



Application of the Pre-stressed Concrete Box-girder with Corrugated Steel Webs in Bridge Engineering in China

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Summary

The pre-stressed composite box-girder with corrugated steel webs is a new kind structure, which includes corrugated steel webs, external pre-stressed cables and shear connectors that connect the corrugated steel webs and the concrete flange slab. In recent years more and more attention has been given to this kind structure and important achievement has been got in bridge engineering in China. In this paper three pre-stressed composite box-girder bridges with corrugated steel webs in China are introduced. Design experiences about the bridges are summarized, and their construction are discussed.

Key words: corrugated steel webs; continuous box-girder bridge; structural design

1. Introduction

The box-girder bridge with corrugated steel webs is a new type bridge which appeared in the 1980s and having some special characteristics that differ from the ordinary concrete box-girder. The different main shown in three sides: using corrugated steel webs, externally pre-stressed and shear connector which connects the corrugated steel webs and top or lower concrete flange slab. Corrugated steel plate has high cutting flexure intensity[1], it used as webs of the concrete box-girder can not only satisfied web's mechanical properties request fully but also large scale reduced the main girder weight and the upside dead load which withstands including the foundation substructure, then reduced the project total construction cost. Moreover, the free expansion in longitudinal of the corrugated steel plate causes it not to resist the axial force nearly and can more effective exert the pre-stressed to the concretes floorboard, raised the pre-stressed efficiency. In addition, it reduced massive supports, the template and the concrete placement project in construction, it has omitted arranges the steel bar in the web plate when the construction, buries the pipeline, establishments template in advance and so on, thus it has facilitated the construction, reduced the time.

2. The Pre-stressed Concrete Box-girder with Corrugated Steel Webs bridge in China

In recent years, under some scientific research Unit's impetus in domestic, the box-girder bridge with corrugated steel webs structure pattern which appeared in the

1980s obtained the development and application in China. In January 2005 the continual PC box-girder with corrugated steel webs pedestrian bridge - Long March bridge has completed[2], the bridge floor width is 7 meters, the greatest span is 30 meters, this is the first PC combination box-girder with corrugated steel webs bridge in our country, it used the having support cast-in-place job practice. In July 2005 the continual PC box-girder with corrugated steel webs highway bridge - Po-river bridge has completed[3], it located at 213 Henan provincial road of Guangshan County boundaries. Po-river bridge span is 120 meters, the structure is 4 hole 30 meters first simple support then continuously assembly type in vitro pre-stress PC combination box-girder with corrugated steel webs structure. In may 2007 the simple support variable cross-section PC box-girder with corrugated steel webs pedestrian bridge - Yinzuo bridge has completed[6], the bridge extends 6m, one cross crossed river. In 2007, three this type bridges are in constructing, they are Yingyugou 2nd bridge, the superstructure uses cast-in-place pre-stressed concrete box-girder corrugated steel webs, it is for full house support cast-in-place construction; the Wei-River bridge, the span combination for $9 \times (5 \times 30) + 6 \times 40 + 3 \times (5 \times 30) + 2 \times (4 \times 30)$ m, this bridge is divided into 15 parts. Among them, the 30m span for prefabricated pre-stressed box-girder, 40m span uses cast-in-place in vitro pre-stress box-girder with corrugated steel webs; the Chuancheng Yellow River especially big bridge, this bridge uses the suspended wagon construction, its main span $(70\text{m} + 11 \times 120\text{m} + 70\text{m})$ is the biggest span in domestic which has completed and in constructed and the biggest scale of multi-span continual PC box-girder with corrugated steel webs bridge in the world.

3. Conclusion

Looking from France, Japan and our country's box-girder with corrugated steel webs bridge which had completed, regardless of the structural style, the pre-stressed system, construction craft, has its originality, this structure has fully displayed the concrete's high resistant to compression, in vitro pre-stressed friction loss is small, the construction is convenient, corrugated steel webs shearing strength is high, self-possessed is light and does not have the restraint in the axis direction to main span's expansion and so on remarkable merit, compared to the same span's structure, the dead weight reduces 25%~30%[4,5]. Moreover the bridge type has developed from the beginning's beam bridge to the diagonal cable bridge now, therefore, some scholars predicted the box-girder with corrugated steel webs bridge, its prospects for development will be optimistic. Although present our country only had completed three this type bridge, but our country is a terrain complex country, specially along with the western big development strategy decision-making's implementation, seeks one kind of the light quality, excel, persistent effect's bridge structure form, satisfies the construction request, appears especially important. Combination box-girder with corrugated steel webs just has the characteristic of light, assembly exactly, artistic and construction convenient, and coordinates with the western ecological environment, therefore, may expect that box-girder with corrugated steel webs bridges will have broader application in China.