



APTA STANDARDS DEVELOPMENT PROGRAM

## STANDARD

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Rail Transit Vehicle Inspection and  
Maintenance Working Group

# Emergency Signage for Rail Transit Vehicles

**Abstract:** This Standard specifies the minimum performance criteria for the design of the emergency signage for rail transit vehicles.

**Keywords:** emergency signage

**Summary:** APTA rail transit system members have expressed a commitment to increase the effectiveness of safety devices and features present on rail transit vehicles, not only for the passengers but also for the operators and emergency personnel. This standard is intended to incorporate safety considerations during the design and specification process when procuring new vehicles; incorporate safety considerations when determining scope of work during the design and specification of major overhauls or retrofit campaigns; identify those safety critical standards that provide a high level of passenger safety; and identify those safety critical standards that provide a high level of crew safety.

**Scope and purpose:** This standard applies to rail transit systems that are procuring new vehicles, retrofitting existing vehicles or overhauling existing vehicles. This standard specifies minimum design and performance criteria for rail transit car emergency signage that not only functions under normal conditions but also will operate when normal and/or emergency lighting systems are unavailable. This standard also requires tests to validate the design. Other complementary emergency systems provide lighting and path markings to locate, operate and reach emergency exits and are covered in separate APTA standards.

This document represents a common viewpoint of those parties concerned with its provisions, namely operating/planning agencies, manufacturers, consultants, engineers and general interest groups. The application of any standards, recommended practices or guidelines contained herein is voluntary. In some cases, federal and/or state regulations govern portions of a transit system's operations. In those cases, the government regulations take precedence over this standard. The North American Transit Service Association (NATSA) and its parent organization APTA recognize that for certain applications, the standards or practices, as implemented by individual agencies, may be either more or less restrictive than those given in this document.

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## **Introduction**

*This introduction is not part of APTA RT-S-VIM-022-10, Rev. 1, “Low-Location Emergency Path Marking for Rail Transit Vehicles.”*

This standard represents a common viewpoint of those parties concerned with its provisions, namely transit operating/planning agencies, rail transit systems, manufacturers, consultants, engineers and general interest groups. The application of any standards or recommended practices contained herein is voluntary. In some cases, federal and/or state regulations govern portions of a rail transit system’s operations. In those cases, the government regulations take precedence over this standard. APTA recognizes that for certain applications, the standards or recommended practices, as implemented by individual rail transit systems, may be either more or less restrictive than those given in this document.

APTA recommends the use of this document by:

- individuals or organizations that operate rail transit systems;
- individuals or organizations that contract with others for the operation of rail transit systems; and
- individuals or organizations that influence how rail transit systems are operated (including but not limited to consultants, designers and contractors).

## **Note on alternate practices**

Individual rail transit systems may modify the practices in this standard to accommodate their specific equipment and mode of operation. APTA recognizes that some rail transit systems may have unique operating environments that make strict compliance with every provision of this standard impossible. As a result, certain rail transit systems may need to implement the standards and practices herein in ways that are more or less restrictive than this document prescribes. A rail transit system may develop alternates to APTA standards so long as the alternates are based on a safe operating history and are described and documented in the system’s safety program plan (or another document that is referenced in the system safety program plan). Documentation of alternate practices shall:

- identify the specific APTA rail transit safety standard requirements that cannot be met;
- state why each of these requirements cannot be met;
- describe the alternate methods used; and
- describe and substantiate how the alternate methods do not compromise safety and provide a level of safety equivalent to the practices in the APTA safety standard (operating histories or hazard analysis findings may be used to substantiate this claim).

## 1. General system requirements

Emergency signs/markings shall be designed to provide evacuation guidance for passengers and train crew members and rescue access guidance for emergency responders. All signs and instructions shall be visible and easily readable.

### 1.1 Visual identity and recognition

All emergency exit and rescue access signage/markings systems shall contain brief and quickly understandable information, with consideration for useful field of view (UFOV). That is, emergency exit signage/markings systems shall enable passengers and/or train crew members to make positive identification of emergency exits. Rescue access signage/markings systems shall enable emergency responders to make positive identification of rescue access points without undue hesitation, delay or confusion. Signs/markings and instructions shall utilize, to the extent practical, commonly recognized or used information symbols, icons, graphics and pictograms, as well as standardized color, contrast, content and placement.

