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Uncertainty and Soil-Structure Interaction Effects on the Seismic Response Evaluations of Base Isolated Bridge Structures

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1. Introduction

Uncertainty and soil-structure interaction effects on the seismic response evaluations of base isolated bridge structure systems for the earthquake-proof design are examined in this study.

Chapter 1 describes the background and objective of this study on the uncertainties and soil-structure interaction effects on the seismic responses evaluation of the base isolated bridge structure systems, and reviews on some papers concerning with the base isolation system and the seismic responses evaluation of the base isolated bridge system.

2. Results and Discussions

Chapter 2 describes the uncertain parameters effects on the maximum responses of the four degrees of isolated bridge with different pier properties are evaluated using the Monte Carlo Simulation Method (MCSM). The uncertain parameter (such as natural frequency, yield displacement, yield stiffness, damping factor and seismic force) effects are evaluated with the MCSM to clarify the maximum response characteristics of the base isolated bridge. The MCSM gives effective tools on evaluating the stochastic characteristics of the nonlinear dynamic structure. Furthermore, the reliability of the base isolated bridge structure by means of results of Monte Carlo Simulation is examined. It is shown that the uncertain parameters provide significant roles on the maximum response evaluations for the nonlinear dynamic responses.

Chapter 3 also describes the uncertain parameter effects on the maximum responses of the multi-span continuous isolated bridge with different pier height are evaluated using the MCSM. For the examination of the more exact evaluation on the base isolated structure system, it is represented with an idealized framed structure model with the finite element method. The finite element model of isolated bridge are available to determine more specific evaluations of the uncertain parameter effects on the maximum responses of the multi span continuous isolated bridge with different pier heights. It is shown that the uncertainty effects on the base isolated bridge structure can be evaluated with the safety factors by means of the results from the MCSM.

Chapter 4 discusses the soil-structure interaction effects on the responses of the base isolated bridge system are examined with the 4 degrees of the base isolated bridge to the different type of seismic motions. For the simplified model of the base isolated bridge, the soil structure interaction is represented with the sway-rocking model and the nonlinear characteristic on the pier are dealt with the *Takeda* model. It is shown that the soil structure interaction gives significant effects on the response evaluation of the base isolated bridge to the second type of seismic motion.

Furthermore, it is also essential to clarify the relation between the dominant frequency of the soil-structure interaction system and the seismic input motion. Finally, the energy absorption of the isolator and pier for the base isolated bridge structure are examined on the nonlinear pier response situations under soil-structure-interactions. It is shown that the soil-structure interaction has important contributions on the hysteretic energy evaluations of the base isolated bridge structure to the second type of ground seismic motion.

3. Conclusions

For the reliable design of the structure with base isolation system, it is important to clarify the soil-structure interaction effects due to various seismic motion..

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