DESIGN RESOURCE MANUAL

pole base®

POLEBASE.COM

A DIVISION OF REDI-ROCK®

pole base®

TABLE OF CONTENTS

CONTACT INFO
05481 US 31 South
Charlevoix, MI 49720
polebase.com
866 222 8400
info@polebase.com

WHAT IS POLE BASE?

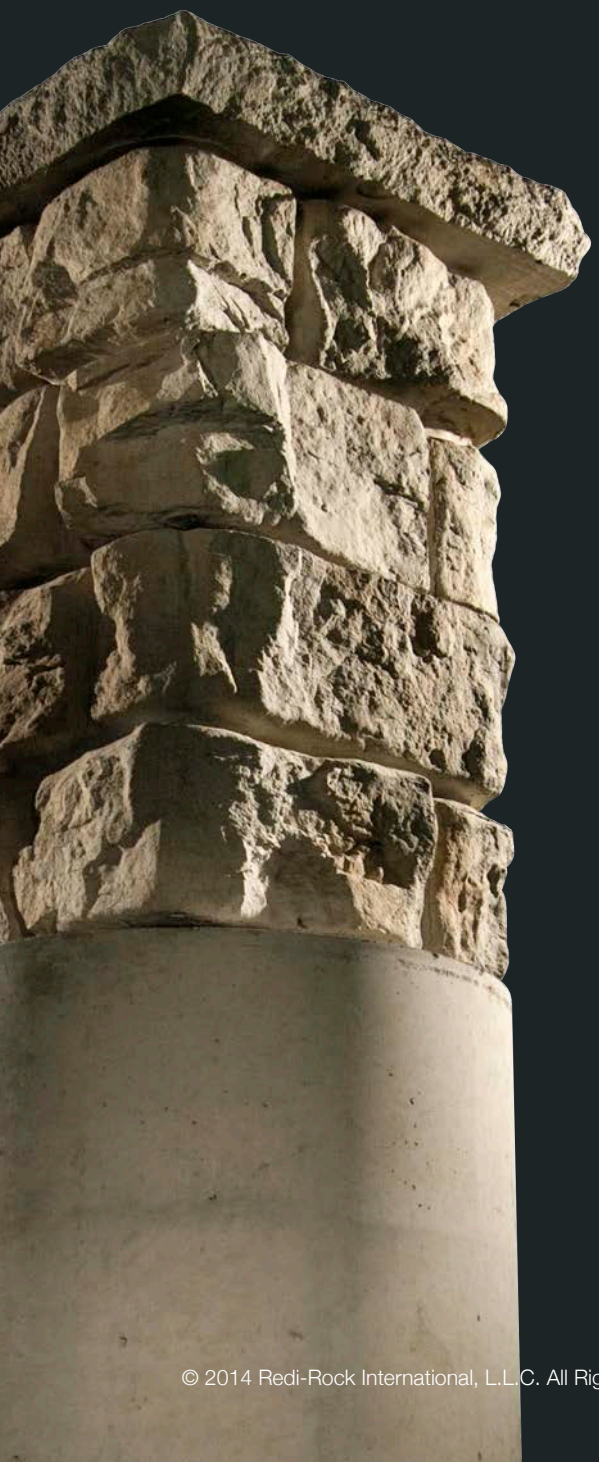
POLE BASE® IS AN ARCHITECTURAL PRECAST FOUNDATION SYSTEM FOR LIGHTING, FLAG POLES, AND MORE.

pole base®

INTRO AND GENERAL INFO

WHAT IS DIFFERENT ABOUT POLE BASE?

INTRODUCING POLE BASE



STUNNING, AREN'T THEY?

When you walk onto a construction project or even a grocery store parking lot, you step out of your car and are met with unsightly light pole bases. They are everywhere and generally, they look terrible.

That is why we created something that looks remarkable. Stunning even. We have three standard textures: Ledgestone, Fluted, and Smooth. And for those looking for something truly unique, we offer an option with brick ledge so you can veneer your Pole Base to make it look like whatever you want.

Pretty cool, huh?

SIMPLE AND EFFECTIVE

Think about it, a typical light pole base is formed with a piece of cardboard; you have to install the rebar, the j-bolts, and the conduit – not to mention more complicated things like junction boxes.

We are in the 21st century and people are still using cardboard for this stuff! With Pole Base, we do all of the archaic stuff for you. When Pole Base shows up on the site, all you have to do is:

We do the hard part for you!

WE THOUGHT IT OUT

Now, how many people think about engineering when they think about light pole bases? Exactly...not many. We've taken light pole design a step further by developing preliminary design charts so you can easily figure out how deep and big the hole around your Pole Base needs to be.

We have construction details, specs, CAD details, and a design guide. We think this stuff is awesome! We put together a robust and technical system when we designed Pole Base.

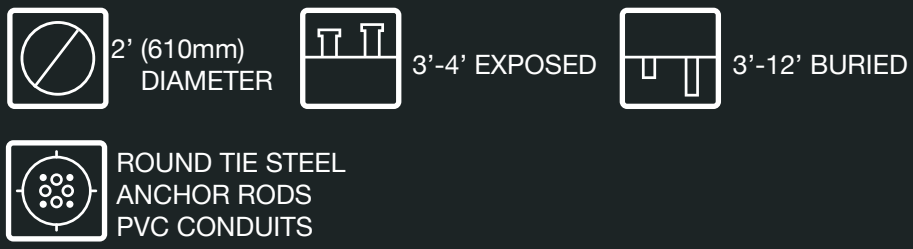
We are different than cardboard tubes. Spec us today and see the difference.

This project featured a round base with a horizontal architectural rustication joint and custom junction box. The base is buried 6 ft. below grade and supports a 15 ft. tall double-headed light fixture.

TOP 10 Q&A ABOUT POLE BASE

STANDARD SIZES AND SPECS

QUESTION: ***What are the standard sizes and specifications for Pole Base*** **Units?**



ANSWER: The durable precast concrete Pole Base units are typically 2 feet (610 millimeter) in diameter, with a height of 3–4 feet (915–1,220 millimeter) exposed above grade and 3–12 feet (910–3660 millimeter) buried below grade. The concrete is reinforced with four #5 vertical and #3 round tie steel reinforcement. They also typically incorporate four galvanized anchor rods and four PVC electrical conduits for mounting and wiring light poles.

SPECIFY CONCRETE

QUESTION: ***Can I specify the type of concrete used in Pole Base units?***

ANSWER: Yes, because we understand that certain applications can require different concrete mix design requirements. However, we believe that the standard durable concrete specifications for Pole Base units, found on page 3.7, will endure well in most locations. The Pole Base standard concrete specification is tailored to conform with the requirements for Severe Exposure in accordance with ACI-318. In general, the standard concrete mix design specifies the following: 5,000 psi (34.5 MPa) compressive strength at 28 days, 0.40 water to cementious materials ratio, durable 5S large aggregate per ASTM C33, and 6% entrained air.

BACKFILL MATERIAL

QUESTION: ***What material should I use to backfill around the Pole Base units after they are set into the excavated hole?***

ANSWER: Because these create the foundation for light poles that shouldn’t move, the material around the Pole Base in the excavation needs to be dense enough to resist the wind forces. There are three general types of material that can be used to backfill Pole Base units, they include: concrete, controlled low-strength material, 1 inch (25.5 millimeter) stone, or sand placed in well compacted layers less than 8 inches (200 millimeter) thick. Find installation details on page 6.1.

COST COMPARISON

QUESTION: ***How does the cost of Pole Base compare to that of our competitors site built light pole bases?***


SAVE TIME


SAVE LABOR


SAVE SPACE


SAVE REPAIRS

ANSWER: The cost of the two options depends upon the contractor. Some contractors believe Pole Base units are less expensive and other contractors haven't tried the system to really know for sure. The big differences are that Pole Base products create savings in time, labor, space, and remedial repairs. You can rest assured that the anchor rods will be set properly and there won't be surprises when the cardboard form is removed. Pole Base units are delivered to the job site ready to install and have light poles connected. There is no delay waiting for the bases to be formed, cast, and cured – we all know time is money! Contact us at www.polebase.com for additional information.

HEIGHT

QUESTION: ***How tall do the Pole Base units need to be?***

ANSWER: The height of Pole Base units is comprised of two portions: the exposed upper portion and the concealed buried lower portion below grade. The bury depth is dependent upon the size and heights of the base, pole, and fixtures as well as the local wind load and site soil conditions. The Pole Base Design Resource Manual has preliminary embedment design charts on page 4.3 that were generated from the methods described in the AASHTO LTS-6, "Structural Supports for Highway Signs, Luminaries, and Traffic Signals." The project's engineer of record is encouraged to use this or other industry recognized design standards to calculate the Pole Base unit embedment using the actual site conditions. See section 4 for important background charts.

TOP 10 Q&A ABOUT POLE BASE

WEIGHT

QUESTION: ***How much do Pole Base units weigh?***

1 TON

2 TONS

ANSWER: They are solid concrete and generally weigh between 2,000 and 4,000 pounds (4,400 to 8,800 kilograms) each depending upon texture pattern, diameter, and height. See page 3.2 – 3.6 for exact weights.

INSTALLATION TIME

QUESTION: ***How long does it take to install Pole Base units?***

ANSWER: Installing Pole Base units is fairly simple. Depending upon the soil conditions and equipment, they can typically be installed between 45 and 90 minutes. First, you need to either auger or excavate a hole in the earth. Then, a 6 inch (150 millimeter) thick stone foundation is placed at the bottom of the excavation to provide good base support and to fine adjust the final base elevation. Next, the Pole Base unit is set on the stone foundation, leveled, and backfilled. During the backfilling operation, the site electrical conduit is connected to the embedded conduit in the base. The final step is the backfilling and compaction of the excavation around the Pole Base.

CUSTOMIZE TO YOUR SPECS

QUESTION: ***Can I get Pole Base units customized for my project?***


CONCRETE FINISH


LENGTH 4’-12’


ELECTRICAL CONDUIT


ANCHOR RODS


CONCRETE REINFORCEMENT


FINISH COLOR

ANSWER: Absolutely! Customization is something that Pole Base does best. We build all of our bases to your specification for your particular project. You are able to specify the concrete finish texture, length (4–12 feet or 1220–3660 millimeters), electrical conduit, anchor rod size and spacing, concrete reinforcement, finished color, etc. Feel free to ask your sales representative if you have a question or suggestion about your specific requirements for your next project. Get your project started today at polebase.com!

SPECIAL EQUIPMENT

QUESTION: ***What special equipment do I need to unload the truck, lift the Pole Base units and install them into the ground?***


FORK LIFT


EXCAVATOR OR CRANE


DELIVERY TRUCK

ANSWER: Typically, the Pole Base units arrive on wooden pallets and are removed from the delivery truck and moved around the job site with a rough terrain fork lift (Pettibone, Skytrac, etc.) or forks mounted to a loader. The units are set into the ground with either a lifting plate or choked nylon lifting sling hoisted from a chain hook on one of the previously mentioned equipment, an excavator, or a crane. Full equipment list found on page 6.2.

LEAD TIME

QUESTION: ***What is the lead time to have Pole Base units delivered?***


AVAILABLE IN A FEW SHORT WEEKS

ANSWER: Depending upon the precast manufacturer, Pole Base units could be available in stock or within a few short weeks depending on level of customization. Feel free to ask your sales representative about your required delivery schedule. Contact your local sales rep for exact lead times!

pole base®

CASE STUDIES

SECTION 2: CASE STUDIES

WHY CHOOSE POLE BASE?

pole base®

PROJECT INFORMATION

PROJECT NAME
Agro-Culture Liquid Fertilizer Project

CUSTOMER
JC Electric

ENGINEER
Hobbs & Black Associates Inc.

MANUFACTURER
MDC Contracting

INSTALLER
JC Electric

LOCATION
St. Johns, MI

YEAR BUILT
2013

Precast Bases Save Time & Money for Complex Site Lighting Project

THE CHALLENGE

In 2013, Agro-Culture Liquid Fertilizer was building a new headquarters in St. Johns, Michigan. This expansive new complex included a beautiful new building and parking lot. Constructing the parking lot required 21 separate site lights, many of which had junction boxes due to complex requirements.

THE SOLUTION

"The site portion of the project was delayed due to weather multiple times, and we needed junction boxes in a third of the bases on site due to the surveillance cameras mounted on the poles," said Doug Haviland, President of JC Electric.

Originally, the concrete bases for the site lighting were supposed to be created using a cardboard tube forming system. However, the poor weather made it impossible to use this system because the wet conditions would deteriorate the cardboard tubing. Haviland explained: "It was a very complicated project, and we found that Pole Base was by far the most efficient, most cost-effective, and least labor intensive option for installation."

Contractors were able to run the wires and conduit and skip the complications involved with the poured-in-place concrete foundation. In addition, the Pole Base precast foundations were manufactured in a controlled setting, ensuring quality concrete durability.

The Agro-Culture Liquid Fertilizer Project included 21 Pole Base units, featuring the round face, a bevel, and chamfer. Pole Base added a distinct and unique finish to the site.

PROJECT INFORMATION

PROJECT NAME
Walloon Marina Site Lighting

CUSTOMER
Steadfast Land Holdings, LLC

ENGINEER
Architectural Area Lighting

MANUFACTURER
MDC Contracting

INSTALLER
Wayne's Electric

LOCATION
Walloon, MI

YEAR BUILT
2013

Precast Bases Allow Site Lighting Installation in Wet Location

THE CHALLENGE

After decades of service, the Walloon Marina was ready for an overhaul. This marina is the epicenter of a quaint shoreline town in Northern Michigan, and local developers broke ground in 2013. The goal was to renovate the marina with extensive landscaping, paving a nearby gravel parking lot, and accenting the project with site lighting.

"For the first three weeks, it was raining every day and the site was just mud," explained Dick Borisch, Facilities Coordinator for the developer.

THE SOLUTION

Seeing the weather delays this project was facing, Wayne McPhall of Wayne's Electric suggested that the developer consider Pole Base, a precast system that could be installed regardless of weather conditions or water levels.

"They are pre-fabbed and that makes them easier to install because you can just dig the hole at any time, put the pier in, and be ready for your lights," Borisch explained. "The contractors could install them during bad weather or good. Using Pole Base was the best bet for us to get this project completed."

The advantages of Pole Base include superior aesthetics, as well as the ability to install at any time. Pole Base products are manufactured in a controlled environment and delivered on site. "It's a cleaner, easier job to just drop them in the ground than to have all that other equipment coming in," Borisch said. "It gives you more flexibility. It's up to you when you want to install them."

A total of 25 bases were installed at Walloon Marina, and the town is VERY HAPPY with the finished result.

pole base®

PROJECT INFORMATION

PROJECT NAME
Petoskey Big Boy Renovation

ENGINEER
Williams and Works

MANUFACTURER
MDC Contracting

INSTALLER
Wayne's Electric

LOCATION
Petoskey, MI

YEAR BUILT
2012

Contractor Saves Thousands on Restaurant Site Lighting

THE CHALLENGE

After decades of service, the Big Boy restaurant in Petoskey, Michigan was in dire need of a renovation. In 2012, the owner decided to tear the building down and start over from scratch.

THE SOLUTION

Plans for the overhaul included a completely new building with a cultured stone exterior. Designers also needed to create a new parking lot complete with site lighting.

With deep texture and natural colors, the Ledgestone Pole Base was a perfect fit to match the color of the cultured stone on the new building's exterior walls. Brian Ludlow, the owner of the land on which the restaurant was built, approved Pole Base due to its high-end look and the opportunity to save time and money on the installation.

Wayne McPhall of Wayne's Electric was the installer of the project. When the time came to install the 8 bases, all of the contractors in the area were behind schedule due to setbacks. "Whoever held up the project got a $10,000 a day fine, and I didn't want to get the fine," explained McPhall.

Pole Base played a large role in allowing the contractors to meet the tight schedule. "The average installation time per base was 15 to 30 minutes. I saved at least 20 man hours, so that saved me a couple thousand dollars. Especially on a rushed project, it made a big difference. I would recommend these to any electrical contractor out there, especially if the client he's working for wants a new modern look, something that looks better than the neighbors' property. It's a very easy, simple, affordable solution compared to the Sonotube."

PROJECT INFORMATION

PROJECT NAME
Shanahan Field

CUSTOMER
Charlevoix Township

ENGINEER
Gosling Czubak Engr. Sciences, Inc.

MANUFACTURER
MDC Contracting

INSTALLER
MDC Contracting

LOCATION
Charlevoix, MI

YEAR BUILT
2012

City Chooses Unique Flag Pole Base to Match Stone Work

THE CHALLENGE

When Charlevoix Township, Michigan needed a flag pole base for a newly renovated softball field, it wanted to achieve two goals. The Township needed something structurally sound, and they wanted something unique that could match the stone work used throughout the entire project.

Conventional methods of pouring bases below grade seemed out of place on a project with so much stone work. As the project will be developed in phases over the years, the Township wanted the stone work on the retaining walls to match the flag pole base, as well as the future light pole bases for the parking lot. That is when Pole Base began to make a lot of sense to the designers.

THE SOLUTION

Pole Base in Ledgestone texture was the perfect solution to the aesthetic needs of the site. Pole Base is an architectural precast concrete foundation for flag pole bases as well as outdoor site lighting. With multiple face textures, color options, and customizable finishes, Pole Base offers an aesthetic and diverse set of options for construction projects. Pole Base also has the ability to achieve deep and complex stone textures and match colors of existing stone in the area.

MDC Contracting in Charlevoix, Michigan produced the base for the Shanahan Field project. Later, MDC also installed the flag pole base in just a few short hours. The Township Officials were very pleased with the appearance of the base and the speedy installation.

pole base®

PROJECT INFORMATION

PROJECT NAME
West Branch Streetscape Project

CUSTOMER
Rauhorn Electric

ENGINEER
Lapham Associates

MANUFACTURER
MDC Contracting

INSTALLER
Rauhorn Electric

LOCATION
West Branch, MI

YEAR BUILT
2013

Contractor Saves Time With Precast Bases for Highway Lighting

THE CHALLENGE

In early 2013, the City of West Branch, Michigan began construction on a project to enhance the entrance into the town and improve safety. The West Branch Streetscape Project consisted of a 2-mile stretch of road that leads from the freeway to the downtown. The Michigan Department of Transportation (MDOT) designated 97 roadway lights to line the road.

Maximizing efficiency and minimizing space requirements were key goals to keep the project on schedule and keep the roadway completely open during the length of construction.