Each interior emergency exit sign and emergency exit locator sign shall be conspicuous (i.e., clearly recognizable and distinguishable) or become conspicuous to passengers and train crew members immediately and automatically upon the loss of power for normal lighting, from a minimum distance of 5 ft (1.52 m). Each sign/markings shall remain conspicuous under the minimum general emergency light illumination levels as specified in the APTA *Standard* “Emergency Lighting System Design for Rail Transit Vehicles,” as well as under total darkness should the emergency lighting systems fail. The signs/markings shall operate independently of the car’s normal and emergency lighting systems for a minimum of 1.5 hours after loss of all power for normal lighting. An emergency exit locator sign shall be located in close proximity of each emergency exit and shall work in conjunction with the emergency exit sign. The location of the sign, directional arrow(s) or wording shall guide passengers and train crew members to the emergency exit route.

Each emergency rescue access sign/markings shall be conspicuous on the exterior of the car.

### 1.2 Multilingual signs

At a minimum, any words included in emergency exit/rescue access signage shall be in English. However, when system-specific determinations are made or are otherwise mandated by local, municipal, state or other regulations, signage/instructions shall be written in designated language(s), in addition to English.

## 2. Design requirements, interior

Emergency exit and evacuation information placed within the interior of the car body shall, at a minimum, consist of the following signs/markings/instructions:

- Door exit signs/markings and instructions
- Door exit locator signs/markings, if necessary
- Door exit control locator signs/markings
- Emergency window exit locator signs/markings, if necessary
- Emergency window exit signs/markings and instructions

## 2.1 Location

### 2.1.1 Door exits

#### Door signs/markings

Each vestibule door, end-frame door and side door leading to the exterior that is intended for emergency egress shall be identified by a sign/marketing that contains the wording “EXIT,” “EMERGENCY EXIT” or other similar wording in capital letters.

Each sign shall be located on the door or door glazing, or in the immediate proximity. The center of the sign shall be located on the upper half of the door/car, and shall be conspicuous.

#### Door exit locators/markings

If a door exit is not within sight of any seat or standee location (e.g., visibly blocked by a bulkhead or divider), a door locator sign shall be provided to enable passengers and train crew members in those areas to identify the location of such door exit.

The locator sign(s) shall consist of brief text, graphic arrow(s) or symbol(s) that are placed on bulkheads, dividers, seat frames/pockets, armrests, luggage racks, ceilings, etc., to direct passengers toward the nearest door that can be used for emergency egress.

#### Door exit emergency release locator signs/markings

Each door exit handle, latch, or operating button shall be marked with high-performance photoluminescent (HPPL) material using one of the following methods:

- Outline stripping that is no less than 1 in. (2.54 cm) wide to the extent practicable around the perimeter of the opening device; or
- Area wide pad that is applied to the door or doorframe directly behind the handle or latch with no less than 16 in.<sup>2</sup> (103 cm<sup>2</sup>).

In addition, each door equipped with a separate manual override device for a power-operated door intended for emergency egress shall be marked with a sign/marketing containing the words “Emergency Door Release,” “Manual Door Release,” or other similar wording. These signs/marketing shall be placed at the manual door control or at an appropriate location in its immediate proximity.

If it is not obvious where the manual release device is located relative to the door handle, latch or operating button, then a door emergency release locator sign shall be posted. The manual door release locator sign(s)/marking(s) shall consist of brief text, graphic arrow(s), or symbol(s) to direct passengers and crew members from the door control to the location of the manual door release.

## Instructions

If the method for opening a door intended for exit is not obvious, operating instructions shall be posted at that door’s control or in its immediate vicinity. Signage shall be visible and easily readable.

Operating instructions shall be posted at or near each manual release device for a door intended for emergency egress. Signage shall be visible and easily readable.

## 2.1.2 Emergency window exits

### 2.1.2.1 Exit locator signs/markings

Emergency exit locator signs/markings directing passengers and crew members to the nearest emergency window exit location(s) shall be provided. The signage/marking shall use the words “EMERGENCY EXIT,” or similar wording. This signage/marking may take the form of:

- Signage/marking on walls;
- Signage/markings on light fixtures located above the emergency window exit; and/or
- Signage/markings located on the ceiling, window or seat frames/armrests.

