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Test and Numerical Study on the Seismic Performance of A Cable Restrainer for Girder Bridges

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1 Abstract

In China, most of the support systems applied by short/medium span bridges are elastomeric pad bearings (EPBs). This type of support system has no reliable connections between bearings and girders as well as bearings and piers, which will cause structural damages due to large lateral displacement of bearings under earthquakes. The restrainers used currently could restrict the deformation of bridges under normal service conditions and could only restrict unidirectional displacement. Considering the disadvantages of these restrainers, a new restrainer called Connected Cable Restrainer (CCR), which can be used in short/medium span bridges supported by EPBs, is developed in this paper. The design principle, basic configuration, isolation mechanism and the design method of CCR are introduced. A pseudo static test to study the seismic performance of CCR is conducted. Seismic responses of a 3-span continuous girder bridge with CCR are simulated using OpenSees platform and parametric analyses of the two main parameters, lateral restraining displacement and restraining stiffness, are also carried out. Results show that the deformation of bridges under normal service conditions would not be restrained using CCR and the displacement responses can be mitigated effectively by using CCR through parameter optimization.

Keywords: bridge restrainers; Connected Cable Restrainer; pseudo static test; seismic analyses; parametric analyses

2 Introduction

Shot/medium span bridges, with elastomeric pad bearings (EPBs) as their support systems, are extensively constructed all over the world due to their convenient construction. Bearings of these bridges are simply placed between girders and piers with no bonding at the contact surfaces. However, such simplified installation style can produce large lateral displacements during earthquakes, which will lead to structural damages such as the collapse of bridges and the pounding between adjacent girders.

Since the San Fernando earthquake in 1971, restrainers have been generally used in highway

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