

PHMSA Research, Technical and Policy Perspectives



Working Group #2

Preventing and Mitigating Geo-Forces on Pipelines and Facilities

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Pipeline Research and Development Forum

February 19-20, 2020



Geo-Forces: Threat Prevention

- Program Objective: Research in this area supports general knowledge or technology development that can remotely monitor the occurrence and severity of various integrity threats to pipelines.
 - Solutions are sought in technology and knowledge enabling safe operations
- Several secondary research funded assessing natural force damage both in determining the severity and In Line Inspection efforts to affectively detect and characterize.
- However, lets focus on the projects shown on the next few slides as more specifically relevant.



Geo-Forces: Accidents/Incident

- PHMSA's Accident Investigation Division (AID) has investigated nine (9) failures since its inception in October 2017 caused by natural force damage from land movement.
- In each accident, strain developed from various land movements caused weld or body failures.
- Natural force damage to pipelines can come from mudslides, landslides, and subsidence.



Previous Accidents/Incidents

- Summerfield, Ohio (1/31/2018) – Rupture on a 24-inch Enbridge interstate natural gas pipeline. Failure caused by axial stress due to pipe movement.
- Moundsville, West Virginia (6/7/2019) – Rupture on a 36-inch natural gas TransCanada pipeline. Failure of the pipeline due to a single overload event.



Previous Accidents/Incidents

- Billings County, North Dakota (12/5/2016) – Release of 12,615 barrels of crude oil from a 6-inch Bell Fourche pipeline. Failure likely due to compressive and bending forces.



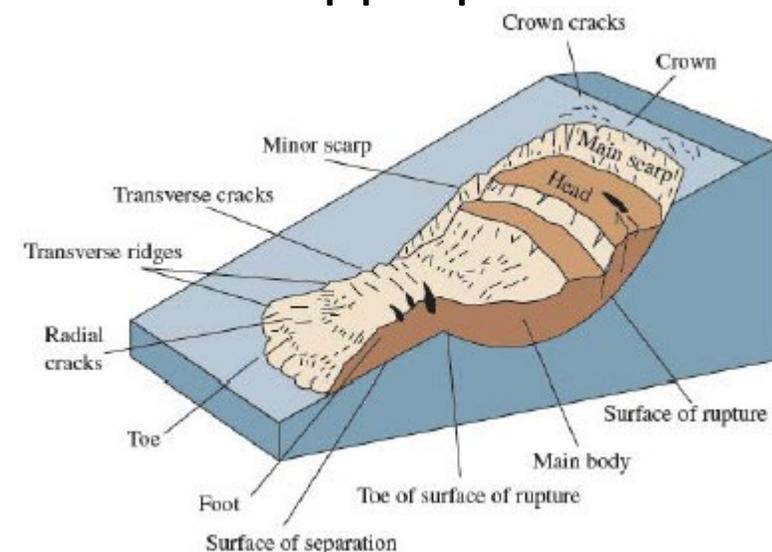
Completed Research

Pipeline Integrity Management for Ground Movement Hazards

Main Objective: Addressed large scale ground movement events related to landslides, long term slope movement and ground subsidence. Project developed recommendations on engineering practices with respect to the assessment of these large scale ground movement geohazards, and guidance to define appropriate and sufficient pipeline design and operational measures for the mitigation of large scale ground displacement effects on buried pipelines.

