





p-CAT™ Goes to Infinity and Beyond in Clearwater, Florida

CASE STUDY



Characteristics of the sections inspected:

-  **Location**
Clearwater, FL
-  **Pipeline Diameters**
6-Inch and 8-Inch
-  **Lengths**
1.5 Miles
-  **Material**
Ductile Iron & Cast Iron

OVERVIEW

In partnership with the City of Clearwater, CHA Consulting, Inc. set out to identify an effective solution for assessing an active water pipeline. The pipe selected for assessment was a section of Clearwater's distribution network running along Drew Street that had previously been identified as an area of concern. Approximately 1.5 miles of 6-inch and 8-inch ductile & cast iron pipe was selected with the long-term goal of removing and replacing the aging pipe and allowing for a validation study of the deployed assessment technologies.

PROJECT DETAILS

CHA sought to identify technologies with the ability to assess a ductile iron distribution main with minimal construction and operational requirements. Having previously assessed the pipeline with Echologics ePulse®, CHA wanted to identify market alternatives capable of providing pipe wall condition assessment on small diameter pipelines. Hydromax USA's p-CAT™ Infinity was evaluated and ultimately selected based on its capacity to provide actionable sub-sectional pipe wall condition data.

CHALLENGES

p-CAT™ Infinity is a modification of the proven, original condition assessment technology, p-CAT™. While p-CAT™ Infinity had been deployed internationally, it had not been heavily utilized within the US. Clearwater's Drew Street pipeline provided an opportunity for CHA and the City to observe the technology

in the environment for which it was specifically designed. Buried beneath the asphalt of a busy thoroughfare, it was clear excavating and tapping access points would be incredibly costly and operationally burdensome for the City. With the added importance of maintaining service to residential, business, and tourist customers, the solution was required to operate without system isolation.

Deploying updated equipment, the new p-CAT™ Infinity methodology is specifically designed for inspections of 6-inch to 16-inch mains within water distribution systems. In contrast to the traditional p-CAT™ methodology, the water main does not need to be isolated, and equipment can be deployed via fire hydrants and 1-inch taps. The project location was ideal for testing these parameters as there were operable hydrants within 300 – 1,000 feet, and most offtakes could be isolated without impacting water supply to nearby residents and businesses.



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THE TECHNOLOGY

p-CAT™ (pipe condition assessment technology) is a non-invasive pipeline condition assessment tool that utilizes inverse transient pressure wave analysis to determine pipe wall degradation and identify anomalies. In addition to wall degradation, p-CAT™ identifies anomalies which may include pockets of air, pipe material changes, blockages and valve closure. It is suitable for pressurized metallic and asbestos cement pipelines and is applicable for potable water pipelines, raw water and wastewater pipelines. Developed over 18 years ago by Dr. Young-il Kim from Australian-based Detection Services and validated in the U.S. through engineering case studies, p-CAT™ is designed to test long stretches of pipe efficiently and effectively while giving the utility detailed analysis capable of change detection down to 30 ft. sub-sections.

p-CAT™ Infinity is a variation on the non-invasive, non-destructive, reliable and safe p-CAT. It can be applied to a pipeline or pipeline system with more complex configurations than p-CAT™, such as networks and trunk mains with multiple off-takes (side branches) which may not be easily isolated. The technology still uses the unique and proven technique of inverse transient analysis to measure and determine the condition of pipelines. All procedures for p-CAT™ Infinity are the same as p-CAT™.

APPROACH

The results of the p-CAT™ Infinity program in Clearwater were overwhelmingly successful. Testing demonstrated the effectiveness of p-CAT™ Infinity as a low-cost external condition assessment tool for active water distribution mains. Thirteen known features and twenty-three anomalies were identified along the main. The high priority anomalies included possible air pockets, areas of significant

deterioration, and sections warranting replacement.

To better understand any impacts to the data quality between p-CAT™ and p-CAT™ Infinity, two test scenarios were undertaken. This included a condition where all offtake valves were closed (Category 1: high resolution) and a condition where all offtake valves were open along the same stretch of pipeline (Category 3: medium resolution).

CONCLUSION

The table below presents the subsection results, identifying the maximum differences between p-CAT™ (Category 1: high resolution) and p-CAT™ Infinity™ (Category 3: medium resolution). These findings show variance between the two categories was 0.01 inch. *This validated a high level of accuracy (over 97%) between traditional p-CAT™ and the new p-CAT™ infinity™.*

Table: Recorded Differences Between p-CAT™ and p-CAT™ Infinity

Subsection 11	p-CAT™ Category 1		p-CAT™ Infinity Category 3		Variance (in)
	Wall (in)	Lining (in)	Wall (in)	Lining (in)	
Assumed Internal Corrosion	0.17	0.00	0.16	0.00	0.01
	(-0.03)	(-0.16)	(-0.04)	(-0.16)	
Assumed External Corrosion	0.14	0.16	0.13	0.16	0.01
	(-0.06)	0.00	(-0.07)	0.00	
Average Wave Speed (ft/s)	3,348.60		3,321.90		

MEASURABLE RESULTS

The survey conducted using p-CAT™ Pipeline Condition Assessment - Sub-Sectional Partitioned Wave Speed Analysis will give the following results at a resolution down to 30 linear feet:

- Residual pipe wall thickness
- Internal and external wall thinning due to corrosion and damage
- Lining loss

Localized fault detection of significant anomalies such as:

- Dissolved air/gas
- Entrapped air/gas pockets
- Blockages
- Sealing status of valves
- Unknown system configuration

