non-shrink, Non-metallic Grout: Commercial formulation requiring only addition of water with minimum 28-day compressive strength of 5,000 psi conforming to ASTM C 1107, Grade A, B or C. Grout shall be:

1. Five Star grout manufactured by U.S. Grout Corp.
2. SikaGrout 212 manufactured by Sika Corporation.
3. Masterflow 928 Grout manufactured by Master Builders
4. Or equal.

O. Vapor Retarder: 10 mil [0.25 mm] polyethylene sheet conforming to ASTM E 154.

P. Do not use fly ash, blast furnace slag or pozzolans in structures to contact potable water.
Q. Blast Furnace Slag: Provide grade 120 blast furnace slag in conformance with ASTM C 989.

R. Fly Ash: Provide fly ash conforming to the following requirements:
   1. Class F fly ash conforming to ASTM C 618 for chemical and physical properties.
   2. Supplemental requirements in percent:
      a. Maximum carbon content: 3%
      b. Maximum sulfur trioxide \((SO_3)\) content: 4%
      c. Maximum loss on ignition: 3%
      d. Maximum water requirement (as a percent of control): 100%
      e. Fineness, maximum retained on No. 325 sieve: 25%

S. Fibrous Reinforcing: Provide fibrous reinforcing conforming to the following requirements:
   1. Fiber reinforcing shall conform to ASTM C 116, Type III.
   2. Fibers shall be macro fibers. Micro fibers are prohibited.
   3. Fibers shall be 100 percent virgin polypropylene fibrillated fibers containing no reprocessed olefin materials and specifically manufactured to an optimum gradation for use as concrete secondary reinforcement
   4. Volume of fibers shall be a minimum of 0.1% \((1.5 \text{ pounds per cubic yard} [890 \text{ grams per cubic meter}])\).
   5. Fibrous concrete reinforcement shall be as manufactured by a company approved by the Engineer.
   6. Physical Characteristics:
      a. Specific gravity: 0.91
      b. Tensile strength: 40,000 to 110,000 psi \([275 \text{ to } 758 \text{ MPa}]\)
      c. Fiber length: \(\frac{1}{2} \text{ inch} [13 \text{ mm}] \text{ to } \frac{3}{4} \text{ inch} [19 \text{ mm}]\)
   7. Fibrous concrete reinforcement materials provided in this section shall produce concrete conforming to the requirements for strength of concrete specified.
2.02 MIXES:

A. Use ready-mixed, air-entrained concrete secured from a batching or mixing plant conforming to ASTM C 94 capable of developing specified characteristics and being placed without segregation.

B. Concrete Strengths:

1. Use 4,000 psi [28 MPa] concrete for all concrete paving and work unless otherwise indicated or specified. All concrete & flowable fill shall have “Mesa Buff” coloring to match existing Mission Reach concrete.

2. Use 4,500 psi [31 MPa] concrete for all liquid containment structures unless otherwise indicated or specified.

3. Use 4,000 psi [28 MPa] fiber reinforced concrete for all concrete fills and toppings, unless otherwise indicated or specified.

4. Use 1,500 psi [10 MPa] concrete for concrete under foundations, filling over excavations or whenever low strength concrete is indicated, specified or permitted by the Engineer.

C. Secure, for every part of work, concrete of homogeneous structure having required strength, water tightness, and durability.

D. Use the following coarse aggregate sizes for concrete:

1. 1-1/2 inches [38 mm] for walls greater than 30 inches [750mm] in thickness, grade beams, footings, foundation mats, and base slabs.

2. 3/4 inches [19 mm] for all other concrete.

3. 3/8 inches [10 mm] in congested areas where approved by the engineer and for fireproofing around structural steel beams and columns and to fill cored holes.

E. Provide concrete meeting the requirements in Table 03300-1.
<table>
<thead>
<tr>
<th>Minimum compressive strength at 28 days (psi)</th>
<th>Minimum compressive strength at 28 days (MPa)</th>
<th>Maximum water cement ratio*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,500</td>
<td>10</td>
<td>0.76</td>
</tr>
<tr>
<td>3,000</td>
<td>20</td>
<td>0.53</td>
</tr>
<tr>
<td>4,000</td>
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<td>0.45</td>
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<tr>
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<tr>
<td>5,000</td>
<td>35</td>
<td>0.40</td>
</tr>
<tr>
<td>5,500</td>
<td>38</td>
<td>0.39</td>
</tr>
</tbody>
</table>

*Total water in mix at time of mixing, including free water in the aggregates and liquid admixtures.

F. Consistency: Mix concrete to produce homogeneous consistency, capable of being worked into constricted areas of forms, corners and around embedded items, without segregation or bleeding of free water.

G. Fly ash or pozzolan shall not exceed 15 percent of the combined weight of fly ash, pozzolan or ground granulated blast-furnace slag and cement.

H. Use silica fume concrete where indicated on the drawings. Silica fume not to exceed 10 percent of the total weight of the silica fume plus cement.

I. Concrete Slump: Provide concrete with a maximum slump of 4 inches. Provide concrete using water reducing admixtures with a maximum slump of 4 inches before addition of the water reducer and a maximum slump of 6 inches after the addition of a mid-range water reducer or a maximum slump of 8 inches after the addition of a high range water reducer. Determine concrete slump in conformance with ASTM C 143.

