E07

Assessment of a Multi-span Reinforced Concrete Bridge in the Low Seismicity Area under Two Earthquake Levels

〇Sherliza ZAINI SOORIA, Yoshikazu TAKAHASHI

1.0 Introduction

As part of an earthquake mitigation strategy, seismic assessment of existing structures is becoming increasingly popular in the low seismicity region. Following into that step, this study aims to assess the seismic performance of a reinforced concrete bridge in Malaysia under two levels of ground motion.

2.0 The Bridge Structure

The bridge was modeled as a multiple degree of freedom (MDOF) system and dynamic analysis was performed in OpenSees (OpenSees 2000; Fenves *et al.* 2006) version 2.2.0. All structural elements were idealized by elastic elements, except for columns, which were modeled as nonlinear fibre elements.

3.0 Input Ground Motion

The structure was excited in the longitudinal and transverse directions using two earthquake levels, namely the level 1 and level 2 earthquakes. In this study, level 1 earthquake was represented by the 1995 Kobe ground motion (PGA=0.8g), while the long distance, March 28, 2005 Sumatera input motion (PGA=0.2g) represented level 2 earthquake.

4.0 Results and Discussion

4.1 Response to the 1995 Kobe input motion

The bridge system experienced a maximum displacement of 240 mm in fixed piers, while free piers were displaced by a maximum of 120 mm. Simulation demonstrated that under large magnitude earthquakes, the bridge would go into nonlinear behavior, and stiffness reduced, as shown by plots of hysteresis.

4.2 Response to the Sumatera input motion

Dynamic analysis using the Sumatera ground motion showed that the bridge experienced very small displacement, a maximum of 0.6 mm. Hysteresis loops indicated linear behavior in all piers during the excitation.

5.0 Conclusion

The bridge is likely to suffer considerable damage when excited by large earthquakes such as the 1995 Kobe earthquake. However, very small, if any, damage is expected to be observed in the structure when subjected to small earthquakes. Nevertheless, further probe into the response spectrum of the Sumatera input motion indicated that structures with natural period between 1.5 to 3.0 seconds are expected to experience larger displacement when subjected to the Sumatera input motion.

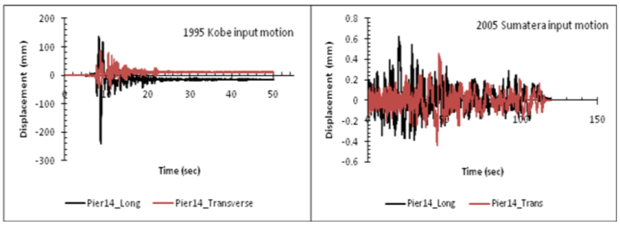

Figure 1. Displacement response to ground motions

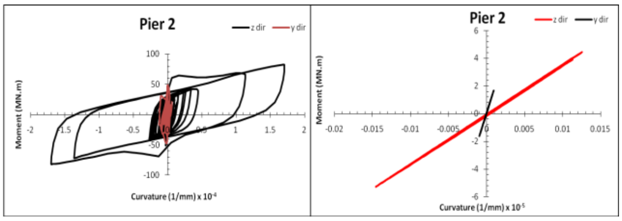

Figure 2. Nonlinear response in pier when subjected to large earthquake (left), and linear response of pier under small input motion (right)