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Fire protection of suspension bridge main cables

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Abstract

Large suspension bridges are increasingly exposed to fire risks as the traffic carried by them increases. A truck fire on a suspension bridge may be a relatively likely accident that may lead to main cable failure or a strength reduction that will either cause down classification of the load carrying capacity or need for long lasting repairs of the main cable, all at high costs for society.

To consider fire protection of suspension bridge cables is not yet standard practice but there is a need for systematically assessing the fire risks for the cables and implementing mitigation measures as needed for both new and existing bridges.

In 2017, the New Little Belt Bridge in Denmark was retrofitted with passive fire protection for the main cables and in 2018, a similar retrofit of the Great Belt East Bridge in Denmark starts. The dimensions, design and configuration of the main cables are different for the two bridges. Special efforts were to model heat penetration into the main cable following a fire, and the resulting strength reduction.

This paper describes the systematic process to evaluate and provide fire protection for the main cables of these bridges.

Keywords: Suspension, bridge, cable, fire, protection, risk, cost/benefit, heat-intrusion, society, cold-drawn.

1 Introduction

Considerations of protecting suspension bridge cables from fire are not yet standard design practice and not addressed in codes and design guidelines as it is for bridge stay cables at least in some places of the world [1]. However large suspension bridges are most often vital to society, and they are increasingly exposed to the risk of serious truck or tanker fires as the traffic carried by them increases. Experience shows that even a fire in a truck without dangerous goods, like the serious fire in 2013 [2] on the New Little Belt Bridge (from 1970), may cause rapidly-rising flame temperatures to above 1000 °C, thereby making it a fire similar to a hydrocarbon fire. The relatively high traffic frequency of such trucks when compared to fuel or gas tankers makes such fires relatively more likely. Such a fire accident on the bridge may lead to cable failure or a strength reduction that will either cause down classification of the load carrying capacity or need for extensive and long lasting repairs of the main cable. Such outcomes will have high costs for society. Thus, there is a need for systematically assessing the fire risk for the cables and implementing mitigation measures as needed.

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