One sign/marking may serve more than one emergency window exit if the sign can readily identify each such exit. If all the side windows installed in the passenger compartment of the rail car can be used for emergency egress, then locator signs are not required.

An emergency window exit sign may serve as a locator sign if it meets the minimum requirements for a locator sign.

### 2.1.2.2 Exit signs/markings and instructions

Each interior emergency window exit shall be identified with a sign/marking located on or adjacent to each such window. In addition, instructions, including pictorial diagrams, for opening the window shall be posted on or adjacent to each such window.

## 2.2 Letter/sign size

### 2.2.1 Letter size

The letter characters on emergency exit signs and markings and emergency exit locator signs intended to be read by the general public shall have a minimum character height using uppercase letters of:

- 1 in. (2.54 cm) on emergency window exits signs and locator signs; or
- 1.5 in. (3.81 cm) on door exit signs and locator signs.

In addition, the characters shall have the following characteristics:

- A width-to-height ratio between 3:5 and 1:1;
- A stroke-to-width ratio (i.e., the width of the lines that are combined to produce a letter) between 1:4 and 1:6; and
- Spacing between letters of a minimum of 1/16 the height of the uppercase letters.

**NOTE:** These requirements do not apply to instructional signage/marking.

### 2.2.2 Sign size

A minimum sign area of 16 in.<sup>2</sup> (103 cm<sup>2</sup>) is required for all end and side door exit signs.

## 2.3 Color and contrast

Lettering and pictogram(s) utilized on interior emergency exit signage/marking shall be designed to achieve a luminance contrast ratio of not less than 0.5, as measured by a color-corrected photometer.

**NOTE :** The recommended color contrast choice for all new and replacement signage is red lettering/graphics on a light PL background, preferably with a matte finish, except for those instances in which bold contrast with the background on which the sign is placed would not be attainable.

A contrasting border around the outer edge of the sign will also enhance visibility.

The more of the HPPL surface that is visible (i.e., not covered with letters, symbols, etc.), the more conspicuous the resulting sign. Graphics or heavy text covering the HPPL material will reduce the light output of the sign letters, and thus the conspicuity and legibility of the signs as well, even though the HPPL material passes the tests required.

## 2.4 Illuminance/luminance criteria

### 2.4.1 Materials

Signs/markings constructed of HPPL material shall provide a luminance value of at least 7.5 mcd/m<sup>2</sup> for 1.5 hours after loss of normal power.

### 2.4.2 Charging light

Because the illuminance levels required to provide sufficient charging vary according to the type of light source used, the minimum charging light values, are as specified in **Table 1**:

**TABLE 1**

Minimum Illuminance Values for Charging HPPL Materials

HPPL Illuminance fc (lux)	Type of Luminaire (Charging Light)
0.8 (8.6)	Cool-white LED (6500 K)
0.9 (9.7)	Warm-white LED (4700 K)
1.0 (10.8)	Cool-white fluorescent (4000 to 4500 K)
1.5 (16.1)	Warm-white fluorescent (3000 to 3500 K)
3.5 (37.7)	Incandescent (2900 K)

These illuminance values shall be measured with a light meter with cosine correction accurate to 3 percent or better and with the sensor placed flat against the surface of the sign/markings.

HPPL materials certified by an independent test laboratory to meet **Table 1** with the lower amount of charging light are permitted for use at that location as long as the specified amount of light is available.

HPPL signs/markings certified by an independent test laboratory to be capable of meeting the specifications for high-performance photoluminescent material that are located in partitioned vestibules/compartments/passageways that are no longer than 5 ft (1.5 m) longitudinally (including partially portioned vestibules) are not subject to the illuminance requirements in **Table 1**.

To ensure that the normal lighting system provides an adequate charge to the HPPL system, luminaires (light fixtures) shall be located in the proximity of each HPPL component and oriented to ensure that the HPPL material is adequately exposed to charging light.



Luminaires (light fixtures) located in the proximity of each HPPL component shall be specified such that their light-dispersion patterns provide the above listed minimum illuminance levels at the surface of the component.

## **2.5 Component materials**

Sign/markings component illumination or luminance levels, as applicable, shall be initially verified in accordance with Section 4 and maintained in accordance with Section 7.

The difference between the physical characteristics of electrically powered light sources and HPPL materials has an impact on their visibility and thus the performance criteria and installation location within various rail car configurations.

