

ABSTRACT

Fixed Firefighting Systems (FFFS) have been widely accepted in the building industry, but this approach has only limited use in highway tunnels in the United States. Limited research in this area may have created initial misconceptions about its effectiveness, but experiences in other countries (e.g., Japan and Australia) have demonstrated that this technology provides significant safety benefits and helps to protect the structure.

Today's highway tunnel owners are faced with protecting life and facility against potentially catastrophic events such as heavy goods freight and tanker vehicle fires. These large fires are not mitigated effectively by emergency ventilation alone. Fire suppression systems can save lives by keeping the fire size low and maintaining a tenable environment for the tunnel user and enhance the ability of first responders to aid in evacuation and fight the fire. Reducing the design fire size and fire growth rate has significant economic benefit to the tunnel owner since the scale of expensive fire and life safety systems (including passive fire resistance) can be substantially reduced.

The Federal Highway Administration (FHWA), the American Association of State Highway Transportation Officials (AASHTO), the National Fire Protection Association (NFPA) and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) are considering the possibility of reducing the design fire size when integrating FFFS with the emergency ventilation system. The professional tunnel community agrees that integration of this technology is long overdue. However, there is a currently a knowledge gap in evaluation of effectiveness and reliability of integrated systems, which limits full realization of the benefits. As such, research is being performed to develop a uniform approach for considering the benefits of an integrated design for FFFS on systems including emergency ventilation.

This report is intended to provide a comprehensive synthesis of currently available information and published reports that have resulted from a significant amount of international research conducted in recent years regarding the effectiveness, performance, and benefit of FFFS in road tunnel applications.