

[S] CHAPTER 41

**ROAD TUNNELS, BRIDGES AND OTHER
LIMITED ACCESS HIGHWAYS**

Note: Chapter 41 is entirely Seattle amendments to the *International Fire Code* and is not underlined.

**SECTION 4101
SCOPE**

Road tunnels, bridges and other limited access highways shall be in accordance with NFPA 502 (2017) and as amended as follows:

Chapter 3 Definitions

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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 Requirements

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4.2 Safeguards During Construction. During the course of construction or alteration of any facility addressed in this standard, the provisions of ~~((NFPA 244))~~ 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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4.3.3* Limited Access Highways. Fire protection for limited access highways shall comply with the requirements of Chapter 5 and Chapter 10.

4.3.4 Bridges and Elevated Highways. Fire protection for bridges and elevated highways shall comply with the requirements of Chapter 6 and Chapter 10.

4.3.5* Depressed Highways. ~~((Standpipe systems or fire extinguishers, or both, shall be installed on depressed highways where physical factors prevent or impede access to the water supply or fire apparatus.))~~ Fire protection for depressed highways shall comply with the requirements of Chapter 5 and Chapter 10.

4.3.6* Road Tunnels. Fire protection for road tunnels shall comply with the requirements of Chapter 7 and Chapter 10.

4.3.7* Roadway Beneath Air-Right Structures. Fire protection for roadways that are located beneath air-right structures shall comply with the requirements of Chapter 8 and Chapter 10.

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4.5 Emergency Communications. Emergency communications, ~~((where))~~ if required by the authority having jurisdiction, shall be provided by the installation of outdoor-type emergency telephone boxes, ~~((coded alarm telegraph stations.))~~ radio transmitters, or other approved devices that meet the following requirements:

- (1) They shall be made conspicuous by means of indicating lights or other approved markers.
- (2) They shall be identified by a readily visible number plate or other approved device.
- (3) They shall be posted with instructions for use by motorists.
- (4) ~~((They))~~ Where practicable, they shall be located in approved locations so that motorists can park vehicles clear of the travel lanes.
- (5) Emergency communication devices shall be protected from physical damage from vehicle impact.
- (6) Emergency communication devices shall be connected to an approved constantly attended location.

Chapter 5 Limited Access and Depressed Highways

5.1 General. This chapter (~~((shall))~~) provides fire protection requirements for limited access and depressed highways.

~~((5.6* Fire Hydrants. (Reserved)))~~

Chapter 6 Bridges and Elevated Highways

6.6 (~~((Standpipe,))~~) Fire Hydrants (~~((s))~~) and Water Supply

6.6.1* Applicability. Where the (~~((length of a bridge or elevated highway exceeds 300 m (1000 ft), a horizontal standpipe system shall be installed on the structure))~~) distance from any point on the bridge or elevated highway exceeds 120 m (400 ft) to a fire hydrant, the bridge or elevated highway shall be provided with a hydrant system in accordance with the requirements of Chapter 10.

6.10 Control of Hazardous Materials. Where required by the authority having jurisdiction, control of hazardous materials shall be in accordance with the requirements of Chapter 14.

Chapter 7 Road Tunnels

7.2* Application. For the purpose of this standard, factors described in 4.3.1, shall dictate fire protection and fire life safety requirements. Multiple tunnels on a roadway may have their length combined to determine the assigned category as determined by the fire code official. The minimum fire protection and fire life safety requirements, based on tunnel length, are categorized as follows and additional requirements determined by the fire code official:

- (1) Category X – Where tunnel length is less than 90 m (300 ft), an engineering analysis shall be performed in accordance with 4.3.1, an evaluation of the protections of structural elements shall be conducted in accordance with 7.3, and traffic control systems shall be installed in accordance with requirements of Section 7.6.
- (2) Category A – Where tunnel length is 90 m (300 ft) or greater, an engineering analysis shall be performed in accordance with 4.3.1, an evaluation of the protection of structural elements shall be conducted in accordance with 7.3, and a standpipe system and traffic control systems shall be installed in accordance with the requirements of Chapter 10 and Section 7.6. A fixed water-based fire-fighting system shall be installed per Chapter 9.
- (3) Category B – Where tunnel length equals or exceeds 240 m (800 ft) and where the maximum distance from any point within the tunnel to a point of safety exceeds 120 m (400 ft), all provisions of this standard shall apply unless noted otherwise in this document.
- (4) Category C – Where the tunnel length equals or exceeds 300 m (1000 ft), all provisions of this standard shall apply unless noted otherwise in this document.
- (5) Category D – Where the tunnel length equals or exceeds 1000 m (3280 ft), all provisions of this standard shall apply.

