Capacity Spectrum Analysis for the Seismic Performance of RC Bridge Piers in terms of Ductility Parameters

Young Soo Chung
Professor, Civil Engineering
Chung-Ang University.
Ansung, Korea
chung47@cau.ac.kr

Young Soo Chung received his Ph.D degree from Columbia University in the city of New York, USA.

Dae Hyoung Lee
Professor, Civil Engineering
GyeongBuk Provincial College.
Kyung Sang Buk do, Korea
dhlee@gpc.ac.kr

Dae Hyung Lee received his Ph.D degree from Chung-Ang University, Korea

Dong Wook Yang
Grad. Student, Civil Engr.
Chung-Ang Univ., Seoul, Korea
yang4ever@hanmail.net

Dong Wook Yang born on 1981, received his M.S. degree from Chung-Ang university, Korea

Yeon Hun Lee
Grad. Student, Civil Engr.
Chung-Ang Univ.
Seoul, Korea
Yeonhuny1@lycos.co.kr

Yeon Hun Lee born on 1984 received his B.S. degree from Chung-Ang University, Korea

Summary

The recent developments in performance-based guidelines were triggered by the necessity to develop assessment criteria for existing structures. Thus, safety assessment of such structures necessitated the commitment to various hazards level and performance objectives. Near fault ground motion (NFGM) is a single long period velocity pulse of large magnitude. These earthquakes have caused severe and impulsive damage on various infrastructures when the epicenter is close to the urban area. These characteristics are unique compared to the far-fault ground motion (FFGM), upon which nearly seismic design criteria are based. The objective of this study is to explore the shaking responses of reinforced concrete bridge piers and to assess their seismic safety using the capacity spectrum analysis. The seismic performance of two RC bridge piers under NFGM's and FFGM's was investigated on the shake table. In addition, comparative tests were made for RC bridge piers subjected to Pseudo-dynamic loadings and Quasi-Static loadings. Test results showed that NFGM generally induced worse seismic performance than FFGM.

Keywords: Near fault ground motion, Far fault ground motion, Shake table, Pseudo-dynamic, Quasi-Static, Capacity spectrum analysis

1. Introduction

The recent earthquakes have caused extensive damage to highway bridge structures due to near-fault ground motions. Even though Korean peninsula is located far from the active fault, it has been increased number of low or moderate earthquakes in Korea. The objective of this research is to evaluate the effect of different ground motion characteristics, near-fault ground motions(NFGM) and far-fault ground motions(FFGM), on the seismic performance of RC bridge piers with lap-spliced longitudinal rebars and various confinement steel ratios. Eight RC bridge columns were investigated under various test method such as shaking table test, Quasi-static test, and Pseudo dynamic test. Test result showed that 1) RC specimens under the shake table test failed at relatively low displacement ductility compared to that of RC bridge piers subjected to the quasi-static test, 2) large residual displacement was observed under impulsive near-fault ground motions, and 3) RC

https://doi.org/10.2749/222137810796063526