Pipe Bursting Operation In West L.A. Proves Advantageous

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PROJECT

This project upsized 520 feet of 6" sewer using HDPE pipe and static pipe bursting.

HISTORY

The City of Los Angeles (the City) with its population of more than 4 million maintains and operates more than 6,500 miles of sewer pipe line. In October 2004, the city agreed to a seven year program of removing, replacing, and rehabilitating old secondary sewers as part of a Settlement Agreement. This project requires rehabilitating or replacing an average of 60 miles of sewer per year. The secondary sewers are small sewers that range from 6 inches to 15 inches in diameter. The group of engineers who evaluate the condition of the existing sewer are part of the Secondary Sewer Renewal Program (SSRP). The SSRP engineers' decision to rehabilitate or replace the old sewers is based on root intrusion, structural defects, corrosion, outdated structures, or lack of capacity in the sewer lines. The poor conditions of existing pipe necessitates to replacement in most cases. Cracks and holes shown in Figure 1 are examples of structural defects. Root intrusion shown in Figure 2 is a common problem at sewer lateral.

Figure 1

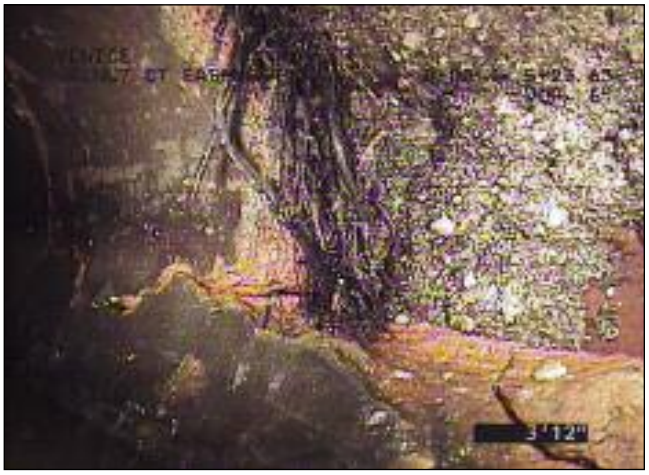

Figure 2

METHODS

The repair methods that are being employed by the City include open trench for removal and replacement and lining for rehabilitation of existing sewers. The SSRP group is now starting to use other trenchless methods such as pipe bursting with HDPE pipes to upsize sewers of 6 inches to the standard of 8 inches. This method is especially convenient compared to open trench when the sewer reach is located in difficult access areas such as in private properties where structures such as garages, pools, walls, and limited space can obstruct the work.

MATERIAL USED

The most common material used for secondary sewer pipes is vitrified clay pipe (VCP) because of its high strength, long durability (as long as 100 year life span) and corrosion resistance. The disadvantage of this product is root intrusion through pipe joints. The standard length of VCP pipes are about 3 to 6 feet per section. The pipe product used to install a new pipe using pipe bursting is often high density polyethylene (HDPE) solid wall pipe. This material is an approved material by the city of Los Angeles for use in the sewer system. It passed stan-

dard tests such as initial tensile strength and elongation, initial flexural modulus, specific gravity, impact strength, apparent cell classification, and the pickle jar test. The length of each pipe section is up to 40 feet long and joints are fused, allowing a seamless pipe to be installed between maintenance holes. This prevents future root intrusion through joints compared to the standard clay pipe section of 3 to 6ft. In secondary sewer reaches this can typically range from 200 to 400 ft long, or longer.

STAGING AREA AND TRAFFIC CONTROL

Allocating a staging area for the machinery and equipment is a critical part of the project. In this project, a staging area was allocated to fuse the HDPE pipe sections onsite. Also, the staging space was used for equipment set-up. Coordination with the Department of Transportation was necessary to obtain desired feasibility and constructability. The traffic control areas incorporated street closures, detour signs and street parking restrictions. Figure 3 shows how an alley was used as the staging area as the streets surrounding the sewer reach were closed and no-parking signs were placed on public streets prior to construction.

Figure 3

PROCEDURE

The secondary Sewer Renewal Program (SSRP) group decided to use pipe bursting to upsize the existing 6" Vitrified Clay Pipe (VCP) sewer line to an 8" High Density Polyethylene (HDPE) pipe. For this operation a "Launching Pit" was excavated at the point of entry for the HDPE pipe, and a receiving pit was excavated at the ending point. A hydraulic machine was placed in the Receiving Pit to establish a link between the Receiving Pit and the Launching Pit; a chain link was established by inserting one meter long interlocking steel rods (Bursting Rods) through the existing 6" line. An operator fed the bursting rods through the hydraulic machine one at a time and the hydraulic machine pushed the bursting rods through the reach. (Figure 4)

Figure 4

The contractor had a sufficient staging area; neighborhood side streets and alleys proved to have enough space available to fuse all of the forty foot sections of the HDPE pipe prior to the installation. To fuse two sections of the HDPE pipes, their cross sections were shaved clean, 500-degree heat was applied to both cross section areas, and then the two pipe sections were held together for about 15 minutes. There were no chemicals involved in the process of fusing HDPE pipe sections. The bonding of the fused pipes has proved to be water tight and super strong.