### **2.5.1 Signs/markings**

#### **Vestibule, end-frame and side doors**

Emergency exit signs/markings shall identify the location of all vestibule, end-frame and side doors leading to the exterior of the car and intended for emergency egress.

Rail transit cars ordered on or after the adoption of this standard shall have HPPL material.

#### **Requirements to mark side door exit locations without independently powered emergency lighting**

Each side door opening intended for emergency egress leading to the exterior of the car shall be marked with a minimum of 144 in.<sup>2</sup> (930 cm<sup>2</sup>) of HPPL material placed no higher than 18 in. (45.7 cm) off the floor, with its lowest point no higher than 6 in. off the floor. The marking may be comprised of one or more panels placed either on the door and/or in its immediate vicinity.

**NOTE:** A door with two leaves that open for emergency egress is considered a single door opening. Therefore, 144 in.<sup>2</sup> (930 cm<sup>2</sup>) of HPPL material is sufficient for that door opening.

To provide some illumination at the floor for passengers and crew members as they exit, to the extent practical, the material should not be placed on a door leaf/panel that is intended to open for emergency egress or on the part of a wall or partition that would be covered by a door leaf/panel in any position.

Signs and markings used to comply with the low-level egress path marking (LLEPM) requirements contained in the APTA *Standard* “Rail Transit Vehicle Low Level Exit Path Marking” may be counted toward this requirement to the extent that they meet the criteria noted above (e.g., HPPL door delineators required to meet the LLEPM requirements that are installed on the door 18 in. off the floor would count as 36 in.<sup>2</sup> of the 144 required).

#### **Door exit control locator signs/markings**

Each door control locator sign/markings shall be constructed of HPPL material.

#### **Emergency window exits**

All emergency window exit markings shall be constructed of HPPL material.

### 3. Design requirements, exterior

Rescue access information for emergency responders placed on the exterior of the car body shall, at a minimum, consist of the following:

- Rescue access door signs/markings and instructions.
- Rescue access door control locator signs/markings and instructions.
- Rescue access window locator signs/markings and instructions.
- Roof access locator signs/markings and instructions, if applicable.

#### 3.1 Location

##### 3.1.1 Rescue access doors

###### Door signs/markings

Each door intended for use by emergency responders for rescue access shall be identified with emergency access signs, symbols or other conspicuous marking consisting of retroreflective material that complies with Sections 6.2 and 6.3.

###### Door control signs/markings and instructions

Each door intended for use by emergency responders for rescue access shall have operating-instructions for opening the door from outside the car placed on or immediately adjacent to the door on the car body. If a power door does not function with an integral release mechanism, the instructions shall indicate the location of the exterior manual door control.

Each power door intended for use by emergency responders for rescue access which has a non-integral release mechanism located away from the door, shall have a door control sign/markings placed at the location of this control that provides instructions for emergency operation either as part of the access sign/markings or as another sign /markings.

Each car equipped with manual doors shall have operating instructions for opening the door from the exterior, either as part of the access sign/markings or as another sign /markings.

##### 3.1.2 Rescue access windows

On rail cars equipped with rescue access windows, each rescue access window shall be identified with a unique retroreflective and easily recognizable sign, symbol, or other conspicuous marking that complies with Sections 3.2 and 3.3.

Signs, symbols or marking shall be placed at the bottom of each such window, on each window or adjacent to each window, utilizing arrows where necessary to clearly designate rescue access window locations. Legible and understandable window-access instructions, including any pictogram/instructions for removing the window, shall be posted at or near each rescue access window.

##### 3.1.3 Emergency roof access

On rail cars equipped with an emergency roof access, the location of each emergency access point provided on the roof of a rail car shall be clearly marked with retroreflective material of contrasting color that complies with Sections 3.2 and 3.3. Legible and understandable instructions shall be posted at or near each such location.


If emergency roof access is provided by means of a structural weak point:

- The retroreflective material shall clearly mark the line along which the roof skin shall be cut; and
- A sign plate with a retroreflective border shall also state:

 “CAUTION—DO NOT USE FLAME CUTTING DEVICES”

 “CAUTION—WARN PASSENGERS BEFORE CUTTING”

 “CUT ALONG DASHED LINE TO GAIN ACCESS”

 “ROOF CONSTRUCTION—[STATE RELEVANT DETAILS]”

### 3.2 Color and contrast

A light background color should be used for the signs/markings along with dark lettering, providing a luminance contrast ratio of 0.5 or lighter (e.g., red letters on a white or yellow background).

