FTA RESEARCH

FEDERAL TRANSIT ADMINISTRATION

Emergency Lighting and Signage for Rail Transit Passenger Vehicles

AUGUST 2021

FTA Report No. 0199

PREPARED BY
MaryClara Jones
Transportation Technology Center, Inc.
A subsidiary of the Association of American Railroads

U.S. Department of Transportation
Federal Transit Administration

COVER PHOTO

Courtesy of Bay Area Regional Transit (BART)

DISCLAIMER

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Metric Conversion Table

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
NOTE: volumes greater than 1000 L shall be shown in m^3				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
^oF	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	^oC

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14. ABSTRACT

This study collected information necessary to issue recommendations, voluntary standards, or guidance documents related to emergency lighting and signage for rail transit passenger vehicles. Industry needs identified include signage related to emergency egress near a third rail, signage for emergency personnel that would relay emergency information, and signage that is more internationally-recognizable. Current standards were evaluated for necessary modifications to make them applicable to rail transit; results indicate that non-transit rail standards would need some modification, but rail transit standards could be implemented without modifications.

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Abstract

This study collected information necessary to issue recommendations, voluntary standards, or guidance documents related to emergency lighting and signage for rail transit passenger vehicles. Industry needs identified include signage related to emergency egress near a third rail, signage for emergency personnel that would relay emergency information, and signage that is more internationally-recognizable. Current standards were evaluated for necessary modifications to make them applicable to rail transit; results indicate that non-transit rail standards would need some modification, but rail transit standards could be implemented without modifications.

This report is based on investigations and tests conducted by Transportation Technology Center, Inc. (TTCI), a subsidiary of the Association of American Railroads, with the direct participation of the Federal Transit Administration (FTA) and the Center for Urban Transportation Research (CUTR) at the University of South Florida. The contents of this report imply no endorsements whatsoever by TTCI of products, services, or procedures, nor are they intended to suggest the applicability of the test results under circumstances other than those described in this report. TTCI makes no representations or warranties, either express or implied, with respect to this report or its contents. TTCI assumes no liability to anyone for special, collateral, exemplary, indirect, incidental, consequential, or any other kind of damages resulting from the use or application of this report or its contents.

EXECUTIVE SUMMARY

The Federal Transit Administration (FTA) entered into a Cooperative Agreement with the Center for Urban Transportation Research (CUTR) at the University of South Florida to research areas of transit safety risk, identify existing standards and recommended practices to address those areas of risk, and perform a gap analysis to establish the need for additional standards, guidance, or recommended practices to support and further the safe operation of the nation's public transportation industry. At the direction of FTA, CUTR and its research partner, the Transportation Technology Center, Inc. (TTCI) are performing research and background studies on various topics to collect the information necessary for FTA to issue recommendations to the industry on voluntary standards or publish guidance documents or resource reports to assist the industry in mitigating areas of risk. The findings of this report and subsequent guidance can be leveraged to guide public transit agency decision-making. One area of research is Emergency Lighting and Signage, including Low Location Emergency Path Markings (LLEPM) for rail transit vehicles for heavy rail, light rail, and streetcar modes.

A review of available reports, standards, and regulations related to emergency lighting and signage on all rail modes and their use was completed. The documents were reviewed for applicability to rail transit (heavy rail, light rail, and streetcar modes). Evaluation of industry needs for emergency lighting and signage standards was completed through research reports, National Transportation Safety Board (NTSB) recommendations, and the CUTR Transit Safety Standards Working Group established for industry stakeholder input. Industry needs identified can be summarized in the following focus areas:

- Signage related to emergency egress near a third rail
- Signage for emergency personnel that would relay emergency information
- Signage that is more internationally recognizable

Emergency lighting and signage standards identified during the literature search include American Public Transportation Association (APTA) standards, Code of Federal Regulations (CFR), Association of American Railroads (AAR) Manual of Standards and Recommended Practices (MSRP), and three non-US international standards. Refer to Appendix A for all identified standards.

Standards were evaluated for necessary modifications to make the standard applicable to rail transit and testing required to confirm they meet the standard. Whereas non-transit rail standards would have to be slightly modified, rail transit standards could be implemented without modification. All standards require specific installation testing, but only APTA specifications for emergency lighting, emergency signage, and LLEPM required periodic inspection to confirm the emergency lighting is still working and emergency signage and LLEPM is not damaged.

Data collection on emergency lighting and signage implementation in transit agency fleets in the US was completed through a data collection form delivered to all State Safety Oversight Agency (SSOA) managers. As reported:

- Emergency lighting has been implemented in 78% of rail transit vehicles; however, fewer than 2.4% of those vehicles are designed to a publicly-availably standard such as APTA's; rather, the emergency lighting was designed to meet agency-specific Requests For Proposal (RFP) that do not refer to any publicly-available standard.
- Emergency signage has been implemented in 80% of rail transit vehicles; however, only 3.4% of those vehicles are designed to a publicly-available standard. Only one agency has implemented signage related to emergency exits near third rail(s), and two agencies have implemented bilingual emergency signs.
- Implementation of LLEPM is low, with only 12% of rail transit vehicles equipped with it. Currently, transit implementation is voluntary, and it is unknown if LLEPM incorporation will grow.

The research revealed several findings based on feedback and suggestions from the CUTR Transit Standards Working Group:

- **Finding 1**: Installation of new rail transit vehicle emergency lighting that meets or exceeds APTA-RT-VIM-S-020-10 (Latest Revision), Emergency Lighting System Design for Rail Transit Vehicles will homogenize the implementation of emergency lighting on fleets and ensure that emergency lighting meets a recognized industry standard.
- **Finding 2**: Implementation of emergency lighting on mid-life overhaul vehicles that meets or exceeds APTA-RT-VIM-S-020-10 (Latest Revision), Emergency Lighting System Design for Rail Transit Vehicles will homogenize emergency lighting on fleets and ensure that the emergency lighting meets a recognized industry standard.
- **Finding 3**: Third rail hazard signs next to emergency exits that are near third rails (specifically for heavy rail transit systems) and general egress signage (all modes) may incorporate more internationally-recognizable symbols to enhance passenger knowledge and safety about egress procedures next to high voltage apparatus.
- **Finding 4**: Rail vehicle general egress signage (all modes) containing internationally-recognizable symbols will enhance passenger (all nationalities) knowledge and safety about egress procedures. There is a gap in the available rail signage standards showing a lack of internationally-recognizable general egress signage.
- **Finding 5**: New vehicle procurements can meet or exceed the APTA-RT-VIM-S-021-10 Emergency Signage for Rail Transit Vehicles standard, which will ensure that new vehicles meet industry standards.

- **Finding 6**: Mid-life rehabilitation vehicle procurements may be able to meet or exceed APTA-RT-VIM-S-021-10 (Latest Revision), Emergency Signage for Rail Transit Vehicles.
- **Finding 7**: New rail transit vehicle LLEPM installations can meet or exceed the APTA-RT-VIM-S-022-10 (Latest Revision) Low-Location Emergency Path Marking for Rail Transit Vehicles standard. Research showed that only 8% of rail transit vehicles currently have LLEPM.
- **Finding 8**: Mid-life rehabilitation procurements may implement LLEPM that meets or exceeds APTA-RT-VIM-S-022-10 (Latest Revision) Low-Location Emergency Path Marking for Rail Transit Vehicles. Due to legacy design workarounds and cost considerations, active lighting solutions may not be practical for remaining rail vehicle lives, whereas passive self-illuminating markings may be practical.
- **Finding 9**: This review did not include a significant sampling size of modern Emergency Lighting and Signage RFP specifications. A comparison of new-build emergency lighting and signage performance, characteristics, maintenance, and testing requirements may identify best industry designs and practices.
- **Finding 10**: There are additional ways to provide meaningful public emergency preparedness and notifications using visual and audio safety signs, dynamic messages such as cell phone messages and electronic signs, and tailored disability notifications that are in accordance with the Americans with Disabilities Act (ADA).

SECTION 1

Introduction

The Federal Transit Administration (FTA) entered into a Cooperative Agreement with the Center for Urban Transportation Research (CUTR) at the University of South Florida to research areas of transit safety risk, identify existing standards and recommended practices to address those areas of risk, and perform a gap analysis to establish the need for additional standards, guidance, or recommended practices to support and further the safe operation of the nation's public transportation industry. At the direction of FTA, CUTR and its research partner, the Transportation Technology Center, Inc. (TTCI), are performing research and background studies on various topics to collect the information necessary for FTA to issue recommendations to the industry on voluntary standards or publish guidance documents or resource reports to assist the industry in mitigating areas of risk. The findings of this report and subsequent guidance can be leveraged to guide public transit agency decision-making. One area of research is emergency lighting and signage on rail transit passenger vehicles. Emergency lighting and signage on the inside of rail transit passenger vehicles allows for passengers to exit in an emergency such as a crash, power loss, etc. Emergency lighting and signage also provides emergency responders with information about accessing areas of the rail transit passenger vehicles in an emergency.

The main tasks of the project included the following:

- Conduct background research to collect information on existing rail- and transit-related specifications or voluntary standards that can be applied to the rail transit industry.
- Analyze industry needs through discussions with industry stakeholders, review of reports and recommendations from the National Safety Transportation Board (NTSB), and conduct of a literature review of other available sources.
- Identify gaps in standards that address industry needs.
- Review existing standards and specifications and identify those deemed inadequate or those that may require modification or enhancement to make them applicable to rail transit.
- Make recommendations on existing standards that may be directly applicable without modifications.

A Transit Safety Standards Working Group was formed comprised of industry stakeholders from small and large US transit agencies. The role of the Working Group was to inform the project team, validate and verify the need for given

standards, make recommendations related to transit safety-related standards, and provide overall advice and direction to the project team.

This final report details the main tasks on emergency lighting and signage in the rail transit industry, which includes heavy rail, light rail, and streetcar.

Industry Need

The ability for passengers to exit a train during an emergency and for emergency personnel to enter a rail car to assist passengers is a complex process that depends on several dynamic factors and conditions. The conditions present at the time of the emergency (darkness, fire, smoke, etc.) and emergency lighting and signage on the rail car affect the time required for evacuation. Lack of sufficient lighting prevents passengers from being able to see their surroundings, identify exit locations, and read emergency signage so they can effectively react and evacuate after an accident.

