

SECTION 31 66 13

PRECAST ARCHITECTURAL CONCRETE LIGHT POLE BASE UNITS

PART 1 – GENERAL

1.01 Summary

- A. Work under this section includes furnishing and the installation of architectural finished precast concrete light pole base units as a special load-bearing foundation for the support of electrical utility poles, flag poles or poles to support signage. The pole base units shall be furnished together with all necessary anchor rods for structural attachment and integral components necessary for the connection and intended operation of any utilities otherwise affixed to the pole ready for installation into the ground upon delivery to the jobsite.
- B. Specifications for poles to be supported by precast concrete pole base units are not covered by this section.

1.02 Price And Payment Procedures

- A. Allowances. No allowance shall be made in the price of the precast concrete pole base unit for excavation beyond the limits required for installation as shown on the project plans. All costs associated with site access shall be the responsibility of the Contractor. Removal of unsuitable soils and replacement with select fill shall be as directed and approved in writing by the Owner or Owner's representative and shall be paid under separate pay items.
- B. Measurement and Payment. The unit of measurement for furnishing the precast concrete pole base units shall be each unit installed. Payment shall be made for the total quantity of units acceptably installed in accordance with this specification. No separate payment will be made for excavation or structure backfill placement related to the installation of the pole base units.

1.03 References

A. Design

1. ACI 318-14/318R-14 Building Code Requirements for Structural Concrete and Commentary, American Concrete Institute (2011).
2. ASCE/SEI 7-10 Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers Structural Engineering Institute (2010).
3. IBC 2012 International Building Code, International Code Council, Inc. (2012).
4. AASHTO Standard Specifications for Structural Supports for Highway Luminaries and Traffic Signals, 6th Edition (2013), American Association of State Highway Transportation Officials.

B. Reference Standards

1. ASTM A36/A36M Specification for Carbon Structural Steel

2. ASTM A123/A123M Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
3. ASTM A615/A615M Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
4. ASTM A706/A706M Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
5. ASTM A767/A767M Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
6. ASTM A775/A775M Specification for Epoxy-Coated Steel Reinforcing Bars
7. ASTM A934/A934M Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
8. ASTM C31/C31M Practice for Making and Curing Concrete Test Specimens in the Field
9. ASTM C33/C33M Specification for Concrete Aggregates
10. ASTM C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens
11. ASTM C42/C42M Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
12. ASTM C94/C94M Specification for Ready-Mixed Concrete
13. ASTM C125 Standard Terminology Relating to Concrete and Concrete Aggregates
14. ASTM C138/C138M Test Method for Density (Unit Weight), Yield and Air Content (Gravimetric) of Concrete
15. ASTM C143/C143M Test Method for Slump of Hydraulic Cement Concrete
16. ASTM C150/C150M Specification for Portland Cement
17. ASTM C173/C173M Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
18. ASTM C192/C192M Practice for Making and Curing Concrete Test Specimens in the Laboratory
19. ASTM C231/C231M Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
20. ASTM C494/C494M Specification for Chemical Admixtures for Concrete
21. ASTM C595/C595M Specification for Blended Hydraulic Cements
22. ASTM C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
23. ASTM C685/C685M Specification for Concrete Made by Volumetric Batching and Continuous Mixing
24. ASTM C823/C823M Practice for Examination and Sampling of Hardened Concrete in Constructions
25. ASTM C989/C989M Specification for Slag Cement for Use in Concrete and Mortars
26. ASTM C1157/C1157M Performance Specification for Hydraulic Cement
27. ASTM C1610/C1610M Test Method for Static Segregation of Self-Consolidating Concrete Using Column Technique
28. ASTM C1611/C1611M Test Method for Slump Flow of Self-Consolidating Concrete
29. ASTM C1712 Test Method for Rapid Assessment of Static Segregation Resistance of Self-Consolidating Concrete Using Penetration Test
30. ASTM C1758/C1758M Practice for Fabricating Test Specimens with Self-Consolidating Concrete
31. ASTM D422 Standard Test Method for Particle-Size Analysis of Soils
32. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort

33. ASTM F512 Standard Specification for Smooth-Wall Poly(Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation.

1.04 Coordination

- A. The Contractor shall coordinate the size and configuration of the anchor rods to be cast in the precast concrete base unit for attachment of the pole specified.
- B. The Contractor shall coordinate the size and location of grounding wire, electrical conduits, and any other embedded items for use in work specified elsewhere.
- C. Installation of the precast concrete pole base units shall be concurrent with the installation of any site utilities that may be required to connect through the pole base unit. The Contractor shall be responsible for coordination of this work.
- D. The Contractor is responsible for coordinating the testing verification of the soil site conditions at the precast concrete Pole base unit installation locations to assure they are consistent with the Geotechnical Report.
- E. The Contractor is responsible for the coordination of testing and inspection of the backfill materials and compaction associated with the installation of the precast concrete pole base units.

1.05 Submittals

- A. Product Data. At least 30 days prior to installation of the precast concrete pole base units, the Contractor shall submit 4 copies of the precast concrete pole base product submittal package to the Owner for review and approval. The submittal shall include the manufacturer's product data and technical specifications detailing the physical properties and manufactured dimensions of the pole base units, handling weights, recommended installation procedures and color photographs depicting the texture and color of the exposed surfaces of the actual units to be furnished. The product data shall also include representative test results of the concrete mix-design as follows:
 - 1. 28-Day Compressive Strength per ASTM C39
 - 2. Air Content per ASTM C138, ASTM C173 or ASTM C231
- B. Structural Calculations and Construction Detail Drawings. In addition to the product data, at least 30 days prior to installation of the precast concrete pole base units, the Contractor shall furnish 4 sets of construction detail drawings and upon request supporting structural calculations for the internal reinforcement and soil embedment of the pole base units to be furnished for the specified jobsite conditions. The construction detail drawings shall illustrate all pertinent aspects of the construction of pole base unit as well as the means and fixed location of attachment between the pole base unit and the pole or poles approved for use on the project. The structural calculations shall be prepared in accordance with the design references listed in paragraph 1.03 A of this section and demonstrate that the factored structural capacity of the Pole base unit exceeds all project specific design requirements. The structural calculations and

construction detail drawings shall be sealed by a registered professional engineer licensed to practice in the project jurisdiction.

1.06 Delivery, Storage and Handling

- A. Delivery. The Contractor shall inspect the materials upon delivery to ensure that the proper type and size of pole base units with the approved exposed surface texture and color have been delivered.
- B. Storage. The precast pole base units shall be stored in an area with positive drainage away from the units. Support pole base units on adequate dunnage and bracing. Provide covering and protect units to prevent soil contact, staining, cracking, or other physical damage. The Contractor shall take care to protect the exposed surfaces of the pole base units from chipping or breakage as well as contact with mud. At no time shall the pole base units be stacked in direct contact with each other.
- C. Handling. The Contractor shall handle the pole base units in accordance with the manufacturer's recommendations and in a manner that prevents damage to the units using manufacturer's approved methods and techniques. Choke chains shall never be used.

PART 2 – PRODUCTS

2.01 Manufactured Units

- A. Manufacturers. All precast concrete pole base units furnished for the project shall be produced by the same licensed manufacturer. The manufacturer shall be licensed by and a member of a national network of independently owned companies authorized to produce the pole base units by the unit patent holder/licensor.
- B. Preapproved Manufacturers.
 - 1. Pole base by Redi-Rock International, LLC. of Charlevoix, Michigan. Telephone No. 866-222-8400; Website: www.polebase.com
 - 2. Engineer approved equal.
- C. Substitution. Technical specifications and product data demonstrating conformance with the requirements of this section for alternative precast concrete pole base units must be submitted to the Owner's agent for preapproval at least fourteen (14) days prior to the bid date. Acceptable pole base units found to be in conformance with this section, shall be approved in writing by the Owner's agent seven (7) days prior to the bid date. The Owner and Owner's agent reserve the right to provide no response to submissions made out of the time requirements of this section or to submissions of products that are deemed to be unacceptable to the Owner.
- D. Value Engineering Alternatives. Alternative precast concrete pole base products may be submitted to the Owner for consideration as a value engineering alternative up to seven (7) days following the award of the contract. Value engineering alternative submittals shall include