THE SOLUTION

The electrical contractor Rauhorn Electric chose the Pole Base precast system for this project. “We use precast bases on projects like this because of the flexibility of the system,” said Del Rau, President of Rauhorn Electric. “They can be installed in harsh weather conditions, areas with wet or undesirable soil, and are quick and easy to install.”

Pole Base is an architecturally designed precast concrete foundation for outdoor site lighting, streetscapes, parking lots, and more.

“The ability to inventory the bases on site eliminates the disadvantages of cast-in-place methods like short loads with cement mixers, waiting for the mixers to arrive on site between loads, and assembly in an uncontrolled setting. We can work on our own schedule, and that makes us more efficient,” Rau said.

On this project, total installation time per base took just 1.5 to 2 hours.

pole base®

SPECIFICATIONS

SECTION 3: SPECIFICATIONS

POLE BASE DELIVERS EXACTLY WHAT YOU ORDER

POLE BASE™ 24" (610 mm) DIAMETER ROUND SMOOTH UNITS

Pole Base™ 24" (610 mm) diameter round smooth units are machine-placed, wet-cast, precast light pole bases. The bases are manufactured from air-entrained, structural grade concrete mixes in accordance with ASTM C94 or ASTM C685 that produce a finished product with excellent resistance to deterioration from freeze-thaw cycles and deicing chemical exposure. The bases have a round smooth pattern, with a chamfered top, rustication strip, and recessed vertical joint lines, providing superior aesthetics over traditional site cast alternatives. All Pole Base™ units are manufactured and distributed through an international network of individually owned licensed precast concrete manufacturers. The controlled, factory conditions in which the bases are manufactured produce consistent, high quality products with tight dimensional tolerances on the concrete unit, reinforcing steel, anchor rods, and electrical conduits. Precast Pole Base™ units are also very easy to install, with the contractor simply needing to auger a hole, place the stone foundation, connect site conduits, lower the Pole Base™ unit into the hole, and backfill. A full listing of Pole Base™ units, detailed construction installation recommendations, design recommendations, application details, and customization options are available at www.polebase.com.

CONCRETE MIX PROPERTIES (1)

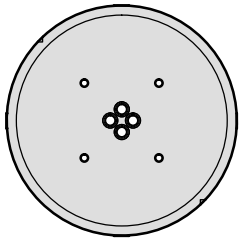
PORTLAND CEMENT (2)	MINIMUM 28 DAY COMPRESSIVE STRENGTH (3)	MAXIMUM WATER CEMENT RATIO	NOMINAL MAXIMUM AGGREGATE SIZE	AGGREGATE CLASS DESIGNATION (6)	AIR CONTENT (7)
TYPE I OR III	5,000 psi (34.5 MPa)	0.40	1 inch (25 mm)	4S	6.0% ± 1.5%
MAXIMUM WATER-SOLUBLE CHLORIDE ION (Cl^-) CONTENT IN CONCRETE, PERCENT BY WEIGHT OF CEMENT (8)					0.15
MAXIMUM CHLORIDE AS Cl^- CONCENTRATION IN MIXING WATER, PARTS PER MILLION					1000
MAXIMUM PERCENTAGE OF TOTAL CEMENTITIOUS MATERIALS BY WEIGHT (9) (VERY SEVERE EXPOSURE CLASS ONLY)					
FLY ASH OR OTHER POZZOLANS CONFORMING TO ASTM C618					25
SLAG CONFORMING TO ASTM C989					50
SILICA FUME CONFORMING TO ASTM C1240					10
TOTAL OF FLY ASH OR OTHER POZZOLANS, SLAG, AND SILICA FUME (10)					50
TOTAL OF FLY ASH OR OTHER POZZOLANS AND SILICA FUME (10)					35
ALKALI-AGGREGATE REACTIVITY MITIGATION PER ACI 201					

(1) Concrete mix properties are in general accordance with ACI 318 durability requirements. Research has shown that concrete manufactured to these standards demonstates good durability and performance. When these requirements are followed, specific freeze thaw testing of the concrete is typically NOT required.
(2) Defined in ASTM C150.
(3) Test method ASTM C39.
(6) Defined in ASTM C33 Table 3 *Limits for Deleterious Substances and Physical Property Requirements of Coarse Aggregate for Concrete* .
(7) Test method ASTM C231.
(8) Test method ASTM C1218 at age between 28 and 42 days.
(9) The total cementitious material also includes ASTM C150, C595, C845, and C1157 cement. The maximum percentages shall include:
(a) Fly ash or other pozzolans in type IP, blended cement, ASTM C595, or ASTM C1157.
(b) Slag used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157.
(c) Silica fume, ASTM C1240, present in a blended cement.
(10) Fly ash or other pozzolans and silica fume shall constitute no more than 25 and 10 percent, respectively, of the total weight of the cementitious materials.

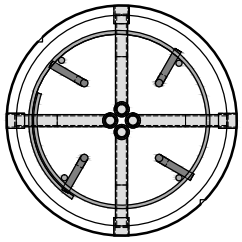
ADDITIONAL MATERIALS

STEEL REINFORCING BARS - ASTM A615 OR ASTM A706 (LOW ALLOY "WELDABLE"), GRADE 60	
VERTICAL BARS	(4) #5 (#16) BARS, 1.5" (38 mm) MINIMUM COVER
HORIZONTAL ROUND TIES	#3 (#10) BARS, TOP (3) SPACED AT 6" (150 mm), BALANCE SPACED AT 12" (300 mm) TO BOTTOM OF BASE
ANCHOR RODS	
CUSTOM OPTION	RODS SUPPLIED BY LIGHT POLE MANUFACTURER, INSTALLED TO SPECIFIED PATTERN AND PROJECTION
STANDARD OPTION	(4) ¾" (19 mm) DIA. RODS, ASTM A36, GALVANIZED PER ASTM A123 CLASS C
	10 THREADS PER INCH (25 mm), 30" (760 mm) LONG WITH ADDITIONAL 4" (100 mm) 90° BEND
	INSTALLED IN A 8.5" (216mm) OR 11" (279 mm) BOLT CIRCLE PATTERN, 4" (100 mm) PROJECTION
PVC ELECTRICAL CONDUIT	
CUSTOM OPTION	CONDUIT NUMBER, DIAMETER, CONFIGURATION, AND MATERIAL INSTALLED PER PROJECT ENGINEERING
STANDARD OPTION	(4) 1" (25 mm) DIA. CONDUITS WITH 90° BENDS, ASTM F512, INSTALLED AT CARDINAL POINTS, AND COUPLERS,
	ASTM F512, AT ALL CONDUIT EXIT POINTS ON TOP AND SIDES OF BASE. CONDUITS TERMINATE AT THE
	SIDES OF THE BASE 24" (610 mm) BELOW THE FINISHED TEXTURE PORTION OF THE UNIT.

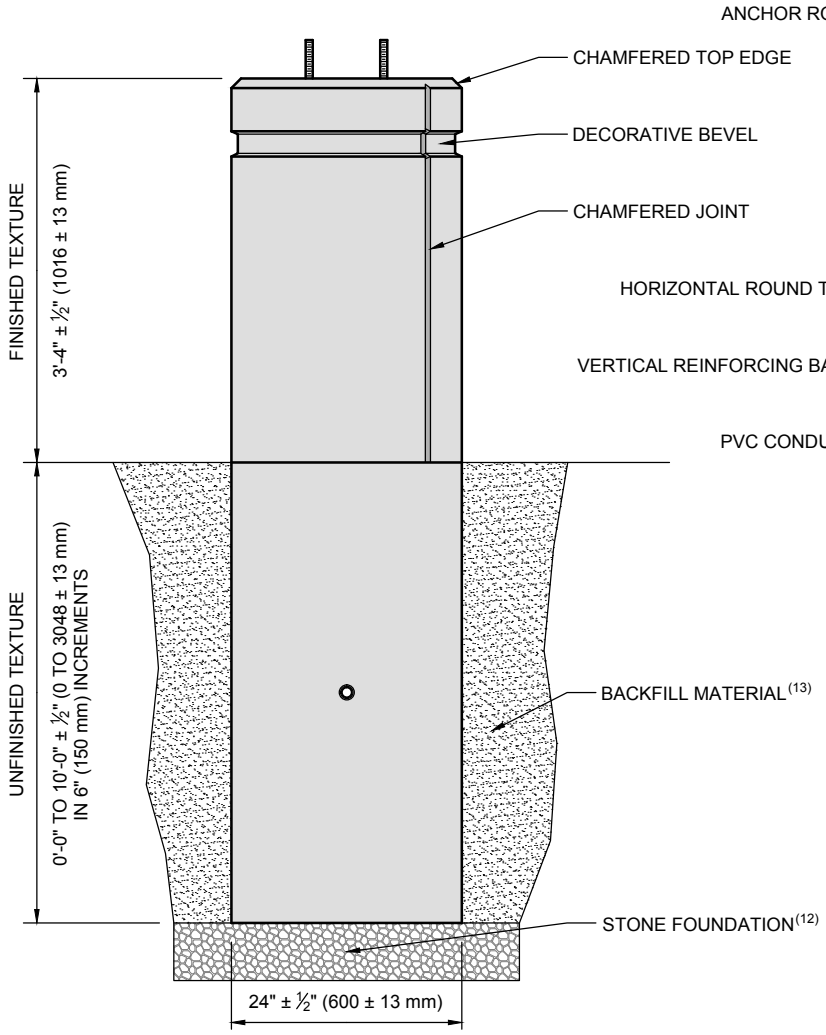
POLE BASE™ 24" (610 mm) DIAMETER ROUND SMOOTH UNITS



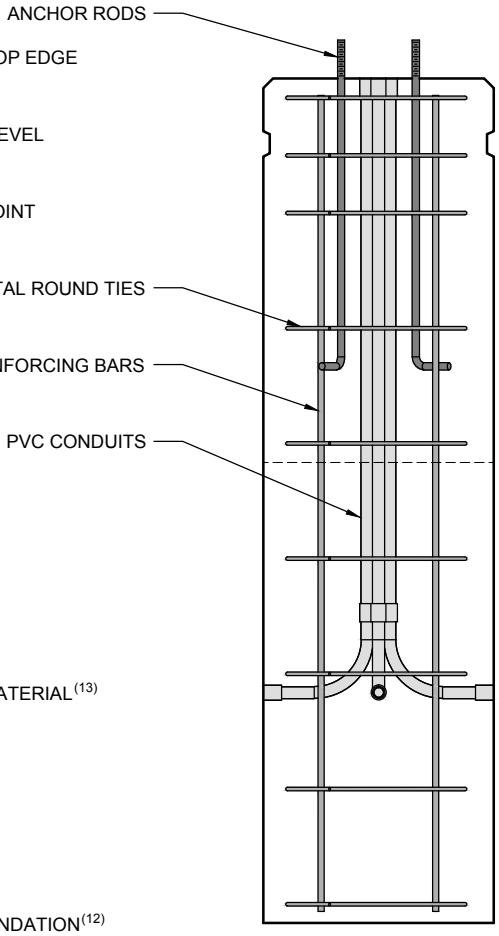
TOP VIEW



TOP VIEW - SECTION



SIDE VIEW - INSTALLATION



SIDE VIEW - SECTION

	CONCRETE VOLUME	SHIPPING / HANDLING WEIGHT (11)
FINISHED TEXTURE PORTION	10.38 ft^3 (0.294 m^3)	1490 lb (675 kg)
UNFINISHED TEXTURE PORTION	1.57 ft^3 (0.044 m^3) FOR EACH 6" (0.150 m) INCREMENT	225 lb (102 kg) FOR EACH 6" (0.150 m) INCREMENT

(11) Based on an assumed concrete unit weight of 143 lb/ft^3 (2300 kg/m^3). Actual weights will vary.
(12) Stone foundation shall conform to ASTM C33 No. 57. Compact to 90% relative density determined per ASTM D4253 and D4254 or on-site performance testing. Stone to be minimum of 6" (150 mm) thick and extend 6" (150 mm) beyond base all around.
(13) Backfill material shall be one of the following: crushed stone, granular material, or controlled low-strength material. Crushed stone, Size 57 per ASTM C33, compacted to 90% relative density per ASTM D4253 & D4254. Granular material shall be soil types GW, GP, SW, or SP per ASTM D2487, compacted to 95% maximum density per ASTM D698. Controlled low-strength material shall be per ACI 229, maximum compressive strength of 100 psi (0.7 MPa) per ASTM D4832, flow consistency per ASTM D6103, minimum uniform spread of 8" (200 mm) with no segregation.

Revised 10/21/14

POLE BASE™ 24" (610 mm) DIAMETER ROUND FLUTED UNITS

Pole Base™ 24" (610 mm) diameter round fluted units are machine-placed, wet-cast, precast light pole bases. The bases are manufactured from air-entrained, structural grade concrete mixes in accordance with ASTM C94 or ASTM C685 that produce a finished product with excellent resistance to deterioration from freeze-thaw cycles and deicing chemical exposure. The bases have a classic heavy fluted textured column look and monolithic cap with chamfered edges at the top of the unit, providing superior aesthetics over traditional site cast alternatives. All Pole Base™ units are manufactured and distributed through an international network of individually owned licensed precast concrete manufacturers. The controlled, factory conditions in which the bases are manufactured produce consistent, high quality products with tight dimensional tolerances on the concrete unit, reinforcing steel, anchor rods, and electrical conduits. Precast Pole Base™ units are also very easy to install, with the contractor simply needing to auger a hole, place the stone foundation, connect site conduits, lower the Pole Base unit into the hole, and backfill. A full listing of Pole Base™ units, detailed construction installation recommendations, design recommendations, application details, and customization options are available at www.polebase.com.

CONCRETE MIX PROPERTIES (1)

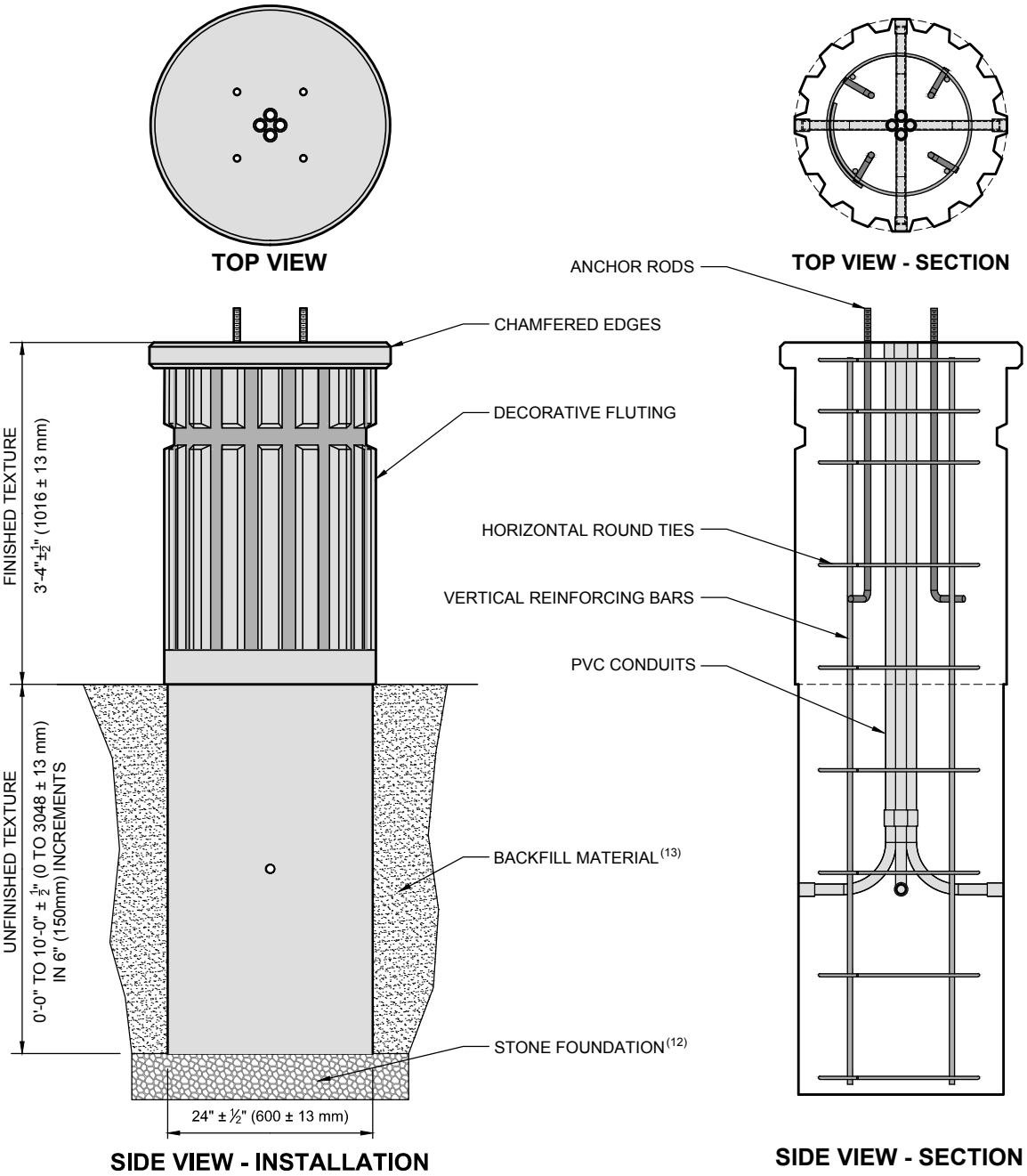
PORTLAND CEMENT (2)	MINIMUM 28 DAY COMPRESSIVE STRENGTH (3)	MAXIMUM WATER CEMENT RATIO	NOMINAL MAXIMUM AGGREGATE SIZE	AGGREGATE CLASS DESIGNATION (6)	AIR CONTENT (7)
TYPE I OR III	5,000 psi (34.5 MPa)	0.40	1 inch (25 mm)	4S	6.0% ± 1.5%
MAXIMUM WATER-SOLUBLE CHLORIDE ION (Cl^-) CONTENT IN CONCRETE, PERCENT BY WEIGHT OF CEMENT (8)					0.15
MAXIMUM CHLORIDE AS Cl^- CONCENTRATION IN MIXING WATER, PARTS PER MILLION					1000
MAXIMUM PERCENTAGE OF TOTAL CEMENTITIOUS MATERIALS BY WEIGHT (9) (VERY SEVERE EXPOSURE CLASS ONLY)					
FLY ASH OR OTHER POZZOLANS CONFORMING TO ASTM C618					25
SLAG CONFORMING TO ASTM C989					50
SILICA FUME CONFORMING TO ASTM C1240					10
TOTAL OF FLY ASH OR OTHER POZZOLANS, SLAG, AND SILICA FUME (10)					50
TOTAL OF FLY ASH OR OTHER POZZOLANS AND SILICA FUME (10)					35
ALKALI-AGGREGATE REACTIVITY MITIGATION PER ACI 201					

(1) Concrete mix properties are in general accordance with ACI 318 durability requirements. Research has shown that concrete manufactured to these standards demonstates good durability and performance. When these requirements are followed, specific freeze thaw testing of the concrete is typically NOT required.
(2) Defined in ASTM C150.
(3) Test method ASTM C39.
(6) Defined in ASTM C33 Table 3 *Limits for Deleterious Substances and Physical Property Requirements of Coarse Aggregate for Concrete* .
(7) Test method ASTM C231.
(8) Test method ASTM C1218 at age between 28 and 42 days.
(9) The total cementitious material also includes ASTM C150, C595, C845, and C1157 cement. The maximum percentages shall include:
(a) Fly ash or other pozzolans in type IP, blended cement, ASTM C595, or ASTM C1157.
(b) Slag used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157.
(c) Silica fume, ASTM C1240, present in a blended cement.
(10) Fly ash or other pozzolans and silica fume shall constitute no more than 25 and 10 percent, respectively, of the total weight of the cementitious materials.