Results: Posted in 2008 – Final Report viewed/downloaded 1029 times

PHMSA: \$525,241 + \$523,580 PRCI



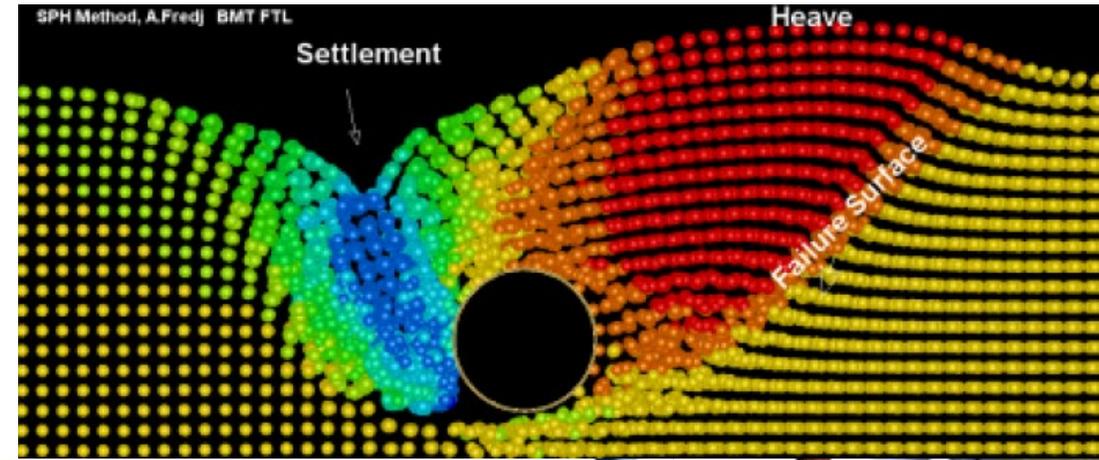
Completed Research

Definition of Geotechnical and Operational Load Effects on Pipeline Anomalies

Main Objective: The project validated a pipe soil interaction model and developed an engineering tool to define the effects of operational and geotechnical loads on pipeline systems that can support decision making regarding threat severity or repair scheduling. The resulting tool can define the local nominal strain state used to assess localized anomalies /defects (e.g. corrosion, cracks, dents, weld faults, gouges, etc.).

Results: Posted in 2017 – Final Report viewed/downloaded 616 times

PHMSA: \$314,500 with BMT Fleet



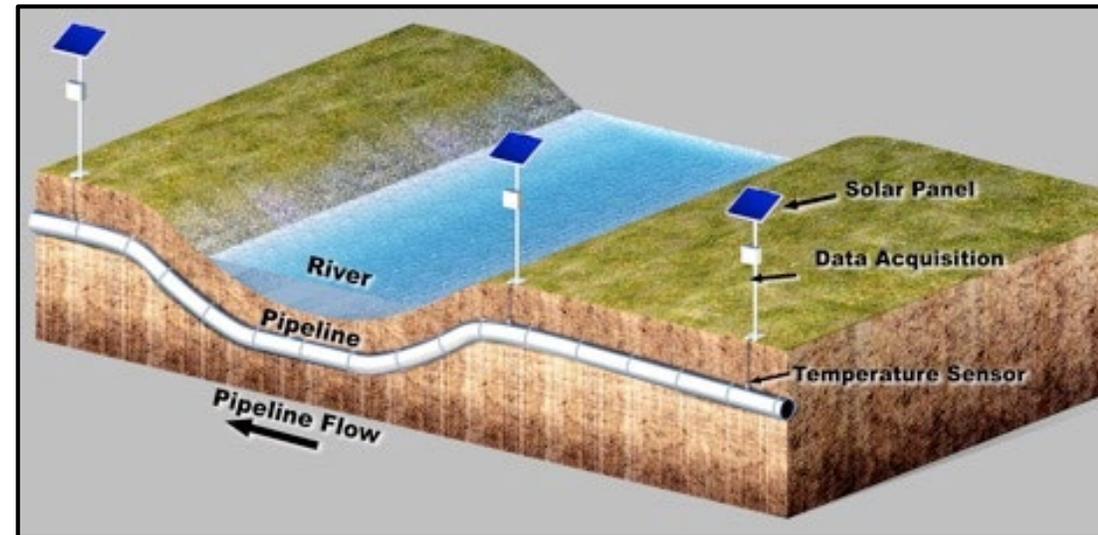
Ongoing Research

Threat Prevention for Pipeline River Crossings

Main Objective: This project will demonstrate an "active" remote monitoring system capable of determining the degree of scour in a river bed thereby alerting pipeline operators should the amount of cover of the pipeline become reduced. The proposed technology is based on a temperature gradient decay method for monitoring a subject pipeline river crossing for scour conditions.

Results: Feb 1, 2021

PHMSA: \$400,000 + \$400,000 Arizona State University



Ongoing Research

Modernize the Assessment of River Crossings

Main Objective: This project will supplement guidance from API RP 1133, and expand and improve the capabilities of existing tools available to assess and monitor pipeline riverine crossings. Additionally, the project aims to develop and adapt risk screening tools through advances in engineering analysis that are field validated.

