REPORT SUMMARY

FTA Report No. 0233
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FTA RESEARCH
FEDERAL TRANSIT ADMINISTRATION

CRASH ENERGY MANAGEMENT FOR HEAVY RAIL VEHICLES, LIGHT RAIL VEHICLES, AND STREETCARS

Background

Crash energy management (CEM) is a performance-based technique that is used to improve passenger safety. Passenger injuries are the result of two main mechanisms—primary and secondary collisions. A primary collision produces high acceleration levels due to the impact of the train with another substantial structure (for example, another railcar). The possibility of an external object penetrating the railcar during the primary collision is high. Secondary impacts occur between the passengers and interior fittings or other passengers. Secondary impacts represent a major injury mechanism during low-speed crashes. CEM components are designed to reduce acceleration inside the car during the crash and avoid overriding derailments that cause structure penetration.

Objectives

The objectives of this project were to conduct background research and analysis on needs and gaps for new standards related to transit crashworthiness and CEM and on any existing standards implemented into industry related to crashworthiness and CEM and to present findings related to the development of standards, protocols, guidelines, or recommended practices related to transit crashworthiness and crash energy management.

Findings and Conclusions

Research indicates that ASME has new procurement crashworthiness/CEM guidelines and that interior designs that minimize passenger secondary impacts associated with collisions are being used.

An industry data collection effort was completed to investigate the implementation of crashworthiness and CEM on transit railcars, including the standards used. The data collection effort used State Safety Oversight Agencies (SSOA) contacts to collect data from the rail transit agencies in representative states. Analysis of the data from the 31 rail transit agencies that responded shows that CEM-equipped rail transit vehicles represent almost 54% (5,840 railcars) of the agencies' existing fleets (10,781 railcars). By transportation mode, CEM-equipped vehicles represent 59% of their heavy rail vehicles (5,173), 33% of their light rail vehicle LRVs (644), and 22% of their streetcars (23).

Findings include the following:

- ASME -RT-1-2015 and ASME -RT-2-2014 standards provide new procurement crashworthiness/CEM guidelines.
- There are interior vehicle designs for new and rehabilitation procurements, including passenger seating devices, attachments and tracking/anchorages, and seatback designs, that minimize passenger secondary impacts associated with collisions.
- There are risks associated with the collisions of CEM-equipped revenue rail vehicles interacting with non-CEM-equipped rail vehicles, as identified by FTA research and real-world incidents.

Benefits

The report findings can support future FTA efforts in providing guidance to the industry on minimum crashworthiness standards to use in agency specifications for rail transit vehicles. It can be used as a resource for public transit agency decisionmaking and their SMS practices.

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Project Information

This project was performed by the Transportation Technology Center, Inc., under contract with the Center for Urban Transportation Research in support of FTA's Standards Development Program. For more information, contact FTA Project Manager Raj Wagley at (202) 366-5386 or Raj.Wagley@dot.gov.

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