APTA STANDARDS DEVELOPMENT PROGRAM

STANDARD

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APTA PRESS Passenger Systems Working Group

Emergency Evacuation Units for Passenger Railcars

Abstract: This standard contains the minimum requirements for an emergency egress system for new and remanufactured passenger railcars using a combination of doors and emergency window exits suitably equipped for use in an emergency.

Keywords: EEU, egress, emergency exit, emergency window, evacuation

Summary: As a result of derailments, onboard fires and other emergency incidents that require passengers to exit a passenger railcar without the intervention of a member of the train crew, each car must have a sufficient number of exit paths that remain usable after an incident. In the most likely derailment and fire scenarios, one side and one end of a railcar will not be suitable for emergency egress, requiring alternative means to exit the car on the remaining usable paths. Due to the great number of car configurations, the passenger railroad operator and the car designer shall determine the combination of exit doors and emergency exit windows required to establish an emergency egress system, as expressed in emergency evacuation units (EEUs).

Scope and purpose: This standard is intended to ensure that passenger railcar occupants have usable emergency exit paths. It applies to both new and remanufactured passenger railcars. A combination of doors and emergency exit windows providing no fewer than the minimum number of EEUs per car constitutes the emergency egress system for a specific car design. EEU calculations apply only to passenger car occupants exiting the vehicle and not to emergency responders trying to gain access from the exterior. In applying this standard, the preferred method of egress is through doors supplemented by sufficient emergency windows as required to achieve the minimum EEU value for the car design.

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Introduction

This introduction is not part of APTA PR-PS-S-003-98, Rev. 2, "Emergency Evacuation Units for Passenger Railcars."

This standard applies to all:

- railroads that operate intercity or commuter passenger train service on the general railroad system of transportation; and
- railroads that provide commuter or other short-haul rail passenger train service in a metropolitan or suburban area, including public authorities operating passenger train service.

This standard does not apply to:

- rapid transit operations in an urban area that are not connected to the general railroad system of transportation;
- tourist, scenic, historic, or excursion operations, whether on or off the general railroad system of transportation;
- operation of private cars, including business/office cars and circus trains; or
- railroads that operate only on track inside an installation that is not part of the general railroad system of transportation.

The ability of passengers to evacuate a passenger car immediately following a derailment or other emergency condition is determined by the number of usable exits and alternate means of egress. Predicting the number of usable exits requires a selection of emergency scenarios to ascertain what is likely to occur and what steps passengers with minimal orientation and on-scene guidance can be expected to take to reduce their exposure to danger. The NTSB in rail accident investigations has focused attention on the need to improve the passengers' ability to protect themselves in times of peril when train crew members are either not able or are not surviving to organize a rescue effort. Prescriptive solutions in the past have simply imposed a set number of emergency exits without regard to car configuration or seat capacity. Likewise, there are a multitude of car designs for which a prescriptive approach neither improves emergency egress nor satisfactorily addresses some likely scenarios, even though they are "compliant."

The Federal Railroad Administration (FRA) regulations contained in 49 CFR, Part 238, require that each passenger railcar be equipped with at least two exterior side doors that are at least 30 in. in width. In addition, the FRA requires that at least four emergency window exits with a minimum size of 24 × 26 in. be provided on each main level of the railcar.

This standard establishes a performance-driven emergency egress protocol that allows the passenger railroad operator and car builder to effectively combine various types of exits in a car that are related to the seating capacity, using the emergency evacuation unit to determine the number of exit paths needed considering that after an accident significant numbers of windows and doors may be inoperative or inaccessible due to overturning or crushing of the carbody.

Emergency Evacuation Units for Passenger Railcars

1. Design requirements

Each passenger rail car shall have designated exit paths composed of a combination of door exits, removable panel exits, roof hatches and emergency window exits to achieve a usable exit path (UXP) factor composed of applicable emergency evacuation units (EEUs), no less than the capacity exit factor (CXF), i.e. a UXP ≥ CXF.

