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Lake Tuscaloosa - Intake Crib Improvements Project
City of Tuscaloosa

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TECHNICAL SPECIFICATIONS FOR CONSTRUCTION OF THE

**LAKE TUSCALOOSA
INTAKE CRIB IMPROVEMENTS PROJECT**

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100% BID DOCUMENTS

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LAKE TUSCALOOSA – INTAKE CRIB IMPROVEMENTS PROJECT

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SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

- A. The Work to be performed under this Contract shall consist of furnishing all tools, equipment, materials, supplies, and manufactured articles and furnishing all labor, transportation, and services, including fuel, power, water, and essential communications, and performing all work, or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The Work shall be complete, and all work, materials, and services not expressly indicated or called for in the Contract Documents which may be necessary for the complete and proper construction of the Work in good faith shall be provided by the Contractor as though originally so indicated, at no increase in cost to the Owner.

1.02 THE WORK

- A. The Work consists of construction of improvements to the City of Tuscaloosa, Alabama's Lake Tuscaloosa intake and aerator valve intake. Elements of the work include, but are not limited to:
 - 1. Demolition and removal of the existing primary intake timber crib and rock ballast structure.
 - 2. Demolition and removal of the existing steel leaf screen guide rails.
 - 3. Construction of a new intake crib foundation and new stainless steel crib at the primary intake structure.
 - 4. Construction of a new galvanized steel intake crib at the existing aerator valve intake.
 - 5. All other elements of the work indicated on the drawings and in technical specifications.

1.03 LOCATION OF PROJECT

- A. The Work is located at Lake Tuscaloosa Dam, Tuscaloosa, AL 35406.

1.04 ACTIVITIES BY OTHERS

- A. Activities by others which may affect performance of work include:
 - 1. The Tuscaloosa County Park & Recreation Authority's (PARA) Rock Quarry landing boat ramp shall remain in operation during the construction. The contractor may use the boat ramp for launching boats, sectional barges, equipment and materials for the construction of marine portions of the work. Any full closures of the boat ramp and dock, or the access road to the dock and intake will require preapproval from the proper authorities and shall be limited in duration.
 - 2. The Contractor shall cooperate fully with all utility forces of the Owner or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the

Work, and shall schedule the Work so as to minimize interference with said relocation, altering, or other rearranging of facilities.

1.05 COORDINATION OF WORK

- A. The Contractor shall coordinate and cooperate fully with all utility forces of the Owner or forces of other public or private agencies engaged in the operations of the facilities where the work is to be performed and shall make all reasonable accommodations to maintain access and operability of the facilities when required by the Owner or other agencies.

1.06 CONTRACTOR USE OF PROJECT SITE

- A. The Contractor's use of the project site shall be limited to its construction operations and shall limit on-site storage of materials and equipment to items specifically needed and prepared for use or installation at the site. The contractor shall not limit public use of the access roads without preapproval by the Owner.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 02050 DEMOLITION

PART 1 GENERAL

1.1 THE REQUIREMENT

- A. The Contractor shall demolish and reconstruct all existing construction for the leaf screen guide rails, primary intake crib and aerator valve intake crib, as shown, and install all new structures and concrete as indicated, in accordance with the Contract Documents.

1.2 COORDINATION

- A. The Contractor shall carefully coordinate the Work in areas where existing facilities shall remain operational. The Drawings identify the major facility that shall be demolished and reconstructed.
- B. The Contractor shall note that the Drawings used to indicate demolition and reconstruction are based on record drawings of the existing facilities which have been reproduced to show existing conditions and to clarify the Scope of Work. The Contractor shall conduct a comprehensive survey at the Site to verify the correctness and exactness of the Drawings, the Scope of Work, and the extent of auxiliary utilities prior to the beginning of the Work
- C. While demolition and reconstruction are being performed, the Contractor shall provide adequate access for the continued operation and maintenance of the facilities as required by the Owner. The Contractor shall erect and maintain fences, warning signs, barricades, and other devices around the reconstruction as required for the protection of the Contractor's employees and the Owner's personnel at the sites. The Contractor shall remove all such protection when reconstruction activities are complete, or as Work progresses, or when directed by the Owner.

1.3 DEMOLITION

- A. Items to be removed at the site are summarized on the drawings.
 - 1. Demolish and remove existing steel leaf screen guide rails.
 - 2. Demolish and remove the existing wooden intake cribs.
 - 3. **Aerator Valve Intake Crib:** Remove all materials except the existing concrete pad before installing the new intake crib.
 - 4. **Intake Crib:** Demolish and remove existing wooden intake crib and rock ballast in each corner. Remove all materials before installing new intake crib.
- B. Existing structures and related appurtenances shown or required to be demolished as part of the Work shall be removed and disposed of unless otherwise indicated. Removed items shall be disposed of offsite by the Contractor or areas onsite identified and approved by the Owner.

1.4 REHABILITATION

- A. Existing civil, structural, and electrical Work disturbed or damaged by reconstruction activities shall be repaired and rehabilitated as indicated and at no additional costs to the Owner.
- B. Damaged items shall be repaired or replaced with new items, approved by the Owner, to restore damaged items or surfaces to a condition equal to and matching that existing prior to damage.

1.5 DISPOSAL

- A. The Contractor shall be responsible for the disposal of debris resulting from reconstruction in compliance with local, state, and federal codes and requirements.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Contractor shall provide materials as indicated on the Drawings and in the technical specifications.

