NORTH VANCOUVER PIPE BURST REQUIRES CAREFUL PLANNING

Close proximity to storage silos, poor ground conditions and clogged storm sewer pipe puts trenchless contractor to the test

BY **ANDREW TOPF, EDITOR**

One of the most effective ways of replacing a pipe using trenchless technology is pipe bursting, which replaces a traditional construction trench with launching and receiving pits that pull the new pipe through the existing one, breaking the old pipe into fragments that stay in the ground in-situ.

Sewer, water and gas pipes can all be replaced with pipe bursting, which involves a bursting head, winched cable or shuttle rods, a pulling machine, a retaining device and a hydraulic power pack. Patented by British Gas in the 1960s, pipe bursting is now a proven trenchless technology.

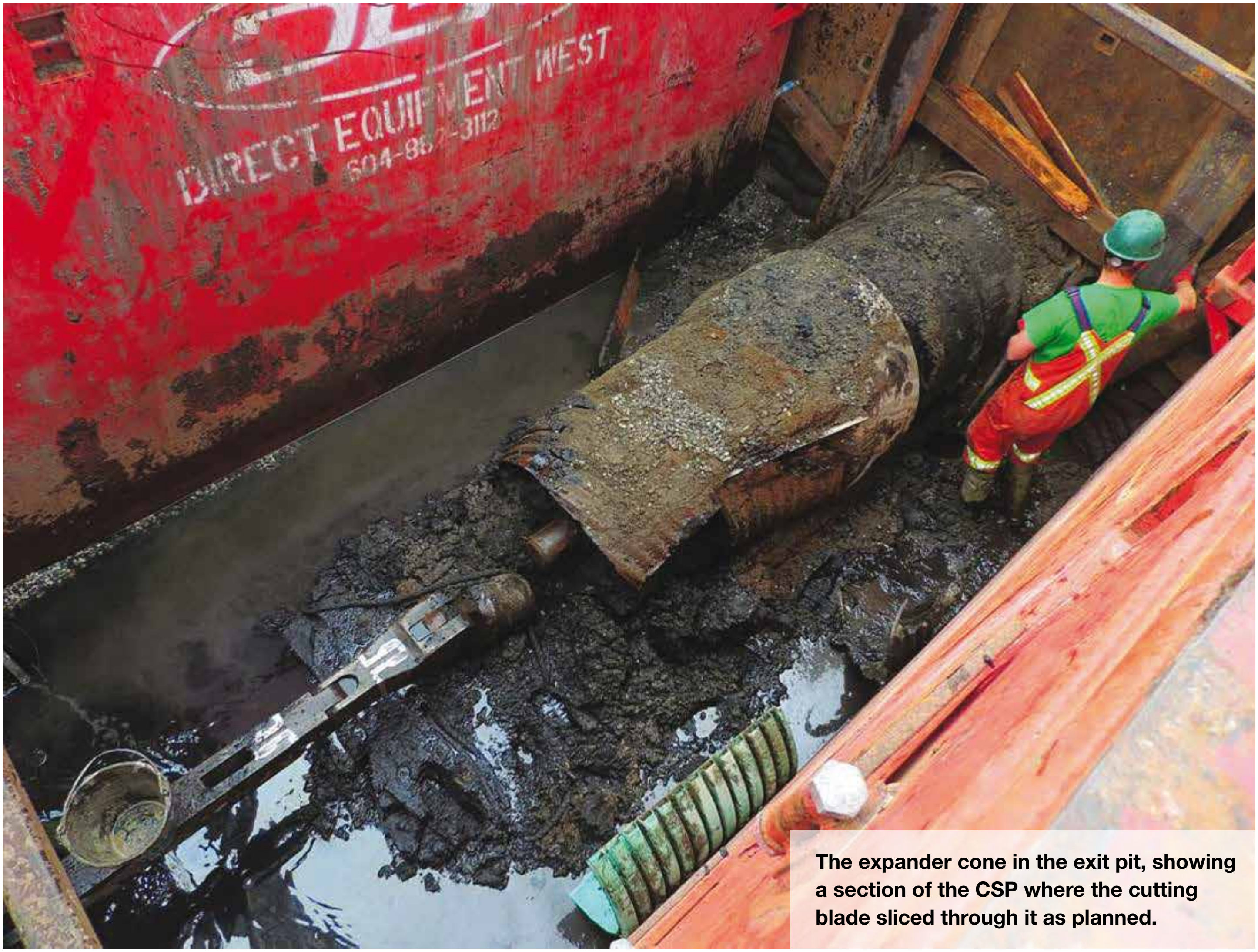
The primary advantages of pipe bursting are the time saved by avoiding digging a trench to lay the pipe, and its minimal impact on vehicle and pedestrian traffic, compared to a major disruption involved in open-cut construction. A pipe can be burst and a new, often upsized pipe pulled through in a day or two, or even less, depending on the length of pipe and the level of difficulty.