ADDITIONAL MATERIALS

STEEL REINFORCING BARS - ASTM A615 OR ASTM A706 (LOW ALLOY "WELDABLE"), GRADE 60	
VERTICAL BARS	(4) #5 (#16) BARS, 1.5" (38 mm) MINIMUM COVER
HORIZONTAL ROUND TIES	#3 (#10) BARS, TOP (3) SPACED AT 6" (150 mm), BALANCE SPACED AT 12" (300 mm) TO BOTTOM OF BASE
ANCHOR RODS	
CUSTOM OPTION	RODS SUPPLIED BY LIGHT POLE MANUFACTURER, INSTALLED TO SPECIFIED PATTERN AND PROJECTION
STANDARD OPTION	(4) ¾" (19 mm) DIA. RODS, ASTM A36, GALVANIZED PER ASTM A123 CLASS C
	10 THREADS PER INCH (25 mm), 30" (760 mm) LONG WITH ADDITIONAL 4" (100 mm) 90° BEND
	INSTALLED IN A 8.5" (216mm) OR 11" (279 mm) BOLT CIRCLE PATTERN, 4" (100 mm) PROJECTION
PVC ELECTRICAL CONDUIT	
CUSTOM OPTION	CONDUIT NUMBER, DIAMETER, CONFIGURATION, AND MATERIAL INSTALLED PER PROJECT ENGINEERING
STANDARD OPTION	(4) 1" (25 mm) DIA. CONDUITS WITH 90° BENDS, ASTM F512, INSTALLED AT CARDINAL POINTS, AND COUPLERS,
	ASTM F512, AT ALL CONDUIT EXIT POINTS ON TOP AND SIDES OF BASE. CONDUITS TERMINATE AT THE
	SIDES OF THE BASE 24" (610 mm) BELOW THE FINISHED TEXTURE PORTION OF THE UNIT.

POLE BASE™ 24" (610 mm) DIAMETER ROUND FLUTED UNITS



	CONCRETE VOLUME	SHIPPING / HANDLING WEIGHT (11)
FINISHED TEXTURE PORTION	11.12 ft^3 (0.315 m^3)	1590 lb (723 kg)
UNFINISHED TEXTURE PORTION	1.57 ft^3 (0.044 m^3) FOR EACH 6" (0.150 m) INCREMENT	225 lb (102 kg) FOR EACH 6" (0.150 m) INCREMENT

(11) Based on an assumed concrete unit weight of 143 lb/ft^3 (2300 kg/m^3). Actual weights will vary.
(12) Stone foundation shall conform to ASTM C33 No. 57. Compact to 90% relative density determined per ASTM D4253 and D4254 or on-site performance testing. Stone to be minimum of 6" (150 mm) thick and extend 6" (150 mm) beyond base all around.
(13) Backfill material shall be one of the following: crushed stone, granular material, or controlled low-strength material. Crushed stone, Size 57 per ASTM C33, compacted to 90% relative density per ASTM D4253 & D4254. Granular material shall be soil types GW, GP, SW, or SP per ASTM D2487, compacted to 95% maximum density per ASTM D698. Controlled low-strength material shall be per ACI 229, maximum compressive strength of 100 psi (0.7 MPa) per ASTM D4832, flow consistency per ASTM D6103, minimum uniform spread of 8" (200 mm) with no segregation.

Revised 10/21/14

POLE BASE™ SQUARE LEDGESTONE UNITS

Pole Base™ Square Ledgestone units are machine-placed, wet-cast, precast light pole bases. The bases are manufactured from air-entrained, structural grade concrete mixes in accordance with ASTM C94 or ASTM C685 that produce a finished product with excellent resistance to deterioration from freeze-thaw cycles and deicing chemical exposure. The bases have a square pattern that replicates the appearance of dry stacked limestone blocks, with a textually matched monolithic cap, providing superior aesthetics over traditional site cast alternatives. All Pole Base™ units are manufactured and distributed through an international network of individually owned licensed precast concrete manufacturers. The controlled, factory conditions in which the bases are manufactured produce consistent, high quality products with tight dimensional tolerances on the concrete unit, reinforcing steel, anchor rods, and electrical conduits. Precast Pole Base™ units are also very easy to install, with the contractor simply needing to auger a hole, place the stone foundation, connect site conduits, lower the Pole Base™ unit into the hole, and backfill. A full listing of Pole Base™ units, detailed construction installation recommendations, design recommendations, application details, and customization options are available at www.polebase.com.

CONCRETE MIX PROPERTIES (1)

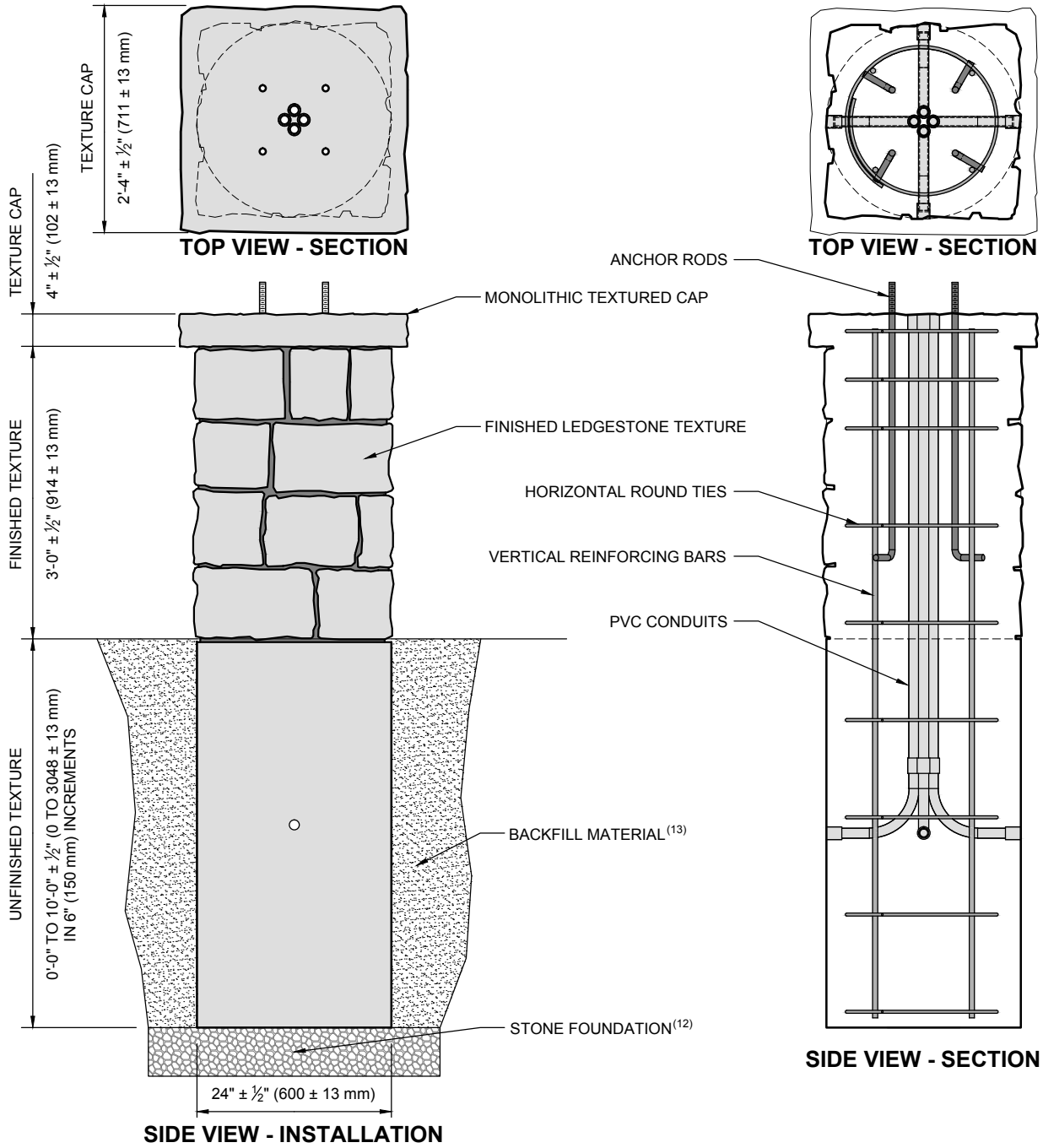
PORTLAND CEMENT (2)	MINIMUM 28 DAY COMPRESSIVE STRENGTH (3)	MAXIMUM WATER CEMENT RATIO	NOMINAL MAXIMUM AGGREGATE SIZE	AGGREGATE CLASS DESIGNATION (6)	AIR CONTENT (7)
TYPE I OR III	5,000 psi (34.5 MPa)	0.40	1 inch (25 mm)	4S	6.0% ± 1.5%
MAXIMUM WATER-SOLUBLE CHLORIDE ION (Cl^-) CONTENT IN CONCRETE, PERCENT BY WEIGHT OF CEMENT (8)					0.15
MAXIMUM CHLORIDE AS Cl^- CONCENTRATION IN MIXING WATER, PARTS PER MILLION					1000
MAXIMUM PERCENTAGE OF TOTAL CEMENTITIOUS MATERIALS BY WEIGHT (9) (VERY SEVERE EXPOSURE CLASS ONLY)					
FLY ASH OR OTHER POZZOLANS CONFORMING TO ASTM C618					25
SLAG CONFORMING TO ASTM C989					50
SILICA FUME CONFORMING TO ASTM C1240					10
TOTAL OF FLY ASH OR OTHER POZZOLANS, SLAG, AND SILICA FUME (10)					50
TOTAL OF FLY ASH OR OTHER POZZOLANS AND SILICA FUME (10)					35
ALKALI-AGGREGATE REACTIVITY MITIGATION PER ACI 201					

(1) Concrete mix properties are in general accordance with ACI 318 durability requirements. Research has shown that concrete manufactured to these standards demonstates good durability and performance. When these requirements are followed, specific freeze thaw testing of the concrete is typically NOT required.
(2) Defined in ASTM C150.
(3) Test method ASTM C39.
(6) Defined in ASTM C33 Table 3 *Limits for Deleterious Substances and Physical Property Requirements of Coarse Aggregate for Concrete* .
(7) Test method ASTM C231.
(8) Test method ASTM C1218 at age between 28 and 42 days.
(9) The total cementitious material also includes ASTM C150, C595, C845, and C1157 cement. The maximum percentages shall include:
(a) Fly ash or other pozzolans in type IP, blended cement, ASTM C595, or ASTM C1157.
(b) Slag used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157.
(c) Silica fume, ASTM C1240, present in a blended cement.
(10) Fly ash or other pozzolans and silica fume shall constitute no more than 25 and 10 percent, respectively, of the total weight of the cementitious materials.

ADDITIONAL MATERIALS

STEEL REINFORCING BARS - ASTM A615 OR ASTM A706 (LOW ALLOY "WELDABLE"), GRADE 60	
VERTICAL BARS	(4) #5 (#16) BARS, 1.5" (38 mm) MINIMUM COVER
HORIZONTAL ROUND TIES	#3 (#10) BARS, TOP (3) SPACED AT 6" (150 mm), BALANCE SPACED AT 12" (300 mm) TO BOTTOM OF BASE
ANCHOR RODS	
CUSTOM OPTION	RODS SUPPLIED BY LIGHT POLE MANUFACTURER, INSTALLED TO SPECIFIED PATTERN AND PROJECTION
STANDARD OPTION	(4) ¾" (19 mm) DIA. RODS, ASTM A36, GALVANIZED PER ASTM A123 CLASS C
	10 THREADS PER INCH (25 mm), 30" (760 mm) LONG WITH ADDITIONAL 4" (100 mm) 90° BEND
	INSTALLED IN A 8.5" (216mm) OR 11" (279 mm) BOLT CIRCLE PATTERN, 4" (100 mm) PROJECTION
PVC ELECTRICAL CONDUIT	
CUSTOM OPTION	CONDUIT NUMBER, DIAMETER, CONFIGURATION, AND MATERIAL INSTALLED PER PROJECT ENGINEERING
STANDARD OPTION	(4) 1" (25 mm) DIA. CONDUITS WITH 90° BENDS, ASTM F512, INSTALLED AT CARDINAL POINTS, AND COUPLERS,
	ASTM F512, AT ALL CONDUIT EXIT POINTS ON TOP AND SIDES OF BASE. CONDUITS TERMINATE AT THE
	SIDES OF THE BASE 24" (610 mm) BELOW THE FINISHED TEXTURE PORTION OF THE UNIT.

POLE BASE™ SQUARE LEDGESTONE UNITS



	CONCRETE VOLUME	SHIPPING / HANDLING WEIGHT (11)
FINISHED TEXTURE PORTION	13.20 ft^3 (0.374 m^3)	1890 lb (858 kg)
UNFINISHED TEXTURE PORTION	1.57 ft^3 (0.044 m^3) FOR EACH 6" (0.150 m) INCREMENT	225 lb (102 kg) FOR EACH 6" (0.150 m) INCREMENT

(11) Based on an assumed concrete unit weight of 143 lb/ft^3 (2300 kg/m^3). Actual weights will vary.
(12) Stone foundation shall conform to ASTM C33 No. 57. Compact to 90% relative density determined per ASTM D4253 and D4254 or on-site performance testing. Stone to be minimum of 6" (150 mm) thick and extend 6" (150 mm) beyond base all around.
(13) Backfill material shall be one of the following: crushed stone, granular material, or controlled low-strength material. Crushed stone, Size 57 per ASTM C33, compacted to 90% relative density per ASTM D4253 & D4254. Granular material shall be soil types GW, GP, SW, or SP per ASTM D2487, compacted to 95% maximum density per ASTM D698. Controlled low-strength material shall be per ACI 229, maximum compressive strength of 100 psi (0.7 MPa) per ASTM D4832, flow consistency per ASTM D6103, minimum uniform spread of 8" (200 mm) with no segregation.

Revised 10/21/14

SECTION 31 66 13

PRECAST CONCRETE POLE BASE™ UNITS

PART 1 – GENERAL

1.01 Summary

A. Work under this section includes furnishing and the installation of precast concrete 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.

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 measured 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 318-11/318R-11 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 2009 International Building Code, International Code Council, Inc. (2009).
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 supporting structural calculations for the Pole Base™ units to be furnished. The construction detail drawings shall illustrate all pertinent aspects of the construction of Pole Base™ unit as well as the means 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 manufacturer. The manufacturer shall be 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. Local manufacturers to be inserted here.

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 all wiring conduits, structural reinforcement and structural connection devices with a total height above grade, of up to 40 inches (1.0m). The above grade section of the Pole Base™ unit shall consist of an architectural exterior finished upper portion (further described in Section 2.05), and a lower portion consisting of a formed concrete cylinder to be embedded in the earth below grade. A set of up to (4) customized steel j-bolts and up to (4) PVC electrical conduits (detailed in Section 1.05B) shall be provided at the top of the Pole Base™ unit for attachment to the pole flange.

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. J-Bolt Anchor Rod Connectors:. The j-bolt 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 to match the connection requirements of the pole flange.

D. Electrical Conduit: PVC electrical conduit and fittings integrally cast in the precast concrete Pole Base™ unit shall meet the requirements of ASTM F512.

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:

Gradation per U.S. Standard (Metric) Sieve Size:		Percentage Passing
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 unit features a 40” (1.0m) tall square column with 24” (610mm) wide sides and a cap that has all exposed surfaces of the Pole Base™ unit, with the exception of the top surface, that simulate a natural Ledgestone texture approximating the appearance 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 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 connection strength to 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 unit features a 40" (1.0m) tall above grade by 24" (610mm) diameter cylinder, with vertical rustication strips, and topped with a round capitol. This piece features light texturing, a cap, and angular bevel, and "fluted" indentations surrounding the surface of the above grade section of the base.

D. Standard Smooth: This unit is a 40" (1.0m) tall above grade by smooth finished 24" (610mm) diameter cylinder, with a horizontal rustication strip near the top of the unit to create a capitol appearance above grade.

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.

Gradation per U.S. Standard (Metric) Sieve Size:		Percentage Passing
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/m^3)

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. This should achieve 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. This should achieve 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

pole base®

DESIGN CHARTS

SECTION 4: DESIGN CHARTS

THE HARD PART IS ALREADY DONE

Important Notice

The design specifications for Pole Base™ units suggest earth embedment depths with certain assumed conditions. The earth embedments were calculated using the assumed material properties and loading conditions described in the Design Resource Manual. These will vary from location to location depending upon the soil properties and terrain. Since soil conditions and topography vary greatly from site to site, a detailed engineering analysis must be performed for each Pole Base™ installation.

Because Pole Base™ does not manufacture nor install these units, it does not assume any responsibility regarding structural suitability of its products for any particular project. In addition, Pole Base™ assumes no responsibility in connection with any injury, death, or property damage claim whatsoever whether asserted against a Leasee, Leasor, Purchaser or others, arising out of or attributable to the operation of or produced with Pole Base™ equipment.

Pole Base™ – Foundation Design Guide

Analysis Methods:

- This Guide was prepared for preliminary estimating and conceptual purposes only. All information is believed to be true and accurate; however, Pole Base™ assumes no responsibility for the use of this design guide for actual construction. Determination of the suitability of each chart is the sole responsibility of the user. Final designs for construction purposes must be performed by a licensed Professional Engineer, using the actual conditions of the site.
- The foundation design guide for embedment of the round concrete poles is based upon the provisions described in the American Association of State Highway and Transportation Officials (AASHTO) publication: Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals, 6th Edition, 2013 (LTS-6), Washington, DC.