PART 3 EXECUTION

3.1 GENERAL

- A. The Contractor shall coordinate demolition and reconstruction Work with the Owner and Engineer. Unless otherwise indicated, the Contractor shall be responsible for the sequence of activities. Work shall be performed in accordance with applicable safety rules and regulations.
- B. The Contractor shall ensure that any utilities connected to structures, equipment, and facilities to be removed, relocated, salvaged, replaced, or abandoned are rendered inoperable, replaced with new utilities, or adequately bypassed with temporary utilities before proceeding with demolition and reconstruction.
- C. The Contractor shall take precautions to avoid damage to adjacent facilities and to limit the Work activities to the extent indicated. If reconstruction beyond the Scope indicated is required, the Contractor shall obtain written approval from the Owner prior to commencing Work.

3.2 PROTECTION OF EXISTING FACILITIES

- A. Before beginning any reconstruction Work, the Contractor shall carefully survey the existing facilities and examine the Specifications and Drawings to determine the extent of reconstruction and coordination with the Work. Existing facilities not subject to reconstruction shall be protected and maintained. Damaged existing facilities shall be repaired to the previous condition or replaced.

- B. The Contract Documents indicate existing items to be demolished, and/or relocated. Auxiliary utilities including such services as water, air, drainage, and electrical wiring are not necessarily indicated. The Contractor shall verify the Scope of the Work to remove the items indicated. The removal of existing items for demolition, and relocation shall be completed at no additional cost to the Owner.

3.3 REHABILITATION

- A. Certain areas of existing structures, piping, conduits, and the like will be affected by Work necessary to complete modifications under this Contract. The Contractor shall be responsible to rehabilitate those areas affected by its construction activities.

3.4 DISPOSAL

- A. Demolition and removal of debris shall minimize interference with roads, walks, and other adjacent occupied or used facilities which shall not be closed or obstructed without permission from the Owner. Alternate routes shall be provided around closed or obstructed traffic ways.

3.5 CLEANING

- A. During and upon completion of Work, the Contractor shall promptly remove tools and equipment, surplus materials, rubbish, debris, and dust and shall leave areas affected by Work in a clean, approved condition.
- B. Adjacent structures shall be cleaned of dust, dirt, and debris caused by reconstruction, as directed by the Engineer or governing authorities, and adjacent areas shall be returned to condition existing prior to start of Work.

END OF SECTION

SECTION 03310
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The Contractor shall provide cast-in-place concrete, reinforcement and appurtenant Work, formwork, and supports, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Commercial Standards:

ACI 117	Standard Specifications for Tolerances for Concrete Construction Materials
ACI 214	Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 301	Specifications for Structural Concrete
ACI 304	Measuring, Mixing, Transporting, and Placing Concrete
ACI 305	Hot Weather Concrete
ACI 306	Cold Weather Concrete
ACI 315	Details of Concrete Reinforcement
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures
ACI 347	Recommended Practice for Concrete Formwork
ASTM A185	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A615	Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
ASTM C31	Standard Practice for Making and Curing Concrete
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94	Standard Specification for Ready-Mixed Concrete

ASTM C143	Standard Test Method for Slump of Hydraulic Cement Concrete
ASTM C150	Standard Specification for portland Cement
ASTM C156	Standard Test Method for Water Retention by Liquid Membrane-Forming Curing Compounds for Concrete
ASTM C157	Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
ASTM C192	Method For Making and Curing Test Specimens
ASTM C260	Standard Specification of Air-Entraining Admixtures for Concrete
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C920	Standard Specification for Electromeric Joint Sealants
ASTM C1077	Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D1752	Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
AASHTO T 260	Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete raw Materials
AASHTO T 303	Standard Method of Test for Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars Due to Alkali-Silica Reaction
IBC 1704	Special Inspections

1.3 CONTRACTOR SUBMITTALS

A. Mix Design & Shop Drawings:

1. Mix Designs: Prior to beginning the Work, submit proposed concrete mix designs which shall show the proportions and gradations of materials proposed for each class and type of concrete. The mix designs shall be checked by an independent testing laboratory acceptable to the Engineer. Costs related to such checking shall be the Contractor's responsibility. When a water reducing admixture is to be used, the Contractor shall furnish mix designs for concrete both with and without the admixture.

