



U.S. Department of Transportation
Federal Transit Administration



FTA Standards Development Program: Crashworthiness/Crash Energy Management for Transit Bus

Background

Collisions are a major challenge faced by the public transportation bus sector that result in high costs associated with property damage or bodily harm and damage the perception of the entire public transportation industry. The National Transit Database (NTD) shows that 411 fatal transit bus incidents occurred during 2011–2015, resulting in 427 fatal injuries; more than 21,500 total collisions occurred that involved buses, resulting in more than 40,600 non-fatal injuries.

For the public transportation industry, improved crashworthiness of transit vehicles is an important element in the safe operations of bus systems. Crashworthiness and crash energy management (CEM) increase the likelihood of survivability for operators, passengers, and occupants of other vehicles involved in a collision.

Objectives

The objective of this research was to examine the standards, guidelines, and recommendations associated with crashworthiness and CEM for transit buses, including articulated buses, BRT buses, and paratransit body-on-chassis buses, as well as standards that exist in the U.S. and elsewhere and those issued by Standards Development Organizations (SDOs).

Findings

Examination of safety standards, guidelines, and recommendation related to crashworthiness and CEM specific to transit buses revealed limited and/or minimum standards that could be enhanced to increase occupant safety.

Federal Motor Vehicle Safety Standards (FMVSS) include 22 standards associated with crashworthiness and the protection of occupant space; many have applicability restrictions determined by gross vehicle weight rating and are thus inapplicable to general transit buses. Several FMVSS are applicable only to the driver's seat, and some FMVSS structural standards are limited to school buses. Some states have adopted FMVSS for vans or buses manufactured or operated in their state. Outside the U.S., entities such as the United Nations Economic Commission for Europe (UNECE) and Australian Design Rules have minimum standards for vehicle crashworthiness, occupant safety, and interior fittings.

Several National Transportation Safety Board (NTSB) recommendations advocate improved crashworthiness of mass transit bus vehicles, including removing the weight applicability restrictions for several standards; developing standards for frontal, side, rear, and rollover collisions; requiring manufacturers to comply with newly-developed occupant crash protection standards; and increasing roof strength standards. In addition, NTSB recognizes that medium-size buses, regardless of weight, operate in a manner similar to motorcoaches and, as such, should be held to similarly stringent standards. NTD data-driven analyses and a literature review provided insufficient evidence that crashworthiness standards should be mandatory for purpose-built transit, generally vehicles used in public transit fixed-route service over 40 ft in length, including articulated and BRT buses.

Using available data, recommendations from previous studies and reports that establish the efficacy of any established standards are presented. Specific findings of the study include the following:

- Some existing crashworthiness/CEM standards can be used for 40-ft or longer bus new vehicle procurements.
- As part of new or rehabilitation procurements, designs can include improved secondary impact designs that reduce injuries and fatalities. Passenger seating devices, attachments and tracking/anchorages, and seatback designs can be optimized to consider secondary impact collisions.
- Tailoring body-on-chassis cutaway vehicle procurement criteria to include rollover testing standards may improve crashworthiness for these types of vehicles.

Benefits

Although data are limited, FTA has long recognized the importance of bus crashworthiness and crash energy management, including secondary impact design improvements for these purpose-built buses. This report and FTA Report No. 0021, *Crashworthiness Evaluation of Mass Transit Buses*, are excellent resources for the transit industry and promote vehicles designed and built to improve transit safety.

Project Information

This research project was conducted by the Center for Urban Transportation Research at the University of South Florida. For more information, contact FTA Project Manager Raj Wagley at 202-366-5386 or Raj.Wagley@dot.gov. All FTA research reports can be found at <https://www.transit.dot.gov/about/research-innovation>.

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FTA Report No. 0179

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