Wang, Y.-Y., M. Liu, Stephens, M., Petersen, R., Horsley, D., Recent Developments in the Strain-Based Design of Pipelines, Proceedings of 17th Joint Technical Meeting of EPRG/PRCI/APIA, 2009

Abstract

There have been significant activities worldwide in the development of strain-based design (SBD) technologies. SBD is applicable to pipelines expected to experience large longitudinal strains typically associated with ground movements. This paper describes a PRCI and US DOT co-funded project aimed at developing tensile strain capacity models and procedures. The materials covered in this research program consist of 12.75-inch (324-mm) OD × 0.5-inch (12.7 mm) wall thickness ERW pipes manufactured by two pipe mills. 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 experimental tests, including curved wide plates and full-scale pipes, are briefly described, while the details are referred to another publication. 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 the material property variations. The paper concludes with a brief summary of current work on SBD and a few emerging issues being investigated. The importance of understanding the interactions between material properties and mechanics in SBD is emphasized.

Keywords

Pipeline, Strain-based design, Welding, Girth weld, Experimental test