Several rail accidents over the past 20+ years show the need for standardized emergency lighting and signage on passenger rail cars. One particular US commuter rail incident resulted in National Transportation Safety Board (NTSB) recommendations for emergency lighting and signage. In February 1996 in Silver Springs, Maryland, collision between an Amtrak passenger train and a Maryland Area Rail Commuter (MARC) passenger train caused the fuel tank of the MARC train to be ruptured; as a result, a fire started.[1] On the MARC train, all three crew members were fatally injured. Of the 20 passengers, 8 were fatally injured in the derailment and subsequent fire, and 11 were injured; on the Amtrak train, 15 of the 182 passengers and crew were injured.

Due to the difficulty in finding and using emergency egress doors and windows, the NTSB recommended that "all exterior emergency door release mechanisms on passenger cars be functional before a passenger car is placed in revenue service, that the emergency door release mechanism be placed in a readily accessible position and marked for easy identification in emergencies and derailments, and that these requirements be incorporated into minimum passenger car safety standards."[2]

Other international incidents have occurred since the 1990s that also have identified the need for emergency lighting and signage standards.

[1] National Transportation Safety Board (NTSB), "Collision and Derailment of a Maryland Rail Commuter MARC Train 286 and National Railroad Passenger Railroad (Amtrak) Train 29 Near Silver Spring, Maryland on February 16, 1996," Report No. NTSB/RAR-97/02, adopted July 3, 1997.

[2] Transport Safety Regulation Division North/South Wales, "Train Door Emergency Egress and Access and Emergency Evacuation Procedures," Safety Report, November 2004.

In addition to the NTSB recommendation on emergency lighting and signage and other international incidents, the Working Group subcommittee provided insight into industry needs not specifically identified in NTSB recommendations, including the following:

- Emergency egress of passengers from a rail transit passenger vehicle is a critical safety concern, and standards should address all needs across transit rail modes.
- Emergency lighting and signage for transit vehicle tunnel evacuations are critical concerns due to the potential for poor lighting and ventilation, especially for smoke and fire incidents.
- Available industry standards, especially for heavy rail, do not address emergency egress door signage for evacuations on the third rail sides of vehicles.
- Available industry standards do not address train emergency egress sign requirements and do not specify standardized and internationally-recognized symbology that would assist diverse local populations.
- Available technologies can be added to improve emergency egress and notification for passengers, including but not limited to visual and audio safety signs and dynamic messages such as cell phone localized messages and electronic signs for specific disability notifications in accordance with the ADA.

SECTION 2

Literature Review

Emergency Lighting and Signage Specification Used in Rail Modes

Effective egress of passengers during an emergency requires a system-based approach. This includes emergency lighting and signage characteristics and performance requirements specific to interior locations. An emergency lighting and signage specifications literature search was completed to identify current rail industry standards. (Note: This report examines only lighting and signage standards used during emergency events such as loss of power, smoke/fire, and crash incidents; it does not include an examination of normal operation lighting and signage standards. Low Location Emergency Path Markings (LLEPM) were considered separately in this literature review, as LLEPM have specific standards related to emergency egress.)

Review of the standards identified the following key classifications:

- Emergency Lighting – lighting used during an emergency (when normal lighting fails) inside the rail car only.
- Emergency Signage – signs attached to the rail car for emergency egress of people.
- LLEPM – markings that illuminate the exit path(s) to safety.

Specifications were classified by type and reviewed based on requirements listed in each document. The following subsections contain more detailed descriptions of each classification and the type of information provided in the standards. (See Appendix A for all specifications identified during the literature search.)

Emergency Lighting in Rail Modes

Passenger railcar interior emergency lighting specifications detail certain installation, performance, and operation requirements. Requirements found in the literature are categorized by the following:

- Locations – lighting should be placed to illuminate defined areas.
- Illuminance Criteria – measured and defined for locations at initial start and after a defined time lapse. (Note: Some specifications are different based on the age of the rail transit passenger vehicle.)
- Power Source – most specifications detail either main battery source or alternative sources.

- Procedures for testing – developed to meet illuminance criteria as noted above.
- Operating Conditions – operational and post-incident emergency lighting conditions including shock, electromagnetic interference (EMI), and orientation of the rail car.
- Maintenance – minimum maintenance and retesting requirements to ensure defined illuminance criteria as noted above.

The identified emergency lighting specifications are summarized in Table 2-1. Note that "Yes" indicates if the specification includes details that fall into that category; only specifications with details (not references to other specifications) are listed in the table.[3]

Of the specifications listed in Table 2-1, only three documents list requirements that target each of the six identified categories.[4,5] Note that the APTA RT-VIM-S-023-12, Emergency Egress/Access for Rail Transit Vehicles standard is listed because it references the APTA RT-S-VIM-020-08, Emergency Signage for Rail Transit Vehicles standard and is part of a family of rail transit vehicle emergency egress/access standards.

Emergency Signage in Rail Modes

Emergency signage specifications for passenger rail cars detail certain signage requirements for installation, instructions, material type, and illuminance. The requirements found in the literature are categorized as follows:

- Interior Sign Locations – where signs should be placed inside the rail car in relation to emergency exit points.
- Location of Exterior Signs – specific exterior areas where signs should be placed for emergency personnel.
- Sign Size and Letter Size – size and lettering characteristics of the sign.
- Illuminance Criteria – color and contrast of the sign material.
- Component Material – material characteristics of the sign.
- Operating Conditions – performance characteristics and environmental condition requirements such as mechanical vibrations, shock and electromagnetic interference
- Inspection and Maintenance – inspection and maintenance requirements of the sign.

[3] AMTRAK, PRIIA 305 Next-Generation Equipment Committee Standardized Technical Specifications, 2012.

[4] American Public Transportation Association, APTA RT-VIM-S-020-10, Emergency Lighting System Design for Rail Transit Vehicles, Washington, DC, 2010.

[5] American Public Transportation Association, APTA SS-E-013-99, Standard for Emergency Lighting System Design for Passenger Vehicles, Washington, DC, 1999.

Identified emergency signage specifications are summarized in Table 2-2. Note that "Yes" indicates if the specification has details that fall into that category; only specifications with details (not a reference to another specification) are listed in the table. APTA RT-VIM-S-023-12, September 2012, Emergency Egress/Access for Rail Transit Vehicles is listed because it references a commuter rail standard (APTA RT-S-VIM-020-08, Revision 1 Emergency Signage for Rail Transit Vehicles) and is part of a family of standards for emergency egress/access of rail transit vehicles.

No specific standards were found for signage related to the danger of exiting a heavy rail transit vehicle onto a side where a third rail is present. There are several examples of third rail danger signs used in the industry for signage on the right-of-way, but there is no specific industry standard for emergency exiting from rail vehicles with a third rail nearby.

Figures 2-1, 2-2, and 2-3 provide examples of third rail danger signs for notification of a third rail on a right-of-way.

Table 2-1 *Emergency Lighting Specifications*

Country, Type of Vehicle	Document	Location	Illuminance	Power Source	Testing Procedures	Operating Conditions	Maintenance
US, Commuter & Passenger Rail	FRA Regulation: Title 49 CFR 238.115, Emergency Lighting	Yes	Yes	Yes	No	Yes	No
US, Rail Transit	APTA RT-VIM-S-020-10, Emergency Lighting System Design for Rail Transit Vehicles	Yes	Yes	Yes	Yes	Yes	Yes
US, Freight Rail	*AAR Manual of Standards and Recommended Practices*, Section M, Locomotives and Locomotive Interchange Equipment	Yes	Yes	Yes	Yes	Yes	No
US, Commuter & Passenger Rail	APTA PR-E-S-013-99, Standard for Emergency Lighting System Design for Passenger Vehicles	Yes	Yes	Yes	Yes	Yes	Yes
EU, Passenger Rail	BS EN 13272:2012, Railway Applications. Electrical Lighting for Rolling Stock in Public Transport Systems	Yes	Yes	Yes	Yes	Yes	Yes
Australia, Passenger Rail	T HR RS 12001 ST, Interior and Exterior Lighting for Passenger Rolling Stock	Yes	Yes	Yes	No	No	No
US, Rail Transit	APTA RT-VIM-S-023-12, Emergency Egress/Access for Rail Transit Vehicles	No – References APTA RT-VIM-S-020-10, Emergency Lighting System Design for Rail Transit Vehicles and is part of a family of standards for emergency egress					

Table 2-2 *Emergency Signage Specification*

Country, Type of Vehicle)	Document	Location (Interior/ Exterior)	Sign Size and Letter Size	Illuminance	Component Material	Operating Conditions	Maintenance & Inspection
US, Commuter & Passenger Rail	APTA PR-PS-S-002-98, Standard for Emergency Signage for Egress/ Access of Passenger Rail Equipment	Yes/Yes	Yes	Yes	Yes	Yes	Yes
US, Rail Transit	APTA-RT-VIM-S-021-10, Emergency Signage for Rail Transit Vehicles	Yes/Yes	Yes	Yes	Yes	Yes	Yes
US, Commuter & Passenger Rail	FRA Regulation: Title 49 CFR 238.123, Emergency Roof Access	Yes	No	No	No	No	No
US, Public Rail Transit	APTA RT-VIM-S-023-12, Emergency Egress/Access for Rail Transit Vehicles	No – References APTA RT-VIM-S-020-10, Emergency Lighting System Design for Rail Transit Vehicles and is part of a family of standards for emergency egress					

Figure 2-1
Example of Third Rail Danger Sign

Source: Dennis Mojado

Figure 2-2
Example of Third Rail Danger Sign

Source: Richard Masoner / Cyclelicious, Flickr

Figure 2-3
Example of Third Rail Danger Sign

Source: Kreg Steppe, Flickr

Low Location Emergency Path (LLEPM) Markings in Rail Modes

The use of LLEPM markings is intended to provide visual guidance for passengers and operators to locate and operate primary emergency exits during conditions of low-light or darkness when the emergency lighting system is inoperative or when smoke conditions obscure overhead emergency light transmission. Passive LLEPM methods use photo luminescent materials that are charged with continuous ambient light. APTA standards indicate that LLEPM is intended to be used with other emergency lighting and signage. Major requirements in APTA documents include the following:

- Location of LLEPM for emergency exit identifications
- Illuminance criteria
- Evaluation measurement and tests
- System reliability
- Operating conditions
- Maintenance requirements

Table 2-3 shows available rail transit and commuter/passenger rail LLEPM standards. The APTA RT-VIM-S-023-12 Rev 0, Emergency Egress/Access for Rail Transit Vehicles standard is shown because it references APTA RT-S-VIM-020-08 Rev 1, Emergency Signage for Rail Transit Vehicles and is part of a family of rail transit emergency egress/access standards.

