[W] CHAPTER 40

FIXED GUIDEWAY TRANSIT AND PASSENGER RAIL SYSTEMS

Note: This chapter is unique to Washington State.

SECTION 4001
FIXED GUIDEWAY TRANSIT AND PASSENGER RAIL SYSTEM

[S] 4001.1 Scope. Fixed guideway transit and passenger rail systems shall be in accordance with NFPA 130 as amended.

The National Fire Protection Association (NFPA) Standard 130, Standard for Fixed Guideway Transit and Passenger Rail Systems, 2017 edition, is amended as follows:

Chapter 1 Administration

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

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Chapter 3 Definitions

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.~~)) The fire chief or other designated authority charged with the administration of the fire code, or a duly authorized representative.

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Chapter 4 General

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4.4.1.1 Emergency power assumptions. The emergency power requirements in this standard assume a fire or other emergency event within the station or trainway concurrent with a power outage of the primary source of electrical power unrelated to the event within the transit system.

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

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Chapter 5 Stations

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5.1.2.3 Fixed guideway transit and passenger rail stations shall comply with the applicable provisions of Section 1114 of the 2018 *Seattle Building Code.*

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5.1.3.1.1 Fixed guideway transit and passenger rail stations are classified as Group A, Division 3 occupancies in accordance with the 2018 *Seattle Building Code* and 2018 *Seattle Fire Code.*

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5.2.1.1 During the course of construction, provisions of ((~~NFPA 241~~)) Chapter 33 of the 2018 *Seattle Fire Code* and Chapter 33 of the 2018 *Seattle Building Code* ((~~shall~~)) apply. ((~~except as modified herein.~~))

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5.2.2.1 Building construction for all new enclosed stations shall be not less than Type I or Type II or combinations of Type I and Type II noncombustible construction as defined in ((~~NFPA 220, in accordance with the requirements of NFPA *101*, Chapter 12~~)) Chapter 6 of the 2018 *Seattle Building Code*, for the station configuration, or as determined by fire hazard analysis of potential fire exposure hazards to the structure.

5.2.2.2 Other types of construction ((~~as defined in NFPA 220 shall be~~)) are permitted for open stations in accordance with the provisions of ((~~NFPA *101*, Chapter 12~~)) Chapter 6 of the 2018 *Seattle Building Code*, for corresponding station configurations.

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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 regularly used by passengers for circulation during normal revenue service in enclosed stations equipped throughout with an automatic sprinkler system ((~~shall not be~~)) are not required to be fire-separated if the station is constructed in accordance with Chapter 7 of the 2018 *Seattle Building Code*. All required exit stairs shall be enclosed in accordance with Chapter 10 of the 2018 *Seattle Building Code.*

(2) Public areas on different levels in open stations are 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.

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5.2.4.3 ((~~Ancillary~~)) Accessory Spaces. Fire resistance ratings of separations between ((~~ancillary~~)) accessory occupancies shall be established ((~~as required by NFPA *101*~~)) in accordance with Chapter 7 of the 2018 *Seattle Building Code* and in accordance with ASTM E 119 and ANSI/UL 263.

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5.2.5 Interior Finish.

5.2.5.1 Materials used as interior wall and ceiling finish in enclosed stations shall be noncombustible or comply with Chapter 8 of the 2018 *Seattle Fire Code.* ((~~except as permitted in the following:~~

~~(1) Except as required for materials listed in (2), materials exhibiting a flame spread index not exceeding 25 and a smoke developed index not exceeding 450 when tested in accordance with ASTM E 84 shall be permitted as interior wall and ceiling finish in enclosed stations.~~

~~(2) The following materials shall not be used as interior wall or ceiling finish, whether exposed or covered by a textile or vinyl facing, unless they are tested in accordance with NFPA 286 and meet the requirements of (3):~~

~~(a) Foam plastic insulation~~

~~(b) Textile wall or ceiling coverings~~

~~(c) Polypropylene~~

~~(d) High density polyethylene~~

~~(3) Materials in accordance with NFPA 286, and meeting the following requirements shall be permitted as interior wall and ceiling finish in enclosed stations.~~

~~(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).~~))

5.2.5.2 Materials used as interior floor finish materials in enclosed stations shall be noncombustible or comply with Chapter 8 of the 2018 Seattle Fire Code. ((~~shall exhibit a critical radiant flux not less than 0.8 W/cm^2 (0.7 Btu/ft^2·sec) when tested in accordance with ASTM E 648.~~))

5.2.5.3 Materials used as interior finish in open stations shall comply with the requirements of ((~~NFPA 101, Chapter 12~~)) Chapter 8 of the 2018 *Seattle Fire Code*.

