

Field Load Test of Cable Crane for a Record-breaking Cable-stayed Bridge

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Abstract

Yachihe Bridge is a record-breaking cable-stayed bridge with 800m steel truss deck of main span. It is the first time for cable crane used in the deck erection of cable-stayed bridge in the world. Unusually, the cable crane has no temporary towers but uses the bridge pylons directly. Field load tests are carried out before the cable crane putting into services. The cable crane load tests include static load test and dynamic load test, during which main cable forces, deformations of pylon tips, main cables and anchorages, etc. are measured in situ. Wherein, the cable crane is well instrumented with strain gauges at critical locations of the anchorages to record the main cable forces. This paper mainly describes the design, schemes and instrumentations of the cable crane load tests, meanwhile field measurements and numerical results are presented and compared.

Keywords: cable-stayed bridge; cable crane; load test; deformation; main cable force; strain gauge

1 Introduction

Yachihe Bridge (Fig.1) is a record-breaking cable-stayed bridge with span arrangement $72+72+76+800+76+72+72=1240\text{m}$ (Fig.2), the side spans are concrete girders and the main span is steel truss deck. The bridge site is featured with mountainous terrain, low-grade roads and a deep canyon that is more than 305m below the deck with an unnavigable river. Conventional construction methods of derrick crane ^[1], floating crane ^[2], incremental launch ^[3] are not logical for the bridge steel truss deck erection considering the site terrain and construction schedule. Therefore, cable crane is adopted for steel truss deck construction, which is the first time for cable crane used in the deck erection of cable-stayed bridges in the world.

Cable crane is an equipment used for load transportation horizontally and vertically, which has been used in the construction of arch bridges^[4-5] and suspension bridges^[6-7]. Unusually,

the cable crane has no temporary towers but use the bridge pylons directly, i.e., cable crane and the bridge share the same pylons to reduce cost. However, this will challenge the bridge geometry control since the bridge and cable crane mix together and interact with each other during construction.

Cable crane is a complex and critical equipment for the bridge construction, so load tests for cable crane are carried out to check the cable crane safety and serviceability, its effects on the bridge and verify the finite element analysis method of cable crane. The load tests include static load test and dynamic load test, during which main cable forces, deformations of pylon tips, main cables and anchorages, etc. are measured in situ. Wherein, main cable forces are instrumented with strain gauges at critical locations of anchorages. This paper describes the cable crane design, schemes and instrumentations of load tests, finally field measurements and numerical results are presented.