Standards for Emergency Lighting and Signage in Other Industries

Emergency lighting and signage standards for other industries exist. A review of the standards from other organizations was completed to identify applicability to rail transit vehicles. The two organizations with several emergency lighting and signage standards are:

- Occupation Safety and Health Administration (OSHA)
- International Organization for Standardization (ISO) Graphical Symbols

A review of the OSHA regulations revealed that 29 CFR §1910.37(b) has some applicability to emergency lighting and signage for rail transit vehicles. The regulation includes guidelines for emergency lighting and signage for exit routes, but the guidelines are more generalized for several industry applications and not as specific for the rail transit industry.[6] Further, 29 CFR §1910.145 defines signage

[6] Occupational Safety and Health Administration, Maintenance, Safeguards, and Operational Features for Exit Routes, Regulations 29 CFR § 1910.37(b), 2002.

and symbol requirements for specific hazards that could harm workers or the public, such as high voltage and accident hazards (Figures 2-4 and 2-5).[7]

Source: www.ComplianceSigns.com (https://www.compliancesigns.com/OCE-28645.shtml)

Figure 2-4

OSHA High Voltage Caution Signage

Source: www.ComplianceSigns.com (https://www.compliancesigns.com/OCE-28404.shtml)

Figure 2-5

OSHA Trip Hazard Alert Signage

Table 2-3 *LLEPM Standards*

Country, Type of Vehicle	Document	Location	Illuminance	Evaluation Measurements and Tests	System Reliability	Operating Conditions	Maintenance
US, Commuter & Passenger Rail	APTA PR-PS-S-004-99, Rev. 2, Standard for Low-Location Exit Path Markings	Yes	Yes	Yes	Yes	Yes	Yes
US, Rail Transit	APTA RT-VIM-S-022-10, Low-Location Emergency Path Marking for Rail Transit Vehicles	Yes	Yes	Yes	Yes	Yes	Yes
US, Commuter & Passenger Rail	FRA Regulation: Title 49 CFR 238.127, Low-location Emergency Exit Path Markings (refers to APTA PR-PS-S-004-99, Rev. 2)	Yes	Yes	Yes	Yes	Yes	Yes
US, Public Rail Transit	APTA RT-VIM-S-023-12, Emergency Egress/ Access for Rail Transit Vehicles	No – References APTA RT-VIM-S-020-10, Emergency Lighting System Design for Rail Transit Vehicles, which provides aisle and passageway lighting levels and is part of a family of standards for emergency egress					

[7] https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.145.

Additional standards were identified through ISO, including standards related to signs indicating an evacuation route.[8,9] ISO 7010, Graphical symbols–Safety colours and safety signs–Registered safety signs, defines safety signs by graphical description and verbiage. Figure 2-6 displays examples from ISO 7010 of safety signs related to an evacuation route. Figure 2-7 provides an illustration of safety message components in ANSI Z535 (effective 2013).

Figure 2-6

Example Safety Signs from ISO 7010 (2011)

Safety sign, reference number and referent	E Evacuation route, location of safety equipment or safety facility, safety action (safe condition signs)
Safety sign Reference number Referent	 E001 Emergency exit (left hand)
Safety sign Reference number Referent	 E002 Emergency exit (right hand)

Source: ISO

The use of graphical signs allows riders of different cultural and language backgrounds to recognize emergency signs. Several safety signs from ISO could be applicable to emergency signage on rail transit vehicles, including:

- Emergency Exit (E001 and E002)
- Break to Obtain Access (E08)
- How to Open Door (E018 and E019)

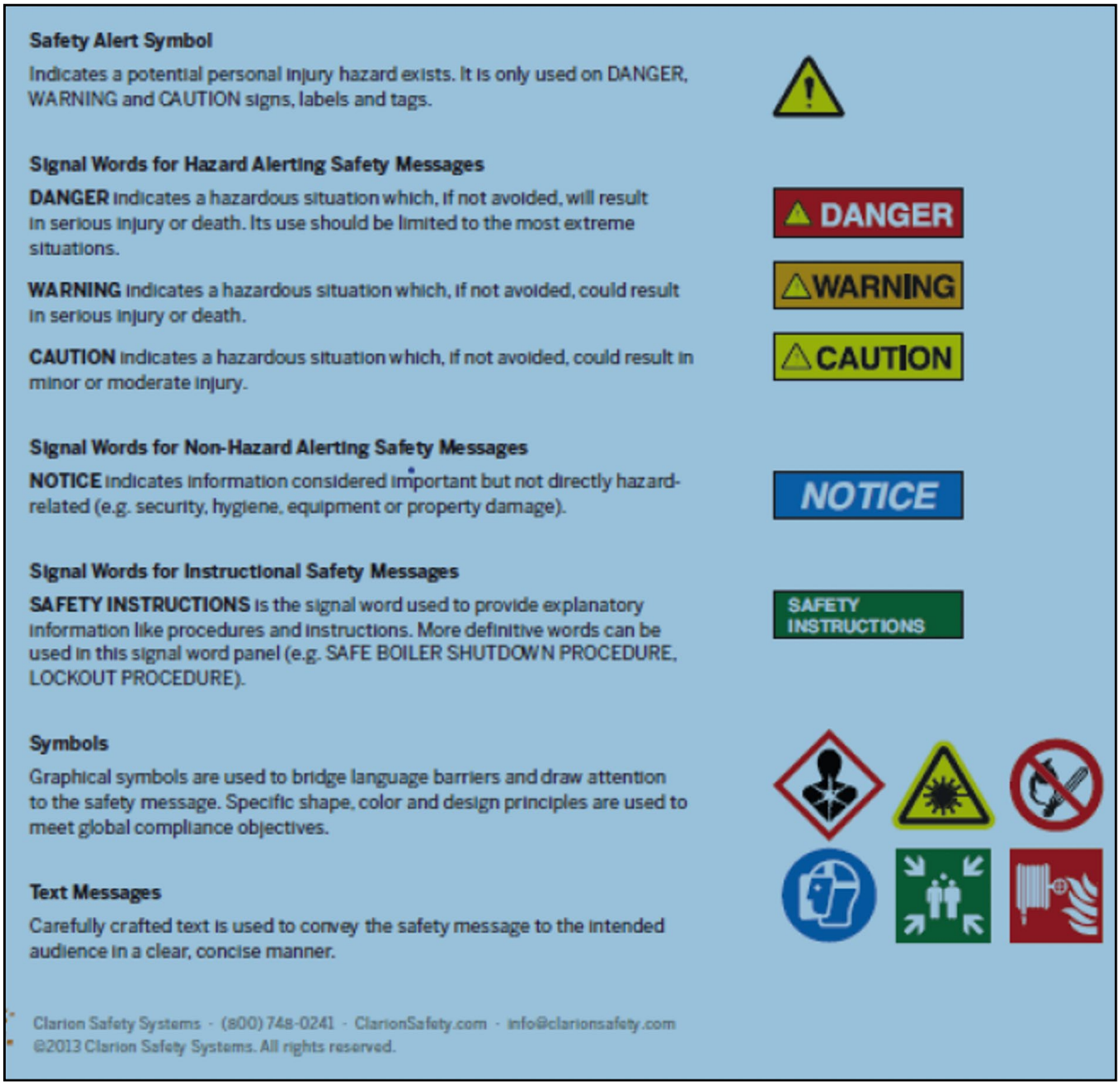
Creation of new public information symbols is addressed in ISO 22727: 2007, Graphical Symbols–Creation and design of public information symbols–Requirements, which details criteria that should be considered when designing a new public information sign. The following criteria are considered in this standard:

[8] ISO 7010, Graphical symbols–Safety colours and safety signs–Registered safety signs, 2011.

[9] ISO 22727, Graphical symbols–Creation and design of public information symbols-Requirements, 2007.

- Assignment of meaning
- Methods to design symbol
- Template use
- Line width
- Standardized representations of symbol elements

Figure 2-7 *Safety message components in ANSI Z535 (effective 2013)*



Source: NTSB Report RSR19/01

SECTION 3

Gap Analysis

The research team conducted a review of rail transit industry needs related to available recommendations, standards, and regulations to compare transit industry lighting and signage needs with available industry standards. Standards also were reviewed for applicability to each rail transit mode (heavy rail, light rail, streetcar). The standards were reviewed not only for requirements for emergency egress but also for signage related to potential exit onto a third rail, emergency signage with general information for emergency personnel, and internationally-recognized graphics and verbiage.

Review of emergency lighting specifications found that two APTA specifications meet industry needs related to NTSB recommendations.[10,11] These standards could be used as base-line emergency lighting design and maintenance standards for rail vehicles (all modes) and those going through a mid-life rehabilitation:

- APTA PR-E-013-99, Rev. 1, Standard for Emergency Lighting System Design for Passenger Cars
- APTA RT-VIM-S-020-10, Emergency Lighting System Design for Rail Transit Vehicles

Review of specifications for emergency signage found that two APTA specifications meet industry needs related to NTSB recommendations.[12,13] These standards could be used in rail transit modes for emergency lighting design and maintenance in new rail transit vehicles or rail transit vehicles going through a mid-life rehabilitation:

- APTA-PR-PS-S-002-98, Rev. 3, Standard for Emergency Signage for Egress/Access of Passenger Rail Equipment
- APTA-RT-VIM-S-021-10, Emergency Signage for Rail Transit Vehicles

Although the two APTA emergency signage standards address NTSB recommendations related to identification of emergency egress points for passenger rail, they do not completely address industry needs identified by the Working Group.[14,15] In particular, they do not address:

[10] APTA PR-E-013-99, Rev. 1, Standard for Emergency Lighting System Design for Passenger Vehicles.

[11] APTA RT-VIM-S-020-10, Emergency Lighting System Design for Rail Transit Vehicles.

[12] APTA PR-PS-PS-S-002-98, Rev. 3, Standard for Emergency Signage for Egress/Access of Passenger Rail Equipment.

[13] APTA RT-VIM-S-021-10, Emergency Signage for Rail Transit Vehicles.

[14] APTA PR-PS-S-002-98, Rev. 3, Standard for Emergency Signage for Egress/Access of Passenger Rail Equipment.

[15] APTA-RT-VIM-S-021-10, Emergency Signage for Rail Transit Vehicles.