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5.2.7.2* Permanent rubbish containers in the station shall comply with Section 304.3 of the 2018 *Seattle Fire Code.* ((~~be manufactured of noncombustible materials.~~))

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5.3.1.1 The provisions for means of egress for a station shall comply with ((~~Chapters 7 and 12 of NFPA 101~~)) Chapter 10 of the 2018 *Seattle Building Code*, except as herein modified.

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5.3.1.3 Enclosed fixed guideway transit and passenger rail stations shall be posted with the occupancy load in accordance with Section 1004.3 of the 2018 *Seattle Fire Code.*

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5.3.2.1* The occupant load for a station shall be based on whichever is greater, the train load of trains simultaneously entering the station on all tracks in normal traffic direction plus the simultaneous entraining load awaiting trains or the number of occupants computed at the rate of one occupant per 7 sq. ft. for stations serving event venues or dense neighborhoods or one occupant per 15 sq. ft. for outlying stations serving less dense populations.

(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.

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5.3.2.4 ((~~Where~~)) If 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*~~)) Chapter 10 of the 2018 *Seattle Building Code* 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.

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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, but in no case shall the required egress width (excluding escalators) be less than prescribed by Section 1005 of the 2018 *Seattle Building Code*.

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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)~~)) (1) Means of egress from separate platforms shall be permitted to converge.

((~~(3)~~)) (2) 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.

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5.3.3.7.1 Every required stairway in enclosed stations serving floor levels more than 30 feet (9144 mm) below its level of exit discharge, except those regularly used by passengers shall comply with the requirements for a pressurized stairway in Section 1023.11 of the 2018 *Seattle Building Code.*

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5.3.5.4* Escalators ((~~shall not~~)) may account for ((~~more than~~)) up to one-half of the required means of egress capacity at any one level except as permitted by 5.3.5.5.

5.3.5.5 Escalators ((~~shall~~)) may be permitted to account for ((~~more than~~)) up to one-half of the required means of egress capacity at any one level for purposes of calculating platform evacuation time 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 means of egress capacity from each station level is stairs.

(3) For enclosed stations, at least one enclosed exit stair or exit passageway provides continuous access from the platforms to the public way.

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((5~~.3.6 Elevators.~~

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

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

~~(1) They shall account for no more than 50 percent of the required egress capacity.~~

~~(2) *At least one elevator shall be considered out of service, and one elevator shall be reserved for fire service.~~

~~(3) *The capacity of each elevator shall be the carrying capacity of the elevator within 30 minutes.~~

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

~~(1) The holding areas or lobbies shall be separated from the platform by a smoketight fire separation having a fire resistance rating of at least 1 hour but not less than the time required to evacuate the holding area occupant load.~~

~~(2) At least one stair shall be accessible from the holding area.~~

~~(3) The holding area shall be sized to accommodate one person per 0.46 m^2 (5 ft^2).~~

~~(4) If the holding area includes portions of the platform, the area within 460 mm (18 in.) of the trainway shall not be considered in the calculation.~~

~~(5) Upon activation of smoke control in the platform or adjacent trainway areas, the holding area shall be pressurized to a minimum of 25 Pa (0.1003 in. of water gauge).~~

~~(6) The holding area shall be provided with emergency voice alarm devices with two-way communication to the system operations control center.~~

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

~~(1) Shaft enclosures shall be constructed as fire separations having a 2 hour fire resistance rating.~~

~~(2) *The design shall limit water flow into the shaft.~~

~~(3) No more than two elevators used for means of egress or fire department access shall share the same machine room.~~

~~(4) Machine rooms shall be separated from each other by fire separations having a minimum fire resistance rating of 2 hours.~~

~~(5) The elevators shall be connected to emergency power.~~

~~(6) *During emergency evacuation, the elevators shall travel only between the incident level and a point of safety.~~

~~(7) *Provisions for Phase I emergency recall operation shall be based on analysis of fire scenarios on each level served and demonstrate safe egress for those scenarios.~~))

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5.3.7.2 Gates in a means of egress shall be designed in accordance with the requirements for doors serving as a means of egress in accordance with Chapter 10 of the 2018 *Seattle Building Code* and maintain the clear width of the exit walkway.

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5.3.8.5 Turnstile-type fare barriers shall be permitted in accordance with ((~~NFPA *101*~~)) Chapter 10 of the 2018 *Seattle Building Code* and shall in the means of egress shall meet the following criteria:

(1) Dimensions shall be in accordance with the requirements of ((~~NFPA *101*~~)) Chapter 10 of the 2018 *Seattle Building Code*.

(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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5.3.11 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*~~)) Section 1008 of the 2018 *Seattle Building Code*.

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*~~)) Section 1008 of the 2018 *Seattle Building Code*.

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5.4.1* Fire Command Center.

