Experimental Study of the Post-Tensioned Prefabricated Retaining Blocks with Mortise-Tenon Joint

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Abstract

Conventional sacrificial shear keys in both bridge abutments and pier cap beams have been proved to be helpful to limit the over displacement of the superstructure under the designed earthquake event. However, the advantage of the sacrificial shear keys depends on the severe damage of the shear key itself or the stem wall, which would completely break off the mechanical connection between one concrete component and another. In addition, it is time-consuming and costly to repair and reinforce the conventional shear keys once it is severely damaged in huge earthquake event. Therefore, this paper proposed a novel post-tensioned prefabricated concrete retaining block with mortise-tenon joint. Four retaining block specimens were designed and tested to study its anti-seismic effectiveness and basic mechanical properties. The influence of the structural material and forms on seismic damage mode of the proposed retaining blocks were investigated.

Keywords: bridge; retaining block; post-tensioned; mortise-tenon joint; test; UHPC.

1 Introduction

Conventional sacrificial shear keys in both bridge abutments and pier cap beams have been proved to be helpful to limit the over displacements of the superstructure under the designed earthquake event. Meanwhile, they also can be used as a seismic fuse to protect the bridge abutments or piers from severe damage in potential huge earthquake event[1, 2]. Therefore, these sacrificial shear keys have been used widely around the world. In order to better understand and predict the seismic behavior of the sacrificial concrete shear keys in actual earthquake, lots of researchers have studied the seismic performance of this shear key. These researches have investigated the seismic failure modes and shear strength of different concrete shear keys by conducting a series of laboratory tests, which have enriched the knowledge of seismic behavior for the concrete shear keys and highlighted the significant of the rational design of concrete shear keys in bridge design. Especially, the isolated shear keys with a smooth construction joint is recommended by SDC [3]. However, the advantage of the sacrificial shear keys depended on the severe damage of the shear key itself or the corresponding cap beam. It is time-consuming and costly to repair and retrofit the conventional shear keys once they are severely damaged in huge earthquake. Especially in China,

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