

CASE STUDY

Utility Mapping

Project Summary

Customer:

Delaware Department of Transportation (DELDOT)

Type of Project:

Locating HDPE pipe with Gyroscopic Technology.

Date:

January 2023.

Results:

- *Successfully located 2,000 feet of HDPE pipe underwater with gyroscope technology.*
- *Minimal disruption and enhanced project efficiency.*
- *Overcame complex construction problems with industry expertise and groundbreaking accurate mapping technology.*
- *GPS quality mapping allowed for previously unknown locations to be mapped.*



OCEAN CITY, MARYLAND



“Gyroscopic technology demonstrates engineering at its finest with precision and stability.”

Introduction:

Gyroscope technology has and continues to change the inspection and preventative care of pipelines. With precise locational data (GPS quality), previously unknown or inaccurate locations have been successfully mapped. In January, the DELDOT, was met with a unique challenge. They were recently tasked with the challenge of locating and mapping 2000 feet of High-Density Polyethylene (HDPE) pipe buried underwater within a populated urban area. With the pending construction of a bridge, it was vital for the pipeline to be precisely located. Traditional methods of pipe location were deemed insufficient due to the complexity of the environment, prompting the exploration of advanced technologies such as gyroscopes.

Challenges:

1. **Urban Environment:** The HDPE pipe was buried 200 feet underwater. Conventional locating methods like electromagnetic induction and ground penetrating radar were limited by the presence of metallic structures and varying soil compositions.
2. **Precision and Accuracy:** Accurate, GPS quality mapping was essential to prevent damage to existing infrastructure during construction. The client required sub-12-inch accuracy to ensure the safety of the construction crew and minimize disruptions to the local community.
3. **Limited Access Points:** Access to the pipe for manual inspections or marker placement was challenging, requiring a non-intrusive technology that could effectively work without direct contact with the pipe.

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Solution:

The solution was to implement gyroscope technology combined with inertial navigation systems. Gyroscopes are devices that measure angular rotation and orientation, while inertial navigation systems utilize accelerometers and gyroscopes to calculate position and trajectory. By integrating these technologies, the path of the buried HDPE pipe was accurately tracked.

Implementation Steps:

1. **Selection:** After researching various options, the DELDOT chose the high-precision gyroscope system that American Pipeline Solutions offers which is known for its accuracy and stability even in challenging environments. This system was chosen for its ability to provide high-quality locational data.
2. **Calibration:** Prior to deployment, the gyroscope system underwent rigorous calibration to ensure accurate measurements. This involved establishing a baseline reference and adjusting the gyroscope's settings for optimal performance.
3. **Sensor Integration:** The selected gyroscope system was integrated with an inertial navigation unit to combine angular rotation data with acceleration data. This combination provided a comprehensive understanding of the pipe's movement and position changes.
4. **Data Collection:** The integrated system was deployed at strategic points along the suspected path of the HDPE pipe. As the construction crew moved along the route, the gyroscope system continuously collected data on the pipe's orientation changes and movements.
5. **Data Analysis:** The collected data was processed using advanced algorithms to calculate the pipe's trajectory and position accurately. This involved filtering out noise, compensating for external disturbances, and applying mathematical models to refine the results.

Results:

By utilizing gyroscope technology and inertial navigation systems, American Pipeline Solutions successfully located and mapped the 2000 feet of HDPE pipe buried within the complex urban environment. The implementation of this technology yielded the following outcomes:

1. **Sub 12-inch Accuracy:** The gyroscope-based system achieved sub-12-inch accuracy, ensuring precise tracking and mapping of the pipe's path.
2. **Reduced Disruptions:** The accurate mapping allowed construction crews to excavate with confidence, avoiding potential clashes with other underground utilities and infrastructure.
3. **Efficiency:** The non-intrusive nature of the technology eliminated the need for frequent access points or markers on the pipe, resulting in a more efficient workflow.
4. **Data Visualization:** The data collected by the gyroscope system was used to create 3D visualizations and interactive maps, aiding in project planning and communication with stakeholders.

Conclusion:

The successful utilization of gyroscope technology and inertial navigation systems by American Pipeline Solutions for the DELDOT showcased the potential of advanced mapping technologies in complex infrastructure projects. By addressing the challenges posed by buried HDPE pipes within a dense environment, the company achieved accurate location mapping, minimized disruptions, and enhanced project efficiency. American Pipeline Solutions demonstrates the importance of embracing innovative solutions to overcome complex construction challenges.