7.4 Fire Alarm and Detection.

7.4.1 (~~((Tunnels described in categories B, C, and D shall have at least one manual means of identifying and locating a fire in accordance with the requirements of 7.4.6.))~~) A minimum of one automatic fire detection system to identify and locate a fire in a tunnel shall be provided.

7.4.2 (~~((Tunnels described in categories B, C, and D without 24-hour supervision shall have an automatic fire detection system in accordance with 7.4.7.))~~) All fire alarm, detection, supervisory, and trouble signals shall be distinctly different and shall be automatically transmitted to a central station service that is listed in the current edition of the Underwriters Laboratories FIRE

PROTECTION EQUIPMENT DIRECTORY under the category Central Station (UUFX) as a Full Service Company or as a Fire Alarm Service–Local Company which subcontracts the monitoring, retransmission and associated record keeping and reporting to a listed Full Service Company or Monitoring Company. The listing shall indicate that the Full Service Company or Fire Alarm Service – Local Company provides service to the Seattle area.

Exception: The operations control center may serve as a proprietary supervising station in accordance with NFPA 72 where approved by the authority having jurisdiction.

~~7.4.3* Closed-circuit television (CCTV) systems ((with traffic flow indication devices or surveillance cameras shall be permitted for use to identify and locate fires in tunnels with 24-hour supervision)) shall be provided in categories B, C, and D tunnels, and shall be capable of identifying the location of the fire within 15 m (50 ft) or as required by the fire code official.~~

~~7.4.5 ((Ancillary spaces within tunnels defined in categories B, C, and D (such as pump stations and utility rooms) and other areas shall be supervised by automatic fire alarm systems in accordance with 7.4.7)) CCTVs with or without traffic-flow indication devices may automatically identify fires in tunnels if all of the components of the video image fire detection system, including hardware and software, are listed for the purpose of fire detection.~~

~~7.4.6 ((Manual Fire Alarm Boxes)) **Emergency Telephones.**~~

~~7.4.6.1 ((Manual fire alarm boxes mounted in NEMA Enclosure Type 4 (IP 65) or equivalent boxes shall be installed at intervals of not more than 90 m (300 ft) and at all cross-passages and means of egress from the tunnel)) Emergency telephones shall be installed at intervals of not more than 90 m (300 ft) and at all cross-passages, standpipe hose connection locations, and means of egress from the tunnel.~~

~~7.4.6.2 ((The manual fire alarm boxes shall be accessible to the public and the tunnel personnel)) The location of the emergency telephones during off-hook condition shall be indicated at the monitoring station.~~

~~((7.4.6.3 The location of the manual fire alarm boxes shall be approved.~~

~~7.4.6.4 The alarm shall indicate the location of the manual fire alarm boxes at the monitoring station.~~

~~7.4.6.5 The system shall be installed, inspected, and maintained in compliance with NFPA 72.))~~

~~7.4.7.1* Automatic fire detection systems and fixed water-based fire-fighting system water flow alarm-initiating devices shall be installed in accordance with NFPA 72 and approved by the AHJ.~~

~~7.4.7.5 Spot detectors shall have a light that remains on until the device is reset, or shall be provided with remote alarm or supervisory indication in a location acceptable to the authority having jurisdiction.~~

~~7.4.8 **Fire Alarm Control Panel.** An approved fire alarm control panel (FACP) shall be installed, inspected, and maintained in accordance with NFPA 72.~~

~~7.4.8.1 Automatic fire detectors and fixed water-based fire-fighting system water flow alarm-initiating devices protecting the roadway and ancillary spaces within tunnels (pump stations, utility rooms, cross-passages, ventilation structures) and other areas shall be supervised by automatic fire alarm systems.~~

~~7.4.8.2 Automatic fire detection systems for zoned deluge fixed water-based fire-fighting systems within a tunnel shall be zoned to correspond with the fixed water-based fire-fighting system zones.~~

~~7.4.8.3 Automatic fire detection systems within a tunnel shall be zoned to correspond with the tunnel ventilation zones if tunnel ventilation is provided.~~

~~7.4.9 **Fire Command Center.** If required by the authority having jurisdiction, road tunnels shall be provided with a fire command center in accordance with Section 508 of the 2018 *Seattle Fire Code*.~~

