External Quarterly Report

Date of Report: 7th Quarterly Report – June 30, 2023 Contract Number: #693JK3211RA0001 Prepared for: PHMSA DOT Project Title: Assessment of Nondestructive Examination (NDE) and Condition Monitoring Technologies for Defect Detection in Non-Metallic Pipe Prepared by: EWI Contact Information: Meghan Harley Yugulis <u>MYugulis@ewi.org</u> 614-688-5279 For quarterly period ending: June 30, 2023

1: Items Completed During this Quarterly Period:

The seventh quarterly update was completed during Quarter seven. Additionally, EWI completed a modification to scope, budget, and schedule with DOT-PHMSA, completed erosion testing and is awaiting NDE work to finish the erosion analysis.

Item	Task	Activity/Deliverable	Title	Federal	Cost
#	#			Cost	Share
11	10	Submit 7 th Quarterly Report	6 th Quarterly Status Report & Quarterly collaboration meeting	\$11,602.45	\$0.00

2: Items Not Completed During this Quarterly Period:

EWI anticipated receiving the modification documents in April per information provided by previous DOT-PHMSA program managers, the award came in June 2023, EWI paused completion of NDE work until additional funding was received and thus the NDE review will shift out based on schedule of review and receiving additional pipe materials from new project partners.

EWI completed the inner liner erosion NDE work and analysis in quarter 8.

Item #	Task #	Activity/Deliverable	Title	Federal Cost	Cost Share
14	4	Task 4 NDE Project Review	Review Progress to review NDE inspection data, outcome, and Trends	\$18,050	
11	6	Perform inner liner erosion tests & assess NDE detection	Task report summarizing erosion test procedure and results, and NDE inspection results	\$95,755.10	\$1,832.84

3: Project Financial Tracking During this Quarterly Period:

The actual spend is behind planned.

• EWI received a modification in June 2023 and anticipated receiving additional pipe materials as well. EWI is awaiting those materials and will assess the potential time delays to either work ahead, this would be less effective with two set-ups needed, one for the current set of pipes, and one for the future set. Or to pause which could cause time delays but allow for more efficient operating practices.



4: Project Technical Status -

Item	Task	Activity/Deliverable	Title			
1	10	Submit 1st quarterly report	1st Quarterly Status Report & Quarterly			
			collaboration meeting			
2	1	Task report summarizing findings of	Literature review of recent research on NDE of			
		literature review	polymers & composites - issue task report			
3	2	NMP sample matrix detailing type of	Prepare detailed matrix of NMP samples			
		prove and defects, anomanes, or damage per sample				
4	3	Develop NDE procedures for inspection	Completion of written NDE procedures			
		3 coupled UT methods, microwave				
		inspection method and 2 thermography				
		methods				
5	10	Submit 2 nd Quarterly Report	2 nd Quarterly Status Report & Quarterly			
			collaboration meeting			
6	6	Task 6 Test Procedures and Chamber	Prepare & Provide a Written Test Procedure for			
		Assembly	Erosion Tests			
7	4	NDE Review Progress to date (samples.	Task 4 NDE Project Review			
		procedures, early inspection data)	1			
8	10	Submit 3 rd quarterly report	3 rd Quarterly Status Report & Quarterly			
-		the second second	collaboration meeting			
9	10	4 th Quarterly Status Report	4 th Quarterly Status Report & Quarterly			
11	-		collaboration meeting			
11	6	Perform inner linear erosion tests &	Task report summarizing erosion test procedure			
1(10	assess NDE detection	and results, and NDE inspection results			
10	10	5 th Quarterly Status Report	5 th Quarterly Status Report & Quarterly			
26	10	Appuel Poviow	Poviov Monting (virtual)			
15	10	Alliudi Kevlew	6 th Ouerterly Status Papert & Ouerterly			
13	10	Vultienty Status Report	collaboration meeting			
21	10	Submit 7 th Quarterly Report	6 th Ouarterly Status Report & Ouarterly			
41	10		collaboration meeting			

Task 1 – Literature Review was completed by EWI and NDE4zero's Mark Lozev. The report was supplied to the project team on 3/31/2022

Task 2 – NMP Sample Matrix. EWI received additional pipes in late June and is updated the Matrix 10/31/2022

Task 3 – The internal NDE procedures have been developed. NDE procedures for external technologies have begun, report provided on 6/27/2023.

Task 4 – CT scanning was completed in mid-June on pipe samples that had been received by the project at that time. New pipe samples were received late summer 2022 and CT scanning was completed in December 2022. EWI NDE has begun testing selected pipe samples from this batch of material. The NDE testing, and analysis is underway, data and images were shared at the Q4 meeting on 9/21/22 and Q5 meeting on 12/16/2022. Testing will continue for several months with EWI completing multiple forms of NDE.

