NFPA® 1141

Standard for Fire Protection Infrastructure for Land Development in Suburban and Rural Areas

2008 Edition

NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

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Standard for

Fire Protection Infrastructure for Land Development in Suburban and Rural Areas

2008 Edition

This edition of NFPA 1141, *Standard for Fire Protection Infrastructure for Land Development in Suburban and Rural Areas,* was prepared by the Technical Committee on Forest and Rural Fire Protection. It was issued by the Standards Council on June 4, 2007, with an effective date of June 24, 2007, and supersedes all previous editions.

This edition of NFPA 1141 was approved as an American National Standard on June 24, 2007.

Origin and Development of NFPA 1141

Work on this standard was begun in 1972 by the former Technical Committee on Suburban and Rural Fire Prevention and Promotion in response to needs expressed by several members. Several drafts were prepared and a document was adopted by the Correlating Committee on Suburban and Rural Fire Protection and Prevention (predecessor to present committee) for presentation at the 1977 Annual Meeting. Due to technical problems, the standard was withdrawn from the meeting agenda. Following reorganization of the committee in 1982, a task group undertook a review and update of the 1977 document, which resulted in the 1985 edition prepared by the committee. The current committee revised the 1985 edition, resulting in the 1990 edition.

The committee's proposed revision for the 1995 edition was returned to the committee to clarify specific issues on conflicting requirements between this document and NFPA 1144, and other requirements and NFPA 1 and NFPA *101*®. The requisite changes resulted in moving the document to a 1998 revision cycle.

In the 1998 edition, the committee was able to resolve many issues in clarity and consistency by bringing this document into concert with NFPA 1 and NFPA *101*. Because of specific fire protection circumstances found in rural areas (as listed in the revised scope and purpose of the document), the committee continued to require that some elements remain more restrictive than comparable elements referenced in other NFPA documents.

In the 2003 edition, the technical committee responded to the rapid development of structures into areas that present unusual characteristics to responding fire agencies and worked extensively on making NFPA 1141 current with other documents and more usable by adopting jurisdictions. The committee was particularly interested in keeping the flexibility in the application of the standard by jurisdictions so that it works with existing codes and standards that may or may not adequately cover planned building groups.

The scope of the document was revised to focus on providing guidance on the development of the community infrastructure necessary to eliminate fire protection problems that result from rapid growth and change. The title change from "Fire Protection in Planned Building Groups" to "Fire Protection Infrastructure for Land Development in Suburban and Rural Areas" also reflects this broader look at the challenges facing suburban and rural areas. While creating this edition, the technical committee concurrently revised NFPA 1144 to provide complementary documents for fire protection in suburban and rural development, including special considerations for wildland interface areas. As a result, the requirements for community infrastructure (e.g., roads, water supplies) were moved from the 2001 edition of NFPA 1144 to this document, and additional guidance was taken from the USDA Forest Service and the National Wildland/Urban Interface Fire Program (Firewise Communities), as well as input from several committee members and outside experts.

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NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on fire protection for rural, suburban, forest, grass, brush, and tundra areas. This Committee shall also have primary responsibility for documents on Class A foam and its utilization for all wildland and structural fire fighting. This excludes fixed fire protection systems.

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex B. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex B.

Chapter 1 Administration

1.1* Scope. This standard covers the requirements for the fire protection infrastructure in suburban and rural areas where there is an intended change of land use or intended land development.

1.2 Purpose. The purpose of this standard is to develop fire protection and emergency services infrastructure to reduce the impact of land use changes in suburban and rural areas.

1.3 Application.

1.3.1* This standard shall apply to land development or changes in land use in suburban and rural areas.

1.3.2 If the authority having jurisdiction (AHJ) determines that additions to existing structures or new structures have a negative impact on the fire protection of existing land use, the requirements of this standard shall be permitted to be imposed.

1.3.3 Equivalencies, Alternatives, and Modifications.

1.3.3.1 Equivalencies. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety to those prescribed by this standard, provided technical documentation is submitted to the AHJ to demonstrate equivalency and the system, method, or device is approved for the intended purpose.

1.3.3.2 Alternatives. The specific requirements of this standard shall be permitted to be altered by the AHJ to allow alternative methods that will secure equivalent fire safety, but in no case shall the alternative afford less fire safety, in the judgment of the AHJ, than that which would be provided by compliance with the provisions contained in this standard.

1.3.3.3 Modifications. The AHJ is authorized to modify any of the provisions of this standard upon application in writing by the owner, a lessee, or a duly authorized representative where there are practical difficulties in the way of carrying out the provisions of the standard, provided that the intent of the standard shall be complied with, public safety secured, and substantial justice done.

1.3.3.4 Buildings with equivalency, alternatives, or modifications approved by the AHJ shall be considered as conforming with this standard.

1.3.3.5 Each application for an alternative fire protection feature shall be filed with the AHJ and shall be accompanied by such evidence, letters, statements, results of tests, or other supporting information as required to justify the request. The AHJ shall keep a record of actions on such applications, and a signed copy of the AHJ's decision shall be provided for the applicant.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers,* 2007 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2007 edition.

NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes,* 2007 edition.

NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height,* 2007 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems,* 2007 edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances,* 2007 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* 2008 edition.

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work,* 2003 edition.

NFPA 54, *National Fuel Gas Code,* 2006 edition.

NFPA 58, *Liquefied Petroleum Gas Code,* 2008 edition.

NFPA 72®, National Fire Alarm Code®, 2007 edition.

NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations,* 2004 edition.

NFPA 291, *Recommended Practice for Fire Flow Testing and Marking of Hydrants,* 2007 edition.

NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting,* 2007 edition.

NFPA 1144, *Standard for Reducing Structure Ignition Hazards from Wildland Fire,* 2008 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System,* 2005 edition.

2.3 Other Publications.

2.3.1 AWWA Publications. American Water Works Association, 6666 West Quincy Avenue, Denver, CO 80235.

AWWA Manual 31, *Distribution System Requirements for Fire Protection*, 1998.

2.3.2 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 914, *Code for Fire Protection of Historic Structures,* 2007 edition.

NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting,* 2007 edition.

NFPA 5000®, Building Construction and Safety Code®, 2006 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.4* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.5 Shall. Indicates a mandatory requirement.

3.2.6 Should. Indicates a recommendation or that which is advised but not required.

3.2.7 Standard. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

3.3 General Definitions.

3.3.1 Accessory Building. Any building used incidentally to another building.

3.3.2 Adjacent Ground Elevation. The reference plane representing the average elevation of the finished ground level measured at a distance of 10 ft (3 m) from all exterior walls of the building.

