NFPA® 130

Standard for Fixed Guideway Transit and Passenger Rail Systems

2023 Edition

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NFPA® 130

Standard for

Fixed Guideway Transit and Passenger Rail Systems

2023 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 and acted on by the NFPA membership during the 2022 NFPA Technical Meeting held June 8-9. It was issued by the Standards Council on August 12, 2022, with an effective date of September 1, 2022, 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 September 1, 2022.

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 was the potential for the entrapment and injury of the large number 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; fortunately, the loss of life was limited. However, 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 also introduced creepage distance.

The scope of the 1988 edition was expanded to include automated guideway transit (AGT) systems.

The 1990 edition included minor changes to integrate provisions and special requirements for AGT systems into the standard.

Definitions for *enclosed station* and *open station* were added in the 1993 edition.

The 1997 edition included a new chapter on emergency ventilation systems for transit stations and trainways and a new Appendix B addressing ventilation.

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*®.

In the 2003 edition, 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, in addition to changes to the traditional prescriptive-based requirements.

The 2007 edition included revisions for station egress calculations, the use of escalators in the means of egress, vehicle interior fire resistance, and power supplies for 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.

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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 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 the prevention of flammable and combustible liquids intrusion in Chapters 5 and 6; and improvements to Annex C.

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

The 2020 edition of NFPA 130 added several new definitions, as well as guidance on the concept and permissible uses of limited combustible materials. Chapter 8 provided a testing alternative for miscellaneous, discontinuous small parts; requirements for testing of adhesives and sealants; and requirements for the testing and analysis of vehicles with end frame assemblies. Chapter 9 included requirements for the possibility of multiple concurrent emergencies. A new Annex B consolidated recommendations from Annexes D, G, and H regarding emergency ventilation and a new Annex D consolidated all the non-emergency ventilation provisions from Annexes B, D, G, and H. Other changes include reconciliation of terminology related to enclosed trainways; engineering versus fire hazard analyses and egress; means of egress and exit; clarification of construction types for various station and trainway configurations; and new requirements for the consideration of background noise relating to emergency procedures and the design of emergency communications systems in Chapters 9 and 10.

The 2023 edition has been revised to include two new annex sections. Annex G provides information regarding onboard fire suppression systems; Annex H provides recommendations on the roles and responsibilities of authorities and designers, as well as guidance on projects that span multiple jurisdictions with potentially competing requirements. Additional changes include a new section on stops; clarification of passive and active fire protection requirements; updates on egress requirements and egress component performance; revised platform load calculations, vehicle material testing requirements, and fire alarm system and command center requirements; clarification on ventilation equipment listing, testing, and acceptance requirements; as well as changes to wiring requirements.

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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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A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. 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 and extracted 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.

Δ **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 3.3.64.1)* or *passenger rail system (see 3.3.64.2)*

Δ **1.1.4** To the extent that a system, including those listed in 1.1.3(1) through 1.1.3(5), 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).

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.

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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 4, *Standard for Integrated Fire Protection and Life Safety System Testing,* 2021 edition.

NFPA 10, *Standard for Portable Fire Extinguishers,* 2022 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2022 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems,* 2019 edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection,* 2018 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,* 2023 edition.

NFPA 70®, National Electrical Code®, 2023 edition.

NFPA 72®, National Fire Alarm and Signaling Code®, 2022 edition.

NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids,* 2020 edition.

NFPA *101®, Life Safety Code®,* 2021 edition.

NFPA 110, *Standard for Emergency and Standby Power Systems,* 2022 edition.

NFPA 220, *Standard on Types of Building Construction,* 2021 edition.

NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations,* 2022 edition.

NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source,* 2019 edition.

NFPA 262, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces,* 2019 edition.

NFPA 275, *Standard Method of Fire Tests for the Evaluation of Thermal Barriers,* 2022 edition.

NFPA 286, *Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth,* 2019 edition.

NFPA 703, *Standard for Fire-Retardant-Treated Wood and Fire-Retardant Coatings for Building Materials,* 2021 edition.

NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems,* 2019 edition.