Bi-parting doors in an exit path may only be assigned an EEU value, provided that each door leaf is at least 30 in. (76 cm) in width or the manual override mechanism releases both leafs to create a clear 30 in. path.

In addition to the EEU requirements for the general seating spaces of the railcar, each sleeping compartment shall have one emergency window exit EEU. Only 25% of sleeping compartment EEUs may be included in the calculation of UXP.

Each passenger railcar shall have a minimum of two emergency removable panels or window exits per car level, per car side. Any level other than a main level used for passenger seating in a multilevel passenger car, such as an intermediate level, shall have a minimum of two emergency removable panels or window exits in each seating area. The emergency removable panels or window exits shall be accessible to passengers in the seating area without requiring movement through an interior door or to another level of the car. At least one emergency removable panel or window exit shall be located in each side of the seating area. An emergency removable panel or window exit may be located within an exterior side door in the passenger compartment if it is not practical to place the emergency removable panel or window exit in the side of the seating area. This standard does not prohibit use of dual-function emergency windows that serve as emergency exits and emergency responder access points.

Only one emergency window exit is required in a seating area in a passenger compartment if:

- it is not practical to place an emergency window exit in a side of the passenger compartment; and
- there are no more than four seats in the seating area; and
- a suitable, alternate arrangement for emergency egress is provided.

Emergency window exits shall be distributed throughout the passenger carbody to reduce interior travel distance.

Exit doors and emergency window exits shall be manually operable without special tools. For breakable emergency exit windows, a readily accessible tool appropriate to break the glass shall be provided with markings.

Exit doors and window exits shall be marked in accordance with 49 CFR Part 238, as well as APTA PR-PS-S-002-98, Rev. 3, “Emergency Egress/Access Signage for Passenger Rail Equipment,” APTA PR-PS-S-004-

98, Rev. 2, "Low-Location Exit Path Marking," and correspond with emergency instructions distributed to passengers and procedures included in the 49 CFR Part 239.101 Emergency Preparedness Plan.

TABLE 1
Emergency Exit Unit Values by Emergency Exit Type

Emergency Exit Type		EEU Value
Exit Path Door (Height ≥ 74 in.)	Width ≥ 60 in.	4.0
	30 in. ≤ Width < 60 in.	2.0
Emergency Window Exit 26 (horizontal) × 24 (vertical) in.		1.0
Roof Hatch		0.5
Removeable Panel or Window on Exit Path Door (Compliant with 49 CFR 238.112(f))		0.5
End-Frame Door in Cab		0.0
End Frame Door in Vestibule with Side Doors		0.0
End Frame Door with Door Threshold > 5 ft above TOR		0.0

Related APTA standards

APTA PR-PS-S-002-98, Rev. 3, "Emergency Signage for Egress Access of Passenger Railroad Equipment"
APTA PR-PS-S-004-98, Rev. 2, "Low-Location Exit Path Marking"

References

Code of Federal Regulations:
- Title 49 CFR, Part 238, Passenger Equipment Safety Standards
  - Subpart B, Safety Planning and General Requirements
    - Section 112, Door emergency egress and rescue access systems.
    - Section 113, Emergency window exits.
- Title 49 CFR, Part 239, Passenger Train Emergency Preparedness
  - Subpart B, Specific Requirements
    - Section 101, Emergency preparedness plan.
- Title 49 CFR, Part 270, Passenger System Safety Program

Urban Mass Transportation Administration (UMTA) Bay Area Rapid Transit (BART) C Car, Report No. UMTA-MA-06-0178-87-1, September 1987.

