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## Fire Risk Evaluation of Bridge underneath Conditions based on Field Investigation

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### Abstract

As the road network becomes complicated and the traffic volume increases, the occurrence of unexpected disaster including fire events also increases. In case fire occurs underneath a bridge, the bridge can be seriously damaged. Of importance is the underneath conditions of bridges such as the amount, quantity and kind of disposed scrapheaps as well exposure conditions. This study shares the information of fire risks of bridges by field investigation of bridge underneath conditions. In addition, proto-type model to assess fire risk of bridges was suggested based on the relative ranking method. And the weighted value for fire risk and fire resistance factors were determined.

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## 1. Introduction

In recent years the cases in which the fire caused by terrorism and accidents frequently occur in many structures in Korea and worldwide. In the cases of bridges, recently, there is a rapid increase of serious damage caused due to fire.

Depending on the damage due to fire and nature of structure serious direct and indirect damages occur, resulting in secondary social and economic damages if road traffic is blocked.

This study was conducted on two different types of bridges: special bridges like, suspension bridge, cable stayed Girder Bridge, truss bridge, arch bridge, etc. and general bridges like RC bridge, PSC Bridge, Rigid frame bridge, Preflex etc.

In the case of general bridge, the fire from lower part of the bridge causes more damage than the fire above the bridge. Present available literatures and methodologies are not enough for the risk assessment in this case.

Therefore this study investigated the risk factors for the fire risk of general bridges and analyzed the basic model for the relative ranking method.

## 2. Field Survey

Firstly, to investigate the exact risk due to fire on bridges many cases domestic and international were studied. From the investigation, it was found that fire damages in special bridges are different from the normal bridges. The damage in special bridges only occurred due to fire in upper surface and the damage due to fire in lower surface were negligible.

From the research, it was found that in the case of special bridges cables are one of the most prominent structures. The fire damage in upper part of the bridge causes damage to the cable which leads to the obstruction of the traffic resulting in chaotic transportation system.

Special bridges generally have a higher volume of traffic. However, only about 1% of the total bridges in Korea are special bridges and also there is the variation on the special bridges types. Therefore, the study of fire risk assessment on bridge were carried out only on the general bridges. On-site assessments were conducted to investigate current condition of bridges for fire risk.

Field surveys were conducted in two phases. In first phase, the assessment of bridges in west area. And secondly, assessments were carried out in south areas.

### 2.1 1st Field Survey

From the field survey in west area potential fire hazards were investigated. The potential fire hazards in this area are shown in the figure below.



Fig. 1. Hazards under bridge



Fig. 2. High volt line under bridge



Fig. 3. Concrete damage

In figure 1, and figure 2, high risk for potential fire hazard can be seen. In figure 1, various potential fire factors such as construction equipment, materials and also other kind of highly inflammable materials were found lying or stored just underneath the bridge.

In figure 2 it can be seen that a high-voltage line for railway tracks is installed just below the girder.

In figure 3, damage of concrete on the pier can be seen by fire whose source is unknown.

### 2.2 2st Field Survey

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