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Abstract

Construction of a cross-country pipeline involves lifting the pipeline off the skids and lowering it into the trench (lifting and lowering-in). This can introduce the highest stress magnitude that the pipe may experience over its service life. If not managed properly, overly high stresses may cause integrity issues during construction and/or service. If the girth welds are qualified and accepted using alternative flaw acceptance criteria, such as those in API 1104 Annex A and CSA Z662 Annex K, these stresses must be kept below a preset level during lifting and lowering-in to satisfy the requirements of those standards.

This paper covers the development and usage of a stress analysis tool for the continuous lifting and lowering-in of pipe strings without a concrete coating or river weights. The outcome of the stress analysis can be used to develop lifting and lowering-in plans for construction crews.

The core functionality of the application tool is to calculate the stresses from bending in the vertical and horizontal planes. The stresses from vertical bending are derived from an extensive analysis of continuous lifting and lowering-in processes. The stresses from horizontal bending are calculated using closed-form analytical solutions. The tool provides a graphical interface that interprets the background stress analysis results and displays information necessary for the development of lifting and lowering-in plans. The tool can be used to evaluate what-if scenarios for various tentative lifting and lowering-in scenarios.

The process of using the tool to develop lifting and lowering-in plans is demonstrated in this paper through an example problem. The number of sidebooms and other lifting and lowering-in parameters such as sideboom spacing and lifting height range are changed to make the lifting and lowering-in plan easy to use for the laying contractors. Such tradeoffs can be addressed proactively with construction contractors to ensure that a mutually acceptable approach to lifting and lowering-in is taken.

Keywords

Pipe laying, lifting and lowering-in, construction stress, stress analysis, lifting and lowering-in plan