

SECTION 03 48 22
PRECAST CONCRETE OSSUARY VAULT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work covered by this Section includes fabrication, handling, delivery to the site, unloading, storage and installation of precast ossuary vault; hereafter referred to as vault or units, subbase foundation and drainage, placement of the vault, backfilling, grading, and other, all as shown on the plans or specified herein.
- B. The design of the vault shall be as described in this Section and installation layout shall be as illustrated on the Drawings. All designs will require that the manufacturer provide fabrication drawings stamped by a Professional Engineer indicating that the design meets or exceeds the structural requirements contained herein. The Contractor may propose alternative designs of the corresponding components if all the following requirements are met.
 - 1. Any proposed alternative design shall comply with the design criteria and the functional tests of this specification.
 - 2. All provisions of this specification shall apply to any proposed alternative design.
 - 3. The Government may accept or reject part or all of any proposed alternative design. The Contractor will pay for all cost for alternate designs, submittals, and reviews.

1.2 RELATED WORK

- A. Excavation and Backfill: Division 31 "EARTHWORK."
- B. Waterproofing: Division 07 "THERMAL AND MOISTURE PROTECTION"
- C. Materials Testing and Inspection during Fabrication and Construction: Division 1 Section TESTING LABORATORY SERVICES.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: With submittal of bid documents, Contractor shall submit documentation regarding the manufacture of comparable vaults. Provide evidence that manufacturer has a minimum of three years' experience with pre-casting vaults of similar type, and provide evidence that the manufacturer plant(s) used are certified by the **National Precast Concrete Association** (NPCA).
- B. Precast concrete manufacturer shall provide a licensed Structural Engineer to certify the vault conforms to specified requirements.
- C. Installation Qualifications: Regularly engaged for at least three years in installation of pre-cast concrete similar to this project.

PRECAST CONCRETE OSSUARY VAULT

- D. Fabricate vault to the interior dimensions described below.
- E. In lieu of the above qualifications, contractor shall meet and pay for following requirements:
 - 1. Retain an independent testing or consulting firm approved by COR.
 - 2. This firm shall inspect precast plant at two-week intervals during production and issue a report, certified by a registered Professional Engineer verifying that materials, methods, products and quality control meet all requirements of specifications and drawings. When report indicates to the contrary, Resident Engineer may reject any or all products produced during period of noncompliance with above requirements.

1.4 DESIGN CRITERIA

- A. Design Criteria:
 - 1. Ossuary vault shall be designed with precast reinforced concrete meeting the requirements listed within:
 - a. Interior dimensions: 84-inches by 84-inches (length by width). Provide a minimum 76-inches interior height.
 - b. Wall dimensions: wall thickness shall be designed by a Licensed Structural Engineer. The walls and base shall be integral with no construction joints.
 - c. Top section dimensions: top section (or slab) shall be designed by a Licensed Structural Engineer for specified loading conditions.
 - d. Loading conditions: uniform pressure due to soil, grade beam, and slab on grade of 250 pounds per square foot (psf) and uniform live load of 100 pounds per square foot (psf); as shown on plans.
 - e. Pipe penetration: sleeve shall be integrated and cast-in to vault top section to allow for installation of a modular pipe seal as shown on the plans.
 - f. Keyway: Slab and vault walls shall include a keyway for two joint sealants.
 - 2. Waterproofing: In-place vault shall be waterproofed to eliminate water penetration into the vault. Roller or sprayed application, or waterproofing membrane shall be applied.
 - 3. Testing: Vault shall be tested by Negative Air Pressure (Vacuum) Test per ASTM C 1244. No leakage will be permitted. After proof of successful testing is provided to the owner, the specified drainage holes shall be core drilled.

1.5 ALLOWABLE TOLERANCES

- A. Tolerances of individual units shall be as follows:
 - 1. Variation in vault inside dimensions: 1/2 inch plus or minus

PRECAST CONCRETE OSSUARY VAULT

2. Maximum height differential in final placement in the ground: 1/4 inch above or below design grade.
3. Cracks greater than 0.016 inches in width are cause for vault rejection by NCA inspector.

