External Quarterly Report

Date of Report: 3rd Quarterly Report -June30th, 2025

Contract Number: 693JK32410008POTA

Prepared for: DOT PHMSA

Project Title: A Non-Destructive Toughness Measurement

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For quarterly period ending: June 30th, 2025

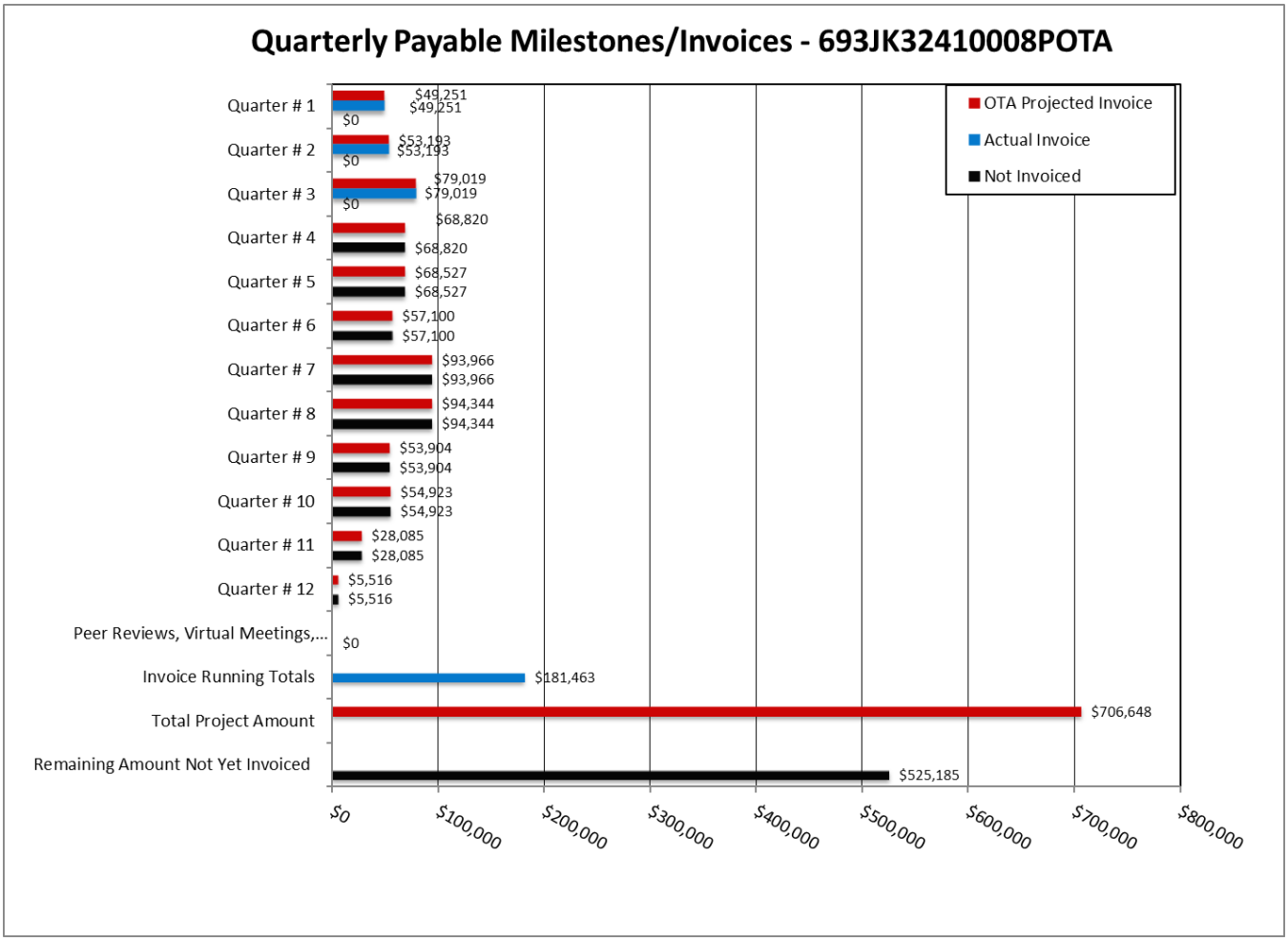
1: Items Completed During this Quarterly Period:

Item #	***Task #***	***Activity/Deliverable***	***Title***	***Federal Cost***	***Cost Share***
8	2	Literature Review	Literature Review Report	11,058.00	
9	4	Information Exchange with ILI Providers	First Interim Information Exchange Report	15,247.00	100,270.00
10	6	Surface Indentation Testing	First Interim Surface Indentation Testing Report	25,007.00	41,975.00
11	10	3rd Quarterly Status Report	Submit 3rd quarterly report	27,707.00	

2: Items Not Completed During this Quarterly Period:

1. No outstanding Q3 deliverables.

3: Project Financial Tracking During this Quarterly Period:



4: Project Technical Status

The project is progressing to plan and buget with no outstanding deliverables. There are three deliverables due this quarter:

1st. **Appendix 1: Literature Review Report:**

To ensure the safe transport of natural gas through steel pipelines, structural integrity must be assessed using fitness-for-service (FFS) methodologies. These assessments—such as the ASME FFS Level 2—require accurate input data on material properties (particularly toughness), flaw or defect geometry, and loading conditions to evaluate the safety of pipeline networks. Currently, obtaining reliable toughness values is only possible through destructive testing. However, such results are specific to the tested segment or weld and are not applicable to other parts of the pipeline. The ability to estimate toughness in-situ, using non-destructive methods, would significantly improve the accuracy and applicability of FFS assessments across the pipeline network. There is a need to research methodologies to achieve this objective, and to develop commercially available equipment that implements successful approaches for non-destructive pipeline toughness estimation in the ditch, or through inline inspection (ILI).

This literature review evaluates the different available and under-development destructive and non-destructive toughness measurement approaches for pipeline steels, namely

* Destructive testing – standards-based fracture & impact toughness testing
* Minimally invasive (quasi non-destructive) techniques – instrumented indentation, frictional sliding, profilometry based indentation plastometry
* Electromagnetic/acoustic techniques – ultrasonic testing, acoustic emissions and magnetic coercivity
* Toughness prediction models – empirical and analytical models

Over 50 published sources are reviewed, including ASTM, BS, ISO, and ASME standards, as well as journal and conference articles and industry reports, focusing on fracture and impact toughness testing, the development of non-destructive technologies, and their industrial applications. This report examines the capabilities and limitations of destructive and non-destructive testing methods, identifies technical barriers to their effective use, and assesses the accuracy and applicability of fracture prediction models.

2nd. Appendix 2: First Interim Information Exchange Report

The appendix details the discussions that were held with several ILI providers and the outcome of the discussions'.

3rd. Appendix 3: First Interim Surface Indentation Testing Report

The appendix details the progress made in the indentation testing task and what is expected in the upcoming quarter

End of report