



RESEARCH NEED STATEMENT

Call for Projects 2015

Project Research Title: New Spectrum Matching Procedures for the Central United States

TDOT Sponsor Director: Wayne Seger - Structures, Brian Egan - Materials and Tests

List TDOT Research Team Lead: Tim Huff

List TDOT Research Team Members: Wayne Seger, Houston Walker, Tim Huff, Robert Jowers

1. Define the problem or research requested. What is the goal/objective of the research?

Improve site-specific seismic loading definition in West TN, where little strong motion data of significance is available. The objective of this research is to develop a new frequency-domain spectrum matching using recordings of small earthquake by generating broadband seismograms for large magnitudes target earthquake in West TN.

2. Is this research a continuation of a past or present project?

☒ No ☐ Yes

If yes, provide current research project title, RES # and reason for the project continuation.

3. Describe anticipated benefits/expected deliverables.

Currently, there are limited moderate and large ground motions in Central United States. This reserch will be another step towards application of a new frequency-domain spectrum matching process to develop a suit of accelration time histories whose characteristics will represent the ground motions expected for the sites in West TN . Frequency-domain spectrum-matching software which could generate matched time histories would be the deliverable, along with a report and user's manual.

4. What is your timeline for completion of the research?

2 years

5. List the anticipated tasks for this research.

- a. Develop low-frequency simulated ground motions
- b. Develop broadband ground-motions time histories for CEUS using small event earthquakes.
- c. Generation of realistic acceleration time histories for large-magnitude events appropriate for West TN.
- d. Process the generated acceleration time histories for the target earthquakes with moment magnitudes ranging from 5.5 to 8.0 located at distances up to 1000 km from earthquake.

- e. Develop a new spectrum-matching in frequency domain for West TN.
- f. Comparison of the new spectrum-matching procedure with other spectrum-matching processes.
- 6. Describe how the project results will be implemented?

Contractors will be working with TDOT engineers closely with all aspects of this research.

7. Will this study produce software, web page or other technology that will involve the Information Technology Division?

☐ No ☒ Yes, please describe:

Software will be developed in Microsoft Excel and Matlab environment.

8. Will training be provided to employees as a result of this research?

☐ No ☒ Yes, please describe:

A two day seminar will be provided which all aspects of the procedure will be discussed.

9. Will this research involve equipment or materials purchase?

☒ No ☐ Yes, please describe:

10. Research must support the Long Range Transportation Plan Policy Recommendations **and/or** TDOT Operational Goals and/or Strategic Initiative. (*See attachments for additional information*)

Please indicate which categories the research will support:

Transportation Long Range Plan Policy Recommendations

☒ (A) Accessibility

☒ (B) Safety, Security, and Transportation Resilience

☐ (C) Coordination, Cooperation, and Consultation

☐ (D) Demographic and Employment Changes and Trends

- ☐ (E) Freight Logistics and Planning
- ☐ (F) Financial
- ☐ (G) Mobility
- ☐ (H) Travel Trends and System Performance

TDOT Operational Goals and/or Strategic Initiative

- ☐ (A) Deliver transportation projects on schedule and within budget
- ☒ (B) Maintain the state transportation system to protect the long term investment in our infrastructure assets
- ☒ (C) Operate and manage Tennessee's transportation system to provide a high level of safety and service to our customers and workers
- ☐ (D) Expanding mobility choices to maximize access
- ☐ (E) Dramatically change the paradigm for delivery of transportation products and service to improve the efficiency and effectiveness of Tennessee's transportation network

11. Please explain how the research supports the Long Range Transportation Plan Policy Recommendations **and/or** TDOT Operational Goals and/or Strategic Initiative selected above:

The new software and spectrum matching procedure will advance the state of knowledge regarding the effects of deep soil deposits on ground motion during earthquakes in the Mississippi Embayment and will impact the design of bridge structures for seismic considerations in West TN. The deep soil deposits are not precisely accounted for in the current AASHTO design specifications and site specific studies in West TN are warranted. The software would enable more meaningful and accurate site specific studies.

For additional information, please contact:

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