

Vehicle Weight Estimation Using Wireless Accelerometers on a Steel-Box Girder Bridge

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Abstract

While the traffic loads need to be understood toward efficient management of bridges, the loads on each bridge are not well assessed. An easy-to-implement vehicle weight estimation technique toward Bridge Weigh-In-Motion (BWIM) is developed based on wireless accelerometers; the algorithm is studied for the application to ordinary road bridges where traffic speed is not necessarily high and drive speed fluctuation is not insignificant. The method uses only accelerometers installed on the girders, decreasing installation cost and time which typical BWIM systems based on strain measurement need. A measurement system consisting of battery operated wireless sensors is employed. The system can continue to work over weeks to assess the vehicle weigh distributions of days of a week. The system is installed on a continuous box-girder bridge and the performance is examined. The system was shown to assess the weight of all heavy vehicles.

Keywords: Bridge Weigh-In-Motion; wireless accelerometer; deflection estimation; live load.

1 Introduction

While Bridge Weigh-In-Motion (BWIM) has long been studied and practiced [1], the algorithms are in principle based on strain measurement. Installation of strain gauges and cabling are time consuming. The system cost including the

installation is thus high preventing wide-spread use on many road bridges.

To improve the installation difficulty, the estimation of passing vehicle weight only using accelerometers installed on a bridge has recently been proposed [2]. Girder deflection numerically estimated from the measured vertical acceleration signals are utilized and compared with the deflection estimated from

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