



A study on a modelling method for analysis of steel arch bridges

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Summary

When using the 3D frame analytical method in bridges design as well as in structural soundness evaluation of existing bridges such as steel arches or steel trusses, as structural responses vary according to modeling methods of bridge members, their margins of safety should be differently evaluated. By examining the effect on analytical and final design results due to differences in modelling methods on a 3D frame analysis of a steel arch bridge, it is confirmed that the method of modelling without secondary members (considered as safe evaluation) does not result in safe evaluation for all primary members.

Keywords: Steel arch bridges; 3D frame analysis; Arch rib; Stiffening Girder; Stringer; Lateral Bracing; Cable.

1. Introduction

In recent years, with the development of computing technology, sophistication of analytical models used in steel bridge design and structural soundness of existing bridges has been progressing. Especially in the case of steel framed structures such as truss and arch bridges, the 3D frame analytical method is often adopted for the design work. In this method, considered as safe-side design, members such as stringers and lateral bracings are sometimes not modeled. As analytical responses vary to modeling methods, this can result in the different margins of safety for bridge members. In the other hand, while analytical methods which can realize more properly the actual structural response are desired when assessing structural states of existing bridges, a more prompt response and a more simple method, i.e. the frame analysis, are usually adopted in this case.

So far, there have been researches on modeling methods which can realize more properly the actual structural response when assessing structural states of existing bridges. By comparing actual measured data on steel girder bridges, steel truss bridges and steel arch bridges to FEM analytical results, there has been also examination on modeling method's adequacy and structural state evaluation methods [1]- [3]. However, in actual practice, frame analysis methods are usually used due to its simplicity and availability. In this method, members' correlation and secondary members' functions are already organized and there have been various studies on difference in responses between 3D frame and plane-frame analysis, or effect on stringers, lateral bracings, etc. by using the 3D frame analysis [4]. However, few have been done on the effect due to differences on members' modeling methods in 3D frame analysis.

This paper thus demonstrates the effect on analytical and final design results, caused by differences in modeling methods in 3D frame analysis of a steel arch bridge.