

Federal Transit Administration Testing of Buses

August 1999

National Association of State Directors of Pupil Transportation Services

Information Report

Federal Transit Administration Testing of Buses

In 1987, the United States Congress directed the Federal Transit Administration (FTA) of the U.S. Department of Transportation to establish a Bus Testing Program for transit buses. Under the program, testing is required on all new model buses before they can be purchased with Federal funds. [Note: Since school buses are not purchased using Federal funds, they are not required to be tested under the Bus Testing Program.] Most of the testing under the Bus Testing Program is conducted at the Altoona Research and Testing Center in Altoona, Pennsylvania, and is often referred to as the “Altoona Tests.” Some of the testing is conducted at the Bus Research and Test Facility at Penn State University.

There are significant differences between the Federal Transit Administration’s Bus Testing Program and the testing required by the Federal Motor Vehicle Safety Standards (FMVSS) that are issued by the National Highway Traffic Safety Administration (NHTSA).

- Tests conducted under the Bus Testing Program is done by the Federal government, while FMVSS testing is the responsibility of the vehicle manufacturer. NHTSA conducts limited, random compliance testing to verify the manufacturers’ certification that their products meet the FMVSSs.
- The results of the tests conducted under the Bus Testing Program are compiled into a test report that is made available to the manufacturer of the bus, and are provided to potential purchasers during the bus procurement process.
- The results of the FMVSS testing conducted by manufacturers are used by those manufacturers to certify that a vehicle meets all applicable FMVSSs as of the date of vehicle production. For example, a manufacturer must have extensive, objective laboratory test results on the seat structure, seat anchorage, seat foam, and, if applicable, the restraint system and associated anchorages to certify that the school bus meets the passenger crash protection requirements of FMVSS No. 222.
- The tests required by the Bus Testing Program are significantly different from the tests required by bus manufacturers to show compliance with the FMVSS.
- FMVSS tests provide quantitative “pass” or “fail” information, while the Bus Testing Program provides mostly qualitative comparative information on buses.
- While the tests conducted under the Bus Testing Program provide important operational information about buses, they are not a substitute for the FMVSS vehicle safety tests.

Attached is a description of the nine (9) areas of bus performance tested under the Bus Test Program. Also attached is a chart which shows which FMVSSs apply to transit buses, small school buses, and large school buses, followed by a brief description of each of those FMVSSs.

**Federal Transit Administration
Bus Test Program
Areas of Testing for Transit Buses**

Maintainability – This area consists of evaluations of:

- Accessibility of Components and Subsystems – the focus is on items that would normally require maintenance or service.
- Servicing, Preventive Maintenance, and Repair and Maintenance during Testing – the collection of maintenance data during testing.
- Replacement and/or Repair of Selected Subsystems – this effort looks at the components that may be expected to fail or require replacement during the service life of the bus.

Reliability – This test is designed to evaluate the reliability of the bus by documenting unscheduled breakdowns, repairs, down time, and repair time that occur during testing.

Safety – This test is designed to assess the handling and stability characteristics of the bus. The bus is driven through a double lane-change course utilizing an “obstacle-avoidance maneuver” at increasing speeds until the test driver determines that the operation is unsafe, or until the top test speed is reached.

Performance – The objective of this test is to determine the acceleration, gradeability, and top speed capabilities of the bus. The bus is operated at its Seated Load Weight (empty weight plus 150 pounds for each passenger seating position and the driver) on a smooth and level test surface. The bus is accelerated at full throttle from a standstill to a maximum “geared” speed, maximum “governed” speed, or maximum “safe” speed, not to exceed 50 miles per hour.

Structural Integrity and Durability – This test consists of seven different procedures designed to assess structural integrity and durability. For example, a “structural shakedown” test is conducted by loading and unloading the bus frame with ballast equivalent to 2-1/2 times the maximum passenger capacity of the bus. Measurements are made to determine the amount of frame deflection at strategic locations on the frame, and to determine if any permanent deformation of the frame occurred. This test is conducted three times. Other tests are conducted in the areas of structural distortion, static and dynamic towing, jacking, hoisting, and structural durability.

Fuel Economy – This test provides comparable fuel consumption data on transit buses produced by different manufacturers. The test results will not represent actual “in-service” fuel consumption, and bears no relationship to the fuel efficiency calculations done by the Environmental Protection Agency.

