HILLSBOROUGH COUNTY FLORIDA UTILIZES VARIED TRENCHLESS METHODS WITH SUCCESS

By Richard Kirby

Sr. Professional Engineer, Hillsborough County Public Utilities, 925 E Twiggs Street, Tampa, FL, Tel: (813) 272-5977, Email: kirbyr@hillsboroughcounty.org

ABSTRACT

Hillsborough County Public Utilities Department faces a lot of the same challenges that many utilities face – aging infrastructure, system weaknesses and needed improvements, and system and service expansion, just to name a few. The County's mission statement includes the desire to provide its services ‘in an environmentally sensitive, cost conscious manner utilizing contemporary quality processes to meet customer requirements.’ It is with these two main drivers that the County has turned to more advanced and specialized trenchless installation methods, and settled on several specifically, to meet their needs.

The County has successfully used jack and bore techniques (J&B) and horizontal directional drilling (HDD) methods in various configurations. These techniques have not only allowed construction in difficult situations and project sites, but have also minimized construction impacts on constituents and businesses, due to the small footprint required. The County has utilized J&B technology to cross under roadways, and other obstructions. They have maximized the process and materials to limit the size of required casing and carrier pipe as part of the process. One major project that took advantage of this technique was the construction of a wastewater transmission force main along State Road 674 in southern Hillsborough County. The County has also used HDD extensively over the past decade including crossings of waterways, roadways, and other obstructions, as well as construction along and in busy rights of way. HDD has been used to successfully install water and wastewater infrastructure, as well as casings and carrier piping.

INTRODUCTION
Hillsborough County is centrally located along Florida's west coast on Tampa Bay. The Hillsborough County Public Utilities Department (HCPUD) serves potable water, wastewater, and reclaimed water customers within a defined service area, outside the three incorporated cities. The utility also provides solid waste collection and disposal, since the recent combination of the County's Water and Solid Waste Departments. Water utilities are provided to 155,682 billed accounts equaling approximately 300,000 customers. Originally, the Hillsborough County Water Department was formed in the 1970s when the County purchased existing franchise utilities. Although most of the current infrastructure has been installed in the past 40 years, there are some significantly older sections going back many decades.

HCPUD is divided into two distinct service areas, Northwest and South-Central. The City Of Tampa splits the county from Tampa Bay north to the county line. The cities of Temple Terrace and Plant City are also within Hillsborough County. Each of these cities own and maintain their own utility systems, although the City of Temple Terrace purchases waste water treatment services from City of Tampa.

The county is predominantly flat with some low rolling terrain. Since Hillsborough County is located along the coast, the ground water table is within a few feet of ground surface in most areas. This topography, combined with the large areas, leads to the need for significant piping distribution and collection systems, as well as a large number of pumping stations with some much larger booster and repump stations. The current wastewater treatment system is made up of six regional plants and one subregional facility. The system also includes one bio-solids management facility, which produces dry pelletized sludge meeting AA standards. Potable water is provided by four regional facilities. HCPUD currently owns and maintains 597 miles of sewer force mains, 1,276 miles of gravity sewer, 2,391 miles of potable water main, and 333 miles of reclaimed water mains. Currently the utility owns and operates 702 sewage pumping stations in the system.

Although the county has chosen polyvinyl chloride (PVC) and ductile iron pipe (DIP) as the utility's standards, HCPUD's pressure piping system is made up of virtually every type of material, including a small amount of tongue and groove oak still showing on inventory. Steel casings are required for all pressure pipes crossing arterial or feeder roads. Standardization was done to minimize the number of tools and amount of training field personnel need to maintain infrastructure. It also serves to minimize the number and type of spare parts which must be kept in inventory. Standard technical specifications have been written for gravity sewers, potable water mains, sewer force mains, reclaimed water mains, and sewage pumping stations. These specifications are updated on a two-year cycle.

This paper will present case studies involving installation of pipelines through trenchless technology methods. Problems encountered during the projects will be discussed as well as how they were resolved.

**GRAVITY MAIN REHABILITATION**
More than a decade ago HCPUD decided to develop a proactive program to get ahead of gravity sewer main failures. A master fund was established within the county's Capital Improvement Program (CIP). This is a multi-year, ongoing project, with current annual funding of $1.5 million.

Fold and form and cured in place liners have been used effectively to rehabilitate the system. This is a well established technology so this paper does not go into depth describing the process. Fold and form liners are used in pipes up to 15 inches in diameter. Cured in place liners are used to rehabilitate pipes above 15 inches in diameter. Bypass pumping of the gravity system is required to divert sewage around the pipes being lined. One unexpected problem was encountered when cleaning lines prior to slip lining. While jet cleaning pipelines in some of the older neighborhoods, back pressure caused contents of toilets and pee traps to blow into homes. This occurred in areas with very shallow gravity pipes. The solution was to have jet cleaning crews work extra carefully when working with very shallow pipes. HCPUD also chose to include warnings on the door-hanger notices explaining the possibility to customers of this blow back and ask them to make sure toilet lids were kept closed during the work.

