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130

Standard for Fixed Guideway Transit and Passenger Rail Systems

2017

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ISBN: 978-145591396-1 (PDF)

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NFPA® 130

Standard for

Fixed Guideway Transit and Passenger Rail Systems

2017 Edition

This edition of NFPA 130, *Standard for Fixed Guideway Transit and Passenger Rail Systems,* was prepared by the Technical Committee on Fixed Guideway Transit and Passenger Rail Systems. It was issued by the Standards Council on May 13, 2016, with an effective date of June 2, 2016, and supersedes all previous editions.

This document has been amended by one or more Tentative Interim Amendments (TIAs) and/or Errata. See "Codes & Standards" at www.nfpa.org for more information.

This edition of NFPA 130 was approved as an American National Standard on June 2, 2016.

Origin and Development of NFPA 130

The Fixed Guideway Transit Systems Technical Committee was formed in 1975 and immediately began work on the development of NFPA 130. One of the primary concerns of the committee in the preparation of this document centered on the potential for entrapment and injury of large numbers of people who routinely use these types of mass transportation facilities.

During the preparation of the first edition of this document, several significant fires occurred in fixed guideway systems, but fortunately the loss of life was limited. The committee noted that the minimal loss of life was due primarily to chance events more than any preconceived plan or the operation of protective systems.

The committee developed material on fire protection requirements to be included in NFPA 130, *Standard for Fixed Guideway Transit Systems.* This material was adopted by NFPA in 1983. The 1983 edition was partially revised in 1986 to conform with the NFPA Manual of Style. Incorporated revisions included a new Chapter 8; a new Appendix F, Creepage Distance; minor revisions to the first four chapters and to Appendices A, B, C, and E; and a complete revision of Appendix D.

The scope of the 1988 edition was expanded to include automated guideway transit (AGT) systems. The sample calculations in Appendix C were revised, and Appendix D was completely revised.

The 1990 edition included minor changes to integrate provisions and special requirements for AGT systems into the standard. Table 1 from Appendix D was moved into Chapter 4, Vehicles, and new vehicle risk assessment material was added to Appendix D.

Definitions for *enclosed station* and *open station* were added in the 1993 edition, along with minor changes to Chapters 2 and 3; the 1995 edition made minor changes to Chapters 1, 2, and 3.

The 1997 edition included a new chapter on emergency ventilation systems for transit stations and trainways. A new Appendix B addressing ventilation replaced the previous Appendix B, Air Quality Criteria in Emergencies. Also, the first three sections of Chapter 6 (renumbered as Chapter 7 in the 1997 edition), Emergency Procedures, were revised, and several new definitions were added.

The 2000 edition of NFPA 130 addressed passenger rail systems in addition to fixed guideway transit systems. The document was retitled *Standard for Fixed Guideway Transit and Passenger Rail Systems* to reflect that addition, and changes were made throughout the document to incorporate passenger rail requirements. Additionally, much of Chapter 2 was rewritten to incorporate changes that were made to the egress calculations in NFPA *101*®, *Life Safety Code*®. The examples in Appendix C were modified using the new calculation methods. The protection requirements for Chapter 3 were modified, addressing emergency lighting and standpipes. Chapter 4 also was modified to clarify and expand the emergency ventilation requirements.

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The 2003 edition was reformatted in accordance with the 2003 *Manual of Style for NFPA Technical Committee Documents*. Beyond those editorial changes, there were technical revisions to the egress requirements and calculations for stations. The chapter on vehicles was extensively rewritten to include a performance-based design approach to vehicle design as well as changes to the traditional prescriptive-based requirements.

The 2007 edition included revisions affecting station egress calculations, the use of escalators in the means of egress, vehicle interior fire resistance, and power supply to tunnel ventilation systems. The chapter on vehicle maintenance facilities was removed because requirements for that occupancy are addressed in other codes; the performance-based vehicle design requirements were substantially revised to more accurately address the unique qualities of rail vehicles.

The 2010 edition of NFPA 130 included provisions that allowed elevators to be counted as contributing to the means of egress in stations. The 2010 edition also contained revisions relating to escalators, doors, gates, and turnstile-type fare equipment. The units in the standard were updated in accordance with the 2004 *Manual of Style for NFPA Technical Committee Documents*. Several fire scenarios were added to Annex A to provide guidance on the types of fires that can occur in vehicles, stations, and the operating environment as well.

The 2014 edition of NFPA 130 included substantial reorganization of Chapters 5 and 6 for consistency and consolidation of wire and cable requirements into a new Chapter 12. Other changes included reconciliation of terminology related to enclosed trainways and engineering versus fire hazard analyses; revisions to interior finish requirements; revisions to requirements for prevention of flammable and combustible liquids intrusion in Chapters 5 and 6; and improvements to Annex C.

The 2017 edition of NFPA 130 adds several new definitions and modified requirements for materials used as interior wall and ceiling finishes. Enclosed stations are now required to be equipped with a fire alarm system and stations, and enclosed trainways are now required to be equipped with an emergency communication system, as outlined in revised Chapter 10. A new Annex B now provides guidance on establishing noise levels in order to maintain a minimum level of speech intelligibility through the emergency communication system. In Annex C, modifications have been made to the example showing means of egress calculation. A new Annex H provides information on fire scenarios and methodologies used for predicting fire profiles.

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NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents pertaining to fire safety requirements for underground, surface, and elevated fixed guideway transit and passenger rail systems including stations, trainways, emergency ventilation systems, vehicles, emergency procedures, communications and control systems and for life safety from fire and fire protection in stations, trainways, and vehicles. Stations shall pertain to stations accommodating occupants of the fixed guideway transit and passenger rail systems and incidental occupancies in the stations.

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2017 Edition

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex I. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex I.

Chapter 1 Administration

1.1 Scope.

1.1.1* This standard shall cover life safety from fire and fire protection requirements for fixed guideway transit and passenger rail systems, including, but not limited to, stations, trainways, emergency ventilation systems, vehicles, emergency procedures, communications, and control systems.

1.1.2 Fixed guideway transit and passenger rail stations shall pertain to stations accommodating only passengers and employees of the fixed guideway transit and passenger rail systems and incidental occupancies in the stations. This standard establishes minimum requirements for each of the identified subsystems.

1.1.3 This standard shall not cover requirements for the following:

(1) Conventional freight systems
(2) Buses and trolley coaches
(3) Circus trains
(4) Tourist, scenic, historic, or excursion operations
(5) Any other system of transportation not included in the definition of *fixed guideway transit system (see 3.3.63.1)* or *passenger rail system (see 3.3.63.2)*
(6)* Shelter stops

1.1.4 To the extent that a system, including those listed in 1.1.3(1) through 1.1.3(6), introduces hazards of a nature similar to those addressed herein, this standard shall be permitted to be used as a guide.

1.2 Purpose. The purpose of this standard shall be to establish minimum requirements that will provide a reasonable degree of safety from fire and its related hazards in fixed guideway transit and passenger rail system environments.

1.3 Application.

1.3.1 This standard shall apply to new fixed guideway transit and passenger rail systems and to extensions of existing systems.

1.3.2 The portion of the standard dealing with emergency procedures shall apply to new and existing systems.

1.3.3* The standard also shall be used for purchases of new rolling stock and retrofitting of existing equipment or facilities except in those instances where compliance with the standard will make the improvement or expansion incompatible with the existing system.

1.3.4 This standard shall also apply as a basis for fixed guideway transit and passenger rail systems where nonelectric and combination electric-other (such as diesel) vehicles are used. Where such vehicles are not passenger-carrying vehicles or are buses or trolley coaches, the standard shall not apply to those vehicles but shall apply to the fixed guideway transit and passenger rail systems in which such vehicles are used.

1.4* Equivalency. Nothing in this standard is intended to prevent or discourage the use of new methods, materials, or devices, provided that sufficient technical data are submitted to the authority having jurisdiction to demonstrate that the new method, material, or device is equivalent to or superior to the requirements of this standard with respect to fire performance and life safety.

1.4.1 Technical Documentation. Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.4.2 Approval. The new methods, materials, or devices shall be approved for the intended purpose.

1.4.3* Equivalent Compliance. Alternative systems, methods, materials, or devices approved as equivalent shall be recognized as being in compliance with this standard.

1.5 Units and Formulas.

1.5.1 SI Units. The metric units of measurement in this standard are in accordance with the International System of Units (SI).

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1.5.2 Primary and Equivalent Values. If a value for a measurement as given in this standard is followed by an equivalent value in other units, the first stated value shall be regarded as the requirement. A given equivalent value might be approximated.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers,* 2013 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2016 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems,* 2016 edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection,* 2013 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,* 2017 edition.

NFPA 70® , *National Electrical Code®,* 2017 edition.

NFPA 72® , *National Fire Alarm and Signaling Code,* 2016 edition.

NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids,* 2015 edition.

NFPA *101®* , *Life Safety Code®,* 2015 edition.

NFPA 110, *Standard for Emergency and Standby Power Systems,* 2016 edition.

NFPA 220, *Standard on Types of Building Construction,* 2015 edition.

NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations,* 2013 edition.

NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source,* 2015 edition.

NFPA 262, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces,* 2015 edition.

NFPA 275, *Standard Method of Fire Tests for the Evaluation of Thermal Barriers,* 2013 edition.

NFPA 286, *Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth,* 2015 edition.

NFPA 703, *Standard for Fire Retardant–Treated Wood and Fire-Retardant Coatings for Building Materials,* 2015 edition.

