

Case study of a simply-supported channel-box girder under special live load

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Summary

This paper is about a design and analysis of 64m simply-supported channel-box girder which is a part of expansion project used for hot iron transportation for Lianyuan Steel Plant. Its span, created the world's largest span record of such bridges. Moreover, the special live load is nearly three times the weight as the UIC. Hence, an innovative combined cross-section is adopted to reduce the structure's height and meet the clearance requirements under the bridge. Then, the piecewise-cast construction method has been used, so the calculation must take the actual construction process into account. Besides, due to the air and bridge's thermal performance parameters are not easy to determine, it is difficult to calculate the temperature field generated by the mobile thermal radiation effects.

Hence, based on the above-mentioned characteristics of the bridge, a detailed calculation and comparative analysis are carried out to determine a reasonable cross-section form and dimensions optimize the tension phase and study the bridge's force status under different temperature modes. The analysis showed that the design of this bridge meets the requirements of relevant codes and has adequate safety factors, the calculation methods and conclusions proposed by this paper can be a reference for similar bridge designs in the future.

Keywords: channel-box girder, mobile thermal radiation effect, piecewise-cast construction method, special live load

1 Introduction

The railway line expansion project for Lianyuan Steel Plant, used for molten iron transportation, locates in the southwest of Loudi City. It begins at the Loudi Coal Energy Co., Ltd on the east and ends at the Gaoxi gas station on the west. The total length of the line is about 1.0 kilometres. Due to the various production facilities, plants everywhere and many roads along the line, so the new railway line adopts the form of viaducts in order not to take lands.

The span arrangements of the whole bridge with a total length of 716.45m, is as follows: (1-36m+1-64m+1-24m+1-36m) simply-supported box girder + (7.5m) the middle abutment + (10-3x12m) frame structure + (6.5m) the middle abutment + (3-24m+1-64m) simply-supported box girder. Among them, the main span is the 64m simply-supported box girder, which overpasses four existing railway lines, and a 5.5m clearance under the girder was taken into consideration. The interchange of the main bridge is shown in Fig.1.

Since the main bridge crosses the four existing lines, space about 5 meters between the lines, and has an angle of about 27° with them, therefore, a 64m span program must be needed to meet the net width for the existing lines. Besides, at the site of Gaoxi River, the same span is also adopted to avoid not impacting the river flows.