Analytical Study on Connection Part Modelling Method of Dissipation Device Installed in Oblique Direction on I-Girder Bridge

Joon-Ho CHOI
Assistant Professor
Kyushu University
Fukuoka, Japan
choi@doc.kyushu-u.ac.jp

Joon-Ho CHOI, born 1976, received his civil engineering doctoral degree from the Kyushu University, Japan. He is specialized in seismic bridge design using isolation devices.

Koichi HOZOJI
Graduate Student
Kyushu University
Fukuoka, Japan
houzouji@doc.kyushu-u.ac.jp

Koichi HOZOJI, born 1989, received his bachelor degree from the Kyushu University, Japan. He is in graduate school of civil engineering in the Kyushu University.

Hitoshi YATSUMOTO
Chief
Hanshin Expressway Company Limited,
Osaka, Japan
hitoshi-yatsumoto@hanshin-exp.co.jp

Hitoshi YATSUMOTO, born 1976, received his civil engineering master's degree from the Kyoto University, Japan.

Summary

In this study, in order to clarify the influence of connection part modelling method of dissipation device installed in oblique direction on an I-girder bridge, case studies using time series analysis with material nonlinearity were conducted. Here in, fixed connected models and pin connected models in between dissipation devices and bridge members were analysed respectively in a few models varied with the installing angle of dissipation device. The parametric analyses were conducted by inputting single earthquake wave in longitudinal direction and vertical direction respectively. From the time series analyses, it was identified that the connection parts modelling of dissipation device contribute little to the response of the dissipation device and it has the influence on the vertical and longitudinal displacement at girder.

Keywords: bridge structure, dissipation device, seismic retrofit, dynamic analysis, modelling method, installation direction

1. Introduction

To make existing bridges more resistant to seismic activity, recently, seismic retrofit method using dissipation devices is being developed. However, detailed design method and specification for applying the dissipation device has not been established, because there are few the previous studies for the dissipation device. Consequently, we have been researched on the efficiency evaluation method and the modelling method of dissipation device based on experiments and analyses. For instance, dynamic response characteristics of dissipation devices by shaking table tests, mathematical modelling method for them based on those tests results and the influence of performance variation of dissipation device on the seismic response of bridge structure by parametric simulation analyses have been identified by Public Works Research Institute and J-H.CHOI et al. [1, 2].

In equipping bridge structure with dissipation device, connection parts were designed skilfully in order to transfer the inertial force of structure by earthquake to the dissipation device. In case of installing cylinder type dissipation device, generally, it is connected to bridge structure with clevis type pin at both ends of the dissipation device. In simulation analysis for seismic design using this cylinder type dissipation device in bridge structure, in general, dissipation device is simply modelled by adopting like a spring member with nonlinear characteristic in which bearing support located as shown in Fig 3. Although this modelling method has the advantage which simply modelling is possible, behavior of the dissipation device could not be evaluated precisely because connection part of the dissipation device is not modelled accurately. Especially, in the case of dissipation device installed in oblique direction on bridge as shown in Photo 1, the influence connection part of the dissipation device on the behavior of the dissipation device and the seismic responses of bridge structure could be larger than the case installed in parallel.

In this study, in order to clarify the influence of connection part modelling method of dissipation device installed in oblique direction on an I-girder bridge, case studies using time series analysis

https://doi.org/10.2749/222137814814028205