Wind Loading Assumptions:

- The wind loading on the fixtures, poles, and bases is based upon Section 3.8 – Wind Load
- The Basic Wind Speed Section 3.8.2. Assumed wind speed 90 mph (40 m/s).
- The following factors and assumptions were used in the creation of the guide. These factors will need to be analyzed and verified by the Licensed Professional Engineer of the project:
    - Wind Importance Factor, I_r = 1.00 (Section 3.8.3)
    - Velocity Conversion Factor, C_v = 1.00 (Table 3.8.3-3)
    - Height and Exposure Factor, Pole & Fixture K_z = 1.00; Base K_z = 0.86 (Section 3.8.4)
    - Gust Effect Factor, G=1.14 (Section 3.8.5)
    - Drad Coefficients, C_d: (Table 3.8.6-1)
        - Light Fixture, C_d=1.2
        - Light Pole, 6” square, C_d=1.875; 6” round, C_d= 0.915
        - Pole Base (40” tall), 24” square, C_d=1.75; 24” round, C_d= 0.45

Foundation Design Assumptions:

- The formulas for the earth embedment depth are based upon Section 13: Foundation Design.
- The following factors and assumptions were used in the creation of the guide. These factors will need to be analyzed and verified by the Licensed Professional Engineer of the project:
    - Dense backfill around the base: 2000 psi concrete, Well compacted clean sand, or (CLSM).
    - Minimum earth embedment of Pole Base™ units is at least: the calculated value, 3’-0” (0.9 m), or the depth of local frost penetration.
    - Overload Factor = 2.5; Undercapacity Factor = 0.7 (Section C13.6.1.1)
    - Embedment Length in Granular Soil, Equation (C13.6.1.1-3)
    - Embedment Length in Cohesive Soil, Equation (C13.6.1.1-7)

MINIMUM EMBEDMENT GUIDE

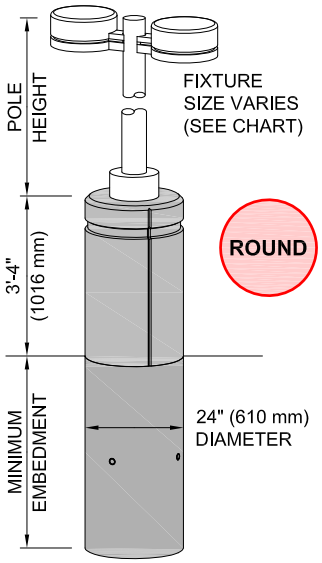
24" (610 mm) DIAMETER ROUND POLE BASE™ UNITS [1] **6" (150 mm) DIAMETER ROUND LIGHT POLE**

MINIMUM EMBEDMENT

POLE HEIGHT	SIGN OR FIXTURE AREA			
	2 ft² (0.186 m²)	**4 ft²** (0.372 m²)	**6 ft²** (0.557 m²)	**8 ft²** (0.743 m²)
BASES IN GRAVEL SOILS (GW, GP) [2] [7]				
15' (4.6 m)	**3'-0"** (0.9 m)	**3'-6"** (1.1 m)	**3'-6"** (1.1 m)	**4'-0"** (1.2 m)
20' (6.1 m)	**3'-6"** (1.1 m)	**4'-0"** (1.2 m)	**4'-0"** (1.2 m)	**4'-6"** (1.4 m)
25' (7.6 m)	**4'-0"** (1.2 m)	**4'-6"** (1.4 m)	**4'-6"** (1.4 m)	**5'-0"** (1.5 m)
30' (9.1 m)	**4'-6"** (1.4 m)	**4'-6"** (1.4 m)	**5'-0"** (1.5 m)	**5'-6"** (1.7 m)
35' (10.7 m)	**5'-0"** (1.5 m)	**5'-6"** (1.7 m)	**5'-6"** (1.7 m)	**5'-6"** (1.7 m)
BASES IN SANDY SOILS (SW, SP, SM, SC, GM, GC) [3] [7]				
15' (4.6 m)	**3'-6"** (1.1 m)	**4'-0"** (1.2 m)	**4'-0"** (1.2 m)	**4'-6"** (1.4 m)
20' (6.1 m)	**4'-0"** (1.2 m)	**4'-6"** (1.4 m)	**4'-6"** (1.4 m)	**5'-0"** (1.5 m)
25' (7.6 m)	**4'-6"** (1.4 m)	**4'-6"** (1.4 m)	**5'-0"** (1.5 m)	**5'-6"** (1.7 m)
30' (9.1 m)	**5'-0"** (1.5 m)	**5'-0"** (1.5 m)	**5'-6"** (1.7 m)	**5'-6"** (1.7 m)
35' (10.7 m)	**5'-6"** (1.7 m)	**5'-6"** (1.7 m)	**6'-0"** (1.8 m)	**6'-0"** (1.8 m)
BASES IN CLAYEY SOILS (CL, ML, CH, MH) [4] [7]				
15' (4.6 m)	**6'-6"** (2.0 m)	**7'-0"** (2.1 m)	**7'-6"** (2.3 m)	**8'-0"** (2.4 m)
20' (6.1 m)	**7'-6"** (2.3 m)	**8'-0"** (2.4 m)	**8'-6"** (2.6 m)	**9'-0"** (2.7 m)
25' (7.6 m)	**8'-0"** (2.4 m)	**9'-0"** (2.7 m)	**9'-6"** (2.9 m)	**10'-0"** (3.0 m)
30' (9.1 m)	**9'-0"** (2.7 m)	**9'-6"** (2.9 m)	**10'-0"** (3.0 m)	**10'-6"** (3.2 m)
35' (10.7 m)	**10'-0"** (3.0 m)	**10'-6"** (3.2 m)	**11'-0"** (3.4 m)	**11'-6"** (3.5 m)

DESIGN FORCES

POLE HEIGHT	UNFACTORED SHEAR FORCE / OVERTURNING MOMENT [5] [6]			
15' (4.6 m)	**255 lb** (1.14 kN) **2,579 lb * ft** (3.50 kN * m)	**305 lb** (1.37 kN) **3,500 lb * ft** (4.75 kN * m)	**355 lb** (1.59 kN) **4,421 lb * ft** (5.99 kN * m)	**406 lb** (1.82 kN) **5,342 lb * ft** (7.24 kN * m)
20' (6.1 m)	**315 lb** (1.41 kN) **4,022 lb * ft** (5.45 kN * m)	**368 lb** (1.65 kN) **5,255 lb * ft** (7.12 kN * m)	**421 lb** (1.89 kN) **6,488 lb * ft** (8.80 kN * m)	**474 lb** (2.12 kN) **7,722 lb * ft** (10.47 kN * m)
25' (7.6 m)	**379 lb** (1.70 kN) **5,816 * ft** (7.89 kN * m)	**434 lb** (1.94 kN) **7,376 lb * ft** (10.00 kN * m)	**489 lb** (2.19 kN) **8,936 lb * ft** (12.12 kN * m)	**544 lb** (2.44 kN) **10,497 lb * ft** (14.23 kN * m)
30' (9.1 m)	**444 lb** (1.99 kN) **7,975 lb * ft** (10.81 kN * m)	**501 lb** (2.24 kN) **9,874 lb * ft** (13.39 kN * m)	**558 lb** (2.50 kN) **11,773 lb * ft** (15.96 kN * m)	**615 lb** (2.76 kN) **13,672 lb * ft** (18.54 kN * m)
35' (10.7 m)	**511 lb** (2.29 kN) **10,507 lb * ft** (14.25 kN * m)	**570 lb** (2.55 kN) **12,757 lb * ft** (17.30 kN * m)	**629 lb** (2.82 kN) **15,006 lb * ft** (20.34 kN * m)	**687 lb** (3.08 kN) **17,255 lb * ft** (23.40 kN * m)



Design Reference: *AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*, 6th Edition, 2013 (LTS-6).

[1] Calculations have been run for a 24" (610 mm) diameter round base 3'-4" (1016 mm) above grade with a 24" (610 mm) diameter bury portion in the soil.

[2] Assumed $\phi = 34°$, $\gamma = 130$ lb/ft^3 (2080 kg/m^3), c = 0 lb/ft^2 (0 kPa).

[3] Assumed $\phi = 30°$, $\gamma = 120$ lb/ft^3 (1920 kg/m^3), c = 0 lb/ft^2 (0 kPa).

[4] Assumed $\phi = 10°$, $\gamma = 130$ lb/ft^3 (2080 kg/m^3), c = 250 lb/ft^2 (12.0 kPa).

[5] Calculations run with the following factors and assumptions:

- Exposure Condition C
- Basic Wind Speed, V = 90 mph (40m/s)
- Importance Factor, $I_r = 1.0$
- Velocity Conversion Factor, $C_v = 1.00$
- Gust Factor, G = 1.14
- Overload Factor = 2.5
- Drag Coefficient (Fixture), $C_{d\ fixture} = 1.2$
- Drag Coefficient (Pole), $C_{d\ pole} = 0.915$
- Drag Coefficient (Base), $C_{d\ base} = 0.45$
- Height and Exposure Factor (Pole and Fixture), $K_{z\ pole} = 1.00$
- Height and Exposure Factor (Base), $K_{z\ base} = 0.86$
- Undercapacity Factor = 0.7

[6] Calculations assume a double light fixture with the total surface area of both fixtures equal to the value shown in the chart. Unbalanced loading from a single offset fixture is not included in this preliminary guide, and must be addressed in final design calculations if planned for use.

[7] Minimum recommended embedment shall be the calculated value, depth of local frost penetration, or 3'-0" (0.9 m), whichever is greater.

This preliminary guide was prepared by Pole Base™ for estimating and conceptual purposes only. All information is believed to be true and accurage; however, Pole Base™ assumes no responsibility for the use of these preliminary guides for actual construction. Determination of the suitability of each recommendation is the sole responsibility of the User. Final designs for construction must be performed by a licensed Professional Engineer using the actual conditions of the site. *(Rev. 5SEP2014)*

MINIMUM EMBEDMENT GUIDE

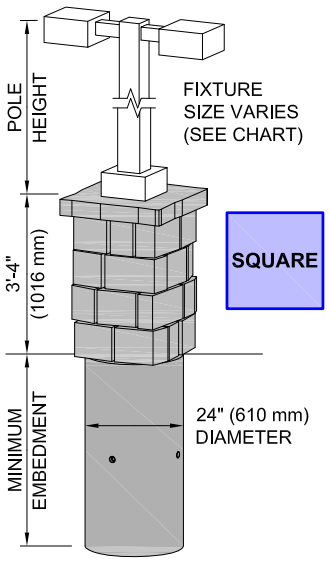
LEDGESTONE OR 24" (610 mm) SQUARE POLE BASE™ UNITS [1] **6" (150 mm) SQUARE LIGHT POLE**

MINIMUM EMBEDMENT

POLE HEIGHT	SIGN OR FIXTURE AREA			
	2 ft² (0.186 m²)	**4 ft²** (0.372 m²)	**6 ft²** (0.557 m²)	**8 ft²** (0.743 m²)
BASES IN GRAVEL SOILS (GW, GP) [2] [7]				
15' (4.6 m)	**4'-0"** (1.2 m)	**4'-0"** (1.2 m)	**4'-6"** (1.4 m)	**4'-6"** (1.4 m)
20' (6.1 m)	**4'-6"** (1.4 m)	**4'-6"** (1.4 m)	**5'-0"** (1.5 m)	**5'-0"** (1.5 m)
25' (7.6 m)	**5'-0"** (1.5 m)	**5'-0"** (1.5 m)	**5'-6"** (1.7 m)	**5'-6"** (1.7 m)
30' (9.1 m)	**5'-6"** (1.7 m)	**6'-0"** (1.8 m)	**6'-0"** (1.8 m)	**6'-0"** (1.8 m)
35' (10.7 m)	**6'-0"** (1.8 m)	**6'-6"** (2.0 m)	**6'-6"** (2.0 m)	**6'-6"** (2.0 m)
BASES IN SANDY SOILS (SW, SP, SM, SC, GM, GC) [3] [7]				
15' (4.6 m)	**4'-6"** (1.4 m)	**4'-6"** (1.4 m)	**4'-6"** (1.4 m)	**5'-0"** (1.5 m)
20' (6.1 m)	**5'-0"** (1.5 m)	**5'-0"** (1.5 m)	**5'-6"** (1.7 m)	**5'-6"** (1.7 m)
25' (7.6 m)	**5'-6"** (1.7 m)	**5'-6"** (1.7 m)	**6'-0"** (1.8 m)	**6'-0"** (1.8 m)
30' (9.1 m)	**6'-0"** (1.8 m)	**6'-6"** (2.0 m)	**6'-6"** (2.0 m)	**6'-6"** (2.0 m)
35' (10.7 m)	**6'-6"** (2.0 m)	**7'-0"** (2.1 m)	**7'-0"** (2.1 m)	**7'-0"** (2.1 m)
BASES IN CLAYEY SOILS (CL, ML, CH, MH) [4] [7]				
15' (4.6 m)	**8'-0"** (2.4 m)	**8'-6"** (2.6 m)	**9'-0"** (2.7 m)	**9'-6"** (2.9 m)
20' (6.1 m)	**9'-0"** (2.7 m)	**9'-6"** (2.9 m)	**10'-0"** (3.0 m)	**10'-6"** (3.2 m)
25' (7.6 m)	**10'-6"** (3.2 m)	**11'-0"** (3.4 m)	**11'-0"** (3.4 m)	**11'-6"** (3.5 m)
30' (9.1 m)	**11'-6"** (3.5 m)	**12'-0"** (3.7 m)	**12'-6"** (3.8 m)	**13'-0"** (4.0 m)
35' (10.7 m)	**12'-6"** (3.8 m)	**13'-0"** (4.0 m)	**13'-6"** (4.1 m)	**14'-0"** (4.3 m)

DESIGN FORCES

POLE HEIGHT	UNFACTORED SHEAR FORCE / OVERTURNING MOMENT [5] [6]			
15' (4.6 m)	**582 lb** (2.61 kN) **4,506 lb * ft** (6.11 kN * m)	**632 lb** (2.83 kN) **5,427 lb * ft** (7.36 kN * m)	**682 lb** (3.06 kN) **6,348 lb * ft** (8.61 kN * m)	**733 lb** (3.28 kN) **7,269 lb * ft** (9.86 kN * m)
20' (6.1 m)	**703 lb** (3.15 kN) **7,135 lb * ft** (9.67 kN * m)	**756 lb** (3.39 kN) **8,368 lb * ft** (11.35 kN * m)	**809 lb** (3.63 kN) **9,601 lb * ft** (13.02 kN * m)	**862 lb** (3.86 kN) **10,834 lb * ft** (14.69 kN * m)
25' (7.6 m)	**830 lb** (3.72 kN) **10,469 * ft** (14.19 kN * m)	**885 lb** (3.97 kN) **12,029 lb * ft** (16.31 kN * m)	**940 lb** (4.21 kN) **13,589 lb * ft** (18.42 kN * m)	**995 lb** (4.46 kN) **15,149 lb * ft** (20.54 kN * m)
30' (9.1 m)	**962 lb** (4.31 kN) **14,536 lb * ft** (19.71 kN * m)	**1,019 lb** (4.57 kN) **16,435 lb * ft** (22.28 kN * m)	**1,076 lb** (4.82 kN) **18,334 lb * ft** (24.86 kN * m)	**1,133 lb** (5.08 kN) **20,234 lb * ft** (27.43 kN * m)
35' (10.7 m)	**1,098 lb** (4.92 kN) **19,358 lb * ft** (26.25 kN * m)	**1,157 lb** (5.19 kN) **21,608 lb * ft** (29.30 kN * m)	**1,216 lb** (5.45 kN) **23,857 lb * ft** (32.35 kN * m)	**1,274 lb** (5.71 kN) **26,106 lb * ft** (35.40 kN * m)



Design Reference: *AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*, 6th Edition, 2013 (LTS-6).

[1] Calculations have been run for a 24" (610 mm) square base 3'-4" (1016 mm) above grade with a 24" (610 mm) diameter round bury portion in the soil.

[2] Assumed $\phi = 34°$, $\gamma = 130$ lb/ft^3 (2080 kg/m^3), c = 0 lb/ft^2 (0 kPa).

[3] Assumed $\phi = 30°$, $\gamma = 120$ lb/ft^3 (1920 kg/m^3), c = 0 lb/ft^2 (0 kPa).

[4] Assumed $\phi = 10°$, $\gamma = 130$ lb/ft^3 (2080 kg/m^3), c = 250 lb/ft^2 (12.0 kPa).

[5] Calculations run with the following factors and assumptions:

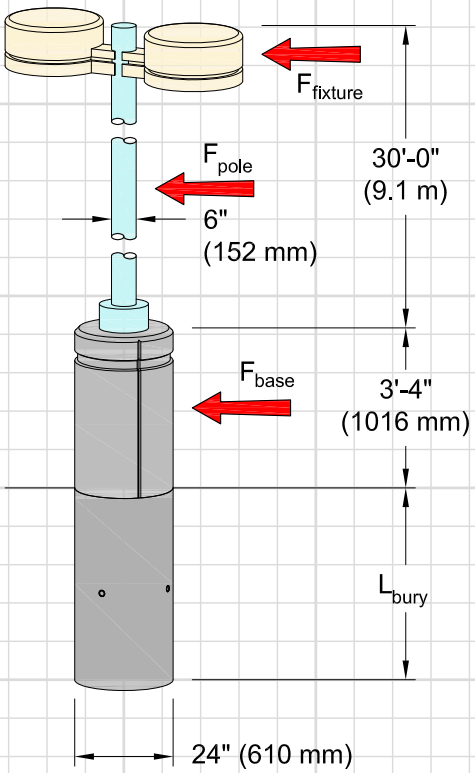
- Exposure Condition C
- Basic Wind Speed, V = 90 mph (40m/s)
- Importance Factor, $I_r = 1.0$
- Velocity Conversion Factor, $C_v = 1.00$
- Gust Factor, G = 1.14
- Overload Factor = 2.5
- Drag Coefficient (Fixture), $C_{d\ fixture} = 1.2$
- Drag Coefficient (Pole), $C_{d\ pole} = 1.875$
- Drag Coefficient (Base), $C_{d\ base} = 1.75$
- Height and Exposure Factor (Pole and Fixture), $K_{z\ pole} = 1.00$
- Height and Exposure Factor (Base), $K_{z\ base} = 0.86$
- Undercapacity Factor = 0.7

[6] Calculations assume a double light fixture with the total surface area of both fixtures equal to the value shown in the chart. Unbalanced loading from a single offset fixture is not included in this preliminary guide, and must be addressed in final design calculations if planned for use.