2. Provide the following Submittals in Accordance with ACI 301:
 - a. Mill tests for cement
 - b. Admixture Certification (Chloride ion content shall be included.)
 - c. Aggregate gradation and certification
 - d. Materials and methods for curing
 3. Reinforcement fabrication, erection and placement drawings:
 - a. Shop bending diagrams, placing lists, and drawings of reinforcing steel prior to fabrication. Details of the concrete reinforcing steel and concrete inserts shall be submitted to Engineer for review and approval. Contractor shall allow a minimum of 14 days for review of submittal by Engineer. Include bar placement diagrams.
 - b. Shop drawings shall conform to ACI 315.
 - c. Placement drawings shall include location of reinforcement, water stops, anchor bolts and other items embedded in concrete that influences placement of reinforcement.
 4. Manufacturer's information demonstrating compliance with requirements of the following:
 - a. Preformed joint filler
 - b. Backing rod
 - c. Bond breaker
 - d. Form gaskets
 - e. Form release agent
 - f. List of form materials and locations of use
 5. Placement drawings showing the location and type of joints for each structure.
- B. **Delivery Tickets:** Where ready-mix concrete is used, the Contractor shall furnish certified delivery tickets at the time of delivery of each load of concrete. Each ticket shall show the state certified equipment used for measuring, and the total quantities, by weight, of cement, sand, each class of aggregate, admixtures, the amounts of water in the aggregate, added at the batching plant, and the amount allowed to be added at the Site for the specific design mix. In addition, each certificate shall state the mix number, total yield in cubic yards, and the time of day to the nearest minute, corresponding to the time when the batch was dispatched, when it left the plant, when it arrived at the Site, when unloading began, and when unloading was finished.
- C. **Underwater Concrete Placement Plan:** The Contractor shall submit their proposed underwater concrete placement plan to the Engineer for review and approval. Contractor shall allow a minimum of 14 days for review of submittal by the Engineer. The placement plan shall include all equipment proposed for mixing, batching and depositing the concrete to the locations identified within the Contract Documents along with the Contractors proposed plan for placement.

1.4 QUALITY ASSURANCE

A. Testing of Materials:

1. Tests on component materials and for compressive strength and shrinkage of concrete will be performed as indicated herein. Tests for determining slump will be in accordance with the requirements of ASTM C143.
2. Testing for aggregate shall include sand equivalence, reactivity, organic impurities, abrasion resistance, and soundness in accordance with ASTM C33 and AASHTO T260.
3. The cost of laboratory tests on cement, aggregates, and concrete, will be borne by the Contractor and the Contractor shall pay the cost of any additional tests and investigations on Work that does not meet the Specifications. The laboratory will meet or exceed the requirements of ASTM C1077.
4. Concrete for testing shall be furnished by the Contractor at no additional cost to the Owner, and the Contractor shall be responsible for obtaining samples, testing and disposal and cleanup of excess material under the supervision of the Engineer.

B. Field Compression Tests:

1. Compression test specimens shall be taken during construction from the first placement of each class of concrete and at intervals selected by the Engineer to ensure continued compliance with these Specifications. Each set of test specimens will be a minimum of 6 cylinders.
2. Compression test specimens for concrete will be made in accordance with Section 9.2 of ASTM C31. Specimens will be 4-inches diameter by 8-inches high cylinders.
3. Compression tests will be performed in accordance with ASTM C39. Two (2) test cylinder will be tested at seven (7) Days and three (3) at 28 Days. The remaining cylinder will be held to verify test results, if needed.

C. Evaluation and Acceptance of Concrete:

1. Evaluation and acceptance of the compressive strength of concrete will be according to the requirements of ACI 318 and ACI 350.
2. If any concrete fails to meet these requirements, immediate corrective action shall be taken to increase the compressive strength for subsequent batches of the type of concrete affected.
3. Concrete that fails to meet the ACI requirements and these Specifications is subject to removal and replacement as part of the Work.

D. **Construction Tolerances:** The Contractor shall set and maintain concrete forms and perform finishing operations so that the concrete is within the tolerances herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the permissible variation from lines, grades, or dimensions indicated. Where tolerances are not indicated, permissible deviations will be in accordance with ACI 117.

1. The variation from required lines or grades shall not exceed 1/4-inch in 10-feet and there shall be no offsets or visible waviness in the finished surface.

PART 2 - PRODUCTS

2.1 FORM AND FALSEWORK MATERIALS

- A. Form materials shall be welded ½" carbon steel bent plate. Material shall not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade required. Metal forms shall be an approved type that will accomplish such results.

2.2 FORM TIES (NOT USED)

- A. Form ties shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties or other removable form-tie fasteners having a circular cross-section shall not exceed 1-1/2 inches; and such fasteners shall be such as to leave holes of regular shape for reaming. Form ties shall be **Hex Head Snap Tie** by **MeadowBurke**, **Snap Ties** by **Dayton Superior**, or equal.

2.3 REINFORCING STEEL

- A. **General:** Reinforcing steel for cast-in-place reinforced concrete construction shall conform to the following requirements:
 - 1. Bar reinforcement shall conform to the requirements of ASTM A615 for Grade 60 Billet Steel Reinforcement, unless otherwise indicated.
- B. Accessories:
 - 1. Include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position and secure reinforcement during concrete placement. Bar supports shall conform to CRSI Manual of Standard Practice. Wire bar supports shall be CRSI Class 1 for maximum protection with a 1/8-inch minimum thickness of plastic coating which extends at least 1/2-inch from the concrete surface. Plastic shall be gray in color.
 - 2. Concrete blocks (dobies) used to support and position reinforcing steel shall have the same or higher compressive strength as required for the concrete in which they are located. Wire ties shall be embedded in concrete block bar supports.

