

Spatial Analysis of Benefits of Site Specific Ground Motion Response Analysis



Investigating spatial analysis of site-specific ground motion response analysis to determine cost savings in bridge construction in Arkansas

The purpose of this study is to develop a decision tree or a GIS map that can be used by the Arkansas Department of Transportation (ArDOT) to determine when site-specific ground motion response analysis (SSGMRA) should be conducted and possible cost savings. A cost-benefit analysis will be performed at the end of the project to determine the cost saving based on the type, size, and the location of the bridge. To achieve this goal, researchers will build on the existing work and obtaining shear-wave velocity (V_s) profiles for 20 sites, in addition to 15 sites previously surveyed in earlier ArDOT projects.

For all sites that have been surveyed through previous studies and those sites that will be investigated as part of this project, comprehensive site-specific analyses will be performed. To be able to perform a comprehensive site-specific hazard analysis, one must have expertise in probabilistic seismic hazard, be able to characterize seismic sources and ground motion that incorporate current scientific knowledge; incorporation of uncertainty in seismic source models, ground motion models, and parameter values used in the analysis.

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Background

Figure 1 shows a map of Arkansas' six major natural geographic divisions: (1) Ozark Mountains, Arkansas Valley, Ouachita Mountains, West Gulf Coastal Plain, Mississippi Alluvial Plain, and Crowley's Ridge. Using this map and with collaboration with ArDOT, we will select 20 sites that will be geographically distributed among these six major geographic divisions. These 20 sites will be in addition to the 15 sites surveyed through a previous project. The goal is to have a geographically distributed set of sites to provide a good basis for developing a geo-statistical map that was initially created under a previous project. In addition, we have 15 sites where we performed MultiChannel Analysis of Surface Wave (MASW) that will be added to our database.

Project Summary

ArDOT will be provided with a detailed shear-wave velocity profile at 20 sites distributed geographically with the state of Arkansas. Hazard maps will be developed at the ground surface. A set of guidelines will be provided to ArDOT to be used to assess the qualification of hazard analysts as well as requirements needed for an analyst to perform a successful SSGMRA.

Status Update

This project started late in August 2018. The research team had a kick-off meeting with the ArDOT Research Panel to review the scope of the project. The team is currently working on gathering pertinent information on selecting bore log sites that can be used for analysis. Figure 2 shows a typical dispersion curve obtained by performing seismic survey.

Also, the team is in process of obtaining a copy of the TRC 1603 report to get a better understanding of its contents. A graduate student has been hired and trained to conduct this study.

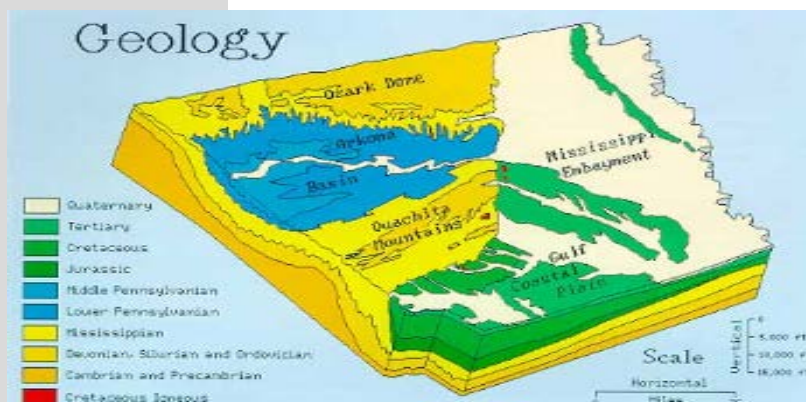


Figure 1. Map of Arkansas including its six major natural geographic divisions.

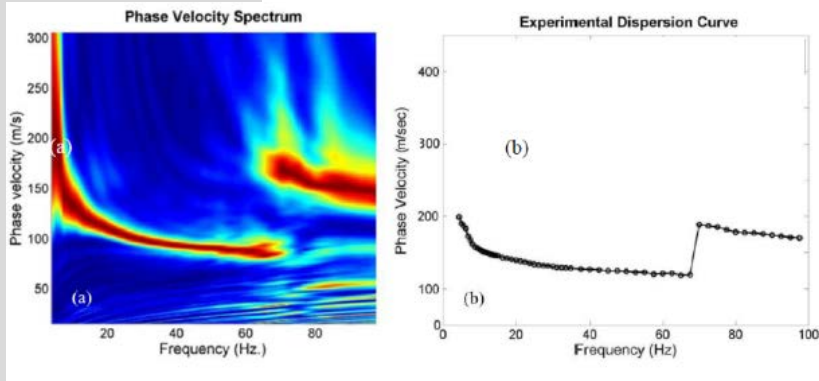


Figure 2. Phase velocity dispersion curve.

Impacts

The developed hazard maps will provide ArDOT engineers with an important tool to determine when and where they need to perform SGMRA to reduce seismic demands or to obtain better data.

Tran-SET

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