2.3 Other Publications.

2.3.1 AMCA Publications. Air Movement and Control Association International, Inc., 30 West University Drive, Arlington Heights, IL, 60004-1893.

ANSI/AMCA 210, *Laboratory Methods of Testing Fans for Aerodynamic Performance Rating*, 2007.

ANSI/AMCA 250, *Laboratory Methods of Testing Jet Tunnel Fans for Performance*, 2012.

ANSI/AMCA 300, *Reverberant Room Method for Sound Testing of Fans*, 2014.

2.3.2 APTA Publications. American Public Transportation Association, 1666 K Street NW, Washington, DC 20006.

APTA PR-PS-S-002, Rev 3, *Standard for Emergency Signage for Egress/Access of Passenger Rail Equipment*, 1998, revised 2007.

2.3.3 ASHRAE Publications. ASHRAE Inc., 1791 Tullie Circle, NE, Atlanta, GA 30329-2305.

ASHRAE Handbook — Fundamentals, 2013.

ASHRAE 149, *Laboratory Methods of Testing Fans Used to Exhaust Smoke in Smoke Management Systems*, 2013.

2.3.4 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM C1166, *Standard Test Method for Flame Propagation of Dense and Cellular Elastometric Gaskets and Accessories,* 2006 (2011).

ASTM D2724, *Standard Test Methods for Bonded, Fused, and Laminated Apparel Fabrics*, 2007 (2015).

ASTM D3574, *Standard Test Methods for Flexible Cellular Materials — Slab, Bonded, and Molded Urethane Foams*, 2011.

ASTM D3675, *Standard Test Method for Surface Flammability of Flexible Cellular Materials Using a Radiant Heat Energy Source*, 2014.

ASTM D7568, *Standard Specification for Polyethylene-Based Structural-Grade Plastic Lumber for Outdoor Applications*, 2013.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2015a.

ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, 2015.

ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, 2012.

ASTM E162, *Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source*, 2015a.

ASTM E648, *Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source*, 2015.

ASTM E662, *Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials*, 2015.

ASTM E814, *Standard Test Method for Fire Tests of Through-Penetration Fire Stops*, 2013a.

ASTM E1354, *Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter*, 2015a.

ASTM E1537, *Standard Test Method for Fire Testing of Upholstered Furniture*, 2013.

ASTM E1590, *Standard Test Method for Fire Testing of Mattresses*, 2013.

ASTM E2061, *Standard Guide for Fire Hazard Assessment of Rail Transportation Vehicles*, 2012.

ASTM E2652, *Standard Test Method for Behavior of Materials in a Tube Furnace with a Cone-Shaped Airflow Stabilizer, at 750°C*, 2012.

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2.3.5 California Technical Bulletins. State of California, Department of Consumer Affairs, Bureau of Home Furnishings and Thermal Insulation, 3485 Orange Grove Avenue, North Highlands, CA 95660-5595.

Technical Bulletin 129, *Flammability Test Procedure for Mattresses for Use in Public Buildings*, October 1992.

Technical Bulletin 133, *Flammability Test Procedure for Seating Furniture for Use in Public Occupancies*, January 1991.

2.3.6 ICEA Publications. Insulated Cable Engineers Association, P.O. Box 1568, Carrollton, GA 30112.

ICEA S-73-532 ANSI/NEMA WC-57, *Standard for Control, Thermocouple Extension, and Instrumentation Cables*, 2014.

ICEA S-95-658 ANSI/NEMA WC-70, *Nonshielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy*, 2009.

2.3.7 IEC Publications. International Electrotechnical Commission, 3, rue de Varembé, P.O. Box 131, CH-1211 Geneva 20, Switzerland.

IEC 60331-11, *Tests for electric cables under fire conditions — Circuit integrity — Part 11: Apparatus — Fire alone at a flame temperature of at least 750°C*, 2009.

IEC 62520, *Railway applications electric traction, short primary type linear induction motors (LIM) fed by power converters*, 2011.

2.3.8 IEEE Publications. IEEE, 3 Park Avenue, 17th Floor, New York, NY 10016-5997.

IEEE 11, *Standard for Rotating Electric Machinery for Rail and Road Vehicles*, 2000 (R2006).

IEEE 16, *American Standard for Electric Control Apparatus for Land Transportation Vehicles*, 2004.

IEEE 1202, *Flame Testing of Cables for use in Cable Tray*, 2012.

2.3.9 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 44, *Standard for Safety Thermoset-Insulated Wires and Cables*, 2014.

ANSI/UL 83, *Standard for Safety Thermoplastic-Insulated Wires and Cables*, 2014.

ANSI/UL 263, *Standard for Fire Tests of Building Construction and Materials*, 2014.

ANSI/UL 1685, *Standard for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*, 2015.

UL 1724, *Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems*, 2006.

ANSI/UL 2196, *Standard for Safety for Tests for Fire Resistive Cables*, 2001, revised 2012.

2.3.10 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 14, Code of Federal Regulations, Part 25, Appendix F, Part I, "Vertical Test."

2.3.11 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 72®, *National Fire Alarm and Signaling Code*, 2016 edition.

NFPA 92, *Standard for Smoke Control Systems*, 2015 edition.

NFPA *101®*, *Life Safety Code®*, 2015 edition.

NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*, 2015 edition.

NFPA 270, *Standard Test Method for Measurement of Smoke Obscuration Using a Conical Radiant Source in a Single Closed Chamber*, 2013 edition.

NFPA 402, *Guide for Aircraft Rescue and Fire-Fighting Operations*, 2013 edition.

NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2013 edition.

NFPA 502, *Standard for Road Tunnels, Bridges, and Other Limited Access Highways*, 2017 edition.

NFPA 921, *Guide for Fire and Explosion Investigations*, 2014 edition.

NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents*, 2012 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.4* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

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3.2.5 Shall. Indicates a mandatory requirement.

3.2.6 Should. Indicates a recommendation or that which is advised but not required.

3.2.7 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1* Airflow Control Devices. Nontraditional equipment used to minimize tunnel airflow, including air curtains, barriers, brattices, tunnel doors, downstands, enclosures, tunnel gates, and so forth.

3.3.2 Ancillary Area/Ancillary Space. The nonpublic areas or spaces of the stations usually used to house or contain operating, maintenance, or support equipment and functions.

3.3.3 Authority. The agency legally established and authorized to operate a fixed guideway transit and/or passenger rail system.

3.3.4 Backlayering. The reversal of movement of smoke and hot gases counter to the direction of the ventilation airflow.

3.3.5* Blue Light Station. A location along the trainway, indicated by a blue light, where a person can communicate with the operations control center and disconnect traction power.

3.3.6 Certified. A system whereby a certification organization determines that a manufacturer has demonstrated the ability to produce a product that complies with the requirements of this standard, authorizes the manufacturer to use a label on listed products that comply with the requirements of this standard, and establishes a follow-up program conducted by the certification organization as a check on the methods the manufacturer uses to determine continued compliance with the requirements of this standard. [**1994,** 2012]

3.3.7 Combustible Load of a Vehicle. The total value of heat energy that can be released through complete combustion of the components of a vehicle or fuel, expressed in joules [British thermal units (Btu)].

3.3.8 Command Post (CP). The location at the scene of an emergency where the incident commander is located and where command, coordination, control, and communications are centralized. [**402,** 2013]

3.3.9 Computational Fluid Dynamics. A solution of fundamental equations of fluid flow using computer techniques allowing the engineer to identify velocities, pressures, temperatures, and so forth.

3.3.10* Concourse. Intermediate area connecting a station platform(s) to a public way via stairs, escalators, or corridors.

3.3.11 Critical Radiant Flux. The level of incident radiant heat energy in units of W/cm^2 on a floor covering system at the most distant flameout point. [**253,** 2015]

3.3.12 Critical Velocity. The minimum steady-state velocity of the ventilation airflow moving toward the fire within a tunnel or passageway that is required to prevent backlayering at the fire site.

3.3.13 Decibel. The logarithmic units associated with sound pressure level.

3.3.13.1 ***A-weighted Decibel (dBA).*** Decibel values with weighting applied over the frequency range of 20 Hz to 20 kHz to reflect human hearing.

3.3.13.2 ***Unweighted Decibel (dBZ).*** Decibel values without weighting applied.

3.3.14 Emergency Communications System. A system for the protection of life by indicating the existence of an emergency situation and communicating information necessary to facilitate an appropriate response and action. [**72,** 2016]

3.3.15 Emergency Procedures Plan. A plan that is developed by the authority with the cooperation of all participating agencies and that details specific actions required by all those who will respond during an emergency.

3.3.16* Engineering Analysis. A system analysis that evaluates all the various factors of relative to specific objectives for system performance.

3.3.16.1* ***Fire Hazard Analysis.*** A specific type of engineering analysis relative to the contribution of a material, component, or assembly to the overall fire hazard and the estimation of the potential severity of fires that can develop under defined fire scenarios.

3.3.17 Equivalency. An alternative means of providing an equal or greater degree of safety than that afforded by strict conformance to prescribed codes and standards.

3.3.18 Fire Command Center. The principal attended or unattended room or area where the status of the detection, alarm communications, control systems, and other emergency systems is displayed and from which the system(s) can be manually controlled. [**72,** 2016]

3.3.19 Fire Emergency. The existence of, or threat of, fire or the development of smoke or fumes, or any combination thereof, that demands immediate action to mitigate the condition or situation. [**502,** 2017]

3.3.20 Fire Growth Rate. Rate of change of the heat release rate. Some factors that affect the fire growth rate are exposure, geometry, flame spread, and fire barriers.

