

SECTION 31 66 13 PRECAST CONCRETE LIGHT POLE BASE UNITS

PART 1 GENERAL

1.1 SUMMARY

- A. This work pertains to furnishing and installing precast concrete light pole base units, as special foundations supporting area and site lighting electrical poles, in accordance with the Project Drawings and this Specification. Each precast light pole base unit shall be installed with the required minimum bury depth and at the elevation and location shown on the Project Drawings.
- B. Related Sections:
 - 1. Section 31 23 33 Trenching, Backfilling and Compacting
 - 2. Section 31 23 00 Excavation and Fill

1.2 REFERENCES

- A. Design:
 - 1. LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, First Edition, 2015 (LRFDLTS-1), American Association of State Highway Transportation Officials
 - 2. ACI 318-14 Building Code Requirements for Structural Concrete and Commentary, American Concrete Institute
 - 3. ASCE/SEI 7-10 Minimum Design Loads for Building and Other Structures, American Society of Civil Engineers / Structural Engineering Institute
 - 4. IBC 2012 International Building Code, International Code Council, Inc.
- B. Reference Standards:
 - 1. ASTM A36 Specification for Carbon Structural Steel
 - 2. ASTM A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 3. ASTM A194 Specification for Carbon Steel, Alloy Steel, and Stainless-Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
 - 4. ASTM A615 Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 5. ASTM C31 Practice for Make and Curing Concrete Test Specimens in the Field
 - 6. ASTM C33 Specification for Concrete Aggregates
 - 7. ASTM C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - 8. ASTM C94 Specification for Ready-Mixed Concrete
 - 9. ASTM C109 Compressive Strength of Hydraulic Mortars
 - 10. ASTM C125 Standard Terminology Relating to Concrete and Concrete Aggregates
 - 11. ASTM C138 Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
 - 12. ASTM C143 Test Method for Slump of Hydraulic-Cement Concrete
 - 13. ASTM C150 Specification for Portland Cement
 - 14. ASTM C173 Test Method for Density (Unit Weight), Yield and Air Content (Gravimetric) of Concrete
 - 15. ASTM C191 Setting Time of Hydraulic Cement
 - 16. ASTM C192 Practice for Making and Curing Concrete Test Specimens in the Laboratory
 - 17. ASTM C231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
 - 18. ASTM C260 Specification for Air-Entraining Admixtures for Concrete
 - 19. ASTM C494 Specification for Chemical Admixtures for Concrete
 - 20. ASTM C989 Specification for Slag Cement for Use in Concrete and Mortars
 - 21. ASTM C1107 Packaged Dry, Hydraulic Cement Grout (Non-Shrink)
 - 22. ASTM C1610 Test Method for Static Segregation of Self-Consolidating Concrete Using Column Technique
 - 23. ASTM C1611 Test Method for Slump Flow of Self-Consolidating Concrete
 - 24. ASTM C1712 Test Method for Rapid Assessment of Static Segregation of Self-Consolidating Concrete Using Penetration Test
 - 25. ASTM C1758 Practice for Fabricating Test Specimens with Self-Consolidating Concrete

26. ASTM D422 Standard Test Method for Particle-Size Analysis of Soils
 27. ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
 28. ASTM D1241 Standard Specification for Materials for Soil-Aggregate Subbase, Base and Surface Courses
 29. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
 30. ASTM D2487 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
 31. ASTM D2729 Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 32. ASTM D3080 Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions
 33. ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
 34. ASTM D4767 Test Method for Consolidated-Undrained Triaxial Compression Test for Cohesive Soils
 35. ASTM F1554 Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
 36. ASTM F436 Specification for Hardened Steel Washers Inch and Metric Dimensions
 37. ASTM F2329 Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
- C. Additional References:
1. LPB Reference Manual - Engineering – Current Version - www.lightpolebase.com
 2. LPB Reference Manual – Installation – Current Version - www.lightpolebase.com
 3. LPB Standard Product Drawings – www.lightpolebase.com