all of the elements required in paragraph 1.05 as well as a summary statement of the net advantages to the Owner that the alternative pole base product or technology offers. In addition to the technical submittal, all value engineering alternatives will be evaluated based upon conformance with the overall aesthetic requirements of the project and the net cost savings the system or technology offers to the Owner. Value engineering alternatives that do not offer the Owner a net reduction in the overall Contract price will not be considered. The Owner and Owner's agent reserve the right to reject submissions made out of the time requirements of this section without consideration.

2.02 Description

- A. The precast concrete pole base unit shall be cast as a single, continuous monolithic unit complete with embedded electrical wiring conduits and couplers, structural steel reinforcement and structural connection devices. The pole base unit shall have an architectural textured finish for a total height above grade of up to 40 inches (1.0m) and a below ground embedded portion. Units shall have a nominally consistent exterior horizontal dimension above grade. The above grade section of the pole base unit shall consist of an architectural exterior finished upper portion (further described in Section 2.05). The pole base unit shall include a set of up to (4) customized steel anchor bolts and up to (4) PVC electrical conduits (detailed in Section 1.05B) be provided at the top of the pole base unit for attachment to the pole flange. The anchor bolts and conduits shall be permanently cast into the concrete.

- B. The monolithically cast lower portion of the pole base unit shall have a uniformly shaped cylindrical shape for embedment below grade. The below grade portion of the pole base shall be of consistent cross section without formed voids, sleeves, protrusions, or indentions except for the integrally cast electrical conduit and form stripping insert. The uniform buried sidewall shape shall be maintained to provide uniform lateral soil bearing for the entire embedment depth.

2.03 Design Criteria

- A. In addition to the requirements set forth in the design references listed in paragraph 1.03A, the design of the precast concrete pole base unit shall consider soil parameters appropriate to the project site conditions and the specific loading requirements for the poles to be supported in accordance with local building codes and manufacturer recommendations.

2.04 Materials

- A. Concrete: Concrete used in the production of the precast pole base units shall be fresh, first-purpose, production mix architectural grade concrete. No returned, reconstituted, or waste concrete shall be allowed. The concrete shall be manufactured in accordance with the requirements of ASTM C94 or ASTM C685 and exhibit the following minimum physical properties:
 - 1. Portland cement ASTM C150, Type I or III.
 - 2. Maximum fly ash or other pozzolans, in accordance with ACI 318-11, Table 4.4.2
 - 3. Coarse Aggregate per ASTM C33, Size 57, Class 4S.

4. Minimum 28-day compressive strength of 5,000 psi (34.5MPa).
5. Maximum water to cementitious materials ratio = 0.40 Maximum slump of 5 inches +/- 1½ inches (127±38mm) per ASTM C143 for conventional concrete mix designs before the addition of any water-reducing admixtures.
6. The maximum water soluble chloride ion concentration shall be less than 0.15% by weight of cement. Admixtures shall not contain chloride.
7. Air-entrainment in concrete as measured per ASTM C173, shall be in accordance with the appropriate climate zone provided in ASTM C94.
8. Slump Flow for Self-Consolidating Concrete (SCC) mix designs shall be between 18 and 32 inches (460-810mm) as tested in accordance with ASTM C1611.

