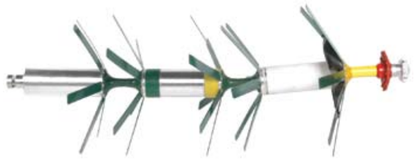

PIPETRACKING

By Mike Stadnyckyj

Aging pipeline infrastructure, and the increasing cost to repair and replace that infrastructure, is a huge challenge for utilities and pipeline operators. The traditional approach of replacing pipe once it fails or reaches a predetermined "asset life" will not be a sustainable practice over the long run. The good news is that recent advances in remote field transformer coupling (RFTC) and acoustic fiber-optic technology are helping to reduce or defer expenditures, while safely extending the life of pipeline assets.

Extending the safe operating life of critical water mains

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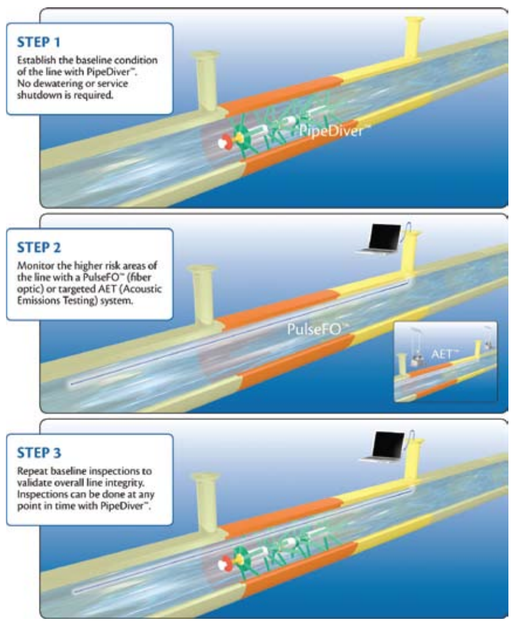
These condition assessment and monitoring solutions provide utilities with critical information about their prestressed concrete cylinder pipe (PCCP) lines, including baseline condition, active deterioration and remaining life.

RFTC technologies have become the standard for the condition assessment of large-diameter PCCP over the past decade because of their accuracy in pinpointing the location, distribution and number of broken prestressing wires along the length of individual pipe segments. If a sufficient number of these wires are broken, the structural integrity of the pipe becomes compromised.

RFTC technology functions much in the same way as a radio transmitter and receiver. The "transmitter" produces an electromagnetic field. The prestressing wires in the pipe amplify the signal that is recorded by the "receiver." If there are broken wires, the signal is distorted. A measurement of the distortion quantifies the number of broken wires.



Manned and robotic RFTC tools have been used in hundreds of inspections throughout the world with great success. These tools were and still are ideal for emergency inspections once a failure has occurred, or for inspecting short to medium distances. The challenge is that many utilities find it difficult to dewater their lines due to cost or permits. Furthermore, critical feeder lines often have no redundancy, which means that lines cannot be taken out of service for extended periods of time.

To overcome these challenges, the Pressure Pipe Inspection Co. (PPIC) developed a free-swimming RFTC tool called PipeDiver. The tool is designed to work within operating water mains with a diameter of 24 in. or greater.

The tool can be inserted into a live pipeline via a hot tap connection and insertion sleeve, an existing access or a submerged tank. Once inside the line, PipeDiver will travel with the flow of the water, collecting structural integrity data until it reaches a predetermined extraction point.

This technological advancement offers several unique advantages, including the ability to inspect long distances during a single deployment, lower overall inspection costs (as there is no need for dewatering or service shutdown) and the ability to inspect lines at any point in time, simplifying the reinspection process.

Big Savings in Texas

Established in 1938, Dallas County Park Cities Municipal Utility District (DCPCMUD) is located near Dallas Love Field Airport and serves the town of Highland Park and the city of University Park. These two communities are completely surrounded by the city of Dallas and have a combined population of approximately 33,000.

