

Part III—Building and Equipment Design Features

CHAPTER 5

FIRE SERVICE FEATURES

User note:

About this chapter: Chapter 5 provides requirements that apply to all buildings and occupancies and pertain to access roads, access to building openings and roofs, premises identification, key boxes, fire protection water supplies, fire command centers, fire department access to equipment and emergency responder radio coverage in buildings. Although many safety features are part of the building design, features such as proper fire department access roads and radio coverage are necessary in case of emergency and are important tools for emergency responders for public safety and their own safety.

SECTION 501 GENERAL

501.1 Scope. Fire service features for buildings, structures and premises shall comply with this chapter.

501.2 Permits. A permit shall be required as set forth in Sections 105.6 and 105.7.

501.3 Construction documents. *Construction documents* for proposed fire apparatus access, location of *fire lanes*, security gates across fire apparatus access roads and *construction documents* and hydraulic calculations for fire hydrant systems shall be submitted to the fire department for review and approval prior to construction.

501.4 Timing of installation. Where fire apparatus access roads or a water supply for fire protection are required to be installed, such protection shall be installed and made serviceable prior to and during the time of construction except where *approved* alternative methods of protection are provided. Temporary street signs shall be installed at each street intersection where construction of new roadways allows passage by vehicles in accordance with Section 505.2.

SECTION 502 DEFINITIONS

502.1 Definitions. The following terms are defined in Chapter 2:

AGENCY.

FIRE APPARATUS ACCESS ROAD.

FIRE COMMAND CENTER.

FIRE DEPARTMENT MASTER KEY.

FIRE LANE.

KEY BOX.

TRAFFIC CALMING DEVICES.

SECTION 503 FIRE APPARATUS ACCESS ROADS

[S] **503.1 Where required.** Fire apparatus access roads shall be provided and maintained in accordance with Sections 503.1.1 through 503.1.3 and Appendix D as amended.

[S] **503.1.1 Buildings and facilities.** *Approved* fire apparatus access roads shall be provided for every facility, building or portion of a building hereafter constructed or moved into or within the jurisdiction. The fire apparatus access road shall comply with the requirements of this section and shall extend to within 150 feet (45 720 mm) of all portions of the facility and all portions of the *exterior walls* of the first story of the building as measured by an *approved* route around the exterior of the building or facility.

Exceptions:

1. The *fire code official* is authorized to increase the dimension ~~((of 150 feet (45 720 mm)))~~ where any of the following conditions occur:
 - 1.1. The distance may be increased to 375 feet when the building is equipped throughout with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 ((;)) or 903.3.1.2. ~~((or 903.3.1.3.))~~ The distance may be increased to 500 feet for one- or two-family dwellings when the building is equipped with an approved automatic sprinkler system installed in accordance with Section 903.3.1.3.
 - 1.2. Fire apparatus access roads cannot be installed because of location on property, topography, waterways, nonnegotiable grades or other similar conditions, and an *approved* alternative means of fire protection is provided.
 - 1.3. ~~((There are not more than two Group R-3 or Group U occupancies.))~~ The distance may be increased to 200 feet for not more than two one- and two-family dwellings served by an access road. The access road can serve more than two dwellings, but only two are permitted to use the 200-foot distance.
 - 1.4. Where smoke detection monitored by a central station is provided throughout school portables exceeding the 150-foot distance.
2. Where approved by the *fire code official*, fire apparatus access roads shall be permitted to be exempted or modified for solar photovoltaic power generation facilities.

503.1.2 Additional access. The *fire code official* is authorized to require more than one fire apparatus access road based on the potential for impairment of a single road by vehicle congestion, condition of terrain, climatic conditions or other factors that could limit access.

503.1.3 High-piled storage. Fire department vehicle access to buildings used for *high-piled combustible storage* shall comply with the applicable provisions of Chapter 32.

503.2 Specifications. Fire apparatus access roads shall be installed and arranged in accordance with Sections 503.2.1 through 503.2.8.

[S] **503.2.1 Dimensions.** Fire apparatus access roads shall have an unobstructed width of not less than 20 feet (6096 mm), exclusive of shoulders, except for *approved* security gates in accordance with Section 503.6, and an unobstructed vertical clearance of not less than ~~((13 feet 6 inches (4115 mm)))~~ 14 feet (4267 mm).

Exceptions:

1. Access roads serving not more than two Group R-3 or U occupancies shall have an unobstructed width of not less than 12 feet.
2. Public streets shall be in accordance with the Seattle Right-of-Way Improvements Manual.

503.2.2 Authority. The *fire code official* shall have the authority to require or permit modifications to the required access widths where they are inadequate for fire or rescue operations or where necessary to meet the public safety objectives of the jurisdiction.

503.2.3 Surface. Fire apparatus access roads shall be designed and maintained to support the imposed loads of fire apparatus and shall be surfaced so as to provide all-weather driving capabilities.

[S] **503.2.4 Turning radius.** The required turning radius of a fire apparatus access road shall be ~~((determined by the fire code official.))~~ 25 feet minimum inside curb and 50 feet minimum outside curb.

[S] **503.2.5 Dead ends.** Dead-end fire apparatus access roads in excess of 150 feet (45 720 mm) in length shall be provided with ~~((an approved area for turning around fire apparatus))~~ a turnaround in accordance with Appendix D as amended.

[S] **503.2.6 Bridges and elevated surfaces.** Where a bridge or an elevated surface is part of a fire apparatus access road, the bridge shall be constructed and maintained in accordance with ~~((AASHTO HB-17))~~ the Seattle Right-of-Way Improvements Manual. Bridges and elevated surfaces shall be designed for a live load sufficient to carry the imposed loads of fire apparatus. Vehicle load limits shall be posted at both entrances to bridges where required by the *fire code official*. Where elevated surfaces designed for emergency vehicle use are adjacent to surfaces that are not designed for such use, *approved* barriers, *approved* signs or both shall be installed and maintained where required by the *fire code official*.