2.03 CONCRETE TOLERANCES:

A. Conform to the requirements specified in Section 03100 for finish tolerances for formed surfaces.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Batch, mix and deliver Portland cement concrete in conformance with ASTM C 94. Batch all constituents at a central batching or mixing plant. Produce concrete in conformance with ACI 301 and as specified herein.

B. Seasonal Conditions:

1. Conform to ACI 305R and as specified herein for hot weather concreting. Do not add retarder admixture to any concrete.
2. Conform to ACI 306R and as specified herein for cold weather concreting. Do not add accelerator admixture to any concrete.

3. Do not place concrete containing pozzolan during cold weather concreting, as defined in ACI 306R.

C. Placement of Fibrous Reinforcement:

1. Placement of fibrous reinforcement shall comply with manufacturer’s recommendations for adding and mixing requirements.

2. Finished fibrous reinforced concrete surface shall have no exposed fibers.

3.02 FORMS:

A. Provide and remove all formwork as specified in Section 03100.

3.03 JOINTS AND EMBEDDED ITEMS:

A. Provide construction and expansion joints as specified in Section 03250:

1. Clean all construction joints to remove loose concrete and laitance before placing adjoining concrete. Do not damage exposed concrete edges, key grooves, waterstops or reinforcement.

2. Do not place concrete against construction joints for at least 72 hours after initial concrete set.

B. Embedded Items:

1. Clean embedded items of oil and all foreign matter.

2. Install inserts, anchors, sleeves and other items into formwork where indicated or specified under other sections of these specifications.

3. Aluminum items shall not be embedded in concrete.

4. Complete required tests on embedded piping before starting concrete placement.

5. Check location and support of piping, electrical conduits and other embedded items before depositing concrete. Correct locations as required and secure in place.

C. Embedded Pipes And Conduit:
1. Embedded pipes and conduit in concrete shall conform to the requirements and limitations of ACI 318, ACI 350 and these specifications and shall be as approved by the engineer.

2. Conduits, pipes, and sleeves of any material not harmful to concrete and within the limitations specified herein shall be permitted to be embedded in concrete with the approval of the Engineer.

3. Conduits, pipes and sleeves of aluminum shall not be embedded in concrete.

4. Pipes passing through walls of a liquid-containing structure shall include an integral waterstop.

5. Conduits, pipes, and sleeves passing through a slab, wall, or beam shall not impair significantly the strength of the construction.

6. Conduits and pipes, with their fittings, embedded within a column shall not displace more than 4 percent of the area of cross section.

7. Except when drawings for conduits and pipes are approved by the structural engineer, conduits and pipes embedded within a slab, wall, or beam (other than those merely passing through) shall satisfy the following:
   a. Conduits and pipes shall not be larger in outside dimension than 1/3 the overall thickness of the slab, wall, or beam in which they are embedded.
   b. Conduits and pipes shall not be spaced closer than 3 times the outside diameters on center.
   c. Conduits and pipes shall be placed within the middle third of the element and between reinforcement layers. Do not install runs of piping or conduit between formwork and reinforcement.
   d. Avoid crossing pipes and conduit in concrete.

8. Pipes and fittings shall be designed to resist the effects of the material, pressure, and temperature to which they will be subjected.

9. No liquid, gas, or vapor, except water not exceeding 90 F or 50 psi pressure, shall be placed in the pipes until the concrete has attained its design strength.

10. Reinforcement with an area not less than 0.002 times area of concrete section shall be provided perpendicular to piping or conduit at a maximum spacing of 12 inches [300 mm].
11. Piping and conduit shall be so fabricated and installed that cutting, bending, or displacement of reinforcement from its proper location will not be required.

12. Close ends of conduits, piping and sleeves embedded in concrete with caps or plugs prior to concrete placement.

3.04 VAPOR RETARDER:

A. Install vapor retarder material under all interior floor slabs on ground whether indicated on the drawings or not.

B. Install material with 6 in. [150 mm] lap at joints and seal joints with tape as recommended by the vapor retarder manufacturer. Tape material cut for slab penetrations to the pipe, conduit or other items passing through the slab. Use tape recommended by the vapor retarder manufacturer.

C. Install vapor retarder without punctures or tears and protect against punctures and breaks.

3.05 TRANSPORTING AND MIXING:

A. General: Conform to concreting procedures set forth in ACI 304R and as specified herein.

1. Transport concrete to discharge locations without altering the specified properties of water-cement ratio, slump, air entrainment, temperature and homogeneity.

2. Discharge concrete into forms within 1-1/2 hours after cement has entered mixing drum or before the drum has revolved 300 revolutions after the addition of water, whichever occurs first. Do not add water at the jobsite, nor exceed the maximum water content in the approved concrete design mix.

3. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time is necessary, in conformance with the following:

   a. Reduce maximum mixing and placement time from 90 to 45 minutes maximum when concrete temperature at time of placement is between 85 and 90 degrees Fahrenheit.

   b. Reject concrete with a temperature in excess of 90 degrees Fahrenheit.

