Trenchless Installation as the Economical Choice: Mission Bay & Pacific Beach CA

By: Jeff Boschert P.E., National Clay Pipe Institute

The communities of Mission Bay and Pacific Beach, in San Diego, CA (the City) are much like many other oceanfront areas with high tourism, and high-water tables; they have an expectation of, and a need for, uninterrupted services.

The Sewer Group 786 project in this area of San Diego included replacing, rehabilitating, or realigning approximately 15,145 linear feet (LF) of sewer mains in areas adjacent to Sea World and other tourist traffic. The project was planned for depths ranging from 4 – 21 feet with ground water present at 8 – 14 feet. As an added challenge, many of the slopes on this gravity flow sewer project were very flat, ranging from 0.25 – 0.75 percent.

The original plan for the Sewer Group 786 project included the replacement of existing 8- and 12-inch sewer mains via the following construction methods:

- **replace-in-place** approximately 7,973 linear feet (LF) within existing trench alignments via open trenching (4-21 feet deep)
- **realign** approximately 3,672 LF of sewer main within new trenches via open trenching (11-21 feet deep)
- **construct** approximately 3,500 LF using trenchless technology (4-21 feet deep)

The project footprint was located entirely within the public right of way (including alleys), easements on private property and streets within the communities of Pacific Beach and Mission Bay with an average surface elevation of just 14 feet above sea level and unstable soils. This area has a great deal of tourist traffic. Any lane closures would cause backups in all directions on major arterial roadways and the unstable soils would necessitate closure of multiple lanes of traffic on those roads in the case of open trench installations.

The bid documents specified the installation of new pipe via the use of Horizontal Directional Drilling (HDD) as the trenchless method for approximately 3,500 linear feet (30 percent of the entire project scope). The design slopes for these 8 and 12-inch gravity flow sewer pipelines ranged from 0.25 – 0.75 percent. To maintain these exacting slopes in unstable soils with concerns about contaminants and maintaining traffic flows, Ortiz based their bid on a plan to use the Pilot Tube Method of Guided Boring (PTM) with Vitrified Clay Jacking Pipe (VCP-J) and the Akkerman Guided Boring Machine (GBM) 240A system in lieu of the specified HDD method. PTM is applicable for gravity flow installations and includes a theodolite guidance system, pilot tubes, jacking frame, power pack, and lubrication pump.

As a knowledgeable general contractor with extensive experience in the area, Ortiz Corporation (Ortiz) worked with the city's plan calling for a blend of open trench installation and

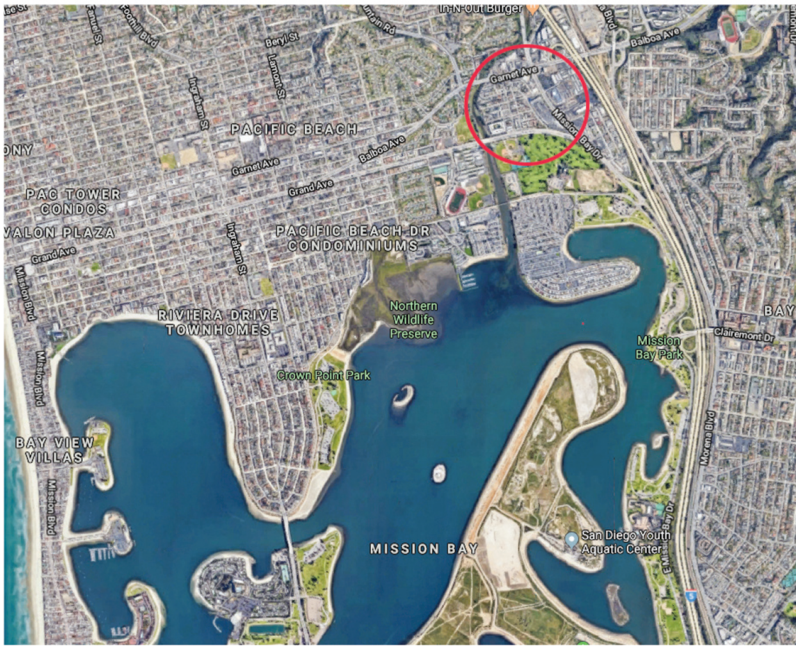

Figure 1. The project (located in the red circle above) was affected by tidal influence and needed to be managed entirely within the public right of way

trenchless technology to upgrade a portion of the collection system in the Mission Bay area. They also recommended consideration of planning the full project as a PTM project.