[S] **503.2.7 Grade.** The grade of the fire apparatus access road shall be ~~((within the limits established by the fire code official based on the fire department's apparatus))~~ in accordance with Appendix D as amended.

[S] **503.2.8 Angles of approach and departure.** The angles of approach and departure for fire apparatus access roads shall be ~~((within the limits established by the fire code official based on the fire department's apparatus))~~ in accordance with the Seattle Right-of-Way Improvements Manual.

503.3 Marking. Where required by the *fire code official*, *approved* signs or other *approved* notices or markings that include the words NO PARKING—FIRE LANE shall be provided for fire apparatus access roads to identify such roads or prohibit

the obstruction thereof. The means by which *fire lanes* are designated shall be maintained in a clean and legible condition at all times and be replaced or repaired when necessary to provide adequate visibility.

503.4 Obstruction of fire apparatus access roads. Fire apparatus access roads shall not be obstructed in any manner, including the parking of vehicles. The minimum widths and clearances established in Sections 503.2.1 and 503.2.2 shall be maintained at all times.

503.4.1 Traffic calming devices. Traffic calming devices shall be prohibited unless *approved* by the *fire code official*.

503.5 Required gates or barricades. The *fire code official* is authorized to require the installation and maintenance of gates or other *approved* barricades across fire apparatus access roads, trails or other accessways, not including public streets, alleys or highways. Electric gate operators, where provided, shall be *listed* in accordance with UL 325. Gates intended for automatic operation shall be designed, constructed and installed to comply with the requirements of ASTM F2200.

503.5.1 Secured gates and barricades. Where required, gates and barricades shall be secured in an *approved* manner. Roads, trails and other accessways that have been closed and obstructed in the manner prescribed by Section 503.5 shall not be trespassed on or used unless authorized by the *owner* and the *fire code official*.

Exception: The restriction on use shall not apply to public officers acting within the scope of duty.

503.6 Security gates. The installation of security gates across a fire apparatus access road shall be *approved* by the *fire code official*. Where security gates are installed, they shall have an *approved* means of emergency operation. The security gates and the emergency operation shall be maintained operational at all times. Electric gate operators, where provided, shall be *listed* in accordance with UL 325. Gates intended for automatic operation shall be designed, constructed and installed to comply with the requirements of ASTM F2200.

SECTION 504

ACCESS TO BUILDING OPENINGS AND ROOFS

504.1 Required access. Exterior doors and openings required by this code or the *International Building Code* shall be maintained readily accessible for emergency access by the fire department. An *approved* access walkway leading from fire apparatus access roads to exterior openings shall be provided where required by the *fire code official*.

504.2 Maintenance of exterior doors and openings. Exterior doors and their function shall not be eliminated without prior approval. Exterior doors that have been rendered nonfunctional and that retain a functional door exterior appearance shall have a sign affixed to the exterior side of the door with the words THIS DOOR BLOCKED. The sign shall consist of letters having a principal stroke of not less than 3/4 inch (19.1 mm) wide and not less than 6 inches (152 mm) high on a contrasting background. Required fire department access doors shall not be obstructed or eliminated. Exit and *exit access* doors shall comply with Chapter 10. Access doors for *high-piled combustible storage* shall comply with Section 3206.7.

504.3 Stairway access to roof. New buildings four or more stories above grade plane, except those with a roof slope greater than four units vertical in 12 units horizontal (33.3-percent slope), shall be provided with a *stairway* to the roof. *Stairway* access to the roof shall be in accordance with Section 1011.12. Such *stairway* shall be marked at street and floor levels with a sign indicating that the *stairway* continues to the roof. Where roofs are used for roof gardens or for other purposes, *stairways* shall be provided as required for such occupancy classification.

SECTION 505

PREMISES IDENTIFICATION

505.1 Address identification. New and existing buildings shall be provided with *approved* address identification. The address identification shall be legible and placed in a position that is visible from the street or road fronting the property. Address identification characters shall contrast with their background. Address numbers shall be Arabic numbers or alphabetical letters. Numbers shall not be spelled out. Each character shall be not less than 4 inches (102 mm) high with a minimum stroke width of 1/2 inch (12.7 mm). Where required by the *fire code official*, address identification shall be provided in additional *approved* locations to facilitate emergency response. Where access is by means of a private road and the building cannot be viewed from the *public way*, a monument, pole or other sign or means shall be used to identify the structure. Address identification shall be maintained.

505.2 Street or road signs. Streets and roads shall be identified with *approved* signs. Temporary signs shall be installed at each street intersection when construction of new roadways allows passage by vehicles. Signs shall be of an *approved* size, weather resistant and be maintained until replaced by permanent signs.

SECTION 506 KEY BOXES

506.1 Point of Information

The *fire code official* has approved the “KnoxBox” as the access key box for use in the City of Seattle. For more information see Seattle Fire Department Information Bulletin 5965, Key Boxes for Emergency Access.

[S] **506.1 Where required.** Key boxes shall be installed in accordance with this section.

[S] **506.1.1 Access key box.** Where access to or within a structure or an area is restricted because of secured openings or where immediate access is necessary for life-saving or fire-fighting purposes, the *fire code official* is authorized to require a key box to be installed in an *approved* location. The key box shall be of an *approved* type listed in accordance with UL 1037, and shall contain keys to gain necessary access as required by the *fire code official*.

