Numerical Simulation on Seismic Performance of HPS-UHPFRC Composite Pier-foundation Embedded Joint

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Abstract

The assembled composite bridge pier with high performance steel (HPS) and ultra-high performance fibre reinforced cementitious composite material (UHPFRC) possess the advantages of factory production and good seismic performance. In order to improve the connection degree and seismic performance of pier-foundation embedded joint in HPS-UHPFRC composite pier, PBL shear connectors and UHPFRC were adopted in the embedded part. Numerical simulation was carried out on the seismic performance of the joint with PBL shear connectors and without the connectors. Besides, the parametric analysis of the main influencing factors was conducted, including the construction of PBL shear connector, embedded depth of the pier and material types of the joint. The influence laws were obtained through the comparisons, and reasonable suggestions were provided for the design of HPS-UHPFRC composite pier-foundation joint.

Keywords: HPS-UHPFRC composite pier; embedded joint; seismic performance; PBL shear connector.

1 Introduction

High performance steel (HPS) and ultra-high performance fibre reinforced cementitious composite material (UHPFRC) possess the advantages of high compressive, tensile and toughness properties, which can be applied to assembled concrete filled steel tube (CFST) composite pier to form assembled HPS-UHPFRC composite pier, so as to improve the bearing capacity and ductility of the bridge pier, and meet the stress requirements of assembled substructure of bridge in strong earthquake areas. The connection joint between the pier and the foundation is the key part of the assembled HPS-UHPFRC composite pier, which controls the overall performance and safety of the structure.

In order to improve the seismic performance of pier-foundation joint, relevant scholars have carried out experimental and theoretical studies. Pertold et al. [1] researched on two groups of embedded steel footings, and showed that the bond strength between the steel and concrete and the punching strength of the concrete base were conducive to vertical load transmission. Hsu et al. [2] proposed a connection method of CFST column foot by adding stiffeners in the embedded part, and verified the superiority through quasi-

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