B. Conveying: Convey concrete from agitator or mixer truck to place of final deposit in forms by one of the following methods:

1. Buckets or hoppers with discharge gates having a clear opening equal to not less than one-third the maximum interior horizontal area or five times the maximum
aggregate size being used, whichever is greater, and side slopes of not less than 60 degrees to horizontal.

2. Buggies or wheelbarrows equipped with pneumatic tires.

3. Round bottom, metal or metal-lined chutes with inclined slope of between two to three feet horizontally to one foot vertically and of sufficient capacity to avoid overflow.

4. Circular drop pipes with a top diameter of at least eight times the maximum aggregate size, but not less than 6 in. [150 mm], or tapered to not less than six times maximum aggregate size. Do not drop concrete more than 5 feet [1.5 meters] without drop pipes.

3.06 CONCRETE ACCEPTANCE:

A. The Contractor shall accept or reject each batch of concrete delivered to the point of agitator or mixer truck discharge. The signature of a Contractor’s authorized representative on the delivery batch ticket shall indicate concrete acceptance.

B. The Contractor shall reject concrete delivered without a complete concrete delivery batch ticket as specified herein. The concrete supplier will furnish copies of the signed batch ticket to the Contractor and Engineer.

C. The Owner’s testing agency shall perform field tests at the point of agitator or mixer truck discharge. Accept or reject concrete on the basis of conformity with slump, air content and temperature specified.

D. The Owner’s testing agency shall inspect concrete transit truck's barrel revolution counter and gauge for measuring water added to the concrete. Reject concrete which exceeds the maximum barrel revolution of 300 or which has water content exceeding the specified water-cement ratio.

E. The Contractor shall reject concrete exceeding the time or temperature limitations specified.

F. The Contractor shall reject concrete not conforming to specification before discharging into the forms.

3.07 PLACING:

A. Intentionally roughen surfaces of set concrete in a manner to expose bonded aggregate uniformly at all joints where keys or keyways are not provided.

B. Deposit concrete into its final position in conformance with ACI 304R and as specified herein. Place concrete in horizontal layers 1-1/2 to 2 feet [450 to 600 mm] thick
maximum completely across forms. Avoid inclined layers and cold joints. Place concrete at lower portion of slope first on sloping surfaces.

1. Do not deposit partially hardened concrete in forms. Retempering of partially hardened concrete is not permitted. Remove all partially hardened concrete from site at no additional compensation.

2. Do not allow concrete to fall freely in forms to cause segregation (separation of coarse aggregate from mortar). Do not move concrete horizontally more than four feet from point of discharge. Space points of deposit not more than eight feet apart.

3. Do not splash forms and reinforcing above level of concrete being placed. Regulate placing of concrete so that pressure caused by wet concrete will not distort or deflect forms beyond finish tolerances specified in Section 03100 – CONCRETE FORMWORK or result in leakage of the cement paste.

C. Pump Concrete:

1. Use equipment and procedures and schedule deliveries to maintain steady flow of concrete at the discharge end of pipe.

2. Maintain concrete properties of slump, air content and temperature. Make adjustments in concrete proportions as necessary to provide concrete properties in accordance with the approved concrete design mix and as specified herein.

3. Do not pump concrete through aluminum piping.

4. Use pipe having a diameter at least three times the maximum coarse aggregate size, but no less than 4 in.

5. Take samples at the point of agitator or mixer truck discharge.

6. Furnish labor and assistance as required by the testing laboratory in obtaining and handling test specimens.

D. Consolidation:

1. Consolidate concrete using mechanical vibrators operated within the mass of concrete and/or on the forms conforming to procedures set forth in ACI 309R and as specified herein.

2. Conduct vibration in a systematic manner with regularly maintained vibrators. Furnish sufficient backup units at job site. Use vibrators having minimum frequency of 8,000 vibrations per minute and of sufficient amplitude to
consolidate concrete. Use not less than one vibrator with crew for each 35 to 40 cubic yards [25 to 30 cubic meters] of concrete placed per hour.

3. Insert and withdraw vibrator vertically at a uniform spacing over the entire area of placement. Space distances between insertions such that spheres of influence of each insertion overlap.

4. Place concrete in horizontal lifts. Insert vibrator rapidly to bottom of layer, and at least six inches into underlying layer. Hold stationary for several seconds, and then withdraw at a rate of about 3 inches [75 mm] per second. Conduct vibration to produce concrete of uniform texture and appearance, free of honeycombing, streaking, cold joints or visible lift lines.

5. Use additional vibration with pencil vibrators on vertical surfaces and on all exposed concrete to bring full surface of mortar against the forms so as to eliminate air voids, bug holes and other surface defects. Employ the following additional procedures for vibrating concrete as necessary to maintain proper consolidation of concrete:

a. Reduce distance between internal vibration insertions and increase time for each insertion.

b. Insert vibrator as close to face of form as possible without contacting form or reinforcement.

c. Thoroughly vibrate area immediately adjacent to waterstops without damaging the waterstop.

d. Use spading as a supplement to vibration where particularly difficult conditions exist.