### 3.3 Materials

Exterior emergency rescue access locator signs/markings shall be constructed of retroreflective material that conforms to the specifications for Type I, as specified in ASTM D4956, “Standard Specification for Retroreflective Sheeting for Traffic Control.”

In order to maintain optimum retroreflective properties of the base material, any retroreflective markings that have ink or pigment applied shall utilize a translucent or semi-translucent ink, as per the manufacturer’s instructions. This may include a UV clear coat to prevent fading. Signs utilizing protective coatings or other materials for the enhancement of sign durability shall meet the retroreflectivity requirements.

## 4. Evaluation measurements and tests

### 4.1 Interior signs/markings

To verify that emergency signage system component design complies with the requirements of Section 2.4, a qualification test shall be conducted on at least one representative passenger car/area of each signage system layout in accordance with this section.

For equipment ordered on or after the adoption of this standard, the first car to have the system installed may be tested and this test shall be completed prior to the car’s release for operation in revenue service.

Rail transit systems shall confirm that emergency exit signage system components comply with the minimum required illumination or luminance criteria, as applicable, for the specified duration.

#### 4.1.1 Passive HPPL systems

##### Material luminance

Manufacturer/supplier provided independent laboratory certified test result reports shall show that all tested samples of passive HPPL material, as used in the finished component configurations (including any cover or protective coating if used, but not including text or graphics) comply with the minimum luminance criterion of 7.5 mcd/m<sup>2</sup> after 1.5 hours when tested according to the provisions of ASTM E2073, “Standard Test Method for Photopic Luminance of Photoluminescent (Phosphorescent) Markings,” with the following three modifications:

- **Section 8.3, Activation:** The HPPL material shall be activated with a fluorescent lamp of 40 W or less that provides no more than 1 fc of illumination as measured on the material surface.
- **Section 8.4, Luminance:** The photopic luminance of all specimens of the HPPL material shall be measured with a luminance meter, as described in 5.2 of ASTM E2073, a minimum of 1.5 hours after activation has ceased.
- **Section 9.1.12, Luminance in mcd/m<sup>2</sup>:** The test report shall include a luminance measurement 1.5 hours after activation has ceased.

The manufacturer/supplier is required to have a minimum of one batch of material for signs/markings of a given type certified. Signs/markings of the same certified type of material can be sold to multiple customers, even with minor changes in text or typography.

### **Ambient light charge**

To confirm that HPPL emergency sign/markings components are installed in locations that receive adequate charging light, illuminance measurements shall be taken in accordance with Section 2.4.2 of this standard. This requirement applies to each representative car/area tested.

The charging light shall consist only of that provided by the car's normal lighting system. All natural or other external light shall be excluded. Several methods can be used to eliminate ambient light for accurate data collection (e.g., work at night with cars parked away from bright yard lights; locate cars in a dark, windowless shop, paint booth or carwash; mask windows and vestibules with roofing paper, flooring paper or similar opaque materials; or drape cars with opaque tarpaulins).

To take the measurement readings, the sensor is placed on the area of the HPPL sign/markings surface location where the light is brightest (or on the floor location as permitted in Section 5.4.1.2). The observer records the reading(s) using a data collection form.

The sensor and the readout device of the illuminance meter should be held in a manner so that they can be read without the observer's shadow affecting the readings.

If light diffusers are used on the light fixtures, then the measurements shall be made with the light diffusers in place.

## **4.2 Exterior signs/markings**

Rail transit systems shall ensure that retroreflective material is certified by an independent test laboratory to be in conformance with ASTM E810, "Standard Test Method for Coefficient of Retroreflection of **Retroreflective Sheeting Utilizing the Coplanar Geometry.**"

## **4.3 Recordkeeping**

Rail transit systems shall retain a copy of the car manufacturer/supplier provided independent laboratory certified test report results showing that the illuminance or luminance measurements, as appropriate, on the active area of the signage/markings component comply with the criteria specified in Section 2.4 of this standard. Such records shall be kept until all cars with those components are retired, transferred, leased or conveyed.

