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# SEISMIC BEHAVIOR OF CURVED BRIDGE SUBJECTED TO NEAR-FAULT GROUND MOTIONS

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## *Abstract*

The 2016 Kumamoto Earthquake occurred in central Kyushu, Japan, on April 14th with Mw 6.2 followed by the Mw 7.0 mainshock on April 16th. These earthquakes were mainly caused by the Futagawa fault and Hinagu fault where surface ruptures extended about 34 km long. Some of the bridges located in mountain area and close to the fault were damaged due to these near-fault earthquakes. Oginosaka Bridge is one of the damaged bridges and is a horizontally curved bridge with longitudinal and transverse slope, which is a feature of the bridges located in mountain area. The superstructure was rotated on plane and displaced transversely at both abutments to the opposite side, and there was an evidence of the deck-abutment pounding in longitudinal direction.

In order to investigate the seismic behavior of the curved bridge, nonlinear analyses including a deck-abutment pounding interaction were carried out. The deck-abutment pounding interaction considered in the analyses could capture the post-impact response of the superstructure observed in the field survey. The near-fault ground motions were used for the analyses. The analytical results showed that the curved bridge is susceptible to the deck rotation caused by pounding in longitudinal direction at the deck end under earthquake loading.

*Keywords: Curved Bridge, Near-fault Earthquake, Seismic Behavior, Nonlinear time history analyses*

## 1. Introduction

The 2016 Kumamoto Earthquake occurred in central Kyushu, Japan, on April 14th with Mw 6.2 followed by the Mw 7.0 mainshock on April 16th. These earthquakes were mainly caused by the Futagawa fault and Hinagu fault where surface ruptures extended about 34 km long. Some of the bridges located in mountain area and close to the fault were damaged due to these near-field earthquakes. Oginosaka Bridge is one of the damaged bridges and is a horizontally curved bridge with longitudinal and transverse slope, which is a feature of the bridges located in mountain area [1]. The superstructure was rotated on plane and displaced transversely at both abutments to the opposite side, and there was an evidence of the deck-abutment pounding in longitudinal direction.

The rotation of the horizontally curved earthquake has been also observed in the previous earthquakes. Therefore, in order to investigate the seismic behavior of the curved bridge, nonlinear time-history analyses including a deck-abutment pounding interaction were carried out. The deck-abutment pounding interaction considered in the analyses could capture the post-impact response of the superstructure. To examine the bridge located in mountain area like Oginosaka Bridge in Kumamoto Earthquake, the near-field ground motions were used for the analyses.

## 2. Summary

Nonlinear time-history analyses were carried out in order to investigate the seismic behavior of the curved bridge. The analytical model is shown in Fig. 1. A deck-abutment pounding interaction was considered in the analyses to investigate the post-impact response of the superstructure. The near-field ground motions in the 2016 Kumamoto Earthquake and 1995 Kobe Earthquake were used for the analyses.

This research investigated the seismic behavior, especially rotational behavior, of the curved bridge by nonlinear analyses including a deck-abutment pounding interaction. The analytical results showed that the curved bridge is susceptible to the deck rotation caused by pounding in longitudinal direction at the deck end under strong earthquake loading.

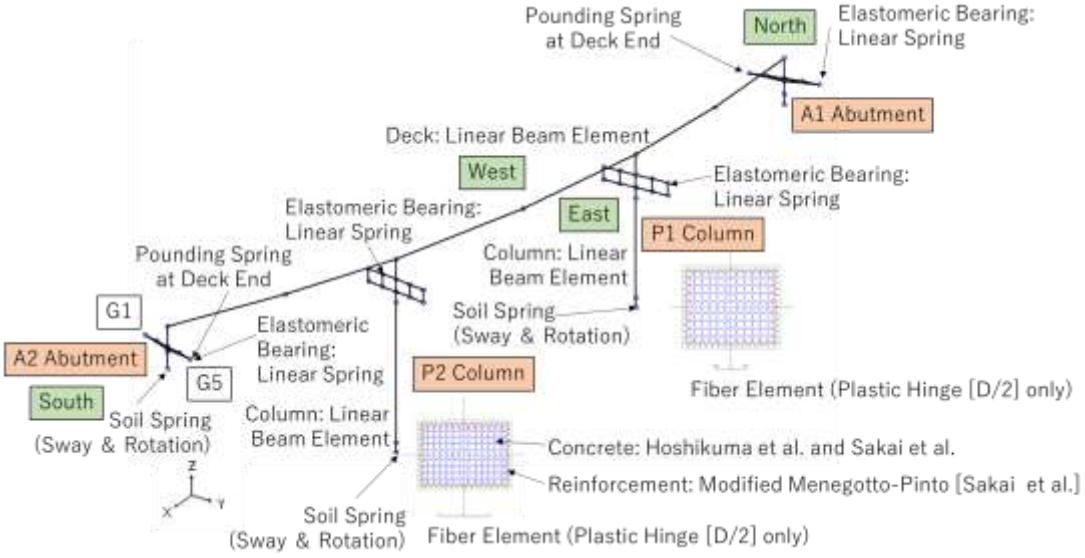


Fig. 1 – Analytical model

## 3. References

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