

Wang, Y.-Y., Liu, M., Stephens, M., Peterson, R., and Horsley, D., Recent Development in Strain-Based Design in North America, Proceedings of the 19th International Offshore and Polar Engineering Conference (ISOPE 2009)

Abstract

There has been a wide range of research and application activities worldwide in the strain-based design (SBD) of pipelines. SBD may be applied to pipelines expected to experience large longitudinal strains typically associated with ground movement. This paper describes a PRCI and US DOT co-funded project aimed at developing tensile strain capacity models and procedures. The materials tested so far include 12.75-inch (324-mm) OD \times 0.5-inch (12.7 mm) wall thickness ERW pipes manufactured by two pipe mills. The testing of higher grade and larger diameter pipes is planned but not reported here. The initial attempts at correlating the small-scale material properties with the large-scale experimental test results are the focus of this paper. Considerable coverage is given to the results of the small-scale material characterization tests. Large-scale tests, including curved wide plates and full-scale pipes, are briefly described, while the details are referred to a companion paper. Samples of post-test metallurgical examinations are presented. Finite element analysis of selected large-scale tests shows that multiple interacting factors affect the tensile strain capacity. The varied degree of agreement between the experimental and analysis results demonstrates the importance of understanding and accounting for material property variations. The paper concludes with a brief status update on the current work and emerging issues related to SBD.

Keywords

Strain-based design, Tensile strain capacity, Fracture mechanics, Ductile fracture, Pipeline