

GEOMSA Produces Reliable Subsea Pipeline System Design in the Gulf of Mexico

Bentley's AutoPIPE[®] Saves Time and Money Finding Best Pipeline Route

ASSESSING PIPELINE INTEGRITY TO INCREASE OIL PRODUCTION

Extracting oil reserves from shallow waters in the Gulf of Mexico often requires placing new subsea pipelines to transport the crude oil efficiently and safely at a high pressure and temperature. Grupo Especializado en Obras Marinas (GEOMSA) is a major developer of pipe-soil systems in the Gulf of Mexico. With more than 18 years of experience in marine platform and submarine platform engineering projects, GEOMSA assesses the strength of subsea pipeline systems by determining the effect that expansion and lateral wear have on its life expectancy.

The organization specializes in terrestrial pipe and industrial installation projects for hydrocarbon collection and processing. Recently, GEOMSA was tasked with assessing pipeline integrity under various conditions in the clay soil trenches of an underwater pipeline system.

DETERMINING PIPELINE BEHAVIOR

The project's objective was to increase domestic oil production in the surrounding region. The project team needed to determine how the new pipeline system would react to expansion and lateral deformation considering the route's horizontal curves, the varying widths of the trench, the number of ocean floor levels above the pipeline, and how the pipeline would interact with the clay soil environment in which it was being placed.

The team also had to determine the logical and reliable behavior of the pipeline by simulating it inside the trench and considering variables such as temperature, lateral deformations, and system stress. Determining the characteristics of the trench allowed the design team to select the best materials to construct the system with the optimal pipeline route.

DETERMINING MATERIAL TYPES AND SOIL CHARACTERISTICS

To address these challenges, GEOMSA deployed AutoPIPE to perform the structural analysis and accurately model the geometry of the pipeline and the characteristics of the soil. The project occurred in two phases. In the first phase, the engineering team used AutoPIPE to develop a 3D model using the project's informational database that describes the types of materials needed for the pipes, connections, and valves. The team could then select boundary conditions for the pipe above and below sea level.

In the second phase, the design team input codes and regulations, design factors, design pressure and temperature, and bend radius elbows. These factors were then used to calculate how the system would interact with the soil. The engineers manipulated the parameters of the soil-pipe interaction in the model to simulate the variations in the width of the trench. They also performed several flexibility analyses so that the team could obtain stress results and deformations in the clay soil.

"Bentley's software provides engineering-friendly tools that allow us to model and analyze complex problems, like in this case soil-pipe interaction, and to obtain the structural behavior of submarine pipelines," GEOMSA's CEO, Roberto Chávez Argüelles explained. "It helped us to make informative decisions about the recommended geometry of the pipeline and the minimum dimensions of the trench."

REALISTIC DESIGNS IN LESS TIME

By using AutoPIPE, GEOMSA saw significant benefits. The application helped the engineering team reduce the time that it would have normally taken to modify

PROJECT SUMMARY ORGANIZATION

Grupo Especializado en Obras Marinas S.A.

SOLUTION

Transmission and Distribution

LOCATION

Campeche Bay, Gulf of Mexico, Mexico

PROJECT OBJECTIVES

- ◆ To implement a new pipeline system in the clay soil of the shallow Gulf of Mexico to transport oil reserves efficiently and safely.
- ◆ To increase oil production in Mexico and create employment opportunities for the surrounding communities.

PROJECT PLAYBOOK

AutoPIPE, SACS™

FAST FACTS

- ◆ By performing a flexibility analysis, GEOMSA easily confirmed the wall thickness that the system required.
- ◆ The structural analysis helped establish accurate stress levels throughout the lifecycle of the system.
- ◆ AutoPIPE helped the team to comply with local and international codes..

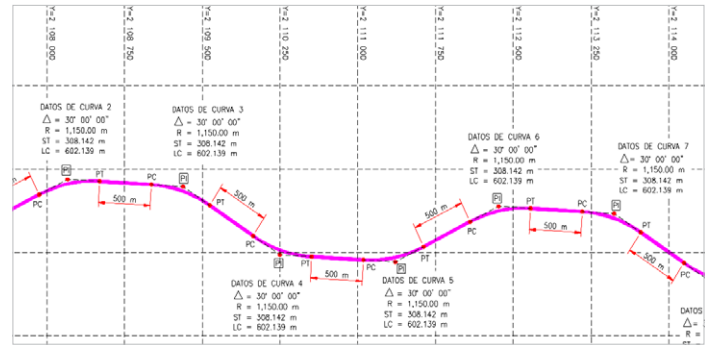
“Bentley’s software provides engineering-friendly capabilities that allow us to model and analyze complex problems, such as soil-pipe interaction, as well as to obtain the structural behavior of submarine pipelines that help us to make informative decisions about the recommended geometry of the pipeline and the minimum dimensions of the trench.”

– Roberto Chávez Argüelles, CEO, GEOMSA

how the piping system would interact with the soil, while also accurately representing gradual variations in the trench’s width. AutoPIPE also enabled the engineering team to create realistic designs that reduced the risk of the pipeline failing. The user-friendly application displayed the analysis to the project team in a fully graphical environment so that the results could be clearly understood by all stakeholders. This improved collaboration, and saved time and cost. Bentley applications also helped GEOMSA continue its mission to reliably meet its clients’ requirements.

Other benefits provided by the software included reducing the amount of time it took to process the design analysis, delivery time, and costs, as well as automatically preparing a report of the results. AutoPIPE was also instrumental in allowing the project team to meet local and international regulations or codes. The application allowed the team to automatically consider design code parameters for different load combinations to compare stresses and deformations. This capability allowed the engineers to feel confident that they

were creating the safest pipeline system, reducing the risk of marine pipeline failure and the severe environmental impact on the surrounding area. Moreover, optimizing the volume of domestic oil production improves the country’s economy and helps create more jobs for the surrounding communities.



Snake-like subsea pipeline alignment.