One of the nice things about pipe bursting is its versatility. The method can be utilized to replace pipes made of clay, concrete, PVC, ductile iron, corrugated steel, and even asbestos concrete (AC). And with pipe bursting, most of the time the pipe is upsized, meaning a gain in interior pipe diameter. Compare that to cured-in-place-pipe (CIPP), where a deteriorated pipe is re-lined, resulting in a loss of interior pipe diameter.

Pipe bursting turned out to be the winning method of pipe rehabilitation for a 300-metre section of corrugated steel pipe (CSP) in North Vancouver that originally was laid down to function as a storm sewer in an industrial part of the municipality, but had since become so deteriorated that it was no longer useful.

Below-tide invert caused corrosion

The pipe runs between the Vancouver Shipyards operated by Seaspan, and a wood fibre export terminal run by Fibreco Export Inc. The 900-mm CSP was buried at an average depth of 3.5 metres at zero percent grade. Its close proximity to Burrard Inlet meant that the invert (bottom of the pipe) was below tide, causing sea water to enter the pipe twice a day. The pipe also had two or



The expander cone in the exit pit, showing a section of the CSP where the cutting blade sliced through it as planned.

"Bursting corrugated steel pipe is tricky, and can easily bunch up on the expander and cause a stall in the machine. From the test pits we also knew that the pipe was in fact 90 percent full of debris, so that was something that we had to take into account."

GREG DEACON, PROJECT MANAGER, PW TRENCHLESS CONSTRUCTION

three services tied into the pipe, but since it had not been surveyed with a CCTV camera, the District of North Vancouver was unable to tell where the services were located. The pipe was nearly completely clogged full of debris, making a camera inspection impossible without clearing it.

Realizing the ineffectiveness of the pipe, in 2012 North Vancouver put in a 350-mm bypass line at a higher elevation, and a year later, solicited a design-build request for proposals to replace the deteriorated CSP. The district received two pipe bursting proposals and one for pipe ramming. The successful bid went to PW Trenchless Construction Ltd., which proposed to complete a CCTV inspection of the pipe, produce engineered drawings, and pipe burst the 900-mm CSP with a section of 1,050-mm HDPE (high-density polyethylene pipe).

Almost immediately, Surrey-based PW Trenchless Construction ran into difficulties as they tried to get a camera into the pipe. A series of test pits showed the ground conditions in extremely poor shape, evidenced by sinkholes and contaminated soils – the site sits on reclaimed land.

"The top of the pipe would collapse and material would come in. There were large sections of the pipe missing and groundwater started coming into the pit after around 30 seconds," said Greg Deacon, project manager for PW Trenchless Construction.

The solution was to break up the pipe burst into three sections of 100-m bursts. A series of portable water treatment plants were set up to treat the groundwater, since it was not deemed to be suitable for discharging into the sanitary sewer system.

Deacon said the job was a challenge for PW Trenchless Construction due to the relatively large 42-inch pipe needed for the catchment area, and the pipe bursting equipment it required.

"A burst of this size is something that we hadn't done before. Earlier in 2013 we burst from an 18 to a 28-inch in Surrey, so we had an idea what size machine was going to be needed. Bursting corrugated steel pipe is also tricky, and can easily bunch up on the expander and cause a stall in the machine. From the test pits we also knew that the pipe was in fact 90 percent full of debris, so that was something that we had to take into account."

PW Trenchless Construction chose the Grundoburst Static Pipe Bursting System from TT Technologies. The 2500G machine has 287 tonnes of pulling force and its rods are two-metres long, each weighing 200 kilograms.