[S] (~~506.1.1 Locks.~~ An *approved* lock shall be installed on gates or similar barriers where required by the *fire code official*.)

~~506.1.2 Key boxes for nonstandardized fire service elevator keys.~~ Key boxes provided for nonstandardized fire service elevator keys shall comply with Section 506.1 and all of the following:

- ~~1. The key box shall be compatible with an existing rapid entry key box system in use in the jurisdiction and *approved* by the *fire code official*.~~
- ~~2. The front cover shall be permanently labeled with the words “Fire Department Use Only—Elevator Keys.”~~
- ~~3. The key box shall be mounted at each elevator bank at the lobby nearest to the lowest level of fire department access.~~
- ~~4. The key box shall be mounted 5 feet 6 inches (1676 mm) above the finished floor to the right side of the elevator bank.~~
- ~~5. Contents of the key box are limited to fire service elevator keys. Additional elevator access tools, keys and information pertinent to emergency planning or elevator access shall be permitted where authorized by the *fire code official*.~~
- ~~6. In buildings with two or more elevator banks, a single key box shall be permitted to be used where such elevator banks are separated by not more than 30 feet (9144 mm). Additional key boxes shall be provided for each individual elevator or elevator bank separated by more than 30 feet (9144 mm).~~

Exception: A single key box shall be permitted to be located adjacent to a *fire command center* or the non-standard fire service elevator key shall be permitted to be secured in a key box used for other purposes and located in accordance with Section 506.1.)

[S] **506.1.2. Elevator key box.** An elevator key box locked and keyed to the standard city elevator key box access key shall be provided at the designated recall floor above the Phase I recall switch or in the main lobby above the hall call button when no recall feature exists.

[S] **506.1.2.1 Elevator key box requirements.** The elevator key box shall meet the following standards:

1. Dimensions – 8 inches (203 mm) high, 6 inches (152 mm) wide and 1 inch (25 mm) deep.
2. Material – 16 gauge steel welded.
3. Color – red unless located in the main lobby above the call button, 6 feet nominal above the floor, in which case any color is approved.
4. Labeling – “FOR FIRE DEPARTMENT USE.”
5. Lock openable with factory restricted Medeco 3, level 7 key.
6. Mounting height shall be 6 feet (1829 mm) nominal above the floor.

[S] **506.1.2.2 Elevator key box contents.** Keys for access to and for the operation of elevator equipment shall be tagged, labeled, and retained in the key box. The elevator key box shall contain standard and non-standard fire emergency service keys (Phase I and II, one key for each switch) in addition to keys for all of the following:

1. Machine room door;
2. Secondary level door;
3. Pit door;
4. Roof door;
5. Independent, hospital emergency and/or attendant operation;
6. Hoistway access;
7. Mechanical hoist access devices (broken arm, lunar, etc.);
8. Miscellaneous switch keys;

9. Fire alarm panel room.
10. Sprinkler valve control room.

506.1.2.2 Point of Information

Due to security consideration, elevator key boxes should not contain master keys to tenant spaces. Keys in elevator key boxes should be limited to those for access of the building systems and equipment listed in *Seattle Fire Code, Section 506.1.2.2.*

[S] 506.1.3 Locks. An approved lock shall be installed on gates or similar barriers when required by the fire code official.

506.2 Key box maintenance. The operator of the building shall immediately notify the *fire code official* and provide the new key where a lock is changed or rekeyed. The key to such lock shall be secured in the key box.

SECTION 507 FIRE PROTECTION WATER SUPPLIES

[S] 507.1 Required water supply. An approved water supply capable of supplying the required fire flow for fire protection shall be provided to premises on which facilities, buildings or portions of buildings are hereafter constructed or moved into or within the jurisdiction, and for buildings undergoing a substantial alteration as determined by the Seattle Department of Construction and Inspections.

507.2 Type of water supply. A water supply shall consist of reservoirs, pressure tanks, elevated tanks, water mains or other fixed systems capable of providing the required fire flow.

507.2.1 Private fire service mains. Private fire service mains and appurtenances shall be installed in accordance with NFPA 24.

507.2.2 Water tanks. Water tanks for private fire protection shall be installed in accordance with NFPA 22.

[W][S] 507.3 Fire flow. Fire-flow requirements for buildings or portions of buildings and facilities shall be ~~((determined by an approved method))~~ in accordance with Appendix B.

Exceptions:

1. Fire flow is not required for structures under 500 square feet with a B, U, or R-1 occupancy where structures are at least 30 feet from any other structure and are used only for recreation.
2. In rural and suburban areas in which adequate and reliable water supply do not exist, the fire code official is authorized to utilize NFPA 1142 or the *International Wildland-Urban Interface Code.*
3. Fire flow requirements for shipyards and designated marine hot work facilities shall be in accordance with Administrative Rule 26.02.14 and any future revisions to this rule adopted by the fire code official.
4. Fire flow requirements for new and existing covered marinas shall be in accordance with Chapters 36 and 94 respectively.

507.4 Water supply test. The *fire code official* shall be notified prior to the water supply test. Water supply tests shall be witnessed by the *fire code official* or approved documentation of the test shall be provided to the *fire code official* prior to final approval of the water supply system.

507.5 Fire hydrant systems. Fire hydrant systems shall comply with Sections 507.5.1 through 507.5.6.

507.5.1 Where required. Where a portion of the facility or building hereafter constructed or moved into or within the jurisdiction is more than 400 feet (122 m) from a hydrant on a fire apparatus access road, as measured by an *approved* route around the exterior of the facility or building, on-site fire hydrants and mains shall be provided where required by the *fire code official*.