1.6 SUBMITTALS

- A. In accordance with Section 01 33 23, SAMPLES AND SHOP DRAWINGS, within 45 days of the approval of the shop drawings, Contractor shall furnish to the Owner and the NCA Crypt Specialist the following:
- B. Submit a detailed concrete Mix Design of Self Consolidating Concrete (SCC) with a **15% minimum requirement** of a cement substitute of fly ash and/or other pozzalons.
- C. Submit Shop Drawings:
 1. Erection Narrative:
 - a. Method of transportation.
 - b. Method of handling and placement.
 2. Production Drawings:
 - a. Elevation view of each unit.
 - b. Plan view of unit.
 - c. Sections and details to show quantities, sizes and position of reinforcing steel, inserts, and essential embedded hardware for fabrication, handling, transportation and installation.
 - d. Dimensions and finishes.
- D. Submit Product Design Data:
 1. Structural adequacy calculations of vault performed by a licensed Structural Engineer.
 2. Loadings for Design Calculations:
 - a. Initial handling and erection stresses.
 - b. Dead and live loads specified.
 - c. Other loads specified for units as applicable.
 - d. Deflection of precast members.
 - e. Product test reports:
 - 1) The concrete shall be tested for the compressive strength and beam flexural strength as specified herein. An approved independent, commercial testing laboratory shall perform tests. Certified copies of test reports, including test data and results shall be submitted to the Resident Engineer (NCA inspector) immediately after the strength tests have been completed. The tests shall be as specified herein.
 3. Manufacturer's Literature and Data:
 - a. Each type of anchorage, angle, and fastener.

- b. Waterproofing, joint sealants, and modular pipe sleeve and seals for ossuary vault.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery and Handling: Units shall be transported, stored and handled so as to prevent damage to surfaces, edges and corners and to prevent development of stresses and cracks. The Contractor shall provide temporary bracing protection devices and measures as necessary to prevent damage to the units during handling, transportation and storage. Contractor is responsible for transportation, storage and handling of units such that any negligence on the Contractor's part shall be corrected at the Contractor's expense. Vault handling shall be per manufacturer's requirements.
- B. Storage:
 - 1. Units may be stored at designated locations(s) on site.
- C. Markings and Identifications:
 - 1. Markings, including logos, trademarks and proprietary information are prohibited on surfaces of ossuary vault.
 - 2. Date of manufacture (month, day, and year) shall be written on the box and lid with permanent ink or an equivalent marking.

1.8 COORDINATION

- A. Coordinate the manufacture, delivery, storage and installation of the units with related work.

1.9 GUARANTEE

- A. After erection, completed work will be, subject to terms of Article, GUARANTEE in Division 01, GENERAL CONDITIONS, except guarantee period is extended to 10 years.

1.10 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this Specification to extent referenced. Publications are referenced in text by basic designation.
- B. American Association of State Highway and Transportation Officials
 - T99-01(2004).....Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop.
 - T180-01(2004).....Moisture-Density Relations of Soils using a 4.54 kg (10 lb) Rammer and a 457 mm (18 inch) Drop.
- C. American Concrete Institute:
 - ACI Manual of Concrete Practice 2011 Edition.
 - ACI 318-05..... Building Code Requirements for Structural Concrete
- D. American Society for Testing and Materials (ASTM):

A36/A36M-08.....Standard Specification for Carbon Structural Steel.

A82/A82M-07.....Standard Specification for Steel Wire, Plain for Concrete Reinforcement.

A153/A153M-09.....Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.

A185/A185M-07.....Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

A615/A615M-09.....Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

C31/C31M-10.....Standard Practice for Making and Curing Concrete Test Specimens in the Field.

C33/C33M-11.....Standard Specification for Concrete Aggregates

C39/C39M-10.....Standard Test Method for Compressive Strength of Cylindrical Concrete Specimen

C78/C78M-10.....Standard Test Method for Flexural Strength for Concrete (Using Simple Beam with Third-Point Loading)

C150/C150M-09.....Standard Specification for Portland Cement.

C172/C172M-10.....Standard Practice for Sampling Freshly Mixed Concrete.

C260/C260M-10.....Standard Specification for Air-Training Admixtures for Concrete.

C494/C494M-10.....Standard Specification for Chemical Admixtures for Concrete

C595/C595-10.....Standard Specification for Blended Hydraulic Cement.

C990-09.....Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

C1017/C1017M-07.....Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

C1116/C1116M-10.....Standard Specification for Fiber-Reinforced Concrete.

C1157/C1157M-10.....Standard Performance Specification for Hydraulic Cement

C1244.....Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill

C1602/C1602M-06.....Standard Specification for Mixing Water Used in
the Production of Hydraulic Cement Concrete.