3.08 TESTING:

A. General:

1. The Owner’s testing agency will use concrete samples provided by the Contractor at the point of agitator or mixer truck discharge to perform slump, air content, and temperature tests and for field control test specimens.

B. Notification of Delivery:

1. Notify the Engineer of concrete deliveries a minimum of 48 hours in advance of the scheduled placement. Include within this notification, the mix design and quantity of concrete, method and location of placement, frequency of trucks, ordered slump and time of initial delivery. The Contractor shall also notify the Owner’s testing laboratory firm of scheduled concrete deliveries.
2. Place concrete during normal working hours whenever possible. Notify the Engineer of special conditions at least 48 hours in advance of placement when concrete placement schedules require concrete placement at times other than during normal working hours.

3. Furnish delivery batch ticket to the representative from the owner’s testing laboratory or to the Engineer’s representative in the field with each batch delivered to the discharge locations in conformance with ASTM C 94. Batch tickets shall be written in ink or computer printed. Batch tickets bearing any information written in pencil will be sufficient cause for rejection of the load.

4. Batch tickets shall include the following information:
   a. Load number, truck number and driver's name
   b. Strength of concrete (compression strength)
   c. Amount of concrete (cu. yds. [cu. meters])
   d. Time truck was charged with cement
   e. Revolution counter reading at first addition of water
   f. Type, brand and amount of cement
   g. Type, brand and amount of admixtures
   h. Information necessary to calculate total mixing water
   i. Maximum size of aggregate
   j. Weights of fine and coarse aggregates
   k. Signature of ready-mix representative
   l. Concrete temperature at batching plant
   m. Type and amount of fly ash, pozzolan or ground granulated blast-furnace slag.

C. Test Measurements at Discharge:
   1. The Owner’s testing laboratory firm will take measurement of concrete slump, air content and temperature for each load of concrete. The laboratory firm will
conduct the slump, air content and temperature test measurements in conformance
with ASTM C 143, ASTM C 231, and ASTM C 1064, respectively.

2. The Owner’s testing laboratory firm will submit test reports of concrete field
measurements specified above to the Contractor and to the Engineer.

D. Control Test Specimens:

1. The Owner’s testing laboratory firm will cast a minimum of one set of four field
control test specimens in conformance with ASTM C 31 for each 50 cu. yd. [38
cu. meters] of each mix design of concrete but not less than once a day nor less
than once for each 5,000 sq. ft. [450 sq. meters] of surface area of foundation
mats, base slabs, footings, pile caps, slabs on grade, grade beams, walls, or
elevated slabs.

2. Laboratory personnel will record truck and load number from the delivery batch
ticket, the concrete placement location of each specimen, the date, concrete
strength, slump, air content and temperature.

3. The Contractor shall furnish tightly constructed 6 in. [150 mm] diameter by 12 in.
[300 mm] long nonabsorbent test cylinder molds. Use molds of same type and
manufacture for all test specimens. Leave molds on cylinders until received in
testing laboratory.

4. The Contractor shall furnish boxes for initial curing of test cylinders in
conformance with ASTM C 31 from time of fabrication until they are transported
to the testing laboratory.

5. The Owner’s testing agency will compression test one of each set of four
specimens at seven days. Immediately notify the Contractor and the Engineer if
the seven day strength is deficient. Test two of the remaining cylinders at twenty
eight days for concrete strength acceptance. The acceptance test result is the
average of the strengths of the two specimens tested at 28 days. The laboratory
firm shall submit compression test results of the control test specimens to both the
Contractor and the Engineer. The fourth cylinder shall be held for testing at 56
days only if the 28 day cylinder strengths are deficient. The fourth cylinder of
each set shall be discarded if the 28 day strengths exceed the specified minimum.

6. The Contractor may take field control test specimens for small quantities of
concrete only if approved by the Engineer.
E. Concrete Coring:

1. The Contractor will be directed by the Engineer to take concrete cores at least 2 inches [50 mm] in diameter from the structure in conformance with ASTM C 42 should the control test specimen's compression test fail to be in compliance with the Contract Documents or if the Engineer detects deficiencies in the concrete.

2. Obtain at least three representative cores from each member or area of concrete that is considered potentially deficient.

3. Obtain additional cores to replace cores that show evidence of having been damaged subsequent to or during removal from the structure.

4. The Engineer will determine the core locations.

5. Remove all anchors used to secure coring machine to concrete and patch holes as specified herein.

6. The Owner’s testing laboratory firm shall compression test the cores taken from the structure in conformance with ASTM C 39. The Owner’s testing laboratory firm will submit test strength test results of cores specified above to the Contractor and to the Engineer.

7. All costs associated with coring and testing by the Owner’s testing laboratory will be borne by the Contractor at no additional cost to the Owner.

F. Load Testing:

1. The Contractor will be directed by the Engineer to conduct a load test of the structure in conformance with ACI 318 under the direction of the Owner’s testing firm should compression tests of concrete cores taken from the structure fail to be in compliance with ACI 301 and ACI 318.

2. The structure will be removed from the site and replaced should the load test fail. All costs associated with testing, removal and replacement of the structure will be borne by the Contractor at no additional cost to the Owner.