Exceptions:

1. For Group R-3 and Group U occupancies, the distance requirement shall be 600 feet (183 m).
2. For buildings equipped throughout with an *approved automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2, the distance requirement shall be 600 feet (183 m).

507.5.1.1 Hydrant for standpipe systems. Buildings equipped with a standpipe system installed in accordance with Section 905 shall have a fire hydrant within 100 feet (30 480 mm) of the fire department connections.

Exception: The distance shall be permitted to exceed 100 feet (30 480 mm) where *approved* by the *fire code official*.

507.5.2 Inspection, testing and maintenance. Fire hydrant systems shall be subject to periodic tests as required by the *fire code official*. Fire hydrant systems shall be maintained in an operative condition at all times and shall be repaired where defective. Additions, repairs, *alterations* and servicing shall comply with *approved* standards. Records of tests and required maintenance shall be maintained.

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507.5.3 Private fire service mains and water tanks. Private fire service mains and water tanks shall be periodically inspected, tested and maintained in accordance with NFPA 25 at the following intervals:

1. Private fire hydrants of all types: Inspection annually and after each operation; flow test and maintenance annually.
2. Fire service main piping: Inspection of exposed, annually; flow test every 5 years.
3. Fire service main piping strainers: Inspection and maintenance after each use.

Records of inspections, testing and maintenance shall be maintained.

507.5.4 Obstruction. Unobstructed access to fire hydrants shall be maintained at all times. The fire department shall not be deterred or hindered from gaining immediate access to fire protection equipment or fire hydrants.

507.5.5 Clear space around hydrants. A 3-foot (914 mm) clear space shall be maintained around the circumference of fire hydrants, except as otherwise required or *approved*.

[S] 507.5.6 Physical protection. Where fire hydrants are subject to impact by a motor vehicle, guard posts or other *approved* means shall comply with Section 312. Any horizontal, lateral, or diagonal elements that are a part of the protection for a fire hydrant shall not interfere with the ability to freely access and safely operate the hydrant.

SECTION 508 FIRE COMMAND CENTER

508.1 General. Where required by other sections of this code and in all buildings classified as high-rise buildings by the *International Building Code*, a *fire command center* for fire department operations shall be provided and shall comply with Sections 508.1.1 through 508.1.6.

508.1.1 Location and access. The location and accessibility of the *fire command center* shall be *approved* by the *fire code official*.

[W][S] 508.1.2 Separation. The *fire command center* shall be separated from the remainder of the building by not less than a ((±)) 2-hour *fire barrier* constructed in accordance with Section 707 of the *International Building Code* or *horizontal assembly* constructed in accordance with Section 711 of the *International Building Code*, or both.

[S] 508.1.3 Size. The *fire command center* shall be not less than ((0.015 percent of the total building area of the facility served or)) 200 square feet (19 m²) in area, ((which ever is greater,)) with a minimum dimension of ((0.7 times the square root of the room area or)) 10 feet (3048 mm), ((, whichever is greater.))

508.1.4 Layout approval. A layout of the *fire command center* and all features required by this section to be contained therein shall be submitted for approval prior to installation.

508.1.5 Storage. Storage unrelated to operation of the *fire command center* shall be prohibited.

[S] 508.1.6 Required features. The *fire command center* shall comply with NFPA 72 and shall contain the following features:

1. The emergency voice/alarm communication system control unit.
2. The fire department communications system.
3. Fire detection and alarm system annunciator.
4. Annunciator unit visually indicating the location of the elevators and whether they are operational.
5. Status indicators and controls for air distribution systems.
6. The fire fighter's control panel required by Section 909.16 for smoke control systems installed in the building.
7. Controls for unlocking *interior exit stairway* doors simultaneously.
8. Sprinkler valve and water-flow detector display panels.
9. Emergency and standby power status indicators.
10. A telephone for fire department use with controlled access to the public telephone system.
11. Fire pump status indicators.
12. Schematic building plans indicating the typical floor plan and detailing the building core, *means of egress*, *fire protection systems*, fire-fighter air-replenishment systems, fire-fighting equipment and fire department access, and the location of *fire walls*, *fire barriers*, *fire partitions*, *smoke barriers* and smoke partitions.
13. An *approved* Building Information Card that includes, but is not limited to, all of the following information:
 - 13.1. General building information that includes: property name, address, the number of floors in the building above and below grade, use and occupancy classification (for mixed uses, identify the different types of occupancies on each floor) and the estimated building population during the day, night and weekend;

- 13.2. Building emergency contact information that includes: a list of the building's emergency contacts including but not limited to building manager, building engineer and their respective work phone number, cell phone number and e-mail address;
 - 13.3. Building construction information that includes: the type of building construction including but not limited to floors, walls, columns and roof assembly;
 - 13.4. *Exit access stairway* and *exit stairway* information that includes: number of *exit access stairways* and *exit stairways* in building; each *exit access stairway* and *exit stairway* designation and floors served; location where each *exit access stairway* and *exit stairway* discharges, *interior exit stairways* that are pressurized; *exit stairways* provided with emergency lighting; each *exit stairway* that allows reentry; *exit stairways* providing roof access; elevator information that includes: number of elevator banks, elevator bank designation, elevator car numbers and respective floors that they serve; location of elevator machine rooms, control rooms and control spaces; location of sky lobby; and location of freight elevator banks;
 - 13.5. Building services and system information that includes: location of mechanical rooms, location of building management system, location and capacity of all fuel oil tanks, location of emergency generator and location of natural gas service;
 - 13.6. *Fire protection system* information that includes: location of standpipes, location of fire pump room, location of fire department connections, floors protected by automatic sprinklers and location of different types of *automatic sprinkler systems* installed including but not limited to dry, wet and pre-action;
 - 13.7. Hazardous material information that includes: location and quantity of hazardous material.
14. Work table.
 15. Generator supervision devices, manual start and (~~transfer~~) stop features.
 16. Public address system, where specifically required by other sections of this code.
 17. Elevator fire recall switch in accordance with ASME A17.1/CSA B44.
 18. Elevator emergency or standby power selector switch(es), where emergency or *legally required* standby power is provided.
 19. On-site fire protection water tank fill valve control switch, tank level indicators, tank low level alarm, and tank fill signal.

