

Effect of Firewall on a Suspension Bridge under Vehicle Fire

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Abstract

In this study, a firewall was proposed as such countermeasure against the risk of vehicle fires on a suspension bridge, and the effect of the firewall was investigated by CFD analyses considering the proposed firewall. CFD analyses results, it is observed that temperatures exceeding the regulation of PTI standards (300°C) occur in the tanker fire scenario. Thus, countermeasures are required in this case. Therefore, analyses of the cases with firewall were performed, and it was confirmed that installing a firewall reduces the maximum temperature of the cable. Finally, the optimal dimensions of the firewall were suggested through a parametric study of a series of CFD analyses. In the future, if additional CFD analyses for various scenarios and assessment of wind stability considering the firewall installation are performed, it is expected that the cable members of the actual cable-supported bridges can effectively be protected from vehicle fire.

Keywords: firewall; suspension bridge; vehicle fire; fire test; heat transfer analysis; CFD analysis.

1 Introduction

Until recently, fire accidents on bridges have been occurring frequently worldwide. Vehicle fires affect bridges, the consequent damage is serious, and large fires can lead to the bridge collapsing [1]. With the development of construction technology and the high strength of materials, bridge spans are increasing, and numerous suspension bridges are in operation around the world. Figure 1 show the case of a fire accident that occurred in The New Little Belt Bridge in Denmark in 2013. If a vehicle fire occurs on a suspension bridge, damage to the main member may occur and cause the bridge to collapse. If the suspension bridge collapse, it can cause enormous human casualties and economic loss, so fire protection countermeasures are needed. However, fire accidents such as vehicle fires on the suspension bridge are currently not sufficiently protected. Therefore, in this study, a firewall system was proposed to protect the main

members of the bridge from vehicle fires occurring in the suspension bridge, and the installation effect of the firewall was analyzed by CFD analyses considering the proposed firewall.



Figure 1. Fire accident on suspension bridge

2 Firewall system proposal

Fire tests and heat transfer analyses were conducted to investigate the fire resistance performance of the proposed firewall system.