3.09 CURING AND PROTECTION:

A. General:

1. Protect concrete from premature drying, hot or cold temperatures, and mechanical injury, beginning immediately after placement and maintain concrete with minimal moisture loss at relatively constant temperature.
2. Comply with curing procedures set forth in ACI 301, ACI 308 and as specified herein.

3. Perform hot weather concreting in conformance with ACI 305R and as specified herein when the ambient atmospheric temperature is 80 °F [25 °C] or above.

4. Perform cold weather concreting in conformance with ACI 306R and as specified herein when the ambient atmospheric temperature is 40 °F [5 °C] or below.

5. Concrete required to be moist cured shall remain moist for the entire duration of the cure. Repeated wetting and drying cycles of the curing process will not be allowed.

B. Duration:

1. Start initial curing after placing and finishing concrete as soon as free moisture has disappeared from unformed concrete surfaces. Initial curing starts as soon as concrete achieves final set. Forms left tightly in place are considered as part of the curing system, provided that wooden forms are kept continuously moist. Keep continuously moist for not less than 72 hours.

2. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301 procedures for a total curing period, initial plus final, of at least 10 days.

3. Avoid rapid drying at the end of the final curing period

C. Curing Requirements:

1. Unformed Surfaces: Cover and cure entire surface of newly placed concrete immediately after completing finishing operations and water film has evaporated from surface or as soon as marring of concrete will not occur. Protect finished slabs from direct rays of the sun to prevent checking, crazing and plastic shrinkage.

2. Formed Surfaces: Minimize moisture loss for formed surfaces exposed to heating by the sun by keeping forms wet until safely removed. Keep surface continuously wet by warm water spray or warm water saturated fabric immediately following form removal.

3. Water containment and below Grade Structures: Moist cure by the application of water to maintain the surface in a continually wet condition. Use water that is free of impurities that could etch or discolor exposed concrete surfaces.
4. Other concrete: Moisture-retaining cover curing, or by the use of curing compound. Use curing compound for water containment and below grade structures only in cold weather after the initial curing period or when approved by the engineer, in writing.

D. Curing Methods

1. Water Curing: Use warm water curing for unformed surfaces. Continuously water cure all exposed concrete for the entire curing period. Provide moisture curing by any of the following methods:
   a. Keeping the surface of the concrete continuously wet by ponding or immersion.
   b. Continuous water-fog spray or sprinkling.
   c. Covering the concrete surface with curing mats, thoroughly saturating the mats with water, and keeping the mats continuously wet with sprinklers or porous hoses. Place curing mats so as to provide coverage of the concrete surfaces and edges, with a 4-inch lap over adjacent mats. Weight down the curing cover to maintain contact with the concrete surface, as necessary.

2. Sealing Materials:
   a. Use common sealing materials such as plastic film or waterproofing (kraft) paper when approved by the Engineer.
   b. Lap adjacent sheets a minimum of 12 inches [500 mm]. Seal edges with waterproof tape or adhesive. Use sheets of sufficient length to cover sides of concrete member.
   c. Place sheet materials only on moist concrete surfaces. Wet concrete surface with fine warm water spray if the surface appears dry before placing sheet material.
   d. The presence of moisture on concrete surfaces at all times during the prescribed curing period is proof of acceptable curing using sheet material.

3. Membrane Curing Compound:
   a. Provide a copy of manufacturer’s certification that the curing compound meets the requirements of ANSI/NSF 61 for concrete surfaces that will be in contact with potable water.
b. Apply membrane-curing compound uniformly over concrete surface by means of roller or spray at a rate recommended by the curing compound manufacturer, but not less than 1 gallon per 150 sq. ft. [1 liter per 4 sq. meters] of surface area. Agitate curing material in supply container immediately before transfer to distributor and thoroughly agitate it during application for uniform consistency and dispersion of pigment.

c. When curing compound is authorized for application to liquid retaining or below grade members, it shall be applied at the manufacturer’s recommended coverage rate and then applied again at the same rate to provide twice the recommended coverage.

d. Do not use curing compounds on construction and expansion joints or on surfaces to receive liquid hardener, dustproofer/sealer, concrete paint, tile, concrete fills and toppings or other applications requiring positive bond.

e. Reapply membrane-curing compound to concrete surfaces that have been subjected to wetting within 3 hours after curing compound has been applied by method for initial application.

f. Maintain the continuity of the coating and repair damage to the coating during the entire curing period.

E. Protection from environmental conditions: Maintain the concrete temperature above 50 degrees F [10 degrees C] continuously throughout the curing period. Make arrangements before concrete placing for heating, covering, insulation or housing as required to maintain the specified temperature and moisture conditions continuously for the curing period.

1. When the atmospheric temperature is 80 degrees F and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation of wind breaks or shading, and for fog spraying, wet sprinkling, or moisture-retaining covering.

2. Protect the concrete continuously for the entire curing period.

3. Maintain concrete temperature as uniformly as possible, and protect from rapid atmospheric temperature changes.


F. Protection from physical injury: Protect concrete from physical disturbances such as shock and vibration during curing period. Protect finished concrete surfaces from
damage by construction equipment, materials, curing procedures and rain or running water. Do not load concrete in such a manner as to overstress concrete.

