New Pipeline Construction Product Allows for Simple Installation of Standard PVC Pipe in Houston HDD Project

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Objective

Present a New, Alternative Material for HDD Pipe Installation

Discussion Points

- Project Description
- Contractor
- Submittal Process
- Engineering Concerns
- Installation
- Lessons Learned
Scope of Work

Major improvements to transmission system to convert from groundwater to surface water

- Combination of water line construction, public utility adjustments and paving
- 7,055 linear feet of 48-inch and 42-inch prestressed concrete cylinder pipe by open cut and tunneling
- 515 linear feet of 36-inch and 48-inch steel water line by open cut
- 2,740 linear feet of 8 inch water line by open cut and trenchless construction
- 1,010 linear feet of 12-inch waterline
- Improvements to existing Chlorine Building at Southwest Pump Station
- Existing 6-inch, 8-inch, and 12-inch Asbestos Cement pipelines to be abandoned in place
Contractor

For more than 40 years, BRH-Garver Construction, L.P. has been known for its ability to handle difficult and one-of-a-kind civil construction projects throughout the United States. QUALITY, SAFETY, AND CLIENT SATISFACTION are the most important objectives of the company.
**Contractor**

• BRHGarver, Inc. is a Houston based contracting firm that was established in 1970.
• This contractor specializes in complex civil projects for public and private clients.
• In the mid-eighties BRH-Garver pioneered the use of micro-tunneling in North America.
Contractor

Trenchless Technology
March 1995

C. Michael Garver
Trenchless Technology Person-of-the-Year, 1995

Also in this issue:
- Paletom High-Pressure Gas Pipe Line Testing
- 1/1 Reduction in Greater Chicago

NO-Dig '95 Preview Issue
Contractor

HOUSTON PLUGS A GUSHER
$1.2-billion sewer upgrade
Contractor

Texas Contractor
Limited Space Applications

FOCUS - Public Work Projects
Most of the 8-inch and 12-inch pipe was to be installed with Horizontal Directional Drilling because of the location in an established residential neighborhood.

Piping systems approved by the City of Houston that are typically used for HDD
- Integral restrained joint ductile iron pipe
- Spline and groove style PVC pipe
- Integral bell restrained PVC pipe

BRH-Garver submitted on use of standard bell and spigot PVC pipe
1. The HDD Procedure identifies anticipated pull back pressures at various lengths. These pull back forces appear to be high for the distances given. Since most of the pipe will be pushed, Contractor should determine the anticipated pushing forces and verify with manufacturer that the supplied PVC pipe can be adequately pushed for 200–250 ft distances, as identified in the submittal.
2. The HDD Procedure states that “Bell jointed (C–900) pipe will be pushed rather than pulled….” Pushing the pipe through a reamed hole for a 200–250–ft distance could cause over-insertion of the pipe joint. PVC pipe manufacturer’s installation guide requires the Contractor to take measures to protect against over-insertion. Contractor to provide a detailed description of these measures to be implemented and/or submit certification from manufacturer that PVC pipe can be adequately pushed for 200–250–ft distances without over-inserting, damaging, or over-stressing the joints.
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Reason for Concern about Over-Insertion of PVC Pipe Joints

Analytical Model of Stresses Caused by Over-Belling PVC Pipe

Steven L. Folkman, Associate Professor, Utah State University
A. P. Moser, Emeritus Associate Dean and Emeritus Professor, Utah State University
Thomas Fronk, Associate Professor, Utah State University

Plastic Pipes XV, Vancouver, BC, Canada, September 20–22, 2010

“When pipe joint failures occur, in most instances the pipe was inserted well beyond the manufacturers recommended mark. This is referred to as “Over-Belled” pipe.”
Reason for Concern about Over-Insertion of PVC Pipe Joints

Longitudinal Mechanics of Buried Thermoplastic Pipe: Analysis of PVC Pipes of Various Joint Types

Shah Rahman, Vice President – Technical Services, S&B Technical Products/Hultec
Reynold K. Watkins, Professor Emeritus, Utah State University
ASCE Pipelines Conference 2005, Houston, TX, August 21–24, 2003

“Numerous pipeline failure analyses have been traced back to excessive stresses on the bell as result of over-insertion.”