SECTION 509

FIRE PROTECTION AND UTILITY EQUIPMENT IDENTIFICATION AND ACCESS

509.1 Identification. Fire protection equipment shall be identified in an *approved* manner. Rooms containing controls for air-conditioning systems, sprinkler risers and valves, or other fire detection, suppression or control elements shall be identified for the use of the fire department. *Approved* signs required to identify fire protection equipment and equipment location shall be constructed of durable materials, permanently installed and readily visible.

509.1.1 Utility identification. Where required by the *fire code official*, gas shutoff valves, electric meters, service switches and other utility equipment shall be clearly and legibly marked to identify the unit or space that it serves. Identification shall be made in an *approved* manner, readily visible and shall be maintained.

509.2 Equipment access. *Approved* access shall be provided and maintained for all fire protection equipment to permit immediate safe operation and maintenance of such equipment. Storage, trash and other materials or objects shall not be placed or kept in such a manner that would prevent such equipment from being readily accessible.

SECTION 510

EMERGENCY RESPONDER RADIO COVERAGE

[S] 510.1 Emergency responder radio coverage in new buildings. (~~New buildings shall have approved~~) *Approved* radio coverage for emergency responders shall be provided within (~~the~~) buildings (~~based on the existing coverage levels of the public safety communication systems utilized by the jurisdiction, measured at the exterior of the building-~~) meeting any of the following conditions:

1. High rise buildings;
2. The total building area is 50,000 square feet or more;
3. The total *basement* area is 10,000 square feet or more; or
4. There are floors used for human occupancy more than 30 feet below the finished floor of the lowest level of exit discharge.

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The radio coverage system shall be installed in accordance with Sections 510.4 through 510.5.5 of this code and the provisions of NFPA 1221 (2019), Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems. This section shall not require improvement of the existing public safety communication systems.

Exceptions:

- ~~((1. Where approved by the building official and the fire code official, a wired communication system in accordance with Section 907.2.12.2 shall be permitted to be installed or maintained instead of an approved radio coverage system.~~
- ~~2. Where it is determined by the fire code official that the radio coverage system is not needed.))~~
1. Buildings and areas of buildings that have minimum radio coverage signal strength levels of the King County Regional 800 MHz Radio System within the building in accordance with Section 510.4.1 without the use of a radio coverage system.
 2. In facilities where emergency responder radio coverage is required and such systems, components or equipment required could have a negative impact on the normal operations of that facility, the *fire code official* shall have the authority to accept an automatically activated emergency responder radio coverage system.
 3. One- and two-family dwellings and townhouses.

510.2 Emergency responder radio coverage in existing buildings. Existing buildings shall be provided with *approved* radio coverage for emergency responders as required in Chapter 11.

510.3 Permit required. A construction permit for the installation of or modification to emergency responder radio coverage systems and related equipment is required as specified in Section 105.7.6. Maintenance performed in accordance with this code is not considered a modification and does not require a permit.

Point of Information

Prior coordination and approval from the Public Safety Radio System Operator is required before installation of an Emergency Responder Radio System. Until 2022, such approval is required from Seattle. In 2022 PSERN will be the single operator of a county wide system. In order to be forward compatible, designers and contractors should be aware of PSERN's requirements for Distributed Antenna Systems which can be found via www.psern.org/requirements.

[W][S] 510.4 Technical requirements. Systems, components, and equipment required to provide the emergency responder radio coverage systems shall comply with Sections 510.4.1 through 510.4.2.8.

[S] 510.4.1 Emergency responder communication enhancement system signal strength. The building shall be considered to have acceptable emergency responder communications enhancement system coverage when signal strength measurements in ~~((95))~~ 90 percent of all areas on each floor of the building meet the signal strength requirements in Sections 510.4.1.1 through 510.4.1.3.

[W][S] 510.4.1.1 Minimum signal strength into the building. The minimum inbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the *fire code official*. The inbound signal level shall be a minimum of -95 dBm in 95 percent of the coverage area and 99 percent in critical areas and sufficient to provide not less than a Delivered Audio Quality (DAQ) of 3.0 or an equivalent Signal-to-Interference-Plus-Noise Ratio (SINR) applicable to the technology for either analog or digital signals.

[S] 510.4.1.2 Minimum signal strength out of the building. The minimum outbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the *fire code official*. The outbound signal level shall be sufficient to provide not less than a DAQ of 3.0 or an equivalent SINR applicable to the technology for either analog or digital signals.

Exception: Critical areas, such as the *fire command center(s)*, the fire pump room(s), *interior exit stairways, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas required by the fire code official*, shall be provided with 99 percent floor area radio coverage.

[S] 510.4.1.3 System performance. Signal strength shall be sufficient to meet the requirements of the applications being utilized by public safety for emergency operations through the coverage area as specified by the ~~((fire code official))~~ Public Safety Radio System Operator in Section 510.4.2.2.

Point of Information

When determining if the minimum signal strength referenced in Section 510.4.1.1 exists at a subject building, the signal strength shall be measured at any point on the exterior of the building up to the highest point on the roof.