G. Protection from Deicing Agents: Do not apply deicing chemicals to concrete.
3.10 REPAIR:

A. General: Repair all surface defects immediately after form removal. Surface defects include tie holes, air voids and bug holes with a nominal diameter or depth greater than 1/4 inch [6 mm], honeycombed areas, visible construction joints, fins, burrs, color and texture variations and other defects as determined by the Engineer. Make concrete repairs in concrete surfaces to produce a uniform color and texture and free of all irregularities.

B. Surface defects in all concrete surfaces that in the opinion of the engineer adversely affect the durability of the concrete shall be repaired per the requirements of this section. Such surface defects that require repair include all visible cracks in tank floors and walls and the exterior envelope of structures below grade, regardless of width; and cracks in all other areas in excess of 0.02-inch wide, honeycomb, rock pockets, holes left by tie rods and bolts, and spalls.

C. Repair of Cracks:
   1. Cracks, which have resulted from overstress conditions and are structural in nature, shall be pressure grouted using an injectable epoxy.
   2. Cracks in liquid retaining or below grade members, which have resulted from shrinkage stresses and show any sign of leakage, or are positioned such that leakage cannot be observed, shall be pressure grouted using a hydrophilic resin.
   3. Cracks in other members, which have resulted from shrinkage stresses and exceed 0.020 inch in width shall be pressure grouted using a hydrophilic resin.
   4. Apply crack repair materials in accordance with the manufacturer’s directions and recommendations.

D. Repair of Defective Areas:
   1. Remove rock pockets, honeycombed and other defective concrete down to sound concrete. Chisel edges a minimum of 1 inch [25 mm] deep perpendicular to the surface or slightly undercut. Do not feather edges.
   2. Dampen the area to be patched and area at least 6 inches [150 mm] wide surrounding it for at least 24 hours to prevent absorption of water from patching mortar.
   3. Concrete repair material shall be a prepackaged polymer-modified cementitious repair mortar with the following minimum properties:
b. Compressive strength at 28 days: 6000 psi (ASTM C 109).

c. Bond strength at 28 days: 1800 psi (ASTM C 882 modified).

d. Provide a copy of manufacturer’s certification that the repair material meets the requirements of ANSI/NSF 61 for concrete surfaces that will be in contact with potable water.

4. Use no more mixing water than necessary for handling and placing. Mix patching mortar and allow to stand with frequent manipulation with a trowel, without addition of water, until it has reached stiffest consistency that will permit placing.

5. Brush bond coat of neat cement well into surface after surface water has evaporated from area to be patched. Consolidate mortar into place and strike off so as to leave patch slightly higher than surrounding surface to permit initial shrinkage. Leave patch undisturbed for at least 1 hour before final finish. Keep patched area damp for a minimum of 7 days.

E. Tie Holes: Fill tie holes solid with non-shrink, non-metallic patching mortar after cleaning and dampening.

F. Core Holes: Roughen concrete surface, clean and dampen for at least 24 hours. Fill core holes with the specified repair mortar. Wet cure for 7 days after placement. Fill anchor holes completely with non-shrink, non-metallic patching mortar after cleaning and dampening.

G. Final determination as to acceptability of concrete finishes and repair of surface defects will be made by Engineer.

3.11 FINISHES:

A. General: Dusting with dry cement or other mixtures or water addition during finishing is not permitted.

B. Formed Surfaces:

1. Provide rough form finish on concrete surfaces not exposed to view

2. Provide smooth form finish on interior surfaces of tank or containment walls.

3. Provide smooth form rubbed finish on concrete surfaces exposed to view.

C. Unformed Surfaces:

1. Provide float finish to surfaces scheduled to receive waterproofing, roofing, insulation, or sand-bed terrazzo.
2. Provide scratched finish to surfaces scheduled to receive concrete fills and toppings.

3. Provide steel-trowel finish to all top, horizontal and inclined surfaces not otherwise specified or indicated. This includes concrete fills and toppings and floors. Provide hand steel-trowel finish to all surfaces such as weirs or walls over which liquids will flow.

4. Provide broom finish to exterior walkways, exterior stairs, entrance platforms and loading docks.

D. Descriptions:

1. Rough Form Finish: Patch tie holes and defects. Chip or rub off fins exceeding 1/2 in. in height. Leave surfaces with the texture imparted by the forms.

2. Smooth Form Finish: Patch tie holes and defects. Remove fins flush with parent concrete and make necessary repairs. Wet and rub finned and repaired areas as described for smooth form rubbed finish, below.

3. Smooth Form Rubbed Finish: Patch tie holes and defects. Remove fins flush with parent concrete. Wet surface and rub with carborundum stone or other abrasive until uniform color and texture are produced. Complete rubbing not later than 24 hours after the curing period. Use no cement grout other than cement paste drawn from the concrete itself by the rubbing process.

4. Float Finish: Prepare surfaces by tamping to force coarse aggregate away from surface, screeding with straight edges to bring surfaces to required line. Begin floating with a hand float, a bladed power float equipped with float shoes, or a powered disk float when the bleed water sheen has disappeared and the surface has stiffened sufficiently to permit the operation.

