

SECTION 03 48 22 PRECAST CONCRETE URN VAULTS

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 concrete burial urn vaults; hereafter referred to as Units or Urn Vaults, subbase foundation and drainage, placement of the units, backfilling urn vault field gaps and cover over lids with hatch, grading, and other, all as shown on the plans or specified herein. In addition contractor to provide:
1. Three (3) OSHA-approved urn vault lid lifting apparatus.
 2. Two (2) extra concrete urn vault square lids.
 3. Eight (8) extra circular concrete hatches for urn vault access.
- B. The design of the units shall be as described in this Section and their installation layout shall be as illustrated on the Drawings. All urn vaults shall be structurally designed for overhead and lateral soil pressure plus live loads specified hereafter. 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. 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 the units. Provide evidence that manufacturer has a minimum of three years experience with pre-casting units 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 that the units conform to specified requirements.
- C. Installation Qualifications: Regularly engaged for at least three years in installation of pre-cast concrete similar to this project.
- D. Fabricate urn vaults to dimensions described below and shown on plans. Replace or repair units that do not comply with the individual dimensions and tolerances.
- E. Prior to or in the initial stage of urn vault production, furnish at the site a single urn vault section (four or eight lids with hatches and headstone boxes) and a wire rope lid and hatch lifting apparatus to demonstrate quality of construction of urn vaults and conduct on-site buried urn vault load testing to include removal and replacement of lids and hatches. Commence production of urn vaults only after submittal approval and on-site load testing has been scheduled for witnessing by the NCA Crypt Specialist.
- F. Functional Load Test: A functional on-site load test will be made at the Contractor's expense to insure the units are capable of supporting loads stated. The functional test will consist of following loading conditions:
 - 1. Confined Loading: An urn vault section shall be placed in a hole dug in the ground on site and covered with 24 inches of soil or covered to the maximum depth as shown on the plans, whichever is greater. The soil will be compacted to Standard Proctor (AASHTO T-99) density along the sides of 95% and reduced density over the lid, both as shown on the plans. An axle load of 12,000 lbs. will then be passed over the covered urn vaults for a minimum of 10 times in repetition, in a manner that causes maximum lateral pressure due to wheel load on the sides of the urn vault. The urn vault shall then be fully excavated, exposed and the hatch and lids removed to allow careful examination inside and outside. The urn vault must not show any signs of stress or cracking.
 - 2. NOT APPLICABLE

1.4 DESIGN CRITERIA

A. Design Criteria (Urn Vault):

- 1. The units shall be of the following type, style, and size:
 - a. Type: Precast concrete.

- b. Style: One-piece multiple urn vault section with separate removable lids that each are monolithically poured with headstone containment box and a hatch opening. A circular removable concrete tapered hatch with flush-mounted anchor for lifting shall complete the lid section. The unit shall have a 4-inch diameter drain hole in each urn vault floor bottom and 1-inch holes in the headstone containment box to allow complete water drainage with no standing water.
 - c. Urn Vault interior and exterior and all other dimensioning are as shown on plans.
 - d. Layout: Urn Vaults shall fit in a 16-foot by 8-foot plot or a lesser plot size as noted on the plans. If the contractor's layout or unit size dimensions differ from Drawings, the Contractor at no cost to the Owner shall submit a Layout/Size Plan for approval by the Owner.
- 2. Units shall be designed for a burial depth with soil cover as indicated on the plans, and be capable of structurally withstanding a wheel point load of 6,000 lbs prior to burial, passage of a wheel axle load of 12,000 lbs after burial, and a 3-foot tall pile of excavated material on top of or adjacent to buried urn vaults.
- 3. The Contractor shall submit to the NCA inspector for approval five sets of design documentation showing structural design of the units. **Contractor to provide one set to NCA Crypt Specialist.** This documentation shall include dimensions, methods of construction, and calculations. All design calculations and drawings shall be signed and sealed by qualified licensed Structural Engineer.
- 4. The urn vault lid with one hatch and one monolithically poured headstone containment box each shall be designed to be removable and replaceable. Lid lifting shall be from top positioned hot-dipped galvanized anchors with removable anchor covers to prevent dirt from entering the anchor bowl and installed in such a manner as to stay in-place when excavating equipment is scraping backfill off the top of the lid. The Contractor shall furnish the cemetery with three (3) OSHA approved and tag certified wire rope lifting devices for removing the hatch and lid. No chain lifting devices allowed.
- 5. The square concrete urn vault lid shall be beveled along the entire top perimeter. Chamfer top edge of lid with a 1:1 chamfer beginning ½ inch down from top.