5.4.1.1 Enclosed stations shall be provided with a fire command center in accordance with NFPA 72 and Section 508 of the 2018 *Seattle Fire Code*.

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5.4.4 Automatic Fire Suppression Systems.

5.4.4.1* An automatic sprinkler ((~~protection~~)) system shall be provided ((~~in~~)) throughout all areas of enclosed fixed guideway transit and passenger rail stations. ((~~used for concessions, in storage areas, in trash rooms, and other similar areas with combustible loadings, except trainways.~~))

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

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

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5.4.5 Standpipe and Hose Systems.

5.4.5.1* A Class I ((~~standpipes~~)) standpipe system shall be installed in enclosed stations and elevated transit stations in accordance with NFPA 14 except as modified herein.

5.4.5.1.1 Fire department connections for fire department use in supplying the standpipe system shall be located in accordance with Seattle Fire Department Administrative Rule 9.03.20, *Automatic Sprinkler and Standpipe Systems*, and any future revisions of this rule adopted by the *fire code official*.

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5.4.5.3.1 Hydraulic design information signs shall be provided at each fire department connection indicating the residual inlet pumping pressure(s) required for the hydraulically most remote and/or other selected hose connection outlet location(s).

* * *

5.4.7.1.1 Smoke control system. A smoke control system shall be provided in underground fixed guideway transit and passenger rail stations in accordance with Section 909 of the 2018 *Seattle Building Code*. Smoke control shall restrict movement of smoke to the general area of fire origin and non-occupied exhaust areas and maintain tenability in the means of egress.

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5.4.8 Emergency Power Supply System (EPSS)

5.4.8.1 Emergency Power Supply System (EPSS). ((~~Emergency power~~)) A Class 2, Type 60, Level 1 Emergency Power Supply System (EPSS) in accordance with Article 700 of *NFPA 70*, and Chapter 4 of NFPA 110 shall be provided for underground and enclosed stations.

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5.4.8.5 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~~
~~(5) Elevators providing required egress capacity [see 5.3.6.4(5)]~~))
(1) Exit signs and means of egress illumination.
(2) Elevator car lighting.
(3) Emergency voice/alarm communication systems.
(4) Automatic fire detection systems.
(5) Fire alarm systems.
(6) Power and lighting for the fire command center.
(7) Lighting for mechanical rooms containing critical equipment.
(8) Electrically powered fire pumps.
(9) Ventilation and automatic fire detection equipment for smoke proof enclosures.
(10) Smoke control systems.
(11) A selected elevator in each bank of elevators in accordance with 2018 Seattle Building Code Section 3016.7. A bank of elevators is a group of elevators or a single elevator controlled by a common operating system and all elevators that respond to a single call button constitute a bank of elevators. All elevators shall be transferable to emergency power.

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Chapter 6 Trainways

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6.3.1.4* Within enclosed trainways, the maximum distance between exits shall not exceed ((~~762~~)) 244 m (((~~2500~~)) 800 ft).

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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.)~~)) 760 mm (30 in.) at the walking surface to ((~~760 mm (30 in.)~~)) 910 mm (36 in.) at 1575 mm (62 in.) above the walking surface to ((~~430 mm(17 in.)~~)) 760 mm (30 in.) at 2025 mm (80 in.) above the walking surface.

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

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6.3.3.10 Exit stairs and doors shall comply with Chapter ((~~7 of NFPA *101*~~)) 10 of the 2018 *Seattle Building Code*, except as herein modified.

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((**~~6.3.3.15~~** ~~Exit hatches shall be permitted in the means of egress, provided the following conditions are met:~~
~~(1) Hatches shall be equipped with a manual opening device that can be readily opened from the egress side.~~
~~(2) Hatches shall be operable with not more than one releasing operation.~~
~~(3) The force required to open the hatch when applied at the opening device shall not exceed 130 N (30 lb).~~
~~(4) The hatch shall be equipped with a hold-open device that automatically latches the door in the open position to prevent accidental closure.~~
~~6.3.3.16~~ ~~Exit hatches shall be capable of being opened from the discharge side to permit access by authorized personnel.~~
~~6.3.3.17*~~ ~~Exit hatches shall be conspicuously marked on the discharge side to prevent possible blockage.~~))

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6.3.5.2 System egress ((~~points~~)) walk surfaces shall be illuminated at a level of not less than 2.69 lx (0.25 ft.-candles) or as approved by the authority having jurisdiction.

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6.3.5.12 Lighting systems for enclosed trainways shall be installed in accordance with ((~~Sections 7.8 and 7.9 of NFPA 101~~)) Chapter 10 of the 2018 *Seattle Building Code*, except as otherwise noted in 6.3.5.

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

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6.4.5.9.1 Hydraulic design information signs shall be provided at each fire department connection indicating the residual inlet pumping pressure(s) required for the hydraulically most remote and/or other selected hose connection outlet location(s).