[7] Minimum recommended embedment shall be the calculated value, depth of local frost penetration, or 3'-0" (0.9 m), whichever is greater.

This preliminary guide was prepared by Pole Base™ for estimating and conceptual purposes only. All information is believed to be true and accurage; however, Pole Base™ assumes no responsibility for the use of these preliminary guides for actual construction. Determination of the suitability of each recommendation is the sole responsibility of the User. Final designs for construction must be performed by a licensed Professional Engineer using the actual conditions of the site. *(Rev. 5SEP2014)*

pole base™ www.polebase.com	PROJECT: *EXAMPLE CALCULATION*	SHEET: *1 of 4*
	PREPARED BY: *B. LINDFORS*	DATE: *5SEP2014*



EXAMPLE CALCULATION

Determine minimum required embedment for a Pole Base™ Unit in the following conditions:

Pole Base™ Unit = 24" (610 mm) diameter round base with 3'-4" (1016 mm) textured portion above grade and a 24" (610 mm) diameter round bury portion.

Site Soils = Poorly graded sand (SP) with:
internal friction angle, ϕ = 30°
unit weight, γ = 120 lb/ft^3 (1920 kg/m^3)
cohesion, c = 0 lb/ft^2 (0 kPa).

Light Pole = 30' (9.1 m) tall, 6" (152 mm) diameter round pole.

Light Fixture Size = 4 ft^2 (0.372 m^2)

Site Exposure Condition = C

Basic Wind Speed = 90 mph (40 m/s)

Design Reference: *AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*, 6th Edition, 2013 (LTS-6).

- DETERMINE WIND LOADS ON POLE BASE™ UNIT, LIGHT POLE, AND LIGHT FIXTURE:

Site Exposure Condition C (Given)

Basic Wind Speed, V = 90 mps (40 m/s) (Given)	*Reference AASHTO Figures 3.8.3-1 to 3.8.3-5*
Wind Importance Factor, I_r = 1.0	*AASHTO Table 3.8.3-1 (50 year recurrence, non-hurricane region)*
Design Life = 50 years	*AASHTO Table 3.8.3-2*
Velocity Conversion Factor, C_v = 1.00	*AASHTO Table 3.8.3-3 (50 year recurrence, basic wind speed in non-hurricane region)*

Height and Exposure Factor, K_z — *AASHTO Section 3.8.4*

$K_z = 2.01 * (z / z_g)^{2/alpha}$ — *AASHTO C3.8.4-1*

alpha = 9.5 and z_g = 900 ft (274.3 m) — *AASHTO Commentary C3.8.4*

z = height above ground ≥ 16 ft (5 m)

For Pole Base™:
$K_{z\ base} = 2.01 * (16 / 900)^{2/9.5} = 0.86$

For Light Pole and Fixture:
$K_{z\ pole} = 2.01 * (30 / 900)^{2/9.5} = 1.0$

Gust Factor, G = 1.14 — *AASHTO Commentary C3.8.5*

Drag Coefficients, C_d — *AASHTO Section 3.8.6*

For Light Fixture:
$C_{d\ fixture} = 1.2$ — *AASHTO Table 3.8.6-1 (luminaires with rectangular flat shide shapes)*

For Light Pole:
$C_v*V*d = 1.0 * 90\ mph * 0.5\ ft = 45\ mph * ft$
$C_{d\ pole} = 129 / (C_v*V*d)^{1.3} = 0.915$ — *AASHTO Table 3.8.6-1 (cylindrical)*

For Pole Base Unit:
$C_v*V*d = 1.0 * 90\ mph * 2.0\ ft = 180\ mph * ft$
$C_{d\ base} = 0.45$ — *AASHTO Table 3.8.6-1 (cylindrical)*

Wind Pressure, $P_z = 0.00256 * K_z * G * V^2 * I_r * C_d$ — *AASHTO 3.8.3-1*

For Light Fixture
$P_{z\ fixture} = 0.00256 * 1.0 * 1.14 * 90^2 * 1.0 * 1.2 = 28.5\ psf$

For Light Pole
$P_{z\ pole} = 0.00256 * 1.0 * 1.14 * 90^2 * 1.0 * 0.915 = 21.7\ psf$

For Pole Base™
$P_{z\ base} = 0.00256 * 0.86 * 1.14 * 90^2 * 1.0 * 0.45 = 9.2\ psf$

DETERMINE SHEAR FORCES AND OVERTURNING MOMENTS

Shear Forces

For Light Fixture:

$F_{fixture} = P_{z\ fixture} * A_{fixture} = 28.5 * 4.0 = 114.0$ lbf (0.51 kN)

For Light Pole:

$F_{pole} = P_{z\ pole} * A_{pole} = 21.7 * (30 * 0.5) = 325.8$ lbf (1.46 kN)

For Pole Base™:

$F_{base} = P_{z\ base} * A_{base} = 9.2 * (3.33 * 2.0) = 61.0$ lbf (0.27 kN)

Total Applied Shear Force = $F_{fixture} + F_{pole} + F_{base} = 500.8$ lbf (2.24 kN)

Overturning Moment

For Light Fixture:

$M_{fixture} = F_{fixture} * (h_{base} + h_{pole}) = 114.0 * (3.33 + 30) = 3{,}798$ lbf * ft (5.15 kN * m)

For Light Pole:

$M_{pole} = F_{pole} * (h_{base} + h_{pole}/2) = 325.8 * (3.33 + 30/2) = 5{,}973$ lbf * ft (8.10 kN * m)

For Pole Base™:

$M_{base} = F_{base} * (h_{base}/2) = 61.0 * (3.33 / 2) = 102$ lbf * ft (0.14 kN * m)

Total Applied Overturning Moment = $M_{fixture} + M_{pole} + M_{base} = 9{,}874$ lbf * ft (13.39 kN * m)

DETERMINE MINIMUM REQUIRED EMBEDMENT

Factor Shear and Overturning Moment for Use with Broms Design Method

Overload Factor = 2.5 and *AASHTO Commentary C13.6.1.1*
Undercapacity Factor = 0.7

Safety Factor = Overload Factor / Undercapacity Factor = 3.57

V_F = Total Shear * (Safety Factor) = 1.79 kip (8.0 kN) *AASHTO C13.6.1.1-1*

M_F = Total Moment * (Safety Factor) = 35.26 ft * kip (47.8 kN * m) *AASHTO C13.6.1.1-2*

DETERMINE MINIMUM BURY

For a Foundation in Cohesionless Soil:

$$L^3 - \frac{2 * V_F * L}{K_p * \gamma * D} - \frac{2 * M_F}{K_p * \gamma * D} = 0$$ *AASHTO C13.6.1.1-7*

$\phi = 30°$ (Given)

$\gamma = 120$ lb/ft^3 (1920 kg/m^3) (Given)

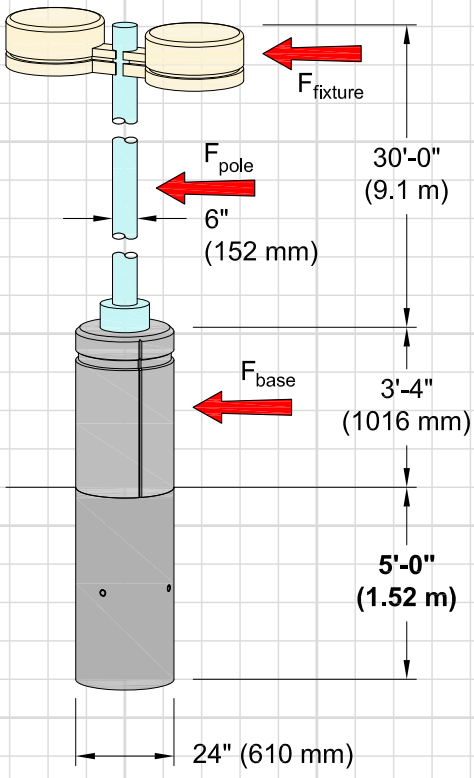
$K_p = \tan^2 (45 + \phi/2) = \tan^2 (45 + 30/2) = 3$ *AASHTO C13.6.1.1-8*

D = Diameter of Base = 2 ft (0.61 m) (Given)

Solve by Iteration to find L = 4.97 ft (1.51 m)

$$L^3 - \frac{2 * V_F * L}{K_p * \gamma * D} - \frac{2 * M_F}{K_p * \gamma * D} = 4.97^3 - \frac{2 * 1.789 * 4.97}{3 * 0.120 * 2} - \frac{2 * 35.26}{3 * 0.120 * 2} \approx 0$$

MINIMUM BURY FOR POLE BASE™ UNIT = 4.97 USE **5'-0" (1.52 m)**.



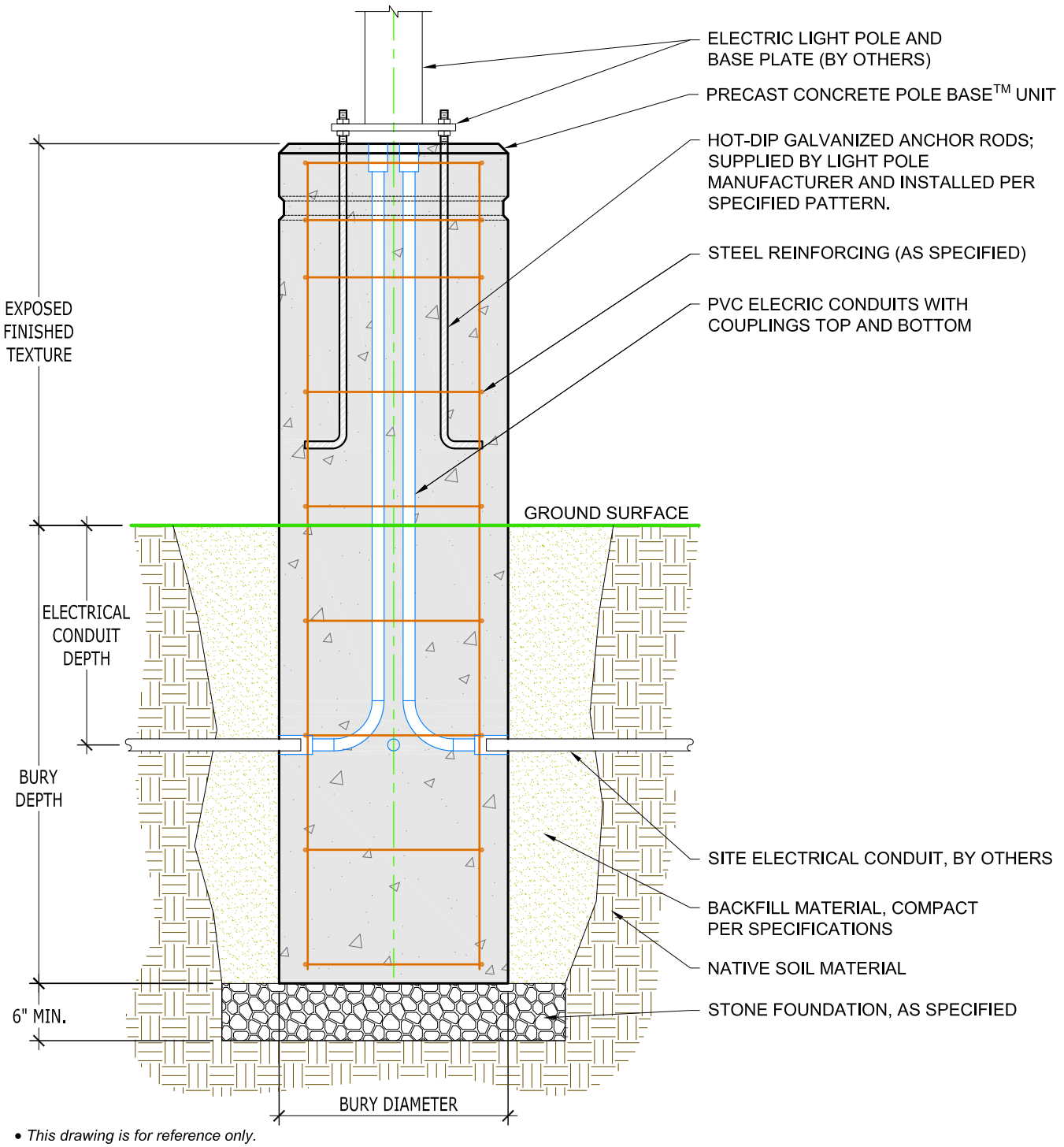
pole base®

CONSTRUCTION DETAILS

A BASE FOR STRONG MINDS AND WEAK BACKS

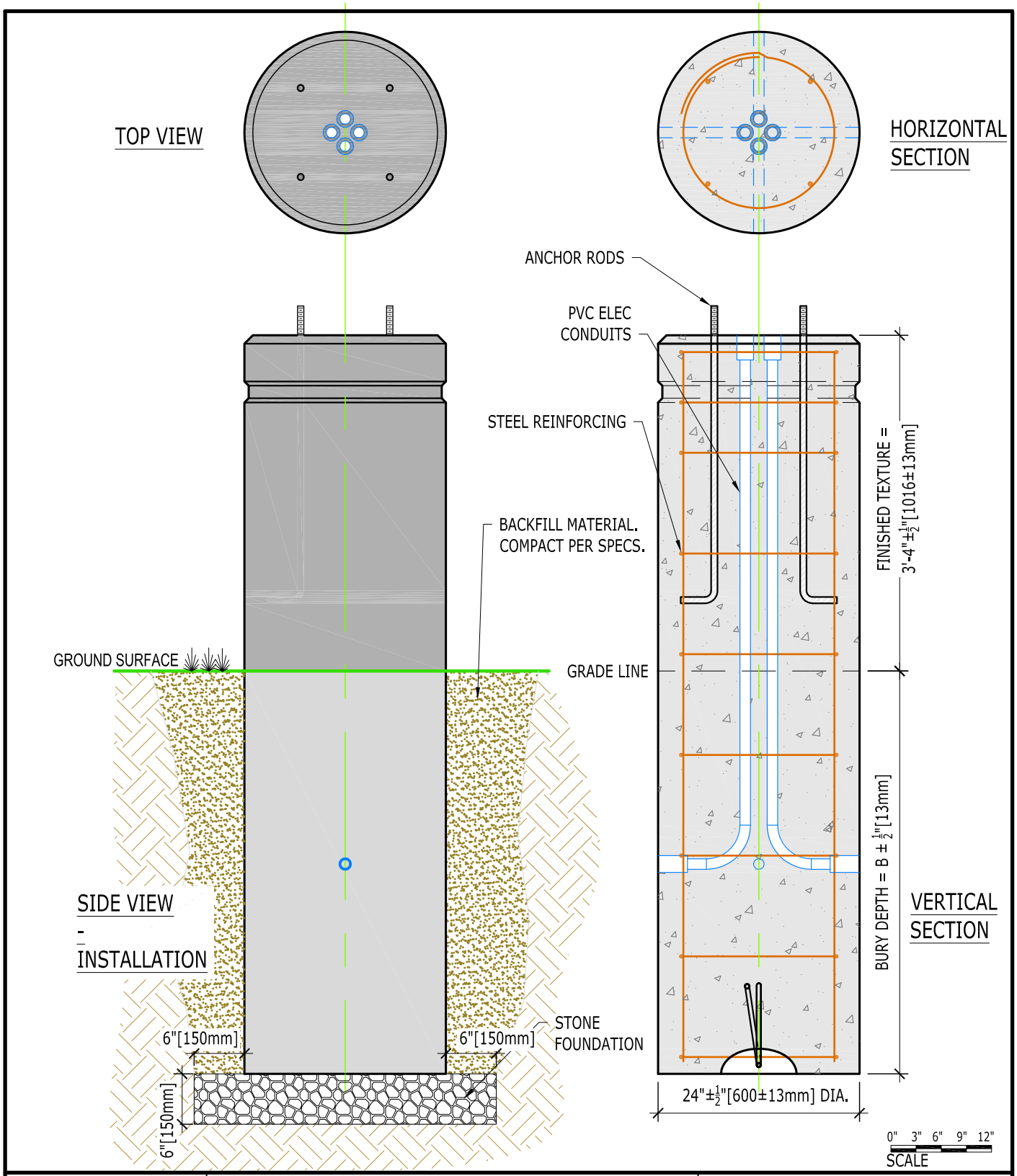
SECTION THROUGH TYPICAL LIGHT POLE BASE™

NO SCALE



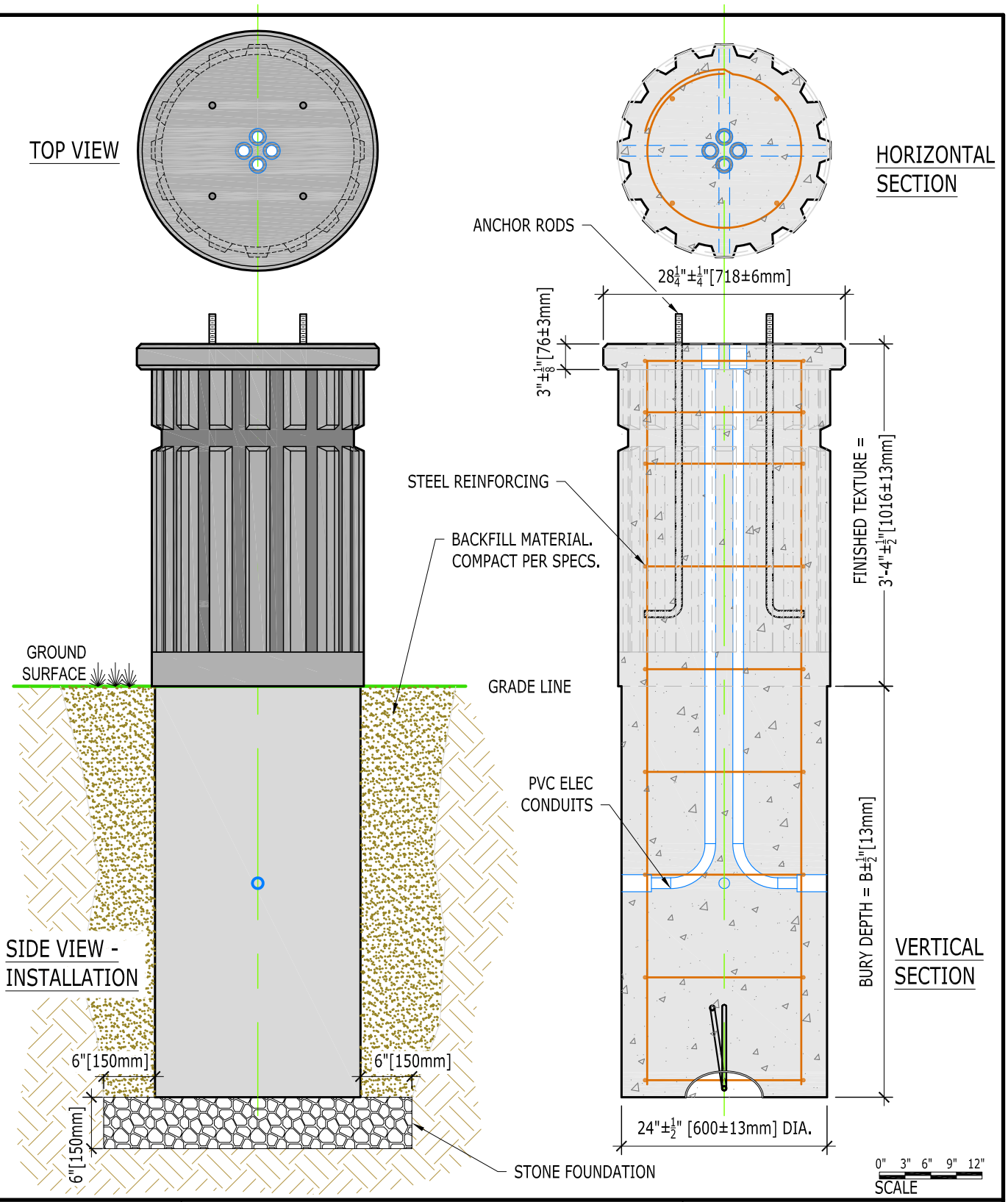
- *This drawing is for reference only.*
- ***Final designs for construction must be prepared by a registered Professional Engineer*** *using the loading and actual conditions of the proposed site.*

