

Shield a Fixed Highway Object and Save a Life



Many fatal highway accidents occur when automobiles run off the road and hit fixed objects. Although good safety design practices have proved effective in reducing fatalities on newly constructed highways, engineers need to know what can be done about the many miles of existing highway systems constructed before present-day safety criteria were established. Answering this question was the target of a California Department of Transportation (Caltrans) research program on crash cushions. Crash cushion protection of fixed objects in gore areas (i.e., between the roadway and an exit ramp) and at other highway locations resulted in saving 330 lives and reducing the severity of many injuries over a 10-year period in California.

PROBLEM

Fixed objects in the gore area are particularly vulnerable to vehicle hits. Motorists must make decisions regarding their travel route as they approach gore areas and they frequently do so with insufficient time to react properly, often because they are sleepy or intoxicated. Consequently, they sometimes leave the roadway and enter the gore area.

Ideally, highways are designed to make this area traversable and free of fixed objects. However, many objects (e.g., gore separation structures, bridge piers and abutments, and sign and lighting supports) cannot be removed from within the safe desirable clear zone and must be given special treatment.

SOLUTION

Installing crash cushions in front of fixed objects is one way to make them relatively safe. When struck by an errant vehicle, crash cushions collapse or crush 15-20 ft, approximately 3/4 the length of the cushion. Thus, by managing the kinetic energy of the vehicle, the dynamic forces are reduced to a low constant level. In this environment, passengers will experience secondary

impacts with the vehicle interior at low relative velocities that are tolerable.

In 1968 Caltrans set out to develop cushions to shield fixed objects along state highways. Working in cooperation with crash cushion manufacturers who had concurrent programs, Caltrans initiated an FHWA-funded research program to evaluate, test, and modify existing crash cushion concepts and systems to meet the state's needs. Results indicated that the cushions would effectively and significantly reduce the chance of fatal injuries, the severity of injuries received, and the extent of vehicle damage. Based on these test results and other available information (principally from the Texas Transportation Institute, which had a large research effort in this area), three crash cushion systems were approved for use in California. Two systems developed by others also were approved in the mid-1970s.

APPLICATION

Since 1970 Caltrans has installed more than 949 crash cushions that, to date, have been hit approximately 2,200 times. These included water cells, sand barrels, steel drums, and two cushions using crushable cartridges.

BENEFIT

Although no direct monetary savings accrued to the state as a result of installing and maintaining these cushions, an estimated 15 percent of the crash cushion hits resulted in a life saved, or 330 lives. The costs associated with the loss of a life have risen yearly and are currently estimated by Caltrans at \$200,000. The total estimated savings are more than \$30 million. There were significant savings due also to reductions in property damage, injuries, and potential law suits against the state. The total research cost was approximately \$345,000; this does not include costs incurred by others leading up to the Caltrans R&D program.

These research findings were reported in technical literature and at numerous conferences. Many states have relied in part on these test results, and more than 10,000 crash cushions have been installed throughout the United States. Although total savings resulting from this research are difficult to quantify, the application of crash cushions nationwide has the potential of saving thousands of lives and many millions of dollars.

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