3.3.21 Fire Load.

3.3.21.1* ***Effective Fire Load.*** The portion of the total fire load (in joules or Btu) under a given, specific fire scenario of a certain fuel package that would be expected to be released in a design fire incident.

3.3.21.2* ***Total Fire Load.*** The total heat energy (in joules or Btu) of all combustibles available from the constituent materials of a certain fuel package.

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3.3.22 Fire Profile. For a given fire scenario, the fire carbon monoxide, heat release, and smoke and soot release rates expressed as a function of time.

3.3.23 Fire Scenario. A set of conditions that defines the development of a fire, the spread of combustion products in a fixed guideway transit or passenger rail system, the reaction of people to the fire, and the effects of the products of combustion.

3.3.24 Fire Soot Release Rate. Rate of soot release for a given fire scenario expressed as a function of time (g/s or lbs/s).

3.3.25 Flaming Dripping. Periodic dripping of flaming material from the site of material burning or material installation.

3.3.26 Flaming Running. Continuous flaming material leaving the site of material burning or material installation.

3.3.27 Green Track. The intentional placement and maintenance of vegetation within a trainway.

3.3.28 Guideway. That portion of the fixed guideway transit or passenger rail system included within right-of-way fences, outer lines of curbs or shoulders, tunnels and stations, cut or fill slopes, ditches, channels, and waterways and including all appertaining structures.

3.3.29 Hazard. Real or potential condition that can cause injury.

3.3.30 Headway. The interval of time between the arrivals of consecutive trains at a platform in a station.

3.3.31* Heat Release Rate (HRR). The rate at which heat energy is generated by burning. [**921,** 2014]

3.3.31.1 ***Average Heat Release Rate (HRR_{180}).*** The average heat release rate per unit area, over the time period starting at time to ignition and ending 180 seconds later, as measured in ASTM E1354 (kW/m^2).

3.3.31.2* ***Fire Heat Release Rate.*** Rate of energy release for a given fire scenario or fire test, expressed as a function of time.

3.3.32 Incident Commander (IC). The individual responsible for all incident activities, including the development of strategies and tactics and the ordering and the release of resources. [**472,** 2013]

3.3.33 L_{eq}. The average sound level over time on an acoustical energy basis.

3.3.34 Noncombustible (Material). See Section 4.6.

3.3.35 Nonmechanical Emergency Ventilation System. A system of smoke reservoirs, smoke vents, and/or dampers that are designed to support the tenability criteria without the use of fans.

3.3.36 Occupancy.

3.3.36.1 ***Incidental Occupancies Within Stations.*** The use of a portion of the station by others who are neither transit system employees nor passengers and where such space remains under the control of the system-operating authority.

3.3.36.2 ***Nonsystem Occupancy.*** An occupancy not under the control of the system-operating authority.

3.3.37 Operations Control Center. The operations center where the authority controls and coordinates the systemwide movement of passengers and trains from which communication is maintained with supervisory and operating personnel of the authority and with participating agencies when required.

3.3.38 Participating Agency. A public, quasipublic, or private agency that has agreed to cooperate with and assist the authority during an emergency.

3.3.39 Passenger Load.

3.3.39.1 ***Detraining Load.*** The number of passengers alighting from a train at a platform.

3.3.39.2 ***Entraining Load.*** The number of passengers boarding a train at a platform.

3.3.39.3 ***Link Load.*** The number of passengers traveling between two stations on board a train or trains.

3.3.40 Point of Safety. A point of safety is one of the following: (1) an enclosed exit that leads to a public way or safe location outside the station, trainway, or vehicle; (2) an at-grade point beyond the vehicle, enclosing station, or trainway; (3) any other approved location.

3.3.41 Power Station. An electric-generating plant for supplying electrical energy to the system.

3.3.42 Power Substation. Location of electric equipment that does not generate electricity but receives and converts or transforms generated energy to usable electric energy.

3.3.43 Radiant Panel Index (I_s). The product of the flame spread factor (F_s) and the heat evolution factor (Q_s), as determined in ASTM E162.

3.3.44 Replace in Kind. As applied to vehicles and facilities, to furnish with new parts or equipment of the same type but not necessarily of identical design.

3.3.45 Retrofit. As applied to vehicles and facilities, to furnish with new parts or equipment to constitute a deliberate modification of the original design (as opposed to an overhaul or a replacement in kind).

3.3.46 Smoke. The airborne solid and liquid particulates and gases evolved when a material undergoes pyrolysis or combustion, together with the quantity of air that is entrained or otherwise mixed into the mass. [**92,** 2015]

3.3.47 Smoke Obscuration. The reduction of light transmission by smoke, as measured by light attenuation. [**270,** 2013]

3.3.48 Smoke Release Rate. Rate of smoke release associated with a given fire scenario or a given fire test; it is expressed in terms of a surface area as a function of time [m^2/sec (ft^2/sec)].

3.3.49 Soot. Black particles of carbon produced in a flame. [**921,** 2014]

3.3.50 Soot Yield. The mass (weight) of soot emitted per mass (weight) of the fuel consumed: g (oz) of soot emitted per g (oz) of fuel burned.

3.3.51 Sound Pressure Level. The logarithmic ratio of the root-mean squared sound pressure to the reference sound pressure (2.0×10^{-5} Pascals).

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3.3.52 Specific Extinction Area. A measure of smoke obscuration potential per unit of mass burned, determined as the product of the specific extinction coefficient and the volumetric mass flow rate, divided by the mass loss rate [m^2/kg (ft^2/lb)].

3.3.53 Specific Optical Density (D_s). The optical density, as measured in ASTM E662, over unit path length within a chamber of unit volume, produced from a specimen of unit surface area, that is irradiated by a heat flux of 2.5 W/cm^2 for a specified period of time.

3.3.54* Speech Interference Level (SIL). A calculated quantity providing a guide to the interfering effect of noise on speech intelligibility; measured in decibels.

3.3.55 Station. A place designated for the purpose of loading and unloading passengers, including patron service areas and ancillary spaces associated with the same structure.

3.3.55.1 ***Enclosed Station.*** A station or portion thereof that does not meet the definition of an open station.

3.3.55.2* ***Open Station.*** A station that is constructed such that it is directly open to the atmosphere and smoke and heat are allowed to disperse directly into the atmosphere.

3.3.56 Station Platform. The area of a station immediately adjacent to a guideway, used primarily for loading and unloading passengers.

3.3.57 System. See 3.3.62.1, Fixed Guideway Transit System, or 3.3.62.2, Passenger Rail System.

3.3.58 Tenable Environment. An environment that permits the self-rescue or survival of occupants.

3.3.59 Tourist, Scenic, Historic, or Excursion Operations. Railroad operations, often using antiquated equipment, that are principally intended to carry passengers traveling for pleasure purposes.

3.3.60 Track.

3.3.60.1 ***Storage Track.*** A portion of the trainway used for temporary storage or light cleaning of trains and not intended to be used for trains occupied by passengers.

3.3.60.2 ***Tail Track.*** A portion of dead-end trainway used for temporary storage, turn-around, or light cleaning of trains and not intended to be used for trains occupied by passengers.

3.3.61 Trainway. That portion of the system in which the vehicles operate.

3.3.62 Transportation Systems.

3.3.62.1 ***Fixed Guideway Transit System.*** An electrified transportation system, utilizing a fixed guideway, operating on right-of-way for the mass movement of passengers within a metropolitan area, and consisting of its fixed guideways, transit vehicles, and other rolling stock; power systems; buildings; stations; and other stationary and movable apparatus, equipment, appurtenances, and structures.

3.3.62.1.1 ***Automated Fixed Guideway Transit System.*** A fixed guideway transit system that operates fully automated, driverless vehicles along an exclusive right-of-way.

3.3.62.2 ***Passenger Rail System.*** A transportation system, utilizing a rail guideway, operating on right-of-way for the movement of passengers within and between metropolitan areas, and consisting of its rail guideways, passenger rail vehicles, and other rolling stock; power systems; buildings; stations; and other stationary and movable apparatus, equipment, appurtenances, and structures.

3.3.63 Vehicle.

3.3.63.1 ***Fixed Guideway Transit Vehicle.*** An electrically propelled passenger-carrying vehicle characterized by high acceleration and braking rates for frequent starts and stops and fast passenger loading and unloading.

3.3.63.2 ***Passenger Rail Vehicle.*** A vehicle and/or power unit running on rails used to carry passengers and crew.

Chapter 4 General

4.1 Fire Safety of Systems.

4.1.1 Fire safety of systems shall be achieved through a composite of facility design, operating equipment, hardware, procedures, and software subsystems that are integrated to protect life and property from the effects of fire.

4.1.2 The level of fire safety desired for the whole system shall be achieved by integrating the required levels for each subsystem.

4.2 Goals.

4.2.1* The goals of this standard shall be to provide an environment for occupants of fixed guideway and passenger rail system elements that is safe from fire and similar emergencies to a practical extent based on the following measures:

(1) Protection of occupants not intimate with the initial fire development
(2) Maximizing the survivability of occupants intimate with the initial fire development

4.2.2 This standard is prepared with the intent of providing minimum requirements for those instances where noncombustible materials (as defined in Section 4.6) are not used due to other consideration in the design and construction of the system elements.