1.3 DEFINITIONS

- A. LPB Precast Concrete Light Pole Base Unit (LPB): A light pole base unit containing a four-slot adjustable anchoring system, four openings in the sides of the unit leading to a central conduit pathway, provided by an authorized manufacturer under license to Recon Retaining Wall Systems, Inc.(d/b/a: LPB – A Forte Company).
- B. LPB Installation Hardware Set: A set of hardware containing four galvanized steel carriage bolts, four plain steel anchor plates, four galvanized steel bearing plates, twelve galvanized heavy hex nuts, and eight galvanized hardened flat washers used to establish the anchoring system and attachment of a light pole flange / base plate (these materials are further defined in Section 2.3.C).
- C. Crushed Stone Foundation: Clean, crushed rock located directly beneath the LPB unit to provide adequate drainage and leveling.

1.4 SUBMITTALS

- A. Contractor shall submit to the Owner the LPB product data and installation instructions for approval.
- B. Contractor shall submit to the Owner the LPB Producer's test reports certifying that the LPB units manufactured at their production facility meet the requirements of this Specification and the requirements of the Project Drawings.
- C. Unless provided within these project documents and/or the project drawings, the Contractor shall submit to the Owner and/or the LPB Producer:
 1. Written notification that the Contractor and/or their Engineer:
 - a. Has reviewed the LPB Reference Manuals (Engineering and Installation),
 - b. Has concluded that the use of the LPB product is appropriate for use on the project,
 - c. Acknowledges that the project specific conditions are consistent with all of the assumptions set forth in the Design Tables found in the LPB Reference Manual – Engineering,
 - d. Acknowledges that the proposed specific pole heights, pole shapes, luminaire fixture area, bolt circle diameter and intended bury depth (based upon the site specific soils), has been compared to the appropriate Design Table and the results indicate that the use of the LPB product is acceptable.
 2. In the event that all portions of Section 1.4.1 cannot be confirmed, the Contractor and/or their engineer shall submit:

- a. A site specific analysis, in accordance with the design procedure outlined in the LPB Reference Manual – Engineering, completed by a Registered Professional Engineer that is familiar with the project specific conditions and is licensed to practice in the state where the project is located.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall inspect all LPB units at delivery to determine that the proper size and type have been delivered and are usable. Damaged material shall not be incorporated into the work.
- B. All LPB units shall be stored in a location and manner that protects against excessive weathering and damage.
- C. During storage, Contractor shall prevent the LPB units from coming in contact with substances which may stain or adhere to the finished visual surfaces of the unit. Provide proper dunnage between the LPB units as well as the ground surface. LPB units shall not be stacked in direct contact with other units.
- D. For the portions of the LPB units which shall be exposed above grade, the finished surface shall be free of excessive chipping, cracking and stains.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. LPB units furnished to the project shall be produced by a manufacturer that has been authorized and licensed, by the licensor listed below, to produce the patented LPB units:
 1. LPB – A Forte Company
11521 Eagle St NW, Suite 3
Coon Rapids, MN 55448
(612) 440-4764 Phone
www.lightpolebase.com

2.2 DESCRIPTION

- A. The precast concrete light pole base unit shall be manufactured:
 1. As a single pour unit that is cast monolithically, containing no cold joints,
 2. Containing internal structural steel reinforcing,
 3. With an embedded anchoring system, just below the top surface, comprised of four slots that receive anchor rods capable of adjusting to match the light pole baseplate required dimensions,
 4. With four openings in the side surface of the unit, located near the midpoint, leading to a central vertical pathway that allow for the installation of electrical wiring conduits.
 5. Additionally, the exterior exposed upper portion of the light pole base unit may contain a 1-inch chamfer, or series of chamfers, creating an architectural finish (further described in Section 2.4).