- Signage related to emergency egress when a third rail is present
- Internationally-recognized graphics

Note that the ISO, ANSI, and OSHA standards for safety signs could support incorporation of internationally-recognized emergency signage graphic symbols for transit specific applications such as third rail warnings and end-door use. Two 2019 NTSB recommendations, R-39 and R-40, identify gap transit standardize signage for non-emergency passenger passage between cars, and a review of APTA-RT-VIM-S-021-10 shows a need for incorporation into that document.

Two identified LLEPM standards address the need for visible exit routes during dark and potentially smoky conditions:

- APTA PR-PS-S-004-99, Rev. 2, Standard for Low-Location Exit Path Markings
- APTA-RT-VIM-S-022-10 Rev 4, Low Location Emergency Path Marking for Rail Transit Vehicles

Modifications Required for Applicability of Standards to Rail Transit Vehicles

Standards identified in the literature search were reviewed for necessary modifications to them applicable to rail transit vehicles. The following subsections detail the required modifications for each main standard area for emergency lighting and signage to be applicable to rail transit vehicles and meet industry needs. Note that the APTA RT-VIM-S-023-12 (no revision number) standard for Emergency Egress/Access for Rail Transit Vehicles is not shown in the tables in this section because they reference the more technical APTA specifications for emergency lighting, signage, and LLEPM and do not provide criteria different than each specification.

Emergency Lighting

Identified emergency lighting standards are shown in Table 3-1. Two standards were written for rail transit and, as such, require no modifications—APTA RT-VIM-S-020-10, Emergency Lighting System Design for Rail Transit Vehicles and BS EN 13272:2012, European Specification Railway Applications, Electrical Lighting for Rolling Stock in Public Transport Systems. Two additional standards were developed for commuter rail and would require no modifications. The two existing standards would require modifications shown in Table 3-1.

Table 3-1

Applicability and Modifications Required for Emergency Lighting Standards

Country, Type of Vehicle	Document	Requires Modifications to Apply to Transit Rail?
US, Commuter & Passenger Rail	FRA Regulation: Title 49 CFR 238.115, Emergency Lighting	No
US, Rail Transit	APTA RT-VIM-S-020-10, Emergency Lighting System Design for Rail Transit Vehicles	No
US, Freight Rail	*AAR Manual of Standards and Recommended Practices*, Section M, Locomotives and Locomotive Interchange Equipment	Yes, primarily location of lighting
US, Commuter & Passenger Rail	APTA SS-E-013-99, Standard for Emergency Lighting System Design for Passenger Vehicles	Yes, modifications to location requirements
EU, Rail Transit	BS EN 13272:2012, Railway Applications, Electrical Lighting for Rolling Stock in Public Transport Systems	No
Australia, Passenger Rail	T HR RS 12001 ST, Interior and Exterior Lighting for Passenger Rolling Stock (refers to BS EN 13272)	No

Emergency Signage

Identified emergency signage standards are shown in Table 3-2, which indicates whether the standard would require modification for rail transit vehicles. Note that the biggest difference between the two APTA standards is that the passenger rail equipment standard has different criteria based on the age of the rail vehicle; the rail transit vehicle standard does not consider age-related lighting degradation.

Table 3-2

Applicability and Modifications Required for Emergency Signage Standards

Country, Type of Vehicle	Document	Requires Modifications to Apply to Transit Rail?
US, Commuter & Passenger Rail	APTA PR-PS-S-002-98, Rev. 3, Standard for Emergency Signage for Egress/Access of Passenger Rail Equipment	No (standard defines criteria based on age of passenger car)
US, Public Rail Transit	APTA-RT-VIM-S-021-10, Emergency Signage for Rail Transit Vehicles	No
US, Commuter & Passenger Rail	FRA Regulation: Title 49 CFR 238.123, Emergency Roof Access	No
International, Non-rail Mode	ISO 7010, Graphical symbols–Safety colours and safety signs–Registered safety signs	Yes, would need to be modified to apply to transit rail vehicles doors
International, Non-rail Mode	ISO 22727, Graphical Symbols–Creation and design of public information symbols–Requirements	No, defines how to develop new symbols

Additional modifications to the standards will be required to meet the following industry needs:

- Signage related to emergency egress points when the possibility of third rail contact is present
- Internationally-recognized graphics that allow for identification of emergency egress locations without need for passenger to be able to read and understand written words
- Guidance for how to incorporate technology through use of electronic signage and notifications through personal devices in emergency situations

LLEPM

LLEPM standards are shown in Table 3-3 and indicates whether modifications will be required for the standard to be applied to rail transit vehicles. APTA-PR-PS-S-004-99 Rev. 2, Standard for Low-Location Exit Path Markings, will require modification to the location of markings due to differences related to commuter and transit rail vehicles. APTA-RT-VIM-S-022-10 Rev. 4, Low Location Emergency Path Marking for Rail Transit Vehicles will not require any modifications, as it was written for rail transit; no additional modifications will be required to meet industry needs identified in this report. Title 49 CFR 238.127, Low-Location Emergency Exit Path Markings will require modification to apply to rail transit, as it refers to APTA PR-PS-S-004-99, Rev 2, which is written for commuter rail cars.

Table 3-3

Applicability and Modifications Required for LLEPM Standards

Country, Type of Vehicle	Document	Requires Modifications to Apply to Transit Rail?
US, Commuter & Passenger Rail	APTA PR-PS-S-004-99, Rev. 2, Standard for Low-Location Exit Path Markings	Yes, location of markings
US, Rail Transit	APTA-RT-VIM-S-022-10, Low-Location Emergency Path Marking for Rail Transit Vehicles	No
US, Commuter & Passenger Rail	FRA Regulation: Title 49 CFR 238.127, Low-Location Emergency Exit Path Markings (refers to APTA PR-PS-S-004-99, Rev. 2)	Yes, location of markings

Testing Requirements in Standards

Many standards list testing requirements to confirm that the emergency lighting or signage meets the standard. Testing and inspection requirements include one-time conformal testing and periodic maintenance as well as initial testing after installation and testing after a period of time. This testing and inspection is completed to ensure that lighting and signage is still in working order.

Emergency Lighting

Standards found for emergency lighting are shown in Table 3-4, which indicates the type of installation testing and periodic maintenance inspection and testing recommended. Note that the standards listed are specific to rail rolling stock; additional standards that are not rail rolling stock specific are produced by the

Illuminating Engineering Society (IES). The standards outline lighting in different conditions (but not rail specifically) and testing requirements. Table 3-5 lists the IES standards.

Table 3-4

Emergency Lighting Standards Installation and Maintenance Requirements

Country, Type of Vehicle	Document	Installation Testing?	Maintenance and Inspection Testing?
US, Commuter & Passenger Rail	FRA Regulation: Title 49 CFR 238.115, Emergency Lighting	Yes, illuminance and acceleration testing	No
US, Rail Transit	APTA RT-VIM-S-020-10, Emergency Lighting System Design for Rail Transit Vehicles	Yes, illuminance and acceleration testing	Yes, cleaning and inspection
US, Freight Rail	*AAR Manual of Standards and Recommended Practices*, Section M, Locomotives and Locomotive Interchange Equipment	Yes, illuminance and acceleration testing	No
US, Commuter & Passenger Rail	APTA SS-E-013-99, Standard for Emergency Lighting System Design for Passenger Vehicles	Yes, illuminance and acceleration testing	Yes, cleaning and inspection
EU, Rail Transit	BS EN 13272:2012, Railway Applications, Electrical Lighting for Rolling Stock in Public Transport Systems	Yes, illuminance testing	No
Australia, Passenger Rail	T HR RS 12001 ST, Interior and Exterior Lighting for Passenger Rolling Stock (refers to EN 13272)	Yes, illuminance testing	No

Table 3-5

IES Lighting Standards

Standard Name	Description
IES LM-79	LED testing guidelines
IES TM-2814	Maintenance of LED Lighting
IES LM-9	Fluorescent light testing guidelines
LM-14-41	Testing of florescent lamps
LM-40-10	Life testing of florescent lamps
IES TM-1-12	Lighting metrics

Emergency Signage

Standards found for emergency signage are shown in Table 3-6, which indicates the type of installation and periodic maintenance inspection done to confirm that the emergency signage is undamaged and operational.

Table 3-6

Applicability and Modifications Required for Emergency Signage Standards

Country, Type of Vehicle	Document	Installation Testing?	Maintenance and Inspection Testing?
US, Commuter & Passenger Rail	APTA PR-PS-S-002-98, Standard for Emergency Signage for Egress/Access of Passenger Rail Equipment	Yes, illuminance and duration testing	Yes, inspection of signs for no damage
US, Rail Transit	APTA-RT-VIM-S-021-10, Emergency Signage for Rail Transit Vehicles	Yes, illuminance and duration testing	Yes, inspection of signs for no damage
US, Commuter & Passenger Rail	FRA Regulation: Title 49 CFR 238.123, Emergency Roof Access	No	No
International, Non-rail Mode	ISO 7010, Graphical symbols–Safety colours and safety signs–Registered safety signs	No, refers to testing of symbol use and adequacy in ISO 9186-1	No
International, Non-rail Mode	ISO 22727, Graphical Symbols–Creation and design of public information symbols–Requirements document	No, refers to testing of symbol use and adequacy in ISO 9186-1	No

LLEPM

Standards found for LLEPM are shown in Table 3-7, which indicate if installation and periodic maintenance testing is performed to determine if LLEPM is undamaged and operational.

Table 3-7

Applicability and Modifications Required for LLEPM Standards

Country, Type of Vehicle	Document	Installation Testing?	Maintenance and Inspection Testing?
US, Commuter & Passenger Rail	APTA PR-PS-S-004-99, Rev. 2, Standard for Low-Location Exit Path Markings	Yes, material prior to installation	Yes, LLEPM present and not damaged
US, Rail Transit	APTA-RT-VIM-S-022-10, Low-Location Emergency Path Marking for Rail Transit Vehicles	Yes, material prior to installation	Yes, LLEPM present and not damaged
US, Commuter & Passenger Rail	FRA Regulation: Title 49 CFR 238.127, Low-Location Emergency Exit Path Markings (refers to APTA PR-PS-S-004-99, Rev. 2)	Yes, material prior to installation	Yes, LLEPM present and not damaged

SECTION

4

Industry Data Collection

In June and July 2017, State Safety Oversight Agencies (SSOAs) were requested to provide information from the rail transit agencies in their state regarding emergency lighting and signage use in their rail transit vehicles. The purposes of the information request were to:

- Identify rail transit agency emergency lighting and signage procurement specifications for new railcars.
- Identify rail transit agency emergency lighting and signage procurement specifications for mid-life overhaul railcars.
- Identify the number of vehicles with emergency lighting and signage.