4.3 Objectives.

4.3.1 Occupant Protection. Systems shall be designed, constructed, and maintained to protect occupants who are not intimate with the initial fire development for the time needed to evacuate or relocate them or to defend such occupants in place during a fire or fire-related emergency.

4.3.2 Structural Integrity. Structural integrity of stations, trainways, and vehicles shall be maintained for the time needed to evacuate, relocate, or defend in place occupants who are not intimate with the initial fire development.

4.3.3 Systems Effectiveness. Systems utilized to achieve the goals stated in Section 4.2 shall be effective in mitigating the hazard or condition for which they are being used, shall be reliable, shall be maintained to the level at which they were designed to operate, and shall remain operational.

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4.4 Fire Scenarios.

4.4.1* Assumption of a Single Fire Event. The protection methods described in this standard shall assume a single fire event from a single fire source.

4.4.2* Design Fire Scenarios. Design scenarios shall consider the location and size of a fire or a fire-related emergency.

4.5* Shared Use by Freight Systems. Where passenger and freight systems are operated concurrently through or adjacent to stations and trainways, the design of the station and trainway fire-life safety and fire protection systems shall consider the hazards associated with both uses, as approved.

4.6* Noncombustible Material.

4.6.1* A material that complies with any of the following shall be considered a noncombustible material: [***101:*** 4.6.13.1]

(1) A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors, when subjected to fire or heat. [***101:*** 4.6.13.1(1)]
(2) A material that is reported as passing ASTM E136. [***101:*** 4.6.13.1(2)]
(3) A material that is reported as complying with the pass/fail criteria of ASTM E136 when tested in accordance with the test method and procedure in ASTM E2652. [***101:*** 4.6.13.1(3)]

4.7* Fire-Life Safety System Integrity. No part of the fire-life safety system critical to the intended system function that addresses an emergency shall be vulnerable to the emergency that it is supposed to address.

Chapter 5 Stations

5.1 General.

5.1.1 Applicability.

5.1.1.1 This chapter shall apply to all portions of stations.

5.1.2* Relationship to Local Codes.

5.1.2.1 The requirements in this chapter shall supplement the requirements of the locally applicable codes for the design and construction of stations.

5.1.2.2 Where the requirements in this chapter do not address a specific feature of fire protection or life safety, the requirements of the local codes shall be considered applicable.

5.1.3 Use and Occupancy.

5.1.3.1 The primary purpose of a station shall be for the use of the passengers who normally stay in a station structure for a period of time no longer than that necessary to wait for and enter a departing passenger-carrying vehicle or to exit the station after arriving on an incoming passenger-carrying vehicle.

5.1.3.2 Where contiguous nonsystem occupancies share common space with the station, where incidental occupancies are within the station, or where the station is integrated into a building used for nonsystem occupancy of which is for neither fixed guideway transit nor passenger rail, special considerations beyond this standard shall be necessary.

5.1.3.3 A station shall also be for the use of employees whose work assignments require their presence in the station structures.

5.2 Construction.

5.2.1 Safeguards During Construction.

5.2.1.1 During the course of construction, provisions of NFPA 241 shall apply except as modified herein.

5.2.1.2 Where access for fire fighting is restricted, standpipes sized for water flow and pressure for the maximum predicted construction fire load shall be installed to within 61 m (200 ft) of the most remote portion of the station.

5.2.1.3 The flow and pressure required at the outlet shall be approved.

5.2.1.4* Illumination levels within construction areas of enclosed stations shall not be less than 2.7 lx (0.25 ft-candles) at the walking surface.

5.2.2 Construction Type.

5.2.2.1 Building construction for all new enclosed stations shall be not less than Type I or Type II or combinations of Type I and Type II noncombustible construction as defined in NFPA 220, in accordance with the requirements of NFPA *101* , Chapter 12, for the station configuration or as determined by fire hazard analysis of potential fire exposure hazards to the structure.

5.2.2.2 Other types of construction as defined in NFPA 220 shall be permitted for open stations in accordance with the provisions of NFPA *101* , Chapter 12, for corresponding station configurations.

5.2.3 Flammable and Combustible Liquids Intrusion.

5.2.3.1 General. Protection of underground system structures against the accidental intrusion of flammable and combustible liquids shall be provided in accordance with this section.

5.2.3.2 Vehicle Roadway Terminations. Vent or fan shafts utilized for ventilation of underground system structures shall not terminate at grade on any vehicle roadway.

5.2.3.3 Median and Sidewalk Terminations. Vent and fan shafts shall be permitted to terminate in the median strips of divided highways, on sidewalks designed to accept such shafts, or in open space areas, provided that the grade level of the median strips, sidewalk, or open-space meets the following conditions:

(1) It is at a higher elevation than the surrounding grade level.
(2) It is separated from the roadway by a concrete curb at least 150 mm (6 in.) in height.

5.2.4 Compartmentation.

5.2.4.1 Interconnected Floor Levels. Interconnection between floor levels in stations shall be permitted as follows:

(1)* Stairs and escalators used by passengers shall not be required to be fire-separated.
(2) Public areas on different levels in open stations shall be permitted to be interconnected.

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(3) Public areas on different levels in enclosed stations shall be permitted to be interconnected, provided fire separation is not required for smoke control or other fire protection purposes.

5.2.4.2* Separation Between Public and Nonpublic Floor Areas. All public areas shall be fire-separated from adjacent nonpublic areas.

5.2.4.3 Ancillary Spaces. Fire resistance ratings of separations between ancillary occupancies shall be established as required by NFPA *101* and in accordance with ASTM E119 and ANSI/UL 263.

5.2.4.4* Agents' and Information Booths. Agents' or information booths shall comply with the following:

(1) Agents' or information booths shall be constructed of noncombustible materials.
(2) Booths used only as agents' and information booths shall not be required to be fire-separated from public station areas.

5.2.4.5* Separation Between System and Nonsystem Occupancies. All station public areas shall be fire separated from adjacent non-system occupancies.

5.2.5 Interior Finish.

5.2.5.1 Materials used as interior wall and ceiling finish in enclosed stations shall comply with one of the following requirements:

(1) The materials shall be noncombustible in accordance with Section 4.6.
(2) The materials shall comply with the following requirements when tested in accordance with NFPA 286:
    (a) Flames shall not spread to the ceiling during the 40 kW (135 kBtu/hr) exposure.
    (b) Flames shall not spread to the outer extremities of the sample on any wall or ceiling.
    (c) Flashover, as described in NFPA 286, shall not occur.
    (d) The peak heat release rate shall not exceed 800 kW (2730 kBtu/hr).
    (e) The total smoke released throughout the test shall not exceed 1000 m^2 (10,764 ft^2).
(3) The materials shall comply with a flame spread index not exceeding 25 and a smoke development index not exceeding 450 when tested in accordance with ASTM E84, except that the materials in 5.2.5.1(4) shall be required to be tested in accordance with NFPA 286.
(4) The following materials shall not be permitted to be used as interior wall and ceiling materials, unless they meet the requirements in 5.2.5.1(2) when tested in accordance with NFPA 286:
    (a) Foam plastic insulation, whether exposed or covered by a textile or vinyl facing
    (b) Textile wall or ceiling coverings
    (c) Polypropylene
    (d) High-density polyethylene.

5.2.5.2 Materials used as interior floor finish materials in enclosed stations shall be noncombustible or shall exhibit a critical radiant flux not less than 0.8 W/cm^2 (0.7 Btu/ft^2·sec) when tested in accordance with ASTM E648.

5.2.5.3 Materials used as interior finish in open stations shall comply with the requirements of NFPA *101* , Chapter 12.

5.2.6 Exposed Insulation.

5.2.6.1 In public circulation areas, exposed insulation shall be protected by a thermal barrier complying with NFPA 275 or by ½ in. (12.7 mm) gypsum board or ½ in. (12.7 mm) concrete.

5.2.6.2 Where thermal barriers are required by 5.2.6.1, penetrations shall be firestopped in accordance with ASTM E814.

5.2.7 Combustible Furnishings and Contents.

5.2.7.1* Where combustible furnishings or contents not specifically addressed in this standard are installed in a station, a fire hazard analysis shall be conducted to determine that the level of occupant fire safety is not adversely affected by the furnishings and contents.

5.2.7.2* Permanent rubbish containers in the station shall be manufactured of noncombustible materials.

5.2.7.3 Seating furniture in stations shall be noncombustible, or it shall have limited rates of heat release when tested in accordance with ASTM E1537, as follows:

(1) The peak rate of heat release for a single seating furniture item shall not exceed 80 kW (270 kBtu/hr).
(2) The total energy released by a single seating furniture item during the first 10 minutes of the test shall not exceed 25 MJ (23,700 Btu).

5.2.7.4 Lockers shall be constructed of noncombustible materials.

5.3* Means of Egress.

5.3.1* General.

5.3.1.1 The provisions for means of egress for a station shall comply with Chapters 7 and 12 of NFPA *101* , except as herein modified.

5.3.1.2 For a station, the design of the means of egress shall be based on an emergency condition requiring evacuation of the train(s) and station occupants to a point of safety.

5.3.2 Occupant Load.

5.3.2.1* The occupant load for a station shall be based on the train load of trains simultaneously entering the station on all tracks in normal traffic direction plus the simultaneous entraining load awaiting trains.

(1) The train load shall consider only one train at any one track.
(2) The basis for calculating train and entraining loads shall be the peak period ridership figures as projected for design of a new system or as updated for an operating system.