2.3 MATERIALS

- A. Concrete:
 1. All concrete used shall be first-purpose. No returned or waste concrete shall be permitted for use in production.
 2. The light pole base unit shall consist of concrete with the average 28-day compressive strength of no less than 5,000 psi.
 3. Concrete shall have air entrainment by volume (as measured in the plastic state in accordance with ASTM C173) of:
 - a. 5.5 – 8.5 percent, or
 - b. In conformance with ASTM C94, latest revision
 4. For conventional concrete, the water-to-cement ratio shall be no greater than 0.4 with a maximum slump of 5 inches +/- 1.5 inches per ASTM C143.
 5. For Self-Consolidating Concrete (SCC) mix designs, the slump flow shall be between 18 and 32 inches as tested per ASTM C1611

- B. Steel Reinforcing:
 1. All internal steel reinforcing shall have a minimum yield strength of 60 ksi and meet the requirements of ASTM A615
 2. All internal steel reinforcing shall have a minimum concrete cover of 2 inches.
- C. Anchor Rods and Connection Hardware:
 1. Steel carriage bolts, received by the embedded four slot anchoring system, shall be 3/4-inch diameter by 9-3/4-inch long or 1-inch diameter by 10-inch long and have a minimum yield strength of 55 ksi. All rods shall meet the requirements of ASTM F1554 and be galvanized per ASTM F2329 and A153.
 2. Steel anchor plate shall be 1-21/32-inch by 3-3/32-inch by 5/8-inch thick and have a minimum yield strength of 100 ksi. All anchor plates shall meet the requirements of ASTM A514.
 3. Steel bearing plates shall be 3-inch by 3-inch by 1/4-inch thick and have a minimum yield strength of 36 ksi. All bearing plates shall meet the requirements of ASTM A36 and be galvanized per ASTM F2329 and A153.
 4. Heavy hex nuts shall be 3/4-inch or 1-inch diameter, Grade 2H, with a minimum proof load stress of 175 ksi. All heavy hex nuts shall meet the requirements of ASTM A194 and be galvanized per ASTM F2329 and A153.
 5. Hardened flat washers shall be 3/4-inch or 1-inch diameter with a minimum Rockwell Hardness of 26 to 45 HRC. All hardened flat washers shall meet the requirements of ASTM F436 and be galvanized per ASTM F2329 and A153.
 6. The combination of four steel carriage bolts, four steel anchor plates, four steel bearing plates, twelve heavy hex nuts and eight hardened flat washers is defined as an LPB Installation Hardware Set (3/4-inch or 1-inch). One LPB Installation Hardware Set shall be included, by the Producer, with each LPB unit furnished to the project.
- D. Grout:
 1. High strength, non-shrink grout, that complies with ASTM C1107, shall have the following compressive strength, per ASTM C109 Modified, when mixed to a fluid consistency:
 - a. 2,500 psi at 24 hours
 - b. 5,000 psi at 3 days
 - c. 6,000 psi at 7 days
 - d. 8,000 psi at 28 days
 2. All other properties and requirements shall be per the Grout Manufacturer's recommendations.
- E. Crushed Stone Foundation:
 - a. The foundation material shall consist of clean, 1-inch minus, crushed stone or crushed gravel meeting the following gradation tested in accordance with ASTM D422:

<u>Sieve Size</u>	<u>Percent Passing</u>
1-inch	100
3/4-inch	75 – 100
No. 4	0 – 10
No. 50	0 – 5

2.4 FINISHES

- A. LPB Classic: This unit consists of an upper surface that is 24-inch diameter and a 1-inch chamfer to the sides of the unit, bringing the outer dimension of the unit to 26-inch diameter. The 26-inch diameter dimension extends down the sides of the unit, 24-inches on units 6-foot or less in height and 48-inches for units greater than 6-feet in height, before returning to 24-inch diameter for the remaining portion of the unit. A 1-inch chamfer is located at the transition of the two dimensions.
- B. LPB Flare: This unit consists of an upper surface that is 24-inch diameter and a 1-inch chamfer to the sides of the unit, bringing the outer dimension of the unit to 26-inch diameter. The 26-inch diameter dimension extends down the sides of the unit 6-inches before returning to 24-inch diameter for the remaining portion of the unit. A 1-inch chamfer is located at the transition of the two dimensions.