2.3 Other Publications.

Δ **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*, 2016.

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, 1300 I Street, NW, Suite 1200 East, Washington, DC 20005.

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, 180 Technology Parkway NW, Peachtree Corners, GA 30092.

ASHRAEHandbook — Fundamentals, 2021.

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 Elastomeric Gaskets and Accessories,* 2021.

ASTM D2724, *Standard Test Methods for Bonded, Fused, and Laminated Apparel Fabrics*, 2019.

ASTM D3574, *Standard Test Methods for Flexible Cellular Materials — Slab, Bonded, and Molded Urethane Foams*, 2017.

ASTM D3675, *Standard Test Method for Surface Flammability of Flexible Cellular Materials Using a Radiant Heat Energy Source*, 2021a.

ASTM D7568, *Standard Specification for Polyethylene-Based Structural-Grade Plastic Lumber for Outdoor Applications*, 2017.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2021a.

ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, 2020.

ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C*, 2019a.

ASTM E162, *Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source*, 2021.

ASTM E648, *Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source*, 2019a e1.

ASTM E662, *Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials*, 2021a e1.

ASTM E814, *Standard Test Method for Fire Tests of Penetration Firestop Systems*, 2013a (2017).

ASTM E1354, *Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter*, 2017.

ASTM E1537, *Standard Test Method for Fire Testing of Upholstered Furniture*, 2016.

ASTM E1590, *Standard Test Method for Fire Testing of Mattresses*, 2017.

ASTM E2061, *Standard Guide for Fire Hazard Assessment of Rail Transportation Vehicles*, 2020.

ASTM E2652, *Standard Test Method for Assessing Combustibility of Materials Using a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C*, 2018.

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2.3.5 California Technical Bulletins. State of California, Department of Consumer Affairs, Bureau of Household Goods and Services, 4244 South Market Court, Suite D, Sacramento, CA 95834-1243.

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 493, Miamitown, OH 45041-9998.

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.

Δ **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, *Standard for Electrical and Electronic Control Apparatus on Rail Vehicles*, 2020.

IEEE 1202, *Flame Propagation Testing of Wire and Cable* , 2006.

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

UL 44, *Thermoset-Insulated Wires and Cables*, 2018.

UL 83, *Thermoplastic-Insulated Wires and Cables*, 2017.

UL 263, *Fire Tests of Building Construction and Materials*, 2011 (2021).

UL 444, *Communications Cables*, 2017.

UL 723, *Test for Surface Burning Characteristics of Building Materials*, 2018.

UL 1479, *Fire Tests of Penetration Firestops*, 2015.

UL 1685, *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.

UL 2196, *Tests for Fire Resistive Cables*, 2017.

UL 2556, *Wire and Cable Test Methods*, 2021.

2.3.10 US Government Publications. US 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.

Δ **2.4 References for Extracts in Mandatory Sections.**

NFPA 72®, National Fire Alarm and Signaling Code®, 2022 edition.

NFPA 92, *Standard for Smoke Control Systems*, 2021 edition.

NFPA *101®, Life Safety Code®*, 2021 edition.

NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*, 2019 edition.

NFPA 270, *Standard Test Method for Measurement of Smoke Obscuration Using a Conical Radiant Source in a Single Closed Chamber*, 2018 edition.

NFPA 402, *Guide for Aircraft Rescue and Fire-Fighting Operations*, 2019 edition.

NFPA 470, *Hazardous Materials/Weapons of Mass Destruction (WMD) Standard for Responders*, 2022 edition.

NFPA 502, *Standard for Road Tunnels, Bridges, and Other Limited Access Highways*, 2023 edition.

NFPA 921, *Guide for Fire and Explosion Investigations*, 2021 edition.

NFPA 1994, *Standard on Protective Ensembles for First Responders to Hazardous Materials Emergencies and CBRN Terrorism Incidents*, 2018 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

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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.

