A Proposed Live Load Model for Bridge Design in Venezuela

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Summary

Information collected from Weight In Motion (WIM) studies conducted in Venezuela indicate the presence of very heavy trucks that produce shears and bending moments significantly larger than those specified by the AASHTO-LRFD and AASHTO-Standard specifications for Bridge design, which are commonly used in Venezuela. In this investigation the WIM recorded data is plotted on the normal-probability paper to facilitate statistical interpretations. The cumulative distribution functions of moments and shears serve to extrapolate results and anticipate design forces up to 75 years for a typical 3 meters-wide design lane. Extrapolations indicate the need to amplify the design shear $V_{u,\ LRFD}$ and moment $M_{u,\ LRFD}$ at ultimate as calculated as per the LRFD Specification to match the predicted demands. Such amplification can be achieved by multiplying $V_{u,\ LRFD}$ by 4/3 and $M_{u,\ LRFD}$ by the factor $(1.30+60/L^2)$ where L is the span length in meters.

Keywords: Bridge Design, Live Load, Weight in Motion, Probability Paper, Heavy Trucks.

1. Introduction

The size and weight of trucks in Venezuela is seldom controlled. This study determines actual truck loads on Venezuelan highways obtained from Weight In Motion studies (WIM) conducted by engineer S. Pulido [1] on the Caracas-La Guaira Highway during a period of fifteen days. The highway connects Caracas, capital of Venezuela and the port of La Guaira, one of the largest in the country. Thus, recorded traffic can be considered as representative for heavy loaded trucks. The original purpose of the study [1] was to investigate the effect of trucks on the existing pavement and was not intended for bridge design applications. In consequence data that may be relevant for estimating live load effects on bridges was not acquired. Yet as will be described in this paper, the gathered information does give an insight of the live load effects on bridges located in Venezuela.

It is commonly accepted that the live load of a bridge includes static and dynamic parts. This investigation deals with the static portion of live load for a typical lane of trucks. For each truck, the measured or recorded parameters included total weight, axle load and spacing. Unfortunately data is not available on the multiple presence of vehicles and thus the development of load spectra for structural components, such as girders, abutments, etc is not warranted. The purpose of this investigation is to develop equations that yield more realistic estimates of the live load effects on bridges in Venezuela than those based on a direct application of the AASHTO-LRFD Specification [2]. Equations obtained from this study shall be interpreted as a temporary design tool that produces lower bound estimates of the design forces at ultimate to be used in the design/retrofit of bridges until a complete reliability study can justify the development of a national bridge code.

https://doi.org/10.2749/222137810796025384