

Section 02476

CAISSON FOR LIFT STATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Constructing external walls of lift station wet well structures by caisson method, including base slab and excavation cell partitions. Valve/pump chamber to be constructed by open cut.
- B. If method of construction is not specified, Contractor may select caisson method as an alternate to open-cut method for wet well construction.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
  - 1. No separate payment will be made for lift station construction using caisson method. Include cost for caisson construction in lump sum for lift station.
  - 2. No separate measurement will be made for payment of concrete in wet well caisson except listed in an approved schedule of values.
  - 3. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 DEFINITION

- A. Caisson is defined as external walls of concrete structure, together with excavation cell partition walls, erected at-grade or in starter pit and sunk by gravity to final position through excavation inside structure under dry or wet conditions. Complete caisson includes structural base slab. Caisson walls provide ground support during construction and for permanent installation.
- B. Dry construction means that Contractor operates sufficient external ground water control system to maintain ground water level and piezometric head safely below excavation bottom within caisson.
- C. Wet construction means that external hydrostatic ground water pressure is counteracted by water or slurry within caisson.

1.04 REFERENCE STANDARDS

- A. ASTM D 698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).

1.05 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit drawings and design calculations prepared by Contractor's Engineer.
  - 1. Show modifications proposed to lift station structure design required for caisson construction.
  - 2. Submit wall design including water jet, bentonite and grout pipes, and injection ports, and dimensions of annular space for bentonite lubrication. Show increased wall thickness for dead weight when required to sink caisson.
  - 3. Show height of each concrete placement lift and construction joint locations.
- C. Submit safety plan to meet OSHA requirements. These procedures will not be subject to approval by City Engineer and are for record purposes only. Address in plan, as minimum but not limited to the following:
  - 1. Protection against caisson instability, soil instability, and ground water inflow.
  - 2. Safety for caisson access and exit, including ladders, stairs, walkways, and hoists.
  - 3. Protection against equipment operations, and for lifting and hoisting equipment and material.
  - 4. Support of surcharge weights.
  - 5. Ventilation systems.
  - 6. Monitoring for hazardous gases.
  - 7. Protection against flooding of caisson and inflow into sewers when connected to caisson structure.
  - 8. Protection of workers and public, including traffic barriers, accidental or unauthorized entry, and falling objects.
  - 9. Safety supervising responsibilities.
- D. Building and Structures Assessment. Submit for review prior to construction, Building and Structures Assessment Plan. Provide preconstruction and post-construction assessment reports for buildings and structures located within distance equal to depth of caisson but at

least 50 feet in plan from proposed caisson perimeter. Include photographs or video of existing damage to structures in vicinity of caisson in assessment reports.

- E. Caisson Survey. Submit Caisson Survey identifying required modifications to complete lift station and to comply with specified tolerances.

**PART 2 PRODUCTS**

**2.01 CONCRETE**

- A. Concrete is to be in accordance with Section 03310 - Structural Concrete.

**2.02 REINFORCEMENT**

- A. Reinforcement is to be in accordance with Section 03211 - Concrete Reinforcement.

**2.03 EMBEDDED ITEMS**

- A. Embedded items is to be in accordance with Section 15140 - Pipe Hangers, Supports, and Restraints.

**2.04 BACKFILL**

- A. Select material is to be in accordance with Section 02316 - Excavation and Backfill for Structures.
- B. Cement stabilized sand is to be in accordance with Section 02321 - Cement Stabilized Sand.

**2.05 GROUT**

- A. Use grout conforming to Section 02431 - Tunnel Grout.

**PART 3 EXECUTION**

**3.01 SITE PREPARATION**

- A. Perform site preparation for site clearing and for grading of site to required elevation. Provide for site drainage.
- B. Relocate and protect utilities to remain that may be affected by caisson construction area, including starter pit.
- C. Install security fencing around caisson construction areas to prevent accidental or unauthorized entry.

- D. Provide for control of ground water and surface water according to Section 01578 - Control of Ground Water and Surface Water.
- E. Compact disturbed soils to 95 percent of maximum density as determined by ASTM D 698. Compact soil at moisture content sufficient to develop required density.

