Impactful Resilient Infrastructure Science and Engineering (IRISE)

-Project Scope of Work-

(FY 2021-22 Annual Work Program)

SUMMARY PAGE

Project Title: Development of a Regional Landslide Inventory to Advance Hazard and Risk Estimates for Southwestern Pennsylvania

Person Submitting Proposal: Daniel Bain, Eitan Shelef, Anthony Iannacchione

Proposed Funding Period: 01/01/2022 - 12/31/2023

Project Duration: 24 months

Project Cost: $344,913.20

PennDOT Work for Hire? No

Project Title: Development of a Regional Landslide Inventory to Advance Hazard and Risk Estimates for Southwestern Pennsylvania

Problem Statement: Landslides have become a major disruption to road networks and infrastructure in Southwestern Pennsylvania due to geological conditions, changes in the distribution of precipitation, and anthropogenic modifications to the landscape. Given the scale of this disruption, transportation agencies and local governments have invested significant resources in landslide repair. However, this problem cannot be examined comprehensively as information about landslides is spread across multiple government and non-government agencies and organizations. A unified inventory of landslides data that incorporates extensive geophysical information will enable interested parties access to a comprehensive and consistent set of information that can guide mitigation efforts based on the cumulative experience across the region, help identify the most important causes for slope failure and/or locations that are most likely to fail, and advance an effective proactive approach to landslide monitoring and mitigation.

Project Objectives: Produce an inventory of landslides that amalgamates data from multiple agencies in a systematic and standardized format that is designed to effectively address the data needs of the interested agencies.

Project Scope: To advance this vision, this project aims to: (1) Design a structure for a unified inventory of landslides that addresses the needs of stakeholders; (2) Initiate a data collection effort focused on historical landslide observations to establish a working database and document workflows that enable the collection, sharing, and analysis of new data across agencies; 3) Demonstrate the power of comprehensive data through evaluation of collected data. The project builds on a diverse network of stake holders, unified through IRISE, to guide the design of the data structure and to collect landslide data. The project is planned for two years, where year 1 will primarily focus on the design of the data structure based on input from stake holders and sample datasets, and year 2 will primarily center on populating the data structure with a subset of landslide information provided by stake holders for key areas.

Task Statements:

The objectives of this project will be realized through the completion of the following tasks:

Task 1: Establish working group of IRISE member representatives to advise on landslide data

Given the broad spatial scale and the complicated drivers contributing to the landslide challenges, development of an effective data resource requires consistent input from both data generators and data users. We will invite IRISE members to participate, leveraging their considerable reach into the local geophysical community to help guide the design of the dataset and the focus of data collection.

Meetings will be held approximately monthly to bimonthly for the entire project period. In general, during these meetings the project team will report on progress and emerging challenges. Substantial time will be allotted to solicit input from the working group through structured discussion.

Fundamentally these meetings will be a primary communication tool. For example, while we are planning to minimize impact on data partners during the data gathering process, these meetings will offer regular opportunities to ensure these plans are realized and to develop effective ways to gather data while minimizing this impact on partners. Further, these meetings will ensure the organized data is collected in manner that maximizes usefulness for the data partners and is compatible with existing data structures used by the partners.

Task 2: Iteratively identify Southwestern Pennsylvania landslide data sources

The research will catalog existing landslide data sources and data categories, focusing first on known data sets compiled by IRISE members in selected focus areas and then potentially broadening the search through the working group and professional networks.

Efforts during this project will focus on historical data, particularly historical data sources with extensive geophysical information, and identification of focus areas and datasets will be guided by the working group. Preliminary plans include a focus on data available in as-built drawings and landslide repair reports. We will pursue a wide variety of additional information on locations of slope failures to help design and guide the dataset querying capabilities.

Data sources and availability will be consistently updated by input from the working group members.

Task 3: Field Visits to Gather Data

We will conduct field visits to relevant agencies to examine and prioritize data for collection, a fundamental part of data gathering. These visits will be made in careful coordination with agency personnel and likely will not begin until COVID mitigation measures have eased.