DRAWN BY: BWL	TITLE: TYPICAL LIGHT POLE BASE™ INSTALLATION	pole base™ www.polebase.com
APPROVED BY:		
DATE: 8SEP2014		
SHEET: 1 of 1	FILE: Typical Light Pole Detail - 5SEP2014.dwg	



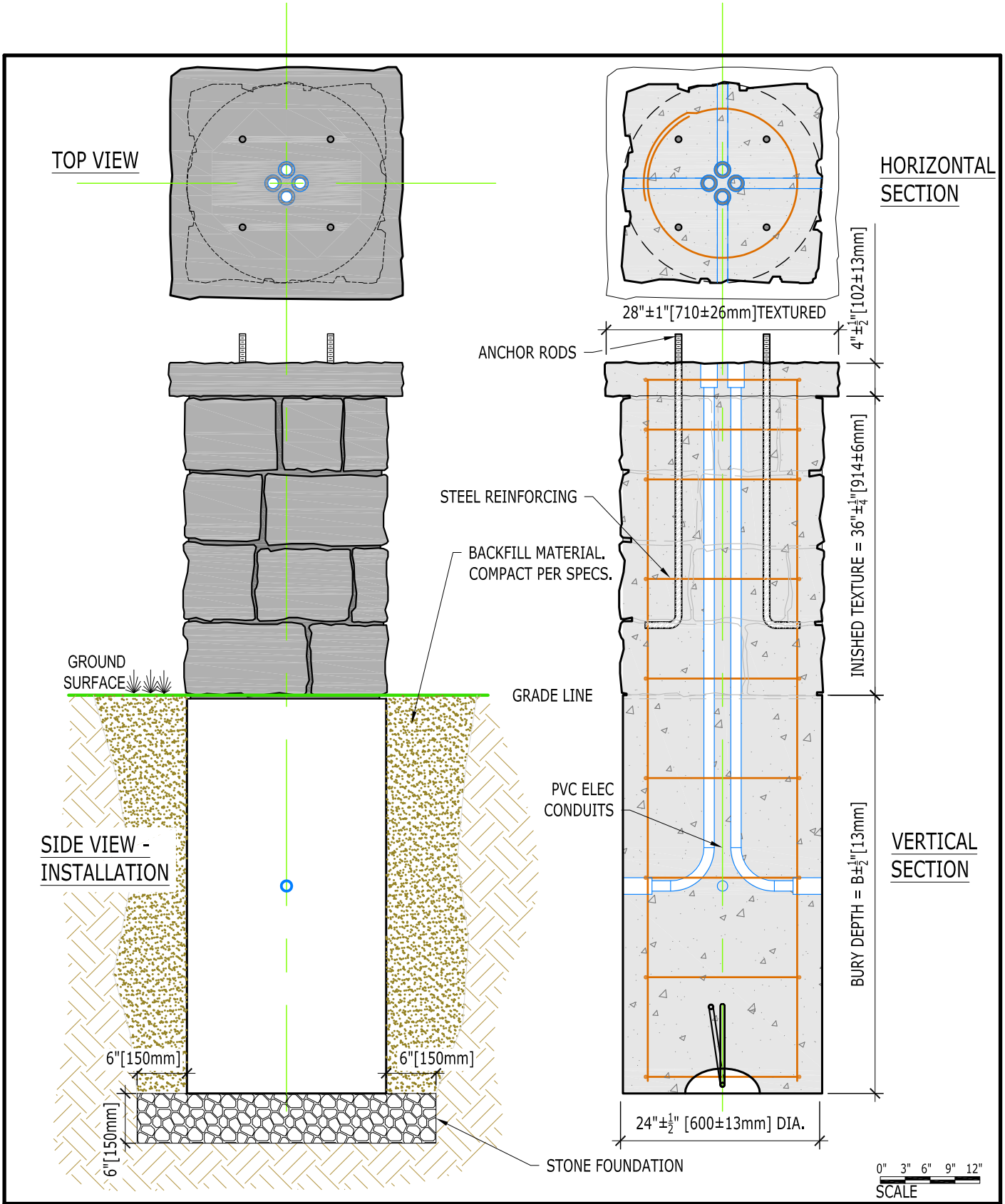
DRAWN BY:	BWL	TITLE:	24in. ROUND SMOOTH POLE BASE™
SCALE:	3/4" = 1'-0"		
DATE:	8SEP2014		
SHEET:	1 of 1	FILE:	POLE BASE DRAWINGS - 090814.dwg

pole base™
www.polebase.com



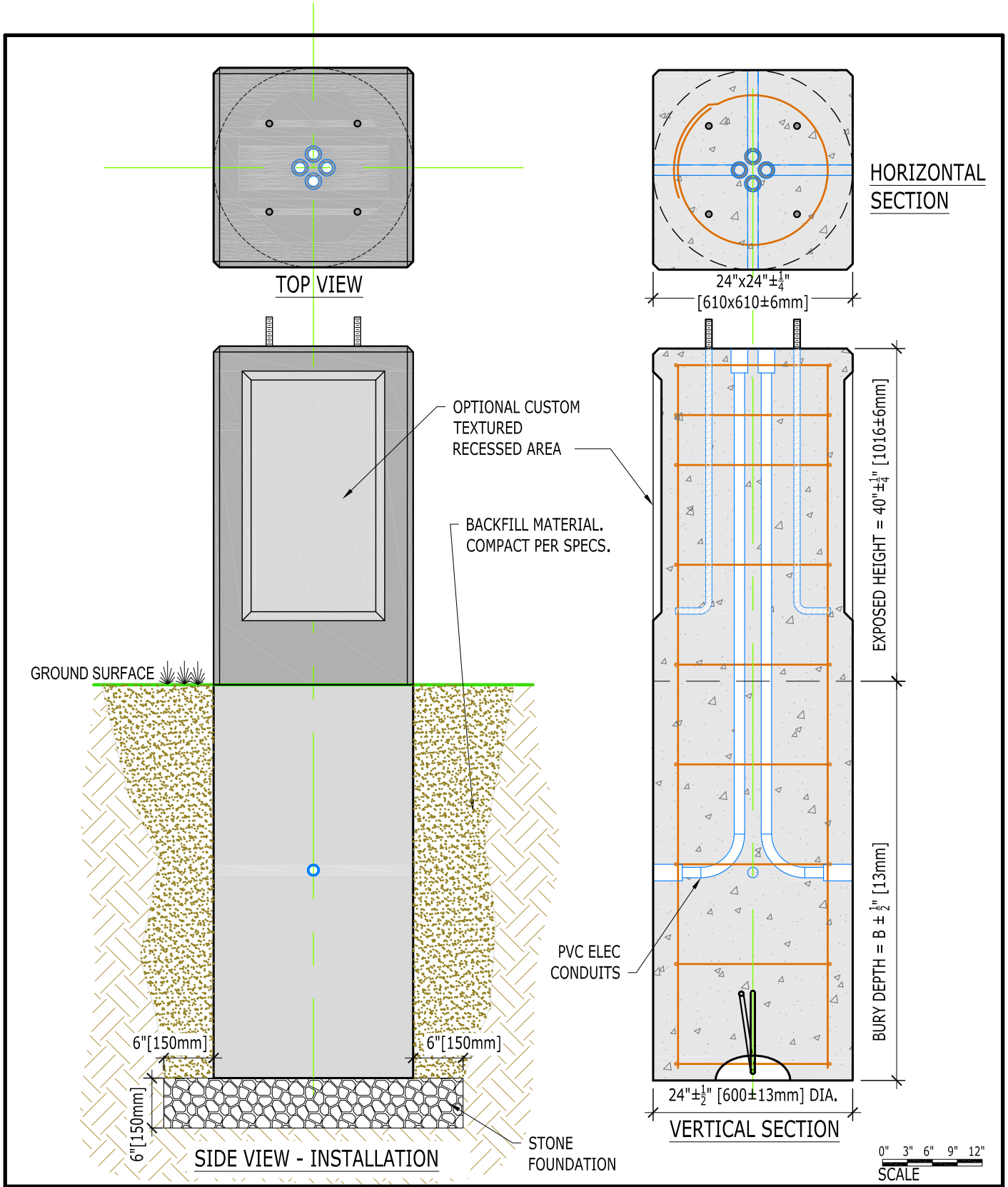
DRAWN BY:	BWL	TITLE:	ROUND FLUTED POLE BASE™
SCALE:	3/4" = 1'-0"		
DATE:	8SEP2014		
SHEET:	1 of 1	FILE:	POLE BASE DRAWINGS 090814.dwg

pole base™
www.polebase.com



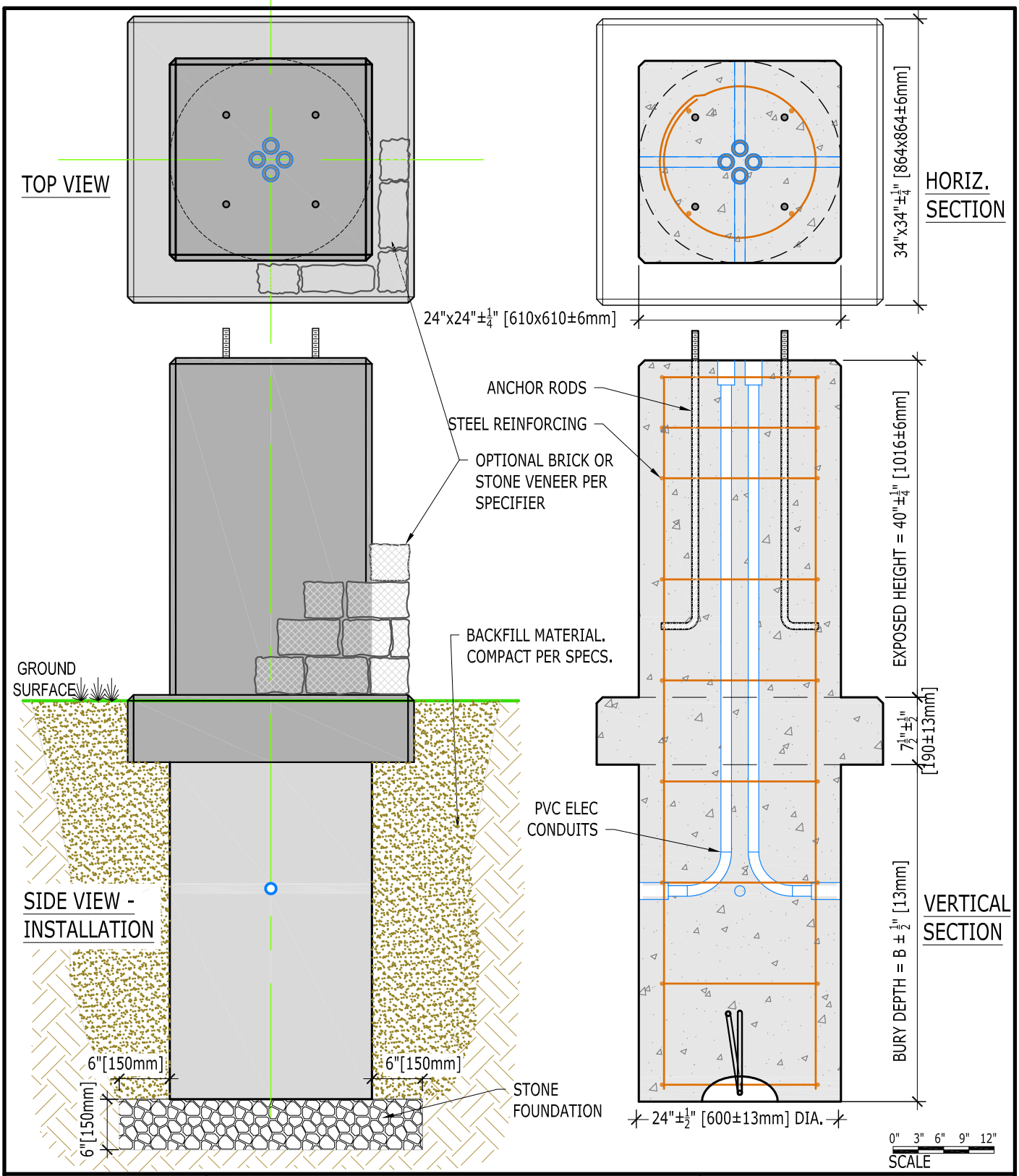
DRAWN BY:	BWL	TITLE:	SQUARE LEDGESTONE POLE BASE™
SCALE:	3/4" = 1'-0"		
DATE:	8SEP2014		
SHEET:	1 of 1	FILE:	POLE BASE DRAWINGS 090814.dwg

pole base™
www.polebase.com



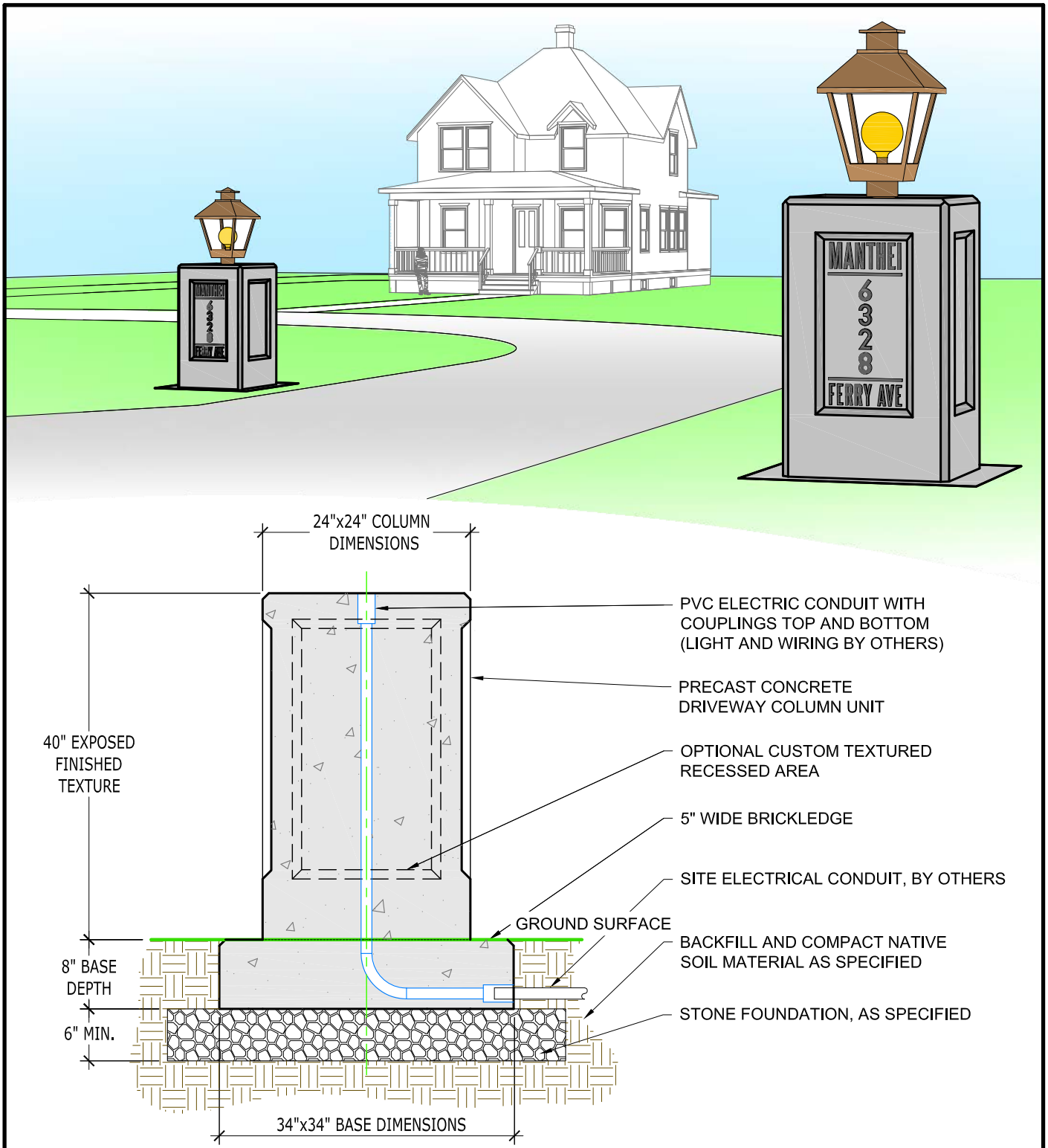
DRAWN BY:	BWL	TITLE:	SQUARE INLAY POLE BASE™
SCALE:	3/4" = 1'-0"		
DATE:	8SEP2014		
SHEET:	1 of 1	FILE:	POLE BASE DRAWINGS 090814.dwg

pole base™
www.polebase.com



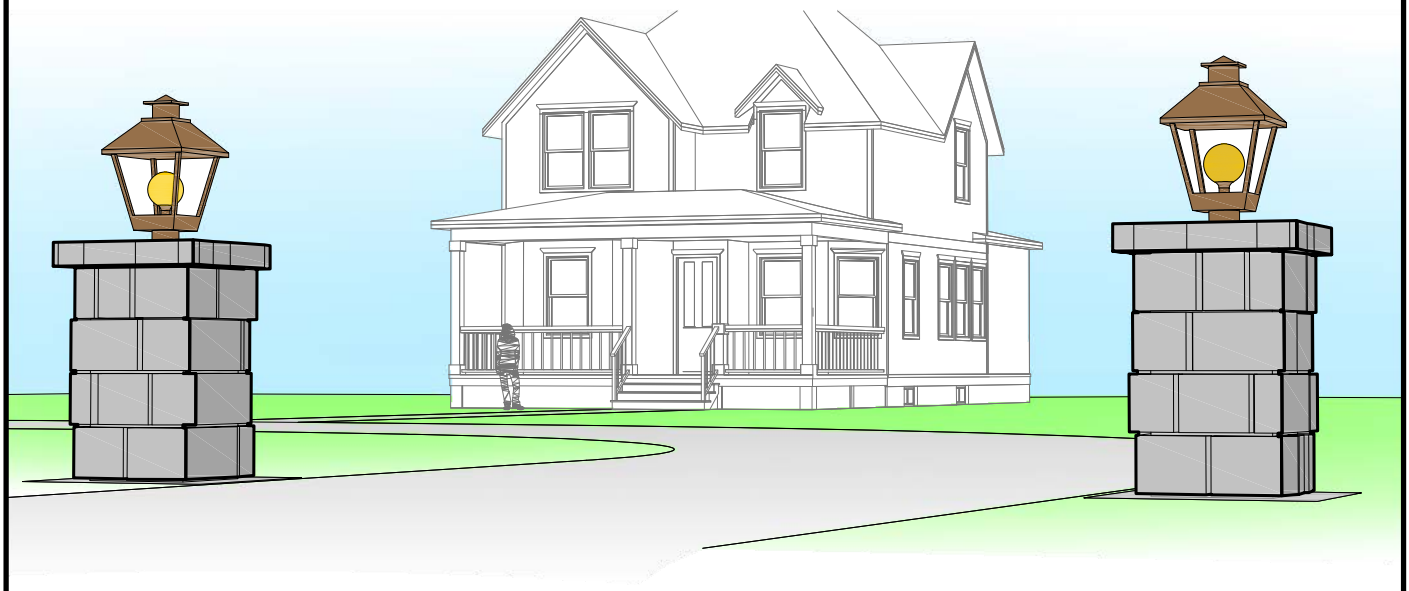
DRAWN BY:	BWL	TITLE:	SQUARE BRICKLEDGE POLE BASE™
SCALE:	3/4" = 1'-0"		
DATE:	8SEP2014		
SHEET:	1 of 1	FILE:	POLE BASE DRAWINGS - 090814.dwg

