



Ultimate Load Carrying Capacity of Two Long Span Arch Bridges

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Summary

Ultimate load carrying capacity is one of important factors for long span arch bridges. In this paper, ultimate load carrying capacity analysis of two long span arch bridges in China is introduced. The first bridge is Taiping Lake Bridge, which is a concrete filled steel tubular (CFST) arch bridge with main span of 336m in Anhui Province. The second bridge is Chaotianmen Bridge, which is a truss bridge with main span of 552m in Chongqing City, and Chaotianmen Bridge will break the world record of arch bridge, which is holding by Lupu Bridge now. The analysis is based on nonlinear finite element method (FEM), and the whole collapse process which passed through several plastic hinges is introduced in detail. Different characteristics of ultimate load carrying capacity about those two types of arch bridges are also compared, which will give some helpful experiences for similar bridges.

Keywords: Ultimate load carrying capacity; CFST arch bridge; truss arch bridge; plastic hinge.

1. Introduction

Arch bridges have been widely used for their beautiful configuration and excellent spanning capacity. There are a lot of structure types for long span arch bridge, for example, if we consider about arch rib at least there are four types suit for long span arch bridges, which are steel box arch rib, steel truss arch rib, concrete filled steel tubular arch rib, concrete box arch bridge. Due to the different properties of ribs, the properties of ultimate load carrying capacity are also different for those long span bridges. With the span increasing, the width-span ratio becomes smaller, those rules about ultimate load carrying capacity which are got from smaller arch bridge, are also changed. Ultimate load carrying capacity properties of long span arch bridges should be paid more attention.

Many studies have investigated ultimate load carrying capacity of long span arch bridges. Most of them investigated the influences of several parameters on the ultimate load carrying capacity of long span arch bridges, such as the effects of the plate girder stiffness and arch bracing stiffness, the rise-to-span ratio and inclination of the arches towards each other and so on. Some studies investigated the influences of load combinations including static wind loads on the ultimate load carrying capacity. But this study mainly investigates differences of collapse process and the ultimate load carrying capacity between two types of arch bridges.

Nonlinear FEM based analysis is carried out to study the problem in the paper for two long span arch bridges. The first bridge is Taiping Lake Bridge, which is a concrete filled steel tubular (CFST) arch bridge with main span of 336m in Anhui Province. The second bridge is Chaotianmen Bridge, which is a truss bridge with main span of 552m in Chongqing City, and Chaotianmen Bridge will break world record of arch bridge, which is holding by Lupu Bridge before. The whole collapse process which passed through several plastic hinges are introduced in detail and difference of ultimate load carrying capacity property about those two types of arch bridges is also compared, which will give some helpful experiences for similar bridges.