Results: Sept 30, 2021

PHMSA: \$386,204.50 + \$381,204.50 PRCI



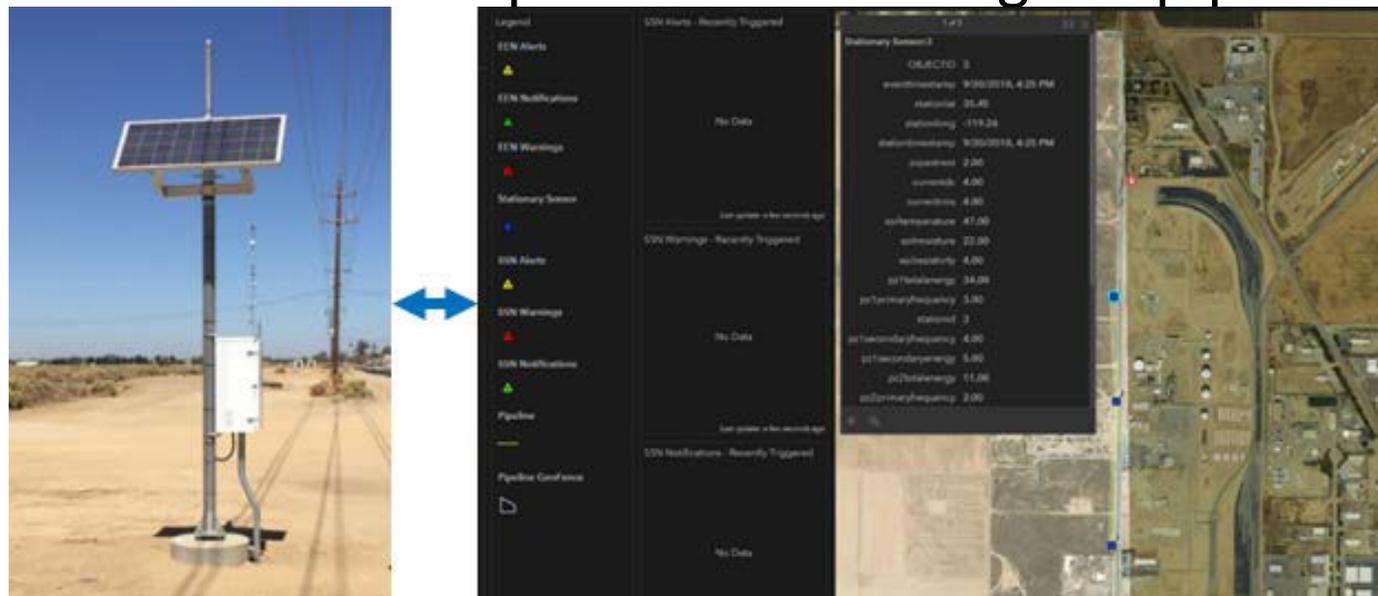
Ongoing Research

Develop and Demonstrate a Remote Multi-Sensor Platform for Right of Way Defense

Main Objective: This project will improve and deploy additional instances of a pipeline right-of-way (ROW) Monitoring System based on stationary sensors mounted on/near the pipeline. Sensor data from multiple locations along the pipe is wirelessly forwarded to a central location for processing and analytics correlate the data from multiple sensors to rapidly alert operators to events occurring in the ROW.

Results: Sept 30, 2021

PHMSA: \$439,000 + \$439,000 OTD



Submitting Research Gap Ideas

Anyone, Anywhere and Anytime via <https://primis.phmsa.dot.gov/matrix/>

PHMSA
U.S. Department of Transportation
Pipeline and Hazardous Materials
Safety Administration

Pipeline Technical Resources
[Return to Pipeline Safety Community](#)

Home	Alt MAOP	Cased Crossings and GWUT	Class Location	CRM	DIMP	GT IM	HL IM	High Volume EFV
Low Strength Pipe	LNG Facility Siting	OQ	Pipeline Construction	Public Meetings	R&D	RMWG	Underground Natural Gas Storage	

Research & Development: Identifying Pipeline Safety Research Gaps

Submit Research Gap Suggestions by [following this link](#).

R&D Menu

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1. BACKGROUND

The Department of Transportation's (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) sponsors Research & Development (R&D) projects focused on providing technological and knowledge solutions that will increase the safety and reliability of the Nation's pipelines. Historically, research gaps are identified and road mapped at public events, held periodically as funding and program actions allow. Although hundreds of attendees usually participate at each event, many stakeholders cannot attend since they either don't have the means or availability.

PHMSA is using this Special Notice to solicit research ideas on a year-round basis to reach the widest set of stakeholders and identify a larger more diverse portfolio of research. The input from this Special Notice will also generate a pool of research ideas for potential future research solicitations.

PHMSA will use submitted research gaps to formulate a research strategy for its Pipeline Safety Research Program.

2. RESEARCH PROGRAMMATIC AREAS/ELEMENTS

The Pipeline Safety Research Program organizes program planning, execution, and tracking around the following subject areas.

Threat Prevention

This area addresses excavation activity damage prevention to all pipeline types and improving sub-surface locating/mapping. Research also addresses preventing or monitoring for other threats whether they are coming from corrosion, outside force damage, etc.

Leak Detection

Research in this area addresses leak detection or monitoring on hazardous liquid and natural gas pipelines, including sub-surface, surface, and airborne-based sensors and deployment platforms. Research also addresses approaches to lessen release volumes from leak/rupture incidents.

Anomaly Detection/Characterization

This area aims to improve the capability to identify and locate critical pipeline defects, and to characterize the severity or interacting nature of such defects. Research in this area includes solutions from within or outside the pipe.