3.3.3 Area.

3.3.3.1 ***Built-Out Area.*** Those portions of a development that have been populated to planned capacity with structures.

3.3.3.2 ***Gross Floor Area.*** The floor area within the inside perimeter of the outside walls of the building under consideration with no deduction for basements, hallways, stairs, closets, thickness of interior walls, columns, or other features.

3.3.3.3 ***Unbuilt Area.*** Those portions of a development intended to be built on that have not yet been populated with structures.

3.3.4 Building. A structure, usually enclosed by walls and a roof, constructed to provide support or shelter for an intended occupancy.

3.3.5 Combustible. Capable of reacting with oxygen and burning if ignited.

3.3.6* Curb Cut. Reduced curb height to facilitate vehicle passage over or across a curb.

3.3.7 Dwelling Unit. One or more rooms arranged for complete, independent housekeeping purposes, with space for eating, living, and sleeping; facilities for cooking; and provisions for sanitation. [***5000,*** 2006]

3.3.8 Fire Department. The governmental or other organization that is responsible for providing fire protection and other emergency services to an area.

3.3.9 Fire Flow. The flow rate of a water supply, measured at 20 psi (138 kPa) residual pressure, that is available for fire fighting.

3.3.10 Fire Hazard. Any situation, process, material, or condition that, on the basis of applicable data, can cause a fire or explosion or that can provide a ready fuel supply to augment the spread or intensity of a fire or explosion, all of which pose a threat to life or property. [**914,** 2007]

3.3.11 Fire Hydrant. A valved connection on a water supply system having one or more outlets and that is used to supply hose and fire department pumpers with water.

3.3.12 Fire Lane. An approved means of access or other passageway designated and identified to provide access for emergency apparatus where parking is prohibited.

3.3.13* Fire Protection. All measures taken to reduce the burden of fire on the quality of life.

3.3.14 Fire Protection System. Any fire alarm device or system or fire-extinguishing device or system, or combination thereof, that is designed and installed for detecting, controlling, or extinguishing a fire or otherwise alerting occupants, or the fire department, or both, that a fire has occurred.

3.3.15 Height. As applied to a building, the vertical distance from the adjacent ground elevation to the average elevation of the roof of the highest story.

3.3.16 Jurisdiction. Any governmental unit or political division or subdivision including, but not limited to, township, village, borough, parish, city, county, state, commonwealth, province, freehold, district, or territory over which the governmental unit exercises power and authority.

3.3.17 Land Development. The change of use of a parcel of land or contiguous parcels of land controlled by a single landowner or by a group of landowners with or without a common agreement to control the land so as to provide the buildings and infrastructure for residential and/or commercial purposes.

3.3.18 Land Use. The type or degree of activity occurring or intended to occur on a piece of land.

3.3.19 Means of Access. The method by which entry or approach is made by emergency apparatus to structures — for example, roadways, fire lanes, and parking lots.

3.3.20 Municipal-Type Water System. A system having water pipes servicing fire hydrants and designed to furnish, over and above domestic consumption, a minimum of 250 gpm (950 L/min) at 20 psi (138 kPa) residual pressure for a 2-hour duration.

3.3.21 Noncombustible. Not capable of igniting and burning when subjected to a fire.

3.3.22 Occupancy. The purpose for which a building or other structure, or part thereof, is used or intended to be used. [***5000***, 2006]

3.3.23 Road. Any accessway, not including a driveway, that gives access to more than one parcel and is primarily intended for vehicular access.

3.3.24 Roadway. Any public or private street, including bridges and rights of way.

3.3.25 Rural. Those areas that are not unsettled wilderness or uninhabitable territory but are sparsely populated with densities below 500 persons per square mile. [**1142,** 2007]

3.3.26 Slope. Upward or downward incline or slant, calculated as rise divided by run and expressed as a percentage.

3.3.27* Standpipe. A pipe and attached hose valves and hose (if provided) used for conveying water to various parts of a building for fire-fighting purposes.

3.3.28 Story. The portion of a building located between the upper surface of a floor and the upper surface of the floor or roof next above. [***5000***, 2006]

3.3.29 Street.

3.3.29.1 ***Private Street.*** Any accessway normally intended for vehicular use not dedicated as a public street.

3.3.29.2 ***Public Street.*** A thoroughfare that has been dedicated for vehicular use by the public.

3.3.30 Structure. That which is built or constructed, an edifice or building of any kind, or any piece of work artificially built up or composed of parts joined together in some definite manner.

3.3.31 Suburb or Suburban. Those moderately inhabited areas with population densities of at least 500 persons per square mile but less than 1000 persons per square mile. [**1142,** 2007]

3.3.32 Water Supply. A source of water for fire suppression activities.

3.3.33 Wildland Fire. An unplanned and uncontrolled fire spreading through vegetative fuels, at times involving structures, including any structures or other improvements thereon.

Chapter 4 General Requirements

4.1 General.

4.1.1 This standard shall be enforced by the authority having jurisdiction (AHJ) designated by the governing body.

4.1.2* The AHJ shall have the authority to apply the requirements in this standard that are specifically addressed for buildings or other structures that are deemed to possess significant life or property loss potential.

4.1.3 If the fire department is not the AHJ, the AHJ shall consult with the fire department on all matters relative to the enforcement of this standard to ensure that the needs of the fire department are met in providing fire protection.

4.1.4 This standard shall not be construed as prohibiting better construction or planning features that will materially improve fire protection.

4.1.5 The AHJ shall use recognized fire protection measures to meet local conditions because this standard does not set forth general fire protection features or procedures addressed in other codes or standards.

4.1.6 Where a provision of any other standard, code, law, or regulation recognized by the AHJ is in conflict with this standard, the more restrictive provision shall apply.

4.1.7* Prior to occupancy of any portion of the development, supporting infrastructure shall be installed, operational, and approved by the AHJ.

4.2* Plans. As a minimum, the AHJ shall require preliminary, working, and as-built plans to be submitted in a timely manner.

4.2.1 Plans shall be limited to the provisions of this standard.

4.2.2* Preliminary Plans.

4.2.2.1 All preliminary plans, when submitted, shall contain, as a minimum, a site plan showing proposed water supply, roadway access, fire department access, conceptual future development, and other items pertinent to the specific project.

4.2.2.2 The AHJ shall be permitted to make recommendations to the submitter, based on the preliminary plans, to assist the developer in developing the working plans.

4.2.3 Working Plans.

4.2.3.1 Previously engineered working plans and any modifications to them shall be drawn to scale and signed by a licensed architect or engineer and shall illustrate the final design of items required by this standard.