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 phrases "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 airflow in enclosed trainways, including air curtains, barriers, brattices, doors, downstands, enclosures, 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,** 2018]

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,** 2019]

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,** 2019]

3.3.12 Critical Velocity. The minimum steady-state velocity of the ventilation airflow moving toward the fire within an enclosed trainway or enclosed passageway that is required to control backlayering at the fire site, such that a tenable environment is maintained along the path of egress upstream of the fire, and as required for designated points of safety.

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,** 2022]

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* End Frame Assembly. Components at vehicle ends incorporating the structural end frame and necessary nonstructural components at the vehicle interior.

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

3.3.17.1* ***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.

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

3.3.19 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,** 2022]

3.3.20 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,** 2023]

3.3.21 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.

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3.3.22 Fire Load.

3.3.22.1* ***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.

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

3.3.23 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.

3.3.24 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.

3.3.25 Fire Soot Release Rate. Rate of soot release for a given fire scenario expressed as a function of time (g/sec or lb/sec).

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

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

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

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

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

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

3.3.32* Heat Release Rate (HRR). The rate at which heat energy is generated by burning. [**921,** 2021]

3.3.32.1 ***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).

Δ **3.3.32.2*** ***Fire Heat Release Rate.*** Rate of energy release for a given fire scenario or fire test.

Δ **3.3.33 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. [**470,** 2022]

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

3.3.35 Noncombustible (Material). See Section 4.6.

3.3.36 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.

3.3.37 Occupancy.

3.3.37.1 ***Incidental Occupancies Within Stations.*** An occupancy within a station that provides services not directly related to transportation operations or transportation services.

Δ **3.3.37.2*** ***Nonsystem Occupancy.*** An occupancy not under the control of the system authority.

3.3.38 Open Gangway Configuration. A vehicle without fire-resistant separations in the form of vertical assemblies equipped with hinged or sliding doors between adjacent vehicles in an assembled consist.

3.3.39 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.

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

3.3.41 Passenger Load.

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

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

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

3.3.42* Point of Safety. An enclosed exit that leads to a public way or safe location outside the structure, an at-grade point beyond any enclosing structure, or other area that affords adequate protection for evacuating passengers.

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

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

3.3.45 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.

3.3.46 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.

3.3.47 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).

3.3.48 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,** 2021]

3.3.49 Smoke Obscuration. The reduction of light transmission by smoke, as measured by light attenuation. [**270,** 2018]

3.3.50 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)].

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3.3.51 Soot. Black particles of carbon produced in a flame. [**921,** 2021]

3.3.52 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.

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

3.3.54 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)].

3.3.55 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.

• Δ **3.3.56 Station.** A building designated for the purpose of loading and unloading passengers, including patron service areas and ancillary spaces.

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

3.3.56.2* ***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.

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

N **3.3.58* Stop.** A place designated for the purpose of loading and unloading passengers that is comprised of a platform configured such that smoke and heat will disperse directly into the atmosphere.

3.3.59 System. See 3.3.64.1, Fixed Guideway Transit System, or 3.3.64.2, Passenger Rail System.

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

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

3.3.62 Track.

3.3.62.1 ***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.

3.3.62.2 ***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.

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

3.3.63.1* ***Enclosed Trainway.*** A trainway or portion thereof that does not meet the definition of an open trainway.

3.3.63.2* ***Open Trainway.*** A trainway that is constructed such that it is directly open to the atmosphere and smoke and heat are allowed to disperse directly into the atmosphere.

3.3.64 Transportation Systems.

3.3.64.1 ***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.

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

3.3.64.2 ***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.

3.3.65 Vehicle.

3.3.65.1 ***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.

3.3.65.2 ***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.

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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.

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 and Limited-Combustible Material.

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

(1) The material, 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) The material is reported as passing ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C*. [***101:***4.6.13.1(2)]

(3) The material is reported as complying with the pass/fail criteria of ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C* when tested in accordance with the test method and procedure in ASTM E2652. [***101:***4.6.13.1(3)]

Δ **4.6.2** A material that complies with the requirements in 4.6.14 of NFPA *101* shall be considered a limited-combustible material.

