

Safety Effects of Fixed Automated Spray Technology Systems

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Fixed automated spray technology (FAST) has emerged as a solution to provide quick, effective service delivery to high-risk locations prone to icy conditions or with high traffic volumes. The Colorado Department of Transportation has installed and used FAST on bridges since 1998, with 32 units currently installed on bridges around the state. There is some concern regarding the effectiveness of FAST in reducing accidents during winter weather. Previous studies of FAST have considered the changes in crash occurrence following deployment, but these studies were basic and compared seasonal figures or rates without accounting for site conditions. To address this shortcoming, an observational before–after study with the empirical Bayes technique was used to determine the effect of FAST systems on crash frequencies. The results revealed that at sites where crashes were reduced, FAST systems contributed to an annual reduction of 2% on multilane rural highways, 14% to 70% on urban Interstates, 31% to 57% on rural Interstates, and 19% to 40% on interchange ramps between Interstates. However, at some sites, safety deteriorated with an increase in crashes. Although the precise causes of such increases are not completely clear, they may have been the result of increased traffic, systems not being maintained properly, or systems applying fluids in improper amounts or at the wrong time. On the basis of the collective results, high-traffic, high-crash severity locations are most suitable for FAST deployment.

A recent review has revealed a consistent pattern in existing studies, that is, adverse winter weather increases crash frequencies on highways, reduces traffic speed, and lessens the chance of fatal crashes (*1*). During the winter, accidents often occur on bridge decks or shaded areas where the surface temperature tends to be lower than the adjacent areas and creates potentially hazardous driving conditions, such as frequent frost and black ice (*2, 3*). Fixed automated spray technology (FAST) has emerged as a solution to provide quick, effective service delivery to such high-risk locations prone to icy conditions or with high traffic volumes. FAST systems are designed as a fixed technology for anti-icing at target areas such as bridges, tunnels, ramps, and other elevated roadways (*4*). The challenges associated with the installation and operation of FAST systems are often site-specific (*5*). This technology is a permanent installation of a pump, tank, nozzles, and a controller for the application of anti-icing chemicals manually or automatically.

The Colorado Department of Transportation (DOT) has installed and used FAST on bridges since 1998, with 32 units currently installed

on bridges around the state. In areas where FAST has been deployed for several years, there is a favorable view of the system. However, there is some concern about how effective the system is in reducing accidents during winter weather events. The Colorado DOT's experience mirrors that of other agencies in North America and Europe, which have generated different views of effectiveness. Consequently, many transportation agencies still consider FAST as an evolving technology.

As one of the main objectives of FAST systems is to provide a safer driving surface through timelier chemical applications, it was necessary to determine whether safety improvements had been achieved through Colorado's deployments. Consequently, this work aimed to determine what changes had occurred in vehicle crash rates at the different FAST sites throughout Colorado. The objective of the study was to determine whether crashes had decreased in a statistical sense after different FAST deployments compared with the years before the deployments. Such an evaluation would provide a clearer picture of whether FAST systems had produced a positive impact on safety at each site.

LITERATURE REVIEW

Although FAST systems have been deployed around the world for a few decades, observations of crash reductions are somewhat limited. Gladbach discussed a FAST system that was installed in 1984 along a 3.7-mi (6 km), topographically and climatically challenging road section between Hagen and Lüdenscheid in Germany (*6*). Safety benefits were assessed by comparing the annual number of crashes caused by winter conditions (e.g., snow and icy patches) in two 7-year periods before and after installation. The number of crashes was reduced by 58% and traffic congestion was also reduced (*6*).

A FAST system was installed in Dover, United Kingdom, and operated for the 2010–2011 winter period. The system was located on Jubilee Way Bridge and designed to operate automatically or manually (*7*). No winter-related crash reduction data were reported, since the number of incidents on Jubilee Way was not sufficient to consider statistically following installation of the system.

The effectiveness of a FAST system installed on an interchange overpass on I-215 in Salt Lake City, Utah, was analyzed for the 1997–1998 winter season. Comparing the 1997–1998 winter season data with the five previous winters, a 64% reduction in snow and ice-related accidents was reported on the northbound lanes (*7*).

The first FAST system in Canada was installed along a 550-ft (168-m) interchange ramp with an average daily traffic of 3,000 vehicles in Ontario. No winter weather-related accidents had occurred since the FAST installation (as of 2001) (*8*).

A FAST system installed on a bridge on Interstate 68 in Allegany County, Maryland, in the 1998–1999 winter season reduced accidents

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Introduction

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