

ABSTRACT

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Title: Simplified Assessment Procedure to Determine the Seismic Vulnerability of Reinforced Concrete Bridges in Indiana

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The possibility of earthquakes in Indiana due to the presence of the New Madrid Seismic Zone has been known for over two centuries. However, the recent identification of the Wabash Valley Seismic Zone has increased our understanding of the seismic hazard in the state of Indiana. Due to this awareness of the increased potential for earthquakes, specifically in the Vincennes District, the seismic vulnerability of Indiana's bridge network must be assessed. As such, the objective of this thesis is to develop a simplified assessment procedure that can be used to conduct a state-wide seismic vulnerability assessment of reinforced concrete bridges in Indiana.

Across the state, variability in substructure type and seismic hazard level influences the vulnerability of bridges. To fully understand the impact of this variation, a detailed assessment is completed on a representative sample. Twenty-five reinforced concrete bridges are selected and analyzed using information from the bridge drawings and a finite element analysis procedure. These bridges are analyzed using synthetic ground motions representative of the hazard level in Indiana. The results of the detailed analysis are used to develop a simplified assessment procedure that uses information that is only available in BIAS or can be added to BIAS. At this time, BIAS does not contain all the necessary information required for accurate estimates of dynamic properties, thus, certain assumptions are made. Several candidate models are developed by incrementally increasing the level of information proposed to be added into BIAS. The simplified assessment is then validated through a comparison with the detailed analysis.

Through the development of the simplified assessment procedure, it is determined that the minimum data item which must be added to BIAS complete the assessment is the substructure type. Additionally, by increasing the level of information available in BIAS, the agreement between the results of the simplified assessment and the detailed assessment is improved.