



## Fire Risk Evaluation of Cable Bridges due to Vehicle Fires

**Youn Ki Son**

*Envico Consultants Co. Ltd, Seoul, Korea*

**Chang Su Kim**

*DM Engineering Co. Ltd, Seoul, Korea*

**Ho Kyung Kim**

*Seoul National University, Seoul, Korea*

**Contact:** [yunki@envico.biz](mailto:yunki@envico.biz)

### Abstract

Cable bridges use multiple cables as main members, and there is a risk of bridge failure in the event of cable loss. To manage the bridge safety from such event, a risk analysis method is necessary. In this study, fire risk analysis was performed on Seohae Bridge, a steel composite cable-stayed bridge, and on Yi Sun-sin Bridge, the longest suspension bridge in Korea. A fire risk analysis method is proposed to determine the final annual frequency of bridge failure. This method calculates the annual frequency of vehicle fires based on statistical data and appropriate assumptions, and determines the conditional probability of exceeding the limit state of the main structural member through fire analysis and bridge structural review. For the statistical data on the annual fire frequency, domestic statistical data were investigated and actual data were analysed and applied, and various probabilities such as oil leakage and ignition probability in the event of an accident were assumed.

**Keywords:** fire risk evaluation; cable loss; fire risk analysis; annual frequency of bridge failure; conditional probability; annual fire frequency.

### 1 Introduction

Recently, the construction of sea-crossing and long-span cable-supported bridges, such as cable-stayed and suspension bridges, has increased to overcome topographical constraints. In the cable-supported bridges, a number of cables are used as a main structural member to provide vertical restraint to the stiffening deck against the superstructure loads, and thus the loss of the

cables may lead to a collapse of the bridge. A risk management of the cable system is subsequently necessary in the event of a disaster. Similarly, a risk management of the other main structural members, which are the tower and the stiffening deck, is also necessary in the event of a collapse of the cable system. For the cable-stayed bridges, there was a cable rupture due to lightning in the Rion Antirion Bridge (Greece) in 2005 and the Seohae Bridge in 2015. In 2007, there was a cable