Noise – Tests are conducted to measure interior noise levels and audible vibrations, as well as exterior noise levels, with the bus under various operating conditions.

Emissions Testing – Emissions testing is conducted while the bus is operated over a simulated transit duty cycle. While the Environmental Protection Agency testing of emissions is typically conducted on a new engine on an engine stand, this testing is done on an in-vehicle engine that has accumulated several thousand miles of operation.

Brake Testing – Tests are conducted on a 20-percent grade to determine the effectiveness of a bus parking brake. Additionally, tests are done to measure stopping distances.

Testing in the Bus Testing Program is conducted on transit buses of all power sources – gasoline, diesel, CNG, LNG, methanol/ethanol, propane, and battery-powered.

Additional information on the Bus Testing Program is available at www.vss.psu.edu/fta.

**National Highway Traffic Safety Administration
Federal Motor Vehicle Safety Standards
for School Buses and Transit Buses**

FMVSS No.	Title of Standard	Transit Buses	School Buses under 10,000# GVWR	School Buses over 10,000 # GVWR
101	Controls and Displays	x	x	x
102	Transmission Shift Lever Sequence, Starter Interlock, and Transmission Braking Effect	x	x	x
103	Windshield Defrosting and Defogging Systems	x	x	x
104	Windshield Wiping and Washing Systems	x	x	x
105	Hydraulic Brake Systems	x	x	x
106	Brake Hoses	x	x	x
108	Lamps, Reflective Devices, and Associated Equipment	x	x	x
111	Rearview Mirrors	x	x	x
113	Hood Latch System	x	x	x
116	Motor Vehicle Brake Fluids	x	x	x
119	New Pneumatic Tires for Vehicles Other Than Passenger Cars	x	x	x
120	Tire Selection and Rims for Motor Vehicles Other Than Passenger Cars	x	x	x
121	Air Brake Systems	x	x	x
124	Accelerator Control Systems	x	x	x
131	School Bus Pedestrian Safety Devices		x	x
201	Occupant Protection in Interior Impact		x	
202	Head Restraints		x	
203	Impact Protection for the Driver from the Steering Control System		x	
204	Steering Control Rearward Displacement		x	

205	Glazing Materials	x	x	x
207	Seating Systems	x ¹	x ¹	x ¹
208	Occupant Crash Protection	x ¹	x	x ¹
209	Seat Belt Assemblies	x ¹	x	x ¹
210	Seat Belt Assembly Anchorages	x ¹	x	x ¹
212	Windshield Mounting		x	
213	Child Restraint Systems		x ²	x ²
214	Side Impact Protection		x	
217	Bus Emergency Exits and Window Retention and Release	x	x	x
219	Windshield Zone Intrusion		x	
220	School Bus Rollover Protection		x	x
221	School Bus Body Joint Strength		x	x
222	School Bus Passenger Seating and Crash Protection		x	x
225	Child Restraint Anchorage Systems		x	
301	Fuel System Integrity		x	x
302	Flammability of Interior Materials	x	x	x
303	Fuel System Integrity of Compressed Natural Gas Vehicles	x	x	x

Footnotes:

¹ Standard applies to the driver's seat only.

² Standard applies to vehicles with an integral child safety seat.

SUMMARY DESCRIPTION AND PURPOSE OF SELECTED FEDERAL MOTOR VEHICLE SAFETY STANDARDS

STANDARD NO. 101 - Controls and Displays

This standard specifies requirements for the location, identification, and illumination of motor vehicle controls and displays. Its purpose is to ensure the accessibility and visibility of motor vehicle controls and displays and to facilitate their selection under daylight and nighttime conditions, in order to reduce the safety hazards caused by the diversion of the driver's attention from the driving task, and by mistakes in selecting controls.

STANDARD NO. 102 - Transmission Shift Lever Sequence, Starter Interlock, and Transmission Braking Effect

This standard specifies the requirements for the transmission shift lever sequence, a starter interlock, and for a braking effect of automatic transmissions, to reduce the likelihood of shifting errors, starter engagement with vehicle in the "drive" position, and to provide supplemental braking at speeds below 25 miles per hour.

STANDARD NO. 103 - Windshield Defrosting and Defogging Systems

This standard specifies requirements for windshield defrosting and defogging systems to ensure driver visibility under adverse weather conditions.

