Measuring heavy traffic with WIM-ROAD and WIM-BRIDGE systems in an urban environment

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Abstract

In this paper we present weight measurements of urban heavy traffic comparing two different Weigh In Motion (WIM) systems. One is a WIM-ROAD system using Lineas quartz pressure sensors in the road surface. The other is a WIM-BRIDGE system using optical fibre-based strain sensors which are applied under the bridge to the bottom fibre of a single span of the bridge deck. We have designed our tests to determine which system is most suited to Amsterdam. We put special focus on the accuracy that each system can achieve and have set up an extensive calibration program to determine this. Our ultimate goal is to draw up a realistic traffic load model for Amsterdam. This model would lead to a recommendation that can be used to re-examine the structural safety of existing historic bridges and quay walls, in addition to the current traffic load recommendations.

Keywords: Weigh In Motion; heavy traffic; bridges; strain sensor; pressure sensor; weight data; vehicle load; axle load; wheel load.

1 Introduction

Amsterdam faces a huge infrastructural challenge. Many of the city's historic bridges and quay walls were built two or three centuries ago on wooden pile foundations. They were not designed for current day heavy traffic. The city has about 830 bridges and 200 km quay walls loaded by motorized traffic. It is estimated that a substantial number of these structures are in a poor state of repair, due to a combination of (too much) heavy traffic and overdue maintenance. Exactly how many of these structures are in a poor state of repair is unknown, which is why all these assets are investigated and tested according to the current assessment standards for existing structures. In addition, safely allowable traffic loads and actual traffic loads are investigated. These investigations are carried out using not only traditional models, but also new experimental research. Gathering all data from these investigations, a more precise and accurate picture emerges of which assets require urgent action and which are in a relatively good state of repair and do not require immediate maintenance or renovation. Using this information, Amsterdam City Council can better plan its maintenance and renovation programme over the next few decades.

1.1 Assessment framework for the Amsterdam bridges and quay walls

Working from Amsterdam Council's Engineering Office and as part of its Bridges and Quay Walls Programma, we are developing an assessment framework for Amsterdam's bridges (Dutch: Toetskader Amsterdamse Bruggen - TAB) and quay walls (Dutch: Toetskader Amsterdamse Kademuren - TAK) to validate their structural safety. This framework comprises calculations of existing constructions' (material) strengths and loads - permanent as well as traffic loads - each with their own dedicated line of research to improve the framework. Within the "Measuring

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