Prior to starting the project, Ortiz conducted research to identify any environmental concerns in the area. GeoTracker is the California Water Board's data management system for sites that impact, or have the potential to impact, water quality in the state. The emphasis of the system is on groundwater. One of the benefits of the program is a user-friendly map very similar to Google Maps. Many of the closed cases on GeoTracker revealed that significant tidal influence may have pushed the plumes around. There was a concern the dewatering system would pull any latent contaminants into the work zone.

The City also hired Allied Geotechnical (Allied) to perform an additional geotechnical exploration. The scope of Allied's investigation did not include a Phase I Environmental Site Assessment to evaluate the possible presence of soil and/or groundwater contamination beneath the project alignment. During the subsurface investigation, soil samples were field screened for the presence of volatile organics using a RAE Systems Mini-RAE

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Figure 2. Onsite GAC treatment plant

3000 organic vapor meter (OVM). The field screening did not reveal elevated levels of volatile organic compounds.

There were several considerations that led to the selection of PTM as the installation method of choice, but the primary motivators were the extreme precision required by the flat slopes, the desire to maintain traffic flows in a tourist area, and the probable spread of contamination plumes based on the state's GeoTracker program.

The contractor still had concerns due to the proximity of other known contaminants and the tidal influence. Soon after dewatering began, the contractor's fears were realized. Once the contaminant was identified, granulated, activated carbon (GAC) system vessels were put in place to pull the hydrocarbons out of the groundwater prior to disposal.

The first five PTM trenchless drives progressed as planned, with all drives being "on-target" and within the constraints of the exacting design slopes.

The first open cut section began after the fifth trenchless drive and involved the following:

- 395 feet of open trench with cuts up to 15 feet deep
- 2,204 square feet of pavement replacement with widths in excess of the trench width
- 1,484 tons of contaminated soils
- 1,636 tons of imported backfill materials to replace contaminated and unsuitable soils.

Figure 3. Pilot tube theodolite with integrated camera and visible LED illuminated target

The installed cost per linear foot of pipe in this open-cut section of the project was $1,267. The installed cost per linear foot of VCP-J installed using PTM was approximately $570.

After experiencing the PTM trenchless method and facing the challenges (and cost) of the first 395-feet of open trench installation, the owner opted to convert the remainder of the project to PTM. With people, equipment, and experience all in place, the City also opted to add five PTM drives which were not included in the original contract.

The rich clays on the project created obstacles for the dewatering filtration and treatment system. The primary issue was clogging of the GAC system. Bag filters were installed to prolong the life of each carbon filter, and bags were replaced one to three times per week with a single change of the GAC filters costing more than $12,000.

Figure 4. Over 250 wells were drilled at depths ranging from 35 to 40 feet

Figure 5. Installing 12-inch VCP-J in the 3rd step of the Pilot Tube Method using a powered reaming head (PRH)

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With the exacting specification for slope, the PTM guidance system was critical to the success of the project. The "real-time" view of the location and steering head orientation of the pilot tubes, together with the ability to make adjustments quickly during the entire installation, resulted in pinpoint accuracies.

Because the average compressive strength of VCP-J is 18,000 psi, the pipe itself can resist the high jacking forces generated as the pipe is pushed through the ground during PTM installation. This eliminated the need for an external casing pipe. The high compressive strength, low-profile, zero-leakage joints of VCP-J make it the cost-effective choice for PTM installations.

VCP-J has the same material benefits as all VCP. The proven lifecycle and greater range of options for long term operations and maintenance are prime considerations for more municipalities as they evaluate the material choices.

Plans were adjusted as the project progressed to limit the impact of contaminants and to minimize disruption to traffic flows. Actual conditions were not consistent with conditions indicated on the plans. Modifications and new alignments were necessary to maintain gravity flow. In the adjusted project map, new alignments caused deletions of planned drives. Those deletions were replaced by rerouted drives. In most cases, grade differentials were non-existent, requiring the team to find new routes for the pipeline while maintaining proper slopes.

PTM can be significantly more cost effective than open trench installation, especially where unstable soils create concerns. The owners are now asking contractors to consider doing more trenchless installations, when feasible. This is becoming a win-win for the community in reducing both the total cost of the installation and the disruption (to both traffic and area businesses) this kind of project can create.

To see the paper presented at NO-DIG 2021 about this project, visit **ncpi.org/education-center/papers-tech-notes/**.

ABOUT THE AUTHOR:

Jeff Boschert, P.E. *is the President of the National Clay Pipe Institute (NCPI) and represents the industry on multiple ASCE and ASTM committees. Jeff was one of the principal authors of the ASCE/UESI Manual of Practice (MOP No. 133) on Pilot Tube and Other Guided Boring Methods and is serving as Vice Chairman on the ASCE/UESI Pipelines Division Executive Committee (ExCom). He holds a BSCE from Missouri University of Science and Technology.*