C1399/C1399M-10.....Standard Test Methods for Obtaining Residual-
Strength of Fiber-Reinforced Concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Precast Concrete: Vault shall be designed and manufactured by Structural Engineer. Vault shall meet strength requirements of concrete with a minimum 28 days compressive strength of 5,000 psi, be Self-Consolidating Concrete (SCC) containing structural fiber with an inverted slump between 22" and 28"; and shall contain a minimum of 15% cement substitute of fly ash and/or other pozzalons. All to be in conformance to the following requirements:

1. Hydraulic Cement: ASTM C150 or ASTM C1157 or ASTM C595
2. Normal weight Aggregates: ASTM C 33
3. Water: ASTM C1602
4. Chemical Admixtures:
 - a. Water reducers, accelerating and retarding: ASTM C 494
 - b. Air Entraining: ASTM C260
 - c. Admixtures for flowing concrete: ASTM C1017
 - d. Admixtures with no standard designation shall be used only with approval of VA.
5. Prohibited Admixtures: Calcium Chloride thyocyanates or admixtures containing more than 0.1 percent chloride ions.

B. Reinforcement:

1. Welded Steel Wire Fabric: ASTM A185.
2. Steel Wire Reinforcement: ASTM A82, cold drawn.
3. Steel Reinforcement: ASTM A615 Grade 60, deformed.
4. Inserts, Anchors, Dowels and Accessories: Steel, ASTM A36, zinc coated ASTM A153 hot-dipped galvanized finish G90.
5. Fiber: Macrofiber complying with ASTM C1116

C. Form Coatings:

1. Use commercial formulation form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces.

D. Waterproofing:

1. Use waterproofing membrane material and protection board to form a waterproof barrier for precast ossuary vault per Specification 07 13 00 "SHEET WATERPROOFING".

E. Modular pipe seal and sleeve

1. Manufactured to be cast into concrete to form watertight seal for pipe penetrations.
 - a. Pipe Penetration Sleeve - molded from non-conductive, high impact resistant HDPE such as those manufactured by Century-Link or approved other.
 - b. Modular pipe seal - suitable for use in water, direct ground burial with EPDM seal such as those manufactured by Link-Seal (Model "L") or approved equal.

F. Gasket or Joint Sealant:

1. ASTM C990 (ASTM C990M), bitumen or butyl rubber, similar to those used for manhole connections.

2.2 FABRICATION

A. General:

1. Ossuary vault shall be fabricated by precast manufacture in accordance with the dimensions and tolerances indicated herein, with concrete surfaces that are smooth, and free of voids and irregularities. Lifting lugs shall be provided in accordance to precast manufacture design engineer. Vault to be waterproofed and vacuum tested prior to backfill.
2. Exposed steel reinforcing, honeycomb, bugholes, and cracks not within tolerances are not permitted.
3. Concrete shall have no evidence of segregation of materials.

C. Reinforcement:

1. Provide steel and fiber reinforcing as required for casting, handling, erection loads, lateral and overhead fill, and equipment live loads.
2. Reinforcing steel shall be free of dirt, mill scale, rust, oil, grease, ice, snow, water and placed within approved tolerances in accordance with ACI 318. Careful placement of reinforcing is required to avoid overlapping at thin points of the units.

D. Concrete Placement:

1. Porosity, strength, weight and gradation of coarse aggregate shall be as required to produce specified characteristics.
2. Units shall be cast in steel forms designed to suit shape and finish required. Each element of the unit shall be cast as an integral piece free of joints and seams.

E. Curing:

1. 75% of specified concrete compressive strength shall be attained before transportation of units to the cemetery or storage site.

2. Units shall be cured as required to develop specified structural characteristics and shall be stored in a manner that will permit all surfaces to cure equally.
3. Units shall be properly cured in accordance with the applicable provisions of the current ACI Manual of Concrete Practice.

F. Surface Treatment and Corrective Work:

1. Units that have minor chipping of edges and corners shall be repaired by a method approved by the NCA inspector.
2. Cracked/damaged units exceeding tolerances shall be removed by the contractor at no cost to the government.

2.3 TESTING AND INSPECTION

- A. Contractor's Responsibility for Inspection: The Contractor is responsible for the performance of all inspection requirements including structural footing, sub-base compaction, backfill and waterproofing.
- B. Vacuum testing: The Contractor is responsible for testing the ossuary vault by the Negative Air Pressure (Vacuum) Test per ASTM C1244 prior to backfill operations core drilling drain holes. Notify the NCA inspector a minimum of 48 hours in advance of testing procedure. Certified copies of test reports, including test data and results shall be submitted to the COR and NCA inspector immediately after the vacuum test has been completed. Vault shall not be drilled for drain holes or backfilled prior to acceptance of testing results by the COR and NCA Inspector.