In addition, field visits will be made to a subset of landslide locations to observe actual field conditions and clarify understanding of the underlying data. Ideally these field visits will occur in conjunction with personnel from the IRISE member organizations.

These visits will be planned on an as needed basis but likely will not exceed a frequency greater than monthly and likely will occur predominantly in the first eighteen months of the project.

Task 4: Data Organization and Database Development

With data in hand, the organization and formalization of a database structure that can be utilized in any database management software will begin. This process will again be repeatedly vetted with the working group to ensure proper interpretation of the data, ease in data translation/storage/querying/analysis, and the comprehensiveness of data stored. The input of the

working group (task 1) will be essential for this task as it will ensure that the data structure accounts for the potentially different data types and needs of different agencies.

Fundamental best practice will be followed in the creation of the data structure. Further, the data structure will be designed to enable data producers to add and maintain data after the project period, including facilitating incorporation into geographic information systems. However, a polished interface is beyond the scope of this work.

The data will be housed with IRISE and no sharing of data beyond the data contributors will occur without explicit permission to share. This project will not create data packaged for public distribution nor will the data be hosted in a publicly available location. The procedure for maintenance and update of the dataset beyond the project duration is beyond the scope of this project, but it will benefit from recommendation and procedures developed throughout this project.

Task 5: Draft Final Report

A draft final report will be prepared to document project activities, findings, and recommendations. The final report may include recommendations for implementation, update, and maintenance of the data management structures developed in this study. This report will include a draft data structure populated with data gathered during the project and recommendations regarding future development of the proposed structure.

Task 6: Final Report

A Final Report taking into consideration comments that were received on the Draft Final Report will be prepared.

Deliverables:

The following deliverables will be provided based on completion of the above tasks:

- *Deliverable #1* – Minutes from the Working Group meetings will be shared with IRISE leadership following each meeting.
- *Deliverable #2* – A memo documenting a comprehensive list of regional data available will be submitted to IRISE within 15 months from notice to proceed.
- *Deliverable #3* – Field visit activities will be documented in the Working Group minutes as part of visit coordination and data interpretation discussions.
- *Deliverable #4* – A memo report summarizing draft data structures will be submitted within 18 months from notice to proceed.
- *Deliverable #5* – A draft final report, submitted within 23 months from notice to proceed.
- *Deliverable #6* – Final report, submitted within 24 months from notice to proceed.

Key Personnel:

Principal Investigator: Daniel J. Bain

Other Key Staff: Eitan Shelef, Anthony Iannacchione

Other Personnel:

Three students will contribute to the successful completion of this research effort :
Grad Assistant 1 (TBN)
Grad Assistant 2 (TBN)
Undergraduate student (TBN)

Proposed Person-Hours by Task:

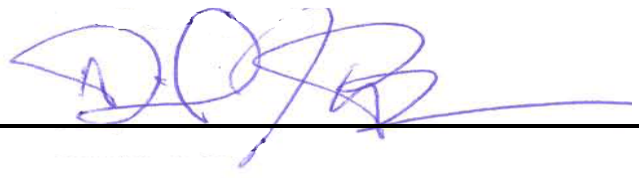
Team Member	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Total
Dr. Daniel Bain, PI	48	50	80	80	48	40	346
Dr. Eitan Shelef	48	50	80	80	48	40	346
Dr. Anthony Iannacchione	48	50	55	80	20	20	273
TBD, Grad Student 1	48	300	600	600	120	90	1758
TBD, Grad Student 2	48	300	600	600	120	90	1758
TBD, Hourly Student	8	92	150	150	0	0	400
Total	248	842	1565	1590	365	280	4881

Schedule:

Task	Y1Q1	Y1Q2	Y1Q3	Y1Q4	Y2Q1	Y2Q2	Y2Q3	Y2Q4
1) Establish working group and convene monthly meetings								
2) Iteratively identify data sources								
3) Gather Data -- Field Visits								
4) Data Organization/Database Development								
5) Draft Report/Draft Database								
6) Final Report								

Budget: The total project cost is $344,913.20.

A**cknowledged By:**



Dan Bain

Principal Investigator