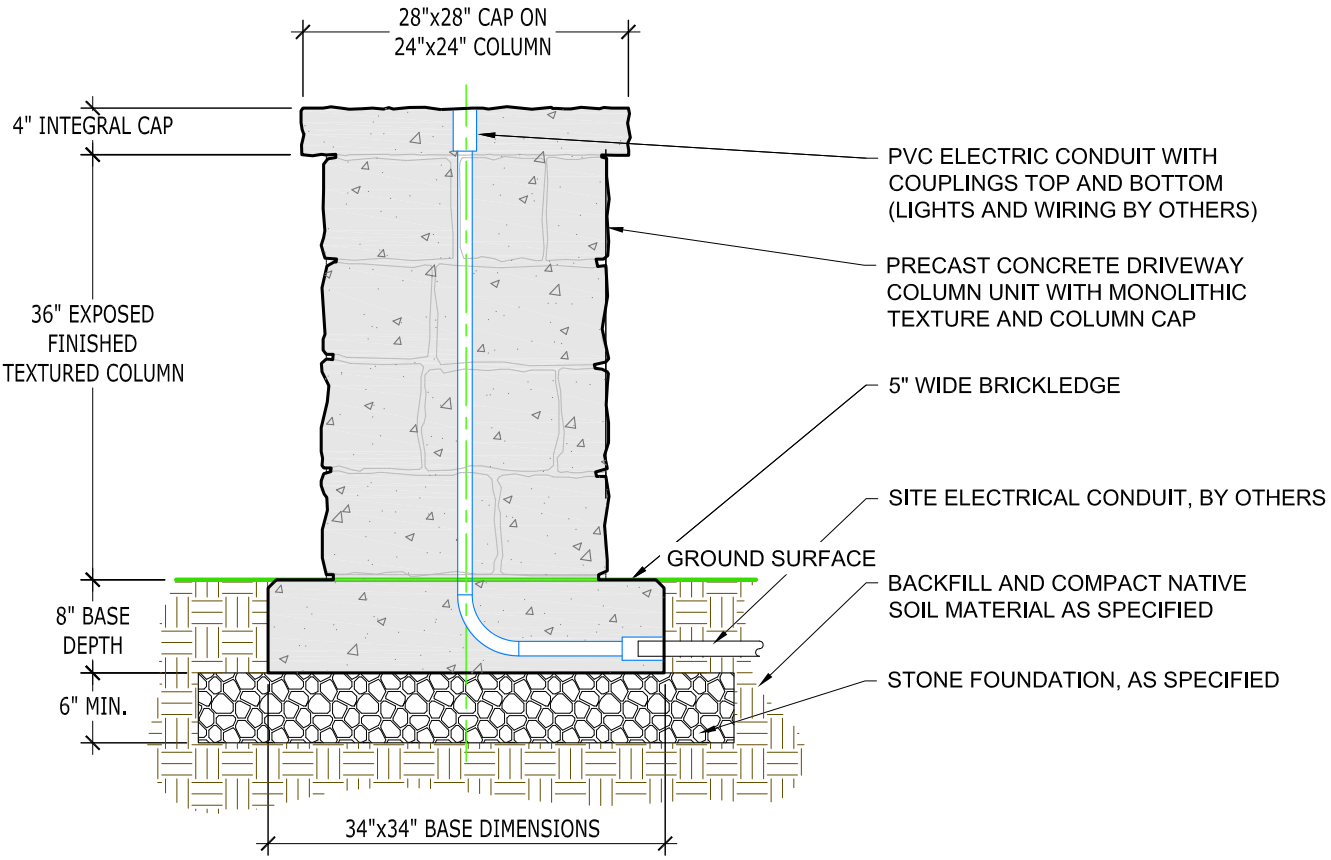
pole base™
www.polebase.com



- *This drawing is for reference only.*
- ***Final designs for construction must be prepared by a registered Professional Engineer** using the loading and actual conditions of the proposed site.*

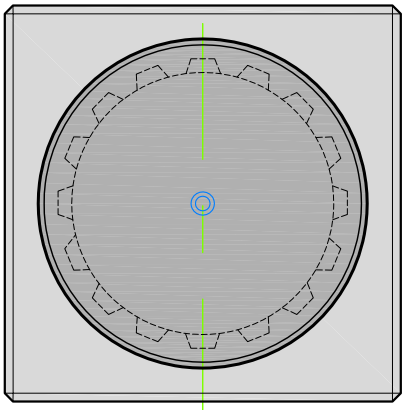
DRAWN BY: BWL	TITLE: **DRIVEWAY COLUMN** *SQUARE WITH INLAY*	pole base™ www.polebase.com
APPROVED BY:		
DATE: 08SEP2014		
SHEET: 1 of 1	FILE: DRIVEWAY COLUMN DETAIL- 032714.dwg	



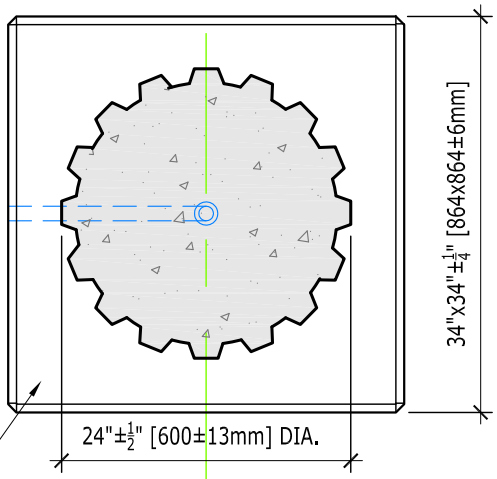


- *This drawing is for reference only.*
- ***Final designs for construction must be prepared by a registered Professional Engineer** using the loading and actual conditions of the proposed site.*

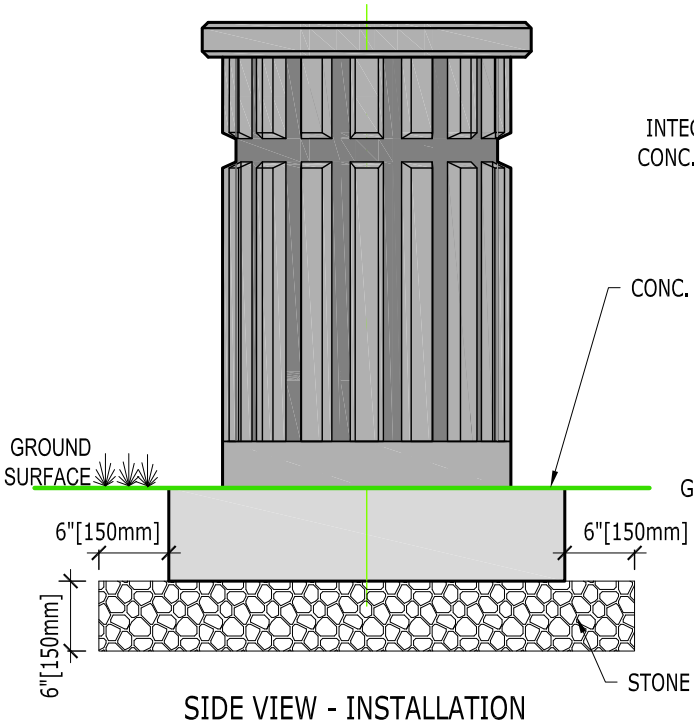
DRAWN BY: BWL	TITLE: **DRIVEWAY COLUMN** *SQUARE LEDGESTONE*	pole base™ www.polebase.com
APPROVED BY:		
DATE: 08SEP2014		
SHEET: 1 of 1	FILE: DRIVEWAY COLUMN DETAIL - 032714.dwg	



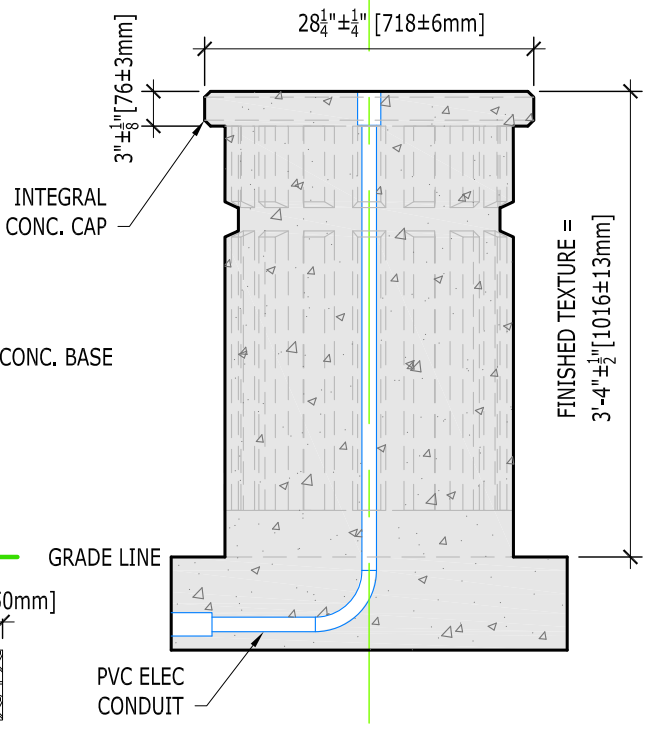
TOP VIEW



HORIZONTAL SECTION



SIDE VIEW - INSTALLATION

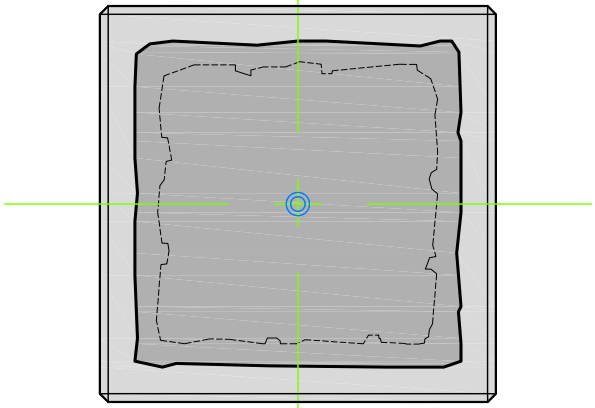


VERTICAL SECTION

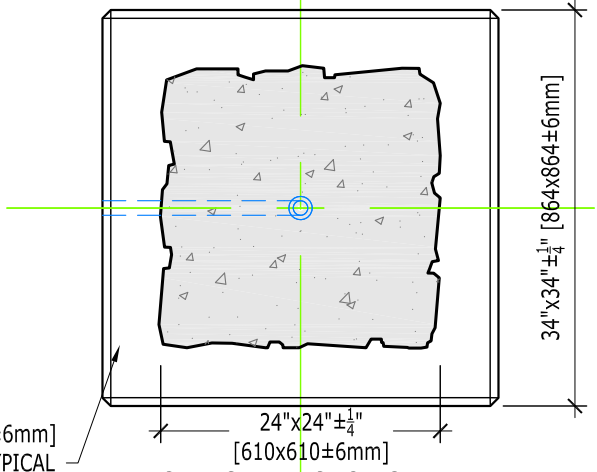
0" 3" 6" 9" 12"
SCALE

DRAWN BY:	BWL	TITLE:	ROUND FLUTED COLUMN
SCALE:	3/4" = 1'-0"		
DATE:	8SEP2014		
SHEET:	1 of 1	FILE:	POLE BASE DRAWINGS - 090814.dwg

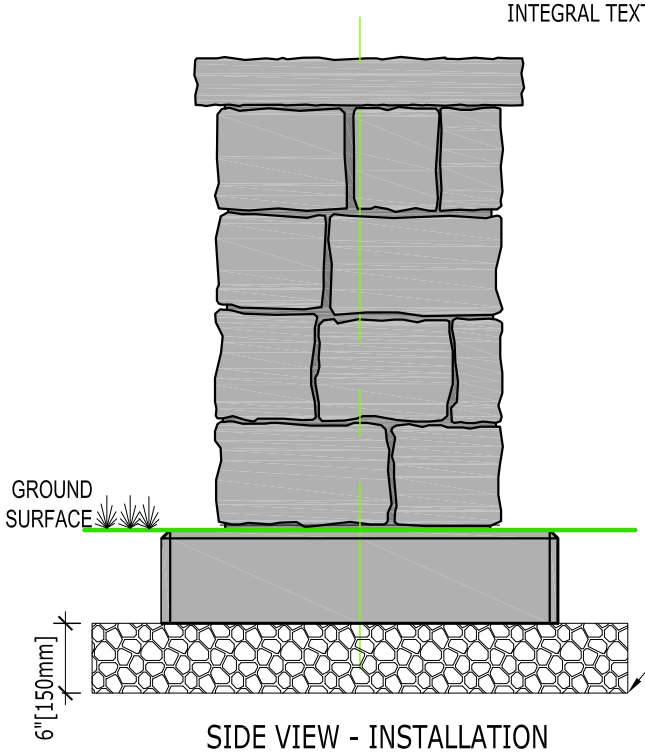
pole base™
www.polebase.com



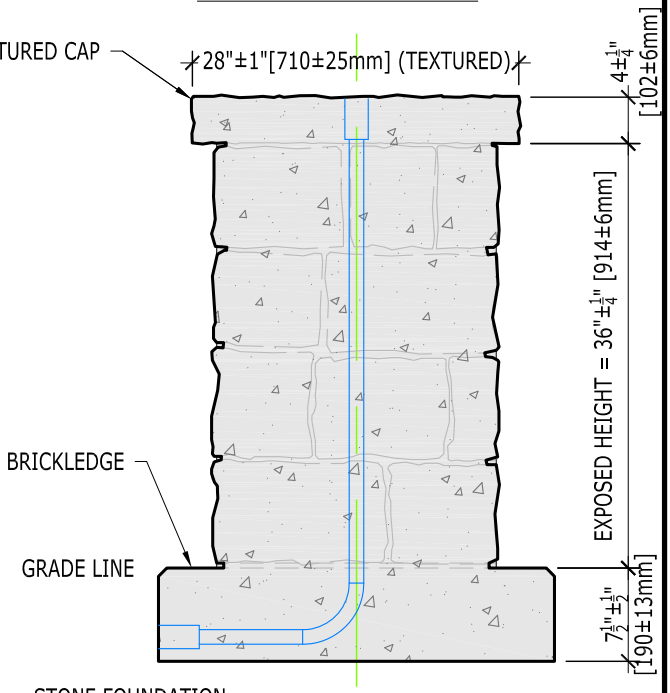
TOP VIEW



HORIZONTAL SECTION



SIDE VIEW - INSTALLATION



VERTICAL SECTION

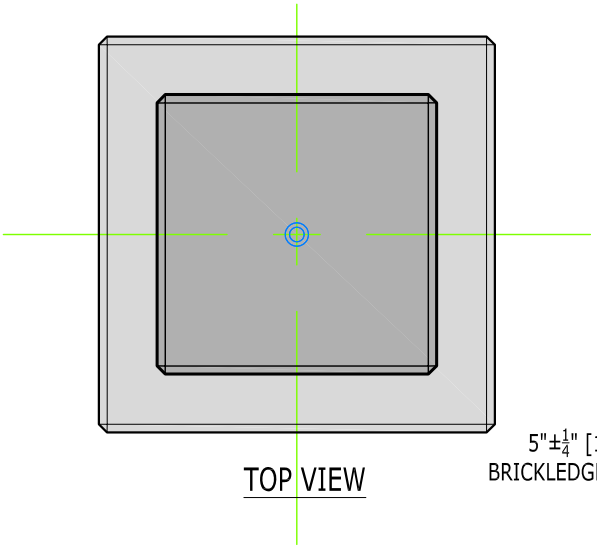
NOTES:

1. UNIT WEIGHT = 2,800 POUNDS [1,270 kg].
2. BEARING PRESSURE: 350psf [16.8 kPa] APPLIED PRESSURE IS LESS THAN ALLOWABLE BEARING PRESSURE FOR MOST SOIL CONDITIONS.