The contractor used a few tricks to burst the nearly completely-decayed pipe.

PW Trenchless Construction was concerned that the 2500G could push the rods through the sides, top or bottom of the CSP. To get around the problem, they used an HDD rig to drill through the pipe from the entry pit to the exit pit, thus removing the debris that was in the pipe this risk. "This allowed us to attach the bursting rod, and use the drill rig to pull it through the pipe," said Deacon.

Expander cone blade cuts CSP

The pipe now ready to be burst, the contractor cut the CSP using a sharp blade on the expander cone. PW Trenchless also reduced the size of the expander cone to limit any ground movement. The latter was important to ensure that a series of storage silos on the Fibreco side of the site did not become structurally compromised during the pipe burst. North Vancouver recognized that it would probably lose the silos if it elected to go with an open-cut method of pipe replacement.

Relief pits were dug every 25 metres along all three 100-metre bursts, which allowed the contractor to track the progress of each burst, and also served as entry points to vacuum out the debris.

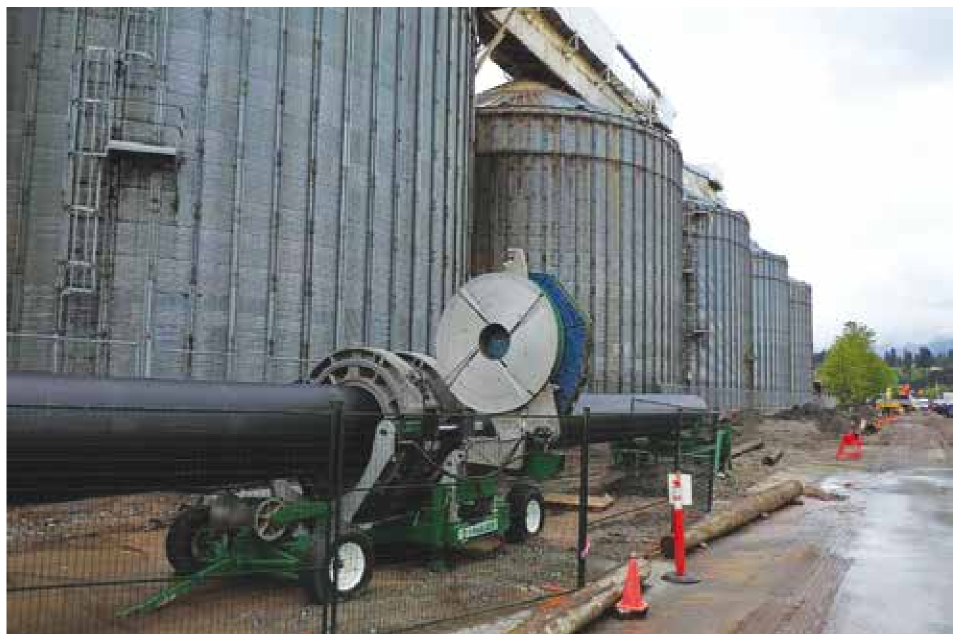
"Because the silos were so close to the pipe alignment (between 3.5 and 5 m), the district was very concerned about any movement. We therefore had them sur-

veyed before construction, during each burst, and after construction, with no movement reported in any of the six silos throughout the entire job," according to Deacon.

Relief pits were dug every 25 metres along all three 100-metre bursts, which served the dual purpose of allowing the contractor to track the progress of each burst, and also served as entry points to vacuum out the debris.

In fact there was very little material for disposal, with most of the soil displaced into the existing ground, according to Deacon. The 1,050-mm pipe that was pulled through, 300 metres of HDP DR17 pipe, was later connected to the existing sanitary storm sewer and two three new manholes installed for access.

Deacon said the success of the project has TT Technologies recommending to its customers that future corrugated steel pipe bursts employ the same procedure of using a blade on the expander cone to cut the CSP. **CUI**



Top: The Vermeer Navigator HDD drill used to drill through the existing CSP pipe to pull through the bursting rods. Right: The McElroy 1648 fusing machine that was used to fuse the pipe together. Note the proximity of the silos to the pipe.