

NOVEMBER/DECEMBER 2015

FOUNDATION DRILLING

**Brayman
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Greensboro
Western Loop
Project**

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The International Association of Foundation Drilling



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Brayman Construction Tackles Greensboro Western Loop Project

By Dan Lessy, Senior Project Manager

Brayman Construction Corporation (BCC) has a code of Business Conduct and Ethics that represent how we engage with, treat one another, respond to clients, and remain accountable in all aspects of our work. The Corporate Values of Equity, Urgency, Tenacity and Professionalism are the heart, soul and character of BCC and determine which projects we pursue.

Background

In September of 2013 (BCC) bid as foundation subcontractor on NCDOT Project C203197 Tip NO. U-2324C known as the Greensboro Western Urban Loop located in Guilford County, North Carolina. The City of Greensboro and the Greensboro Urban Area Metropolitan Planning Organization identified the need to upgrade the Horse Pen Creek Road corridor. Based on consultation with City, County, and NCDOT Division 7 Staff the purpose and need are as follows:

1. Serve forecasted future traffic volumes on Horse-Pen Creek Road,
2. Relieve congestion on Battleground Avenue (running parallel to the corridor, about 1.0 mile to the east),
3. Address anticipated growth along the corridor and in northwest Greensboro,
4. Improve safety throughout the corridor, and
5. Provide enhanced pedestrian and bicycle mobility.

The Western Loop Urban project is one of three improvements planned for the overall corridor.

Ultimately the project was awarded to Vecellio & Grogan, Inc. (V&G) of Beckley, West Virginia who contracted with BCC to complete the drilled shaft installation.

Project Overview and Challenges

When the Western Loop Project is complete it will include:

- A 1.7 mile Western Loop Section of freeway going around Greensboro, North Carolina. Part of the future larger

40-mile urban Loop I-785/I-840.

- A six-lane freeway from north of Bryan Boulevard to U.S. 220 (Battleground Avenue).
- The Greensboro Loop/Bryan Boulevard Extension interchange providing northern Greensboro with a more direct route to Piedmont Triad International Airport.
- A bridge on Fleming Road and Horse Pen Creek Road over the Greensboro Loop.
- A cul-de-sac at the end of Oneida Road north of the Greensboro Loop.
- Bridges on the Greensboro Loop over Drawbridge Parkway and Horse Pen Creek tributary and wetlands.
- An interchange at the intersection of the Greensboro Loop and U.S. 220 (Battleground Avenue).

Contractors involved in the multi-year endeavor face a variety of challenges including utility relocations, adjacent neighborhoods, existing roads and structures, highly variable subsurface conditions; and most notable the protected wetland area known as Horse Pen Creek. Horse Pen Creek feeds Lake Brandt, a water supply for the City of Greensboro and is classified as a critical watershed area. The regulations concerning this watershed are defined by the North Carolina Department of Environmental and Natural

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Cluster drilling on temporary work bridge in Horse Pen Creek wetland.

BRAYMAN Contd.

Multiple hydraulic drill rigs have been used on the project to advance the schedule.



- 318 Drilled Shafts, 60", 54", 48", 42"- with an average rock socket of 10-20 feet.
- 12,000+ LF of drilling, 2,200+ LF of 61.5" permanent casing.
- 2,200+ LF of 61.5" Permanent Casing.
- 8,300+ CYDS of NCDOT Class AA Drilled Shaft Concrete.
- 60,000 LF of CSL Pipes.

The particular geographic area of this project in North Carolina is referred to as the Piedmont. The Piedmont is a plateau region located in the eastern United States between the Atlantic Coastal Plain and the main Appalachian Mountains. Its geology is complex, with numerous rock formations of different materials and ages intermingled with one another. Essentially, the Piedmont is the remnant of several ancient mountain chains that have since eroded away.