Prioritization of pipelines to be restored was originally determined using historical knowledge of field staff, as to where the problem areas existed. In 2007 HCPUD received the final report from a multi-year asset inventory and assessment project conducted by the utility's consultant. The percentage of gravity sewer pipelines classified as needing immediate repair was significantly lower than expected. Immediate repair is defined as pipes in need of rehabilitation or replacement within five years. The better than expected condition of the gravity system was attributed to two primary reasons, the majority of the system is relatively new and most of the pipes are PVC. Also, the worst of the worst pipelines had already been identified and rehabilitated under the CIP slip lining program.

FISHHAWK CREEK WATER MAIN CROSSING

As part of their development agreement, a developer was tasked with installing a 12-inch diameter water main in eastern central Hillsborough County. The route crossed Fishhawk Creek. The creek crossing posed several challenges. The creek bed itself is fairly deep and in an area of rolling sandy terrain. The top of the limestone floridan aquifer is the creek bed. HCPUD standards require pipelines crossing under this type of water to be constructed of Class 55, restrained joint DIP. Local environmental standards require the pipeline crossing to be at least 10 feet below creek bottom. This would have required blocking and rerouting the creek as well as significant dewatering, and cutting into the limestone. Costs and environmental impacts were deemed to be unacceptable.

The proposed solution was to use horizontal directional drill (HDD) to install fusible PVC (FPVC) as the carrier pipe. Since the utility had limited experience with this product at the time, and no experience using the product by horizontal directional drill through rock, HCPUD required an extra safeguard. FPVC, 12 inch diameter, DR 18, was used for the carrier pipe. It was installed in a casing of 18-inch diameter, DR 25 fused PVC. The rational
for requiring the casing was to ensure lime rock would not score the carrier pipe while it was being pulled into place.

The location was well suited for this project. The side of the road where the line was laid out was undeveloped. The right of way was significantly wide and long to allow the entire pipeline to be fused and laid out without interfering with traffic or access to property along the street. One small frac-out occurred close to the creek, but all drilling mud was contained and not allowed to enter the water. Figure 1, below, shows the pipe entry location on the east side of the creek and pipe layout.

![Figure 1 – Insertion and layout of Fishhawk Creek Water Main](image)

**CENTRAL PUMPING STATION/GOLF & SEA GRAVITY SEWER MAIN**

A developer approached HCPUD to connect their proposed subdivision to the county’s waste water system. It was determined that the downstream pumping station would have to be upgraded to handle the extra flow from the project. The developer entered into a Joint Project Agreement (JPA) with the county. Instead of upgrading an old pumping station, at the end of its useful life, HCPUD determined it was more appropriate to add an upsized gravity sewer line to convey existing and new sewage flow to the next downstream pumping station. This allowed the HCPUD to eliminate a pumping station, thereby reducing ongoing operation and maintenance expenses.

The new gravity main had to be installed under an existing road. The area is adjacent to Tampa Bay, with surface elevation of between 5 and 10 feet. Because of the high water table and the need to keep the existing roadway in operation, trenchless installation of the gravity main was chosen as most appropriate. HDD was selected as the best method.

The trenchless portion of the project was a single 466-foot-long boring using 16-inch diameter Certainteed PVC pipe. A proprietary method of boring with greater steering control than traditional HDD was used due to tight grade tolerances required for this installation. Evenly spaced site holes were drilled into the road to allow the installer to
view the pipe from above and ensure it was in the correct alignment. Soils in the area are composed predominantly of sand and shell.

Two problems occurred with the project. The site holes developed into dimples in the road. Also, the pipe was outside allowable tolerance for dips in a gravity main, although not far enough out to warrant replacing the line. The utility’s allowable tolerance for this diameter gravity main is 1.5 inches. The installed line has three dips, the largest of which is just under 2 inches. Since the soils are saturated and predominantly shell and sand, removing soil from the site holes seemed to create voids leading to these results. A clear lesson learned from this example is the value of geotechnical evaluation as a regular part of design for this type of project.

ANGUS ROAD WATER MAIN

Angus Road is located in northwest Hillsborough County. It is a short private residential road with four existing single-family homes and one small commercial structure. The site is immediately south of a closed county landfill. Between the site and the landfill are an arterial county road, Linebaugh Avenue, and a CSX railroad track and right of way. Ground water adjacent to the landfill has been tested for contaminants. Cumene and ammonia have been found at levels above ground water standards.

Although no contamination has been found in the private wells serving the homes and commercial property on Angus Road, HCPUD chose to proactively install a potable water main to ensure safe reliable water was available, should the contamination plume migrate further south.