Initial air coupled UT scans were completed. Methods for UT sensor calibration, determination of sensor offset distances and scanning direction have been identified. Data analysis and reporting is inprocess, but early observations indicate good sensitivity for detecting minor manufacturing anomalies and for dealing with typical pipe eccentricity and dimensional variances (wall thickness variability, air gaps in unbonded pipes, etc.). Data analysis and reporting is in-process. Pipe samples were supplied in mid-June for initial microwave scans. Anticipate results late July or early August.

EWI has begun discussions for coordinating EWI UT inspections on samples to be externally tested. These UT trials would be particularly valuable since the samples will be pressurized while being subjected to denting loads. All NDE work at EWI has been done without internal pressure. This can reduce sensitivity due to natural air gaps that can occur between the inner liner, reinforcement, and outer jacket in unbonded pipe when unpressurized.

Refinements in the thermography method have been made by implementing larger and higher wattage light sources, evaluating frequency of image scans, and assessing through-wall sensitivity using tapes, foils and small artifacts (zip ties, etc.) on the ID surface. Overall, sensitivity is improving and ability the sense through-wall from the OD has been demonstrated. Features of the reinforcement layer are now detectable in several test pipes.

EWI's initial plan for inducing mechanical and corrosion damage in selected pipe samples has begun now that the change request/project extension has been approved (June 2023)

Task 6 – The cost share portion of this task has been completed (Item #6 Task 6): test cells have beenbuilt and a test method developed (5/31/2022). The task began in December 2021 and has beencompleted in June 2022. The federally funded portion of this work began in August 2022. Tests are arecomplete and NDE will occur in July 2023 .

The goal of this testing is to create a laboratory scale representative test to be able to quantify internal pipe erosion and erosion rate. This data will be able to be used to create a lifetime use prediction model for the NMP.

Task 10 – The 1st quarterly status report was provided on 1/4/22. The 2nd quarterly status report was provided on 3/31/2022. The 3rd quarterly status report was provided on 6/30/2022. The 4th quarterly status report was provided on 9/30/2022. The fourth quarterly collaborative meeting occurred on 9/21/2022. The Fifth quarterly meeting was hosted on 12/16/22 with its quarterly report submitted on 1/4/2022. TAP attended two meetings 7/13/2022 and 11/29/2022, TAP was invited to the quarterly meeting on 12/16/2022 and these meetings will be combined going forward. The 6th quarterly meeting occurred 3/30/2023. The most recent quartler report on 6/29/2023 was the 7th quarterly report.

The next quarterly meeting will occur in September 2023 pending Doodle poll feedback. It will be scheduled for ~2 hours, please see upcoming Doodle calendar poll.

While not tied to a specific milestone during the last quarter, the following activities were undertaken:

(1) EWI created, completed, and were awarded a modification to the project extending the program through March 31, 2024, and adding funds to expend our pipe testing to include new partner's pipe samples

5: Project Schedule -

The project schedule has been updated to incorporate the modification requested in March 2023 and awarded in June 2023. The proposed schedule assumed EWI would receive pipe by June 1, 2023. With delays to the aware and pipe arrival EWI anticipates updating the below schedule when pipes arrive.

Task	Description		Quarter										
	Description		2	3	4	5	6	7	8	9	10	11	
1	Literature Review & Report	Χ	Χ										
2	Selection, Procurement & Preparation of Pipe Samples	Х	Χ	Χ	Χ	Χ							
3	Draft NDE Procedures		Χ	Χ	Χ	Χ							
4	NDE Trials			Χ	Х	Χ	Χ						
5	NDE Validation & Assessment					Χ	Χ	Х					
6	Characterization of Erosion Properties and Detectability		X	Х	Х	х							
7	Development of NDE Procedures and Best Practice Guide						Х	Х					
8	Establish Field Inspection Requirements							Х					
9	Virtual Workshop							Х	Х				
	Progress Meetings (virtual and in-person)			Х			Х		Х				
10	Annual Review				Х				Х				
10	Quarterly Progress Reports	Х	Χ	Х	Х	Х	Х	Х	Х				
	Final Report								Χ	Χ			
11	NDE Subcontractors and GTI travel							Χ	Χ				
12	NDE and Mechanical Damage								Χ				
13	NDE and Corrosion Damage									Χ			
PM	Program Management	Χ	Х	Х	Х	Χ	Х	Х	Х	Х	Х		

The schedule will be finalized when the new partner's pipe is made available to EWI for testing.