The district operates a 36-in. PCCP line that stretches almost 4 miles and has been in service since 1948. The line is a critical asset, as it is the only water transmission line for the surrounding communities. Because the pipeline could not be removed from service for an extended period of time, the district turned to PipeDiver to conduct the inspection.

The free-swimming tool travelled under major roadways, through several 53- and 90-degree bends and ultimately inspected nearly 1,100 pipe segments prior to being removed from the line.

District workers and contracting engineers waited for the inspection results, concerned about the possible extent of damage and distress discovered. Though $15 million was budgeted for replacing the pipeline, it was likely that pipeline work along the major roadway would cost more because of expenses associated with traffic control and permits.

Upon completion of the inspection and preliminary data analysis, the RFTC inspection reported only three pipes out of 1,100 pipe segments were showing any distress of concern. This was great news for the district.

"If the final numbers agree, PipeDiver saved us between $10 to $15 million in funding we would have had to expend replacing that pipeline," said DCPCMUD's Larry McDaniel. "The bonds that built our plant and pipeline in 1950 were paid off in 1975, and we didn't want to raise rates any further beyond that already projected with our plant improvements. In short, we didn't want to have to raise rates again if we could avoid it."

DCPCMUD decided against replacing the moderately distressed pipes, and the utility will monitor them with periodic re-inspections to see if there is any ongoing deterioration. If the wire distress progresses to a point where the pipe segment develops 30 or more wire breaks, the district likely will replace it at that time.

Long-Term Monitoring

Like DCPCMUD, an increasing number of municipalities and pipeline operators are turning to long-term monitoring programs to remove the guesswork from determining the condition of underground assets.

Experience shows that each long-term monitoring program is unique and that pipeline owners must understand and select the solutions that best meet their needs. Ultimately, the program implemented must be based on the amount and pattern of distress found during the baseline inspection, tolerance to risk and budget commitment. Once these have been established, the right mix of tools needs to be assembled in order to reduce the most risk per dollar invested.

Prior to implementing a monitoring solution, it is critical to understand the baseline condition of the pipeline asset using RFTC technology. This step identifies the high-risk sections of a pipeline based on the condition of internal prestressing wires and provides a point of comparison for future inspections. PipeDiver simplifies this step, as it allows for an RFTC inspection to be conducted while the line remains in service.

Step two involves the selection of monitoring technologies. If the RFTC inspection reveals distress over a long distance of the pipeline, then PulseFO fiber-optics may provide an optimal solution. If the inspection reveals isolated pockets of distress, then a strategic acoustic emissions testing (AET) solution could be the right solution. Often it is a transient that pushes a pipeline from distress into failure, and remote transient pressure monitoring can provide critical insight on when and how transients occur in order to minimize them within the system. In either case, the utility must carefully consider the cost of monitoring the pipeline over a long period and compare it to actual risk reduction achieved.

Step three involves repeating the baseline inspection. Depending on the critical nature and distress levels within the pipeline, re-inspections should occur on a one- to four-year schedule. With PipeDiver, the inspection can take place at any point in time, as there is no need to wait for a scheduled maintenance shutdown.

The re-inspection step is a critical component of a long-term PCCP monitoring program, as the RFTC technology verifies broken wire locations and acoustic signals. While fiber-optic and strategic AET systems are very accurate for detecting acoustic events, it can be difficult to distinguish between the various acoustic sounds occurring within the pipe. As an example, after a wire break or slip, the prestressing wire may reanchor in the mortar, but it could slip again if the anchoring comes undone. This process can be repeated many times.

A significant advantage of the PPIC long-term monitoring solution is that the PipeDiver and PulseFO technologies are complementary and can both operate in the pipeline at the same time without need for dewatering or service shutdown. Not only does this reduce costs, but it also simplifies the inspection process.

Aging Assets & Advanced Technologies

It is no secret that the challenges presented by aging water pipelines will only increase with time. The good news is that advances in condition assessment and monitoring technologies are removing traditional barriers to inspection and allowing for the safe extension of asset life. By understanding the true condition of pipeline assets, utilities and pipeline operators can better prioritize repair and replacement projects and maximize the impact of their budgets. WWD

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