World Academy of Science, Engineering and Technology
International Journal of Structural and Construction Engineering
Vol:12, No:08, 2018

Uncertainty Quantification of Corrosion Anomaly Length of Oil and Gas Steel Pipelines Based on Inline Inspection and Field Data

Authors : Tammeen Siraj, Wenxing Zhou, Terry Huang, Mohammad Al-Amin

Abstract : The high resolution inline inspection (ILI) tool is used extensively in the pipeline industry to identify, locate, and measure metal-loss corrosion anomalies on buried oil and gas steel pipelines. Corrosion anomalies may occur singly (i.e. individual anomalies) or as clusters (i.e. a colony of corrosion anomalies). Although the ILI technology has advanced immensely, there are measurement errors associated with the sizes of corrosion anomalies reported by ILI tools due limitations of the tools and associated sizing algorithms, and detection threshold of the tools (i.e. the minimum detectable feature dimension). Quantifying the measurement error in the ILI data is crucial for corrosion management and developing maintenance strategies that satisfy the safety and economic constraints. Studies on the measurement error associated with the length of the corrosion anomalies (in the longitudinal direction of the pipeline) has been scarcely reported in the literature and will be investigated in the present study. Limitations in the ILI tool and clustering process can sometimes cause clustering error, which is defined as the error introduced during the clustering process by including or excluding a single or group of anomalies in or from a cluster. Clustering error has been found to be one of the biggest contributory factors for relatively high uncertainties associated with ILI reported anomaly length. As such, this study focuses on developing a consistent and comprehensive framework to quantify the measurement errors in the ILI-reported anomaly length by comparing the ILI data and corresponding field measurements for individual and clustered corrosion anomalies. The analysis carried out in this study is based on the ILI and field measurement data for a set of anomalies collected from two segments of a buried natural gas pipeline currently in service in Alberta, Canada. Data analyses showed that the measurement error associated with the ILI-reported length of the anomalies without clustering error, denoted as Type I anomalies is markedly less than that for anomalies with clustering error, denoted as Type II anomalies. A methodology employing data mining techniques is further proposed to classify the Type I and Type II anomalies based on the ILI-reported corrosion anomaly information.

Keywords : clustered corrosion anomaly, corrosion anomaly assessment, corrosion anomaly length, individual corrosion anomaly, metal-loss corrosion, oil and gas steel pipeline
Conference Title : ICSRS 2018 : International Conference on Structural Reliability and Statistics
Conference Location : New York, United States
Conference Dates : August 27-28, 2018