6. The urn vault section outside lifting wire shall be designed for transport and installation along with provisions for removal/abandonment of unit lifting wire once unit has been installed.

B. Design Criteria (Alternate):

1. The concrete Urn Vault section (bottom one piece) may have eight units or four units as shown on the Plans. Alternative design must be submitted and approved by Owner, all at no cost to Owner. In all cases:
 - a. The shared interior concrete wall thickness may be increased to allow for a gap between lids as deemed appropriate to meet layout requirements.

1.5 ALLOWABLE TOLERANCES

A. Tolerances of individual units shall be as follows:

1. Variation in overall urn vault dimensions of unit (height, length, width): 1/8" plus or minus.
2. Variation in thickness of precast panels and elements: 1/16" plus or minus.
3. Maximum height differential in final placement in the ground: 1/4" above or below design grade.
4. Cracks greater than 0.030 inches in width are cause for urn vault rejection. With evidence of fiber or steel reinforcement, any cracking 0.030 or lesser width that does **not** extend thru wall is acceptable. Any cracking 0.016 inch or lesser that extends thru wall is acceptable. All other cracks are cause for rejecting urn vaults that shall be repaired or removed and replaced at no cost to VA.

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:
 1. Samples: deliver to the site for testing and inspection:
 - a. One urn vault section with lids.
 - b. Lid and hatch lifting devices.
- 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. Section, details and location of specialty lid lifting anchors, caps, and lid lifting system.
 - e. Dimensions and finishes.
- D. Submit Product Design Data:
1. Structural adequacy calculations of units (urn vaults), 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.
 - 2). Prior to backfilling over urn vaults and at contractor expense, the NCA inspector may pick a single unit for coring another bottom slab drainage hole by an independent lab with said core being analyzed (petrography testing) and results submitted verifying evidence of fly ash or other pozzalons as specified.
 - 3). Based on failed testing, the NCA inspector may request more

frequent testing to ensure quality of the product and pozzalons content is present, again at contractor expense.

3. Manufacturer's Literature and Data:
 - a. Each type of anchorage, angle, and fastener.

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. Use the designed lifting wire to transport urn vaults. On the job site, forklift handling of urn may be approved by the Owner upon demonstration that no damage will be incurred.
- 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 urn vaults.
 2. Date of manufacture (month, day, and year) shall be written on the box 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 five 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

1. T99-01(2004) Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop.
2. 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:

1. ACI Manual of Concrete Practice 2011 Edition.
2. ACI 318-05 Building Code Requirements for Structural Concrete

D. American Society for Testing and Materials (ASTM):

1. A 36/A 36M-08 Standard Specification for Carbon Structural Steel.
2. A 82/A 82M-07 Standard Specification for Steel Wire, Plain for Concrete Reinforcement.
3. A 153/A 153M-09 Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
4. A 185/A 185M-07 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
5. A 615/A 615M-09 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
6. C 31/C 31M-10 Standard Practice for Making and Curing Concrete Test Specimens in the Field.
7. C 33/C 33M-11 Standard Specification for Concrete Aggregates
8. C 39/C 39M-10 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimen
9. C 78/C 78M-10 Standard Test Method for Flexural Strength for Concrete (Using Simple Beam with Third-Point Loading)
10. C 150/C 150M-09 Standard Specification for Portland Cement.
11. C 172/C 172M-10 Standard Practice for Sampling Freshly Mixed Concrete.
12. C 260/C 260M-10 Standard Specification for Air-Training Admixtures for Concrete.
13. C 494/C 494M-10 Standard Specification for Chemical Admixtures for Concrete
14. C 595/C 595-10 Standard Specification for Blended Hydraulic Cement.
15. C 1017/C 1017M-07 Standard Specification for Chemical Admixtures for Use in

Producing Flowing Concrete.