5.3.2.2* For station(s) servicing areas such as civic centers, sports complexes, and convention centers, the peak ridership figures shall consider events that establish occupant loads not included in normal passenger loads.

5.3.2.3 At multilevel, multiline, or multiplatform stations, occupant loads shall be determined as follows:

(1) The maximum occupant load for each platform shall be considered separately for the purpose of sizing the means of egress from that platform.
(2)* Simultaneous loads shall be considered for all egress routes passing through each level of that station.

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5.3.2.4 Where an area within a station is intended for use by other than passengers or employees, the following parameters shall apply:

(1) The occupant load for that area shall be determined in accordance with the provisions of NFPA *101* as appropriate for the use.
(2) The additional occupant load shall be included in determining the required egress from that area.
(3) The additional occupant load shall be permitted to be omitted from the station occupant load where the area has independent means of egress of sufficient number and capacity.

5.3.2.5* Calculation of Platform Occupant Load. The platform occupant load for each platform in a station shall be the maximum peak period occupant load calculated according to the following:

(1) The peak period occupant load for each platform shall be based on the simultaneous evacuation of the entraining load and the train load for that platform in the peak period.
(2) The entraining load for each platform shall be the sum of the entraining loads for each track serving that platform.
(3)* The entraining load for each track shall be based on the entraining load per train headway factored to account for service disruptions and system reaction time.
(4)* Where a platform serves more than one line on one track, the calculation of entraining load shall consider the combined effect of accumulation for each of the lines served.
(5) The train load for each platform shall be the sum of the train loads for each track serving that platform.
(6) The train load for each track shall be based on the train load per train headway factored to account for service disruptions and system reaction time.
(7) The maximum train load at each track shall be the maximum passenger capacity for the largest capacity train operating on that track during the peak period.

5.3.3* Capacity and Location of Means of Egress.

5.3.3.1* Platform Evacuation Time. There shall be sufficient egress capacity to evacuate the platform occupant load as defined in 5.3.2.5 from the station platform in 4 minutes or less.

5.3.3.2* Evacuation Time to a Point of Safety. The station shall be designed to permit evacuation from the most remote point on the platform to a point of safety in 6 minutes or less.

5.3.3.3* For stations where the concourse is protected from exposure to the effects of a fire at the platform by distance, geometry, fire separation, an emergency ventilation system designed in accordance with Chapter 7, or as determined by an appropriate engineering analysis, that concourse shall be permitted to be defined as a point of safety.

5.3.3.4 Travel Distance. The maximum travel distance on the platform to a point at which a means of egress route leaves the platform shall not exceed 100 m (325 ft).

5.3.3.5* Common Path of Travel. A common path of travel from the ends of the platform shall not exceed 25 m (82 ft) or one car length, whichever is greater.

5.3.3.6 Alternate Egress. At least two means of egress remote from each other shall be provided from each station platform as follows:

(1)* A means of egress used as a public circulation route shall be permitted to provide more than 50 percent of the required egress capacity from a station platform or other location.
(2) Means of egress from separate platforms shall be permitted to converge.
(3) Where means of egress routes from separate platforms converge, the subsequent capacity of the egress route shall be sufficient to maintain the required evacuation time from the incident platform.

5.3.3.7* Engineering Analysis. Modification of the evacuation times and travel distances shall be permitted based on an engineering analysis by evaluating material heat release rates, station geometry, and emergency ventilation systems.

5.3.4* Platforms, Corridors, and Ramps.

5.3.4.1* A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.

5.3.4.3 The maximum means of egress capacity of platforms, corridors, and ramps shall be computed at 0.0819 p/mm-min (2.08 p/in.-min).

5.3.4.4* The maximum means of egress travel speed along platforms, corridors, and ramps shall be computed at 37.7 m/min (124 ft/min).

5.3.4.5 The means of egress travel speed for concourses and other areas where a lesser pedestrian density is anticipated shall be computed at 61.0 m/min (200 ft/min).

5.3.5 Stairs and Escalators.

5.3.5.1 Stairs and escalators permitted by 5.2.4.1 to be unenclosed shall be permitted to be counted as contributing to the means of egress capacity in stations as detailed in 5.2.2 and 5.3.3.

5.3.5.2 Stairs in the means of egress shall be a minimum of 1120 mm (44 in.) wide.

5.3.5.3* Capacity and travel speed for stairs and escalators shall be computed as follows:

(1) Capacity — 0.0555 p/mm-min (1.41 p/in.-min)
(2)* Travel speed — 14.6 m/min (48 ft/min) (indicates vertical component of travel speed)

5.3.5.4 Escalators shall not account for more than one-half of the means of egress capacity at any one level except as permitted by 5.3.5.5.

5.3.5.5 Escalators shall be permitted to account for more than one-half of the required means of egress capacity at any one level where the following criteria are met:

(1) The escalators are capable of being remotely brought to a stop in accordance with the requirements of 5.3.5.7(3)(b), 5.3.5.7(4), and 5.3.5.7(5).

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(2) A portion of the means of egress capacity from each station level is stairs.
(3) For enclosed stations, at least one enclosed exit stair or exit passageway provides continuous access from the platforms to the public way.

5.3.5.6* In calculating the egress capacity of escalators, the following criteria shall be met:

(1) One escalator at each level shall be considered as being out of service.
(2) The escalator chosen shall be the one having the most adverse effect upon egress capacity.

5.3.5.7 Where escalators are permitted as a means of egress in stations, the following criteria shall be met:

(1)* The escalators shall be constructed of noncombustible materials.
(2)* Escalators running in the direction of egress shall be permitted to remain operating.
(3) Escalators running reverse to the direction of egress shall be capable of being stopped locally and remotely as follows:
  (a) Locally by a manual stopping device at the escalator
  (b) Remotely by one of the following:
    i. A manual stopping device at a remote location
    ii. As part of a pre-planned evacuation response
(4)* Where provision is made for remote stopping of escalators counted as means of egress, one of the following shall apply:
  (a) The stop shall be delayed until it is preceded by a minimum 15-second audible signal or warning message sounded at the escalator
  (b) Where escalators are equipped with the necessary controls to decelerate in a controlled manner under the full rated load, the stop shall be delayed for at least 5 seconds before beginning deceleration, and the deceleration, rate shall be no greater than 0.052 m/sec^2 (0.17 ft/sec^2).
(5) Where an audible signal or warning message is used, the following shall apply:
  (a) The signal or message shall have a sound intensity that is at least 15 dBA above the average ambient sound level for the entire length of the escalator.
  (b) The signal shall be distinct from the fire alarm signal.
  (c) The warning message shall meet audibility and intelligibility requirements.

5.3.5.8 Escalators with or without intermediate landings shall be acceptable as a means of egress, regardless of vertical rise.

5.3.5.9 Escalators exposed to the outdoor environment shall be provided with slip-resistant landing and floor plates, and if they are exposed to freezing temperatures, the landing and floor plates and the steps shall be heated to prevent the accumulation of ice and snow.

5.3.5.10 Stopped escalators shall be permitted to be started in the direction of egress in accordance with the requirements for stopping of escalators described in 5.3.5.7(3), 5.3.5.7(4), and 5.3.5.7(5), provided that the escalators can be restarted in a fully loaded condition and that passengers are given warning.

5.3.6 Elevators.

5.3.6.1 Elevators meeting the requirements of 5.3.6.2 through 5.3.6.4 shall be permitted to account for part of the means of egress capacity in stations.

5.3.6.2 Capacity. Where elevators are counted as contributing to the means of egress capacity, the following shall apply:

(1) They shall account for no more than 50 percent of the required egress capacity.
(2)* At least one elevator shall be considered out of service, and one elevator shall be reserved for fire service.
(3)* The capacity of each elevator shall be the carrying capacity of the elevator within 30 minutes.

5.3.6.3 Holding Area. Elevators counted as contributing to the means of egress capacity from any level of a station shall be accessed via holding areas or lobbies at that level, which shall be designed as follows:

(1) The holding areas or lobbies shall be separated from the platform by a smoketight fire separation having a fire resistance rating of at least 1 hour but not less than the time required to evacuate the holding area occupant load.
(2) At least one stair shall be accessible from the holding area.
(3) The holding area shall be sized to accommodate one person per 0.46 m^2 (5 ft^2).
(4) If the holding area includes portions of the platform, the area within 460 mm (18 in.) of the trainway shall not be considered in the calculation.
(5) Upon activation of smoke control in the platform or adjacent trainway areas, the holding area shall be pressurized to a minimum of 25 Pa (0.1003 in. of water gauge).
(6) The holding area shall be provided with emergency voice alarm devices with two-way communication to the system operations control center.

5.3.6.4 Design Features. Elevators counted as contributing to the means of egress capacity shall be designed as follows:

(1) Shaft enclosures shall be constructed as fire separations having a 2-hour fire resistance rating.
(2)* The design shall limit water flow into the shaft.
(3) No more than two elevators used for means of egress or fire department access shall share the same machine room.
(4) Machine rooms shall be separated from each other by fire separations having a minimum fire resistance rating of 2 hours.
(5) The elevators shall be connected to emergency power.
(6)* During emergency evacuation, the elevators shall travel only between the incident level and a point of safety.
(7)* Provisions for Phase I emergency recall operation shall be based on analysis of fire scenarios on each level served and demonstrate safe egress for those scenarios.

5.3.7* Doors, Gates, and Exit Hatches.