[S] 510.4.2 System design. The emergency responder radio coverage system shall be designed in accordance with Sections 510.4.2.1 through 510.4.2.8 and NFPA 1221 (2019).

[S] 510.4.2.1 Amplification systems and components. Buildings and structures that cannot support the required level of radio coverage shall be equipped with systems and components to enhance the public safety radio signals and achieve the

required level of radio coverage specified in Sections 510.4.1 through 510.4.1.3. Public safety communications enhancement systems utilizing radio-frequency-emitting devices and cabling shall be ~~((approved))~~ allowed by the ~~((fire code official))~~ Public Safety Radio System Operator. Prior to installation, all RF-emitting devices shall have the certification of the ~~((radio licensing authority))~~ Public Safety Radio System Operator and be suitable for public safety use.

510.4.2.2 Technical criteria. The ~~((fire code official))~~ Public Safety Radio System Operator shall ~~((maintain a document providing the specific technical information and requirements for the emergency responder communications coverage system. This document shall contain, but not be limited to,))~~ provide the various frequencies required, the location of radio sites, the effective radiated power of radio sites, the maximum propagation delay in microseconds, the applications being used and other supporting technical information necessary for system design upon request by the building owner or owner's representative.

510.4.2.3 ((Standby power)) Power supply sources. Emergency responder radio coverage systems shall be provided with dedicated standby batteries or provided with 2-hour standby batteries and connected to the facility generator power system in accordance with Section 1203. The standby power supply shall be capable of operating the emergency responder radio coverage system at 100-percent system capacity for a duration of not less than 12 hours.

[W][S] 510.4.2.4 Signal booster requirements. If used, signal boosters shall meet the following requirements:

1. All signal booster components shall be contained in a National Electrical Manufacturer's Association (NEMA) 4, IP66-type waterproof cabinet or equivalent.

Exception: Listed battery systems that are contained in integrated battery cabinets.

2. Battery systems used for the emergency power source shall be contained in a NEMA 3R or higher-rated cabinet, IP65-type waterproof cabinet or equivalent.

Exception: Listed battery systems that are contained in integrated battery cabinets.

3. Equipment shall have FCC or other radio licensing authority certification and be suitable for public safety use prior to installation.
4. Where a donor antenna exists, isolation shall be maintained between the donor antenna and all inside antennas to not less than 20dB greater than the system gain under all operating conditions.
5. Bi-Directional Amplifiers (BDAs) used in emergency responder radio coverage systems shall ~~((have))~~ be fitted with anti-oscillation ((prevention)) circuitry and per-channel AGC.
6. The installation of amplification systems or systems that operate on or provide the means to cause interference on any emergency responder radio coverage networks shall be coordinated and approved by the ~~((fire code official))~~ Public Safety Radio System Operator.
7. Unless otherwise approved by the Public Safety Radio System Operator, only channelized signal boosters shall be permitted.

Exception: Broadband BDAs may be utilized when specifically authorized in writing by the Public Safety Radio System Operator.

Point of Information

BDAs must also comply with PSERN's (www.psern.org/requirements) detailed requirements, which include channelized, minimum of 28 channels, supporting analog, P25 Phase I (FDMA), and P25 Phase II (TDMA).

[S] 510.4.2.5 System monitoring. The emergency responder radio enhancement system shall ~~((be monitored by a listed fire alarm control unit, or where approved by the fire code official, shall sound an audible signal at a constantly attended on-site location))~~ include automatic supervisory and trouble signals that are monitored by a supervisory service and are annunciated by the fire alarm system in accordance with NFPA 72. ((Automatic supervisory signals shall include the)) The following conditions shall be separately annunciated by the fire alarm system, or, if the status of each of the following conditions is individually displayed on a dedicated panel on the radio enhancement system, a single automatic supervisory signal may be annunciated on the fire alarm system indicating deficiencies of the radio enhancement system:

1. Loss of normal AC power supply.
2. System battery charger(s) failure.
3. Malfunction of the donor antenna(s).
4. Failure of active RF-emitting device(s).
5. Low-battery capacity at 70-percent reduction of operating capacity.
6. ~~((Failure of critical system components))~~ Active system component malfunction.
7. ~~((The))~~ Malfunction of the communications link between the *fire alarm system* and the emergency responder radio enhancement system.

510.4.2.6 Additional frequencies and change of frequencies. The emergency responder radio coverage system shall be capable of modification or expansion in the event frequency changes are required by the FCC or other radio licensing authority, or additional frequencies are made available by the FCC or other radio licensing authority.

510.4.2.7 Design documents. The *fire code official* shall have the authority to require “as-built” design documents and specifications for emergency responder communications coverage systems. The documents shall be in a format acceptable to the *fire code official*.

510.4.2.8 Radio communication antenna density. Systems shall be engineered to minimize the near-far effect. Radio enhancement system designs shall include sufficient antenna density to address reduced gain conditions.

Exceptions:

1. Class A narrow band signal booster devices with independent AGC/ALC circuits per channel.
2. Systems where all portable devices within the same band use active power control features.

[W][S] 510.5 Installation requirements. The installation of the public safety radio coverage system shall be in accordance with NFPA 1221 and Sections 510.5.1 through ~~((510.5.4))~~ 510.5.7.

[S] 510.5.1 Approval prior to installation. Amplification systems capable of operating on frequencies licensed to any public safety agency by the FCC or other radio licensing authority shall not be installed without prior coordination and approval of the ~~((fire code official))~~ Public Safety Radio System Manager.

[S] 510.5.2 Minimum qualifications of personnel. The minimum qualifications of the system designer and lead ~~((installation))~~ acceptance test personnel shall include both of the following:

1. A valid FCC-issued general radio telephone operators license.
2. Certification of in-building system training issued by an approved organization or approved school, or a certificate issued by the manufacturer of the equipment being installed.