- 16. C 1116/C 1116M-10 Standard Specification for Fiber-Reinforced Concrete.
- 17. C 1157/C 1157M-10 Standard Performance Specification for Hydraulic Cement
- 18. C 1602/C 1602M-06 Standard Specification for Mixing Water Used in the
Production of Hydraulic Cement Concrete.
- 19. C 1399/C 1399M-10 Standard Test Methods for Obtaining Residual-
Strength of Fiber-Reinforced Concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Precast Concrete: All urn vaults shall be 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. Fiber is required for urn vaults including lid sections. 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. Paint:

2. Use commercial Concrete & Garage Floor Epoxy Acrylic Paint for urn vault lid & inside wall surface numbering as shown on Drawings. Paint as manufactured by BEHR Deep Base #930 or approved equal.

2.2 FABRICATION

A. General:

1. Units shall be fabricated in accordance with the minimum interior dimensions and tolerances indicated herein, with concrete surfaces that are smooth and free of irregularities.

B. Finishes:

1. Surface holes (1/4" and smaller) caused by air bubbles, normal color variations, normal form joint marks, small chips (1/4" and smaller) and spalling (no more than one square foot total per unit) are permitted.
2. Exposed steel reinforcing, honeycomb, bugholes, and cracks not within tolerances are not permitted.
3. The lifting system shall be top mounted and consist of hot dip galvanized steel anchors installed lid and hatch as per Drawings with each in a 2-1/2" diameter minimum recessed bowl of depth sufficient to easily connect lifting device as designated compatible by anchor manufacturer. Anchors to be installed at locations to ensure maximum lifting stability. A removable plastic cap secured to the anchor will prevent fill material from entering the anchor bowl. Cap to be flush mounted to ensure the entire assembly is not an obstruction for unit excavating equipment.
4. 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 the removal of hatches, painting numbers on urn vault interior wall and top surface of hatches, allow vault interior inspection by the NCA Inspector followed by replacement of hatches. The NCA inspector reserves the right to perform any of the inspections set forth in the specification when deemed necessary to assure that the units conform to prescribed requirements.

PART 3 - EXECUTION

3.1 URN VAULT FIELD QUALITY ASSURANCE

- A. Testing: The contractor shall procure an independent qualified testing agency to perform concrete tests during unit production and prepare test reports.
1. Concrete Cylinder testing for compressive strength: Three cylinders per day of

unit production to be taken in accordance to ASTM C172 as applicable to SCC. Strength to exceed 5000 psi after 28 days curing in accordance to ASTM C31 & C39. Test inverted slump when cylinders are made.

2. Beam testing to confirm design flexure strength: Once at the beginning of unit production, a minimum of two beams with fiber shall be taken for testing of Flexural Performance of Fiber-Reinforced Concrete in accordance with ASTM C78 and C1399. All beams' flexural strength shall exceed the urn vault design flexural strength requirements and residual strength of fiber reinforced concrete, and shall exceed capacity of conventionally reinforced concrete wall design as submitted by the Structural Engineer and approved by VA. Fiber Manufacturer shall verify type and dosage rate of the test beams are identical in unit production.
3. A single verification test of fly ash in the urn vault concrete mix required at the discretion of the NCA inspector.

3.2 GENERAL LAYOUT CONTROL

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

3.3 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 unit size other than specified is used.

3.4 HANDLING, INSTALLATION AND PAINTING

- A. Handling:
 1. Units shall be handled in a vertical plane at all times and stacked on wood

supports of adequate strength, until installed. On the job site, use the designed lifting cable to transport units from the truck to storage to the final installation.

2. Lift units with suitable lifting devices at points provided by manufacturer.
3. Provide temporary wood bracing to comply with manufacturer's recommendations to keep units bottom off ground during storage.