A copy of the information request form is provided in Appendix B.

SSOAs provided responses that represented 28 rail transit agencies and 10,759 rail transit vehicles. The rail transit agencies included in the SSOA responses and the results are provided in Appendix C.

Emergency Lighting

Approximately 78% of responding rail transit agencies indicated that some type of emergency lighting was installed on their current fleets. Note that this question did not specifically ask about the type of emergency lighting because a separate question identified type of lighting. Figure 4-1 shows the total number of transit vehicles equipped with emergency lighting.

Figure 4-1

Rail Transit Vehicles Equipped with Emergency Lighting

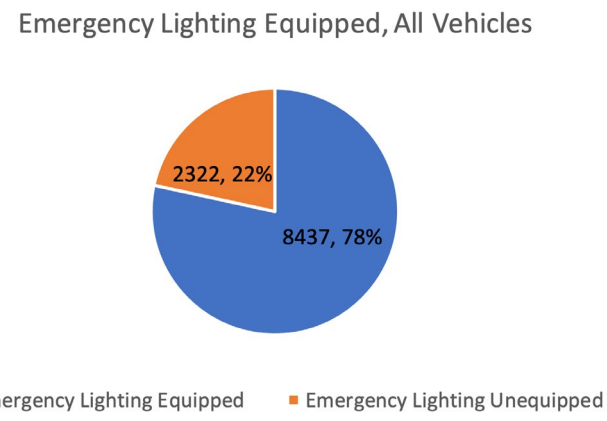


Figure 4-2 show the number vehicles equipped with emergency lighting by mode (heavy rail, light rail, streetcar). Based on responses, 82% of heavy rail vehicles, 62% of light rail vehicles, and 21% of streetcars are equipped with emergency lighting.

Figure 4-2

Heavy Rail Vehicles Equipped with Emergency Lighting

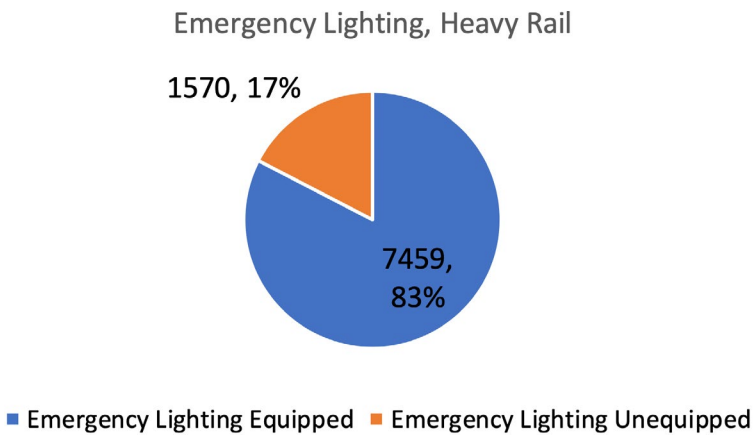


Figure 4-3

Light Rail Transit Vehicles Equipped with Emergency Lighting

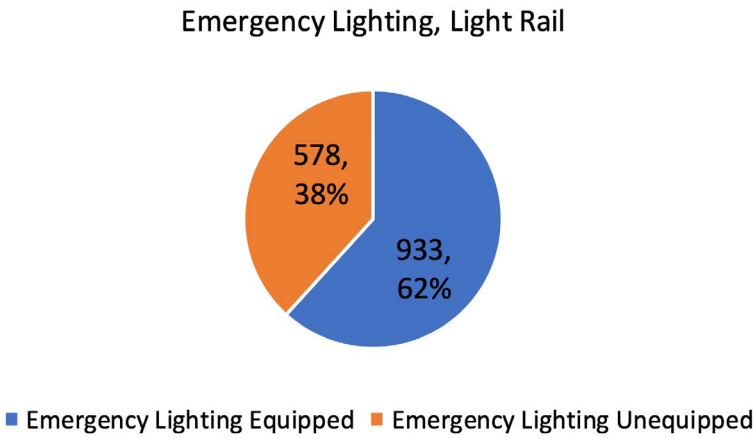
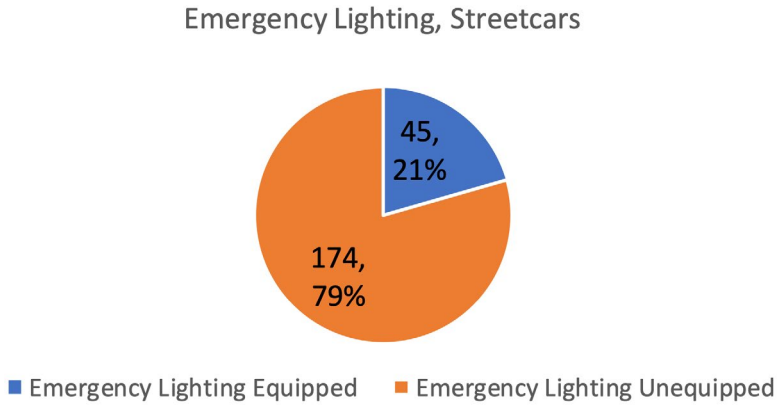


Figure 4-4

Streetcars Equipped with Emergency Lighting



A follow-up question was used to gather information regarding the specification used for emergency lighting on rail transit vehicles. Of the 8,437 vehicles equipped with emergency lighting, only 200 (2.4%) used a publicly-available standard; the remaining 8,217 vehicles used a requirement set forth by the agency and not specifically a public standard. This could be due to limited number of available standards at the time of rail transit vehicle procurements. Future industry efforts could compare a sampling of the latest agency RFPs to

determine which requirements car builders use to specify lighting. A breakdown of standards and RFPs used by mode is shown in Table 4-1.

Table 4-1

Standards Used for Emergency Lighting on Transit Rail

Standard or RFP Used	Heavy Rail	Light Rail	Streetcar	Total
APTA PR-E-S-013-99, Standard for Emergency Lighting System Design for Passenger Rail Equipment	0	190	10	200
APTA-RT-VIM-S-020-10, Emergency Lighting System Design for Rail Transit Vehicles	0	0	0	0
Agency RFP	7,439	743	35	8,217

Emergency Signage

Approximately 80% of rail transit agencies indicated that emergency signage was installed on their current fleets (all modes). Figure 4-5 through 4-8 display the breakdown by installed vs. not installed with emergency signage for each mode. Based on responses, 90% of heavy rail vehicles, 33% of light rail vehicles, and 1% of streetcars were equipped with emergency signage.

Figure 4-5

Rail Transit Vehicles Equipped with Emergency Signage, All Transit Rail Modes

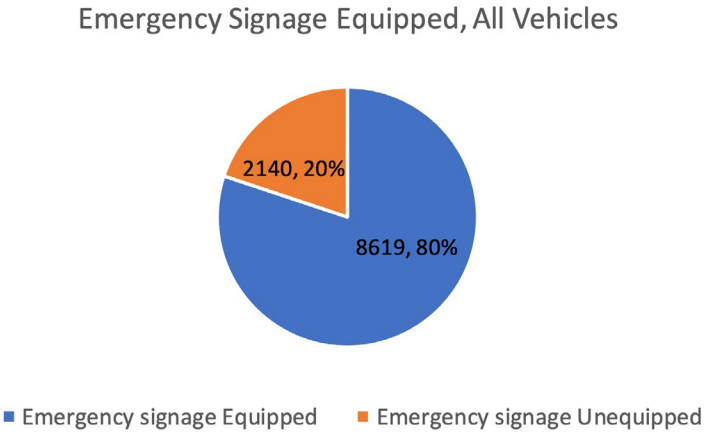


Figure 4-6

Heavy Rail Transit Vehicles Equipped with Emergency Signage

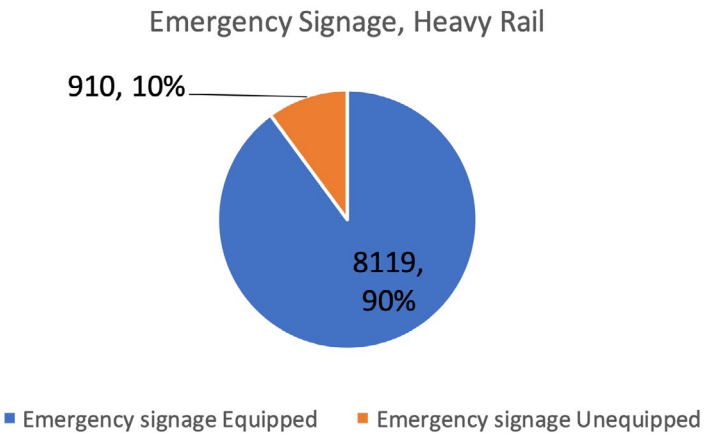


Figure 4-7

Light Rail Transit Vehicles Equipped with Emergency Signage

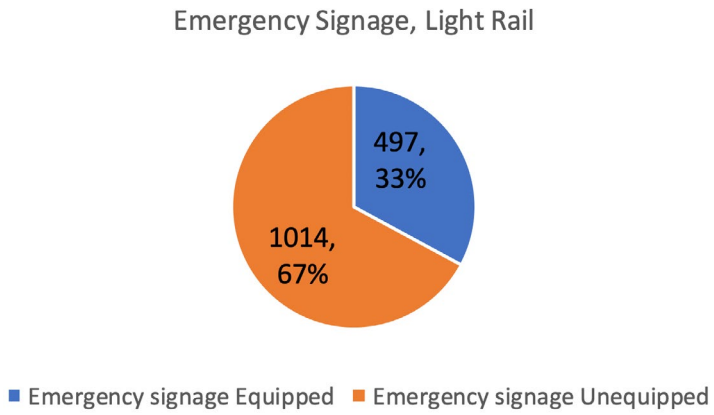
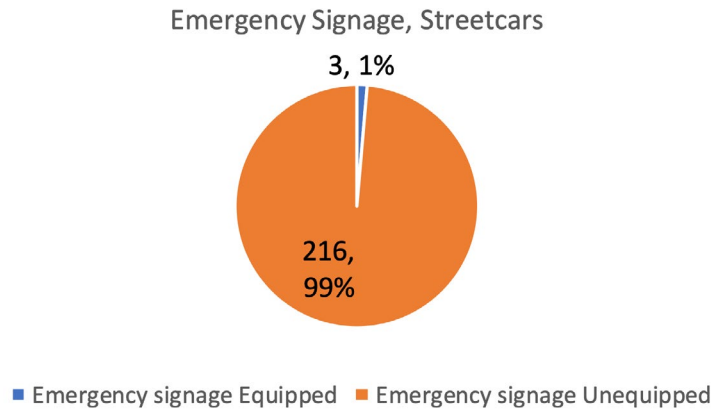


Figure 4-8

Streetcars Equipped with Emergency Signage



A follow-up question asked about emergency signage on rail transit vehicles by mode. Of 8,619 vehicles equipped with emergency signage, only 293 (3.4%) vehicles had emergency signage designed using a publicly-available standard; the remaining 8,410 were equipped with emergency signage from a requirement set forth by the agency but not specifically a public standard. This could be due to the limited availability of standards at the time of the procurement. A breakdown of standards or RFPs used for new and rehabilitated cars by mode is shown in Table 4-2.