Rail transit systems shall retain a copy of the certified independent laboratory test report results that certify that the retroreflective material complies with Type I materials per ASTM D4956 until all cars containing the retroreflective material are retired, or are transferred, leased or conveyed.

## **5. System reliability**

All emergency signage systems shall be designed so that the signs/markings remain conspicuous, notwithstanding the failure of any single individual sign, material segment, single light fixture or battery or other power source.

## **6. Operating conditions**

All emergency signage shall be designed to operate without failure under the conditions typically found in rail transit vehicles, including expected mechanical vibrations, shock and electromagnetic interference.

For rail cars ordered on or after the adoption of this standard, emergency signs/markings shall continue to function after the standby power and any other stages of load shedding have terminated, independently of the main car battery, so that illumination at the minimum levels are maintained for at least 1.5 hours after loss of normal power.

## **7. Maintenance**

### **7.1 Daily inspections**

Rail transit systems that conduct daily inspections shall visually inspect all emergency signage system components, except those for roof access, during those inspections to determine that signs/markings components are present and conspicuous, and that signs and instructions are legible.

### **7.2 Periodic inspections**

Rail transit systems shall conduct periodic inspections to verify that all emergency signage system components are present and function as intended.

### **7.3 Defect reporting, repair and recordkeeping**

Illegible, broken, damaged, missing or nonfunctioning components of either the interior or the exterior emergency signage system shall be corrected and documented in accordance with established local transit system procedures and OEM recommendations.

Recordkeeping shall be in accordance with standard rail transit systems procedures.

## References

- APTA Standard APTA RT-S-VIM-020-10 “*Emergency Lighting System Design for Rail Transit Vehicles,*”
- APTA Standard APTA RT-S-VIM-022-10 “*Low Location Emergency Path Marking for Rail Transit Vehicles,*”
- ASTM International, ASTM D4956, Standard “*Specification for Retroreflective Sheeting for Traffic Control.*” <http://www.astm.org/Standards/D4956.htm>
- ASTM International, ASTM E2073, Standard “*Test Method for Photopic Luminance of Photoluminescent (Phosphorescent) Markings.*” <http://www.astm.org/Standards/E2073.htm>
- ASTM International, ASTM E810, Standard “*Test Method for Coefficient of Retroreflection of Retroreflective Sheeting Utilizing the Coplanar Geometry.*” <http://www.astm.org/Standards/E810.htm>

## Definitions

- auxiliary power system:** An onboard source of electrical power (e.g., alternator/generator/car battery) typically used under normal operating conditions to supply such functions as lighting, air conditioning, etc.
- candela:** A unit of luminous intensity in both the SI and English measurement systems. One candela is 1 lumen per steradian (lm/sr). It is similar to the obsolete unit called the candle.
- color temperature:** A numerical descriptor of the hue of a light source. It is expressed in terms of degrees on the Kelvin scale, and refers to the temperature of a black-body radiator that produces light of the same hue as the source specified. Low color temperatures correspond to reddish sources, such as candle flames or incandescent lamps, whereas higher color temperatures are associated with bluish (or cool) color sources.
- emergency exit locator signs:** Conspicuous emergency marking/signage used to identify and/or direct passengers to the nearest emergency exit location(s).
- emergency signage:** Textual and graphic messages designed to assist passengers and train crew members in locating and using rail car emergency exits and to assist emergency responders in gaining access to rail cars using doors and windows from the exterior.
- foot-candle:** A unit of illuminance. One foot-candle is 1 lumen per square foot (lm/ft<sup>2</sup>). In the international system (SI), the units of illuminance are lux (1 fc = 10.76 lux).
- high-performance photoluminescent (HPPL) material:** A photoluminescent material that is capable of emitting light at a very high rate and for an extended period of time. For this standard, the minimum luminance value for HPPL is 7.5 millicandela per square meter (7.5 mcd/m<sup>2</sup>), for 1.5 hours after removal of the charging light source. Unless otherwise permitted in this standard, the charging light source is specified as a fluorescent lamp with a color temperature of 4000 to 4500 K that provides an illuminance of no more than 1 fc on the test sample for a duration of no more than 1 hour.
- icon:** A sign or representation that stands for an object by virtue of a resemblance or analogy to it.
- illuminance:** The amount of light (luminous flux) falling on a specific unit surface area (e.g., 1 square foot). English units are foot-candles (fc) or lumens per square foot (lm/ft<sup>2</sup>). International units (SI) are lumens per square meter (lm/m<sup>2</sup>) or lux (lx). One fc equals 10.76 lux.