- Regulations
- Advisory Bulletins
- Interpretations

Research & Development Program
Server Version: 3.00.112 Server Time: 01/29/2020 03:04 PM UTC User: Robert Smith

Research Gap Suggestions

Pipeline Safety Gap Suggestion Form

Name of Person Submitting: Email of Person Submitting:

Email address will be used by PHMSA only for verification and follow-up purposes, and will not be released to the public or any other organization.

Stakeholder Type:
[select from choices below]

Gap/Project Title (required):

Main Objective Statement (required):

Identify Major Scope Items for Investigation:

Identify Relevant Subject Matter Experts, Stakeholders, or End User Involvement suggested in Project Scope:

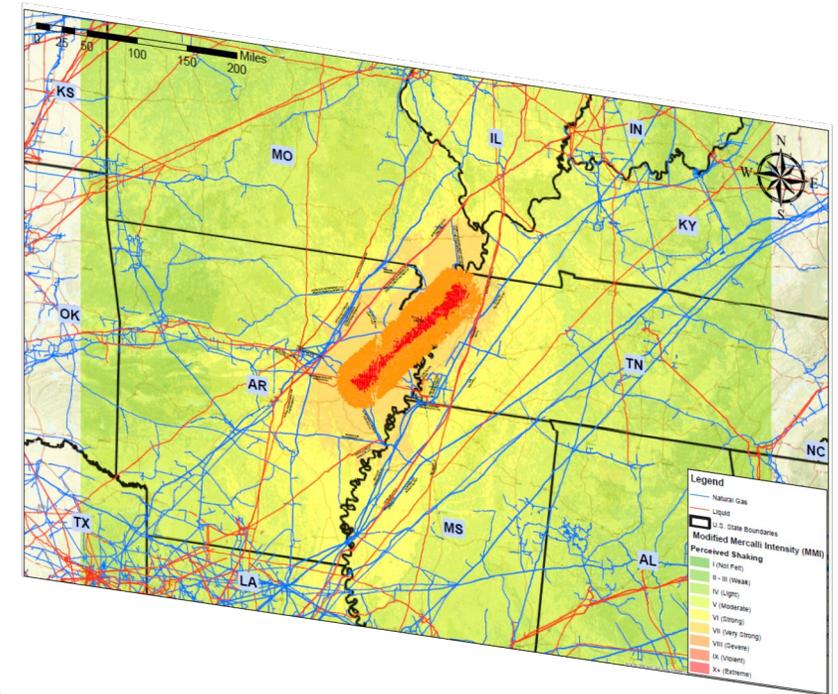
Cost Estimate: Time Estimate (months):

PHMSA Program Element:
[select from choices below]



Earthquake Research

- PHMSA is very interested in the tolerance of pipelines to survive higher magnitude earthquakes.
- PHMSA is regularly consulted on the potential impacts of major earthquakes or earthquake scenarios; such as those presented in the National Level Exercise scenarios.
- Strong interest in research of likely impacts to pipelines of different materials, diameters, and commodities



Land Subsidence Research

- PHMSA has a strong interest in remote monitoring and early warning systems to detect a pending failure due to land subsidence event. Such examples include:
 - Remote monitoring systems for land subsidence in shared right-of-way (ROW) utilizing Commercial off-the-shelf (COTS) equipment.
 - Utilization of satellite imagery to detect concerning land movement



Geomagnetic Disturbance (GMD)

- A GMD event has the possibility of affecting a pipeline Supervisory Control and Data Acquisition (SCADA) system and pipeline integrity could be compromised by ground-induced currents (GICs) caused a GMD
- In October 2013, scientists recorded a GIC of 57 amps on a natural gas pipeline in Southern Finland during a large GMD event.
- Prolonged exposure to elevated currents can lead to pipe wall steel loss under some circumstances.
- Potential impact to US pipelines is an unknown.



National Pipeline Research and Innovation Test Site

At
U.S. DOT Transportation Technology Center (TTC)
Pueblo, Colorado

CONCEPTUAL VIEW



- Additional Study Areas Identified by Industry
- Fiber optics technology
 - Pipeline material aging
 - Welds on specialty materials
 - Compressor emissions
 - Pressure cycling for fatigue
 - Physical & cyber security

Considerations for projects at TTC

- What project(s) would lend itself well to being conducted at TTC?
 - Near real-world scenarios, can't be performed elsewhere, and/or could benefit from TTC intermodal capabilities
- What are examples of challenges associated with project that would need to be addressed?
 - Confidentiality of data for some aspects, overall security
 - Equipment needs
 - Building and infrastructure needs
- Who would be good to provide input for conceptual, types of equipment, and operational needs for launching and maintaining a world class research and test facility ?
- Other considerations?



Questions?

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Thank You!/Research Contacts

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Visit us at <https://www.phmsa.dot.gov/> and search “Research”