Definitions

car level: A horizontal surface with permanently installed seating that is separated by at least 4 ft (1.22 m) vertically from another seating area.

capacity exit factor (CXF): A value equal to the seating capacity of the car, divided by 20, rounded upward to the next whole number.

$$CXF = \frac{Seated\ Capacity}{20}$$

emergency evacuation unit (EEU): A numerical value assigned to an egress element that correlates to the speed and ease of exiting by a rail passenger.

emergency window exit: A window equipped with interior fittings to permit a passenger to easily remove the glazing, complying with 49 CFR, Part 238.113, Emergency Window Exits, which has an EEU value of 1.0.

end frame door: An end-facing door normally located between, or adjacent to, the collision posts or similar end frame structural elements. An end frame door located in a vestibule with side exit doors or a driving cab shall not be considered an exit path door for calculating the car EEU. On multilevel cars, each end frame exit door with a door threshold higher than 5 ft (1.52 m) above top of rail shall have an EEU value of zero and not be considered to be an exit path.

exit path door: A door or sequential series of doors intended to be used as a passenger emergency exit path to gain access to exterior as shown in the railroad's passenger emergency egress instructions and complying with 49 CFR, Section 238.112. Doors shall have an EEU value of 2.0 per door opening. Exit path doors that incorporate a removable panel or removable window complying with 238.112(f) shall have an EEU value of 2.5.

exterior side door: A door used as the primary means of passenger boarding and disembarking from a passenger car and, in the event of an emergency after the train has stopped, the primary emergency exit.

manually operated door: A door that can be operated by a passenger without tools or keys using only body strength to overcome the door closer, friction and gravity.

power-operated door: A door equipped with a power operator that, in an emergency, shall be capable of manual operation with an override device in accordance with 49 CFR, Parts 238.112.

private accommodation: An enclosed room with a door within the passenger car equipped with seating or bedding where one or more people may occupy the space exclusively.

reasonable exit rate: Per the Bay Area Rapid Transit (BART) C Car report (see References), a reasonable exit rate for a door is 35 people per minute. (Using this criterion, one EEU is provided for each group of 20 passenger seats.)

roof hatch: A roof opening to allow passengers to egress a car that is not upright. Each roof opening shall have an EEU value of 0.5.

sleeping compartment: An enclosed room with a door within the passenger car equipped with seating or bedding where one or more people may occupy the space exclusively.

usable exit path value (UXP): The number of emergency windows, exit doors and roof hatches (if applicable) that can be used by passengers after an incident that requires emergency egress from the vehicle. This value shall be the sum of EEUs for one side of the car, plus 50% of exit path doors, plus the sum of the roof hatch(s).

$$UXP = \frac{Total\ EEUs - EEUs\ from\ roof\ hatches}{2} + EEUs\ from\ roof\ hatches$$

vestibule: An area of a passenger car that normally does not contain seating, is located adjacent to a side exit door, and is used in passing from a seating area to a side exit door.

vestibule door: A door complying with 49 CFR Part 238.112(f) separating a seating area from a vestibule. End frame doors and doors separating sleeping compartments or similar private compartments from a passageway are not vestibule doors.

Abbreviations and acronyms

BART	Bay Area Rapid Transit
CFR	Code of Federal Regulations
CXF	capacity exit factor
EEU	emergency evacuation units
FRA	Federal Railroad Administration
NATSA	North American Transportation Services Association
UMTA	Urban Mass Transportation Administration (now Federal Transit Administration)
UXP	usable exit path

Summary of document changes

- Document formatted to the new APTA standard format.

- Sections have been moved and renumbered.
- Scope and summary moved to the front page.
- Definitions, abbreviations and acronyms moved to the rear of the document.
- Two new sections added: “Summary of document changes” and “Document history.”
- Some global changes to section headings and numberings resulted when sections dealing with references and acronyms were moved to the end of the document, along with other cosmetic changes, such as capitalization, punctuation, spelling, grammar and general flow of text.
- Names of participants updated.
- Introduction updated.
- Incorporated 2013 changes to 49 CFR 238.112 regarding exit doors.
- Provided clarification on how to evaluate end frame doors that are included in an exit path.
- Added provision for breakable window, removeable panels.
- Added provisions for removeable panel exits.
- Added clarification for manually operated dual release mechanism for bi-parting doors.
- Added requirements for emergency window placement on multilevel equipment.
- Added provisions for breakable window exits.
- Added table detailing EEU values.
- Changed value of a single EEU to 20 seats.

Document history

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First published	June 15, 1998	—	—	March 17, 1999	May 22, 1999
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