**independent power source:** A sealed battery or other energy storage device located within the car body designed to power one or more emergency light fixtures or other devices when the normal head-end power, main car battery, auxiliary power and/or wayside power are unavailable.

**lighting, emergency:** A lighting mode that is available whenever power for the normal lighting is unavailable. The main car battery or one or more independent power sources can be used to supply the power to operate the fixtures that provide emergency lighting.

**lighting, normal:** A lighting mode that is available when the car is in operation with the normal power system.

**lumen:** The international unit of luminous flux, or the rate of flow of light.

**luminance:** The amount of light reflected from a unit area or surface or the amount of light emitted from a surface, e.g., EL or LED material. English units are foot-lamberts (fl). International units (SI) are candela per square meter (cd/m<sup>2</sup>) (also called “nits”) and millicandela per square meter (mcd/m<sup>2</sup>). (1 fl = 3.426 cd/m<sup>2</sup> or 3426 mcd/m<sup>2</sup>.)

**luminescence:** The emission of light other than incandescent, as in phosphorescence or fluorescence by processes that derive energy from essentially non-thermal sources through excitation by radiation.

**luminaire (light fixture):** A device to produce, control and distribute light. A complete unit consisting of one or more lamps, sockets to hold and protect the lamps, optical devices to direct the light, and circuitry to provide the required electric power to the lamp(s).

**luminance contrast:** Refers to the relationship or difference between the object and its immediate background, defined by the following ratio:

$$\frac{L_1 - L_2}{L_1} \quad \text{Where: } L_1 = \text{luminance of background}$$

$L_2 = \text{luminance of the object in question}$   
(e.g., lettering, pictogram, symbol)

**lux:** The international unit of illuminance (1 lux = 0.0929 fc).

**marking/delineator:** A noticeable sign, symbol, line or trace.

**passive illumination:** Illumination that is generated without the use of direct electrical energy.

**pictogram/pictograph:** A pictorial sign or symbol.

**photoluminescent (PL) material:** Material having the property of emitting light that continues for a length of time after excitation by visible or invisible light has been removed (i.e., self-illuminating).

**reflectance factor:** The ratio of the luminous flux reflected by a surface to the luminous flux it receives.

**representative car/area:** A car/area that shares the relevant characteristics as the car(s)/area(s) it represents (i.e., same signage/markings layout, lighting system, and normal car lighting levels for passive systems or luminance/illuminance for electrically powered systems).

**retroreflective material:** A material that is capable of reflecting light rays back to the light source.



**sign:** A display board, poster, placard or marking/delineator using text and/or graphics to convey information or direction.

**symbol:** A letter, figure, other character, arrow or mark, or any combination thereof, used for designating something else by association, resemblance or convention.


**spatial average:** The average of all samples taken in the vicinity of a specific location. The area of a spatial average varies. For a stairway, it comprises only the area of the stair step(s). For an aisle, the entire length of the aisle is included.

**useful field of view (UFOV):** The sensory, perceptual and attentional processes that address the ability to attend to one’s surroundings, detect information and identify that which demands action. In terms of behavior, UFOV includes information that can be extracted from a glance.

## Abbreviations and acronyms

<b>APTA</b>	American Public Transportation Association
<b>ASTM</b>	ASTM International, (formerly the American Society for Testing and Materials)
<b>EL</b>	electroluminescence
<b>fc</b>	foot-candle
<b>fl</b>	foot-lambert
<b>HPPL</b>	high-performance photoluminescent
<b>LED</b>	light-emitting diode
<b>LLEPM</b>	low-level egress path marking
<b>lm</b>	lumen
<b>mcd</b>	millicandela
<b>NATSA</b>	North American Transit Services Association
<b>OEM</b>	original equipment manufacturer
<b>PL</b>	photoluminescent
<b>SI</b>	Système International d'unités
<b>sr</b>	steradian
<b>UFOV</b>	useful field of view
<b>UL</b>	Underwriters’ Laboratories
<b>UV</b>	ultraviolet

## Summary of document changes

1. Participant list changed to reflect parent organization.
2. Caution triangles added throughout the document as appropriate 

## Document history

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First Published	–	–	–	–	June 6, 2010
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