B. Steel Reinforcing Bars: All steel reinforcing bars provided as reinforcement in the precast concrete Pole base units shall exhibit a minimum yield strength of 60 ksi (420MPa). Deformed or plain bars used as reinforcement in precast concrete pole base units shall meet the requirements of ASTM A615. Reinforcing from bars manufactured in accordance with ASTM A615 shall NOT be welded. Low-Alloy reinforcing bars that are connected in the desired reinforcement configurations by arc welding shall meet the requirements of ASTM A706. Zinc-coated (galvanized) steel reinforcing bars shall meet the requirements of Specification A767 and epoxy-coated steel reinforcing bars shall meet the requirements of Specification A775. Minimum concrete cover over steel reinforcing bars shall be 2 inches (51mm) for reinforcing bars that are size #6 (#19) and larger and 1-1/2 inches (38mm) for reinforcing bars that are size #5 (#16) and smaller.

C. Anchor Rod Connectors: The anchor rods provided by light pole manufacturer. Otherwise, anchor rods for attachment to the pole flange shall be manufactured from carbon steel in accordance with ASTM A36 and hot-dip galvanized in accordance with ASTM A123, Class C. The anchor rod assembly shall be sized and positioned in the factory to match the connection requirements of the pole flange. Field locating or grouting / caulking of anchor rod connections is not permitted.

D. Electrical Conduit: PVC electrical conduit and fittings integrally cast with intimate contact with the precast concrete pole base unit, and shall meet the requirements of ASTM F512. The embedded Electrical conduit shall incorporate couplings located within 1 inch of the face of the concrete pole base unit for field connection to the site lighting conduit. Open electrical raceways are not permitted.

E. Lifting Devices: Lifting device(s) embedded in the concrete for use in handling of the precast concrete Pole base unit shall be manufactured from smooth, round carbon steel rod and shall be capable of supporting at least four times the maximum intended load applied or transmitted to them. Embedded lifting devices intended for final placement of the precast Pole base unit shall be hot-dip galvanized in accordance with ASTM A123 with a minimum coating thickness grade of 60 or greater.

F. Crushed Stone Foundation: Material shall be a durable crushed stone conforming to No. 57 size per ASTM C33 with the following particle-size distribution requirements per ASTM D422:

<u>Gradation per U.S. Standard (Metric) Sieve Size:</u>	<u>Percentage Passing</u>
1 1/2" (38.1mm)	100% passing

1"	(25.4mm)	95-100%
½"	(12.7mm)	25-60%
#4	(4.76mm)	0-10%
#8	(2.38mm)	0-5%

2.05 Exterior Finishes

- A. Ledgestone Texture: This monolithic unit features a 40" (1.0m) tall square column with 24" (610mm) wide sides and an integral 4" (102mm) tall cap that has all exposed surfaces textured to simulate a natural Ledgestone appearance, similar to the look of stacked cut field stones. The Ledgestone texture shall exhibit relief of 3 to 5 inches (76 to 127mm) over any dimension of the exposed vertical face.
- B. Brick Ledge: This monolithic unit features a 40" (1.0m) tall square column with 24" (610mm) wide sides, light texturing that functions as either an artistic accent or for enhanced bonding to masonry mortar, and a slightly recessed inner-embedment as an aesthetic inlay. Around the bottom of the above grade portion, is a 5" (127mm) tall concrete brick ledge to accommodate a site installed natural stone or brick veneer to match surrounding buildings or environments.
- C. Fluted Column: This monolithic unit features a 40" (1.0m) tall above grade by 24" (610mm) diameter cylinder, with regular vertical rustication strips, and topped with a round capitol. This unit features light texturing, a cap with angular bevel, and "fluted" indentations surrounding the surface of the above grade section of the base.
- D. Standard Round Smooth: This monolithic unit is a 40" (1.0m) tall above grade by smooth finished 24" (610mm) diameter cylinder, with a chamfer and horizontal rustication strip near the top of the unit to create a capitol appearance above grade. A helical texture or visible screw-like pattern is not acceptable.
- E. Custom: This unit is as shown in accordance with architectural drawings and specifications.
- F. Color. Color of the exposed surfaces of the precast concrete pole base unit shall be selected by the Owner from the manufacturer's full range of color options available.