5.3.7.1 The egress capacity for doors and gates in a means of egress serving public areas shall be computed as follows:

(1) 60 people per minute (p/min) for single leaf doors and gates
(2)* 0.0819 p/mm-min (2.08 p/in.-min) for bi-parting multi-leaf doors and gates measured for the clear width dimension.

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5.3.7.2 Gates in a means of egress shall be designed in accordance with the requirements for doors serving as a means of egress.

5.3.7.3 Where used, exit hatches shall comply with the requirements of 6.3.3.15 through 6.3.3.17.

5.3.8 Fare Barriers.

5.3.8.1 Fare barriers complying with 5.3.8.2 through 5.3.8.5 shall be permitted in the means of egress serving stations.

5.3.8.2* Except as permitted in 5.3.8.3, fare barriers in the required means of egress shall be designed to release, permitting unimpeded travel in the direction of egress under all the following conditions:

(1) Power failure or ground fault condition
(2) Activation of the station fire alarm signal
(3) Manual activation from a switch in a constantly attended location in the station or operations control center

5.3.8.3 Fare barriers that do not comply with the requirements of 5.3.8.2 shall be permitted in the means of egress where barriers in the equipment are designed to provide egress when a horizontal force not exceeding 66N (15lbf) is applied in the egress direction.

5.3.8.4 Gate-type fare barriers in the means of egress shall meet the following criteria:

(1)* Each unit shall provide a minimum of 455 mm (18 in.) clear width at and below a height of 1000 mm (39.5 in.) and 530 mm (21 in.) clear width above that height.
(2) Each unit shall be credited with a capacity of 50 p/min for egress calculations.

5.3.8.5 Turnstile-type fare barriers shall be permitted in accordance with NFPA *101* and shall in the means of egress shall meet the following criteria:

(1) Dimensions shall be in accordance with the requirements of NFPA *101* .
(2) Turnstiles that drop away from the egress opening under the conditions listed in 5.3.8.2 or 5.3.8.3 shall be credited with a capacity of 50 p/min for egress calculations.
(3) Turnstiles that revolve freely in the direction of egress under the conditions listed in 5.3.8.2 shall meet the following criteria:
    (a) Each unit shall be credited with a capacity of 25 p/min for egress calculations.
    (b) The turnstiles shall not account for more than 50 percent of the required egress capacity for each egress route.

5.3.8.6* Fare barriers shall be designed so that their failure to operate properly will not prohibit movement of passengers in the direction of emergency egress.

5.3.9* Horizontal Exits. Horizontal exits compliant with NFPA *101* shall be permitted for up to 100 percent of the number of exits and required egress capacity provided that not more than 50 percent of the number and required capacity is into a single building.

5.3.10* Platform Edge Provisions.

5.3.10.1 Guards shall not be required along the trainway side of platforms.

5.3.10.2 Horizontal sliding platform screen or platform edge doors shall be permitted to separate the platform from the trainway in stations, provided that the following criteria are met:

(1) The doors permit emergency egress from the train to the platform regardless of the stopping position of the train.
(2) The doors provide egress when a force not exceeding 220 N (50 lb) is applied from the train side of the doors.
(3) The doors are designed to withstand positive and negative pressures caused by passing trains.

5.3.11 Means of Egress Lighting.

5.3.11.1 Illumination of the means of egress in stations, including escalators that are considered a means of egress, shall be in accordance with Section 7.8 of NFPA *101* .

5.3.11.2 Means of egress, including escalators considered as means of egress, shall be provided with a system of emergency lighting in accordance with Section 7.9 of NFPA *101* .

5.3.11.3 In addition to the requirements of 5.3.11.1 and 5.3.11.2:

(1) Lighting for stairs and escalators shall be designed to emphasize illumination on the top and bottom steps and landings.
(2) Where newel- and comb-lighting is provided for escalator steps, such lighting shall be on emergency power circuits.

5.4 Fire Protection.

5.4.1* Fire Command Center.

5.4.1.1 Enclosed stations shall be provided with a fire command center in accordance with *NFPA 72* .

5.4.1.2 The ventilation systems at adjacent trainways and stations shall be permitted to be omitted from the controls of the fire command center.

5.4.2 Protective Signaling Systems.

5.4.2.1 Enclosed stations shall be protected by a fire alarm system designed, installed, and maintained in accordance with *NFPA 72* .

5.4.2.2* Each station having fire alarm initiating devices shall be provided with a fire alarm annunciator panel at a location that is accessible to emergency response personnel in accordance with *NFPA 72* .

5.4.2.3 The location of the fire alarm annunciator panel shall be approved.

5.4.2.4 Annunciator panels shall announce by audible alarm the activation of any fire alarm initiating device in the station and visually display the location of the actuated device.

5.4.2.5 When activated, all indicator signals for fire alarms, smoke detection, valve switches, and waterflow shall be transmitted simultaneously to the local station and to the operations control center.

5.4.2.6* Separate zones shall be established on local station annunciator panels to monitor waterflow on sprinkler systems and supervise main control valves.

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5.4.2.7 Automatic fire detection shall be provided in all ancillary spaces by the installation of listed combination fixed-temperature and rate-of-rise heat detectors or listed smoke detectors except where protected by automatic sprinklers.

5.4.2.8 Fire alarm systems shall be inspected, tested, and maintained in accordance with *NFPA 72* .

5.4.3 Emergency Communications System. Stations shall be provided with an emergency communications system in accordance with Chapter 10.

5.4.4 Automatic Fire Suppression Systems.

5.4.4.1* An automatic sprinkler protection system shall be provided in areas of stations used for concessions, in storage areas, in trash rooms, and other similar areas with combustible loadings, except trainways.

5.4.4.2 Sprinkler protection shall be permitted to be omitted in areas of open stations remotely located from public spaces.

5.4.4.3 Installation of sprinkler systems shall comply with NFPA 13 or applicable local codes as required.

5.4.4.4 A sprinkler system waterflow alarm and supervisory signal service shall be installed.

5.4.4.5 Other fire suppression systems, if approved, shall be permitted to be substituted for automatic sprinkler systems in the areas listed in 5.4.4.1.

5.4.4.6 Automatic fire sprinkler systems shall be tested and maintained in accordance with NFPA 25.

5.4.5 Standpipe and Hose Systems.

5.4.5.1* Class I standpipes shall be installed in enclosed stations in accordance with NFPA 14 except as modified herein.

5.4.5.2 Standpipe systems shall not be required to be enclosed in fire-rated construction provided the following conditions are met:

(1) The system is cross-connected or fed from two locations.
(2) Isolation valves are installed not more than 245 m (800 ft) apart.

5.4.5.3 In addition to the usual identification required on fire department connections for standpipes, there shall also be wording to identify the fire department connection as part of the station system.

5.4.5.4* Standpipes shall be permitted to be of the dry type with the approval of the authority having jurisdiction provided the following requirements are met:

(1)* Systems shall be installed in a manner so that the water is delivered to all hose connections on the system in 10 minutes or less.
(2) Combination air relief–vacuum valves shall be installed at each high point on the system.

5.4.5.5 Dry standpipes shall be permitted to be concealed without the piping integrity being monitored with a supervisory air pressure provided they are pressure tested annually.

5.4.5.6 Where enclosed stations include more than one platform level (such as crossover subway lines), there shall be a cross-connection pipe of a minimum size of 100 mm (4 in.) in diameter between each standpipe system, so that supplying water through any fire department connection will furnish water throughout the entire system.

5.4.5.7 Standpipe and hose systems shall be tested and maintained in accordance with NFPA 25.

5.4.6 Portable Fire Extinguishers. Portable fire extinguishers in such number, size, type, and location as determined by the authority having jurisdiction shall be provided.

5.4.6.1 Portable fire extinguishers shall be maintained in accordance with NFPA 10.

5.4.7 Ventilation.

5.4.7.1 Emergency ventilation shall be provided in enclosed stations in accordance with Chapter 7.

5.4.8 Emergency Power.

5.4.8.1 Emergency power in accordance with Article 700 of *NFPA 70* , and Chapter 4 of NFPA 110 shall be provided for enclosed stations.

5.4.8.2 The supply system for emergency purposes, in addition to the normal services to the station building, shall be one or more of the types of systems described in 700.12(A) through 700.12(E) of *NFPA 70* .

5.4.8.3 The emergency power system shall have a capacity and rating sufficient to supply all equipment required to be connected by 5.4.8.5.

5.4.8.4 Selective load pickup and load shedding shall be permitted in accordance with *NFPA 70* .

5.4.8.5 Systems connected to the emergency power system shall include the following:

(1) Emergency lighting
(2) Protective signaling systems
(3) Emergency communication system
(4) Fire command center
(5) Elevators providing required egress capacity [see 5.3.6.4(5)]

5.4.8.6 The emergency lighting and communications circuits shall be protected from physical damage by system vehicles or other normal system operations and from fire as described in 12.4.4.

Chapter 6 Trainways

6.1 General.

6.1.1* Applicability. This chapter applies to all portions of the trainway, including pocket storage and tail tracks not intended for occupancy by passengers.

6.1.2 Occupancy.

6.1.2.1* The system shall be designed to deter passenger entry to the trainway except during an event that requires evacuation of a train.

6.1.2.2* The system shall include provisions for giving guidance to passengers who may be required to evacuate from a train to a trainway.

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6.1.2.3* Warning signs in accordance with 6.3.5.1 shall be posted at locations where unauthorized personnel might trespass.