3.02 CAISSON WALL CONSTRUCTION

- A. Place concrete as specified in Section 03310 - Structural Concrete.
- B. Inspect concrete surfaces after form removal and repair defects before wall section is sunk into ground.

3.04 CAISSON CLEAN UP AND INSPECTION

- A. Clean interior of caisson after seal slab has been poured. Remove soil, mud, slurries, spilled grout or concrete, or other materials not part of structure from caisson and clean surfaces.
- B. Inspect caisson for possible structural damage or damage to embedded items occurring during excavation and caisson sinking. Notify and allow City Engineer to witness caisson inspection. Repair and replace damage before proceeding with construction.

3.03 CAISSON CONSTRUCTION TOLERANCES

- A. Maximum acceptable deviation of caisson from vertical is 1 inch in 5 feet.
- B. Maximum acceptable horizontal deviation from design location of center of caisson at ground surface level is 12 inches.
- C. Install elevation of base of caisson structure equal to or lower than elevation shown in Drawings. Show top of caisson structure elevation on Drawings.
- D. Provide block-outs with allowance for pipe entry deviations of plus or minus 1.5 inches vertically and plus or minus 6 inches horizontally, plus caisson construction tolerances.
- E. Tolerances defined above are only acceptable provided that Contractor can adjust sewer connections, structural, mechanical and electrical components to resolve deviation from plumpness and horizontal or vertical location as approved by City Engineer. Adjustments must be made without adversely affecting operation or maintenance of lift station.
- F. Monitor caisson installation to verify that no settlement or heave is observed for 10 consecutive days starting not later than 50 days after structural completion.

3.05 BACKFILL

- A. Remove starter pit shoring to depth of at least 8 feet below ground surface and for at least 5 feet from pipes and tunnels penetrating shoring. Remove shoring concurrent with backfilling operations. Perform shoring removal and backfilling so that stability of pit is maintained.
- B. Compact backfill material in accordance with Sections 02316 - Excavation and Backfill for Structures.

3.06 MONITORING

- A. Settlement. Install series of settlement monitoring points on ground and structures within area of potential influence due to soil movements at caisson, before start of caisson or starter pit construction.
  - 1. As minimum, equally space 4 monitoring points around caisson at distance of 15 feet and 4 more at distance 30 feet from caisson for total of 8 monitoring points.
  - 2. Survey monitoring point elevations before start of caisson excavation and weekly thereafter until structure has been completed and dewatering terminated.
- B. Caisson
  - 1. Determine plumpness of caisson at least once each shift at two locations, 90 degrees apart, during caisson sinking operations until caisson is secured by grout and base slab hardened, .
  - 2. As soon as caisson has been secured, install 3 benchmarks, 120 degrees apart, on top concrete placement for settlement monitoring of installed caisson. Transfer benchmarks to higher elevation on structure as required due to continued lift station construction. Continue weekly monitoring of settlement points until 60 days after completed construction of structure.
  - 3. Install and monitor borehole heave points in caisson for dry construction as defined on Drawings. Survey heave points before excavation starts and upon retrieval when final excavation bottom has been reached.
- C. Submit monitoring results to City Engineer weekly.

3.07 CAISSON SURVEY

- A. When caisson has been secured, seal slab poured, and, in case of wet construction, when fluid has been pumped out, survey installed caisson for compliance with tolerances defined in Paragraph 3.04, Caisson Construction Tolerances. Include in Survey:
  - 1. Location of center of caisson at ground level
  - 2. Elevation of top and bottom of caisson and structural slab connection

3. Elevation and locations of penetrations and embedded items and other support points for lift station installation completion
4. Deviation from plumb from caisson top to structural slab at two locations 90 degrees apart

3.08 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 03310 - Structural Concrete and Section 01450 - Contractor's Quality Control.

3.09 DISPOSAL OF EXCESS MATERIAL

- A. Remove excavated material from job site in accordance with Section 01576 - Waste Material Disposal.

END OF SECTION