* * *

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

6.4.5.11 Four-way 2-1/2-inch fire department connections shall be provided at all emergency access points.

6.4.5.12 Standpipes shall be sized to provide 1000 gpm. Hydraulic calculations shall be based on 500 gpm at 130 psi at the hydraulically most remote hose connection, with a simultaneous flow of 500 gpm at the next hydraulically most remote hose connection. The maximum calculated pressure at any point in the system shall not exceed 350 psi.

6.4.5.13 Standpipes shall be interconnected at all tunnel cross passageways and within the stations, with isolation valves provided for each interconnection.

6.4.5.14 Hose connection outlets shall be provided at maximum 200 feet spacing.

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6.4.8 Emergency Power Supply System (EPSS).

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 with a Class 2, Type 60, Level 1 Emergency Power Supply System (EPSS) 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 supply system:

((~~(1) Emergency lighting~~

~~(2) Protective signaling systems~~

~~(3) Emergency communication system~~

~~(4) Fire command center~~))

(1) Exit signs and means of egress illumination.

(2) Elevator car lighting.

(3) Emergency voice/alarm communication systems.

(4) Automatic fire detection systems.

(5) Fire alarm systems.

(6) Power and lighting for the fire command center.

(7) Lighting for mechanical rooms containing critical equipment.

(8) Electrically powered fire pumps.

(9) Ventilation and automatic fire detection equipment for pressurized stairways.

(10) Smoke control systems.

(11) A selected elevator in each bank of elevators in accordance with 2018 Seattle Building Code Section 3016.7. A bank of elevators is group of elevators or a single elevator controlled by a common operating system and all elevators that respond to a single call button constitute a bank of elevators. All elevators shall be transferable to emergency power.

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Chapter 7 Emergency Ventilation System

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7.2.4 ((~~Criteria for the system reliability analysis in 7.2.3 (6) shall be established and approved.~~)) The design analysis shall address the performance of the system with one fan out-of-service.

((~~7.2.4.1~~ ~~The analysis shall consider as a minimum the following events:~~

~~(1) Fire in trainway or station~~

~~(2) Local incident within the electrical utility that interrupts power to the emergency ventilation system~~

~~(3) Derailment~~

~~(4) The loss of a fan that results in the most adverse effect on the ventilation system performance~~))

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7.8.1 ((~~The design of the power for the emergency ventilation system shall comply with the requirements of Article 700 of NFPA 70.~~)) The emergency ventilation system shall be provided with a Class 2, Type 60, Level 1 Emergency Power Supply System (EPSS) in accordance with Article 700 of NFPA 70, and Chapter 4 of NFPA 110.

((~~7.8.1.1~~ ~~Alternatively, the design of the power for the emergency ventilation system shall be permitted to be based upon the results of the electrical reliability analysis according to 7.2.3(7), as approved.~~))

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Chapter 8 Vehicles

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8.8.2.1 A means to allow passengers to safely board the vehicle (rescue train) from a walk surface or other suitable area under the supervision of authorized employees in case of an emergency shall be provided.

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Chapter 10 Emergency Communications System

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10.3.1 If required by the AHJ, underground and ((~~Enclosed~~)) enclosed stations and trainways shall be provided with a public radio enhancement system.

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10.4.1.1 If required by the authority having jurisdiction, stations shall be provided with an approved Emergency Communication System in accordance with the 2016 edition of NFPA 72.

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Chapter 12 Wire And Cable Requirements

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12.4.1 Conduits, raceways, ducts, boxes, cabinets, and equipment enclosures shall be constructed of noncombustible materials. In stations, guideways and tunnels, other approved materials when encased in at minimum of two inches of concrete shall be acceptable.

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Annex A Explanatory Material

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A.5.4.8.1 Emergency Power Supply System. The class defines the minimum time, in hours, that the Emergency Power Supply System (EPPS) is designed to operate at its rated load without being refueled or recharged. The type defines the maximum time, in seconds, that the EPSS will permit the load terminals of the transfer switch to be without acceptable electrical power. NFPA 110 recognizes two levels of EPSS equipment installations, performance and maintenance. Level 1 systems shall be installed where failure of the EPSS to perform could result in loss of human life or serious injuries.

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A.6.4.7.1 The class defines the minimum time, in hours, that the Emergency Power Supply System (EPPS) is designed to operate at its rated load without being refueled or recharged. The type defines the maximum time, in seconds, that the EPSS will permit the load terminals of the transfer switch to be without acceptable electrical power. NFPA 110 recognizes two levels of EPSS equipment installations, performance and maintenance. Level 1 systems shall be installed where failure of the EPSS to perform could result in loss of human life or serious injuries.

* * *

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