FINAL PROJECT SUMMARY REPORT

BUSINESS AND FIRM ADDRESS

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DOT SBIR Program

U.S. Department of Transportation/OST-R

DOT CONTRACT

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PERIOD OF PERFORMANCE

07/29/2020 – 01/26/2021

PROJECT TITLE

Managing Geohazards Quantitative Risk Assessment for Pipelines

SUMMARY OF COMPLETED PROJECT

The technical objective of this Phase I project was to **develop a detailed concept that demonstrates the feasibility of developing a probabilistic, QRA tool for estimating direct and indirect losses** due to geohazards. To accomplish this objective, AEM conducted the following tasks:

- Reviewed the current state of practice – To determine the feasibility of building a tool, it was necessary to review all relevant and useful resources pertaining to geohazard modeling, the availability of spatial and non-spatial data to support modeling, and pipeline-geohazard risk assessment methodologies. In addition, it was important to review the tools that are already available to the industry and to assess the potential market for a new tool that focuses specifically on geohazards.
- Developed tentative model framework – This task included the development of conceptual models for three representative threat-asset pairs: earthquake-landslide, precipitation-landslide, and flood-scour (pipeline stream crossing). This task also included the development of Bayesian Belief Networks (BBN) to estimate failure probability and physical models for assessing slope stability under both seismic and hydrologic loading, estimating scour depth, and consequences.

- Developed a concept of operations (CONOPS) for developing a QRA tool to assess pipeline geohazard risk – A detailed CONOPS was developed for a QRA tool based on a probabilistic framework. The CONOPS demonstrated the analysis workflow, tentative graphical user interface (GUI), and system components and proposed a web-based architecture.

- Developed a detailed, tailored marketing and outreach plan to foster public interest in a QRA tool for pipeline geohazard – Market research shows that the industry has advanced QRA tools at its disposal. However, there is a potential secondary market consisting of non-profits, educators, state and local regulators, and independent consultants who may benefit from an inexpensive, easy-to-use tool, that requires minimal inputs. The marketing plan outlines approaches to promoting the proposed tool developing a website, webinars, conference proceedings, etc.

This approach investigated the following questions to determine the feasibility of building a QRA tool for pipelines and geohazards:

- What is the taxonomy of natural hazards that comprise the category of geohazards impacting pipelines?
- How are geohazards modeled?
- What data is needed to satisfy geohazard models?
- What are the sources for pipeline centerline and natural hazard data?
- What quantitative methods have been used for assessing risk to pipelines?
- What software is available to implement probabilistic modeling?
- What are the consequences of pipeline geohazard incidents, and what are the model outputs that would be useful to potential clients.?

In short, the purpose of the Phase I investigation was to develop a blueprint for implementation of a fully functional tool in Phase II.

APPROVAL SIGNATURES

Name	Title	Date
Kelley Pecheux	Senior Director, Transportation	2/26/2021