PART 3 - EXECUTION

3.1 GENERAL LAYOUT CONTROL

- A. A professional registered Land Surveyor shall establish and control horizontal and vertical alignment of units.

3.2 PREPARATION

- A. Before beginning installation, inspect work of other trades insofar as it affects the work of this section. Commencing installation of units will be construed as accepting as suitable the work of other trades.
- B. Verify by survey, grading of subgrade and aggregate base for proper installation of units. Provide survey to NCA inspector prior to setting.
- C. Verify by testing, compaction of prepared subgrade and subbase to meet Standard Proctor (AASHTO T-99).
- D. Verify by survey locations and elevations of units relative to control points indicated on plans. Submit new control point layout if a crypt size other than specified is used.
- E. Verify underdrain or drain tile has been installed within limits of vault prior to setting. Confirm drain outlets are provided per plan.

3.3 HANDLING, INSTALLATION AND PAINTING

A. Handling:

1. Vault shall be handled in a vertical plane at all times and stacked vertically on wood supports of adequate strength, until erected.
2. Lift vault with suitable lifting devices at points provided by manufacturer.
3. Provide temporary wood bracing to comply with manufacturer's recommendations to keep unit bottom off ground during storage.

B. Installation and Painting:

1. Install vault by competent erector crews trained and certified as competent by units manufacturer.
2. Use all means necessary to protect vault from being damaged in transport and during and after installation.
3. Ossuary vault shall be waterproofed prior to installation. Prevent damage to waterproofing and protection board during backfilling. Provide waterproof membrane at joint between vault and concrete footing. Protection board shall not be applied to bottom of vault. If damage occurs to waterproofing, repair per manufacturer's recommendations.
4. Accurately install by aligning and leveling vault in accordance with plans.
5. Insure all core drilled drain holes through bottom of vault align with drain sleeves in cast in place spread footing per the contract drawings. A layer of filter fabric per the contract drawings must also be verified in place between the precast vault and spread footing.
6. After precast ossuary vault installation and prior to backfill, the Contractor shall have completed the vacuum test per specifications listed herein. Notify the NCA inspector a minimum of 24 hours prior to backfill operations.
7. Installation of stainless steel pipe penetration into the ossuary vault shall include installing and tightening the pipe seal per manufacturer's requirements. Remaining concrete formwork for the ossuary vault can be completed thereafter.

3.4 PROTECTION OF WORK

- A. Use all means necessary to protect units from being damaged during and after installation.
- B. the unit shall be protected from water intrusion at all times during construction

3.5 REPLACEMENT AND REPAIR

- A. Replacement and repair to damaged ossuary vault shall be done at no additional cost to the Government.

3.6 BACKFILLING AND CRYPT FIELD PROTECTION

- A. Protect installed vault during backfill operations.
- B. Install approved backfill against outside walls of all units, insuring no voids are remaining. Approved backfill shall contain no material that will cause a concentrated point load. The perimeter wall backfill shall be compacted to Standard Proctor (AASHTO T-99) to 95% density to the level equal to the top of the crypts. No large vibratory equipment allowed near vault.
- C. No equipment over the vault should exceed the design loads as specified which includes compacting equipment. No vibratory compaction equipment over or along the vault unless impact loads are shown not to exceed design loads.
- D. Immediately during vault install, contractor to mark the vault location with temporary driven 5-foot tall lathes & signage for easy identification by vehicles carrying fill, topsoil, compost, sod, water or other. Signage shall state **"Underground vault. Keep 10 yards away"** and placed at corners of vault.
- E. Lathes & signage to be maintained in-place during backfilling thru final acceptance of the vault installation and columbaria plaza.
- F. Finish grading and prepare surface treatments as indicated on plans.
- G. The contractor shall not store or stockpile any stone, sand, backfill, crypts or any other material over 4-feet high within ten (10) yards of or on top of installed vault.
- H. The contractor shall not allow any vehicle that exceeds the designed loads to traverse or park within ten (10) yards of or on top of installed vault. If vault is subject to said loading condition as determined by the Inspector, the vault shall be inspected for possible damages with all excavation and fill replacement and all other work as necessary, all at contractor's expense.

3.8 INSPECTION AND ACCEPTANCE

- A. Final inspection and acceptance will be by NCA inspector.

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