

## New Robotic Inspection Technology Helps ID Potentially Critical Situation

by Jeff Griffin Senior Editor

Early this year, water officials in Toronto, ON, Canada, became aware there were cracks in one of the city's primary large-diameter sanitary sewer trunk mains that threatened the Don River watershed and homes in one neighborhood. A potentially disastrous impact on the area and its environment could develop if the aging 114-inch pipe should become blocked or collapse.

The three-mile long Coxwell Sanitary Trunk Sewer, described as the city's most critical trunk sewer section, was built in the 1950s and serves 750,000 residents typically carrying more than 105 million gallons of sewage per day to the Ashbridges Bay treatment plant.

The first step in determining how to address the problems was to confirm the locations and extent of damage.

However, because of the sewer's 140-foot depth, the long distances between access manholes, and high flow velocities, detailed inspections and condition assessments had not been possible. Lou Di Gironimo, general manager of Toronto Water Services said at a public meeting in January.

To inspect the line and develop a plan to fix the as yet unknown problems, the city called on trenchless sewer rehabilitation specialist DM Robichaud Associates Limited, Oshawa, ON.

"We received a call asking if we could inspect the Coxwell Trunk Line as they believed there was some kind of anomaly in the line from a previous incomplete inspection," said Earl Brousseau, senior project manager/owner. "The city initially believed that no equipment would be able to reach the reported anomaly due to the high, fast flows, great depth of the trunk line, and the one-mile length between access manholes."

### Previous experiences

DM Robichaud had recently completed a pilot project and inspected 11 miles of sewer trunk lines using RedZone robotic multi-sensor equipment. City officials asked if the equipment could be used to perform inspections to determine the extent of the anomaly's deficiency that another contractor had been unable to complete using conventional inspection methods.

Brousseau said the unique RedZone Robot is equipped with multiple sensors, including a traditional pan and tilt closed-circuit television camera, sonar for seeing below the water line, three-dimensional laser for measuring pipe ovality and precise



surface abnormalities, hydrogen sulfide sensor, inertial measurement unit for line and grade, and water depth sensor. All sensors record continuously and are synchronized over the pay-out distance.

"We have not yet found a large-diameter sewer too demanding for this robot system," Brousseau said. "The multiple sensor approach permits a large amount of synchronized data to be collected, and often it is the combination of sensors that allows full assessments on the pipe condition to be made in one inspection where results otherwise might be inconclusive. On this project, the synchronized high-resolution video, pipe ovality, robot pitch and water level data allowed us to come to very accurate conclusions about an anomaly that might otherwise not be possible."

The specific anomaly was reported to be located about 3,900 feet from the downstream manhole. The line was inspected from both directions in order to isolate the exact length of the anomaly. It was determined that the inspection could best be made during early morning hours when flows in the line would be at the lowest in order to "see" as much of the pipe as possible. Equipment was placed in the pipe about midnight to allow time to have it to the target site by about 5 a.m.

### Specifications

The robot weighs about 650 pounds and has a 6,500-foot-long, high-strength tether with embedded fiber-optic cable. The robot's mast can be lowered or raised to keep



the 3D laser and camera out of the water for optimum visual observations and precise profiling of the inner pipe wall.

The robot is designed to fit through a standard manhole opening. It is lowered by a power winch to the base of the manhole. Once in the pipe, it is remotely controlled from a truck by the tether with a fiber optic, hydraulic and electric power cord with high a high-strength external protective sheath. The robot moves on twin, independently-powered tracks that permits it to traverse debris and turn around inside the pipe. The equipment normally is operated by a crew of three.

"To verify the condition of the entire trunk line, we performed the inspection two times all the way to the anomaly, from both the up and downstream manholes," said Brousseau. "Each required about 10 hours to complete. The robot drove upstream against the very fast flow without a hitch as we recorded excellent technical data."

The two inspections revealed an area of cracking about 262 feet in length. How the trunk line will be repaired has yet to be determined, but Brousseau said fol-

lowing completion of the DM Robichaud inspection, the full extent of the problem is known, allowing engineers to develop the most effective course of action.

"Our observations," said Brousseau, "were that there does not appear to be any immediate danger of a major catastrophe. We have suggested to the city that the RedZone equipment be used intermittently to monitor the condition of the trunk sewer. These inspections will reveal if there are any changes in the integrity of the pipe structure, in effect providing advanced notice to the city if the problem is propagating."

Discovery of the Coxwell trunk line problem and the importance of identifying the cause illustrates the benefits offered by the new wave of high-quality inspection technology for large-diameter pipes, said Brousseau. He also noted that difficult conditions affecting inspections of large sewer lines differentiate such work from the inspections of normal diameter pipes.

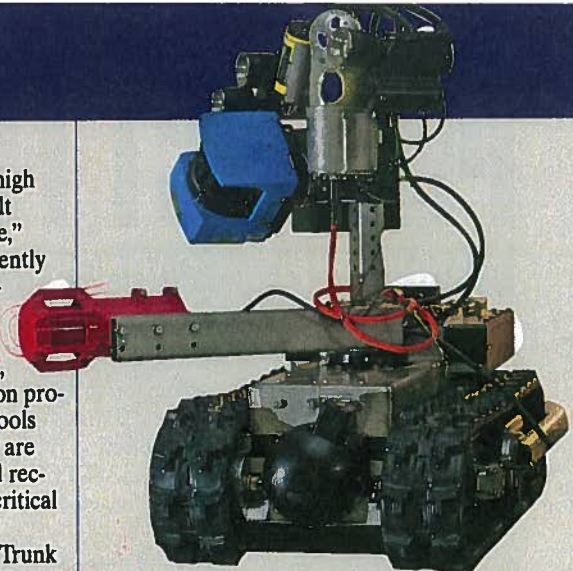
#### Effective inspection

Most large trunk sewers have not been inspected or only with smaller conventional camera systems.

"Large diameter trunk sewers are high value assets and their failure can result in catastrophic environmental damage," Brousseau emphasized. "But only recently has technology like the RedZone Robot been available to inspect them with minimal risk. As capabilities of this equipment become better known, more and more cities are embarking on programs to inspect their trunk sewers. Tools like robots with multiple sensors now are allowing full asset management based recommendations to be made for these critical sewers systems."

The primary lesson of the Coxwell Trunk Sewer Project, believes Brousseau, is that cities should be ramping up trunk sewer inspection programs.

"It is now possible to inspect trunk sewers with multiple sensors and know precisely their condition," he said. "It is better to learn about any structural deficiencies before they become failures in the future with immense repair costs. These inspections provide very true and accurate representations of general pipe conditions. Should deficiencies be identified, a timely, cost effective methods and rehabilitation plans can be implemented on the effective portion of the trunk sewer."



DM Robichaud Associates specializes in trenchless sewer rehabilitation services. In addition to inspections, the company offers sewer cleaning services, dye and smoke testing, obstruction reaming, manhole and pipeline sealing, structural spot repairs, main line lateral lining, T lining and planning and engineering services.

#### FOR MORE INFORMATION:

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