~~7.5* **Emergency ((Communications Systems)) Responder Radio Coverage, ((Two-Way Radio Communication Enhancement System:))**~~

~~7.5.1 ((Two-way radio communication enhancement)) Emergency Responder Radio Coverage systems shall be installed in new and existing tunnels and ancillary facilities if ((where)) required by the ((authority having jurisdiction)) fire code official, ((or by other applicable governing laws, codes, or standards:))~~

~~7.5.2 ((Two-way radio communication enhancement))~~ Emergency Responder Radio Coverage systems shall be designed, installed, tested, and maintained in accordance with the provisions of ~~((NFPA 72, National Fire Alarm and Signaling Code))~~ NFPA 1221 (2019), Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems, and Section 510 of the 2018 Seattle Fire Code.

7.10 Fixed Water-Based Fire-Fighting Systems. See Chapter 9.

7.10.1 Fixed water-based fire-fighting systems shall be ~~((conditionally))~~ mandatory in ~~((category))~~ categories A, B, C, and ((category)) D tunnels.

7.16.1.1* The means of egress requirements for all road tunnels and those roadways beneath air-right structures that the authority having jurisdiction determines are similar to a road tunnel shall be in accordance with ~~((NFPA 101, Chapter 7))~~ Chapter 10 of the 2018 *Seattle Building Code*, except as modified by this standard.

7.16.3 Maintenance. The means of egress shall be maintained in accordance with ~~((NFPA 1))~~ Chapter 10 of the 2018 *Seattle Fire Code*.

7.16.6.4 The emergency exits shall be separated from the tunnel by a minimum of a 2-hour fire-rated construction enclosure, ~~((based on the design fire described in Chapter 11))~~ in accordance with the 2018 Seattle Building Code.

Chapter 9 Fixed Water-Based Fire-Fighting Systems

9.1* General.

9.1.1 Fixed water-based fire-fighting systems ~~((shall be permitted))~~ are required in road tunnels as part of an integrated approach to the management of fire protection and fire life safety risks. All interior spaces within a road tunnel, including exit paths and other occupied spaces, shall be protected.

Exception: Category X Tunnels are not required to provide fixed water-based fire-fighting systems.

~~(9.2 Design Objectives.~~

~~**9.2.1** The goal of a fixed water-based fire-fighting system shall be to slow, stop, or reverse the rate of fire growth or otherwise mitigate the impact of fire to improve tenability for tunnel occupants during a fire condition, enhance the ability of first responders to aid in evacuation and engage in manual fire-fighting activities, and/or protect the major structural elements of a tunnel.~~

~~**9.2.2*** Fixed water-based fire-fighting systems shall be categorized based upon their desired performance objective in 9.2.2.1 through 9.2.2.4.~~

~~**9.2.2.1* Fire Suppression System.** Fire suppression is the reduction in the heat release rate of a fire by a sufficient application of water. Fire size shall remain reduced over the design discharge duration.~~

~~**9.2.2.2* Fire Control System.** Fire control systems shall be designed to stop or significantly slow the growth of a fire within a reasonable period from system activation such that the peak heat release rate is significantly less than would be expected without a fixed fire-fighting system.~~

~~**9.2.2.3* Volume Cooling System.** Volume cooling systems shall be designed to provide substantial cooling of products of combustion but are not intended to directly affect heat release rate.~~

~~**9.2.2.4* Surface Cooling System.** Surface cooling systems shall be designed to provide direct cooling of critical structure, equipment, or appurtenances without directly affecting heat release rate.~~

~~9.3 Performance Evaluation.~~

~~**9.3.1** Fire test protocols shall be designed to address the performance objectives as described in 9.2.2 and the tunnel parameters described in Section 9.4.~~

~~**9.3.2*** Fire test protocols shall be designed to replicate and evaluate the range of the application parameters associated with road tunnels.~~

~~9.3.3*~~ System components shall be listed or as approved by the AHJ.))

~~(9.4 Tunnel Parameters:~~

~~9.4.1 Tunnel parameters~~ shall be the features of the tunnel that affect the design of a water-based fire-fighting system.

~~9.4.2 Tunnel Geometry.~~ The tunnel geometry (width, ceiling height, obstruction location) shall be considered when selecting such parameters as nozzle location and nozzle positioning.

~~9.4.3 Ventilation.~~ Ventilation considerations shall include natural and fire-induced forced ventilation parameters.