2.4 CONCRETE MATERIALS

- A. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. Cement shall be used in the order that it is received.
- B. Materials for the Work shall conform to ACI 301.
- C. Storage of materials shall conform to ACI 301.
- D. Materials for concrete shall conform to the following requirements:

1. Cement shall be standard brand portland cement conforming to ASTM C150 - portland cement for Type II or Type V.
2. Fly Ash shall be non-staining conforming to ASTM C618, Class F, suitable to provide hardened concrete of uniform light gray color.
3. Water shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts, and other impurities. The water shall be considered potable, for the purposes of this Section only, if it meets the requirements of the local governmental agencies. Agricultural water with high total dissolved solids (over 1000 mg/l TDS) shall not be used.
4. Aggregates shall be obtained from pits acceptable to the Engineer, shall be non-reactive, and shall conform to ASTM C33. Maximum size of coarse aggregate shall be as indicated. Lightweight sand for fine aggregate will not be permitted.
5. Ready-mix concrete shall conform to the requirements of ASTM C94.
6. Admixtures: All admixtures shall be compatible and by a single manufacturer capable of providing qualified field service representation. Admixtures shall be used in accordance with manufacturer's recommendations. If the use of an admixture is producing an inferior end result, the Contractor shall discontinue use of the admixture. Admixtures shall not contain thiocyanates nor more than 0.05 percent chloride ion, and shall be non-toxic after 30 days.
 - a. Air-entraining agent meeting the requirements of ASTM C260, shall be used at the Contractor's option. The Owner reserves the right, at any time, to sample and test the air-entraining agent received on the job by the Contractor. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement. Air content shall be tested at the point of placement. Air entraining agent shall be **Master-Air AE 200** by **Master Builders**, **Daravair** by **W.R. Grace**, **Sika AEA-14** by **Sika Corporation**, or equal.
 - b. Set controlling and water reducing admixtures: Admixtures may be added at the Contractor's option to control the set, effect water reduction, and increase workability. The addition of an admixture shall be at the Contractor's expense. The use of an admixture shall be subject to acceptance by the Engineer. Concrete containing an admixture shall be first placed at a location determined by the Engineer. Admixtures specified herein shall conform to the requirements of ASTM C494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used.
 - 1) Concrete shall not contain more than one water reducing admixture. Concrete containing an admixture shall be first placed at a location determined by the Engineer.

- 2) Set controlling admixture shall be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently over 80 degrees F, a set retarding admixture such as **Plastocrete 161 by Sika Corporation; Daratard 17 by Grace Construction Products**; or equal shall be used. Where the air temperature at the time of placement is expected to be consistently under 40 degrees F, a non-corrosive set accelerating admixture such as **Plastocrete 161FL by Sika Corporation, Master Builder MasterSet FP 20, Polarset by Grace Construction Products**, or equal may be used.
- 3) Normal range water reducer shall conform to ASTM C494, Type A. **WRDA 82 by Grace Construction Products; Plastocrete 161 by Sika Corporation**; or equal. The quantity of admixture used and the method of mixing shall be in accordance with the Manufacturer's instructions and recommendations.
- 4) High range water reducer shall conform to ASTM C494, Type F or G. **Plastol 5000 by Euclid Chemical Company**; or equal. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified. No more than 14 ounces of water reducer per sack of cement shall be used. Water reducer shall be considered as part of the mixing water when calculating water cement ratio. The water reducer may include super-plasticizer at the Contractor's option.
- 5) Concrete shall be mixed at mixing speed for a minimum of 30 mixer revolutions after the addition of the high range water reducer.
 - c. Anti-washout admixtures: Admixtures must be added to make the mixture more cohesive and less prone to washout. The addition of an admixture shall be at the Contractor's expense. The use of an admixture shall be subject to acceptance by the Engineer. Anti-washout admixture shall be **Siksament-100SC y Sika Corporation; MasterMatrix UW 450 by Master builders**; or equal.
7. Calcium Chloride: Calcium chloride will not be permitted in concrete.

2.5 GROUT (NOT USED)

A. Cement Grout

1. **Cement Grout:** Cement grout shall be composed of one-part cement, three parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white Portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 4000 psi.
2. Cement grout materials shall be as specified in this Section.

B. Prepackaged Grouts

1. Non-Shrink Grout:

- a. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout specified herein shall be that recommended by the Manufacturer for the particular application.
- b. Non-shrink grouts shall have a minimum 28-day compressive strength of 5000 psi; shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested in accordance with CRD C621.

C. Consistency

1. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.
2. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed 4-inches.

D. Measurement of Ingredients

1. Measurements for cement grout shall be made accurately by volume using containers.
2. Shovel measurement shall not be allowed.
3. Prepackaged grouts shall have ingredients measured by means recommended by the Manufacturer.

2.6 JOINT MATERIALS (NOT USED)

A. Materials for joints in concrete shall conform to the following requirements:

1. Sponge rubber joint filler material shall be of the preformed non-extruding type joint filler constructed of cellular neoprene sponge rubber or polyurethane of firm texture. Bituminous fiber type will not be permitted. Non-extruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D1752; for Type I, except as otherwise indicated.
2. Elastomeric joint sealers:
 - a. Two component, self leveling, polyurethane or polysulfide sealant conforming to Federal Specification TT-S-227E, Class A, Type 1 and ASTM C920, Type M, Class 25, Grade P.
 - 1) SikaFlex 2cNs by Sika Corporation
 - 2) Chem-Calk 500 by Bostic, or equal.