Installation of this line poses several challenges. HCPUD standards require pressure pipes under arterial roads to be installed inside steel casing. CSX also requires steel casing under their right of way. Since the area has high ground water table, any jack and bore pits will be well into the water table, requiring dewatering. In order to discharge contaminated ground water, regulatory agencies would require a surface water discharge permit. The cost and time needed to accomplish this is significant and out of proportion with the size of the job. Potential contamination of the main and water within also had to be addressed.

To ensure protection of the water main equivalent to steel casing, the design called for HDD of restrained joint DIP as casing under the road. HCPUD standards require carrier pipe inside casing to be 100% restrained. FPVC was chosen as the carrier pipe, to eliminate the need for restrainers and to minimize the diameter of DIP casing. HDD also eliminated the need for a jack and bore pit on the north side of the road, the area of cumene contamination. Table 1 below shows standard casing size requirement versus those for fused pipe, as given in HCPUD’s current standard specifications.

**Table 1 - Pipe Sizes and Required Casing Diameter (Inches)**
In order to ensure contaminants would not degrade the pipe and water within, two main factors had to be addressed. First, materials must preclude migration of contaminants into the water supply. Second, the possibility of direct contamination through joints had to be minimized. The level of cumene and ammonia contamination was compared to known data for PVC pipe to verify appropriateness of the material. It was determined that cumene, at levels present in the area, would take significantly more time to migrate through the pipe wall than the expected useful life of the pipe. The use of FPVC eliminated all joints other than those at fittings. Viton gaskets for fittings and valves were selected due to their ability to standup to hydrocarbons.

The requirement for steel casing, installed by jack and bore, under CSX railroad right of way could not be waived. Installation will take place in the dry season. Infiltration areas will by constructed where possible, to allow water pumped from dewatering to percolate back into the soil. A vacuum truck will be kept on stand-by to haul water to the nearest sewage treatment plant, if infiltration proves to be inadequate.

**SUN CITY MOBILE HOME PARK WATER MAIN EXTENSION**

Sun City Mobile Home Park currently has its own water treatment plant and distribution system serving 107 residences in southern Hillsborough County. The system is south of the Little Manatee River and outside of HCPUD’s defined service area. The current plant has two supply wells. The collocated plant and wells are within 3 miles of Tampa Bay and within a half-mile of the tidally influenced lower river. The wells have experienced increasing total dissolved solids, possibly early signs of salt water intrusion. Little Manatee River is classified an “Outstanding Florida Water”. The plant is at the end of its useful life and must be replaced. A capital project was established with a budget of approximately $1 million.

To avoid the possibility of having to increase the level of treatment to reverse osmosis and deal with brine disposal in an environmentally sensitive area, the utility decided to design a

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water main extension to serve these customers. The cost of following road right of ways required building several miles of water main in a circuitous route, much of it already full of utilities. A route was chosen, approximately one mile in length and almost directly across the river. It required obtaining easements from two property owners.

Installation of the water main in the uplands portion of the project will be predominantly by open cut method. Restrained joint DIP will be used on the north side of the river to accommodate future construction and excavation activity when the undeveloped property is ultimately built out.

In crossing the river, the utility weighed options for materials. In order to ensure reliability of the system, the utility considered the options of installing the carrier pipe in a casing or installing two parallel lines. The latter was chosen as providing the best chance for uninterrupted service. HDD was chosen as the installation method. A Geotechnical evaluation of the soils below the river was done. The Geotechnical Engineer recommended the pipe be installed at a depth of 50 feet below surface to ensure the directional drilling is done in cohesive soils, thereby minimizing the chance of frac-out. FPVC was chosen as the material which best satisfied all needs of the 8-inch diameter, 1000 linear feet bundled pull requirement for this project.

CONCLUSIONS

Continuously monitoring available trenchless technologies for installation, replacement, and repair of pipelines is important in enabling engineers and utilities to determine the best available alternatives. Numerous good viable methods and materials exist for these purposes. Establishing and regularly updating technical standards has served the utility very well. Good solid standards, based on real world experience, allow a utility to ensure quality and consistency in providing service. Regularly reviewing and updating these standards ensures designers have access to all available technologies, while allowing obsolete methods and materials to be removed.

Right of way owners in the area are increasing pressure on utilities’ to remove assets taken out of service when replacement assets are installed. As these rights of way become more crowded with soft and hard utilities, it can be expected that this pressure will increase. For water utilities, trenchless technologies such as pipe bursting and slip lining, will become more cost effective when compared to installing a new pipeline and then excavating to remove the old one.

REFERENCE

Hillsborough County Water, Wastewater and Reclaimed Water Technical Specifications, Project Control, Standards, & Master Project Management Section, Original Issue date: 12-28-90, 6th Edition: 10-12-11