~~9.4.4 Hazard Analysis.~~ A fire hazard analysis shall be conducted to determine both the design parameters of the water-based fire-fighting system and the type of detection and activation scheme employed. The water-based fire-fighting system shall address the anticipated vehicle types and contents, ease of ignition and re-ignition of the fuel, anticipated fire growth rate, and difficulty of achieving one or more of the performance objectives established in Section 9.2 or as otherwise acceptable to the AHJ.

~~9.4.5 Obstructions and Shielding.~~ The presence of obstructions and the potential for shielding of water-based fire-fighting system discharge shall be addressed to ensure that system performance is not affected.

~~9.4.6 Ambient Conditions.~~ The range of ambient conditions that could be experienced in the tunnel shall be identified.

~~9.5 System Design and Installation Documentation:~~

~~9.5.1~~ The system design and installation documentation shall identify the design objectives and tunnel parameters over which the system performance evaluation is valid.

~~9.5.2~~ System documentation shall clearly identify engineering safety factors incorporated into the overall system design. Safety factors shall be required to ensure that installed system performance exceeds the performance of the system as tested in accordance with Section 9.3.

~~9.5.3~~ System documentation shall also include recommended testing, inspection, and maintenance procedures and, by reference, the requirements of the relevant NFPA standard or equivalent standard acceptable to the AHJ.

~~9.6 Engineering Design Requirements:~~

~~9.6.1*~~ When a fixed water-based fire-fighting system is included as part of the overall design of a road tunnel, the impact of this system on other measures being part of the overall safety concept shall be evaluated. At a minimum, this evaluation shall address the following:

- (1) Impact on drainage requirements
- (2) Impact on tenability, including the following:
 - (a) Increase in humidity
 - (b) Reduction (if any) in stratification and visibility
- (3) Integration with other tunnel systems, including the following:
 - (a) Fire-detection and alarm system
 - (b) Tunnel ventilation system
 - (c) Traffic control and monitoring systems
 - (d) Visible emergency alarm notification
- (4) Incident command structure and procedures, including the following:
 - (a) Procedures for tunnel operators
 - (b) Procedures for first responders
 - (c) Tactical fire-fighting procedures
- (5) Protection and reliability of the fixed water-based fire-fighting system, including the following:
 - (a) Impact events
 - (b) Seismic events
 - (c) Redundancy requirements
- (6) Ongoing system maintenance, periodic testing, and service requirements))

Chapter 10 Standpipe, Fire Hydrants, and Water Supply

10.1.4.3 (~~Heat trace material shall be listed for the intended purpose and supervised for power loss.~~) Heat tracing systems for freeze protection for standpipes shall be 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 authority having jurisdiction.

10.2 Standpipe Water Supply.

10.2.3 (~~Acceptable water supplies shall include the following:~~

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

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.

10.3.1 Fire department connections shall be of the threaded (~~two way or three way~~) 65-mm (2-1/2-in) four-way type. (~~It shall consist of a minimum 100 mm (4 in.) quick connect coupling that is accessible.~~)

10.4 Standpipe Hose Connections.

10.4.1 (~~Hose~~) Standpipe hose connections shall be spaced so that no location on the protected roadway is more than 45 m (150 ft) from the hose connection.

10.4.2* (~~Hose connection spacing shall not exceed 85 m (275 ft).~~) Dual 65-mm (2-1/2-in) standpipe hose connection outlets having separate valves shall be provided at each standpipe hose connection location.

10.7 Fire Hydrants and Water Supply.

10.7.1 Fire hydrants for limited access and depressed highways shall be provided at spacing not to exceed 1,000 feet to provide for transportation hazards.

10.7.2 Fire hydrants for roadways beneath air-right structures, bridges, and elevated highways shall be provided so that no location on the protected roadway is more than 90 m (300 ft) from a fire hydrant.

10.7.3 Fire hydrants for road tunnels shall be provided so that no location on the protected roadway is more than 45 m (150 ft) from a fire hydrant.

10.7.4 The water supply for fire hydrants shall provide a minimum of 1,000 gpm (63 L/s) at 20 psi (138 kPa) flowing independently, and a minimum of 1,500 gpm (34 L/s) at 20 psi (138 kPa) with two fire hydrants flowing simultaneously.

10.8 Bridges and Elevated Highways.

10.8.1 Fire hydrants for bridges and elevated highways shall be provided in accordance with this section and Section 10.7.

