Bridge weigh-in-motion using bridge influence surface and computer vision: an experimental study

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Abstract

Complicated traffic scenarios, including random lane change and multiple presences of vehicles on bridges are the main obstacles preventing bridge weigh-in-motion (BWIM) technique from reliable and massive application. To tackle the complicated traffic problems of BWIM, this paper develops a novel BWIM method by integrating the bridge influence surface theory and deep-learning based computer vision technique. For illustration and verification, the proposed method is applied to identify gross weights of vehicles in scale experiments, where various complicated traffic scenarios are simulated. Identification results confirm the favourable robustness, accuracy, and cost-effectiveness of the method.

Keywords: bridge weigh-in-motion; bridge influence surface; multiple vehicle problem; computer vision; deep learning.

1 Introduction

The acquisition of traffic loads on bridges is essential for determining the structural and maintenance requirements of bridges and road pavements. Besides, traffic information, such as traffic flow, vehicle speed, and so on, is of interest in the planning of traffic infrastructure, economic statistics as well as enforcement surveys. As a technique invented to identify traffic information on bridges, the bridge weigh-in-motion (BWIM) technique has received considerable attention for its cost-efficiency, durability, and unbiased accuracy.[1]

During the past four decades, numerous methods for the implementation of BWIM have appeared. Among the first were the works of Moses. Though the feasibility of the method was verified by field tests, it was concluded that accurate weight prediction depends on extra vehicle information

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