“Gasketed joints must be able to accommodate the changes in length.”
Reason for Concern about Over-Insertion of PVC Pipe Joints

“Gasketed joints must be able to accommodate the changes in length.”

Rahman, 2003
Reason for Concern about Over-Insertion of PVC Pipe Joints

Stop Line

Gap?
Reason for Concern about Over-Insertion of PVC Pipe Joints
Reason for Concern about Over-Insertion of PVC Pipe Joints

**PVC Pipe Failures**
Russ Dueck, P.Eng City of Calgary, Water Resources
UDI Breakfast Seminar—September 8, 2010

- Distribution System is 50% PVC
- PVC breaks account for 1–3% of total annual break count
- PVC failures are typically catastrophic, leading to substantial water loss and sinkholes

In the Root Cause Analysis “Over insertion of the joint” was listed first as the cause of failure.
Every Piping Material Has Its Strengths and Weaknesses

In 2004 PVC Pipe Comprised
- 48% of Total Municipal Pipe Market Share, feet
- 78% of Water Pipe Market Share, feet
- 81% of Sanitary Sewer Market Share, feet

More than two million miles currently in service including 520 million gasketed joints
Growth of PVC Pipe Market

*Source: Chemical Market Associates, Inc., 2011

* Billions of Pounds

“PVC Pipe: Leading the Market in Water and Wastewater Distribution”
Presented by Bruce Hollands, Uni-Bell PVC Pipe Association
AMI Plastics in Underground Pipes 2011, Hyatt Regency Houston, TX
October 1-2, 2011
In addition to the information submitted for the AWWA C900 PVC bell and spigot pipe the contractor provided information on

• The Mega–Stop product from EBAA Iron with a rated push capacity of 10,000 lbf with a two to safety factor
• The maximum forces of the backhoe equipment that would be used on site
• A detailed description on the drilling and installation techniques
Mega-Stop® Components

Stop Ring
Split, Serrated ductile iron
Grip ring, 4–12 inch
Wedge Style, 14”+

Expansion Retention Spring (ERS)
SBR Rubber spring with
Inspection notches

Push Rating w/ 2:1 Safety Factor

4–12 Inch  10,000 lbf
16 Inch     15,000 lbf

Mega-Stop is a registered trademark of EBAA Iron, Inc.
Patent Pending
Installation of 48” Steel Pipe
Installation of 42” PCCP
First Phase of the 8-Inch PVC Installation
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Wood Push Block
First Phase of the 8-Inch PVC Installation

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Several areas require that the HDD installation be curved to fit the contour of the street.
First Phase of the 8-Inch PVC Installation

Video Inspection of 300 Feet of Installed 8-inch Pipe
First Phase of the 8-Inch PVC Installation

Video Inspection of 300 Feet of Installed 8-inch Pipe
12-Inch PVC Installation
16-Inch PVC Installation, Conroe, TX
16-Inch PVC Installation, Conroe, TX
16-Inch PVC Installation, Conroe, TX
16-Inch PVC Installation, Conroe, TX
16-Inch PVC Installation, San Diego, CA
16–Inch PVC Installation, San Diego, CA

1050 feet of 16” C905 PVC Pipe Pushed Through Casing Under a Major Highway
18’ Installation Depth
16–Inch PVC Installation, San Diego, CA

Monitored Push Force Via Scale Mounted on A Frame Placed at the Bell
16-Inch PVC Installation, San Diego, CA
Lessons Learned

- Saved at least 40% on materials compared to other PVC pipe alternatives
- C900 and C905 PVC pipe and stops were readily available
- Installation was slow initially as workers became familiar with product and installation.
- Once familiar with the installation, crews progressed at a rate of pushing a piece of pipe every 3–4 minutes
- Easily utilized in congested areas
- BRH–Garver is planning to utilize the same techniques on future, short bores in the area
Questions

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Thank You

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