2.06 Structure Backfill

- A. Crushed Stone Backfill Material: Crushed stone backfill material for the precast concrete pole base unit shall be 1" (25.4mm) diameter or smaller meeting the gradation requirements of size No. 57 per Coarse Aggregate of ASTM C-33
- B. Granular Backfill: Granular soil meeting the requirements of USCS soil type GW, GP, SW or SP per ASTM D2487 or alternatively by AASHTO Group Classification A-1-a or A-3 per AASHTO M 145. The backfill shall exhibit a minimum effective internal angle of friction, $\phi = 32$ degrees at a maximum 2% shear strain and meet the following particle-size distribution requirements per ASTM D422.

<u>Gradation per U.S. Standard (Metric) Sieve Size:</u>	<u>Percentage Passing</u>
2" (51mm)	100% passing

#4	(4.76mm)	20-100%
#40	(0.420mm)	0-60%
#200	(0.074mm)	0-10%

- C. **Controlled Low-Strength Material.** Controlled low-strength material (CLSM) also known as flowable fill may be used as structure backfill for precast concrete pole base units. The CLSM shall be a manufactured Portland cement concrete material exhibiting the following properties:
1. 28-day compressive strength between 50 psi (0.34MPa) and 100 psi (0.69MPa)
 2. Air Entrainment of 6% +/- 2%
 3. Wet Density between 115 and 145 pcf (18.1 and 22.8 kN/m³)

2.07 Source Quality Control

- A. **Dimensional Tolerance.** All manufactured dimensions of the precast concrete pole base unit shall be uniform and consistent. Maximum dimensional deviations shall be no more than 1% of the stated dimension in any single unit exclusive of the architectural surface texture.
- B. **Concrete Finish:**
- a. Standard Grade for exposed above grade portion: Normal plant-run finish produced in forms that impart a smooth finish to concrete. Surface holes smaller than 3/4 inch (19mm) caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls are acceptable. Fill all air holes that measure greater than 1/2 inch (12 mm). Major or unsightly imperfections, honeycombs, or structural defects are not permitted. Allowable for joint offset limited to 3/16 inch (5 mm).
 - b. Commercial Grade for buried portion: Remove large fins and protrusions and fill large holes. Rub or grind ragged edges. Faces are to be true, well-defined surfaces. Air holes, water marks, and color variations are acceptable. Allowable form joint offsets are limited to 1/4 in. (6mm).
- C. **Cracks and Chips.** Continuous cracks less than 1/32 inch (0.8mm) in width and/or extending less than 25% of any given exposed face dimension of the unit shall not be grounds for rejection of the unit. Likewise, repairable chips less than 1-1/2 inches (38mm) in the largest dimension shall not be grounds for rejection of the unit. However, through-cracks in the pole base unit and cracks that penetrate to the reinforcing steel may not be repaired and the individual unit exhibiting these cracks shall be rejected.

PART 3 – EXECUTION

3.01 Examination

- A. **Verification of Conditions.** The Contractor shall verify the suitability of site conditions and site access for proper installation of the precast concrete Pole base units. The Contractor shall notify the Owner if the site conditions, including soil shear strength (through the Testing Agency), are not sufficient for proper installation of the Pole base units.

