



## Risk Analysis of Vehicle on Bridge Deck During Strong Side Wind

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### Abstract

This study aims to develop a risk analysis platform for a vehicle over a bridge deck during strong side wind. Two key procedures are presented for risk assessment. One is a proposition of a static model of vehicle for 16 different wind directions. This static model is used in developing so-called critical wind speed curve (CWC) and has been validated by a well-established vehicle-dynamics software, TRUCKSIM. The other is developing probabilistic model of wind speed over a bridge deck from the long-term wind data near the bridge site. The proposed methodology was applied to the Gwangan Bridge, a sea-crossing suspension bridge with the main span of 500 m in length. The parametric study demonstrated vehicle speed and payload of the vehicle were key parameters which effected on the vehicle vulnerability. Especially, it was demonstrated that a vehicle was exposed to more unfavourable condition in curved part of the bridge.

**Keywords:** Wind; Bridge; Vehicle Safety; Vulnerability; Hazard; Curved road; Traffic Control; Probabilistic Assessment.

### 1 Introduction

The sea-crossing bridges are vulnerable to strong side wind and appropriate measures such as adopting wind screens in both side of decks are examined during the design and wind tunnel testing states to ensure the safety of running vehicle. One of the conventional approaches is controlling bridge operation by limiting vehicle speed or even closing bridge operation. When the

bridge plays a particularly important role in vehicular traffic, a temporary closure of the bridge makes social and logistical problems more serious. Therefore, decision-making to control the vehicle in the event of strong winds should be based on a reliable engineering approach.

This study aims to develop a risk analysis framework for running vehicle over the bridge deck during strong side wind and to perform parameter