N **4.7 Flammable and Combustible Liquids Intrusion.**

N **4.7.1* General.** Protection against the accidental intrusion of flammable and combustible liquids by any infiltration route at or below grade shall be provided for belowgrade systems, including tunnel, station, and ancillary structures.

N **4.7.2 Vehicle Roadway Terminations.** Vent or fan shafts utilized for the ventilation of belowgrade system structures shall not terminate at grade within any vehicle roadway, driveway, loading area, or parking area.

N **4.7.3 Median and Sidewalk Terminations.** 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, sidewalks, or open space areas meets the following conditions:

(1) Termination is at a higher elevation than the surrounding grade level.

(2) Termination is separated from the roadway, driveway, loading area, or parking area by a concrete curb at least 150 mm (6 in.) in height.

(3) Termination is provided with other protections determined to be required based on an engineering analysis of potential exposures to flammable and combustible liquid spills.

4.8* 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* General. This chapter shall apply to all portions of stations, except as provided in 5.1.1.2 for stops.

N **5.1.1.2 Stops.** This Chapter shall apply to stops in accordance with the following:

(1)* Where passenger movement to and from the platform area is restricted, the design of the stop shall comply with the applicable requirements of 5.3.1 through 5.3.8, 5.3.11.1, 5.4.3, and 5.4.6.

(2) Where passenger movement to and from the platform area is unrestricted, the requirements of this Chapter shall not apply, except as stipulated in 5.3.1.3.

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.

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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 firefighting 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 stations shall be in accordance with Table 5.2.2.1 based on the station configuration.

5.2.2.2 Construction types shall conform to the requirements in NFPA 220, unless otherwise exempted in this standard.

5.2.2.3 Where supported by a fire hazard analysis of potential fire exposure to the structure, alternative construction types shall be permitted.

5.2.3 Flammable and Combustible Liquids Intrusion.

5.2.3.1 General. Protection of belowgrade system structures against the accidental intrusion of flammable and combustible liquids shall be provided in accordance with Section 4.7.

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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.

Table 5.2.2.1 Minimum Construction Requirements for New Station Structures

Station Configuration	Construction Type†
Stations erected entirely above grade and in a separate building:	
Open stations	Type II (000)
Enclosed station*	Type II (111)
Stations erected entirely or partially below grade:	
Open abovegrade portions of belowgrade structures*	Type II (111)
Belowgrade portions of structures	Type II (222)
Belowgrade structures with occupant loads exceeding 1000	Type I (332)

*Roofs not supporting an occupancy above are not required to have a fire resistance rating.
†Construction types are in accordance with NFPA 220.

(2) Public areas on different levels in open stations shall be permitted to be interconnected.
(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 or UL 263.

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

(1) They shall be constructed of noncombustible materials.
(2) Where they are used only as agent and information booths, they 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 nonsystem 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 be limited-combustible in accordance with 4.6.2.
(3) 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).
(4) 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 or UL 723, except that the materials in 5.2.5.2 shall be required to be tested in accordance with NFPA 286.

5.2.5.2 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(3) when tested in accordance with NFPA 286:

(1) Foam plastic insulation, whether exposed or covered by a textile or vinyl facing
(2) Textile wall or ceiling coverings
(3) Solid thermoplastics, including, but not limited to, high-density polyethylene (HDPE), solid polycarbonate, solid polystyrene, and solid acrylic materials that melt and drip when exposed to flame.

5.2.5.3 Materials used as interior floor finish materials in enclosed stations shall be noncombustible or shall exhibit a

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critical radiant flux not less than 0.8 W/cm^2 (0.7 Btu/ft^2·sec) when tested in accordance with ASTM E648.

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

Δ **5.2.6 Insulation.**

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

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

N **5.2.6.3** Insulation applied to pipes or ducts shall be listed and labeled and exhibit a flame spread index not exceeding 25 and a smoke developed index not exceeding 450 when tested in accordance with ASTM E84 or UL 723.

N **5.2.6.4*** Ceiling spray foam insulation in public circulation areas shall be protected with an approved covering.

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.

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

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.

