

How truck-platooning changes the extreme values of load-effects in single-span bridges.

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Abstract

The load model defined in EN 1991-2 is derived from traffic measurements taken in Auxerre (FR) in 1986. Since then the vehicle industries have changed a lot. For different future traffic scenarios, changes in load patterns are expected. Automated driving, especially truck platooning, will have an impact on future bridge loads. Due to synchronization of traffic flows, or reduced distances between trucks- as it is used for truck platooning- increase of the traffic load per road meter follows. Within this paper, a large-scale parameter study of different bridge types loaded with randomised traffic flows and platoon scenarios is investigated. Structural safety is evaluated for concentrated vertical forces with dynamic resonance interaction on bridges with respect to randomized traffic. Key parameters such as critical intervehicle distances or dynamic load amplification were identified and discussed.

Keywords: Load models, bridge dynamics, future traffic loads, platooning, extreme value, exceedance probability.

1 Introduction

Connected and automated transport systems (CATS) are expected to be introduced in increasing numbers over the next decade. Truck-platooning is a possible future technique for the heavy vehicle traffic. The vehicle industry has already tested the functionality of truck platooning where different trucks are coupled together by an "electronic" drawbar (Figure 1). In addition to the economical and logistical advantages of automated driving, shortage of truck drivers and positive environmental aspects such as saving fuel by using the positive wind shadow-effects of a fleet are main drivers for this technology.

Truck platooning represents a change in the traffic composition, which has potential impacts on the bridge capacity to carry these possible future loads. Due to synchronization of traffic flows or reduced inter vehicle distances - as it is used for platooning

to use the advantage from slipstream- the loading on infrastructure and bridges will increase.



Figure 1. Illustrated truck platoons which is developed in the vehicle industries, Photo ©Scania- published Feb 27, 2020.

Following main effects were identified as relevant for bridges and analyzed in this study:

- Static traffic load effects: the reduced vehicle distances in a platoon cause an increase of traffic load per road meter. Therefore, a potential increase of maximum traffic loads during bridge's lifetime can be expected.