- b. One component, self-leveling, polyurethane or polysulfide sealant conforming to Federal Specification TT-S-230C, Class A, Type 1, and ASTM C920, Type S, Class 25, Grade P.
 - 1) SikaFlex-15LM by Sika Corporation
 - 2) Vulkem 45 by Tremco, or equal.
 - c. One component, gun grade polyurethane based, non sag, vertical and horizontal sealant.
 - 1) Vulkem 116 by Tremco
 - 2) Vulkem 921 by Tremco
 - 3) SikaFlex-15LM by Sika Corporation
 - 4) SikaFlex 1A by Sika Corporation, or equal.
3. Mastic joint sealer shall be a material that does not contain evaporating solvents; that will tenaciously adhere to concrete surfaces; that will remain permanently resilient and pliable; that will not be affected by continuous presence of water and will not in any way contaminate potable water; and that will effectively seal the joints against moisture infiltration even when the joints are subject to movement due to expansion and contraction. The sealer shall be composed of special asphalts or similar materials blended with lubricating and plasticizing agents to form a tough, durable mastic substance containing no volatile oils or lubricants and shall be capable of meeting the test requirements set forth hereinafter, if testing is required by the Engineer.
- B. Preformed joint filler (PJF) shall be a non-extruding resilient, bituminous type conforming to the requirements of ASTM D1751.

2.7 CONCRETE DESIGN REQUIREMENTS

A. General:

- 1. Concrete shall be composed of cement, admixtures, aggregates, and water of the qualities indicated. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage, and where deposited in forms, to have good consolidation properties and maximum smoothness of surface. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the Owner. Mix changes shall be subject to review by the Engineer.
- 2. The Contractor is cautioned that the limiting parameters below are **NOT** a mix design. Admixtures may be required to achieve workability required by the Contractor's construction methods and aggregates. The Contractor is responsible for providing concrete with the required workability.

B. Proportioning and Compressive Strength:

- 1. General:

- a. Proportion ingredients to produce a mixture which will work readily into corners and angles of forms and around reinforcement by methods of placement and consolidation employed without permitting materials to segregate or excessive free water to collect on surface.
 - b. Proportion ingredients to produce proper workability, durability, strength and other required properties.
2. The minimum compressive strength and cement content of concrete shall be not less than the following tabulation.

Type of Work	Class of Concrete Min 28-Day Compressive Strength, psi	Max Size Aggregate, in	Cement Content Per cu yd, lbs	Max W/C Ratio (by weight)
Structural concrete	4,000	3/4	564 to 600	0.45

3. Fly ash:
- a. 25 percent by weight of Portland cement content per cubic yard shall be replaced with fly ash at a rate of 1 LB fly ash for 1 LB cement.
 - b. The water to fly ash plus cement ratio shall not exceed the maximum water cement ratio specified in this Section.

2.8 CONSISTENCY

- A. Consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C143. The slumps shall be 7-inches plus or minus 1-inch.

2.9 MEASUREMENT OF CEMENT AND AGGREGATE

- A. The amount of cement and of each separate size of aggregate entering into each batch of concrete shall be determined by direct weighing equipment furnished by the Contractor and acceptable to the Engineer; provided that, where batches are so proportioned as to contain an integral number of conventional sacks of cement and the cement is delivered at the mixer in the original unbroken sacks, the weight of the cement contained in each sack may be taken without weighing as 94 pounds.

2.10 MEASUREMENT OF WATER

- A. The quantity of water entering the mixer shall be measured by a suitable water meter or other measuring device that is acceptable to the Engineer and capable of measuring the water in variable amounts within a tolerance of one percent.

2.11 READY-MIXED CONCRETE

- A. At the Contractor's option, ready-mixed concrete shall be used. Materials, batching, mixing, transporting, placing, shall conform to ASTM C94 and this specification.

- B. Ready-mixed concrete shall be delivered to the Work, and discharge shall be completed within one hour after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever comes first. In hot weather, under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes.
- C. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counter shall be actuated at the time of starting the mixer at mixing speed.
- D. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. Materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolutions of mixing.
- E. Each batch of ready-mixed concrete delivered to the Work shall be accompanied by a delivery ticket furnished to the Engineer in accordance with the requirements above.
- F. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the Engineer.

PART 3 - EXECUTION

3.1 EVALUATION OF CONCRETE, GROUT OR MORTAR TEST RESULTS

- A. Tests.
 - 1. Test results for standard molded and cured test cylinders to be evaluated separately for each mix design. Such evaluation shall be valid only if tests have been conducted in accordance with specified quality standards. For evaluation of potential strength and uniformity, each mix design shall be represented by at least three strength tests. A strength test shall be the average of two cylinders from the same sample tested at 28 days.
- B. Acceptance:
 - 1. Strength level of each specified compressive strength shall be considered satisfactory if both of the following requirements are met:
 - a. Average of all sets of three consecutive strength tests equal or exceed the required specified 28-day compressive strength.
 - b. No individual strength test falls below the required specified 28-day compressive strength by more than 500 psi.
 - 2. Shrinkage Limitation

- a. The maximum concrete shrinkage, as measured at 21-day drying age or at 28 day drying age, shall be 0.036 percent or 0.042 percent, respectively. The Contractor shall only use a mix design for construction that has first met the trial batch shrinkage requirements.
 - b. The maximum concrete shrinkage for specimens cast in the field shall not exceed average maximum shrinkage requirement by more than 25 percent.
 - c. If the required shrinkage limitation is not met during construction, the Contractor shall take any or all of the following actions, at no additional cost to the Owner, for securing the specified shrinkage requirements. These actions may include changing the source or aggregates, cement, and/or admixtures; reducing water content; washing of aggregate to reduce fines; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage.
3. Alkali-Silica Reactivity limitations:
- a. The maximum percentage increase in specimen length at 14 days shall not exceed 0.1 percent per AASHTO T 303.
 - b. Mix design shall be modified to show proportions of ASR inhibitor.
 - c. If the ASR limitation is not met during construction, the Contractor shall take any or all of the following actions, at no additional cost to the Owner, for securing the specified reactivity requirements. These actions may include changing the source or aggregates, cement, and/or admixtures; or other actions designed to minimize reactivity without deleterious effect on concrete properties.