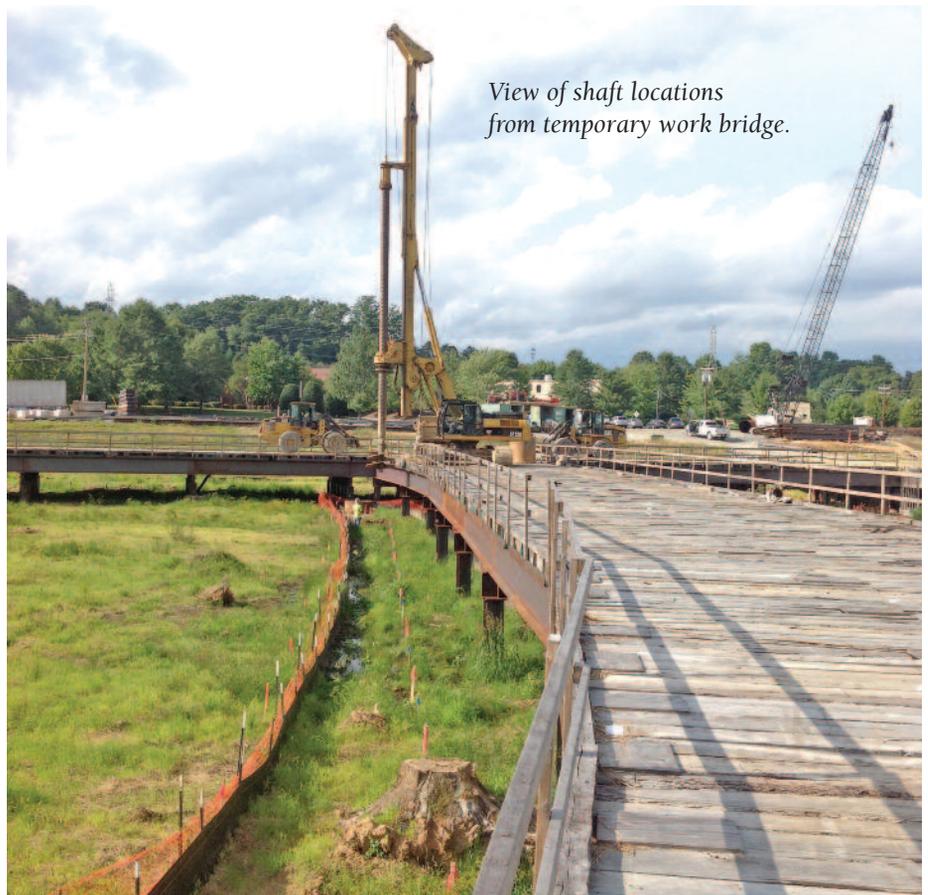
In this specific location the general subsurface profile in the wetland area ranges from swamp

Resources (NCDENR), Division of Water Quality (DWG)

In order to provide equipment access in this area, V&G is constructing over 5,500 Ft of temporary work bridge over the wetlands. The work bridge construction began with an 80 ton crawler crane placing crane mats and a template to drive a series of steel H-piles in rows along the planned route of the work bridge. The H-piles are driven to refusal in the bedrock and a steel substructure is welded to the top of the piles. Each section of substructure is bolted together in 20 foot sections for ease of removal and reuse on the project as work progresses in new areas. Crane mats are placed side by side on the top of the structure to create a working platform with temporary hand rails and tow boards. The final elevation of the platform is approximately 15 feet above the wetlands. Without the work bridge up to 60 structure locations would not be accessible.

Drilled Shaft Scope and Soil Conditions

The contracted deep foundation scope for BCC on the Western Loop project consists of:



View of shaft locations from temporary work bridge.

organics, silty /clays, over soft and stiff sands/gravels, to loose to dense meta-granite and granite bedrock.