Table 4-2

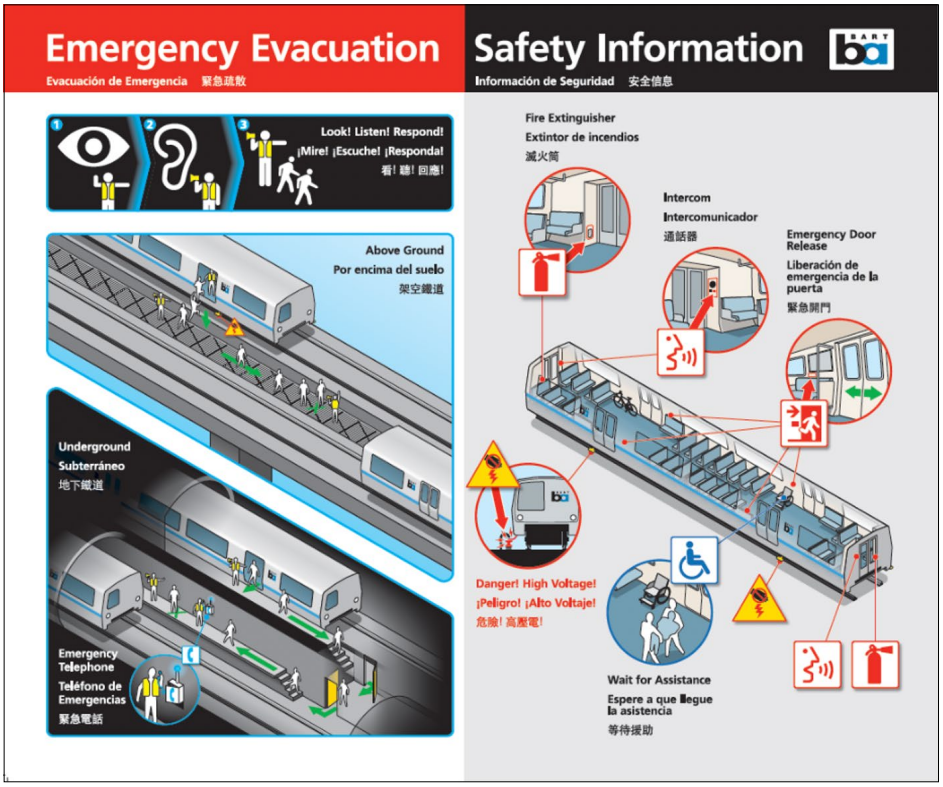
Standards Used for Emergency Signage Equipment on Rail Transit

Standard or RFP Used	Heavy Rail	Light Rail	Streetcar	Total
APTA PR-PS-S-002-98, Rev. 3, Standard for Emergency Signage for Egress/Access of Passenger Vehicles	0	176	0	176
Title 49 CFR 238.115, Emergency Signage	0	0	0	0
APTA RT-VIM-S-021-10, Emergency Signage for Rail Transit Vehicles	0	114	3	117
Agency RFP	8,099	321	0	8,410

Agencies also responded to questions about fleets equipped with emergency signage, standards used for the signs, and emergency egress procedure signs. Only one heavy rail agency indicated having signage that addresses emergency exits near a third rail. A follow-up information request specifically for egress procedure signage would assist industry standardization. Figure 4-9 shows BART's emergency evacuation signage.

Figure 4-9

Example of Emergency Sign Showing Danger near Exit on Third Rail Sign



Source: Bay Area Rapid Transit (BART)

In response to a Southeastern Pennsylvania Transportation Authority (SEPTA) incident in which a 7-year-old boy fell between railcars, the NTSB issued recommendations R-19-039 and R-19-040 to FTA about standardized signage for end-doors situated between railcars. There is a lack of standardized signage that discourages use of end-doors during non-emergencies in transit railcars. Typical mass transit designs provide signage discouraging the use of the end-doors because the open gaps over the couplers between cars present a safety hazard. Although some consists are designed using a protective, articulated floor between car corridors, similar to commuter railcars, most transit cars do not offer safe passage between moving revenue vehicles. Agencies incorporate various versions of signage to warn passengers not to use the doors except as an emergency exit, as shown in Figures 4-10 and 4-11. Other agencies such as MBTA and NYCT have incorporated either manual or remote end-door lock releases to further restrict improper use of the doors. Figure 4-11 shows an example of an MBTA emergency lock manual release.

Figure 4-10

End-of-Railcar Door on New York City Transit Car (warning sign circled in red)

Source: NTSB Report RSR19/01

Figure 4-11

End-of-Railcar Door with Red Octagon Universal Stop Sign on WMATA Railcar

Source: NTSB Report RSR19/01

Figure 4-12

End-of-Railcar Door on MBTA Subway Train – Door Locked, includes Signage Instructing Customers How to Unlock Door during Emergencies

Source: NTSB Report RSR19/01

The final emergency lighting inquiry was whether the transit agency had researched and/or implemented signs that are more internationally-recognizable. In total, 5 of the 28 responding rail transit agencies indicated "yes" and that bilingual signs, ISO graphical signs, or pictorial signs had been installed. Agencies that responded "yes" were:

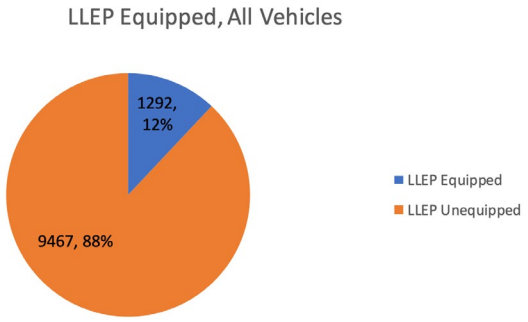
- Bay Area Rapid Transit (BART)
- Metropolitan Transit System – San Diego Trolley, Inc.
- RTD Denver
- MTA NYC Transit
- Honolulu Authority for Rapid Transportation (HART)

LLEPM

Approximately 12% of the responding rail transit agencies indicated that some sort of LLEPM was installed on their current fleet. Figure 4-13 shows the breakdown of rail transit vehicles by equipped vs. not equipped with LLEPM.

Figure 4-13

Rail Transit Vehicles Equipped with LLEPM



Figures 4-14, 4-15, and 4-16 provide details by mode (heavy rail, light rail, streetcar). Based on the responses received, 8% of heavy rail vehicles, 16% of light rail vehicles, and 12% of streetcars are equipped with LLEPM.

Figure 4-14

Heavy Rail Transit Vehicles Equipped with LLEPM

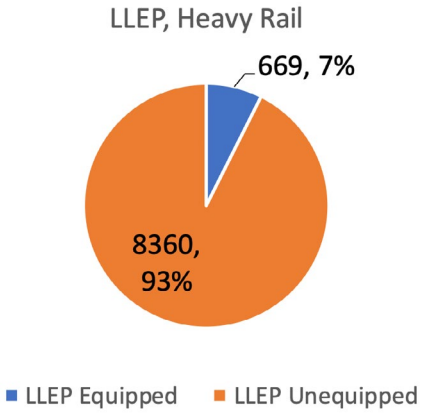


Figure 4-15

Light Rail Transit Vehicles Equipped with LLEPM

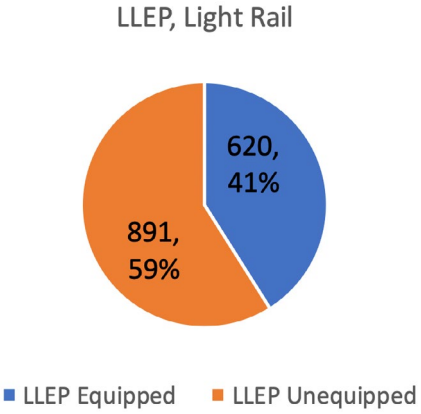
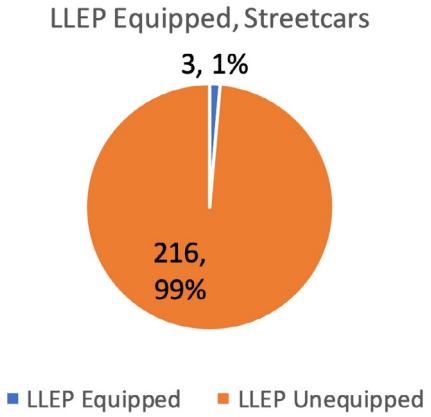


Figure 4-16

Streetcars Equipped with LLEPM



A follow-up question gathered information regarding the specification used for LLEPM on rail transit vehicles. Of the 1,292 vehicles equipped with emergency signage, only 238 were equipped with LLEPM designed using APTA-RT-VIM-S-022-10, Low-Location Emergency Path Marking for Rail Transit Vehicles; the remaining 1,054 vehicles were equipped with LLEPM based on a requirement set forth by the agency and not specifically a public standard. This could be due to the limited availability of standards at the time of vehicle procurement. A breakdown of standards used by mode is shown in Table 4-3.