~~((These qualifications shall not be required where demonstration of adequate skills and experience satisfactory to the fire code official is provided.))~~

[W][S] 510.5.3 Acceptance test procedure and system certification. Where an emergency responder radio coverage system is required, and upon completion of installation, the building *owner* shall have the radio system tested to verify that two-way coverage on each floor of the building is ~~((not less than 95 percent))~~ in accordance with Section 510.4.1. The test procedure shall be conducted as follows:

1. Talk-back testing from a site to the King County Regional 800 MHz Radio System shall use Seattle Fire Department radio(s) and be witnessed by a representative of the Seattle Fire Department.

~~((+))~~ 2. Each floor of the building shall be divided into a grid of 20 approximately equal test areas, with a maximum test area size of 6,400 square feet. Where the floor area exceeds 128,000 square feet, the floor shall be divided into as many approximately equal test areas as needed, such that no test area exceeds the maximum square footage allowed for a test area.

~~((2. The test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency talking through the agency’s radio communications system or equipment approved by the fire code official.))~~

3. Coverage testing of signal strength shall be conducted using a calibrated spectrum analyzer for each of the test grids. A diagram of this testing shall be created for each floor where coverage is provided, indicating the testing grid used for the test in Section 510.5.3(1), and including signal strengths and frequencies for each test area. Indicate all critical areas.

4. Functional talk-back testing shall be conducted using two calibrated portable radios of the latest brand and model used by the agency’s radio communications system or other equipment approved by the fire code official. Testing shall use Digital Audible Quality (DAQ) metrics, where a passing result is a DAQ of 3 or higher. Communications between handsets shall be tested and recorded in the grid square diagram required by Section 510.5.3(2); each grid square on each floor; between each critical area and a radio outside the building; between each critical area and the fire command center or fire alarm control panel; between each landing in each stairwell and the fire command center or fire alarm panel.

~~((3))~~ 5. Failure of more than ~~((one))~~ 5 percent of the test areas on any floor shall result in failure of the test.

Exception: Critical areas shall be provided with 99 percent floor area radio coverage.

~~((4))~~ 6. In the event that two of the test areas fail the test, in order to be more statistically accurate, the floor shall be permitted to be divided into 40 equal test areas. Failure of not more than two nonadjacent test areas shall not result in failure of the test. If the system fails the 40-area test, the system shall be altered to meet the 95-percent coverage requirement.

- ((5)) 7. A test location approximately in the center of each test area shall be selected for the test, with the radio enabled to verify two-way communications to and from the outside of the building through the ~~((public agency's radio communications system))~~ King County Regional 800 MHz Radio System. Once the test location has been selected, that location shall represent the entire test area. Failure in the selected test location shall be considered failure of that test area. Additional test locations shall not be permitted.
- ((6)) 8. The gain values of all amplifiers shall be measured and the test measurement results shall be kept on file with the building *owner* so that the measurements can be verified during annual tests. In the event that the measurement results become lost, the building *owner* shall be required to rerun the acceptance test to reestablish the gain values.
- ((7)) 9. As part of the installation, a spectrum analyzer or other suitable test equipment shall be utilized to ensure spurious oscillations are not being generated by the subject signal booster. This test shall be conducted at the time of installation and at subsequent annual inspections.
- ((8)) 10. Systems incorporating Class B signal-booster devices or Class B broadband fiber remote devices shall be tested using two portable radios simultaneously conducting subjective voice quality checks. One portable radio shall be positioned not greater than 10 feet (3048 mm) from the indoor antenna. The second portable radio shall be positioned at a distance that represents the farthest distance from any indoor antenna. With both portable radios simultaneously keyed up on different frequencies within the same band, subjective audio testing shall be conducted and comply with DAQ levels as specified in Sections 510.4.1.1 and 510.4.1.2.
- 11. **Documentation maintained on premises.** At the conclusion of the testing, and prior to issuance of the building certificate of occupancy, the building owner or owner's representative shall place a copy of the following records in the Distributed Antenna System enclosure or the building engineer's office. The records shall be available to the fire code official and maintained by the building owner for the life of the system:
 - a. A certification letter stating that the emergency responder radio coverage system has been installed and tested in accordance with this code, and that the system is complete and fully functional.
 - b. The grid square diagram created as part of testing in Sections 510.5.3(2) and 510.5.3(3).
 - c. Data sheets and/or manufacturer specifications for the emergency responder radio coverage system equipment; back up battery; and charging system (if utilized).
 - d. A diagram showing device locations and wiring schematic.
 - e. A copy of the electrical permit.
- 12. **Acceptance test reporting to fire code official.** At the conclusion of the testing, and prior to issuance of the building certificate of occupancy, the building owner or owner's representative shall submit to the *fire code official* a report of the acceptance test by way of the department's third-party vendor thecomplianceengine.com

510.5.4 FCC compliance. The emergency responder radio coverage system installation and components shall comply with all applicable federal regulations including, but not limited to, FCC 47 CFR Part 90.219.

[W][S] 510.5.5 Mounting of the donor antenna(s). To maintain proper alignment with the system designed donor site, donor antennas shall be permanently affixed on the highest possible position on the building or where approved by the *fire code official*. A clearly visible sign stating "Movement or repositioning of this antenna is prohibited without approval from the fire code official." The antenna installation shall be in accordance with the applicable requirements in the *International Building Code* for weather protection of the building envelope.