10.8.2 If median dividers and/or four or more traffic lanes are present, fire hydrants for bridges and elevated highways shall be provided on both sides of the roadway at the required spacing or installed in the median divider at the required spacing.

10.8.3 Fire hydrants for bridges and elevated highways shall have two 100 mm (4 in) hose connection outlets, with external threads in accordance with City of Seattle Standard Plan No. 310a, and each outlet provided with a hand-operable valve readily accessible from the roadway.

10.8.4 The hose connection outlets shall be oriented parallel to the roadway and face in both directions of travel.

Exception: The outlets may be angled in towards the roadway at an angle not exceeding 22.5 degrees.

10.8.5 Hose connection outlets shall be positioned such that the centerline of each outlet is installed not more than 400 mm (16 in) horizontally from the inside edge of the top and not less than 200 mm (8 in) above the top of the guardrail or edge barrier, and not more than 1370 mm (54 in) above the roadway.

10.8.6 Hose connection outlets shall be provided with caps that are removable with a standard hydrant wrench.

10.8.7 Hose connection caps shall be provided with a 3 mm (1/8 in) hose and be secured with a short length of chain or cable to prevent falling after removal.

10.8.8 Water shall be supplied to bridge and elevated highways hydrants by the use of approved manually actuated preaction or deluge valves installed in locations not subject to freezing, such as in underground vaults or other *approved* locations.

10.8.9 Access to the preaction or deluge valves and manual actuation capability at the valve locations shall be provided, including access key box if the water supply vault will be locked.

10.8.10 A preaction or deluge valve actuation device (such as an electrical switch, push button, manual pull station, etc.) shall be installed at each hydrant location and be protected from damage in a weatherproof enclosure that can be opened without the use of tools or special knowledge, or with a standard hydrant wrench, or other approved method.

10.8.11 The location of the preaction or deluge valve actuation switch installed at each hydrant shall be readily visible and have approved signage.

10.8.12 A means to indicate that the system is in the tripped condition such as a light beacon or remote monitoring of the system shall be provided.

10.8.13 Hydrant systems for bridges and elevated highways shall have provisions for complete draining after use.

10.8.14 Combination air relief/vacuum valves shall be installed at each high point on the system.

10.8.15 Water supply vault location information, vault access instructions, and a phone number for road crew to drain the system shall be provided at the roadway control panel push button locations.

10.8.16 If used, heat tracing systems for freeze protection for hydrant systems shall be 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 authority having jurisdiction.

10.9 Maintenance and Confidence Testing.

10.9.1 Standpipe and hydrant systems shall be inspected and tested at least annually.

10.9.2 Maintenance and periodic testing are the owner's responsibility, or the responsibility of such other person as may be designated by the owner, and are separate from the fire department inspections.

10.9.3 The person, fire or corporation performing such work shall have a Type STP-1 certificate from the Seattle Fire Department. See Administrative Rule 9.01.20, *Certificates of Competency for Installing, Inspecting, Testing and Maintaining Fire Protection Systems*, and Administrative Rule 9.02.19, *Inspection, Testing, Maintenance and Reporting Requirements for Fire Protection Systems and Emergency Responder Amplification Systems*.

10.10 Standpipe Installation in Tunnels Under Construction.

10.10.1 A standpipe system shall be installed in tunnels under construction in accordance with 10.10.1.1 and 10.10.1.2.

10.10.1.1 A standpipe system shall be installed before the tunnel under construction has exceeded a length of 61 m (200 ft) of the most remote portion of the tunnel.

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

Chapter 11 Emergency Ventilation

11.1.1.1 If an engineering analysis is not conducted, or does not support the use of natural ventilation for the configurations described in 11.1.1, a mechanical emergency ventilation system shall be provided.

11.1.1.2 The engineering analysis of the ventilation system shall include a validated subway analytical simulation program augmented as appropriate by a quantitative analysis of airflow dynamics produced in the fire scenario, such as would result from the application of validated computational fluid dynamics (CFD) techniques.

11.1.1.3 The results of the analysis shall include the no-fire (or cold) air velocities that can be measured during commissioning to confirm that a mechanical ventilation system as built meets the requirements determined by the analysis.