Table 4-3

Standards Used for LLEPM on Rail Transit and Count of Vehicles

Standard or RFP used	Heavy Rail	Light Rail	Streetcar	Total
APTA PR-PS-S-004-99, Rev. 2, Standard for Low-Location Exit Path Markings	0	235	0	2,350
APTA-RT-VIM-S-022-10, Low-Location Emergency Path Marking for Rail Transit Vehicles	0	0	3	3
Title 49 CFR 238.127, Low-location Emergency Exit Path Markings (refers to APTA PR-PS-S-004-99, Rev. 2)	0	0	0	0
Agency RFP	1,054	0	0	1,054

SECTION 5

Conclusions and Findings

A review of available reports, standards, and regulations related to emergency lighting and signage on all rail modes was completed. The documents identified were reviewed for applicability to rail transit (heavy rail, light rail, streetcar). Evaluation of industry needs for emergency lighting and signage standards was based upon various research reports, NTSB recommendations, and industry stakeholder input.

A gap analysis was completed to evaluate the specifications related to rail transit industry needs. Two documents for emergency lighting developed by APTA (APTA-RT-VIM-S-022-10 and APTA RT-VIM-S-021-10) could be used in FTA standards development. Two other documents developed by APTA could be used for FTA standards development for emergency signage (APTA RT-VIM-S-021-10 and APTA RT-VIM-S-023-12). Modifications to those standards will be required to fully meet the industry needs for the following topics:

- Signage related to emergency door egress near third rails
- Signage that is more internationally-recognizable and understandable

Standards were evaluated for necessary modifications to make them applicable to rail transit and testing required to confirm that they meet the standard. Although non-transit railcar standards would require minor modifications, specific rail transit standards could be implemented without modifications. All standards indicate specific installation and testing requirements; however, only the APTA specifications for emergency lighting, emergency signage, and LLEPM require periodic inspection to confirm that emergency lighting and LLEPM systems are still working and that lighting and signage are not damaged.

Information on emergency lighting and signage implementation in rail transit agency fleets in the US was completed based on an information request form delivered to all SSOAs. Results from responses to this request include the following:

- Emergency lighting has been implemented in 78% of rail transit vehicles; fewer than 2.3% of vehicles installed with emergency lighting were designed to APTA PR-E-013-99; rather, the emergency lighting was designed to meet agency-specific RFPs that do not refer to publicly-available standards.
- Emergency signage has been implemented in 80% of rail transit vehicles, but only 3.4% of those vehicles have emergency signage designed specifically based on a publicly-available standard. Only one agency has implemented

signage related to emergency exits near third rails, and only two agencies have implemented bilingual emergency signs.

- Implementation of LLEPM is low, with only 12% of rail transit vehicles equipped with LLEPM designed according to APTA-RT-VIM-S-022-10, Low-Location Emergency Path Marking for Rail Transit Vehicles.

This research provided several findings based on the feedback and suggestions from the CUTR Transit Standards Working Group:

- **Finding 1:** Installation of new rail transit vehicle emergency lighting that meets or exceeds APTA-RT-VIM-S-020-10 (Latest Revision), Emergency Lighting System Design for Rail Transit Vehicles will homogenize the implementation of emergency lighting on fleets and ensure that emergency lighting meets a recognized industry standard.
- **Finding 2:** Implementation of emergency lighting on mid-life overhaul vehicles that meets or exceeds APTA-RT-VIM-S-020-10 (Latest Revision), Emergency Lighting System Design for Rail Transit Vehicles will homogenize emergency lighting on fleets and ensure that the emergency lighting meets a recognized industry standard.
- **Finding 3:** Third rail hazard signs next to emergency exits near third rails (specifically for heavy rail transit systems) and general egress signage (all modes) should incorporate more internationally-recognizable symbols. This will enhance passenger knowledge and safety about egress procedures next to high voltage apparatus.
- **Finding 4:** Rail vehicle general egress signage (all modes) containing Internationally-recognizable symbols will enhance passenger (all nationalities) knowledge and safety about egress procedures. Available rail signage standards show a lack of internationally-recognizable general egress signage.
- **Finding 5:** New vehicle procurements can meet or exceed the APTA-RT-VIM-S-021-10, Emergency Signage for Rail Transit Vehicles standard, which will ensure that new vehicles meet industry standards.
- **Finding 6:** Mid-life rehabilitation vehicle procurements may be able to meet or exceed APTA-RT-VIM-S-021-10 (Latest Revision), Emergency Signage for Rail Transit Vehicles.
- **Finding 7:** New rail transit vehicle LLEPM installations can meet or exceed the APTA-RT-VIM-S-022-10 (Latest Revision), Low-Location Emergency Path Marking for Rail Transit Vehicles standard. Research shows that only 8% of rail transit vehicles currently have LLEPM.
- **Finding 8:** Mid-life rehabilitation procurements may implement LLEPM that meets or exceeds APTA-RT-VIM-S-022-10 (Latest Revision), Low-Location Emergency Path Marking for Rail Transit Vehicles. Due to legacy design workarounds and cost considerations, active lighting solutions may not be

practical for remaining rail vehicle lives; passive self-illuminating markings may be practical.

- **Finding 9:** This review did not include a significant sampling size of modern emergency lighting and signage RFP specifications. Comparing new-build emergency lighting and signage performance, characteristics, maintenance, and testing requirements may identify best industry designs and practices.
- **Finding 10:** There are additional ways to provide meaningful public emergency preparedness and notifications using visual and audio safety signs, dynamic messages such as cell phone messages and electronic signs, and tailored disability notifications that are in accordance with the ADA.

APPENDIX

A

Emergency Lighting and Signage Regulations and Standards

Title	Category	Summary	Type of Rail Vehicle
FRA Regulation: Title 49 CFR 238.115, Emergency Lighting	Lighting	Illuminance level requirements, location, power supply, operating conditions including survivability, time to stay powered	Passenger rail cars
FRA Regulation: Title 49 CFR 238.123, Emergency Roof Access	Signage	Emergency roof access characteristics, dimensions, means of access, location, obstructions, marking and instructions (pictorial depictions)	Passenger rail cars
APTA RT-VIM-S-020-10 Rev 1, Emergency Lighting System Design for Rail Transit Vehicles	Lighting	Minimum performance criteria for emergency lighting for rail transit vehicles; includes types of lighting and power sources, emergency lighting system requirements, and evaluation, reliability maintenance	Rail transit vehicles
APTA-RT-VIM-S-021-10 Rev 1, Emergency Signage for Rail Transit Vehicles	Signage	Emergency signage for rail transit vehicles; includes system requirements, design, evaluation, reliability, operations, maintenance	Passenger rail cars
APTA-PR-PS-S-002-98 Rev 3, Standard for Emergency Signage for Egress/Access of Passenger Rail Equipment	Signage	Emergency signage for passenger rail equipment	Passenger rail cars
AAR Manual of Standards and Recommended Practices, Section M, Locomotives and Locomotive Interchange Equipment	Lighting	Details illumination requirements, activation requirements, time to stay on, location, how to measure illuminance values, power source	Locomotives
Occupational Safety and Health Administration, Regulations 29CFR Subpart 1910.37(b), 2002	Lighting and Signage	Maintenance, safeguards, operational features for exit routes	Not specifically written for rail car
International Standard Organization, ISO 7010, 2011, Graphical symbols–Safety colours and safety signs–Registered safety signs	Signage	Graphical symbols, safety colors and safety signs, registered safety signs	Not specifically written for rail car
APTA PR-PS-S-004-99, Rev. 2, Standard for Low-Location Exit Path Markings	LLEPM	LLEPM standard for passenger rail vehicles	Passenger rail cars
APTA-RT-VIM-S-022-10 Rev 4 Low-Location Emergency Path Marking for Rail Transit Vehicles	LLEPM	LLEPM standard for passenger rail vehicles	Rail transit vehicles
FRA Regulation: Title 49 CFR 238.127, Low-location emergency exit path markings (refers to APTA PR-PS-S-004-99, Rev. 2)	LLEPM	LLEPM standard for passenger rail vehicles	Passenger rail cars
APTA-RT-VIM-S-023-12 Rev 0, Emergency Egress/Access for Rail Transit Vehicles	Lighting, Signage, LLEPM	References APTA standards for emergency lighting, signage, LLEPM is part of family of standards related to emergency egress for rail transit	Rail transit vehicles
BS EN 13272:2012, Railway Applications, Electrical Lighting for Rolling Stock in Public Transport Systems	Lighting	International standard for electrical lighting of rolling stock	Passenger rail cars
T HR RS 12001 ST, Interior and Exterior Lighting for Passenger Rolling Stock (refers to EN 13272)	Lighting	General principles and performance requirements for interior and exterior lighting for heavy rail passenger rolling stock	Heavy rail vehicles

Title	Category	Summary	Type of Rail Vehicle
IES LM-79	Lighting	LED testing guidelines	Not written specifically for rail car
IES TM-2814	Lighting	Maintenance of LED lighting	Not written specifically for rail car
IES LM-9	Lighting	Fluorescent light testing guidelines	Not written specifically for rail car
LM-14-41	Lighting	Testing of florescent lamps	Not written specifically for rail car
LM-40-10	Lighting	Life testing of florescent lamps	Not written specifically for rail car
IES TM-1-12	Lighting	Lighting metrics	Not written specifically for rail car

APPENDIX

B

Information Request Form

Emergency Lighting and Signage on Rail Transit Vehicles

Transportation Technology Center, Inc. (TTCI), with support from the Center for Urban Transportation Research (CUTR) at the University of South Florida (USF), was tasked by the Federal Transit Administration (FTA) in researching Emergency Lighting and Signage standards for heavy rail, light rail and streetcars and assessing existing rail vehicle implementation of emergency lighting and signage. In particular, emergency lighting or signage used on current fleet, standards or specifications previously used, and/or those standards or specifications planned in rail vehicle procurements or retrofits are of interest. As part of this effort, TTCI is collecting data from the transit industry on rail vehicles used or owned by agencies. This data is being requested from the SSOs. We request each SSO reach out to the rail transit agencies in their state to complete the form. Please return this form by July 14, 2017. If technical specifications can be provided in addition to the answers to the questions, please send them to MaryClara_Jones@aar.com.

Note if you have multiple fleets, please provide answers for each fleet (this may require filling out multiple forms).

1. Agency Name

2. Rail Mode(s) of operation (Check applicable mode(s))

   ☐ Commuter Rail Service
   ☐ Heavy Rail Service
   ☐ Light Rail Service
   ☐ Streetcar
   ☐ Other (Please describe)

3. Number of rail vehicles in fleet by mode (please provide number of vehicles)

   _____Commuter Rail Service
   _____Heavy Rail Service
   _____Light Rail Service
   _____Streetcar
   _____Other (Please describe)

4. Present rail fleet – emergency lighting

   a. What type of emergency lighting do your rail vehicles have installed?

   b. Can you provide the emergency lighting requirements specified in the procurement documents for the present rail vehicles? (please send with response)

   c. Does the emergency lighting in your rail vehicles aim to meet any rail specifications?

      i. If YES, what specifications were used in the design (please check all that apply)?