N **5.3.1.3 Stops.** Means of egress serving a stop complying with 5.1.1.2(2) shall be designed in accordance with the following:

(1)* Means of egress components serving the platform area shall be designed in accordance with the requirements of the local applicable building code.
(2) Guards shall be provided in areas raised above the surrounding grade in accordance with the requirements of the locally applicable code, except where the raised areas are adjacent to the track.

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* Peak ridership figures for stations shall consider events that establish occupant loads not included in normal peak period 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.

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.

Δ **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 platform occupant load shall be the sum of the entraining load and the train load for each track that the platform serves.
(2)* The entraining load for each track shall be the entraining load per train headway factored to account for service disruptions and system reaction time.
(3)* Where a platform serves more than one line on one track, the calculation of the entraining load shall consider the combined effect of the accumulating passengers for each of the lines served.
(4)* The calculated train load for each track shall be the train load per train headway factored to account for service disruptions and system reaction time.
(5) The train load at each track shall be the lesser of the calculated train loads as described in 5.3.2.5(4) or the maximum passenger capacity for the trains 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.

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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 each end 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 where substantiated by an engineering analysis that evaluates factors affecting evacuation times and tenability, such as material heat release rates, station geometry, fire protection systems, 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 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 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 egress travel speed along platforms, corridors, and ramps shall be computed at 37.7 m/min (124 ft/min).

5.3.4.5 The 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 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 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 egress capacity on 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).
(2) A portion of the egress capacity from each station level is accounted for with stairs.
(3)* For enclosed stations, at least one enclosed exit provides continuous access from each platform 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 preplanned 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.

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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 egress capacity in stations.

5.3.6.2 Capacity. Where elevators are counted as contributing to the 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 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 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 as 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 multi-leaf doors and gates that do not have a center mullion measured for the clear width dimension.

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 6.3.3.12 through 6.3.3.14.

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 66 N (15 lbf) 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 in accordance with NFPA *101* shall be permitted in the means of egress and 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.

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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 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 design permits 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 133 N (30 lb) is applied to set the door leaf in motion from the train side of the doors.
(3) The doors are designed to withstand positive and negative pressures caused by passing trains or the operation of the emergency ventilation system.

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 designated command post where the status of the fire alarm, communications, and other emergency systems is displayed and from which the system(s) can be controlled.

Δ **5.4.1.2*** The command post shall be designed as a fire command center in accordance with *NFPA 72®* where required by the AHJ.

5.4.2 Fire Alarm Systems.

Δ **5.4.2.1*** Stations shall be protected by fire alarm systems that are designed and installed in accordance with *NFPA 72* where any of the following conditions exist:

(1) An automatic fire suppression system is required by 5.4.4
(2) A standpipe system other than a manual dry standpipe system is required by 5.4.5
(3) An emergency communications system is required by 5.4.3

Δ **5.4.2.2*** Automatic fire detection shall be provided in enclosed stations and enclosed areas of open stations except in the following:

(1) Areas used for public circulation
(2) Trainways within stations
(3) Areas protected by an automatic fire suppression system that initiates a fire alarm signal upon activation

N **5.4.2.3** The fire alarm system shall be initiated by the following:

(1)* Manual activation from the operations control center or station
(2) Activation of an automatic suppression system in accordance with 5.4.4
(3) Activation of a fire detector in accordance with 5.4.2.2

Δ **5.4.2.4*** Annunciation of signals from the fire alarm system shall be provided at an approved location at the station that is accessible to emergency response personnel.

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Δ **5.4.2.5*** Signals from the fire alarm system shall be transmitted to the operations control center.

5.4.2.6 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.

Δ **5.4.4.1*** Automatic sprinkler protection shall be provided in all areas of stations except:

(1) Areas used for public circulation
(2) Trainways within stations

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 Where required, sprinkler systems shall be designed and installed in accordance with NFPA 13.

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.

N **5.4.5.2** Standpipe systems shall be provided with an approved water supply capable of supplying system demand for a minimum of 1 hour.

5.4.5.3 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) The isolation valves are installed not more than 245 m (800 ft) apart.

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5.4.5.4 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.

