STRAIN-BASED DESIGN AND ASSESSMENT OF NEW AND AGEING PIPELINES

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ABSTRACT

Strain-based assessment (SBA) is being increasingly used to assess the fitness for service of pipelines not specifically designed to tolerate high longitudinal strains. SBA relies on the same fundamental principles and methodologies developed for the strain-based design (SBD) of the construction of new pipelines expected to experience high longitudinal strains. SBD and SBA are collectively referred to as strain-based design and assessment (SBDA). This paper starts with a high-level introduction of the basic concepts of SBDA. The second part of the paper discusses the relevance of this methodology to the majority of new and ageing pipelines. The longitudinal strain conditions observed in field conditions are shown to demonstrate the need of applying the SBDA methodology. The third part of the paper covers available and developing SBDA methods for pipelines of different vintage and construction methods. The main attributes of pipelines of different vintage and their impact on the strain capacity are highlighted. The last part of the paper provides brief guidance on the use of SBA for in-service pipelines and proposes a few new considerations for the construction of new pipelines.

KEYWORDS

Pipeline, integrity, strain-based design and assessment, strain-based assessment, strain demand, strain capacity, tensile strain models, geohazard

NOMENCLATURE

Strain demand (SD): the strain imposed on a pipeline by its operational and environmental conditions

Strain capacity (SC): the highest strain level a pipe segment can sustain without negative consequences

Tensile strain capacity (TSC): the strain capacity in tension

Compressive strain capacity (CSC): the strain capacity in compression

Compressive strain capacity by maximum load (CSC_{ML}): the CSC defined at the maximum load (bending moment or compressive load). This is the CSC commonly defined in current codes and standards, such as CSA Z662

Post-maximum-load compressive strain capacity (CSC_{PML}): This is the CSC beyond the maximum load