4.2.3.2 The AHJ shall approve the plans when the requirements of this standard have been reflected in the plans.

4.2.4 As-Built Plans. As-built drawings showing items listed in 4.2.2.1 shall be submitted to the fire department upon completion of the project.

4.3 Wildland Areas. In addition to other requirements in this standard, land use changes in wildland areas shall be subject to the requirements in NFPA 1144, *Standard for Reducing Structure Ignition Hazards from Wildland Fire.*

4.3.1 All new construction in wildland/urban interface areas shall be designed, located, and constructed to comply with NFPA 1144, *Standard for Reducing Structure Ignition Hazards from Wildland Fire.*

Chapter 5 Means of Access

5.1 General.

5.1.1 This section shall apply to all means of access, publicly or privately owned, whether or not they are designated as public thoroughfares.

5.1.2 Means of access shall consist of roads, roadways, bridges, fire lanes, parking lots, or a combination thereof, and shall be provided to all buildings more than 400 ft^2 (37 m^2) in ground floor area and to public occupancies with structural components.

5.1.3* The length of any cul-de-sac shall not exceed the firefighting capability of the fire department.

5.1.4* A cul-de-sac exceeding 1200 ft (366 m) in length shall be provided with approved intermediate turnarounds at a maximum of 1200 ft (366 m) intervals.

5.1.5 Number of Means of Access.

5.1.5.1* A land development shall have one or more means of access in accordance with Table 5.1.5.1(a), Table 5.1.5.1(b), or 5.1.5.2, whichever produces the greater number.

Table 5.1.5.1(a) Required Number of Access Routes for Residential Areas

Number of Households	Number of Access Routes
0–100	1
101–600	2
>600	3

Table 5.1.5.1(b) Required Number of Access Routes for Nonresidential Areas

Number of Parking Spaces	Number of Access Routes
0–1250	1
1251–3000	2
>3000	3

5.1.5.2 Where residential areas are mixed with nonresidential areas, the minimum number of access routes shall be determined by calculating five parking spaces for each dwelling unit, adding that number to the parking spaces count for the nonresidential area, and using Table 5.1.5.1(b).

5.1.5.3 Where multiple means of access are required, one of the means of access shall be permitted to be restricted for emergency use only, when approved by the AHJ.

5.1.5.4 Where multiple means of access are required, they shall be located as remote from each other as practical and acceptable to the AHJ.

5.2 Roadways. Roadways shall be constructed and maintained in accordance with this section.

5.2.1* The legal right-of-way for a roadway shall accommodate the width necessary for the construction, drainage, erosion control, and maintenance of the roadway, and provisions for utilities and sidewalks.

5.2.2 Roadways shall be constructed of a hard, all-weather surface designed to support all legal loads of the jurisdiction.

5.2.3 Roadways shall have a minimum clear width of 12 ft (3.7 m) for each lane of travel, excluding shoulders and parking.

5.2.3.1 Curves shall not reduce the width of the roadway.

5.2.3.2 Provisions shall be made for drainage, snowbanks, parking, utilities, and the like such that they do not impinge on the minimum clear width.

5.2.4 Where parking is permitted, such space shall be provided in accordance with Section 5.4.

5.2.5 Grades.

5.2.5.1 Grades shall not be more than 10 percent, except as permitted by this section.

5.2.5.2* Grades steeper than 10 percent shall be permitted by the AHJ where mitigation measures can be agreed upon by the fire department and the road engineering department, taking into consideration climate, traffic load, environmental conditions, the number of turns that would affect traffic flow, and the ability of fire apparatus to operate on steeper grades.

5.2.5.3 The angle of approach and the angle of departure shall not exceed 8 degrees at any point on the roadway or its intersection with another roadway or fire lane.

5.2.5.4 Where local conditions do not allow the maximum angles of approach and departure be limited to 8 degrees, the AHJ shall permit greater angles where local emergency apparatus can accommodate such angles.

5.2.6 Where grades are less than 0.5 percent, the road shall be crowned in the center to prevent pooling of water in a traveled way.

5.2.7 Any roadway intersecting with another shall be sloped to prevent the accumulation of water and ice on either roadway.

5.2.8 Every dead-end roadway more than 300 ft (91 m) in length shall be provided at the closed end with a turnaround having no less than a 120 ft (36.6 m) outside diameter of the traveled way.

5.2.9 At least 13 ft 6 in. (4.2 m) nominal vertical clearance shall be provided and maintained over the full width of the roadway.

5.2.10 Turns in roadways shall be constructed with a minimum radius of 60 ft (18.2 m) to the outside of the turn.

5.2.11 Median left-turn lanes and traffic signals shall be provided at intersections where necessary to prevent traffic from impeding fire department response time.

5.2.11.1 Where required by the AHJ, any traffic signal system shall have an automatic means for fire apparatus to control the signals to maintain an unimpeded right-of-way.

5.2.11.2 Sight distance shall be incorporated into the design of intersections.

5.2.12 Bridges and culverts shall be designed to accommodate a minimum of 100-year flood elevations and flows in accordance with accepted engineering practices.

5.2.13 The design of grade crossings at railroad tracks shall be done by a professional engineer with expertise in railroad grade crossings.

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

5.2.15 Easements shall be obtained to permit vegetation clearance alongside roads to minimize the likelihood of evacuation routes being blocked during wildfire or other natural disasters.

5.2.16 Addresses shall be assigned in a logical, consistent manner based on the local addressing system. Street names shall be phonetically unique.

5.2.17 At each intersection, noncombustible signs shall be installed with the name of each road.

5.2.17.1 These signs shall be installed a minimum of 7 ft (2.1 m) above the traveled way.

5.2.17.2 The letters on the signs shall be no less than 4 in. (100 mm) in height, with at least a 0.5 in. (12.7 mm) stroke, reflective and of a contrasting color to the background of the sign.

5.2.17.3 Where required by the AHJ, signs shall also include references to address numbers pertinent for that section of the road.

5.2.17.4 Where required by the AHJ, signs shall be erected at intersections indicating directions and distance to the nearest water supply.

5.2.17.5 Where the location of the nearest water supply is not obvious, signs or other directional symbols shall be erected indicating directions and distance to the nearest water supply.

5.2.17.6 The beginning of every dead-end roadway and developments with only single access shall have signage indicating that there is not a second outlet.

5.2.18* Roadways shall not be designed and constructed to include speed bumps or speed humps.

5.2.19 Alternative traffic calming devices such as chicanes and roundabouts shall be acceptable with approval by the AHJ.

5.2.20 The AHJ shall have the authority to require a means of unlocking any security feature that is installed.

5.2.21 Areas Subject to Natural Disasters and Wildfires.

5.2.21.1 Roadway design shall incorporate provisions for emergency pull-offs, spaced according to the AHJ, for disabled vehicles.

5.2.21.2 Consideration shall be given to locating fire hydrants such that fire apparatus can be connected to the fire hydrant without impeding traffic flow.

5.2.22 Any gates in roadways shall not be located closer than 30 ft (9 m) from an intersection and shall open in the direction of emergency vehicle travel unless other provisions are made for safe personnel operation.

5.2.23 The clear opening through gates shall have a usable width at least 2 ft (0.6 m) wider than the roadway it controls.

5.3* Fire Lanes.

5.3.1 Approval.

5.3.1.1 Fire lane plans shall be reviewed and approved by the AHJ and the fire department responsible for the protection of the property.

5.3.1.2 Changes to access points, gates, or fire lane layout shall be pre-approved by the AHJ.

5.3.2 Driveways, parking lot lanes, delivery lanes, and private roadways shall be permitted to be used as fire lanes if they meet the requirements of this section.

5.3.3 Fire lanes shall be constructed of a hard, all-weather surface designed to support any vehicle within the legal load limits of the jurisdiction.

5.3.4 The grade from a fire lane to the exterior wall of the grade level floor of a building shall not exceed 10 percent.

5.3.5 Fire lanes connecting to roadways shall be provided with curb cuts extending at least 2 ft (0.6 m) beyond each edge of the fire lane.

5.3.6 Fire lanes intended for one-way travel shall provide a minimum of 16 ft (5 m) in width of traveled way. Fire lanes providing two-way travel shall be a minimum of 24 ft (7.3 m) in width of traveled way.

5.3.6.1 The AHJ shall be permitted to allow a reduction in fire lane width where the sole purpose of the fire lane is for emergency access and operations.

5.3.6.2 Fire lane widths shall not include shoulders, sidewalks, or drainage.

5.3.7 Extra width shall be provided where the fire department determines such width is necessary to position apparatus for operations during an incident.

5.3.8 Turns in fire lanes shall be constructed to provide sufficient width to accommodate the largest piece of fire apparatus available to be operated on the fire lane, but in no case shall the radius to the outside curb line be less than 50 ft (15.2 m).

5.3.9 All grades in fire lanes shall meet the requirements of 5.2.5.

5.3.10 At least 13 ft 6 in. (4.2 m) nominal vertical clearance shall be provided and maintained over the full width of a fire lane.

5.3.11 The angle of approach and the angle of departure shall not exceed 8 degrees at any point on the fire lane or its intersection with other roads or fire lanes.

5.3.12 Any bridge in a fire lane shall be designed to support any vehicle within the legal load limits of the jurisdiction and constructed and maintained in accordance with nationally recognized standards.

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

5.3.14 Any bridge constructed as part of a fire lane shall provide width of no less than that required for the fire lane.

5.3.15 Dead-end fire lanes that exceed 300 ft (91 m) in length shall be provided with a minimum 120 ft (36.6 m) diameter turnaround at the closed end of the fire lane.

5.3.16 The clear opening through gates in fire lanes shall be at least 2 ft (0.6 m) wider than the traveled way.

5.3.17 All gates at the entrance to fire lanes shall be located a minimum of 30 ft (9 m) from the roadway and shall open away from the roadway, unless other provisions are made for safe personnel operation.

5.3.17.1 The AHJ shall have the authority to require a means of unlocking any security feature that is installed.

5.3.17.2 If needed, fire department personnel shall have ready access to any manual releases that could be required if there is an interruption of utility power.

5.3.17.3 Means shall be provided to override normal operation and allow any gate to remain open until manually closed.

5.3.18 An acceptable plan for wintertime maintenance of access through any gates and along any fire lane shall be submitted to the fire department responsible for the protection of the property.

5.3.19 Approved "No Parking — Fire Lane" signs shall be posted in accordance with the instructions of the fire department having responsibility and a method of enforcing such provisions shall be provided by the local jurisdiction.

5.4 Parking Lots.

5.4.1* The minimum lengths of parking lot stalls shall be measured end to end as shown in Figure 5.4.1, and the minimum stall length and aisle widths shall be as shown in Table 5.4.1.

5.4.2 Parking lot aisles adjacent to any building shall provide a travel lane with a minimum 24 ft (7.3 m) clear width.

5.4.3 The minimum turning radius for parking lot aisles necessary for fire department apparatus access shall be determined by the fire department having responsibility.

Chapter 6 Building Access and Separation

6.1 General. At least one approved means of fire apparatus access shall be provided to each building in accordance with this section.

6.1.1* Approved fire apparatus access shall be provided to within 150 ft (45 m) of any point of the exterior wall of each building.

6.1.1.1 The requirements of 6.1.1 shall be permitted to be extended to 300 ft (91 m) for any building protected by an automatic sprinkler system installed and maintained according to NFPA 13, *Standard for the Installation of Sprinkler Systems*, or NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, whichever is applicable.

6.1.2 Approved fire apparatus access shall be provided to within 50 ft (15.2 m) of at least one exterior door providing access to the interior of the building.

6.1.2.1 The requirement of 6.1.2 shall not apply to one- and two-family dwellings.

6.1.3* Any building, other than a one- or two-family dwelling, exceeding two stories or 30 ft (9 m) in height above average adjacent ground elevation and not protected by an automatic sprinkler system installed and maintained in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, or NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, shall

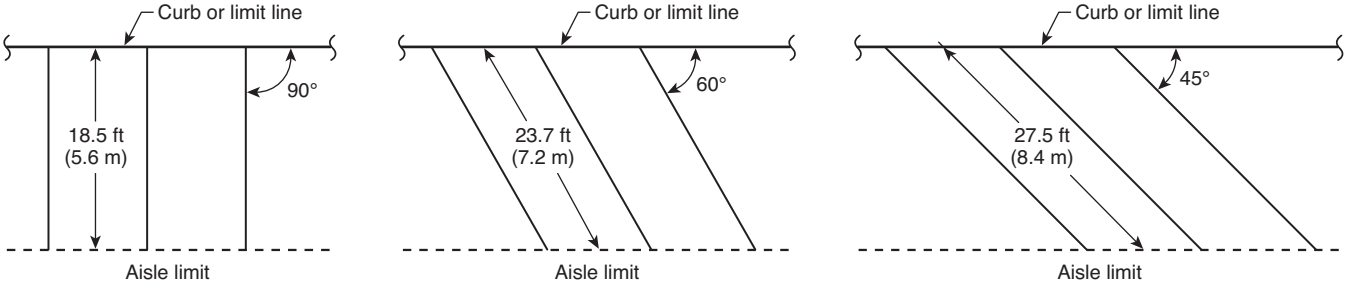

FIGURE 5.4.1 Measurements for Parking Stall Length.

Table 5.4.1 Minimum Parking Lot Stall Dimensions and Minimum Aisle Lengths

Parking Angle	Minimum Stall Length		Minimum Aisle Width, One-Way Traffic Flow		Minimum Aisle Width, Two-Way Traffic Flow	
	ft	m	ft	m	ft	m
45 degrees	27.5	8.4	16	4.9	24	7.3
60 degrees	23.7	7.2	16	4.9	24	7.3
75 degrees	20.9	6.4	23	7.0	24	7.3
90 degrees	18.5	5.6	26	7.9	26	7.9

have an approved means of fire apparatus access to within 30 ft (9 m) of all points of at least 50 percent of the exterior wall perimeter.

6.1.4* Any building exceeding three stories or 35 ft (10.7 m) in height above average adjacent ground elevation and protected by an automatic sprinkler system installed and maintained in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, or NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, whichever is applicable, shall have an approved means of fire apparatus access to within 30 ft (9 m) of an exterior wall.

6.2 Building Separation.

6.2.1 Unless governed by other locally adopted regulations, any building shall be separated from another building by at least 30 ft (9 m) and shall be set back at least 30 ft (9 m) from a property line.

6.2.1.1 If adjacent buildings are both protected with automatic sprinkler systems meeting NFPA 13, *Standard for the Installation of Sprinkler Systems*, the separation shall be permitted to be reduced.

6.2.1.2 If an accessory building is 400 ft^2 (37 m^2) or less in ground floor area, the separation shall be permitted to be reduced.

6.2.2 Any building that exceeds two stories or 30 ft (9 m) in height above average adjacent ground elevation and is not protected by an automatic sprinkler system installed and maintained according to NFPA 13, *Standard for the Installation of Sprinkler Systems*, or NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, shall be separated from any other structure by at least 50 ft (15.2 m) and shall be set back at least 30 ft (9 m) from a property line.

6.3* Structural Requirements. In jurisdictions not governed by fire codes, NFPA fire codes or standards, as they apply for the intended occupancy of the structure, shall be the minimum requirements.

Chapter 7 Fire Protection

7.1 Automatic Fire Protection.

7.1.1 All buildings more than two stories or more than 30 ft (9 m) above adjacent ground elevation shall be fully protected with an automatic sprinkler system installed and maintained according to NFPA 13, *Standard for the Installation of Sprinkler Systems*; NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*; or NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, whichever is appropriate for the occupancy.

7.1.1.1 Where incidental portions of a building exceed two stories or 30 ft (9 m) in height and are not normally occupied, the provisions of 7.1.1 shall not apply.

7.1.2 Any residential building shall have an automatic sprinkler system installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*; or NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*; or NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, whichever is appropriate.

7.1.3* Where municipal-type water systems are available, fire department connections for sprinkler systems designed to NFPA 13, *Standard for the Installation of Sprinkler Systems*, or NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, shall be located not less than 100 ft (30.5 m) along an approved path from a fire hydrant and shall be arranged so that hose lines can be readily and conveniently attached to the inlets without interference from any nearby objects, including buildings, signs, fences, posts, or other fire department connections.

7.1.4 Fire department connections shall be located to facilitate the establishment of a continuous supplemental water supply where municipal-type water systems are not available and shall be arranged so that hose lines can be readily and conveniently attached to the inlets without interference from any nearby objects, including buildings, signs, fences, posts, or other fire department connections.

7.2 Manual Fire Protection.

7.2.1 Standpipe Systems.

7.2.1.1 Where municipal-type water systems are available, the requirements of 7.2.1.3 and 7.2.1.4 shall apply to all new buildings more than three stories in height or more than 50 ft (15.2 m) in height above adjacent ground elevation that contain intermediate stories or balconies, except industrial process structures where the life or property of others would not be imperiled by a fire or explosion.

7.2.1.2 Where municipal-type water systems are not available, the requirements of 7.2.1.3 and 7.2.1.5 shall apply to all new buildings more than two stories in height or more than 40 ft (12.2 m) in height above adjacent ground elevation that contain intermediate stories or balconies, except industrial process structures where the life or property of others would not be imperiled by a fire or explosion.

7.2.1.3 The building shall be equipped with a standpipe system installed in accordance with the provisions of this section and NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*.

7.2.1.3.1 The provisions of 7.2.1.3 shall not apply to one- and two-family dwellings.

7.2.1.4* Fire department connections for standpipe systems shall be located not more than 100 ft (30.5 m) from a fire hydrant along an approved path from a fire hydrant and shall be arranged so that hose lines can be readily and conveniently attached to the inlets without interference from any nearby objects, including buildings, fences, posts, or other fire department connections.

7.2.1.5 Fire department connections shall be located to facilitate the establishment of a continuous supplemental water supply where municipal-type water systems are not available and shall be arranged so that hose lines can be readily and conveniently attached to the inlets without interference from any nearby objects, including buildings, signs, fences, posts, or other fire department connections.

7.2.2* Fire Extinguishers. Any residential buildings containing more than two dwelling units shall have a portable fire extinguisher having a minimum rating of 2-A:10-B:C, in each

dwelling unit near the exit and installed in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*.

7.3 Automatic Fire Warning Systems.

7.3.1 Any residential buildings containing more than two living units shall have a local fire alarm system designed and installed in accordance with *NFPA 72, National Fire Alarm Code*.

7.3.2 In any residential buildings containing four or more living units, the local fire alarm system shall retransmit to an approved central station.

7.3.3 For nonresidential structures exceeding 1000 ft^2 (93 m^2) gross floor area, an approved fire warning or alarm system shall be installed in accordance with *NFPA 72, National Fire Alarm Code*.

7.3.3.1 For nonresidential structures exceeding 5000 ft^2 (465 m^2) gross floor area, such systems shall retransmit an alarm to an approved central station.

7.3.3.2 Alarms or warning systems shall be tested and maintained in accordance with *NFPA 72, National Fire Alarm Code*.

Chapter 8 Water Supply

8.1 General.

8.1.1 Where water mains or fire hydrants are provided for fire protection purposes, the following shall apply:

(1) They shall be installed and maintained in accordance with AWWA Manual 31, *Distribution System Requirements for Fire Protection*, when on public property.
(2) They shall be installed and maintained in accordance with NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, where on nonpublic property.

8.1.2 Where there are no water mains for fire protection purposes, NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*, shall apply.

8.1.3 The number and type of fire hydrants and connections to approved water supplies shall be capable of delivering the required fire flow to one or more buildings of a development as determined by the AHJ using locally adopted codes, or as specified per the following conditions:

(1) For areas without municipal-type water systems, NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*, shall be applied.
(2) For those areas with municipal-type water systems, Annex G of NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*, shall be consulted for guidance.

8.1.4 Fire Hydrants.

8.1.4.1 Fire hydrants shall be marked in accordance with NFPA 291, *Recommended Practice for Fire Flow Testing and Marking of Hydrants*, and shall be made visible from the road by reflective marking or signage as designated by the AHJ.

8.1.4.2 All identification signs for fire hydrants shall be approved by the applicable authority prior to installation if they are to be located in the right-of-way or are subject to other laws.

8.1.4.3 Fire hydrants located in parking areas shall be protected by barriers that will prevent physical damage from vehicles without obstructing fire hydrant operation.

8.1.4.4 Fire hydrants shall be located within 6 ft (1.8 m) of the edge of the pavement unless the fire department determines another location is more acceptable for fire department use.

8.1.4.5* Threads on fire hydrant outlets shall be American National Fire Hose Connection Screw Threads and shall be equipped with thread adapters where local fire department thread is different.

8.1.4.6 The area around fire hydrants shall remain clear of obstructions, including vegetation, signs, fences, light posts, and so forth.

8.2* Water Supply Distribution. Water sources shall be located such that the required fire flow for any building in the development can be established and maintained within 5 minutes of arrival with the fire department resources available.

8.3 Areas with Municipal-Type Water Systems.

8.3.1 For a required fire flow exceeding 1500 gpm (5700 L/min), the water supply system shall be capable of delivering that fire flow for at least 2 hours at 20 psi (138 kPa) residual pressure.

8.3.2 For all required fire flows other than those described in 8.3.1, the water supply system shall be capable of delivering the required fire flow for at least 1 hour at 20 psi (138 kPa) residual pressure.

8.3.3 Fire hydrants in partially built-out or built-out areas shall be installed at a spacing not to exceed 500 ft (152 m) of vehicle travel distance from a building unless the fire department having jurisdiction determines that closer fire hydrant spacing is required.

8.3.4* In unbuilt areas, fire hydrants shall be installed at not more than 1500 ft (456 m) spacing with provisions in place to install fire hydrants to meet 8.3.3 as the area is built out.

8.3.5 The fire department shall approve the location of all fire hydrants.

8.3.6 For non-residential buildings, a fire hydrant shall be located within 500 ft (150 m) of each point of entry.

8.3.7 In residential areas, fire hydrants shall be supplied by not less than a 6 in. (150 mm) diameter main installed on a looped system or by not less than an 8 in. (200 mm) diameter main if the system is not looped or the fire hydrant is installed on a dead-end main exceeding 300 ft (91 m) in length.

8.3.8* In nonresidential areas, detailed fire flow calculations shall be provided and used to determine necessary pipe sizing.

8.3.8.1 Future development in the area shall be considered when fire flow requirements are calculated.

8.3.9 Dead-end mains shall not exceed 600 ft (183 m) in length for main sizes less than 10 in. (250 mm) in diameter.

8.4 Acceptance.

8.4.1 The contractor or installer of new water supply systems or extensions to existing water supply systems shall demonstrate by actual test that the capacity of the water supply system will meet the fire protection design requirements.

8.4.2 The AHJ shall witness the tests, approve the results, and provide a copy of test results to the fire department.

Chapter 9 Fire Protection During Construction

9.1 General Requirements. The provisions of NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*, shall apply in addition to the specific requirements of this chapter.

9.1.1 Before the infrastructure is installed, and prior to the location and construction of buildings or portions thereof, fire protection plans shall be submitted to and approved by the AHJ.

9.1.2 Prior to the delivery of combustible materials and the start of any building construction, the water supply for fire protection, whether temporary or permanent, shall be acceptable to the AHJ and shall be available.

9.1.3 Prior to the final occupancy of any building, the permanent water supply for fire protection, including fire hydrants and fire suppression systems, shall be installed, tested, and acceptable to the AHJ.

9.1.4 Fire department vehicular access to all buildings under construction shall be provided at all times.

9.1.4.1 In areas where ground surfaces are soft or likely to become soft, hard all-weather surface access roads shall be provided.

9.1.5 Combustible trash and debris shall be placed completely within an approved container or removed from the site at the close of each working day.

9.1.6 Flammable or combustible liquids or gases shall be stored, handled, and used on the construction site in accordance with the applicable provisions of NFPA 30, *Flammable and Combustible Liquids Code*; NFPA 54, *National Fuel Gas Code*; and NFPA 58, *Liquefied Petroleum Gas Code*.

9.1.7 Temporary heating devices shall be of an approved type, located away from combustible materials, and attended and maintained by competent personnel.

9.1.8 Smoking shall be prohibited, except in those areas approved. Where required by the AHJ, "No Smoking" signs shall be posted.

9.1.9 Cutting and welding operations shall be in accordance with NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*.

9.2 Extinguishing Equipment.

9.2.1 At least one portable fire extinguisher having a rating of at least 10-A:120-B:C shall be within a travel distance of 75 ft (23 m) or less to any point of a building under construction.

9.2.2 Personnel normally on the construction site shall be instructed in the use of the fire extinguishers provided.

Chapter 10 Community Safety and Emergency Preparedness

10.1 General.

10.1.1 The AHJ shall be responsible for the adoption and maintenance of a multi-agency operational plan for the protection of lives and property during significant emergency incidents.

10.1.2 The primary goal of the plan shall be to protect people in the affected area, including emergency personnel responding to the incident, from injury or loss of life.

10.2 Assessment of Hazards. The AHJ shall identify hazards, the likelihood of their occurrence, and the vulnerability of people, property, the environment, and the community itself to those hazards.

10.3 Operational Plan. The plan shall contain, as a minimum, command, training, community notification and involvement, public fire safety information and education, public safety and evacuation, and mutual assistance elements.

10.3.1 Command Element.

10.3.1.1 The plan shall contain a command element that clearly defines the responsibilities and authorities of all agencies and organizations that will be used in management of the incident.

10.3.1.2 Supporting resources such as social service agencies, local media, law enforcement, and so forth shall be included.

10.3.1.3 An incident management system shall be used in accordance with NFPA 1561, *Standard on Emergency Services Incident Management System*.

10.3.2 Training Element. Training, qualification, and equipment requirements shall be prepared to ensure that all personnel and equipment assigned to an emergency incident will be able to carry out assignments in a predictable, safe, cooperative, and effective manner.