- C. LPB Legacy: This unit consists of an upper surface that is 24-inches diameter and a slight round-over to the sides of the unit. The outer dimension, along the sides of the unit, remains a consistent 24-inch diameter from top to bottom.

2.5 UNIT BACKFILL

- A. Crushed Stone Backfill: A backfill material consisting of clean, 1-inch minus, crushed stone or crushed gravel, meeting the gradation shown in Section 2.3.E.a, may be used as unit backfill material.
- B. Granular Backfill: Granular soils meeting the following gradation, tested in accordance with ASTM D422, may be used as unit backfill:

<u>Sieve Size</u>	<u>Percent Passing</u>
1-inch	100
No. 4	20 – 100
No. 40	0 – 60
No. 200	0 – 10

The USCS soil types, per ASTM D2487, generally meeting the gradation shown are: well-graded and poorly graded gravels (GW and GP), well-graded and poorly graded sands (SW and SP), as well as poorly graded gravels and sands containing silt (GP-GM and SP-SM). On-site soils meeting the above requirements may be used as unit backfill.

2.6 QUALITY CONTROL

- A. Concrete Finish:
1. The upper portion of the unit shall have a smooth, hard, uniform texture on the concrete.
 2. Within the upper exposed portion of the unit, any air-voids greater than 3/4-inch and deeper than 1/4-inch shall be filled with patching mortar.
 3. Minor chips, form joint lines and typical concrete color variation are all acceptable.
- B. Cracks:
1. Cracks penetrating to the depth of the reinforcing steel that are greater than 6-inches in length and 1/32-inch in width shall not be permitted.

2.7 DESIGN

- A. All LPB precast light pole base units furnished to the project shall be designed by a Registered Professional Engineer in accordance with Code references shown in Section 1.2.A as well as the procedure that is outlined in the LPB Reference Manual – Engineering. The design shall consider the actual site soil and light pole loading conditions that will be present. The Design Tables, located within the LPB Reference Manual – Engineering that have been prepared in accordance with the Code requirements, are permitted for use by a Registered Professional Engineer provided that they verify all of the assumptions listed in the tables are applicable to the actual site soil and light pole loading conditions present for the project.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify locations of utilities and existing structures prior to excavation.
- B. Examine the Project site and evaluate the condition of the locations in which the LPB units will be installed. Notify the proper supervising authority in writing of any conditions that may interfere with the proper installation of the LPB units or delay completion.
- C. Promptly notify the design engineer of site conditions which may affect performance, soil conditions observed other than those assumed, or other conditions that may require a reevaluation of the design.

3.2 EXCAVATION

- A. Contractor shall excavate to the lines and grades shown on the construction drawings. Excavation may be completed using auger drilling or typical open-cut excavation. The contractor shall be careful to minimize over-excavation or disturbance of the surrounding soils. Auger drilled holes shall be 6 to 12-inches larger than the diameter of the LPB unit.
- B. The bottom limits of the excavation should be well compacted and flat to allow for installation of the 6-inch thick crushed stone foundation. The crushed stone foundation shall be compacted so as to provide a smooth, hard surface on which to place the LPB unit.
- C. Over-excavated areas shall be filled with suitable Unit Backfill material and compacted to 95% Standard Proctor density determined in accordance with ASTM D698.