Δ **5.4.5.5*** 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 so that the water is delivered to all the hose connections on the system in 10 minutes or less.
(2) Combination air relief/vacuum valves shall be installed at each high point of the system.

5.4.5.6 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.

Δ **5.4.5.7** Where enclosed stations include more than one platform level (such as crossover subway lines), there shall be a cross-connection pipe of a minimum of 100 mm (4 in.) in diameter between each standpipe system so that water supplied by any fire department connection can furnish water throughout the entire system.

5.4.5.8 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 Where required, portable fire extinguishers shall be selected, installed, inspected, tested, and 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.

5.5 Integrated Testing of Fire Protection Systems.

5.5.1 Where two or more fire protection or life safety systems are interconnected, integrated testing shall comply with NFPA 4.

5.5.2 An integrated test shall be performed prior to revenue service.

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.

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

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, the fire resistance ratings of perimeter walls and related construction assemblies shall be not less than those associated with Type I or Type II construction, or combinations of Type I and Type II construction, in accordance with NFPA 220, unless otherwise permitted as a result of a fire hazard 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 constructed of materials or assemblies permitted for use in Type II (000) construction, in accordance with NFPA 220.

6.2.2.5 Exit and Ventilation Structures. Remote vertical exit shafts and ventilation structures shall be constructed of materials or assemblies permitted for use in Type I (332) construction, in accordance with NFPA 220.

6.2.2.6 Surface. Construction materials shall be materials or assemblies permitted for use in Type I or Type II construction, in accordance with NFPA 220, unless otherwise permitted by a

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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 constructed of materials or assemblies permitted for use in Type I or Type II (000) construction, or combinations of Type I and Type II construction, in accordance with NFPA 220, unless otherwise permitted 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 belowgrade system structures against the accidental intrusion of flammable and combustible liquids shall be provided in accordance with Section 4.7.

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.

Δ **6.2.5.1** Where combustible components not specifically addressed in this standard are installed in an enclosed trainway, a fire hazard analysis as described in 6.2.5.2 and 6.2.5.3 shall be conducted to ensure that the level of occupant fire safety is not affected by the trainway contents.

Δ **6.2.5.2*** The fire hazard analysis shall use appropriate engineering methods, such as computer modeling, material fire testing, or full-scale fire testing, to assess the design performance in potential fire scenarios commensurate with the proposed location and trainway environment.

6.2.5.3 The fire hazard analysis shall ensure that, if a fire propagates beyond the component of fire origin, a level of fire safety is provided within an enclosed trainway commensurate with this standard.

6.2.6 Walking Surfaces.

6.2.6.1 In enclosed trainways, walking surfaces designated for the 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 or UL 723 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).

6.2.8 Rail Ties.

Δ **6.2.8.1** Rail ties used in enclosed locations shall be made of noncombustible materials in accordance with 4.6.1.

Δ **6.2.8.2** Rail ties used outdoors at switch or crossover locations shall be made of one of the following types of materials:

(1) Noncombustible materials in accordance with 4.6.1
(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 or UL 723
(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 or UL 723
(5) Limited-combustible materials in accordance with 4.6.2
(6) Wood encased in concrete such that only the top surface is exposed

Δ **6.2.8.3** Rail ties used outdoors at locations other than switch or crossover locations shall be made of one of the following types of materials:

(1) Materials that comply with 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 an engineering 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 exits where separate tracks in enclosed trainways 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 exits, 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.

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(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 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 sections of enclosed trainways. *(See 7.1.2.1.)*

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

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

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 a path of egress 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 path of egress, it shall be nominally level and free of obstructions.

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, except at the following locations:

(1) Guards shall not be required along the trainway side of walkways where the bottom of the trainway is closed by a deck or grating.
(2) Guards shall not be required on walkways that are located between two trainways where the bottom of the trainway is closed by a deck or grating.

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6.3.3.6* Handrails for walkways shall be provided as follows:

(1) 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.
(2) Walkways that are greater than 1120 mm (44 in.) wide and located between two trainways shall not be required to have a handrail.

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

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

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

(1) Open fully when a force not exceeding 133 N (30 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

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

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

6.3.3.12 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.