5. Scratched Finish: Provide float finish then roughen the surface with stiff brushes or rakes before the final set.

6. Steel-Trowel Finish: Remove excess laitance from surfaces by tamping, screeding and magnesium or bull floating. Compact surface with motor-driven floats when slab has hardened so that water and fine material will not work to top and trowel smooth. Hand-trowel the surface smooth and free of trowel marks. Continue hand troweling until a ringing sound is produced as the floor is troweled. Leave surfaces with smooth hard finish free of blemishes.

7. Broom Finish: Steel-trowel surface then broom normal to direction of travel with to produce non-slip surface of uniform appearance.
3.12 METALWORK IN CONCRETE:

A. Secure castings, inserts, conduits and other metalwork encased in concrete to prevent metalwork from being displaced or deformed during concrete work.

B. Set anchor bolts by means of templates.

C. Build dovetail anchor slots into new concrete against which facing brick, concrete masonry units, tile, stone or any type ashlar is to be installed. Provide vertically at 16-in. [400 mm] centers where facing brick, etc., passes by concrete. Provide one continuous anchor slot where facing brick, etc., abuts the concrete work.

D. Aluminum embedded in concrete shall be coated to prevent galvanic corrosion with a zinc chromate primer and one of the following products:
   2. Tarmastic 100 by Porter Coatings Division, Porter Paint Co.
   3. 450 Heavy Tnemecol by Tnemec Company.
   4. Or equal.

3.13 MEASUREMENT AND PAYMENT:

Measurement and Payment will be as outlined in Section "Measurement and Payment" of Part 1, General Provisions.

END OF SECTION
SECTION 05120
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Structural steel.
   2. Deck support angles.
   3. Fabrication and installation inspection and testing.
   4. Grouting under base plates and bearing plates.

B. Related Sections:
   1. Section 01300 "Submittals"
   2. Section 01400 "Quality Control" for independent testing agency procedures and administrative requirements.
   3. Section 05500 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings and erection drawings shall not be made by using reproductions of Contract Drawings.

C. Shop Drawings: Show fabrication of structural-steel components.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment drawings.
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3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

5. Identify demand critical welds.

D. Structural steel members for which Shop Drawings have not been reviewed shall not be fabricated. Engineer’s review shall cover general locations, spacings and details of design. Omission from Shop Drawings of any materials required by the Contract Documents shall not relieve the Contractor of the responsibility of furnishing and installing such materials, even though such shop drawings may have been reviewed and returned.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and fabricator.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:
   1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   2. Direct-tension indicators.
   3. Tension-control, high-strength bolt-nut-washer assemblies.
   4. Shop primers.

F. Source quality-control reports.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
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1. Company specializing in performing the work of this section with a minimum of 5 years documented experience.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.

1. Company specializing in performing the work of this section with a minimum of 10 years documented experience.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.

2. AISC 360.

3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. Pre-installation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.

2. Clean and relubricate bolts and nuts that become dry or rusty before use.

3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.
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1.9 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.

B. Material for W-Shapes, Channels, Angles, Plates and Bars, Cold-Formed Hollow Structural Sections, and Steel Pipe: As specified in the Structural General Notes.

C. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade C, (ASTM A563M, Class 8S) heavy-hex carbon steel nuts; and ASTM F436 (ASTM F436M), Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959, Type 325 (ASTM F959M, Type 8.8), compressible-washer type with plain finish.

B. High-Strength Bolts, Nuts, and Washers: ASTM A490 (ASTM A490M), Type 1, heavy-hex steel structural bolt or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F436M), Type 1, hardened carbon-steel washers with plain finish.

1. Direct-Tension Indicators: ASTM F959, Type 490 (ASTM F959M, Type 10.9), compressible-washer type with plain finish.

C. Anchor Rods: ASTM F 1554, Grade 36, unless noted otherwise.

5. Finish: Plain.
D. Threaded Rods: ASTM A36/A36M.
   2. Washers: ASTM F436 (ASTM F436M), Type 1, hardened carbon steel.
   3. Finish: Plain.

E. Deformed Bar Anchors: ASTM A706, Grade 60.

2.3 PRIMER
   A. Primer: Comply with Division 09 painting sections.
   B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
   C. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 GROUT
   A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION
   A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
      1. Camber structural-steel members where indicated.
      2. Fabricate beams with rolling camber up.
      3. Identify high-strength structural steel according to ASTM A6/A6M and maintain markings until structural steel has been erected.
      4. Mark and match-mark materials for field assembly.
      5. Complete structural-steel assemblies, including welding of units, before starting shop priming or galvanizing operations.
   B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
      1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
   C. Bolt Holes: Cut, drill or punch standard bolt holes perpendicular to metal surfaces.
D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPCSP 2, "Hand Tool Cleaning."

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistant materials (applied fireproofing).
   5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
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1. SSPC-SP 2, "Hand Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPCPS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

2. Galvanize all exposed structural steel members and plates, with the exception of painted members.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
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1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
4. Radiographic Inspection: ASTM E 94.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of baseplate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
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4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer’s written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC’s "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

   1. Level and plumb individual members of structure.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated. Any member having a splice not shown and detailed on the approved Shop Drawings will be rejected.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

   1. Joint Type: Snug tightened, unless noted otherwise.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

   1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs], back gouge, and grind steel smooth.
   3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC’s "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.

