Under Sandy Boulevard

Value Engineering Trenchless Solution for Rehabilitation of Trunk Sewer in Portland

Fahim Rahman, P.E.
City of Portland Engineering
Services, Portland, OR

In June 2008, a video inspection was made of Halsey Combined Trunk Sewer in northeast Portland, Oregon. This trunk sewer runs approximately 35 feet beneath NE 60th Avenue and passes underneath Sandy Boulevard, a busy arterial. The video inspection revealed longitudinal cracks in the pipe at 10, 12 and 2 o'clock throughout the entire length from Klickitat Street down to Brazee Street, with ovality of 10-25% in some areas. NE 60th Avenue is only 23 feet wide curb-to-curb; therefore, open-cut replacement was not an acceptable option. The other problem with the trunk sewer was its existing lateral connections to the surrounding properties, made through deep vertical risers. Most of these deep vertical connection risers were found to have settled and dropped into the trunk sewer.

The sewer system in this area clearly showed signs of catastrophic failure, and so a project to restore the sewer was initiated in 2009. Consulting firms including Brown and Caldwell and Staheli Trenchless Consultants were hired to provide engineering services, and assisted in shaping the design and specifications for the contract package. The project was advertised for bid in April of 2010 with an engineer's estimate of $4.9 million which included installation of 2,144 feet of new 36-inch RCP parallel to the existing sewer via microtunneling. JW Fowler of Dallas, Oregon, was declared the lowest responsible bidder with a bid of $3.7 million.

VALUE ENGINEERING

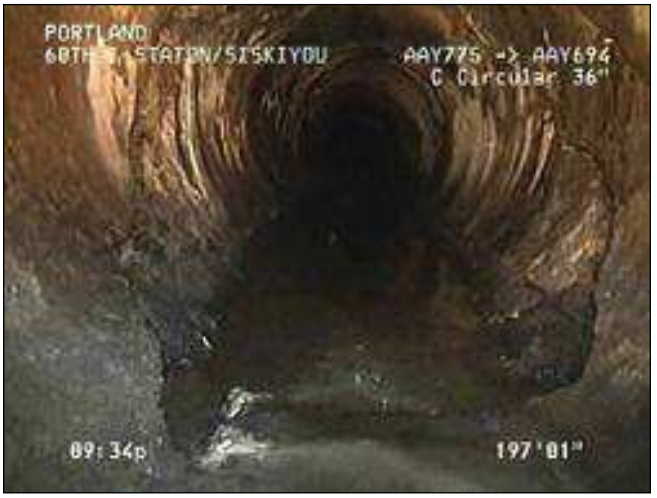
Before beginning the microtunneling portion of the project, the Contractor proposed to use an alternate method to rehabilitate the old sewer. Although the entire pipeline section was found to have longitudinal cracks, laser profiling of the existing pipe performed by Pro-Pipe indicated that only 600 feet of the 2,100-foot section had visible ovality issues.

The Contractor believed that if allowed to reduce the diameter of pipe from 36 to 31 inches, they could install 31-inch pipe to rehabilitate the entire 2,100 feet of deteriorated pipe via sliplining. They proposed to line the section which did not have ovality issues with 31-inch ID PVC Vylon pipe. In the section of the pipe with ovality issues, they proposed to use 31-inch ceramic epoxy-coated Permalok pipe. The Contractor's sliplining proposal demonstrated a net cost saving of $241,584 for the City.

THE DECISION TO CHANGE

The Contractor's value engineering proposal was given full consideration by the City. The proposal appeared to ensure quick rehabilitation of the deteriorated pipe, which was very desirable considering the urgency to fix the sewer. However, switching from the specified microtunneling option to sliplining of the existing 36-inch pipe with 31-inch pipe was a major change with several implications for the City. An informal committee was formed in order to evaluate the Contractor's proposal and address whether the reduced diameter and proposed pipe material met the City's requirements.

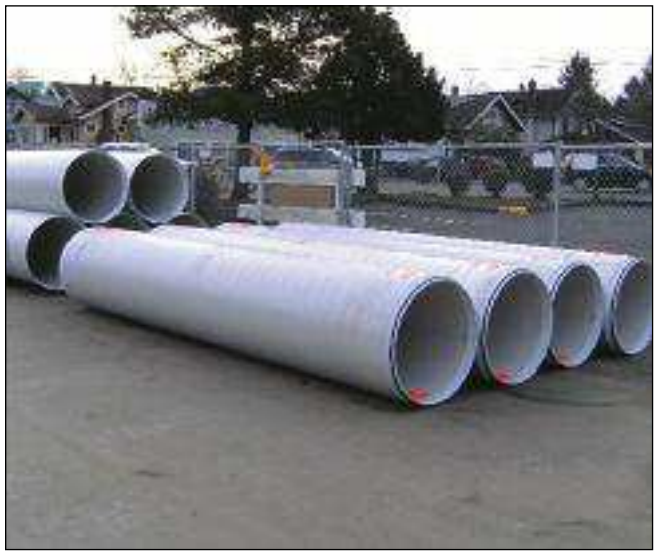
The first question of whether the reduced diameter of the trunk sewer was adequate was directed to our designer, who checked with hydraulic modelers to find out the possible effects on flow by reducing pipeline diameter. It was determined that due to