STANDARD NO. 104 - Windshield Wiping and Washing Systems

This standard specifies requirements for windshield wiping and washing systems to ensure driver visibility under adverse weather conditions.

STANDARD NO. 105 - Hydraulic Brake Systems

This standard specifies requirements for hydraulic service brake and associated parking brake systems. Its purpose is to insure safe braking performance under normal and emergency conditions.

STANDARD NO. 106 - Brake Hoses

This standard specifies labeling and performance requirements for motor vehicle brake hoses, brake hose assemblies, and brake hose end fittings. Its purpose is to reduce brake system failure from pressure or vacuum loss due to hose or hose assembly rupture.

STANDARD NO. 108 - Lamps, Reflective Devices, and Associated Equipment

This standard specifies requirements for original and replacement lamps, reflective devices, and associated equipment, to provide adequate illumination of the roadway and enhance conspicuity of motor vehicles on the public roads.

STANDARD NO. 111 - Rearview Mirrors

This standard specifies requirements for the performance and location of inside and outside rearview mirrors. Its purpose is to ensure that the driver has a clear and reasonably unobstructed view of areas around the vehicle.

STANDARD NO. 113 - Hood Latch System

This standard specifies the requirements for providing a hood latch system(s).

STANDARD NO. 116 - Motor Vehicle Brake Fluids - Passenger Cars, Multipurpose Passenger Vehicles, Trucks, Buses, Trailers, Motorcycles, and All Fluid for Use in Hydraulic Brake Systems of Motor Vehicles.

This standard specifies requirements for fluids for use in hydraulic brake systems of motor vehicles, containers for these fluids, and labeling of the containers. Its purpose is to reduce failures in the hydraulic braking systems of motor vehicles which may occur because of the manufacture or use of improper or contaminated brake fluid.

STANDARD NO. 119 - New Pneumatic Tires for Vehicles Other Than Passenger Cars

This standard establishes performance and marking requirements for tires. Its purpose is to provide safe operational performance levels for tires used on motor vehicles other than passenger cars, and to place sufficient information on the tires to permit their proper selection and use.

STANDARD NO. 120 - Tire Selection and Rims for Motor Vehicles Other Than Passenger Cars

This standard specifies tire and rim selection requirements and rim marking requirements. Its purpose is to provide safe operational performance by ensuring that vehicles to which it applies are equipped with tires of adequate size and load rating and with rims of appropriate size and type designation.

STANDARD NO. 121 - Air Brake Systems

This standard establishes performance and equipment requirements for braking systems on vehicles equipped with air brake systems. Its purpose is to insure safe braking performance under normal and emergency conditions.

STANDARD NO. 124 - Accelerator Control Systems

This standard establishes requirements for the return of a vehicle's throttle to the idle position when the driver removes the actuating force from the accelerator control, or in the event of severance or disconnection in the accelerator control system.

STANDARD NO. 131 - School Bus Pedestrian Safety Devices

This standard establishes requirements for devices that can be installed on school buses to improve the safety of pedestrians in the vicinity of stopped school buses. Its purpose is to minimize the likelihood of vehicles passing a stopped school bus and striking pedestrians in the vicinity of the bus.

STANDARD NO. 201 - Occupant Protection in Interior Impact

This standard specifies requirements to afford impact protection for occupants.

STANDARD NO. 202 - Head Restraints

This standard specifies requirements for head restraints to reduce the frequency and severity of neck injury in rear-end and other collisions.

STANDARD NO. 203 - Impact Protection for the Driver from the Steering Control System

This standard specifies requirements for steering control systems that will minimize chest, neck, and facial injuries to the driver as a result of impact.

STANDARD NO. 204 - Steering Control Rearward Displacement

This standard specifies requirements limiting the rearward displacement of the steering control into the passenger compartment, to reduce the likelihood of chest, neck, or head injury.

STANDARD NO. 205 - Glazing Materials

This standard specifies requirements for glazing materials for use in motor vehicles and items of motor vehicle equipment. Its purpose is to reduce injuries resulting from impact into glazing surfaces, to ensure a necessary degree of transparency in motor vehicle windows for driver visibility, and to minimize the possibility of occupants being thrown through the vehicle windows in collisions.