_____APTA RT-VIM-S-020 Emergency Lighting System Design for Rail Transit Vehicles
_____APTA SS-E-013-99 Standard for Emergency Lighting on Passenger Vehicles
_____EN 13272:2012 Railway applications: Electrical lighting for rolling stock in public transport systems
_____Other (please name and provide) _____

ii. If YES, how many vehicles in your fleet are equipped with emergency lighting following the specifications selected above?
_____Commuter Rail Service
_____Heavy Rail Service
_____Light Rail Service
_____Streetcar
_____Other (Please describe)

iii. If NO, is your agency planning to retrofit any of your rail vehicles with emergency lighting meeting any of the specifications listed in 4ci?

1. If Yes to "iii," what technical specifications will be used for the retrofit (please check all that apply)?

_____APTA RT-VIM-S-020 Emergency Lighting System Design for Rail Transit Vehicles
_____APTA SS-E-013-99 Standard for Emergency Lighting on Passenger Vehicles
_____EN 13272:2012 Railway applications: Electrical lighting for rolling stock in public transport systems
_____Other (please name and provide) _____

5. Present rail fleet – Low Location Emergency Path Marking (LLEP)

a. What type of Low Location Emergency Path Markings do your rail vehicles have installed?

b. Can you provide the LLEP requirements specified in the procurement documents for the present rail vehicles? (please send with response)

c. Does the emergency lighting in your rail vehicles aim to meet any rail specifications?

i. If YES, what specifications were used in the design (please check all that apply)?
_____ APTA PR-PS-S-004-99, Rev. 2 Standard for Low-Location Exit Path Marking
_____ APTA-RT-VIM-S-022-10 Low Location Emergency Path Markings for Rail Transit Vehicles
_____Other (please name and provide) _____

ii. If YES, how many vehicles in your fleet are equipped with LLEP systems following the specifications selected above?
_____Commuter Rail Service
_____Heavy Rail Service
_____Light Rail Service
_____Streetcar

_____Other (Please describe)

iii. If NO, is your agency planning to retrofit any of your rail vehicles with LLEP systems meeting any of the specifications listed in 5ci?

1. If Yes to "iii," what technical specifications will be used for the retrofit?

_____ APTA PR-PS-S-004-99, Rev. 2 Standard for Low-Location Exit Path Marking
_____ APTA-RT-VIM-S-022-10 Low Location Emergency Path Markings for Rail Transit Vehicles
_____Other (please name and provide) _____

6. Present rail fleet – Emergency Signage

a. What type of Emergency Signage does your rail vehicles installed (please provide example pictures?

b. Can you provide the emergency signage requirements specified in the procurement documents for the present rail vehicles? (please send with response)

c. Does the emergency signage in your rail vehicles aim to meet any rail specifications?

i. If YES, what specifications were used in the design (please check)?
_____ APTA PR-PS-S-002-98 Standard for Emergency Signage for Egress/Access to Passenger Rail Equipment
_____ APTA-RT-VIM-S-021-10 Emergency Signage for Rail Transit Vehicles
_____Other (please name and provide) _____

ii. If YES, how many vehicles in your fleet are equipped with emergency signage following the specifications selected above?
_____Commuter Rail Service
_____Heavy Rail Service
_____Light Rail Service
_____Streetcar
_____Other (Please describe)

iii. If NO, is your agency planning to retrofit any of your rail vehicles with emergency signage meeting any of the specifications listed in 6ci?

1. If Yes to "iii," what technical specifications will be used for the retrofit?

_____ APTA PR-PS-S-002-98 Standard for Emergency Signage for Egress/Access to Passenger Rail Equipment
_____ APTA-RT-VIM-S-021-10 Emergency Signage for Rail Transit Vehicles
_____Other (please name and provide) _____

iv. Does your agency have signage for emergency egress from vehicles near third rails?

1. If yes, please provide an example of the sign(s).

v. Has your agency investigated emergency signage that is more internationally recognizably?

1. If yes, can you please describe the result of the research?

2. If yes, did your agency implement new emergency signage with more internationally recognizable emergency signs? Please provide examples pictures.

7. New vehicles

a. Is your agency in the process of procuring new rail vehicles?

i. If YES, what specifications were used for emergency lighting, LLEP, and emergency signage details in the request for proposal?

Emergency Lighting

_____APTA RT-VIM-S-020 Emergency Lighting System Design for Rail Transit Vehicles
_____APTA SS-E-013-99 Standard for Emergency Lighting on Passenger Vehicles
_____EN 13272:2012 Railway applications: Electrical lighting for rolling stock in public transport systems
_____Other (please name) _____

LLEP Systems

_____ APTA PR-PS-S-004-99, Rev. 2 Standard for Low-Location Exit Path Marking
_____ APTA-RT-VIM-S-022-10 Low Location Emergency Path Markings for Rail Transit Vehicles
_____Other (please name and provide) _____

Emergency Signage

_____ APTA PR-PS-S-002-98 Standard for Emergency Signage for Egress/Access to Passenger Rail Equipment
_____ APTA-RT-VIM-S-021-10 Emergency Signage for Rail Transit Vehicles
_____Other (please name and provide) _____

Please provide contact information in case TTCI has any technical questions regarding the specifications:

Name: _____

Phone: _____

Email: _____

APPENDIX

C

Information Request Results

Table C-1 *Emergency Lighting*

Rail Transit Agency	Current Fleet			Emergency Lighting Equipped		
	Heavy Rail	Light Rail	Streetcar	Heavy Rail	Light Rail	Streetcars
Bay Area Rapid Transit (BART)	669			669		
Los Angeles County Metropolitan Transportation Authority (LACMTA)	104	251		NR	NR	
RTD Denver		172			172	
Metropolitan Transit System - San Diego Trolley, Inc.		128			128	
Santa Clara Valley Transportation Authority		99			99	
Seattle Streetcar		10				10
SEPTA	366		141	NR		NR
Sound Transit		62			62	
Tren Urbano ACI – Herzog	74			74		
Utah Transit Authority		114	3		114	3
MTA NYC Transit	6,696			6,696		
Washington Metropolitan Area Transit Authority (WMATA)	1,098			NR		
Kenosha Area Transit			7			0
Dallas Area Rapid Transit (DART)		163	4		NR	NR
Hampton Roads Transit (HRT) Tide Light Rail		9			NR	
Seattle Center Monorail	2			NR		
City of Tucson (Sun Link Streetcar)			8			NR
Sound Transit			3			NR
Metropolitan Transit Authority of Harris Co.		76			76	
Rock Region Metro/Metro Streetcar			5			NR
Valley Metro		50			50	
Honolulu Authority for Rapid Transportation (HART)	20			20		
Port Authority of Allegheny County		83			83	
TriMet		145			NR	
San Francisco Municipal Transit Agency		149	48		149	32

NR=no response or response of N/A from applicant

Table C-2 *Emergency Signage*

Rail Transit Agency	Current Fleet			Emergency Signage Equipped		
	Heavy Rail	Light Rail	Streetcar	Heavy Rail	Light Rail	Streetcars
Bay Area Rapid Transit (BART)	669			669		
Los Angeles County Metropolitan Transportation Authority (LACMTA)	104	251		NR	NR	
RTD Denver		172			172	
Metropolitan Transit System - San Diego Trolley, Inc.		128			NR	
Santa Clara Valley Transportation Authority		99			99	
Seattle Streetcar		10			NR	
SEPTA	366		141	NR		NR
Sound Transit		62			62	
Tren Urbano ACI – Herzog	74			NR		
Utah Transit Authority		114	3		114	3
MTA NYC Transit	6,696			6,696		
Washington Metropolitan Area Transit Authority (WMATA)	1,098			734		
Kenosha Area Transit			7			NR
Dallas Area Rapid Transit (DART)		163	4		NR	NR
Hampton Roads Transit (HRT) Tide Light Rail		9			NR	
Seattle Center Monorail	2			NR		
City of Tucson (Sun Link Streetcar)			8			NR
Sound Transit			3			NR
Metropolitan Transit Authority of Harris Co.		76			NR	
Rock Region Metro/Metro Streetcar			5			NR
Valley Metro		50			50	
Honolulu Authority for Rapid Transportation (HART)	20			20		
Port Authority of Allegheny County		83			NR	
TriMet		145			NR	
San Francisco Municipal Transit Agency		149	48		NR	NR

NR=not reported

Table C-3 *LLEPM*

Rail Transit Agency	Current Fleet			Low Location Emergency Path Marking (LLEPM) Equipped		
	Heavy Rail	Light Rail	Streetcar	Heavy Rail	Light Rail	Streetcars
Bay Area Rapid Transit (BART)	669			669		
Los Angeles County Metropolitan Transportation Authority (LACMTA)	104	251		NR	235	
RTD Denver		172			NR	
Metropolitan Transit System - San Diego Trolley, Inc.		128			NR	
Santa Clara Valley Transportation Authority		99			99	
Seattle Streetcar		10			NR	
SEPTA	366		141	NR		NR
Sound Transit		62			NR	
Tren Urbano ACI – Herzog	74			NR		
Utah Transit Authority		114	3		114	3
MTA NYC Transit	6,696			NR		
Washington Metropolitan Area Transit Authority (WMATA)	1,098			NR		
Kenosha Area Transit			7			NR
Dallas Area Rapid Transit (DART)		163	4		NR	NR
Hampton Roads Transit (HRT) Tide Light Rail		9			NR	
Seattle Center Monorail	2			NR		
City of Tucson (Sun Link Streetcar)			8			NR
Sound Transit			3			NR
Metropolitan Transit Authority of Harris Co.		76			39	
Rock Region Metro/Metro Streetcar			5			NR
Valley Metro		50			50	
Honolulu Authority for Rapid Transportation (HART)	20			NR		
Port Authority of Allegheny County		83			83	
TriMet		145			NR	
San Francisco Municipal Transit Agency		149	48		NR	NR

NR=not reported

U.S. Department of Transportation
Federal Transit Administration

U.S. Department of Transportation
Federal Transit Administration
East Building
1200 New Jersey Avenue, SE
Washington, DC 20590
https://www.transit.dot.gov/about/research-innovation