Vitrified Clay Pipe (VCP) as a Carrier Pipe Within a Steel Casing

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Morty's TRENCHLESS ACADEMY

After more than 30-years of direct jacking Vitrified Clay Pipe (VCP) via Microtunneling and Pilot Tube Methods in the U.S., installation options continue to evolve. In a lesser-known method, VCP has also been installed within a steel casing as a carrier pipe for gravity sanitary sewer. This experience establishes that Bell & Spigot VCP and jacking pipe can both be used within a permanent steel casing.

The Pilot Tube Method of Guided Boring (PTM) with VCP has long been a popular option for many challenging conditions. The reliable rifle-barrel straight installations ensure precise line and grade pipelines suitable for gravity sanitary sewers which do not require casing pipe to be left in the ground.

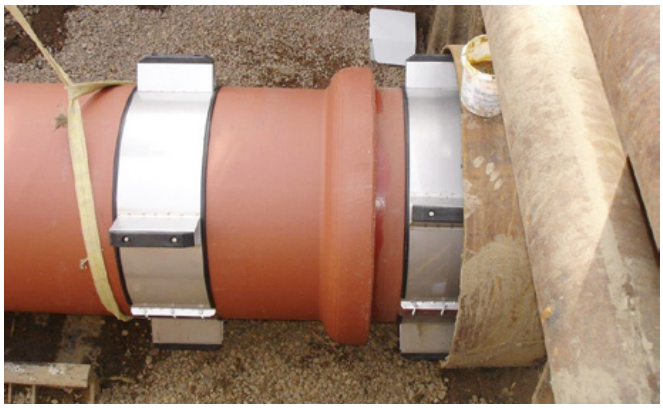
Installing the steel casing is the first step. This is commonly accomplished using Horizonal Auger Boring (HAB) Methods with or without the guidance of a pilot tube.

Using Bell and Spigot Vitrified Clay as the Carrier

Bell and Spigot pipe is a common pipe material used for conventional open trench construction. However, it can be jacked within a steel casing. When this pipe product is used, casing spacers or wooden skids are attached to the pipe barrels to elevate the pipe bells during installation. Bell and Spigot pipe is not specifically designed to be direct jacked and thus, it is typically used for runs within a casing at drive lengths of approximately 200 LF or less. Longer runs with Bell and Spigot pipe have been accomplished using lubricants at the friction points of the casing spacers.

Bell and Spigot pipe needs to have a wood cushion between the section being jacked and the steel push plate on the jacking frame. When pushing on the bell end, the force must be applied to the pipe barrel inside the bell and not to the pipe bell itself. This can be accomplished using wood cribbing, plywood, or a combination thereof.

Unlike Jacking Pipe, the pipe ends are not machined on a lathe to a precise tolerance for squareness, nor are wood rings



Stainless-Steel Casing Spacers with polyethylene runners designed for a 30-inch Bell and Spigot VCP Pipe

(cushions) used between each assembled Bell and Spigot joint. Casing spacers, attached to the pipe barrel, need to be placed at intervals sufficient to support the weight of each pipe section (usually 2 spacers per pipe). Casing spacers also need to resist abrasion and sliding wear during installation without failure within the tunnel.

If skids are used in place of casing spacers, commonly two wood skids placed at the 5 and 7 o'clock positions per section of pipe are held in place with steel banding. Lubrication within the installed casing can be used to reduce the friction (and thus jacking forces) on longer push lengths.

2M section length of 18-inch Vitrified Clay Jacking pipe with redwood skids being lowered in a jacking shaft

"The Pilot Tube Method of Guided Boring (PTM) with VCP has long been a popular option."

Using Vitrified Clay Jacking Pipe as the Carrier

Specialized VCP Jacking Pipe (manufactured in 8- to 24-inch diameters) is commonly direct jacked to advance a temporary casing, a Microtunnel Boring Machine, a powered cutterhead, or a reaming head but it can also be direct jacked within a previously installed casing. Using jacking pipe instead of a pipe designed for use in an open trench allows the casing diameter to be reduced. VCP Jacking pipe with a flush bell design (smooth profile joint) and machined ends for transferring axial loads during installation was introduced to the US in 1992.

Final Installation: Bell & Spigot or Jacking Pipe

A horizontal auger-bore jacking frame should be used to install the carrier pipe (Bell and Spigot or Jacking pipe) after the steel casing is in place. The jacking frame applies a uniform circumferential force to the end of the carrier pipe.

When the annular space between the casing and carrier line is filled; fill materials may include 3/8-inch pea gravel, sand or one of the many mix varieties of flowable, cellular fill, or grout. Bulkheads at the ends of the casing or casing end seal closures may be used to prevent water and/or soil from entering annular space if it is not filled.

Longer drive lengths are practical when using VCP jacking pipe as it is designed and manufactured to be loaded axially. An independent lab for the City of Los Angeles recently completed compression tests on NO-DIG VCP Jacking Pipe. The minimum compression strength of the five pipe sampled and tested was over 30,000 psi. This is well-above the minimum requirement of ASTM C1208 (*Standard Specification for Vitrified Clay Pipe and Joint for Use in Microtunneling, Sliplining, Pipe Bursting and Tunnels*) of 7,000 psi.

Current Installation: Ontario CA Sports Empire Complex Infrastructure

In a project relying on the compression strength of NO-DIG pipe in Ontario, CA, Golden State Boring is currently installing 5,500 LF of 18- and 21-inch VCP jacking pipe as the gravity sewer carrier pipe within a 36-inch casing. Redwood skids are strapped to the pipe and used for invert adjustments for the installed carrier pipe. The average drive length on the Ontario Sports Empire Complex project is over 700 LF. The choice of the longer drive lengths was made due to the depth of the installation at 40 – 45 feet. For this project, where the native soils are soft sandy clays (SC), trenchless installation was more cost effective than a traditional open trench construction. To date, approximately 70 percent of the drives have been completed. Projected completion for this installation is October 2025.

Sustainability of Vitrified Clay Pipe

The options available to owners, engineers and contractors are driving some to look at clay pipe with a fresh perspective. The long-term value of any installation is built on sustainability. The longevity of the material, unmatched corrosion resistance,

24-inch Vitrified Clay Carrier pipe within a Casing: Concrete Bulkhead/ Grout Filled Annulus

18-inch NO-DIG Pipe installed within a 36-inch steel casing in Ontario, CA

and the ability to use aggressive cleaning methods are unique to VCP. For municipalities accepting sustainability as part of their mission, the natural raw materials and manufacturing processes used to make clay pipe are also far preferable to the alternative plastic products.

Drive lengths of over 700 feet were completed out of 14x48 FT jacking shafts averaging over 40-feet deep

As in any ceramic material, the physical properties of the clay pipe will remain unchanged over time and are not susceptible to degradation. Because the raw materials used in the manufacture of clay pipe are just clay, shale and water, the environmental impacts are minimal. The limited environmental impact of raw material extraction and the long life of clay combine to make it far more sustainable than any other pipe product.

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