CAAP Quarterly Report

01/03/2024

Project Name: A Novel Reliability-Based Approach for Assessing Pipeline Cathodic Protection (CP) Systems in External Corrosion Management

Contract Number: 693JK32350002CAAP

Prime University: Marquette University

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Reporting Period: 09/29/2023-12/30/2023

Project Activities for Reporting Period:

The kick-off meeting of this project was held on 12/06/2023. The research team has started Task 1 (literature review) and Task 2 (data collection).

Project Financial Activities Incurred during the Reporting Period:

The professional service from inferModel has been charged, which is being processed by Marquette University.

Project Activities with Cost Share Partners:

No cost share activity during this quarterly period.

Project Activities with External Partners:

Several meetings were held with our external partner to discuss the scope of work and data collection. Weekly meetings were also held between Marquette research team and Project Contractor, inferModel, to discuss the preliminary analysis on the first pipeline dataset.

Specifically, our external partner provided pipeline information and two MFL-A inline inspection (ILI) data for a pipeline from the ILI vendor from 2019 and 2014. This pipeline represents approximately 65 miles of pipe and 6350 joints. Several different data assessments have been performed including but not limited to:

- A data imputation script has been developed for missing joint information following the gap-and-island approach for missing continuous variables, and the most common category based on vintage for missing categorical variables.
- A level 2 API 1163 assessment has been performed on the latest inspection run using existing field trending on field measured depths above ILI detection threshold. With the incorporation of the high field measurement error on excavated areas of thin wall pipe (5.6 mm) and the ILI tool error, the inspection passes the assessment with 80% certainty. However, there is clear bias showing that ILI tool is systematically overcalling features.

- The latest inspection data was analyzed based on external corrosion feature types. There are approximately 2108 single metal loss features, 503 child/callbox features, and 207 clusters using business rule of 6T-by-6T clustering. The older inspection was also reviewed, and it was found that the child level features were not provided on old ILI runs.
- The corrosion morphology, defect locations (pipe body, field coating, heat affected zone region, orientations) and anomaly densities by girth weld under different explanatory factors have been studied in detailed to better understand any basic driving factors of corrosion.
- B2B defect matching has been performed between the two latest inspections using existing practices from our external partner. The depth corrosion growth rates (CGR) have been estimated using the secant line between the matched features.

Potential Project Risks:

So far no risk has been identified.

Future Project Work:

In the next quarter, we will continue working closely with our external partner to collect relevant data on three transmission pipelines, that includes pipe attributes, inspection data, growth data, consequence modelling data, soil data and CP data into usable format for reliability assessments.

Potential Impacts to Pipeline Safety:

At the current phase, the project provides a better understanding of the usage limitation of CP survey data, and the needs in the existing defect analysis frameworks.