Seismic performance of bridge with isolation bearings

Kyoung-Bong Han
Research Professor
Sungkyunkwan University
Suwon, Republic of Korea
pcster@skku.edu

Sun-Kyu Park
Professor
Sungkyunkwan University
Suwon, Republic of Korea
skpark@skku.edu

Kwang-Soo Kim
Research Professor
Sungkyunkwan University
Suwon, Republic of Korea
whitesky@skku.edu

Tae-Wan Kim
Research Professor
Sungkyunkwan University
Suwon, Republic of Korea
tk776@skku.edu

Young-Jae Lee
Professor
Sangju National University
Sangju, Republic of Korea
yjlee@sangju.ac.kr

Summary

An accurate evaluation of seismic performance of bridges in service is important for bridges built with old design standards. If the performance does not meet the design requirements in current standards, seismic retrofit is required. Among various retrofit methods, seismic isolation may be a simple but useful method for practical applications.

In this study, the effectiveness of seismic isolation is rationally verified. For this purpose, two seismic isolations used widely are selected and non-linear static and dynamic analyses are performed. The responses of existing bridges are compared with those of retrofitted bridges by seismic isolation bridge for earthquake of target level, and seismic performances are evaluated.

The results showed that base isolation system was very effective in reducing the magnitude of the forces transferred to the substructure and shifting the period of the bridge. LRB(Lead Rubber Bearing) system can reduce effectively the peak acceleration transmitted to the structure more than those with RB(Rubber Bearing) system under earthquake excitations. Using the results, proposed seismic retrofit method was found to be valid.

Keywords: seismic performance; seismic retrofit; seismic isolation; non-linear; dynamic analyses; existing bridges.

1. Introduction

Most of existing bridges already display developed agedness and their seismic performance in case of potential earthquakes are being questioned. Bridges that do not satisfy standard seismic performance level need installations of effective seismic retrofit, and the most popular methods would include retrofit bridge bearings, piers and abutments, foundations and underlying soil, and using seismic isolation bearings.

Particularly, the seismic isolation bearings are recommended not only for the seismic design of newly constructed bridges, but also for the seismic retrofits of existing bridges, and are increasingly being applied to constructions. The method of using the seismic isolation bearings can improve the seismic performance without retrofit existing piers or foundations by reducing the inertia force generated in case of earthquakes. In particular, it minimizes extra construction expenses because it utilizes the seismic isolation bearings to replace the aged bridge bearings. As the necessity of seismic isolation bearings are being recognized and its construction cases are being increased, the process of accurately inspecting its capacity of seismic performance improvement is required. The inspection process of the performance of seismic isolation bearings is important as it tests whether it actually accomplishes the aimed level of seismic performance of the seismically reinforced bridges.

This paper inspects the improvement of the bridge's seismic performance when the seismic isolation bearing is applied, through an analysis method. For this purpose, two types of most popularly applied seismic isolation bearings were selected and actually applied to a non-seismically constructed existing bridge. The static and dynamic non-linear analysis had been implemented to

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