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Risk Assessment of Vehicle on a Bridge for Strong Wind based on Wind-tunnel Experiment

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1 Abstract

Risk assessment method of vehicle for strong wind on a bridge was developed with consideration of girder shape and wind environment. The method is composed of three steps. In first step, wind tunnel test is performed to estimate aerodynamic coefficients of a vehicle. Coefficients are estimated for every traffic lane on the bridge with consideration of various wind direction. Based on the results, critical wind speed curves of vehicles are calculated through vehicle dynamics analysis. Next step is wind environmental analysis. Utilizing long-term wind data obtained from nearby weather station, wind distribution functions are estimated. As a final step, number of days for traffic control, risk index in this study, is calculated using critical wind speed curves and wind distribution functions. The risk index is obtained not only for main span of the bridge, but also for all side spans or approaches. As a case study, Gwang-an bridge, one of long span bridge in Korea, was evaluated using developed assessment procedure. Risk index was calculated for all sections on the bridge, and mitigation measure was also discussed to ensure the vehicle safety.

Keywords: Vehicle; Risk evaluation; Wind; Quasi-static; Wind tunnel test, Aerodynamic coefficient, Bridge

2 Introduction

Vehicle running on a long-span bridge often get threats from strong cross wind, which can cause wind-induced accidents and resulting economic losses. In order to prevent such unexpected accidents, it is necessary to evaluate the risk of bridges based on reasonable engineering background and to prepare appropriate counter-measures in advance.

Therefore, in this study, a risk assessment method of running vehicle for strong wind was developed with consideration of bridge girder shape and wind environment. Wind tunnel test was performed to estimate aerodynamic coefficients of a vehicle model. 2-D bridge girder section model was utilized during experiment to consider the effect of girder on wind flow. Based on the measurement results, critical wind speed curves(CWC) were obtained through vehicle analysis. Finally, wind environmental analysis was proceeded to estimate

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