3.02 Preparation

- A. Excavation. Excavation for the placement of the precast concrete pole base units may be accomplished through conventional open-cut excavation or auger drilling. The Contractor shall excavate to the lines and grades required for installation of the precast concrete pole base units as shown on the construction drawings. The Contractor shall minimize over-excavation. Excavation support, if required, shall be the responsibility of the Contractor. If auger drilling is selected by the Contractor as the method of excavation, the minimum foundation hole for placement of the Pole base unit shall create at least a 6 inch (150mm) annular space around the perimeter of the base.
- B. Over Excavation. Over excavation necessary for the removal of rock or frozen, low shear strength, deleterious, contaminated or otherwise unsatisfactory soils shall be as directed and quantified by the Owner's inspector. No payment shall be made for over excavation that is not inspected and directed in writing by the Owner.
- C. The base of the excavation shall be flat, horizontal, and compacted before setting the 8" (200mm) thick stone setting base below the bottom of the precast pole base unit. The stone base shall extend at least 6" (150mm) beyond the perimeter of the base of the unit.

3.03 Installation

- A. The Contractor shall coordinate the attachment of any electrical conduits and/or ground wires to the unit before locating the precast concrete Pole base unit into its final position.
- B. The pole base unit shall be lifted in alignment with the vertical axis of the unit (plumb orientation) and placed into the intended position. At no time shall the unit be tilted-up into its final position.
- C. The precast pole base unit shall be set to grade within a tolerance of plus or minus ½ inch (13mm). The elevation of the unit shall be such that the final finished grade corresponds with the base of the textured/exposed upper portion of the unit.
- D. The pole base unit shall be supported in a vertical position as necessary to maintain the unit as level, true and plumb until the structure backfill has been placed and is sufficiently consolidated or cured. If CLSM structure backfill is selected, the Contractor shall exercise all necessary precautions to prevent the dislocation or floating of the pole base unit during the CLSM backfill placement. The CLSM shall be protected from freezing for a minimum of 24 hours following placement.
- E. Granular backfill material for the pole base unit shall be compacted in place with a maximum of 6" (150mm) thick lifts. Consolidate with a minimum of three passes with a minimum 18" (460mm) wide, walk-behind vibrating plate compactor capable of delivering at least 2,000 pounds (8.9kN) of centrifugal force. Additional compaction effort or adjustments to the moisture level of the soil shall be used as needed. The granular backfill shall be compacted to a minimum 95% Standard Proctor density determined in accordance with ASTM D698.
- F. Crushed stone backfill material for the pole base unit shall be compacted in place with a maximum of 6" (150mm) thick lifts. Consolidate with a minimum of three passes with a

minimum 18" (460mm) wide, walk-behind vibrating plate compactor capable of delivering at least 2,000 pounds (8.9kN) of centrifugal force, additional passes shall be used as needed to meet density requirements. The crushed stone backfill shall be compacted to a minimum 90% relative density of the stone determined in accordance with ASTM D4253 & D4254. In place density of the stone fill should be confirmed using ASTM D6938.

- G. The Testing Agency shall test and verify specified backfill compaction density is achieved adjacent of the unit.

3.04 Repair

- A. Exposed Surfaces. Exposed surfaces shall be finished as specified in this section. All other surfaces shall exhibit a smooth cast-bed finish. Bug holes between ½" (12mm) and ¾" (19mm) in diameter, chips less than 1-1/2 inches (38mm) in its largest dimension or cracks less than 1/32" (0.8mm) in width and less than 1 inch (25mm) in depth on the exposed face may be repaired. Acceptable repair materials include Type N mortar with shake-on color hardener or liquid color stain to blend the repair location with the remainder of the surface texture.

3.05 Field Quality Control

- A. Non-Conforming Work. Precast concrete pole base units that are not sufficiently level, true and plumb as to allow the installation of the pole within acceptable construction tolerance shall be rejected. Defects to the architectural surface texture or color that cannot be repaired shall also be grounds for rejection of the unit in accordance with this specification.

PART 4 – AVAILABILITY

4.01 Contact Information

- A. Pole base by Redi-Rock International, LLC
05481 US-31 South
Charlevoix, MI 49720
Telephone: 1-866-222-8400
Website: www.polebase.com

END OF SECTION