[S] 510.5.6 Wiring. The backbone, antenna distribution, radiating, or any fiber-optic cables shall be rated as plenum cables. The backbone cables shall be connected to the antenna distribution, radiating, or copper cables using hybrid coupler devices of a value determined by the overall design. Backbone cables shall be routed through an enclosure that matches the building's required fire-resistance rating for shafts or interior exit stairways. The connection between the backbone cable and the antenna cables shall be made within an enclosure that matches the building's fire-resistance rating for shafts or interior exit stairways, and passage of the antenna distribution cable in and out of the enclosure shall be protected as a penetration per the *International Building Code*.

[S] 510.5.7 Identification signs. Emergency responder radio coverage systems shall be identified by an approved sign located on or near the Fire Alarm Control Panel or other approved location stating "This building is equipped with an Emergency Responder Radio Coverage System. Control Equipment located in room." A sign stating "Emergency Responder Radio Coverage System Equipment" shall be placed on or adjacent to the door of the room containing the main system components.

510.6 Maintenance. The emergency responder radio coverage system shall be maintained operational at all times in accordance with Sections 510.6.1 through ~~((510.6.4))~~ 510.6.7.

[W][S] 510.6.1 Testing and proof of compliance. The owner of the building or owner's authorized agent shall have the emergency responder radio coverage system ~~((shall be))~~ inspected and tested annually or where structural changes occur including additions or remodels that could materially change the original field performance tests. Testing shall consist of the following items (1) through (7):

1. In-building coverage test as required by the fire code official as described in Section 510.5.3, Acceptance test procedure, or 510.6.1.1, Alternative in-building coverage test.

Exception: Group R Occupancy annual testing is not required within dwelling units.

2. Signal boosters shall be tested to verify that the gain/output level is the same as it was upon initial installation and acceptance or set to optimize the performance of the system.
3. Backup batteries and power supplies shall be tested under load of a period of 1 hour to verify that they will properly operate during an actual power outage. If within the 1-hour test period the battery exhibits symptoms of failure, the test shall be extended for additional 1-hour periods until the integrity of the battery can be determined.
4. If a fire alarm system is present in the building, a test shall be conducted to verify that the fire alarm system is properly supervising the emergency responder communication system as required in Section 510.4.2.5. The test is performed by simulating alarms to the fire alarm control panel. The certifications in Section 510.5.2 are sufficient for the personnel performing this testing.
- ~~(4)~~ 5. ~~((Other))~~ All other active components shall be checked to verify operation within the manufacturer’s specifications.
- ~~(5)~~ 6. At the conclusion of the testing, a report, which shall verify compliance with Section ~~((510.5.3))~~ 510.6.1, shall be submitted to the fire code official by way of the department’s third-part vendor thecomplianceengine.com.
7. At the conclusion of testing, a record of the inspection and maintenance along with an updated grid diagram of each floor showing tested strengths in each grid square and each critical area shall be added to the documentation maintained on the premises in accordance with Section 510.5.3.

[S] 510.6.1.1 Alternative in-building coverage test. When the comprehensive test documentation required by Section 510.5.3 is available, or the most recent full five-year test results are available if the system is older than six years, the in-building coverage test required by the fire code official in Section 510.6.1(1), may be conducted as follows:

1. Functional talk-back testing shall be conducted using two calibrated portable radios of the latest brand and model used by the agency’s radio communications system or other equipment approved by the fire code official. Testing shall use Digital Audible Quality (DAQ) metrics, where a passing result is a DAQ of 3 or higher. Communications between handsets in the following locations shall be tested: between the fire command center or fire alarm control panel and a location outside the building; between the fire alarm control panel and each landing in each stairwell.
2. Coverage testing of signal strength shall be conducted using a calibrated spectrum analyzer for:
 - (a) Three grid areas per floor. The three grid areas to be tested on each floor are the three grid areas with poorest performance in the acceptance test or the most recent annual test, whichever is more recent; and
 - (b) Each of the critical areas identified in acceptance test documentation required by Section 510.5.3, or as modified by the fire code official; and
 - (c) One grid square per serving antenna.
3. The test area boundaries shall not deviate from the areas established at the time of the acceptance test, or as modified by the fire code official. The building shall be considered to have acceptable emergency responder radio coverage when the required signal strength requirements in Sections 510.4.1.1 and 510.4.1.2 are located in 95 percent of all areas on each floor of the building and 99 percent in Critical Areas, and any non-functional serving antenna are repaired to function within normal ranges. If the documentation of the acceptance test or most recent previous annual test results are not available or acceptable to the fire code official, the radio coverage verification testing described in Section 510.5.3 shall be conducted.

Point of Information

The alternative in-building coverage test provides an alternative testing protocol for the in-building coverage test in subsection (1) of Section 510.6.1. There is no change or alternative to annual testing requirements enumerated in subsections (2) – (7) of Section 510.6.1, which must be performed at the time of each annual test.

510.6.2 Additional frequencies. The building *owner* shall modify or expand the emergency responder radio coverage system at his or her expense in the event frequency changes are required by the FCC or other radio licensing authority, or additional frequencies are made available by the FCC ~~((or other radio licensing authority))~~ Public Safety Radio System Operator or FCC license holder. Prior approval of a public safety radio coverage system on previous frequencies does not exempt this section.

510.6.3 Nonpublic safety system. Where other nonpublic safety amplification systems installed in buildings reduce the performance or cause interference with the emergency responder communications coverage system, the nonpublic safety amplification system shall be corrected or removed.

[S] 510.6.4 Field testing. ~~((Agency))~~ Seattle Fire Department personnel shall have the right to enter onto the property at any reasonable time to conduct field testing to verify the required level of radio coverage or to disable a system that due to malfunction or poor maintenance has the potential to impact the emergency responder radio system in the region.