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

6.3.3.14* 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 identifi-

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cation 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) Traction power cables connecting power to the power rail or OCS shall meet the requirements of Chapter 12.

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. 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.

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

6.3.5.14 Emergency light fixtures and exit 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, means of egress and exits from the guideway shall serve as emergency access routes.

N **6.4.1.2*** Surface trainways having security fences, open-cut trainways, and elevated trainways shall provide access for emergency responders at intervals not exceeding 762 m (2500 ft) or as otherwise approved.

6.4.1.3 Where security fences are used along the trainway, access gates shall comply with the following:

(1) Access gates shall be placed as close as practicable to the portals to permit easy access to enclosed trainways.
(2) Access gates shall be a minimum of 1120 mm (44 in.) wide and shall be of the hinged or sliding type.
(3) Information that clearly identifies the route to and location of each gate shall be provided on the gates or adjacent thereto.

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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. 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.

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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, Class I fire standpipe system designed in accordance with NFPA 14 shall be provided in enclosed trainways or open trainways where physical factors prevent or impede access to the water supply or fire apparatus, except as modified herein.

6.4.5.2 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 244 m (800 ft) apart.

6.4.5.3 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.

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

6.4.5.5 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

6.4.5.6 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.

6.4.5.7 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.

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

6.4.5.9 A fire department access road shall extend to within 30.5 m (100 ft) of the fire department connection.

6.4.6 Portable Fire Extinguishers.

6.4.6.1 Portable fire extinguishers shall be provided in such numbers, sizes, and types and at such locations in enclosed trainways as determined by the authority having jurisdiction.

6.4.6.2 Where required, portable fire extinguishers shall be selected, installed, inspected, tested, and maintained in accordance with NFPA 10.

6.4.7 Ventilation.

6.4.7.1 Except as described in 6.4.7.2 and 6.4.7.3, emergency ventilation shall be provided in enclosed trainways in accordance with Chapter 7.

6.4.7.2* Emergency ventilation meeting the tenability criteria for occupied spaces shall not be required in tail track areas where a fire hazard analysis indicates that a fire on a train in the tail track area will not impact passengers or passenger areas.

6.4.7.3* Emergency ventilation meeting the tenability criteria for occupied areas shall not be required in storage track areas where the storage track has no openings along its length to passenger trainway areas and where a fire hazard analysis indicates that a fire on a train in the storage track area will not impact passengers or passenger areas.

6.4.8 Emergency Power.

6.4.8.1 Enclosed trainways shall be such that, in the event of failure of the normal supply to or within the system, emergency power shall be provided in accordance with Article 700 of *NFPA 70* and Chapter 4 of NFPA 110. The supply system for emergency purposes, in addition to the normal services to the trainway, shall be one or more of the types of systems described in 700.12(A) through 700.12(E) of *NFPA 70*.

6.4.8.2 The following systems shall be connected to the emergency power system:

(1) Emergency lighting
(2) Protective signaling systems
(3) Emergency communication system
(4) Fire command center

6.4.8.3 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.

6.5 Integrated Testing of Fire Protection Systems.

6.5.1 Where two or more fire protection or life safety systems are interconnected, integrated testing shall comply with NFPA 4.

6.5.2 An integrated test shall be performed prior to revenue service.

Chapter 7 Emergency Ventilation System

7.1* General.

7.1.1* This chapter defines the requirements for the environmental conditions and the mechanical and nonmechanical ventilation systems used to meet those requirements for a fire emergency in a system station, trainway, or both as required by 5.4.7 and 6.4.7.

7.1.2 The requirement for a mechanical or nonmechanical system intended for the purpose of emergency ventilation shall be determined in accordance with 7.1.2.1 through 7.1.2.4.

7.1.2.1* For length determination, all contiguous enclosed trainway and enclosed station segments between portals shall be included.

7.1.2.2* A mechanical emergency ventilation system shall be provided in the following locations:

(1) In an enclosed station
(2) In an enclosed trainway that is greater in length than 1000 ft (305 m)

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