3.2 GENERAL FORMWORK REQUIREMENTS

- A. Forms to confine and shape the concrete to the required lines shall be used wherever necessary. The Contractor shall assume full responsibility for the adequate design of forms as shown on the Contract Drawings, and any forms that are unsafe or inadequate in any respect shall promptly be removed from the Work and replaced. The design and inspection of concrete forms shall comply with applicable local, state and federal regulations. Design, construction, maintenance, and preparation of forms shall be in accordance with ACI 347.
- B. Forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing the concrete.

3.3 CONSTRUCTION

- A. **Vertical Surfaces:** Vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is indicated. Not less than 1-inch of concrete shall be added to the indicated thickness of a concrete member where concrete is permitted to be placed against trimmed ground in lieu of forms. Permission to do this on other concrete members will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

- B. **Construction Joints:** Concrete construction joints will not be permitted at locations other than those indicated, except as may be acceptable to the Engineer. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. Pipe stubs and anchor bolts shall be set in the forms where required.
- C. **Forms:** Concrete forms shall be fabricated from carbon steel as shown on the Contract Drawings. Once concrete is placed the steel form will not be removed. All anchors shall be welded to the form in the locations specified on the Drawings.

3.4 GENERAL REINFORCEMENT REQUIREMENTS

- A. Reinforcement steel and other appurtenances shall be fabricated and placed in accordance with the requirements of the ACI 318 and ACI 350 and the supplementary requirements indicated herein.

3.5 FABRICATION

- A. General:
 - 1. Reinforcement steel shall be accurately formed to the dimensions and shapes indicated, and the fabricating details shall be prepared in accordance with ACI 315, ACI 318, and ACI 350 except as modified by the Drawings.
 - 2. The Contractor shall fabricate reinforcement bars for structures in accordance with bending diagrams, placing lists, and placing drawings. Said drawings, diagrams, and lists shall be prepared by the Contractor.
 - 3. Unless otherwise indicated, dowels shall match the size and spacing of the spliced bar.
- B. **Bending or Straightening:** Reinforcement shall not be straightened or rebent in a manner that will injure the material. Bars shall be bent or straight as indicated. Do not use bends different from the bends indicated. Bars shall be bent cold unless otherwise permitted by the Engineer. No bars partially embedded in concrete shall be field-bent except as indicated or specifically permitted by the Engineer.

3.6 PLACING

- A. Reinforcement shall be accurately positioned as indicated and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. Reinforcement steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers that are strong and rigid enough to prevent any displacement of the reinforcement steel. Concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties which are embedded in the blocks. For concrete over formwork, the Contractor shall provide concrete, metal, plastic, or other acceptable bar chairs and spacers.

- B. The portions of accessories in contact with the formwork shall be made of concrete, plastic, or steel coated with a 1/8-inch minimum thickness of plastic which extends at least 1/2-inch from the concrete surface. Plastic shall be gray in color.
- C. Tie wires shall be bent away from the forms in order to provide the required concrete coverage.
- D. Bars additional to those indicated which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position shall be provided by the Contractor as part of the Work.
- E. Unless otherwise indicated, reinforcement placing tolerances shall be within the limits specified in ACI 318. The minimum spacing requirements of ACI 318 shall be followed for reinforcing steel.

3.7 SPLICING

- A. **General:** Reinforcement splices shall only be used at locations indicated. When it is necessary to splice reinforcement at points other than where indicated, the character of the splice shall be reviewed and accepted by the Engineer.
- B. Splices of Reinforcement
 - 1. The length of lap for reinforcement bars, unless otherwise indicated, shall be in accordance with ACI 318, for a Class B splice.
 - 2. Welded splices shall be performed in accordance with AWS D1.4.
 - 3. Laps of WWF shall be in accordance with ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

3.8 CLEANING AND PROTECTION

- A. Reinforcement steel shall always be protected from conditions conducive to corrosion until concrete is placed around it.
- B. The surfaces of reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcing shall be re-inspected and, if necessary recleaned.

3.9 PROPORTIONING AND MIXING

- A. **Proportioning:** Proportioning of the concrete mix shall conform to the requirements of ACI 301.
- B. **Mixing:** Mixing of concrete shall conform to the requirements of ACI 301.
- C. **Slump:** Slumps shall be as indicated herein.
- D. **Retempering:** Retempering of concrete or mortar which has partially hardened shall not be permitted.