The upper swamp silt/clays were filled with 5-10 feet of Weight of Hammer organic material and large timber debris which created difficulties when trying to maintain shaft alignment and uniform diameter at the top of the shaft. Crews often are required to work from crane mats placed below the work platform at the shaft locations as the swamp provided little to no support for standing. Sands and gravels below the clay layer needed to be fully cased down to bedrock to stabilize the shafts and permit drilling of rock socket. Due to environmental concerns and site constrictions slurry's have not been used.

The granite bedrock itself is highly variable and abrasive in the area ranging from a hard 15,000 psi to a very hard 25,000 psi. During the drilling process attention was paid to production rates when drilling with conventional core barrels and rock tooling and many times required the use of a LP Cluster Drill.

The 60 inch LP Cluster Drill was designed and built by Center Rock, Inc.* of Berlin, Pennsylvania and fitted with thirteen low volume 6 inch class self-rotating 7.875" hammer bits positioned in a specially designed grid pattern to ensure even cutting across the face of the hole and to promote proper flow of cutting outward and upward into the calyx basket. The minimum air requirement to run the LP Drill is between 5200-6500 scfm at around 120 psi. Due to the head pressure from the swamp mul-



LP Cluster Drill in action.



LP Cluster Drill.

multiple 1600 cfm compressors were required to operate the tool efficiently.

Air was supplied to the drill tool via an air manifold connecting the multiple compressors to a single air line which linked to the LP Drill through a ratchet attachment. A ratchet attachment is used to supply the LP Drill with air when the drill rig is not equipped with air inlet. The ratchet is equipped with the LP's mating bolt flange on one side and a kelly box of the drill on the other. To operate, the drill rotates 360° one direction and 360° the opposite direction.

When the calyx basket (mounted above the LP Drill) filled to capacity with cuttings the tool was removed from the hole and dumped.

Other features of the LP Cluster Drill that are utilized while drilling on the project included a water injection system and oil injection system. The water injection system is equipped with a 14.5 HP drive engine and a triple piston pump that puts out 3 to 22 GPM which prevented rock dust from contaminating the wetlands when operating in dry conditions. The oil injection system is a self-contained, air-actuated positive displacement system. It was equipped with a 22 gallon reservoir with sight glass and filled with biodegradable eco-friendly rock drill oil to

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Permanent casing installation.

meet EPA standards for biodegradability due to sensitive site location.

The vast majority of the drilled shafts are laid out together in groups of four or six shafts per bent structure. To allow for installation with a single diameter LP Drill, diameters were increased to 60 inches.

Specific Equipment

The project sequencing has required multiple rig moves around the site. To provide the greatest mobility BCC has taken a multi-faceted approach to selecting the right equipment. The

The primary rig selection for the project has been the European-style Hydraulic Crawler Foundation Rig. To date based on drilling conditions multiple rigs have been utilized on the project including a Bauer BG24H*, IMT AF250*, and CZM EK250*.

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With multiple drills working on the site, close coordination with the General Contractor is done on a daily basis to ensure the necessary support equipment and materials are available