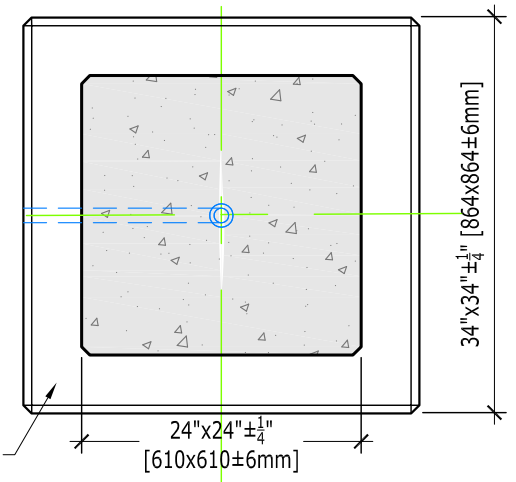
0" 3" 6" 9" 12"
SCALE

DRAWN BY:	BWL	TITLE:	SQUARE LEDGESTONE COLUMN
SCALE:	3/4" = 1'-0"		
DATE:	8SEP2014		
SHEET:	1 of 1	FILE:	POLE BASE DRAWINGS - 090814.dwg

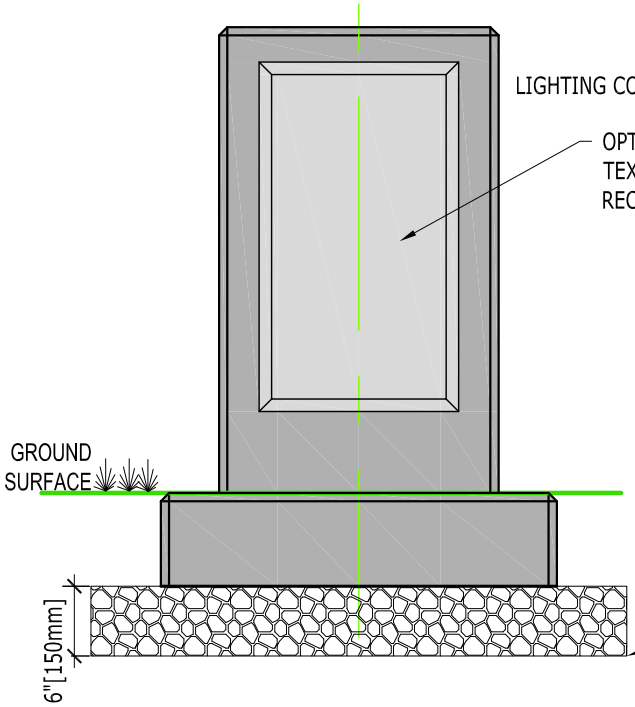
pole base™
www.polebase.com



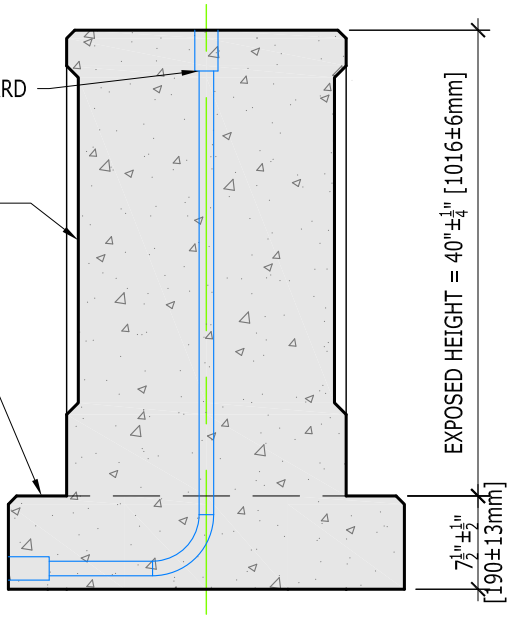
TOP VIEW



HORIZONTAL SECTION



SIDE VIEW - INSTALLATION



VERTICAL SECTION

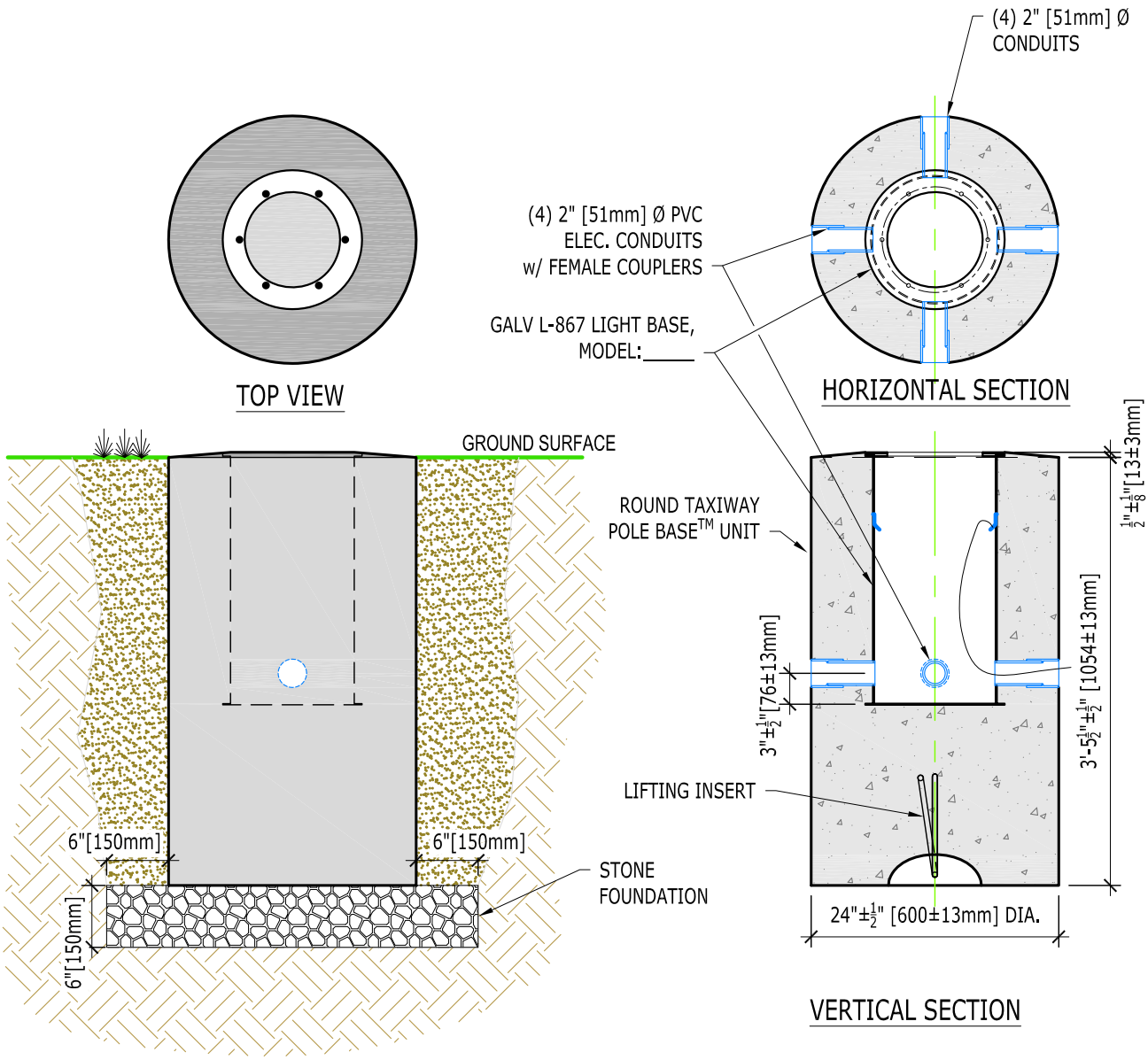
NOTES:

1. BASE UNIT WEIGHT = 2,700 POUNDS [1,230 kg].
2. BEARING PRESSURE: 340psf [16.1 kPa] WITH BASE UNIT. APPLIED PRESSURE IS LESS THAN ALLOWABLE BEARING PRESSURE FOR MOST SOIL CONDITIONS.
3. VERTICAL SURFACES ABOVE BRICKLEDGE MAY BE CUSTOMIZED TO THE SPECIFICIER'S DESIGN OR CLAD WITH A BRICK OR STONE VENEER.

0" 3" 6" 9" 12"
SCALE

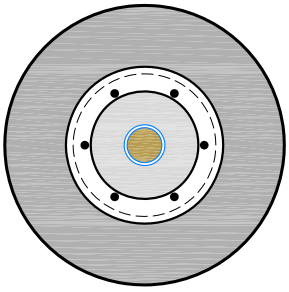
DRAWN BY:	BWL	TITLE:	SQUARE BRICKLEDGE COLUMN
SCALE:	3/4" = 1'-0"		
DATE:	8SEP2014		
SHEET:	1 of 1	FILE:	POLE BASE DRAWINGS - 090814.dwg

pole base™
www.polebase.com

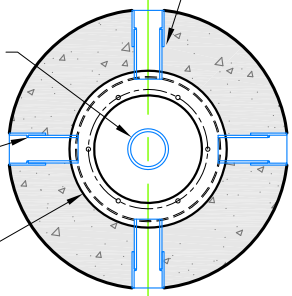


DRAWN BY:	BWL	TITLE:	TAXIWAY (SIDE DRAIN) POLE BASE™
SCALE:	3/4" = 1'-0"		
DATE:	8SEP2014		
SHEET:	1 of 1	FILE:	POLE BASE DRAWINGS - 090814.dwg

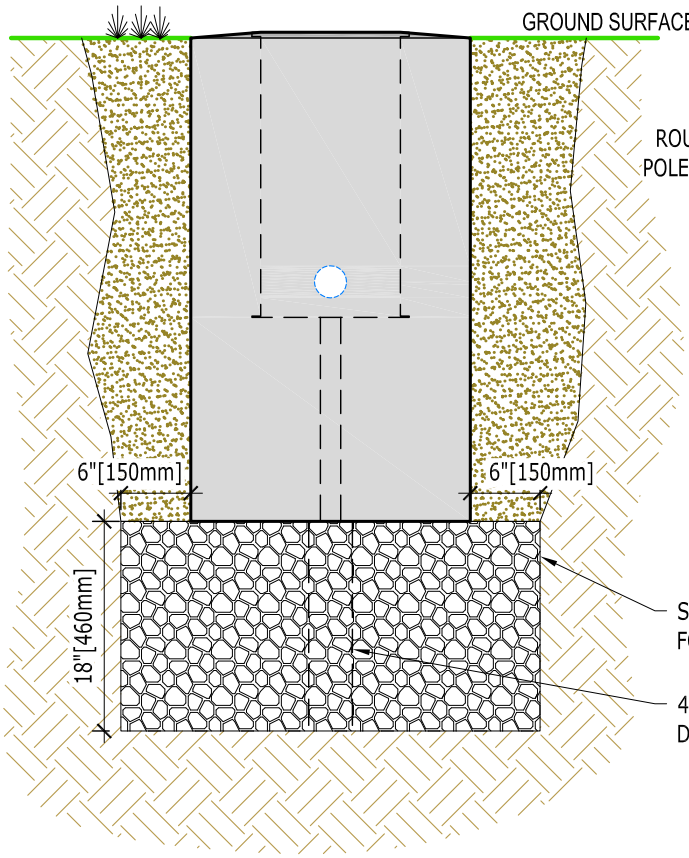
pole base™
www.polebase.com



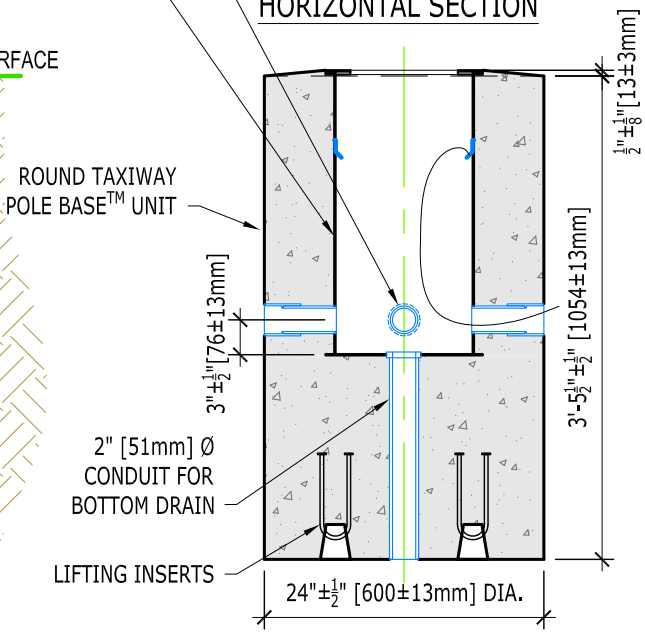
TOP VIEW



HORIZONTAL SECTION



SIDE VIEW - INSTALLATION



VERTICAL SECTION

0" 3" 6" 9" 12"
SCALE

DRAWN BY:	BWL	TITLE:	TAXIWAY (BOTTOM DRAIN) POLE BASE™
SCALE:	3/4" = 1'-0"		
DATE:	8SEP2014		
SHEET:	1 of 1	FILE:	POLE BASE DRAWINGS - 090814.dwg

pole base™
www.polebase.com

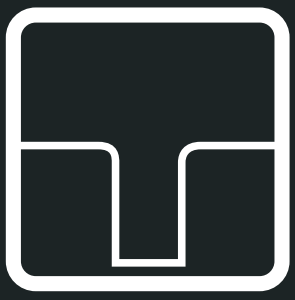
pole base®

INSTALLATION MANUAL

SECTION 6: INSTALLATION MANUAL

HOW TO INSTALL POLE BASE

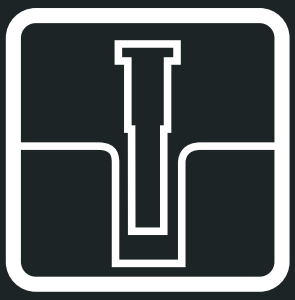
INSTALL WITH EASE



AUGER THE HOLE

Determine the location for placement of the Pole Base, then auger or open cut a hole in the position you need the base.

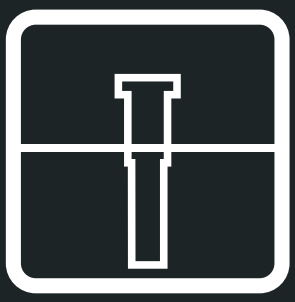
Next, place a 6 inch (152 millimeter) foundation of crushed stone in the bottom of the hole.



PLACE THE BASE

To place Pole Base in the hole, connect the lifting device to the base, then lower the base using a piece of machinery.

Adjust and level the base, then run the wire and conduit into the base.



BACKFILL

Backfill using crushed stone or sand, then compact using standard procedures. Pave, or place topsoil and spread seed or sod.

The whole process is as easy as 1, 2, 3!

POLE BASE™ INSTALLATION NOTES

PRE-CONSTRUCTION CHECKLIST:

□ SAFETY:
- ✓ Personal Protective Equipment (PPE).
- ✓ Maintain safe excavations.
- ✓ Fall protection.
- ✓ Rigging & lifting.
- ✓ Other relevant safety precautions.

□ ENGINEERING & PERMITS:
- ✓ Review the detailed final design prepared by the Engineer/Architect of Record.
- ✓ Review Standard Specification Section 31 66 13, "Precast Concrete Pole Base™ Units".
- ✓ Project design documents take precedence over these recommendations.

□ PROJECT PLAN REVIEW:
- ✓ Make sure you completely understand project plans, details, and specifications.
- ✓ Ask the design engineer any questions you have about the project.
- ✓ Coordinate your work with the GC and other trades.
- ✓ Consider having a Pre-Installation meeting.

□ CONSTRUCTION PLANNING:
- ✓ Locate and mark all underground utilities.
- ✓ Call 8-1-1 or on-line at www.call811.com
- ✓ Pole Base™ should be stored above the ground on wooden cribbing, keeping the units separated from each other.
- ✓ Ensure no damage of the texture, or staining, cracking, chipping, etc.
- ✓ Use approved lifting devices or padded slings.
- ✓ Never use choke chains on the units.
- ✓ Decide upon method of backfilling & coordinate materials required.

□ EQUIPMENT:
- ✓ Lifting and setting equipment.
- ✓ Nylon slings or lifting plate.
- ✓ Verify weight of the units for safe lifting, transport, and installation.
- ✓ Excavator or rotary auger to create the hole.
- ✓ Compactor and soil packing tools.
- ✓ Shovels, rakes, hoes.
- ✓ Level and measuring tapes.
- ✓ PPE (hardhat, gloves, boots, etc.)

CONSTRUCTION:

□ AUGER THE HOLE:
- Mark the center and offset locations before excavating.
- Open cut or auger drill excavation.
- Excavation depth equals the embedment depth plus 6" for crushed stone foundation.
- Excavation diameter or width & breadth should be twice the embedded diameter minimum.
- Bottom of excavation should be flat, horizontal, and compacted.
- Place, level, and compact crushed stone foundation.
- Crushed stone thickness shall be a minimum of 6".
- Extend crushed stone to edge of excavation or 6" minimum from edge of concrete.
- Verify embedment depth of Pole Base™ and top of foundation elevation; adjust as required.

□ PLACE THE BASE:
- Verify orientation of Pole Base™ anchor rods and conduits compared to site requirements and drawings.
- Set Pole Base™ unit while in a plumb orientation into final location (do not tilt-up).
- Set unit to proper elevation, ±1/2".
- Brace Pole Base™ as required to maintain unit level, true, and plumb until backfill has been placed and consolidated.

□ BACKFILL:
- Structure backfilling method per plans & specs; typically one of three options:
- Crushed stone: Size 57 per ASTM C33, compact to 90% relative density per ASTM D4253, D4254.
- Granular backfill (clean angular sand): compact to 95% Std Proctor, ASTM D698.
- Controlled low-strength material, CLSM (flowable fill): maximum 100psi, per ACI-229.
- Place and compact granular or stone backfill uniformly around perimeter of Pole Base™ in 6" lifts.
- Pause backfilling at bottom of conduit trench, then install below grade electrical connections.
- Finish backfilling and compacting in 6" lifts to the rough grade or as contract requires.
- Install lighting fixtures.
- Remove soil or stains from the exposed concrete.
- Take professional quality photographs for your completed project portfolio.

□ DONE !

Revised: 08SEP2014

pole base®

CONTACT

CONTACT INFO
05481 US 31 South
Charlevoix, MI 49720
polebase.com
866 222 8400
info@polebase.com

GET STARTED TODAY AT POLEBASE.COM


pole base®
POLEBASE.COM