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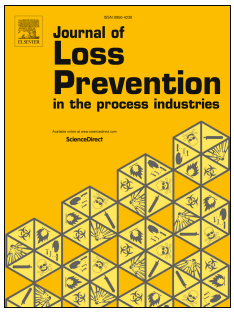

A simplified method to evaluate the fire risk of liquid dangerous chemical transport vehicles passing a highway bridge

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A simplified method to evaluate the fire risk of liquid dangerous chemical transport vehicles passing a highway bridge

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Abstract：The collision or leakage accidents of dangerous chemical transport vehicles (DCTV) are often reported to occur during a travel on the highway bridges, posing a great risk to the safety of bridge structures. This paper proposes a simplified, semi-quantitative fire risk evaluation and classification method for liquid DCTV passing highway bridges. This method integrates four control parameters that significantly affect the fire risk, including the passing frequency and maximum sectional area of vehicles, the flash point and combustion heat of dangerous chemicals. The risk degree of DCTV is determined by the multiplication of the above four parameters after data standardization. Based on the risk evaluation, a risk classification and control method is presented to allow daily risk management of DCTV passing a highway bridge. Taizhou Bridge is used as an example to demonstrate the application of this simplified evaluation method, by which the fire risk classification and control strategies are obtained for DCTV passing Taizhou Bridge.

Key words：Highway bridge; Bridge fire; Tanker fire; Dangerous chemical transport vehicles (DCTV); Risk evaluation; Taizhou Bridge

1 Introduction

A bridge fire can cause significant economic and public losses. When bridge traffic is damaged by fire, it is usually difficult to detour traffic, so overall traffic quality in the region will be significantly affected. Further, a severe fire may lead to the permanent damage or even collapse of bridge. In 2007, a gasoline tanker crashed into the bridgehead of the San Francisco-Oakland Bay Bridge and burst into flames, leading to the melting and collapse of the steel girder on the nearby large freeway interchange in MacArthur Maze, and resulting in serious damage to the bridge structure (Astaneh-Asl et al. 2015, Bajwa et al. 2012). It took nearly one month to complete the reconstruction work. The Maze closure was estimated to have a total economic loss of $6 million dollars per day to the San Francisco Bay Area (Chung & Wolfe 2008, Garlock et al. 2012). In 2008, the New York Transportation Authority (Garlock et al. 2012) conducted a survey on 1746 bridge failures from 18 states and found that that fire caused the bridge collapses as many as nearly 3 times of earthquakes.

With development in bridge capacity, there have been an increasing number of tanker burning accidents. Li et al. (2012) pointed out that there were about 0.5 to 1.5 fires for every ten million driving kilometers for road transport and that 1% of all fires are tanker fires. Many tankers are loaded with dangerous chemicals, which make them moving hazards when crossing a bridge, thus posing a great risk to the bridge structure (Bennetts & Moinuddin 2009, Milazzo et al. 2010, Vandersteen et al. 2003).

Researches on bridge fire have attracted much attention in recent years, and a large number of experimental studies and numerical simulation work are available. However, these performed

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