



Design and construction of a three-span continuous box girder model

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Abstract

Scale model experiments have been widely used in short- and medium-span bridge research, including B-WIM technology and vehicle-bridge interaction mechanisms and applications. A high simulative scale model can be used to verify the relevant theories and technologies effectively. In this paper, a 1:20 scale model has been set up according to a 3×20m three-span continuous box girder bridge prototype. The physical quantities of the scale model have been derived by similitude law to guide the model design. Appropriate materials, such as PMMA and lead blocks, have been adopted to form the basic structure, whose arrangements are detailed. Finite element analysis (FEA) is applied to calculate and compare the static and dynamic characteristics between real bridge and model structure. One experiment case of a B-WIM test integrating influence surface and computer vision has been carried out to illustrate the model's validity. The constructed model can be a useful platform for future researches and provide a reference for practitioners.

Keywords: bridge test model; similitude law; scale-model materials; finite element analysis (FEA); design and construction; experiment case.

1 Introduction

The scale model of the bridge can represent the prototype structure, which inherits part of the original structural characteristics and parameters. By the mean of model design, the real working condition of the prototype bridge can be simulated and calculated. Compared with the full-scale bridge test, the scale-model test avoids the problems of the uneconomical, long test cycle and poor test

environment and plays an important role in research^[1].

The Scale-experiment bridge model is widely adopted in B-WIM research. Chen et al.^[2] set up a simply supported T-beam bridge model made with polymethyl-methacrylate (PMMA) to test the proposed B-WIM method in different scenarios. For validating a series of proposed methods to identify vehicle speed and axle weights on bridges, a T-beam bridge model was built with high similarity by Deng, He, and et al.^[3, 4]