6.2 Construction.

6.2.1 Safeguards During Construction.

6.2.1.1 A standpipe system shall be installed in enclosed trainways under construction in accordance with NFPA 241.

6.2.1.2 The standpipe system shall be installed before the enclosed trainway has exceeded a length of 61 m (200 ft) beyond any access shaft or portal and shall be extended as work progresses to within 61 m (200 ft) of the most remote portion of the enclosed trainway.

6.2.1.3 Standpipes shall be sized for approved water flow and pressure at the outlet, based upon the maximum predicted fire load.

6.2.1.4 Reducers or adapters shall meet the following criteria:

(1) Be provided and attached for connection to the contractor's hose
(2) Be readily removable through the use of a fire fighter's hose spanner wrench

6.2.1.5 Risers shall meet the following criteria:

(1) Be identified with signs as outlined in 6.4.5.7
(2) Be readily accessible for fire department use
(3) Be protected from accidental damage

6.2.1.6* Illumination levels in enclosed trainways under construction shall not be less than 2.7 lx (0.25 ft-candles) at the walking surface.

6.2.2 Construction Type.

6.2.2.1* Cut and Cover. Where trainway sections are to be constructed by the cut-and-cover method, perimeter walls and related construction shall be not less than Type I or Type II or combinations of Type I or Type II noncombustible construction as defined in NFPA 220, as determined by an engineering analysis of potential fire exposure hazards to the structure.

6.2.2.2 Bored Tunnels. Where trainway sections are to be constructed by a tunneling method through earth, unprotected steel liners, reinforced concrete, shotcrete, or equivalent shall be used.

6.2.2.3 Rock Tunnels. Rock tunnels shall be permitted to utilize steel bents with concrete liner if lining is required.

6.2.2.4 Underwater Tubes. Underwater tubes shall be not less than Type II (000) noncombustible construction as defined in NFPA 220, as applicable.

6.2.2.5 Exit and Ventilation Structures. Remote vertical exit shafts and ventilation structures shall be not less than Type I (332) noncombustible construction as defined in NFPA 220.

6.2.2.6 Surface. Construction materials shall be not less than Type II (000) noncombustible material as defined in NFPA 220, as determined by a fire hazard analysis of potential fire exposure hazards to the structure.

6.2.2.7 Elevated. All structures necessary for trainway support and all structures and enclosures on or under trainways shall be of not less than Type I or Type II (000) or combinations of Type I or Type II noncombustible construction as defined in NFPA 220, as determined by a fire hazard analysis of potential fire exposure hazards to the structure.

6.2.3 Flammable and Combustible Liquids Intrusion.

6.2.3.1 General. Protection of underground system structures against the accidental intrusion of flammable and combustible liquids shall meet the requirements of 5.2.3.

6.2.4* Compartmentation.

6.2.4.1 Ancillary areas shall be separated from trainway areas within underwater trainway sections by construction having a minimum 3-hour fire-resistance rating.

6.2.4.2 Ancillary areas shall be separated from trainway areas within enclosed trainway sections by construction having a minimum 2-hour fire-resistance rating.

6.2.5 Combustible Components.

6.2.5.1 Where combustible components not specifically addressed in this standard are installed in a trainway, a fire hazard analysis shall be conducted to determine that the level of occupant fire safety is not adversely affected by the contents.

6.2.5.2 The fire hazard analysis required by 6.2.5.1 shall meet the following criteria:

(1) It shall include, as a minimum, an examination of peak heat release rate for combustible elements, total heat released, ignition temperatures, radiant heating view factors, and behavior of the component during internal or external fire scenarios.
(2) It shall determine that, if a fire propagates beyond involving the component of fire origin, a level of fire safety is provided within an enclosed trainway commensurate with this standard.

6.2.5.3 Computer modeling, material fire testing, or full-scale fire testing shall be conducted to assess performance in potential fire scenarios.

6.2.6 Walking Surfaces.

6.2.6.1 Walking surfaces designated for evacuation of passengers shall be constructed of noncombustible materials.

6.2.7 Coverboard or Protective Material.

6.2.7.1 Coverboard or protective material shall comply with 6.2.7.2 or 6.2.7.3.

6.2.7.2 Coverboard or protective material tested in accordance with ASTM E84 shall have a flame spread index of not more than 25 and a smoke developed index not exceeding 450.

6.2.7.3 Coverboard or protective material tested in accordance with NFPA 286 shall comply with the following:

(1) Flames shall not spread to the ceiling during the 40 kW (135 kBtu/hr) exposure.
(2) Flames shall not spread to the outer extremities of the sample on any test room wall or ceiling.
(3) Flashover as described in NFPA 286 shall not occur.
(4) The peak heat release rate throughout the test shall not exceed 800 kW (2730 kBtu/hr).
(5) The total smoke released throughout the test shall not exceed 1000 m^2 (10,764 ft^2).

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6.2.8 Rail Ties.

6.2.8.1 Rail ties used in enclosed locations shall be noncombustible materials in accordance with Section 4.7.

6.2.8.2 Rail ties used outdoors at switch or crossover locations shall be made of materials that comply with one of the following:

(1) Materials that comply with 6.2.8.1
(2) Fire retardant–treated wood in accordance with NFPA 703
(3) Pressure-treated wood materials that exhibit a flame spread index of not more than 75 when tested in accordance with ASTM E84
(4) Plastic composite materials that comply with the requirements of ASTM D7568 and exhibit a flame spread index of not more than 75 in accordance with ASTM E84
(5) Wood encased in concrete such that only the top surface is exposed

6.2.8.3 Rail ties used outdoors at locations other than switch or crossover locations shall comply with one of the following:

(1) Materials that comply with 6.2.8.1 or 6.2.8.2
(2) Pressure treated wood materials
(3) Plastic composite materials that comply with the requirements of ASTM D7568

6.2.9 Green Track.

6.2.9.1 The type, use, and design of green track shall be as approved.

6.2.9.2 The design of green track shall be based upon a fire hazard analysis of environmental factors.

6.3 Emergency Egress.

6.3.1 Location of Egress Routes.

6.3.1.1* The system shall incorporate a walk surface or other approved means for passengers to evacuate a train at any point along the trainway so that they can proceed to the nearest station or other point of safety.

6.3.1.2 Walkway continuity shall be maintained at special track sections (e.g., crossovers, pocket tracks).

6.3.1.3 Walkway continuity shall be provided by crosswalks at track level.

6.3.1.4* Within enclosed trainways, the maximum distance between exits shall not exceed 762 m (2500 ft).

6.3.1.5 Cross-passageways shall be permitted to be used in lieu of emergency exit stairways to the surface where trainways in tunnels are divided by a minimum of 2 hour–rated fire separations or where trainways are in twin bores.

6.3.1.6 Where cross-passageways are utilized in lieu of emergency exit stairways, the following requirements shall apply:

(1) Cross-passageways shall not be farther than 244 m (800 ft) apart.
(2)* Cross-passageways shall not be farther than 244 m (800 ft) from the station or portal of the enclosed trainway.
(3) Cross-passageways shall be separated from the trainway with self-closing fire door assemblies having a fire protection rating of 1½ hours.
(4) A tenable environment shall be maintained in the portion of the trainway that is not involved in an emergency and that is being used for evacuation.
(5) A ventilation system for the incident trainway shall be designed to control smoke in the vicinity of the passengers.
(6) Provisions shall be made for evacuating passengers via the non-incident trainway to a nearby station or other emergency exit.
(7)* The provisions shall include measures to protect passengers from oncoming traffic and from other hazards.

6.3.1.7 Determination of exit and cross-passageways spacing shall be determined from the ends of contiguous tunnels. See 7.1.2.1.

6.3.1.8 Where cross-passageways are used in lieu of emergency exit stairways, the interior of the cross-passage shall not be used for any purpose other than as an area of refuge or for access/egress to the opposite tunnel except under the following conditions:

(1) The use of cross-passages for the installation of noncombustible equipment is permitted.
(2) Installed equipment does not intrude into the required clear width of the cross-passage.

6.3.1.9 In areas where cross-passageways are provided, walkways shall be provided on the cross-passageway side of the trainway for unobstructed access to the cross-passageway.

6.3.1.10 For open-cut trainways, an engineering analysis shall be conducted to evaluate the impact of the trainway configuration on safe egress from a train fire to a point of safety.

6.3.1.11 Where the engineering analysis indicates that the configuration will impact tenability beyond the immediate vicinity of the fire, egress routes shall be provided such that the maximum distance from any point within the open-cut section to a point of egress from the trainway shall not be more than 381 m (1250 ft).

6.3.2 Size of Egress Routes.

6.3.2.1* The means of egress within the trainway shall be provided with an unobstructed clear width graduating from 610 mm (24 in.) at the walking surface to 760 mm (30 in.) at 1575 mm (62 in.) above the walking surface to 430 mm (17 in.) at 2025 mm (80 in.) above the walking surface.

6.3.2.2 Cross-passageways shall be a minimum of 1120 mm (44 in.) in clear width and 2100 mm (7 ft) in height.

6.3.2.3* The width of exit stairs shall not be required to exceed 1120 mm (44 in.) for enclosed trainways.

6.3.2.4* Doors in egress routes serving trainways shall have a minimum clear width of 810 mm (32 in.).

6.3.3* Egress Components.

6.3.3.1 Walking surfaces serving as egress routes within guideways shall have a uniform, slip-resistant design.

6.3.3.2 Guideway crosswalks shall have a uniform walking surface at the top of the rail.

6.3.3.3 Where the trainway track bed serves as the emergency egress pathway, it shall be nominally level and free of obstructions.