1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
   a. Liquid Penetrant Inspection: ASTM E 165.
   b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   c. Ultrasonic Inspection: ASTM E 164.
   d. Radiographic Inspection: ASTM E 94.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" Section 099123 "Interior Painting."

PART 4 - MEASUREMENT AND PAYMENT

A. No separate payment shall be made to the CONTRACTOR for the work described in this Section. Payments made under the lump sum shall be considered as full compensation for these requirements.

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION:

A. These metal fabrication requirements apply to metal fabrications associated with the sunshade and pedestrian bridge abutments.

1.2 ACTION SUBMITTALS:

A. Product Data: For the following:
   1. Paint products.
   2. Non-shrink grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.3 INFORMATIONAL SUBMITTALS:

A. Welding certificates.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.4 QUALITY ASSURANCE:

A. Welding Qualifications: Qualify procedures and personnel according to AWS for each specification indicated.

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1, “Structural Welding Code - Steel.”

1.5 PROJECT CONDITIONS:

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.6 COORDINATION:
A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers’ written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.1 METALS, GENERAL:

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS:

A. As indicated.

2.3 FASTENERS:

A. General: Unless otherwise indicated, provide hot-dipped galvanized fasteners, washers, and nuts.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and flat washers.

2.4 MISCELLANEOUS MATERIALS:

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

1. Provide product manufactured by:
   a. Sherwin Williams.
   b. Tnemec.
   c. Approved equal.

C. Galvanizing Repair Paint: As specified.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by
manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL:

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200
mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS:

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer.

2.7 STEEL WELD PLATES AND ANGLES:

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.8 FINISHES, GENERAL:

A. Comply with NAAMM’s “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.9 STEEL AND IRON FINISHES:

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153 for steel and iron hardware and with ASTM A123 for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless otherwise indicated.
   1. Shop prime with zinc-rich primer indicated.
C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:


D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, “Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel,” for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL:

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

C. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS:

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers’ written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in “Installing Bearing and Leveling Plates” Article.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in “Installing Bearing and Leveling Plates” Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 FIELD QUALITY CONTROL:

A. Testing Agency: Engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Field-bolted connections will be tested and inspected according to RCSC's “Specification for Structural Joints Using ASTM A325 or A490 Bolts.”

C. Welded Connections: Field welds will be 100 percent visually inspected according to AWS D1.1 and D1.3.

1. Full penetration welds and other welds as specified: In addition to 100 percent visual inspection, 10 percent of connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
   a. Liquid Penetrant Inspection: ASTM E165.
   b. Magnetic Particle Inspection: ASTM E709; performed on root
pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

c. Ultrasonic Inspection: ASTM E164.
d. Radiographic Inspection: ASTM E94.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

1. Corrective measures shall be taken when welding is unsatisfactory or indicates inferior workmanship. Chip and grind if the removal of part of the weld or a portion of the base metal is required. Where deposition of additional weld material is necessary, the sides of the area to be welded shall have no less than one to one (1:1) slope to allow room for depositing new material. Correct defective or unsound welds by the removal and replacement of the entire weld using the following procedures:
   a. Excessive Convexity: Reduce to size by removal of excess weld metal by grinding.
   b. Shrinkage Cracks, Cracks in Base Metal, Craters and Excessive Porosity: Remove defective portions of base and weld material down to sound metal, and deposit additional sound material.
   c. Undercutting, Undersize, and Excessive Concavity: Clean and deposit additional weld metal.
   d. Overlapping and Incomplete Fusion: Remove and replace the defective portion of the weld.
   e. Slag Inclusion: Remove those parts of the welds containing slag. Fill with sound weld metal.
   f. Removal of Adjacent Base Metal during Welding: Clean and form full size by depositing weld material.

2. Remove cracked welds throughout their length.

3. Where work performed subsequently to the making of the deficient weld has rendered the weld inaccessible, or has caused new conditions which make connection of the deficiency dangerous or ineffectual, restore the original conditions by removing welds or members, or both before making the necessary corrections. Another option is to compensate for the deficiency with additional work according to the revised design, approved by the Engineer.

4. Cut apart and reweld improperly fitted and misaligned parts.

5. Straighten members distorted by heat of welding using mechanical means or by carefully supervised application of a limited amount of localized heat. Heated areas shall not exceed 1200 degrees Fahrenheit as measured by Tempilsticks. Parts to be heated for straightening shall be free from external stress forces, except when mechanical means are used in conjunction with heat application.

6. If faulty welding or its removal for rewelding damages the base metal so that, in the Engineer's judgment, it is not in accordance with the intent of the Contract
Documents, remove and replace the damaged material and compensate for the deficiency in a manner acceptable to the Engineer.

7. Maximum space between pieces or members for fillet welds shall be 1/16 inch. Only effective portion shall be considered in measuring fillet welds.

3.4 ADJUSTING AND CLEANING:

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness, but not less than that recommended by the coating manufacturer.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION