

Fire Department Access and Water Supply

CHAPTER 18

Chapter 18 was reorganized for the 2003 edition and now includes most site design issues in one location. The access and fire lane requirements previously located in Section 3.5 of the 2000 edition have been significantly revised and moved to Chapter 18. New requirements in Section 18.3 for water supply and fire hydrants have been added to this chapter. Two annexes, H and I, have been added to complement the water supply and hydrant requirements found in Section 18.3. These annexes can be adopted separately by the jurisdiction to further clarify the hydrant and water supply requirements.

18.1 General

Fire department access and water supplies shall comply with this chapter.

18.2 Fire Department Access

18.2.1 Fire department access roads shall be provided and maintained in accordance with Section 18.2.

18.2.2 Fire Department Access Roads.

18.2.2.1 Required Access. Fire department access roads shall be provided in accordance with Section 18.2 for every facility, building, or portion of a building hereafter constructed or relocated.

To provide effective manual fire suppression operations, a fire department must be able to gain reasonable access to a building. Paragraph 18.2.2.1 attempts to address this need by requiring fire department access roads to all facilities and buildings. A fire department access road, such as the one shown in Exhibit 18.1, can be a public or private roadway that meets the requirements of Section 18.2.

It is important to note that 18.2.2 requires fire department access only for newly constructed or relocated buildings. The *Code* does not require previously approved access to existing buildings to be modified to meet the current *Code* requirements of 18.2.2. Maintaining existing access is addressed in paragraph 18.2.3 ..

Buildings under construction are addressed in paragraph 16.1.4, which requires that a fire lane be provided and maintained during building construction.

18.2.2.1.1 When there are not more than two one- and two-family dwellings or private garages, carports, sheds, and



EXHIBIT 18.1 Fire department access road.

agricultural buildings, the requirements of 18.2.2.1 and 18.2.2.2 shall be permitted to be modified by the AHJ.

Depending on the specific circumstances, the requirements of paragraph 18.2.2.1.1 could be onerous if applied to one- and two-family dwellings or private garages, carports, sheds, and agricultural buildings. Therefore, the AHJ is provided significant leeway in accepting modified access to these types of structures. Such modified access could include reduced roadway widths, increased distances to buildings, and grade changes.

18.2.2.1.2 When access roads cannot be installed due to location on property, topography, waterways, nonnegotiable grades, or other similar conditions, the AHJ shall be authorized to require additional fire protection.

Site conditions or unique structural designs can result in a fire department access road design that does not meet the specific requirements of this *Code*. Paragraph 18.2.2.1.2 recognizes these situations as sometimes unavoidable from a design standpoint. In these circumstances, the AHJ is authorized to require additional fire protection to offset the increased hazard or the delays created by an access road design that does not comply with Section 18.2. For example, additional fire protection could be the utilization of fire sprinkler protection.

18.2.2.2 Access to Building. A fire department access road shall extend to within 50 ft (15 m) of a single exterior door providing access to the interior of the building.

Fire department access roads are designed so that fire apparatus can drive within 50 ft (15 m) of an exterior door that allows access to the interior of the building.

Fire departments typically carry 150 ft (46 m) or 200 ft (61 m) or both of preconnected hose lines on their apparatus. The access design configuration required in paragraph 18.2.2.2 allows fire fighters to quickly extend preconnected hose lines into the building from fire apparatus. If the fire apparatus can access the building within 50 ft (15 m), fire fighters can extend hose lines 100 ft to 150 ft (30 m to 46 m) into the building without an undue delay.

In a multiple-tenant building, the exterior exit door should be placed at a location that allows access to a common hall or common lobby area, or to the largest tenant if there is no common interior area. In single-tenant buildings, the exterior door should be placed at a location that allows unobstructed access to the tenant floor area.

18.2.2.3 Additional Requirements.

18.2.2.3.1 Fire department access roads shall be provided such that any portion of the facility or any portion of an exterior wall of the first story of the building is located not more than 150 ft (46 m) from fire department access roads as measured by an approved route around the exterior of the building or facility.

Fire department access is essential to providing effective manual fire suppression operations. Exhibit 18.2 illustrates an acceptable arrangement for compliance with Section 18.2.

18.2.2.3.2 When buildings are protected with an approved automatic fire sprinkler system that is installed in accordance with NFPA 13, NFPA 13D, or NFPA 13R, the distance shall be permitted to be increased to 450 ft (137 m).

Paragraph 18.2.2.3.2 recognizes the significant benefits of fire sprinkler protection in reducing the severity of fire incidents. Due to the presence of a fire sprinkler system, the access distance required by paragraph 18.2.2.3.1 is permitted

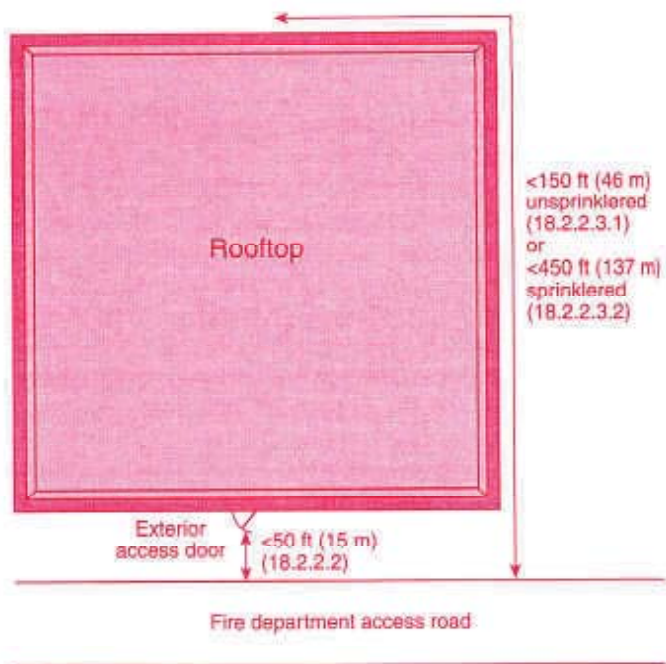


EXHIBIT 18.2 Acceptable fire department access configuration.

to be increased to 450 ft (137 m). See the commentary following paragraph 18.2.2.3.1 and Exhibit 18.2.

18.2.2.4 Multiple Access Roads. More than one fire department access road shall be provided when it is determined by the AHJ that access by a single road could be impaired by vehicle congestion, condition of terrain, climatic conditions, or other factors that could limit access.

The following situations are examples that could warrant multiple fire department access roads:

- Railroad tracks that cross a single fire department access road
- The potential for mud slides along a single fire department access road
- A single fire department access road that is below the 100-year flood elevation

A traffic engineer should review the traffic counts and access design in large-scale development projects to ensure an appropriate access design.

18.2.2.5 Specifications.

The *Code* provides broad minimum design requirements for fire department access roads. For more specific design information, see *A Policy on Geometric Design of Highways and Streets* by the American Association of State Highway and Transportation Officials (AASHTO), available at

www.transportation.org, or consult your specific state and local roadway design standards.

18.2.2.5.1 Dimensions.

The minimum 20-ft (6.1-m) width required by paragraph 18.2.2.5.1.1 allows for two-way vehicular traffic and for one fire apparatus to pass while another is working at a fire hydrant or aerial setup. The 13 ft 6 in. (4.1 m) ensures that fire apparatus can safely pass under power lines, bridges, and other obstructions. The AASHTO design guide recommends a minimum 14-ft (4-m) clearance for local and collector roads. A 16-ft (5-m) clearance is recommended for rural and urban arterials. The 14-ft (4-m) or 16-ft (5-m) recommendations allow for snow accumulation and future changes in roadway depth if additional roadway material is added.

18.2.2.5.1.1 Fire department access roads shall have an unobstructed width of not less than 20 ft (6.1 m) and an unobstructed vertical clearance of not less than 13 ft 6 in. (4.1 m).

18.2.2.5.1.2 Vertical clearance shall be permitted to be reduced, provided such reduction does not impair access by fire apparatus, and approved signs are installed and maintained indicating the established vertical clearance when approved.

One example of acceptable reduced vertical clearance permitted by paragraph 18.2.2.5.1.2 would be the entrance to a parking garage.

18.2.2.5.1.3 Vertical clearances or widths shall be increased when vertical clearances or widths are not adequate to accommodate fire apparatus.

An example of a need for an increased vertical clearance required by paragraph 18.2.2.5.1.3 would be an aircraft rescue fire-fighting vehicle. Many of these vehicles exceed standard apparatus dimensions and require greater vertical clearances.

18.2.2.5.2 Surface. Fire department access roads shall be designed and maintained to support the imposed loads of fire apparatus and shall be provided with a surface suitable for all-weather driving capabilities.

Fire department access roads need to be able to withstand the live loads of fire apparatus, but they are not required to be constructed of any specific material. The roadway design needs to make accommodation for water run-off, ice, and snow accumulations. Special consideration should be given to the design of subsurface structures such as drainage pipes and septic tanks. If improperly designed, these subsurface structures have the potential to collapse under standard fire apparatus loads or the load imposed by an aerial fire appa-

rus stabilizer. The proposed design should be in accordance with a local, state, or nationally recognized standard for roadway design.

18.2.2.5.3 Turning Radius. The turning radius of a fire department access road shall be as approved by the AHJ.

Previous editions of this *Code* required a 50-ft (15-m) center-line turning radius for fire lanes. In the 2003 edition, the specific 50-ft (15-m) requirement was deleted. Fire apparatus designs vary so widely that the 50-ft (15-m) requirement was found to be cumbersome for some jurisdictions and insufficient in others. Local authorities should review their current and, future apparatus needs and specifications to determine a specific design standard in their jurisdiction. In lieu of a specific local design requirement, the dimensions in Exhibit 18.3 should be used as a turning radius guide for most fire apparatus.

18.2.2.5.4 Dead Ends. Dead-end fire department access roads in excess of 150 ft (46 m) in length shall be provided with approved provisions for the turning around of fire apparatus.

Where a fire department access road exceeds 150 ft (46 m) in length and is also a dead end, an approved turnaround is required. Appropriate turning radii must be provided for the turnaround as indicated in paragraph 18.2.2.5.3. Acceptable turnarounds can include a cul-de-sac (see Exhibit 18.3) or a T-turn or Y-turn as shown in Exhibit 18.4.

18.2.2.5.5 Bridges.

18.2.2.5.5.1 When a bridge is required to be used as part of a fire department access road, it shall be constructed and maintained in accordance with nationally recognized standards.

The most widely used nationally recognized standard is the *Standard Specification for Highway Bridges*, which is published by the American Association of State Highway and Transportation Officials (AASHTO).

18.2.2.5.5.2 The bridge shall be designed for a live load sufficient to carry the imposed loads of fire apparatus.

Bridges must be designed to support the live load of the heaviest piece of fire apparatus that is likely to be driven on them. All bridges should be designed for an HS-20 highway vehicle load rating in accordance with the *Standard Specification for Highway Bridges*, which is published AASHTO.

18.2.2.5.5.3 Vehicle load limits shall be posted at both entrances to bridges where required by the AHJ.

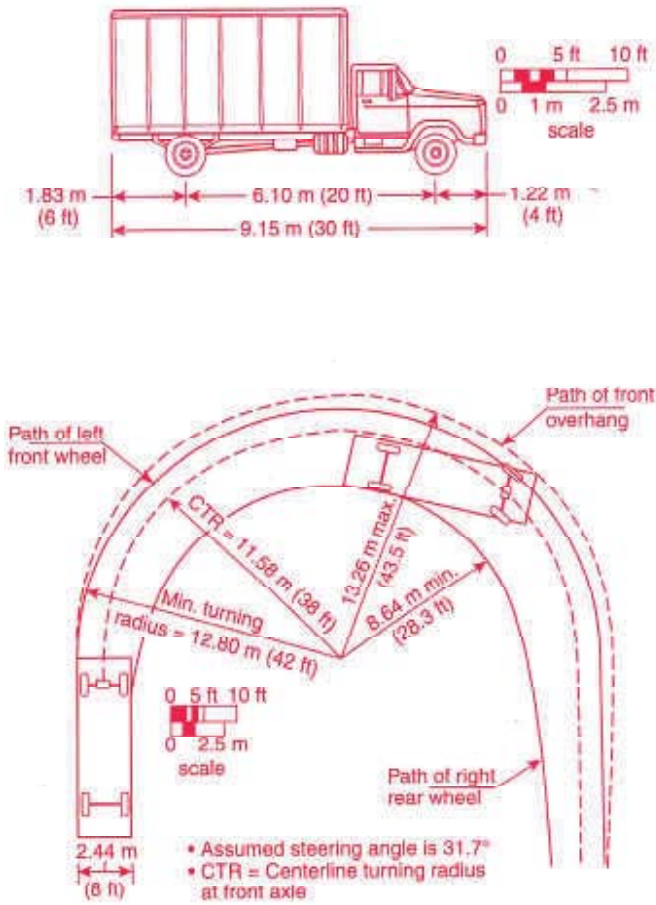


EXHIBIT 18.3 Minimum turning path for single unit truck design vehicle. [Courtesy of A Policy on Geometric Design of Highways and Streets by the American Association of State Highway and Transportation Officials (AASHTO)]

Signage that indicates vehicle load limits should be designed so that it is readily obvious to fire apparatus drivers approaching the bridge.

18.2.2.5.6 Grade.

The grade should permit fire apparatus use of the fire department access road during all conditions, such as snow, ice and rain. It should not be too steep to prevent a speedy response. Fire apparatus designs vary so widely that a specific requirement could be found to be burdensome for some jurisdictions and insufficient in others. Local authorities should review their current and future apparatus needs and specifications to determine a specific design standard in their jurisdiction.

18.2.2.5.6.1 The gradient for a fire department access road shall not exceed the maximum approved.

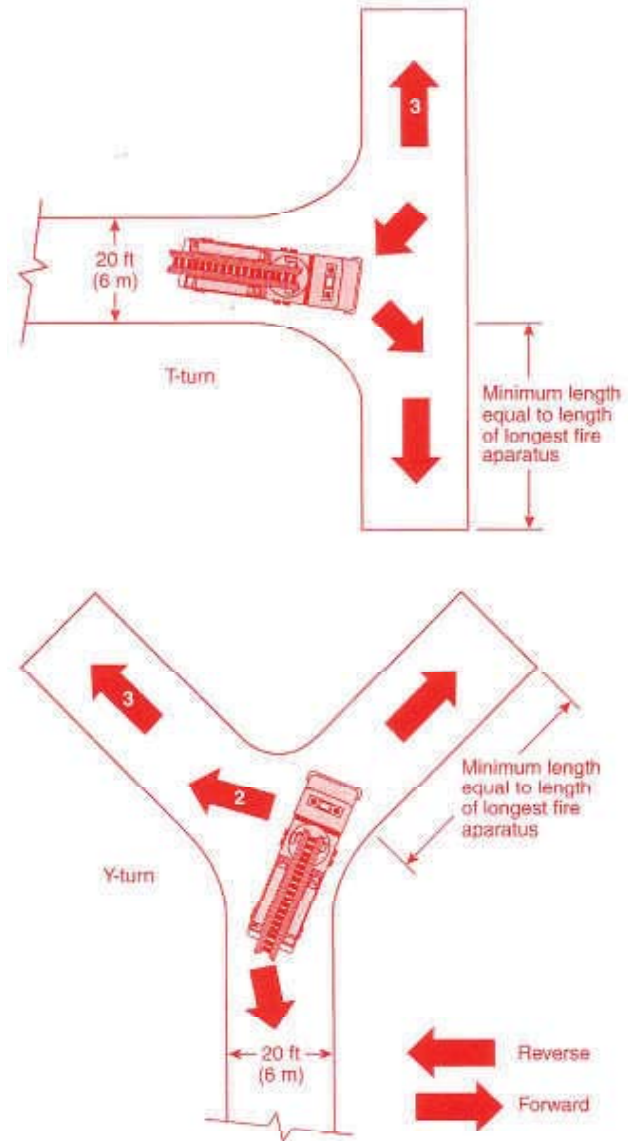


EXHIBIT 18.4 T-turn and V-turn turnaround arrangements.

18.2.2.5.6.2* The angle of approach and departure for any means of fire department access shall not exceed 1 ft drop in 20 ft (0.3 m drop in 6 m), and the design limitations of the fire apparatus of the fire department shall be subject to approval by the AHJ.

A.18.2.2.5.6.2 The design limits of fire department apparatus should take into account mutual aid companies and other response agencies that might respond to emergencies.

18.2.2.5.7 Marking of Fire Apparatus Access Road. Where required by the AHJ, approved signs or other approved notices shall be provided and maintained for fire

department access roads to identify such roads, or prohibit the obstruction thereof, or both.

The AHJ should ensure that approved marking, signs, and notices are consistent with the requirements of local and state laws. See Exhibit 18.5 for examples of ways of marking fire department access roads.

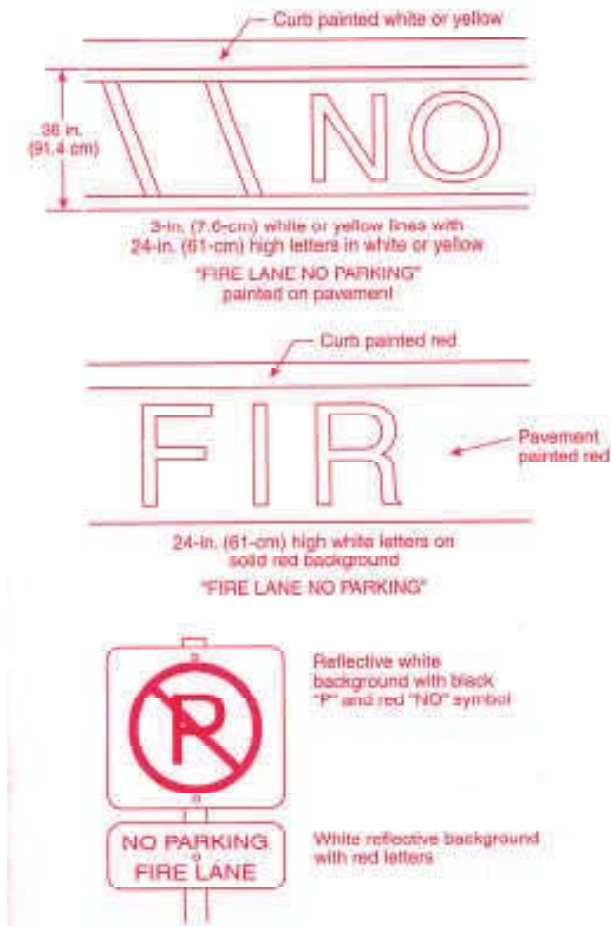


EXHIBIT 18.5 Examples of fire lane markings.

18.2.3* Obstruction and Control of Fire Department Access Road.

A.18.2.3 Fire lanes should be kept clear of obstructions such as parked vehicles, fences, and other barriers, dumpsters, excess vegetation, and so forth. However, it should be understood that a severe snowstorm can make these lanes temporarily inaccessible. In many parts of the country, the annual snowfall is of such magnitude that alternative

arrangements such as temporary roads over the snow accumulation might be necessary.

18.2.3.1 General.

18.2.3.1.1 The required width of a fire department access road shall not be obstructed in any manner, including by the parking of vehicles.

18.2.3.1.2 Minimum required widths and clearances established under 18.2.2.5.1 shall be maintained at all times.

18.2.3.1.3 Entrances to roads, trails, or other accessways that have been closed with gates and barriers in accordance with 18.2.3.2.1 shall not be obstructed by parked vehicles.

Where appropriate circumstances dictate, the AHJ should consult Section 10.12 regarding the requirements for access boxes, gated subdivisions, and access maintenance.

18.2.3.2 Closure of Accessways.

18.2.3.2.1 The AHJ shall be authorized to require the installation and maintenance of gates or other approved barricades across roads, trails, or other accessways, not including public streets, alleys, or highways. Where required, gates and barricades shall be secured in an approved manner.

18.2.3.2.2 Roads, trails, and other accessways that have been closed and obstructed in the manner prescribed by 18.2.3.2.1 shall not be trespassed upon or used unless authorized by the owner and the AHJ.

18.2.3.2.3 Public officers acting within their scope of duty shall be permitted to access restricted property identified in 18.2.3.2.1.

18.2.3.2.4 Locks, gates, doors, barricades, chains, enclosures, signs, tags, or seals that have been installed by the fire department or by its order or under its control shall not be removed, unlocked, destroyed, tampered with, or otherwise vandalized in any manner.

18.2.3.2.5 When authorized by the AHJ, public officers acting within their scope of duty shall be permitted to obtain access through secured means identified in 18.2.3.2.1.

18.3 Water Supplies and Fire Hydrants

18.3.1 * An approved water supply capable of supplying the required fire flow for fire protection shall be provided to all premises upon which facilities, buildings, or portions of buildings are hereafter constructed or moved into the jurisdiction.

A.18.3.1 See Appendix H for guidance determining required fire flow.

Section 18.3 is new for the 2003 edition of NFPA 1, *UFC*. An approved water supply that is capable of supplying the needed fire flow must be provided for all new buildings or buildings moved into the jurisdiction. The section does not specify how the required fire flow should be determined. The AHJ decides which fire flow calculation to use.

Numerous documents exist for determining a required fire flow condition. These include, but are not limited to, Annex H of this *Code*; the ISO *Guide for Determining Needed Fire Flow*; NFPA 1141, *Standard for Fire Protection in Planned Building Groups*; NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*; Iowa State Method; and the Illinois Institute of Technology Research Method. Unfortunately, there is no universally accepted method for determining required fire flow due to the significant number of variables that come into play in determining a required fire flow condition. Some of these variables follow:

- Building construction materials
- Building size
- Occupancy hazard
- Building exposures
- Percentage of openings
- Internal fire separations
- Fire suppression systems
- Wildland urban interface
- Initial fire growth rate
- Fire department response time
- Fire department capabilities
- Tolerable risk level of the jurisdiction

A single change in one of these variables can result in a significantly different fire flow condition even if all of the other variables remain the same. None of the preceding documents take into account all of these variables. As a result, the AHJ should review the various fire flow documents to determine which document meets the unique local conditions within their jurisdiction.

The American Water Works Association Manual of Water Supply Practices, *Distribution System Requirements for Fire Protection*, and the NFPA *Fire Protection Handbook* can provide additional guidance on water distribution system designs for fire protection.

18.3.2* Where no adequate or reliable water distribution system exists, approved reservoirs, pressure tanks, elevated tanks, fire department tanker shuttles, or other approved systems capable of providing the required fire flow shall be permitted.

A.18.3.2 The following documents can serve as a reference for additional water supply and fire flow information. These include NFPA 1141, *Standard for Fire Protection in Planned Building Groups* and NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*.

Paragraph 18.3.2 grants the AHJ flexibility in approving alternative fire flow water supply sources when no adequate or reliable water distribution system exists. See NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*, for additional guidance.

18.3.3* The number and type of fire hydrants and connections to other approved water supplies shall be capable of delivering the required fire flow and shall be provided at approved locations.

A.18.3.3 See Appendix I for guidance determining number and location of fire hydrants.

The design of fire hydrant spacing is contingent upon a number of factors including but not limited to the following:

- Needed fire flow
- Exposures
- Fire department capabilities
- Tolerable risk level of the jurisdiction
- Alternative water sources
- Water distribution system delivery capabilities

As with the required fire flow condition, a single change in one of these factors can create a significantly different fire hydrant spacing approach. For example, a fire department apparatus with 6-in. (152-mm) supply hose might be more readily able to deal with increased spacing than one with 2 1/2-in. (64-mm) hose if all other factors remain the same.

Annex I provides guidance as to one approach for fire hydrant spacing. Additional approaches are in the ISO *Guide for Determining Needed Fire Flow* and the AWWA *Distribution System Requirements for Fire Protection*. The AHJ should review the various fire hydrant spacing documents to determine which document meets the unique local conditions within their jurisdiction.

18.3.4 Fire hydrants and connections to other approved water supplies shall be accessible to the fire department.

Fire hydrants and connections to approved water supplies must be installed and maintained in a manner that allows for the fire department to access the water supply point without being delayed by fences, signs, and other obstructions.

18.3.5 Private water supply systems shall be tested and maintained in accordance with NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire protection Systems*, provides the requirements in paragraph 18.3.5 for testing and maintaining private water supply systems.

REFERENCES**Code References**

- NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2002 edition.
- NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, 2002 edition.
- NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, 2002 edition.
- NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2002 edition.
- NFPA 1141, *Standard for Fire Protection in Planned Building Groups*, 2003 edition.
- NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*, 2001 edition.
- AASHTO, *A Policy on Geometric Design of Highways and Streets*, American Association of State Highway and Transportation Officials, Washington, D.C.
- AWWA, *Manual of Water Supply Practices, Distribution System Requirements for Fire Protection Handbook*.
- Iowa State Method and the Illinois Institute of Technology Research Method.
- ISO, *Guide for Determination of Needed Fire Flow, 2001*.
- NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2002 edition.
- NFPA 1141, *Standard for Fire Protection in Planned Building Groups*, 2003 edition.
- NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*, 2001 edition.
- NFPA, *Fire Protection Handbook*, A. Cote, ed., National Fire Protection Association, Quincy, MA., 19th edition.

Commentary References

- AASHTO, *Standard Specification for Highway Bridges*, American Association of State Highway and Transportation Officials, Washington, D.C.