3.10 PREPARATION OF SURFACES FOR CONCRETING

- A. **Placing Interruptions:** Excessive delays in placement can cause the concrete to stiffen and resist flow when placement resumes. Placement interruptions of approximately 30 minutes or less should allow restarting without any special procedures. Interruptions between 30 minutes and the initial setting time of the concrete should be treated by removing, resealing, and restarting the tremie. Interruptions of a duration longer than the concrete setting time should be treated as a construction joint.
- B. Embedded Items:
1. No concrete shall be placed until formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the Engineer at least 4 hours before placement of concrete. Surfaces of forms and embedded items that have become encrusted with dried grout from previous usage shall be cleaned before the surrounding or adjacent concrete is placed.
 2. Reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms at locations indicated or by Shop Drawings and shall be acceptable to the Engineer before any concrete is placed. Accuracy of placement is the responsibility of the Contractor.
- C. **Corrosion Protection:** Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2-inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.
- D. Anchor bolts shall be accurately set and shall be maintained in position by templates while being embedded in concrete.

3.11 HANDLING, TRANSPORTING, AND PLACING

- A. **General:** Placing of concrete shall conform to the applicable requirements of ACI 301 and the requirements of this Section. No aluminum materials shall be used in conveying any concrete.
- B. **Non-Conforming Work or Materials:** Concrete which during or before placing is found not to conform to the requirements indicated herein shall be rejected and immediately removed from the Work. Concrete which is not placed in accordance with these Specifications or which is of inferior quality shall be removed and replaced at the expense of the Contractor.
- C. **Unauthorized Placement:** No concrete shall be placed except in the presence of a duly authorized representative of the Engineer. The Contractor shall notify the Engineer in writing at least 24 hours in advance of placement of any concrete.

- D. **Temperature of Concrete:** The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 40 degrees F in moderate weather, and not less than 50 degrees F in weather during which the mean daily temperature drops below 40 degrees F. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the required minimum temperature. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the Contractor shall employ effective means, such as precooling of aggregates and mixing water, using ice, or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The Contractor shall be entitled to no additional compensation on account of the foregoing requirements.
- E. **Starting Placement:** Tremies should be filled with concrete before being raised off the bottom. The tremie should then be raised a maximum of 6 inches to initiate flow. Do not lift tremie further until a mound is established around the mouth of the tremie pipe. All vertical movement of the tremie should be done slowly and carefully to prevent loss of seal. If loss of seal occurs, placement through the tremie should stop immediately.
- F. **Placing Concrete Underwater:** Placing concrete underwater shall not start until concrete placing methods have been approved by the Engineer. Concrete placing should be as continuous as possible. The volume of concrete in place should be monitored throughout the placement. Tremie blockages that occur during the placement should be cleared carefully to prevent loss of seal.

3.12 PUMPING OF CONCRETE

- A. **General:** If the pumped concrete does not produce satisfactory end results, the Contractor shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.
- B. Pumping Equipment:
 - 1. The pumping equipment shall have 2 cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the Contractor may have a standby pump on the Site during pumping.
 - 2. The minimum diameter of the hose conduits shall be in accordance with ACI 304.
 - 3. Pumping equipment and hose conduits that are not functioning properly shall be replaced.

3.13 TREMIE EQUIPMENT

- A. The tremie should be fabricated of heavy gauge steel pipe to withstand loads during placement. Tremie pipe diameter shall be large enough to prevent aggregate blockages.

- B. The discharge end shall have a proper seal so that water will not enter the tube at any time. Tremie concrete may also be deposited by means of a bottom dump tremie bucket equipped with a closing top. The tremie bucket shall be of a type approved by the Engineer.
- C. The discharge ends on both the tremie pipe and the tremie bucket shall be fabricated to allow for the full opening of the discharge ends of the pipe or bucket, by slightly raising the pipe or bucket.
- D. All joints between tremie sections should be watertight and should be tested for water tightness before beginning placement.
- E. The size of the funnel or hopper should be suitable for delivering concrete to the tremie. Provide a stable platform to support the tremie during placement.

3.14 FINISHING CONCRETE SURFACES

- A. **General:** Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions indicated are defined as tolerances and are indicated above. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.
- B. **Unformed Surfaces:** unformed top surfaces of slabs shall be brought to a uniform surface with suitable tools.

3.15 CURING

- A. Concrete placed underwater shall self-cure. Concrete shall be cured for not less than seven (7) days after placing. The curing period shall be completed before any work is preformed or materials deposited on the concrete.

3.16 PROTECTION

- A. The Contractor shall protect concrete against damage until final acceptance.

3.17 TREATMENT OF SURFACE DEFECTS

- A. Exposed concrete surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the Engineer. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall be repaired as indicated below. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced. Repairs and replacements shall be performed promptly.

- B. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of laitance or soft material, plus not less than 1/32-inch depth of the surface film from hard portions by means of an efficient sandblast. The material used for repair shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain such a proportion of Atlas white portland cement as is required to make the color of the patch match the color of the surrounding concrete.
- C. Repairs shall be built up and shaped in such a manner that the completed Work will conform to the requirements of this Section as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

3.18 CARE AND REPAIR OF CONCRETE

- A. The Contractor shall protect concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, which becomes defective at any time prior to the final acceptance of the completed Work, which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete.

END OF SECTION

SECTION 05500

MISCELLANEOUS METALWORK

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The Contractor shall furnish, fabricate, and install miscellaneous metalwork and appurtenances, complete, in accordance with the requirements of the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. **Codes:** All codes, as referenced herein, are specified on the drawings.

- B. Federal Specifications:

QQ-F-461 C (1) Floor Plate, Steel, Rolled.

