

## **Preserving Urban History from Earthquake Hazards: The Role of Base Isolation Systems**

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The United States Geological Survey has eleven years of data showing that there has been an upward trend in the number of major earthquakes occurring worldwide. Damages sustained by historical structures through seismic event can, in many cases, be irreversible. Loss of these structures is devastating as they are a major component of a city's historic fabric and heritage. Thus, preservation of such structures is deemed important to retain the historic character of such cities. Seismic base isolation, one of the advanced forms of retrofit, is becoming more common in new constructions and has been utilized in some historic structures as the method does not interfere with the interior fabric or exterior appearance of a structure. We will discuss the competence of three types of seismic base isolation systems that are commonly used today. A four-story historic building has been used as a case study to analyze and evaluate the performance of high damping rubber bearings, lead-plug bearings, and friction pendulum bearings in extreme earthquake events. The selected historic structure has been modeled and analyzed using a nonlinear structural analysis program to identify the structural response due to earthquake time histories. These responses together with the gravity load response have been utilized in the design of the above three types of base isolators. These composite isolators are then modeled in using a finite element analysis program and further analyzed to evaluate their nonlinear material response. The conclusions are drawn based on the level of performance of each isolator in withstanding gravity and earthquake loads. New conceptual systems or combinations of the analyzed base isolations will be proposed based on the results of this research.

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