3.3 LPB UNIT INSTALLATION

- A. The LPB unit shall be lifted into a vertical orientation prior to being placed into the excavated hole. The vertical orientation may be achieved by utilizing the embedded lifting anchors in the sides of the unit or by threading two straps through the center of the LPB. The embedded anchoring system within the top surface of the LPB should never be used for lifting and/or handling during the installation process.
- B. Lower the LPB unit into the hole ensuring that the conduit openings are properly aligned for the site and installation requirements as well as consideration for the final alignment of the light pole and light pole baseplate.
- C. Once the LPB unit is in place, ensure that it is plumb, the top of the unit is level, and that the upper surface elevation is set to the project requirements within +/- 1/2-inch.
- D. Brace the LPB unit as required to maintain the location and level until the unit can be backfilled.
- E. Initial backfilling, using either crushed stone or granular backfill, shall be placed around the unit to an elevation just below the side conduit openings and properly compacted. Either material shall be placed in maximum 6-inch lifts. If granular backfill is used, the material shall be compacted to 95% Standard Proctor density determined in accordance with ASTM D698.
- F. Install the required conduits through the sides of the LPB unit and out the top. Installation of the conduit may be completed by the Contractor or through coordination with the site electrical contractor.
- G. After conduit installation is complete, the remaining portions of the LPB unit shall be backfilled and compacted, in maximum 6-inch lifts, using crushed stone or granular backfill to the finished grade elevation shown within Project Plans. If granular backfill is used, the material shall be compacted to 95% Standard Proctor density determined in accordance with ASM D698.
- H. For additional information on the LPB unit installation process, refer to the LPB Reference Manual – Installation.

3.4 INSTALLING ANCHOR RODS AND GROUTING

- A. Open the supplied LPB Installation Hardware Set. One set is provided with each LPB unit and contains: four steel carriage bolts, four steel anchor plates, four steel bearing plates, twelve heavy hex nuts, eight hardened flat washers and an installation guide.
- B. Place a single anchor plate onto a carriage bolt and slide the plate down until the square hole seats onto the collar of the bolt. The proper orientation of the anchor plate (top up) is with the more extreme rounded corners in the top right and bottom left once placed onto the bolt.
- C. Lower the carriage bolt and anchoring plate into the slot until it reaches the bottom and then turn them clockwise 90 degrees.
- D. Place one bearing plate washer over the bolt and thread on a heavy hex nut. At this point, leave the nut loose enough to allow for adjustment along the slot.
- E. Repeat steps B through D for the remaining slots.
- F. Using a template, slide the each bolt setup along the slot to achieve the required bolt circle diameter.
- G. Once the setups are in the correct location, tighten the hex nuts against the bearing plate washer to lock the bolts in place. Nuts should be installed to hand tight using a standard crescent wrench.
- H. Using your template, recheck the position of each bolt to ensure it did not move during the set up process.

- I. Pour fluid grout into each slot. Be sure to fill each slot completely and trowel off any excess.
- J. For additional information on the installation of the anchor rods and grouting process, refer to the LPB Reference Manual – Installation.

3.5 LIGHT POLE INSTALLATION

- A. The light pole and light pole base plate shall be installed per the specific manufacturer's installation requirements. The remaining eight heavy hex nuts and eight hardened flat washers provided in the LPB Installation Hardware set may be used to install the light pole provided they meet the requirements of the specific light pole manufacturer's installation and product requirements.
- B. During light pole installation, ensure that the light pole is installed plumb using leveling nuts and that the bottom of the lowest leveling nut is in contact with the top of the LPB lock nut that was installed per Section 3.4.G.
- C. All remaining portions of the light pole and fixtures should be installed per the specific manufacturer's recommendations.

3.6 FIELD QUALITY CONTROL

- A. Contractor shall be responsible for proper installation and quality control of all LPB units, the components, and materials.
- B. Owner shall, at their expense, retain a qualified professional to monitor and perform quality assurance checks of the Contractor's work.
- C. Quality Assurance should include soil inspection, frequent backfill compaction testing, verification of geotechnical design parameters and compliance with Project Plans.

3.7 CLEANING AND REPAIRING

- A. After completion of the LPB units, remove construction debris and restore any adjacent finished areas affected by the installation to their pre-construction state.
- B. Wash and remove any soiling and stains from the upper exposed portions of the LPB units. Do not use acid or detergents that may "burn" or discolor face.
- C. Repair any bug holes or chips in the upper exposed portions of the LPB units not meeting this Specification.

END OF SECTION