10.3.3 Community Notification and Involvement Element. Public preparation shall include the following:

(1) The establishment of a communication system to provide rapid and accurate information to the public regarding emergency incidents that endanger their community, including detailed instructions for public notification of impending evacuation
(2) Information regarding actions to be taken for self-protection
(3) Information regarding appropriate assistance that can be rendered by the public to fire protection agencies in the management of emergency incidents
(4) Security measures to protect the evacuated area

10.3.4 Public Fire Safety Information and Education Element.

10.3.4.1 The AHJ shall prepare and implement a public safety information and education program.

10.3.4.2 The program, at a minimum, shall identify and analyze the following:

(1) Fire causes and hazards
(2) Life and property risks from other natural and technological hazards
(3) Prevention and safety programs
(4) Target audiences
(5) Activities

10.3.5 Public Safety and Evacuation Element.

10.3.5.1 A public safety and evacuation element shall provide for the safety of residents and area workers threatened by potential emergency incidents.

10.3.5.2 The public safety and evacuation element shall include the following:

(1) Incident personnel authority and criteria for ordering evacuations or relocations
(2) Incident personnel responsibilities in evacuations or relocations
(3) Procedures for public notification of impending evacuations or relocations
(4) Routes for evacuations or relocations
(5) Shelter locations
(6) Policy addressing the issue of persons who choose to not evacuate or relocate
(7) Policy for allowing evacuees to return when the current emergency has passed

10.3.6 Mutual Assistance Element.

10.3.6.1 Mutual assistance (mutual aid) agreements shall be developed that detail those services and resources available to support the management of emergency incidents.

10.3.6.2 Mutual assistance agreements shall be reviewed annually.

10.3.6.3 Mutual assistance agreements shall specify the following:

(1) Legal authorities
(2) Command organization
(3) Fiscal responsibilities
(4) Operational and logistical responsibilities

Chapter 11 Fire Department Capability

11.1* Assessment.

11.1.1 An assessment shall be conducted to determine the impact of the land use change on the fire protection services offered by the fire department.

11.1.2 The assessment shall address the following:

(1) *Dispatching.* Is the current system and staff able to handle the increased call volume likely to be generated by the build-out resulting from the land use change?
(2) *Fire station locations.* In order to maintain an acceptable level of fire department and emergency response times within the response area, are current fire stations distributed and designed to service changing demands resulting from the land use changes and development?
(3) *Fire department resources.* Are there adequate fire apparatus and staffing to meet the increased service demands likely to be generated by the build-out?
(4) *Special services.* Will the development introduce a need for special services not currently within the capability of the fire department?

11.2* Mitigation. Where the assessment determines that the existing fire department cannot maintain its current level of service delivery while also providing services to the proposed development, the fire department and the developer shall jointly determine how to mitigate the impact on the delivery of fire services or increase the capability of the fire department and how those services are to be provided.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1 Land use changes in suburban and rural areas often occur in areas where there might be an inadequate water supply, inadequate fire department resources, extended fire department response time, limited access, hazardous vegetation, unusual terrain, or unusual characteristics. Without the involvement of the fire department from the outset, the resulting changes could create a situation where the fire department cannot properly access structures or have the resources necessary to deal with emergencies at the property and where the occupants might not be able to escape the incident.

This standard addresses the design of subdivisions and development in areas where threats of natural disasters or human-caused hazards in suburban/rural areas not addressed by other planning and development documents. Moreover, in many areas of the United States, building and fire codes may not have been adopted, in which case this standard is meant to apply.

A.1.3.1 Suburban and rural areas have conditions, threats, and needs that may be different than those assumed under other codes and standards. In addition, other codes and ordinances may not be in place to guide fire departments in many rural areas.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.6 Curb Cut. Curb cut can be an abrupt reduction or a tapering reduction for the length of the curb on each side of the means of access.

A.3.3.13 Fire Protection. Fire protection includes measures such as fire prevention, fire detection and suppression, built-in fire protection systems, and planning and building codes.

A.3.3.27 Standpipe. See NFPA 14, *Standard for the Installation of Standpipe and Hose Systems.*

A.4.1.2 Structures could include such occupancies as amphitheaters, grandstands, or other public assembly structures that could need fire protection infrastructure.

A.4.1.7 Supporting infrastructure includes roads, bridges, water supply systems, and similar utilities.

A.4.2 Additional plans, such as fuel hazard abatement, might be required to address hazards specific to the area or project.

A.4.2.2 Reviewing plans and finding cooperative solutions to problems during the planning stage tends to eliminate many major difficulties, misunderstandings, and economic waste.

A.5.1.3 The AHJ should consider distances to water sources, fire flow, apparatus and equipment capabilities, and personnel availability when determining the acceptable length of a cul-de-sac.

A.5.1.4 Figure A.5.1.4 shows an example of a design for an intermediate turnaround in a cul-de-sac that exceeds 1200 ft (366 m).

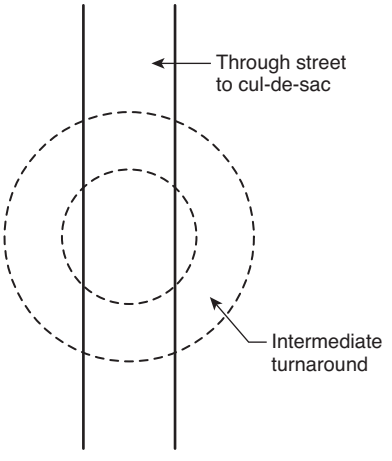

FIGURE A.5.1.4 Example of an Intermediate Turnaround.

A.5.1.5.1 The information in Table 5.1.5.1(a) was crudely estimated using Equation 8-3 in the 1997 *Highway Capacity Manual* (Transportation Research Board 1997).

$$SFi = 2800(v/c)_i f_d f_w f_g f_{HV}$$

This equation states that a road's service flow rate (SFi) in vehicles per hour (vph) is the product of the volume-to-capacity ratio for level-of-service $i(v/c)_i$ and a set of adjustment factors for directional traffic distribution f_d, lane and shoulder width f_w, grade f_g, and the presence of heavy vehicles f_{HV}. A narrow, mountainous road operating at level-of-service F (0.78) (maximum capacity) is assumed (for this analysis) with 100 percent of the traffic in one direction (0.71) on a 9 ft (2.7 m) wide lane and 2 ft (0.6 m) shoulder (0.70) heading downhill (1) with the possible 3 percent presence of large recreational vehicles (0.75) for an estimate of capacity per exit in clear visibility conditions with moderate demand rates of 814 vph (rounded to 800). In communities with uphill exits, wider roads, or no recreational vehicles, this can be adjusted. Concentrated demand could greatly degrade this flow rate to level of service F where capacity can no longer be reliably estimated. Also, it should be noted that this number is very optimistic because it does not consider driveways along a road or other merge points that may create flow turbulence. This information, from "Public Safety in the Urban–Wildland Interface: Should Fire-Prone Communities Have a Maximum Occupancy?," is provided only to reference the rationale and background for the round numbers in the tables, not for specific calculations.