Existing deteriorated 36-inch sewer pipe

recent changes in flow characteristics in the basin (primarily due to separation of storm sewer from sanitary sewer), the reduced diameter of 31 inches was adequate for the City's needs.

The second issue dealt with the pipe material proposed by the Contractor. Since the proposed PVC Vylon pipe is not an approved pipe for use in the City of Portland sewer system, we needed to ensure that the pipe had a good track record. After talking with many city officials throughout the Northwest, we came to the conclusion that the pipe has a good track record as far as its use and performance as sliplining pipe is concerned. It is important to note that every city official we contacted about Vylon PVC pipe emphasized good grouting of the annular space, and pointed out that grouting is the most critical aspect of the sliplining process. They recommended that the grouting be done by experienced professionals and that the grouting pressure must be sufficient to fill the annular space without causing collapse of the pipeline.



31-inch ID PVC Vylon pipe

A final meeting with all committee members who reviewed the Contractor's proposal was held in late November 2010. It was unanimously agreed in the meeting to accept the Contractor's proposal and subsequent cost savings. One significant factor that influenced the decision was the fact that recent open-cut excavation for a separate portion of the project had revealed several 12-foot-diameter boulders in a gravelly soil matrix. This discovery was thought to present serious challenges to the microtunneling method originally specified in the contract.

Once it was agreed by all involved that sliplining using 31-inch Vylon PVC pipe and 31-inch Permalock pipe would be acceptable, a change order was issued authorizing the Contractor to change the method of installation from microtunneling to sliplining.

EXECUTION

Preparation for sliplining commenced with the installation of five 35-foot-deep shafts using engineered slide rail-shoring. Before any actual sliplining began, a tapered steel pipe of 32-inch OD was pulled from Stanton Street to Brazee Street as a pilot to check for any obstacles within the existing pipe. The pilot reached the shaft at Brazee without any problems, and 1,000 feet of Vylon PVC pipe was installed in live flow in just two days.

The Contractor then installed 660 feet of Permalok steel pipe from Stanton to Siskiyou. Since the existing pipe in this area had 10-25% ovality, the pipe was installed using 650 tons of jacking force. The last section of 547 feet from Siskiyou to NE Klickitat was completed with PVC Vylon pipe.

Preparation to fill the annular space with grout took several weeks. Bulkheads and grout ports were installed and a sewer bypass system was put in operation. Grouting was done in five separate sections at an average calculated 9 psi pressure. The annular space between the sliplined pipe and the existing deteriorated pipe was completely filled with grout.

To complete the project, manholes ranging between 72 and 144 inches in diameter were installed in all five shafts.

SUCCESS

The approach that was utilized to perform this complex and time-critical rehabilitation included strong partnership with the Contractor, consultants, other City of Portland Bureaus and the local community. Before the start of construction, a full one-day partnering meeting was held to discuss important issues in design, construction, inspection, safety and public outreach, and to create mutual understanding of the issues to build a team consensus. This was targeted to alleviate chances of dispute and disagreement during execution.

The successful implementation of the project was owed largely to the excellent Public Outreach Program launched jointly by City Public Outreach staff, City Inspectors and the Contractor's site representative. Public meetings held in the project area prior to the start of construction were attended by many local residents. Representatives from the City and the Contractor answered many questions about schedule, service laterals and what to expect during the construction.

Additionally, unlike many other projects, the designer played a very important supporting role during construction of this project. When the Contractor's value engineering proposal to slipline the existing pipe was accepted by the City, the original construction plans had to be revised and reissued showing changes that occurred as a result of the new proposal, which was accomplished promptly by the designer.

By end of July 2011, the project was completed and closed out. Construction management and inspection expenses on this project remained below 6% of the total cost, which is an achievement by itself. The case history of this project is an example of how professionals can work together to creatively and effectively get highly deteriorated pipe rehabilitated in the shortest possible time period. The approach could be used as a model by other cities and communities in similar situations.

PVC Vylon pipe being installed