B. Installation and Painting:

1. Install units by competent erector crews trained and certified as competent by units manufacturer.
2. Use all means necessary to protect units from being damaged in transport and during and after installation. Urn vaults that show damage from bouncing during transport shall be replaced by the contractor at no cost to the Owner.
3. Accurately install by aligning and leveling units in accordance with plans. Assure that units are in straight horizontal alignment and headstone containment boxes meet critical alignment requirements (Sec 3.7).
4. After Urn vault installation and prior to backfill, the contractor shall remove hatches with the specified lifting apparatus for inspection by the NCA inspector and paint numbering. Numbers furnished by NCA shall be painted by the contractor on the top of hatches and on the urn vaults' inside wall to be easily seen from an open hatch. Numbers shall be permanent paint as specified and six inches high. Urn vault hatch number painting must be applied to a clean, dust-free surface requiring paint application **within 10 seconds** of surface cleaning. After completion of inspection and marking, the Contractor shall replace the hatches. Any damage will be the responsibility of the contractor.

3.5 PROTECTION OF WORK

- A. Use all means necessary to protect units from being damaged during and after installation.

3.6 REPLACEMENT AND REPAIR

- A. Remove and replace units that the NCA Inspector has determined are damaged, cracked beyond tolerances, broken, improperly fabricated, or otherwise defective and are structurally unsound and unacceptable.
- B. Units having minor defects not affecting serviceability or appearance may be repaired

when approved by NCA Inspector.

- C. Proposed repair work shall be sound, permanent, and flush with adjacent surfaces and submitted for approval by NCA Crypt Specialist.
- D. Replacements and repairs shall be done at no additional cost to the Government.

3.7 HEADSTONE BOX ALIGNMENT, BACKFILLING AND PROTECTION

- A. Align center of headstone containment boxes to urn vault field plot dimensions on Drawings to **within 1/8" tolerance**. Contactor to provide tolerance verification to NCA Inspector prior and after backfill level to headstone box top.
- B. Protect installed units and alignment during all backfill operations.
- C. 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 hatch level.
- D. Install an approved pea gravel (rounded) fill per gradation into gaps between urn vault sections and lids leaving no voids. Use rodding to assure no bridging occurs and void areas are eliminated. No sand allowed. At NCA's discretion, a cut aggregate substitute of same gradation may be approved with demonstration that filling gaps between urn vault section leaves no voids.

Aggregate Size No	Grading Requirements - Amounts finer than Each Sieve (Square Openings), Mass Percent					
	1/2"	3/8"	No. 4	No. 8	No. 16	No. 50
8	100	85 to 100	10 to 30	0 to 10	0 to 5	
89	100	90 to 100	20 to 55	5 to 30	0 to 10	0 to 5

- E. Install backfill on top of units and compact to level with top of headstone containment box followed by **verification of box alignment** remains within tolerances. Backfill shall be as shown on plans. In absence of plan detail, backfill on top of units working from bottom up consists of 2 inches of identification sand, soil to specified level, and 4 inches of topsoil as the final layer. The entire backfill atop units shall be compacted to 85% density (Standard Proctor (AASHTO T-99).
- F. Complete backfill and top soil installation without disturbing headstone box alignment.
- G. No equipment over the urn vaults should exceed unit design loads as specified herein

(12,000 lbs axle), which includes compacting equipment. No vibratory compaction equipment over or alongside urn vaults unless impact loads are shown not to exceed unit design loads.

- H. Immediately during urn vault install, contractor to mark the field edges with temporary driven 5-foot tall lathes & signage for easy identification by vehicles carrying fill, topsoil, compost, sod, water or other. Signage shall state ***“12,000-lb axle load maximum. Keep 10 yards away”*** and placed minimum 50-ft apart.
- I. Lathes & signage to be maintained in-place during backfilling thru final acceptance of the urn vault field.
- J. Finish grading and prepare topsoil as indicated on plans.
- K. The contractor shall not store or stockpile any stone, sand, backfill, or any other material over 4-feet high within ten (10) yards of or on top of installed urn vaults. Affected units subject to said loading condition as determined by the Inspector shall be inspected for possible damages with all excavation, lid lifting, fill replacement and all other work as necessary, all at contractor's expense.
- L. The contractor shall not allow any vehicle that exceeds a 12,000-lb axle load, 6000-lb wheel load or equivalent pressure per square inch to traverse or park within ten (10) yards of or on top of installed units. Affected urn vaults subject to said loading condition as determined by the Inspector shall be inspected for possible damages with all excavation, unit lifting, 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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