A heavy cone shaped steel device called the "Expander" was attached to the leading end of the HDPE pipe assembly.

The assembly of all fused pipes (520 feet) and the expander was dragged and inserted into the launching pit. During the operation the entire HDPE pipe assembly was pulled by mechanical machinery from the side street to the launching pit, the pipe was dragged, and bent at the corners. One might have expected the fused joints to fail, but the joints held nicely and proved to be very strong. Once the

HDPE pipe with the expander was in place at the launching pit the cone shaped bursting head was connected to the bursting rod chain which was fed through the receiving pit. (Figure 5)

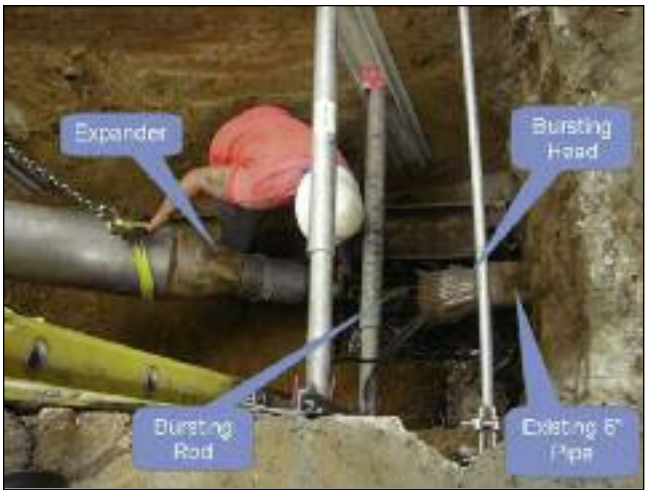

Figure 5

The next step of the operation consisted of pulling the assembly of the bursting head and expander with the HDPE pipe attached through the 6" VCP. This was achieved by working the hydraulic machine in reverse when pulling the assembly through the existing pipe; the expander burst the 6" VCP to a larger diameter to provide enough space for the 8" HDPE pipe.

At this stage, the progress of the operation was speedy, and within minutes, the 6" VCP was replaced with an 8" HDPE pipe. Prior to the pipe bursting process, all house connections were disconnected to prevent them from damage during the bursting operation. When the 8" HDPE pipe was pulled in place, 6" holes were drilled into the newly installed pipe in order to fuse 6" wyes (stubs) on to it at the house connection locations. This was accomplished using a special device, heating both sides of the 8" HDPE pipe and the wye stub leading to the house connection. Then the house connection was established by connecting the stub to the house connection lateral by a couple.

ADVANTAGES AND DISADVANTAGES

Pipe bursting has substantial advantages over the open cut removal and replacement method. It can be faster, cheaper, more efficient, less disruptive to surface improvements, and creates less harmful environmental impacts. The cost advantage is especially notable where the cost of open trench increases through extra excavation, shoring, etc. However, these factors have minimal effect on the cost of pipe bursting. The main advantage of pipe bursting over other trenchless rehabilitation methods such as lining is the ability to upsize sewer lines. While lining methods of rehabilitation follow the grade of the existing pipe, pipe bursting can modify it under particular circumstances - to correct unwanted sags for instance. As a result, the feasibility and cost effectiveness of pipe bursting have made this method of pipe renewal very favorable such that the total footage of sewer pipe replacement is growing every year.

Pipe bursting can be an ideal method for replacing old pipes in areas where there are no or limited house connections, or where disruption to surrounding utilities, local residences, businesses and the environment are a consideration. HDPE is the most common pipe material utilized in this process since it has an added benefit of smooth inner walls, which facilitates the gravity flow and prevents the chances of developing stoppages.

A comparison was made between the cost of pipe bursting and traditional open cut methods. The price per linear foot of pipe bursting was approximately $ 346.00 and the project could be done in only 3 days, whereas, the price per linear foot of open trench method of sewer replacement was estimated to be $ 520.00 per linear foot. Pipe bursting eliminates up to 85 percent of open cut on the project. We were able to further reduce the cost of the project by entering the bursting equipment through a manhole, which resulted in minimal expenses relating to trench cutting, hand digging, backfill, compaction, and traffic control.

The project took place in a residential area in Venice Beach, an ideal setting to highlight the social benefits of pipe bursting as well as the economical benefits. This project proved all of our assumptions about pipe bursting true. The project went smoothly and when we calculated the cost, the figures were impressive and the advantages were measurable. Pipe bursting can be safe for nearby utility and substructure lines and can reduce traffic impact. This method of sewer replacement can be more affordable, especially when it decreases or eliminates the need for expensive excavation and restoration costs.