Chapter 12 Electrical Systems

12.4* Emergency Power. Road tunnels (~~(complying with Category B–D in Section 7.2)~~) shall be provided with (~~(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*. (~~(For emergency and standby power systems, other than separate service, see NFPA 110.)~~)

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

- (1) Emergency (~~(lighting)~~) voice/alarm communication systems
- (2) Tunnel closure and traffic control system(s)
- (3) Exit signs and means of egress illumination
- (4) (~~(Emergency communication)~~) Lighting for mechanical rooms
- (5) Tunnel drainage system(s)
- (6) Emergency ventilation and automatic fire detection equipment for pressurized stairways
- (7) (~~(Fire)~~) Automatic fire alarm and detection
- (8) Closed-circuit television or video system(s) and security system(s)
- (9) (~~(Fire-fighting)~~) Smoke control systems
- (10) Electrically powered fire pumps
- (11) Power and lighting for the fire command center
- (12) Fire alarm systems

Chapter 13 Emergency Response

13.5.1.1* The OCC (~~(shall)~~) may serve as a proprietary supervising station to allow direct receipt of alarms where approved by the authority having jurisdiction. This provides more rapid alarm information, and allows integrated alarm and device/system activation without delays.

13.8.6 Limited Access Highways and Road Tunnels.

Chapter 14 Regulated and Unregulated Cargoes

14.1 General.

14.1.1* (~~(The authority having jurisdiction shall adopt rules and regulations that apply to the transportation of regulated and unregulated cargoes.)~~) This chapter applies to the transportation of hazardous materials through new road tunnels as follows:

- (1) If the tunnel length equals or exceeds 90 m (300 ft).

Exceptions:

- (1) The existing Mount Baker Tunnel (Interstate 90) and the Washington State Convention and Trade Center lid (Interstate 5) if the foam-water fire protection system(s) are fully functional and in-service.
- (2) Fuel contained in the fuel system of the transporting vehicle, or in the fuel systems of vehicles and equipment being towed or carried.
- (3) Tunnels that are provided with a fixed-fire suppression system based on an engineering analysis, approved by the fire code official, and that are maintained fully functional and in-service.

14.1.2 (~~(Design and planning of the facility shall address the potential risk presented by regulated and unregulated cargoes as permitted by 14.1.1.)~~) Vehicles transporting hazardous materials in quantities that require DOT placards in accordance with 49 CFR are prohibited in road tunnels.

14.1.4 Flames used for heating vehicles or loads shall be extinguished before the vehicle enters the road tunnel or its approaches.

14.1.5 Tank vehicles that are empty, or that have a residue, or vehicles transporting empty containers are prohibited from entering road tunnels if they previously transported the following hazardous materials:

- (1) Class 1 explosives, division 1.1, 1.2, and 1.3;
- (2) Class 2, division 2.3, poisonous gas;
- (3) Class 4, division 4.3, dangerous when wet materials;
- (4) Class 6, division 6.1, poisonous materials marked PG I (Inhalation Hazard), or PG III (Stow Away From Foodstuffs).

Exceptions:

1. Tank vehicles or containers that have been sufficiently clean of residue and purged of vapor to remove an potential hazard;
2. Tank vehicles or containers that have been reloaded with a material not classified as a hazardous material.

14.1.6 Alternative-fuel vehicles powered by liquefied petroleum gas (LPG), liquefied natural gas (LNG) or compressed natural gas (CNG) are permitted if the:

- (1) Vehicle has a dedicated alternative-fuel system installed by the manufacturer of the vehicle.
- (2) Vehicle has a fuel system that has been properly converted to an alternative fuel system.
- (3) Vehicle alternative-fuel system conforms to applicable industry standards, including:
 - (a) NFPA 52-Standard for Compressed Natural Gas (CNG) Vehicular Fuel Systems, which is incorporated by reference; or
 - (b) NFPA 58-Standard for the Storage and Handling of Liquefied Petroleum Gases (LPG), which is incorporated by reference; or
- (4) Vehicle alternative-fuel system conforms to applicable federal regulations.
- (5) Fuel capacity of the vehicle does not exceed 300 pounds water capacity.

14.1.6.1 Alternative-fuel vehicles shall display all markings and symbols required by law to identify the alternative-fuel system.

Annex A Explanatory Material

A.12.4 It is expected that the operations of all systems within the vicinity of a fire can fail. Section 12.4 is intended to limit the area of such failure. The class defines the minimum time, in hours, that the Emergency Power Supply System (EPSS) 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 installation, performance and maintenance. Level 1 systems shall be installed if failure of the EPSS to perform could result in loss of human life or serious injuries.