STANDARD NO. 207 - Seating Systems

This standard establishes requirements for seats, their attachment assemblies, and their installation to minimize the possibility of their failure by forces acting on them as a result of vehicle impact.

STANDARD NO. 208 - Occupant Crash Protection

This standard specifies performance requirements for the protection of vehicle occupants in crashes. Its purpose is to reduce the number of deaths of vehicle occupants, and the severity of injuries, by specifying vehicle crashworthiness requirements in terms of forces and accelerations measured on anthropomorphic dummies in test crashes, and by specifying equipment requirements for active and passive restraint systems.

STANDARD NO. 209 - Seat Belt Assemblies

This standard specifies requirements for seat belt assemblies.

STANDARD NO. 210 - Seat Belt Assembly Anchorages

This standard establishes requirements for seat belt assembly anchorages to insure their proper location for effective occupant restraint and to reduce the likelihood of their failure.

STANDARD NO. 212 - Windshield Mounting

This standard establishes windshield retention requirements for motor vehicles during crashes. Its purpose is to provide for retention of the vehicle's windshield during a crash, thereby utilizing fully the penetration-resistance and injury-avoidance properties of the windshield glazing materials and preventing the ejection of occupants from the vehicle.

STANDARD NO. 213 - Child Restraint Systems

This standard specifies requirements for child restraint systems used in motor vehicles. Its purpose is to reduce the number of children killed or injured in motor vehicle crashes.

STANDARD NO. 214 - Side Impact Protection

This standard specifies performance requirements for protection of occupants in side impact crashes. Its purpose is to reduce the risk to vehicle occupants in side impact crashes by specifying vehicle crashworthiness requirements in terms of accelerations measured on anthropomorphic dummies in test crashes, by specifying strength requirements for side doors, and by other means.

STANDARD NO. 217 - Bus Emergency Exits and Window Retention and Release

This standard establishes requirements for the retention of windows other than windshields in buses, and establishes operating forces, opening dimensions, and markings for push-out bus windows and other emergency exits. Its purpose is to minimize the likelihood of occupants being thrown from the bus and to provide a means of readily accessible emergency egress.

STANDARD NO. 219 - Windshield Zone Intrusion

This standard specifies limits for the displacement into the windshield area of motor vehicle components during a crash. Its purpose is to reduce crash injuries and fatalities that result from occupants contacting vehicle components displaced near or through the windshield.

STANDARD NO. 220 - School Bus Rollover Protection

This standard establishes performance requirements for school bus rollover protection. Its purpose is to reduce the number of deaths and the severity of injuries that result from failure of the school bus body structure to withstand forces encountered in rollover crashes.

STANDARD NO. 221 - School Bus Body Joint Strength

This standard establishes requirements for the strength of the body panel joints in school bus bodies. Its purpose is to reduce deaths and injuries resulting from the structural collapse of school bus bodies during crashes.

STANDARD NO. 222 - School Bus Passenger Seating and Crash Protection - School Buses.

This standard establishes occupant protection requirements for school bus passenger seating and restraining barriers. Its purpose is to reduce the number of deaths and the severity of injuries that result from the impact of school bus occupants against structures within the vehicle during crashes and sudden driving maneuvers.

STANDARD NO. 225 - Child Restraint Anchorage Systems

This standard establishes requirements for child restraint anchorage systems to ensure their proper location and strength for the effective securing of child restraints, to reduce the likelihood of anchorage systems' failure, and to increase the likelihood that child restraints are properly secured.

STANDARD NO. 301 - Fuel System Integrity

This standard specifies requirements for the integrity of motor vehicle fuel systems. Its purpose is to reduce fires that result from fuel spillage during and after motor vehicle crashes.

STANDARD NO. 302 - Flammability of Interior Materials

This standard specifies burn resistance requirements for materials used in the occupant compartments of motor vehicles. Its purpose is to reduce deaths and injuries to motor vehicle occupants caused by vehicle fires, especially those originating in the interior of the vehicle from sources such as matches or cigarettes.

STANDARD NO. 303 - Fuel System Integrity of Compressed Natural Gas Vehicles

This standard specifies requirements for the integrity of motor vehicle fuel systems using compressed natural gas (CNG), including the CNG fuel systems of bi-fuel, dedicated, and dual fuel CNG vehicles. Its purpose is to reduce deaths and injuries occurring from fires that result from fuel leakage during and after motor vehicle crashes.