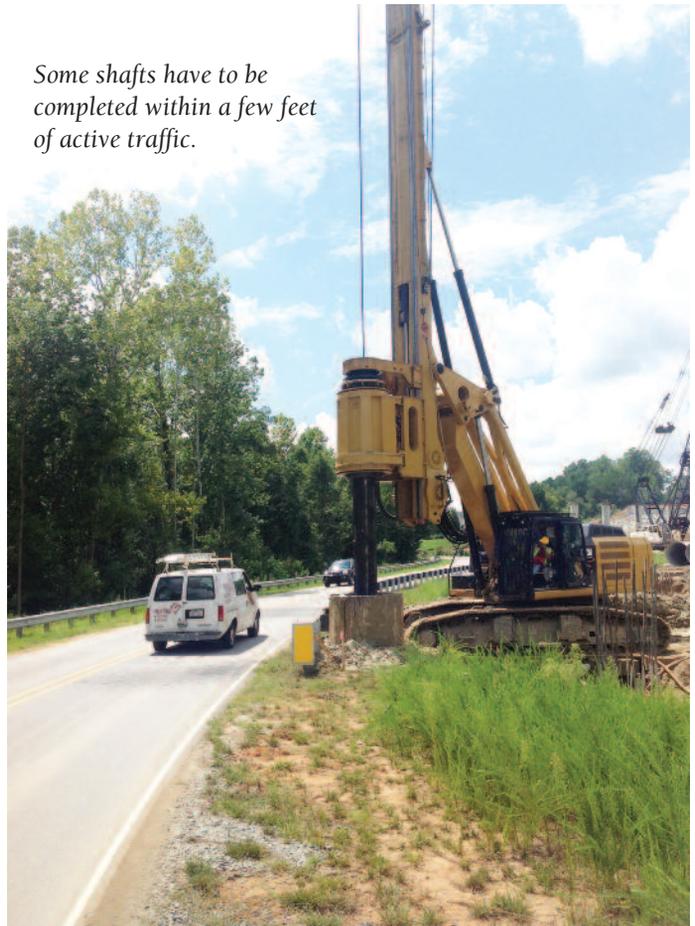
when required. Support equipment utilized on a regular basis include: an 80 ton crawler crane to install full length reinforcing cages and temporary casing, a Caterpillar IT28G front end loader to move drill tooling and casing, tri-axle dump trucks to remove spoils from the work bridge, and a 38 meter concrete pump for tremie pours.

Special Problems Encountered and Solutions

BCC has always prided itself on its ability to provide solutions to various foundation challenges; one of the challenges associated with the construction of the shafts on this project has been the design requirement to install 5 feet of 60 inch diameter permanent steel casing at the surface for use as a form above the water level of the swamp. The casing form keeps the concrete from flowing uncontrollably into the zero blow count material and allows the future column shaft to be constructed above the wetland. To overcome this condition BCC crews built templates made from I-beams across the crane mats prior to placing concrete. During the concrete placement, casing up to 50 feet is extracted, suspended by the crane, and welded to the template. Once secure to the template the casing is torch cut above the final elevation and removed to allow for finishing the top of the shaft.

Another difficulty encountered on the project was the requirement to build three new bridge shafts in twenty feet of overburden at the Horse Pen Creek bridge structure. Based on a requirement to maintain traffic flow at all times on Horse Pen Creek Road, half the new bridge would need to be completed and opened to traffic prior to excavation down to the new road level. Project restraints did not allow for a typical shoring option

Some shafts have to be completed within a few feet of active traffic.





View from the start of the elevated roadway.

and the columns and drilled shafts below needed to be completed prior to excavation. To solve this problem an oversized 72 inch temporary casing was installed to act as shoring at each

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column location during shaft construction. The shaft was completed and poured to the plan elevation approximately 20 feet below existing grade; and the column forms were installed inside the temporary casing. Prior to cap construction the column forms and temporary casing were removed allowing the first half of bridge to be completed as planned.

Summary

In the near future when the work bridge is removed, and the wet lands have reclaimed this section of Horse Pen Creek will people wonder how the project was built? When driving over the swamp below will they care about the multitude of challenges the contractor faced while building the multilane ele-

vated roadway? Brayman Construction is proud of its involvement in the project knowing that although our work will never be seen by the public we were a part of something that will help people for years to come.

Brayman Construction Corp. performs all types of specialty foundation construction, ground improvement deep foundations and heavy civil work. Its markets include commercial, industrial, transportation, marine, electrical generation, and locks and dams. The corporate office is located in Saxonsburg, Pennsylvania with additional offices in West Virginia and North Carolina.

*Indicates ADSC Members.

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Project Team

Project Name:	Greensboro Western Loop
Project Owner:	NCDOT
General Contractor:	Vecellio & Grogan, Inc.
Foundation Contractor:	Brayman Construction Corp.*

*Indicates ADSC Member