Pipe Bursting in Brazil

Removing Brazilian Water Leaks Using Trenchless Results in Major Savings

By Ian Clarke

The City of Jaguariuna, Brazil, is a city that has been in existence for more than 100 years. Situated in the middle of the Campinas metropolitan area, this city has a population of more than 2.5 million people and generates 10 percent of the Brazil's gross national product.

The City of Jaguariuna itself has a population of more than 30,000 people, who are served by a potable water supply network with some 10,000 service connections. The condition of these connections was such that more than 60 percent of the treated potable water pumped into the distribution network was being lost in leaks before reaching the customer. The network itself was constructed of asbestos cement, which was banned from use in Brazil more than 13 years ago. This means that, as the whole system is currently constructed using asbestos cement, that the newest section of pipe is at least 13 years old.

A Hammerhead HB3038 pipe bursting rig in operation on the City of Jaguariuna pipe replacement project.

Because most of the houses at the farthest distance from the water treatment plant did not have water or very low water pressure, construction of a new treatment plant was proposed to supply drinking water. In 2001, figures showed that the city consumed around 2,185 million cubic meters of water. In 2005 this figure had risen to some 2,712 million cubic meters. The city's growth rate is 2.23 percent per year and large corporations such as Motorola, Ambev and others have their main facilities in the city.

Distribution Network

The pipeline network serving Jaguariuna comprises 47.8 km of pipe including diameters of 50, 150 and 250 mm, although the network is predominantly the smaller diameter (50 mm).

With such a high level of leakage, a decision had to be made as to how to proceed. Ultimately, it was decided not to build a new treatment plant, but instead to renovate or replace the entire pipeline network. The problem was how to do it.

Through the efforts of the Brazil Association for Trenchless Technology (ABRATT) and one of its affiliate members, HYDRAX, an initial test was conducted to replace 1,250 m of asbestos cement with HDPE using pipe bursting.

The area chosen for the test was complicated and located in the main square in downtown Jaguariuna, where most of the local commerce and services are located, including the fire station, an emergency hospital and city hall.

The test project proved pipe bursting to be very suitable and cost-effective. The local businesses and services located in the area were also consulted about their perception of the potential inconvenience that pipe replacement jobs such as these could mean in front of their stores and offices. The consultation confirmed what was expected of the technology — that it should not cause disturbance or loss of business.

Subsequently, the Municipal Authority and its Department of Water and Sewer, through its director Luciana Costa Ferreira de Souza and Mayor Tarcisio Cleto Chiavegato, decided to expand on the experience gained from the test project and to undertake a further 12 km of pipe replacement.

Chiavegato authorized the completion of the replacement works over the whole 47.8-km pipeline network. The work to achieve this is estimated to be finished by July 2008.

The equipment used to complete the pipe bursting work was from a HammerHead Static Pipe Bursting product range manufactured by the Earth Tool Corp. in the United States. The HammerHead family has an extensive variety of pipe bursting equipment, including static pipe bursting machines, which can replace pipes from 50 to 500 mm in diameter.

In Jaguariuna, the bursting unit used was a HydroBurst HB3038 pipe bursting system. It is a system that has been used on water, gas and sewer replacement projects around the world.

The compact and versatile 38-ton capacity bursting machine is designed primarily for smaller diameter gas and water replacement from 50 to 150 mm. It can replace 100 m of pipe in as few as two hours. The HB3038 features quick replacement jaws, an on board pressure gauge, auto rod grip and release and rods that feature a double taper quick couple thread design. In addition, the HB3038 can be adapted to pull with a smaller diameter bursting rod. The smaller diameter rod allows operators to work in more heavily encrusted pipes between 50 and 75 mm in diameter. The rig size is just 152 mm long by 51 mm wide by 30 mm high, enabling it to work in tight footprint conditions and limited access situations.

Over the six years of the project, the replacement works have grown significantly each year. In 2002, some 300 m of pipeline were replaced. In 2003, this grew to 1,250 m. In 2004, the total pipeline replaced was 11,250 m and between 2005 and 2008, an additional 35,000 m will be completed.

Cost-effective Solution

What is really remarkable about the Jaguariuna project is the reduction in the potable water production requirements which, as a result of the pipe replacement works, have dropped dramatically. Looking at figures from 2000, some 66.6 percent of the potable water produced was lost from the system at a cost of more than $1.613 million USD. For 2006, these figures now read 39.8 percent of produced water being lost at a cost of almost $702,000 USD.

Luciana Costa Ferreira de Souza, director of the Jaguariuna Municipal Authority Department of Water and Sewer.

It is estimated that on completion in 2008, the project is expected to generate a cash return of a total equivalent to the investment to replace the pipeline, if not more. In monetary terms, this equates to the total cost of the three construction contracts to complete the pipeline replacement work — an estimated total of around $3.4 million USD. The savings in water production costs, as compared to before the entire pipeline network being replaced, will be more than $3.6 million USD. In other words, the savings will be more than the budgeted cost for the all the construction works. The estimates, which were confirmed up to July 2006, also allow the city to foresee another $1.5 million USD in savings thereafter.

In short, the savings made by replacing the pipeline in its entirety have paid for the replacement works.

In the areas where the new, effective replacement pipeline is now in operation, water supplies are extremely good and losses are tending toward zero. Service pressures to outlying areas of the network have increased tremendously and the water pumps that in the past used to work 24 hours a day now work for only eight hours per day, dramatically reducing the cost of both energy to run the system and maintenance. With energy savings being a key focus for the public sector in Brazil at the moment, this is a major achievement for the local authority.

At the start of the work in 2002, more than four crews were continuously employed to carry out repairs and fix leaks on the old network all year around. Now, however, this has been reduced to just one crew that works for just a few days per month. At the end of the pipe replacement project, even this crew is expected to be dedicated to other duties.

Looking at repair figures also shows why the decision to replace the pipeline has been so effective. In 2001, the repair crews were required to complete some 326 operations to mend leaking pipes, but by July 2006 just 72 such repairs had to be completed. With each repair estimated to cost $500 on average, it is easy to understand the financial impact of such a reduction. But, more than that, the people normally working on the repair crews could dedicate their time to other activities, further increasing overall productivity. In addition, there were also significant indirect savings and social benefits, such as reducing the disturbance caused by numerous leaks during weekends and at night, and the effect of leaks in front of businesses and the stoppage of water supply to important business and leisure activities.

While having a significant effect on the water supply network in Jaguariuna, the pipeline replacement project is also having a major impact on all the other local water supply systems — for example, the quantity of water being collected from the main raw water sources (local rivers). If you consider that the City of Jaguariuna is part of the Jaguari basin, from which some 15 other municipalities also collect water, the savings, socially speaking, are broader than are at first apparent in a superficial analysis.

During the course of the works, many illegal service connections were located and the transgressors were required to pay the relevant penalties and were re-connected officially to the service. This also had a financial impact on the municipality cash flow.

Conclusion

This remarkable project is an example to water organizations around the world of what municipalities and companies can achieve, even given the investment limits that exist. By effective intervention in a network, savings against an existing cost level can be achieved that can ultimately outstrip the cost of the installation investment by many times.

Finally, it was and still is easy to identify just how safe, clean and non-disruptive the pipe bursting process is when correctly applied. There are testimonies from many local residents who did not even realized that any work was being done, because the work simply did not impact on their day to day activities.

An example of the condition of the old pipes that are being replaced on the Jaguariuna pipeline project.

Ian Clarke is a president of NoDig Media Services, United Kingdom. Earth Tool Corp. and Sergio Palazzo, with Sotenco and ABRATT, provided information to this article.