

# **ANALYSIS OF GIRTH WELDS IN PIPELINES SUBJECTED TO LIFTING LOADS**

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## **ABSTRACT**

Williams Gas Pipeline requested that Stress Engineering Services provide engineering services to analytically assess issues that occurred in a 30-inch pipeline due to cracked girth welds. The focus of the analytical effort was to simulate the lifting during the pipeline construction process. Using finite element methods, nominal bending stresses were calculated considering a specific set of criteria including 80-foot pipe joints, skid locations, and a given root pass weld thickness. These bending stresses were used to calculate a total stress that included stress concentration factors (SCFs) due to hi-low weld mismatch and weld profile geometry. For conservatism, residual stresses were also included in computing the total stress. As an example, the results showed that if a residual stress of 50 percent yield and a total SCF of 4.5 are assumed, the lift height should be limited to approximately 9 inches for a root pass weld thickness of 0.0625 inches. In this calculation, a stress limit of two times yield was used.

Once the final stress was computed considering the range of variables, a closed-form equation was developed that integrated the variables of interest for the 30-inch pipe. This equation was used to compute data points to guide Williams in establishing permissible lift heights for a range of SCFs for the welds. A stress limit of two times the yield strength was selected as the limiting value. The details of the work presented in this paper will assist pipeline operators in developing a protocol that balances the need for rapid construction and ensuring that proper girth welds are fabricated.

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