

Profit from Expertise

Dent Strain and Remaining Life Assessment

Case Study

THE CHALLENGE

The customer was challenged with a dent in a pipeline that resulted in failing the industry standard fatigue assessments, as defined in API 579 and the European Pipeline Research Group (EPRG). As the pipeline was located in a swamp, a repair would have been not only geographically challenging but also economically strenuous. At the same time, the environmental consequences of a failure in this pipeline were considered to be extremely high, meaning that immediate action was required.

OUR SOLUTION

ROSEN performed a dent strain assessment to provide an indication of the likelihood of cracking caused during indentation. Prior to the assessment, a high-resolution geometry tool run with RoGeo XT was performed twice, at two different pressures, to estimate whether the dent was restrained or unrestrained. The dent was found to not be fully restrained, meaning that the dent was at least partially free to flex and rebound due to variations in internal pressure. With this information, ROSEN was then able to perform a stress-based remaining life assessment of the dent, which consisted of the following:

- Calculation of the Stress Concentration Factor (SCF) using streamlined Finite Element Analysis (FEA)
- Rainflow counting of pressure cycles based on historical and predicted future operation to calculate pressure spectrums for representative operating regimes
- Selection of an appropriate Stress-Endurance (S-N) curve
- Calculation of allowable cycles for the dent based on the calculated SCF, cyclic stress range and S-N curve
- Determination of remaining life from the date of the inline inspection



ROSEN's strain assessment demonstrated that the associated strain was less than the limit referenced in ASME B31.8. This meant that the pipeline was at a low risk of having associated cracking due to formation. Additionally, even though the dent required repair according to the API 579 / EPRG fatigue assessment, ROSEN's subsequent stress-based remaining life assessment using a level three SCF and S-N approach demonstrated that the dent would be acceptable for a further 20 years of operation.

YOUR BENEFITS

The level two dent assessment the operator had performed before consulting ROSEN considered the dent to be unacceptable, requiring costly repairs. However, the more advanced level three assessment performed by ROSEN demonstrated the acceptability of the dent for future operation, thereby eliminating the need for repair. Consulting with ROSEN led to financial savings of more than \$500,000 for the operator in regards to resourcing, excavation and repair.

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