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Yesterday and Today:

Installing a Pipeline Across the World's Busiest Shipping Channel

By **Joe Pikas, Technical Toolbox**

Editor's note: *Pipeline construction veteran Joe Pikas recalls a 50-year-old offshore construction project that highlights the differences between how engineering goals were met in the past, and how they are met today.*

As a young pipeliner fresh out of college in 1967, I was faced with one of the most technically challenging pipeline construction assignments of my career. It was to install a concrete-coated, 26-inch, 33-mile (660-mm, 53-km) pipeline crossing underwater from Morgan, N.J., to Long Beach, N.Y. – through the Lower New York Bay.

This was, technically and logistically, a momentous endeavor. In comparison, a pipeline construction venture of lesser scope in a similar location is today being touted as a $1 billion project.

The line was to cross five shipping channels and major overseas telephone and telegraph links to Europe. Working alongside the Coast Guard, both states' regulations needed to be observed. The initial challenge was to establish multiple base lines from the New Jersey side to the New York side.

Then, the survey line needed to be laid out and the progress of the dredging work in the shipping channels tracked, along with the progress of the lay barge. At the time, GPS was in its infancy and not available for commercial use; therefore, a shrewd combination of civil engineering and unconventional tools was to be harnessed to successfully complete the project.

The whole project hinged upon solving for multiple unknowns in the survey equations using only the limited tools that were available, along with hand calculators to identify coordinates.

It just so happened that a junior engineering student on the team had faced a similar problem in his engineering program and was able to solve for these unknowns within 30 minutes – the same problem that the entire engineering staff had struggled with for several weeks. The timely debut of the electronic calculator also helped to speed things along.

Leveraging the work and experience of others was important then and is just as important now in modern-day digital transformation efforts.

1960s Technology

Laying transcontinental telecommunication lines was a perilous enterprise at the time, and it was essential that the lines were handled with care. Today, we know where we are on the face of the earth within inches of our actual position just by looking at a cell phone's GPS.

We also know, within inches of actual position, the location of pipelines and other obstacles, and the computer is able to process this in fractions of a second.

Working at this level of criticality without the benefits of GPS meant the 1967 workforce was operating under a high level of pressure, while having to simultaneously get to grips with new technology for the age.

The first commercialized laser transits were mounted on strategically placed, temporary offshore platforms and on onshore buildings in both New Jersey and New York.

A 90-foot (27-meter) survey boat made it easier to traverse between the New Jersey and New York areas. A hydro-disc was used to measure long distances over water using microwaves. And, a Loran system used transponders for triangulation in a similar manner to GPS but without the same level of accuracy.

Transponders required daily setup and maintenance daily. These older tools were used to locate crossings, including cables in the deeper water. Transits were used for triangulation and sextons were used as effective screening tools, in conjunction with lighthouses and other prominent sites around the area.

12-Hour Crossing

After months of dredging, the shipping channels were finally prepared for laying the pipe crossing. All commercial shipping into New York Harbor was stopped for 24 hours.

Horizontal directional drilling (HDD) is now used as a standard, and dredging for months or stopping shipping would be unnecessary, which is fortunate because today the port is the second-busiest in the U.S., with many thousands of container ships traversing its waterways annually, carrying hundreds of billions of dollars of cargo.

Back then, the project needed to be completed within that 24-hour period, otherwise fines and lawsuits would be filed against the company for holding up vital shipments.

The barge operators undertaking the work hailed from the Gulf Coast. However, the practicalities of working in the New

York Bay area proved to be much different than what they were used to. For example, cane pole buoys that drifted 200 feet (61 meters) either way were considered "close enough" in the Gulf, but not in the New York bay.

When it came time to cross the Ambrose Channel, the lay barge captain lost sight of the laser light he was following, as lay barges did not have the same electronics that they have today. To deal with this, a fathometer survey was rapidly run, only to find that the pipe was not in the ditch as planned, but approximately 50 feet (15 meters) away from the bank.

When the captain refused to correct his course immediately, the president of the company flew to site and, within a few hours, took a helicopter to the lay barge. The captain eventually invited help to correct his course. This put additional stresses on the pipeline and welds.

Had We Known

Technology has changed drastically in the last 50 years and Technical Toolboxes is a leader in digital transformation in the pipeline space. With today's GPS technology, and the software that is used to design, build, operate and provide integrity for today's pipeline systems, addressing the challenges of this project is trivial.

In 1967, all PLTB-relevant calculations would have been input manually with a pen and paper. Today, we have the capabilities of a software program that can provide reliable answers in seconds. PLTB features calculations for the following parameters, each of which would have been helpful for the 1967 project discussed:

- Buoyancy analysis and anchor forces when traversing bodies of water
- Concrete coating and concrete weight spacing requirements
- Bending stress caused by fluid flowing around pipe
- Restrained and unrestrained stress analysis
- Movement of in-service pipe and movement of unpressured pipe
- Hydrotesting (after installation, to ensure no leaks)
- Accidental releases (measure of severity if leak/rupture occurred)
- Horizontal directional drilling
- Pipeline hydraulics and rotating equipment (compressors and pumps)
- Cathodic protection for corrosion mitigation on land portions
- Weld imperfection assessment (the 33-mile line was made of 40-foot pieces of pipe welded to each other)

Productivity in the modern age has undoubtedly improved, as portable GPS intelligent systems streamline workflows that once took multiple tools and systems to calculate. In addition, GPS locations can now be used for mapping integrated pipeline engineering software to assess other aspects of the pipeline.

Today, the HUB asset database and map features ensure that everyone that needs the data has it at their fingertips. The complexity of identifying hazards and risks to the project is overcome and effective project plans can be made quickly.

"Next-gen" data capture and immediate, pain-free, automated integration into analysis applications is the key to obtaining project data in a leverageable form.

Embracing Change

The oil and gas pipeline industry is usually skeptical of new changes to processes and technology. Change management, therefore, is the most difficult aspect of conducting a successful digital transformation within a pipeline company.

Essentially, digital transformation revolves around the effort to increase profitability by creating paths of communication between people, processes, data sources and technologies that have never talked to each other.

Encouraging operators and engineers to trust the process and believe in the quality of the data that is feeding these calculations actively contributes to the continuous improvement of the process. Put simply, if the software users do not trust it, they will not use it.

However, as the industry continues in its digital transformation, sophisticated, integrated, holistic analysis tools, engineered to integrate solutions for design, construction, operations and integrity, will become the norm. This will enable users to make more efficient and accurate decisions to ensure pipeline safety and improve their management of asset integrity. ***P&GJ***

Author: Joe Pikas *has 54 years' experience in pipeline construction, operations, corrosion, risk and integrity in the oil, gas, water and nuclear industries. He retired from a large gas company in 2002 and is still working with Technical Toolboxes as an engineering subject matter expert. His consulting company is Beyond Corrosion Consultants.*