

Investigation of Composite Truss Arch Bridge's Deterioration in China

Haijun WU

Associate Professor
School of Civil Engineering
& Architecture, Chongqing
Jiaotong University,
Chongqing 400074, China
583921237@qq.com

Fengjuan Liu

Senior Engineer
School of Civil Engineering
& Architecture, Chongqing
Jiaotong University,
Chongqing 400074, China
whj_tj@126.com

Guowen Yao

Professor
School of Civil Engineering
& Architecture, Chongqing
Jiaotong University,
Chongqing 400074, China
whj_tj@126.com

Ping Lu

Lecturer
School of Civil Engineering
& Architecture, Chongqing
Jiaotong University,
Chongqing 400074, China
whj_tj@126.com

Shuixing Zhou

Professor
School of Civil Engineering
& Architecture, Chongqing
Jiaotong University,
Chongqing 400074, China
whj_tj@126.com

Summary

Composite truss arch bridge structure has the advantages of light weight, strong spanning ability, less engineering quantity. Bridges of this kind have been widely applied in Guizhou Province and other mountainous regions in China. Field studies has been made of Jianhe and other 33 composite truss arch bridges in-service, and the result shows that circle cracks and transverse cracks are widely exist in such kind of bridges. It can be learned from the investigation that most of the deteriorations are serious and the deteriorations share certain characteristics and distribution regularities. The investigations and analysis build the foundation for further research on deterioration causes and reinforcement methods.

Keywords: composite truss arch bridge; deterioration investigation; solid-web section; diagonal montant; crack; deflection.

1. Formation and Development of Composite Truss Arch Bridge

Composite truss arch bridge, which is a combination of arch bridge and beam Bridge, originated in Guizhou province in the early 1980s. It has its unique advantage when across valleys over 100m to 300m in the mountainous regions because of its features such as light weight, low cost, good spanning capacity and easy construction. Since it is born 20 years ago, bridge of this kind has got a rapid development all around China.

2. General Situation of Deterioration Investigation and Test of Composite Truss Arch Bridge

The research group investigated 34 bridges and tested 6 representative composite truss arch bridges based on research needs. The investigation shows that deteriorations of the composite truss arch bridge share some common characteristics in location and development trend. The contents include:(1)Collecting related design and construction data of representative composite truss arch bridge;(2)Deterioration investigation on the main structural members (the top, lower chord, the web, the solid-web section and lane board);(3)Deterioration investigation on the secondary components and ancillary facilities(4)Survey on the usage conditions; (5) Collecting the design data, construction data, maintenance data, inspection data and testing data of this kind of bridge inside and outside the province.

3. The deterioration status of composite truss arch bridge

The investigation shows that deteriorations of the composite truss arch bridge share some common characteristics in location and development trend. The deteriorations mainly show in the following

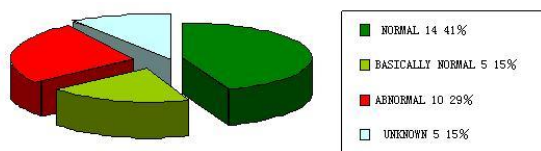


Fig. 1: Statistical Fig of the Composite truss Arch Bridge Elevation Variation

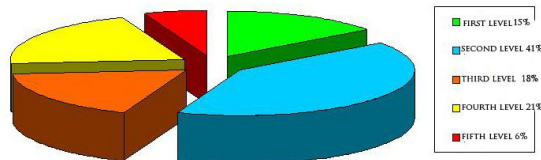


Fig. 2: Technology Status Classification Fig of Composite truss Arch Bridge

forms: cracks of different degrees in joints of chord members and web members, cracks around joints of vertical montant and solid web sections, cracks on the bottom slab of solid web sections and sub-face of carriageway decks, cracks in the superior border of the main arch ring.

Structure deformation can reflect bridge's stress condition and damage situation from another perspective. The thirty-four composite truss arch bridges are classified into four categories: Normal, Basically Normal, Abnormal, Unknown according to the deformation status. As is shown in Fig.1.

According to the actual situation of composite truss arch bridge, the technical conditions of those bridges cannot be reflected by the results of comprehensive evaluation of each component with weight concerned. As for the composite truss arch bridge, it is

recommended to scale via evaluating important components. This study adopted the scaling method of important components and rated the 34 bridges in the research in accordance with standard of technical condition of bridge. Technology status classification is shown in Fig. 2.

4. Conclusion:

Composite truss Arch Bridge's typical diseases can be summarized as follows:

5. 1)Circumferential and transverse cracks can be easily found in some areas of Composite truss Arch Bridge, such as solid web section, central part of diagonal chords, lower part of top chords, the bottom of lower chord, lower part of queen posts, the joint of vierendeel section and solid web section, lower edge of solid web section and so on.
6. 2)Downwarping deformation which greater than expected was detected on the main span's mid span of some bridges.
7. 3) Technical evaluation results suggest that almost one third of the bridges are in dangerous condition. According to the survey, most of the Composite truss Arch Bridge have rather terrible deteriorations, and also share similarity and regularity in those deteriorations. Thus, it's important and urgent to have those bridges which work in bad condition strengthened or reconstructed.

8. References:

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