- C. Commercial Standards:

Aluminum Assn. AA-M32	C22A41.
AISC	Specifications and Commentary.
AISI	Specifications and Commentary.
ASTM A36	Specification for Structural Steel.
ASTM A48	Specification for Gray Iron Castings.
ASTM A53	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
ASTM A123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
ASTM A153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
ASTM A307	Specification for Carbon Steel Bolts and Studs, 6,000 psi Tensile.
ASTM A563	Specification for Carbon and Alloy Steel Nuts.
ASTM A575	Specifications for Steel Bars, Carbon, Merchant Quality, M-Grades.
ASTM B98	Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.

ANSI/AWS D1.1	Structural Welding Code - Steel.
ANSI/AWS D1.6	Structural Welding Code - Stainless Steel.
NFPA 101	Life Safety Code.

1.3 CONTRACTOR SUBMITTALS

- A. **Shop Drawings:** Shop drawings of all miscellaneous metalwork shall be submitted to the Engineer for review. Show drawings shall include anchor bolt layout and weld details. Contractor shall allow a minimum of 14 days for review of submittal by Engineer.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. **Standard:** All structural steel shall conform to the requirements of:
1. W-shapes and DWT-shapes: ASTM A572, Grade 50.
 2. Pipe: ASTM A53, Types E or S, Grade B or ASTM A501.
 3. Hollow Structural Sections: ASTM A500, Grade B (yield 46ksi).
 4. Other shapes and plates: ASTM A36.
- B. **Corrosion Protection:** Unless otherwise shown, all steel metalwork and bolts shall be hot-dip galvanized after fabrication as specified herein.
- C. **Stainless Steel:** Unless otherwise shown, stainless steel metalwork and bolts shall be of Type 304 stainless steel and shall not be galvanized.

2.2 BOLTS AND ANCHORS

- A. **Standard Service Bolts:** Except where otherwise shown or specified, all bolts, anchor bolts, and nuts shall be Type 304 stainless steel and installed with anti-seize. Anti-seize must be suitable for being continuously submerged in water.
- B. Bolt Requirements:
1. The bolt and nut material shall be free-cutting steel.
 2. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. All bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.
 3. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case more than 1/2-inch beyond the nut.
- C. **Adhesive Anchors:** Unless otherwise shown or specified, all drilled, concrete or masonry anchors shall be adhesive anchors. No material substitutions will be considered unless accompanied with ICBO report verifying strength and material equivalency.

1. Epoxy adhesive anchors are required for drilled anchors where exposed to weather, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails, pumps, mechanical equipment, and reinforcing bars. Epoxy systems shall be Hilti HIT-RE 500 V3 epoxy or approved equal. Threaded rod shall be stainless steel Type 316.
- D. **Expanding-Type Anchors:** Expanding-type anchors if shown or permitted, shall be **steel expansion type Phillips Drill Company "Red Head" anchors; McCulloch Industries "Kwick-Bolt;"** or equal. Lead caulking anchors will not be permitted. Size shall be as shown. Expansion type anchors which are to be embedded in grout may be steel. Non-embedded buried or submerged anchors shall be stainless steel.

2.3 POWDER-DRIVEN PINS

- A. **Materials:** Power-driven pins for installation in concrete or steel shall be heat-treated steel alloy. If the pins are not inherently sufficiently corrosion-resistant for the conditions to which they are to be exposed, they shall be protected in an acceptable manner. Pins shall have capped or threaded heads capable of transmitting the loads the shanks are required to support. Pins that are connected to steel shall have longitudinal serrations around the circumference of the shank.

PART 3 - EXECUTION

3.1 FABRICATION AND INSTALLATION REQUIREMENTS

- A. **Fabrication and Erection:** Except as otherwise shown, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."
- B. **Tolerances:** All metalwork shall be sequenced and fabricated to ensure that the finished product is within the specified tolerances. Unless noted otherwise:
1. Overall width, height, and depth measurements shall not vary from design dimensions by more than +/- 1/16-in.
 2. Diagonal dimensions for symmetric fabrications shall not vary by more than +/- 1/16-in.
 3. Flat fabrication faces shall not vary from a true plane by more than 1/16-in. in 5 ft. or 1/8-in. over the entire face.

3.2 WELDING

- A. **Method:** All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.
- B. **Quality:** In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS Code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

- C. **Inspection and Testing:** All welds shall be inspected following criteria outlined in the applicable AWS standard by a certified inspector. Test 50% of groove welds using ultrasonic testing (UT) or Radiographic testing (RT). When the applicable AWS standard does not explicitly state minimum weld testing requirements, coordinate with the Engineer for the required level of testing for each fabricated item. Submit all NDT results to the Engineer for review and approval.

3.3 GALVANIZING

- A. All structural steel plates shapes, bars and fabricated assemblies required to be galvanized shall, after the steel has been thoroughly cleaned of rust and scale, be galvanized in accordance with the requirements of ASTM A123. Any galvanized part that becomes warped during the galvanizing operation shall be straightened. Bolts, anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A153. Field repairs to galvanizing shall be made using "**Galvinox**," "**Galvo-Weld**," or equal.

3.4 DRILLED ANCHORS

- A. Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, cleaned and dry. Drilled anchors shall not be installed until the concrete has reached the specified 28-day compressive strength. Adhesive anchors shall not be loaded until the adhesive has reached its specified strength in accordance with the Manufacturer's instructions.

END OF SECTION