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6.3.3.4 Except as permitted in 6.3.3.3, walking surfaces shall have a uniform, slip-resistant design.

6.3.3.5* Walkways that are more than 760 mm (30 in.) above the floor or grade below shall be provided with a continuous guard to prevent falls over the open side.

6.3.3.6 Guards shall not be required along the trainway side of walkways where the bottom of the trainway is closed by a deck or grating.

6.3.3.7 Guards shall not be required on walkways that are located between two trainways.

6.3.3.8* Walkways that are more than 760 mm (30 in.) above the floor or grade below shall be provided with a continuous handrail along the side opposite the trainway.

6.3.3.9 Walkways that are greater than 1120 mm (44 in.) wide and located between two trainways shall not be required to have a handrail.

6.3.3.10 Exit stairs and doors shall comply with Chapter 7 of NFPA *101*, except as herein modified.

6.3.3.11 Doors in the means of egress, except cross-passageway doors, shall open in the direction of exit travel.

6.3.3.12 Doors in the means of egress shall comply with the following:

(1) Open fully when a force not exceeding 220 N (50 lb) is applied to the latch side of the door
(2) Be adequate to withstand positive and negative pressures caused by passing trains and the emergency ventilation system

6.3.3.13 Horizontal sliding doors shall be permitted in cross-passageways.

6.3.3.14 Platform end gates shall meet the clear width requirements for gate-type fare barriers. *(See Chapter 5.)*

6.3.3.15 Exit hatches shall be permitted in the means of egress, provided the following conditions are met:

(1) Hatches shall be equipped with a manual opening device that can be readily opened from the egress side.
(2) Hatches shall be operable with not more than one releasing operation.
(3) The force required to open the hatch when applied at the opening device shall not exceed 130 N (30 lb).
(4) The hatch shall be equipped with a hold-open device that automatically latches the door in the open position to prevent accidental closure.

6.3.3.16 Exit hatches shall be capable of being opened from the discharge side to permit access by authorized personnel.

6.3.3.17* Exit hatches shall be conspicuously marked on the discharge side to prevent possible blockage.

6.3.4 Traction Power Protection.

6.3.4.1* This subsection shall apply to the traction power subsystem installed in all trainways, which shall include the wayside pothead, the cable between the pothead and the contact (third) rail or overhead contact system (OCS), the contact rail or OCS supports, and special warning and identification devices, as well as electrical appurtenances associated with overhead contact systems.

6.3.4.2 To provide safety isolation from the contact rail, the following requirements shall apply:

(1) Power rail conductor(s) (dc or ac, which supply power to the vehicle for propulsion and other loads) shall be secured to insulating supports, bonded at joints, and protected to prevent contact with personnel.
(2) The design shall include measures to prevent inadvertent contact with the live power rails where such power rails are adjacent to emergency or service walkways and where walkways cross over trainways.
(3) Coverboards, where used, shall be capable of supporting a vertical load of 1125 N (250 lb) at any point with no visible permanent deflection.

6.3.4.3 To provide isolation from the overhead contact system, the following requirements shall apply:

(1) Power conductor(s) (dc or ac, which supply power to the vehicle for propulsion and other loads) shall be secured to insulating supports, bonded at joints, and protected to prevent contact with personnel.
(2) Insulating material for the cable connecting power to the power rail or OCS shall meet the FT4/IEEE 1202 exposure requirements for cable char height, total smoke released, and peak smoke release rate of ANSI/UL 1685.

6.3.5 Signage, Illumination, and Emergency Lighting.

6.3.5.1 Warning signs posted on entrances to the trainway and on fences or barriers adjacent to the trainway shall clearly state the hazard (e.g., DANGER HIGH VOLTAGE — 750 VOLTS) with letter sizes and colors in conformance with *NFPA 70* and Occupational Safety and Health Administration (OSHA) requirements.

6.3.5.2 System egress points shall be illuminated.

6.3.5.3 Points of exit from elevated and enclosed trainways shall be marked with internally or externally illuminated signs.

6.3.5.4 Identification. Emergency exit facilities shall be identified and maintained to allow for their intended use.

6.3.5.5 Enclosed trainways greater in length than the minimum length of one train shall be provided with directional signs as appropriate for the emergency procedures developed for the fixed guideway transit or passenger rail system in accordance with Chapter 9.

6.3.5.6 Directional signs indicating station or portal directions shall be installed at maximum 25 m (82 ft) intervals on either side of the enclosed trainways.

6.3.5.7 Directional signs shall be readily visible by passengers for emergency evacuation.

6.3.5.8 The requirements of 6.3.5.9 through 6.3.5.14 shall apply to all enclosed trainways that are greater than 30.5 m (100 ft) in length or two car lengths, whichever is greater.

6.3.5.9* Lighting systems shall be designed so that, during a period of evacuation, illumination levels of trainway walkways and walking surfaces shall not be less than 2.7 lx (0.25 ft-candles), measured along the path of egress at the walking surface.

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6.3.5.10 The emergency lighting system in the trainway shall produce illumination on the walkway that does not exceed a uniformity ratio of 10:1 for the maximum maintained horizontal illuminance to the minimum maintained horizontal illuminance.

6.3.5.11* Point illumination of means of egress elements shall be permitted to exceed the 10:1 uniformity ratio.

6.3.5.12 Lighting systems for enclosed trainways shall be installed in accordance with Sections 7.8 and 7.9 of NFPA *101* , except as otherwise noted in 6.3.5.

6.3.5.13 Exit lights, essential signs, and emergency lights shall be included in the emergency lighting system in accordance with *NFPA 70* .

6.3.5.14 Emergency fixtures, exit lights, and signs shall be wired separately from emergency distribution panels.

6.4 Fire Protection and Life Safety Systems.

6.4.1 Emergency Access.

6.4.1.1 Except as described herein, points of egress and exits from the guideway shall serve as emergency access routes.

6.4.1.2 If security fences are used along the trainway, access gates shall be provided in security fences, as deemed necessary by the authority having jurisdiction.

6.4.1.3 Access gates shall be a minimum 1120 mm (44 in.) wide and shall be of the hinged or sliding type.

6.4.1.4 Access gates shall be placed as close as practicable to the portals to permit easy access to tunnels.

6.4.1.5 Information that clearly identifies the route and location of each gate shall be provided on the gates or adjacent thereto.

6.4.1.6 Access to the elevated trainway shall be from stations or by mobile ladder equipment from roadways adjacent to the trackway.

6.4.1.7 If no adjacent or crossing roadways exist for the elevated trainway, access roads at a maximum of 762 m (2500 ft) intervals shall be required.

6.4.1.8 Where the configuration of an open-cut trainway prevents or impedes access for firefighting, provisions shall be made to permit fire fighter access to that section of trainway at intervals not exceeding 762 m (2500 ft).

6.4.2 Blue Light Stations.

6.4.2.1* Blue light stations shall be provided at the following locations:

(1) At the ends of station platforms
(2) At cross-passageways
(3) At emergency access points
(4) At traction power substations
(5) In enclosed trainways as approved

6.4.2.2 Adjacent to each blue light station, information shall be provided that identifies the location of that station and the distance to an exit in each direction.

6.4.2.3 For blue light stations at elevated guideways, the graphics shall be legible from the ground level outside the trackway.

6.4.2.4 In systems with overhead traction power, the requirement to disconnect traction power shall be permitted by an approved alternative means.

6.4.3 Emergency Communications System. Enclosed trainways shall be provided with an emergency communications system in accordance with Chapter 10.

6.4.4 Automatic Fire Detection.

6.4.4.1 Heat and smoke detectors shall be installed at traction power substations and signal bungalows and shall be connected to the operations control center.

6.4.4.2 Signals received from such devices shall be identifiable as to the origin of the signals.

6.4.5 Standpipe and Hose Systems.

6.4.5.1 An approved fire standpipe system shall be provided in enclosed trainways where physical factors prevent or impede access to the water supply or fire apparatus, where required by the authority having jurisdiction.

6.4.5.2* Class I standpipe systems shall be installed in trainways in accordance with NFPA 14 except as modified herein.

6.4.5.3 Standpipe systems shall not be required to be enclosed in fire-rated construction, provided the following conditions are met:

(1) The system is cross-connected or fed from two locations.
(2) Isolation valves are installed not more than 244 m (800 ft) apart.

6.4.5.4 Standpipes shall be permitted to be of the dry type with the approval of the authority having jurisdiction provided the following conditions are met:

(1)* Standpipes shall be installed so that the water is delivered to all hose connections on that standpipe in 10 minutes or less.
(2) Combination air relief–vacuum valves shall be installed at each high point on the standpipe.

6.4.5.5 Standpipe systems shall be provided with an approved water supply capable of supplying the system demand for a minimum of 1 hour.

6.4.5.6 Acceptable water supplies shall include the following:

(1) Municipal or privately owned waterworks systems that have adequate pressure, flow rate, and level of integrity
(2) Automatic or manually controlled fire pumps that are connected to water source
(3) Pressure-type or gravity-type storage tanks that are installed in accordance with NFPA 22

6.4.5.7 Identification numbers and letters conforming to the system sectional identification numbers and letters shall be provided at each surface fire department connection and at each hose valve on the standpipe lines.

6.4.5.8 Identifying signs shall be affixed to enclosed trainway walls at each hose outlet valve or shall be painted directly on the standpipe in white letters next to each hose outlet valve.

6.4.5.9 Exposed standpipe lines and identification signs shall be painted as required by the authority having jurisdiction.

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