A.5.2.1 When approving a development, the AHJ should consider whether future rights-of-way might be needed for widening streets or providing additional means of access as the project is built out or adjacent properties are considered for development. Where there is a perceived need, the AHJ should work with the developer to set aside such rights-of-way for future use.

A.5.2.5.2 When considering whether to allow steeper grades, the fire department should recognize that fire apparatus is designed to operate on grades of 6 percent unless it is specifically designed for steeper grades. Moving over a steeper grade is different than operating on a steep grade for a prolonged period of time. Steep grades also often involve switchbacks, which will slow both access for fire apparatus and traffic flow exiting an area if there is a wildland fire. If the steeper grades are being allowed in areas where there are large amounts of natural fuels, the potential for a wildland fire must be recognized.

A.5.2.18 A wide variety of traffic calming devices are available. Prior to installation of any of these devices, the AHJ should work with the emergency response departments to ensure traffic calming devices can be negotiated by emergency response vehicles in a safe and timely manner without damage to those vehicles.

More information on the impact of traffic calming devices on emergency vehicles can be found in *The Influence of Traffic Calming Devices on Fire Vehicle Travel Times,* by the Portland, OR, Office of Transportation and the Fire Rescue and Emergency Services. (For brevity, tables have been eliminated from the following summary, but the full report is available at http://www.portlandonline.com/transportation.)

The Influence of Traffic Calming Devices on Fire Vehicle Travel Times

January 1996

Portland Bureau of Fire, Rescue, and Emergency Service and the Traffic Calming Section Bureau of Traffic Management of the Portland Office of Transportation

Introduction

Traffic calming devices are used on Portland's neighborhood streets when traffic conditions are out of character with their adjacent residential, institutional, and recreational land uses. Calming devices are used to slow vehicle speeds, to encourage the use of more appropriate streets for through trips, and to enhance pedestrian, bicycle, and transit safety. The devices have proven to be effective without significantly impacting convenience, mobility, and travel time for drivers. At the

same time, certain devices affect the speed of various fire vehicles and may increase overall response times.

In 1995, the City's Fire Bureau and Bureau of Traffic Management conducted a thorough data collection effort to help quantify the relationship between three types of traffic calming devices and fire vehicle travel times. The study was conducted to determine how speed bumps and traffic circles affect fire vehicle travel times.

Research Method.

The testing considered four variables that influence the speed at which a fire vehicle can be negotiated around traffic circles or across speed bumps. The variables tested were the driver (36 different drivers), the type of fire vehicle (six fire vehicles of varying characteristics), the desirable vehicle speed, and the types of calming devices. Test runs were conducted on a total of six streets: two with 22-foot speed bumps; two with 14-foot speed bumps; and two with traffic circles. The speed and time data for each test run (four per vehicle/street, total 24 per street) was transcribed and used to calculate the distance traveled after each second as well as the vehicle's distance from the starting line after each second of the run.

For various combinations of the four variables, the time needed to travel a length of street that had no calming device was compared to the time needed to travel the same length with a calming device.

The difference between these times equals the delay associated with the calming device. Delays-per-device were calculated for desirable response speeds of 25, 30, 35, and 40 mph.

Findings.

Depending on the type of fire vehicle and the desirable response speed, the three devices were found to create a range of delays for each device as follows:

(1) 14-foot bumps: 1.0 to 9.4 seconds of delay per bump
(2) 22-foot bumps: 0.0 to 9.2 seconds of delay per bump
(3) Traffic circles: 1.3 to 10.7 seconds of delay per circle

The drivers' performances did not appear to significantly influence the results. Their choices of deceleration and acceleration rates as well as their choices of minimum speeds near the devices were very consistent.

Conclusions.

The results provide quantitative data that can be used in the determination of the impacts of one or more traffic calming devices on fire response times along a given emergency response route. Additional information is necessary in order to make a complete assessment of these impacts. This includes: 1) the types of fire vehicles responding to emergencies; 2) the desirable and appropriate speed of fire vehicles at each of the calming devices located along the response route; 3) the geographical area that will be affected by any increase in delay to response times; and 4) the use of this route by fire vehicles given the likely demand for emergency services and the availability of good alternative routes.

A full assessment of the impacts on response times for a given set of traffic calming devices needs to be balanced with the benefits of traffic calming on reducing speeding problems and enhancing public safety and livability along neighborhood streets. This paper provides the initial quantitative data that is necessary to begin to weigh the pros and cons of traffic calming.

Recommendations.

1. Pursue full assessments of the impacts of specific traffic calming projects, either planned or existing projects, on emergency vehicle responses. The results of this assessment then needs to be compared to the benefits of the traffic calming project, especially the benefits to public safety.

2. To provide both fast response for emergency services and slower overall traffic speeds on neighborhood streets, a public process should be undertaken to address the tradeoffs (options) between these two community values and to provide policy direction for implementing traffic calming on a citywide basis. These options include the use of traffic signal preemption devices, the locating of new fire stations, fire vehicle modifications to minimize weight-to-horsepower ratios, securing and cushioning certain pieces of equipment, and improving vehicle suspensions. This should be done by revising the Transportation Element to include a classification for emergency response routes.

A.5.3 A fire lane can be a subsurface construction of hard material designed to support the heaviest piece of fire apparatus likely to be driven on it and then covered with no more than 3 in. (75 mm) of soil, sod, or both or to the specifications of an engineered subsurface system. When a subsurface fire lane is constructed, it should be identified in a manner acceptable to the fire department.

A.5.4.1 The AHJ should consider requiring wider aisles if it is anticipated that the aisle areas will be used for tactical operations during an incident at the property.

A.6.1.1 Preconnected hose lines on pumping fire apparatus are normally 200 ft to 250 ft (60 m to 75 m) in length. The 150 ft (45 m) requirement allows fire fighters to stretch hose lines to a building access point on any exterior wall with a normal fire-fighting crew and have sufficient hose for fire-fighting operations inside the building.

A.6.1.3 The means of access for fire apparatus required by 6.1.3 is to allow an aerial ladder or elevating platform fire apparatus to have access to the exterior of the building to support fire-fighting operations.

A.6.1.4 The means of access for fire apparatus required by 6.1.4 is to allow an aerial ladder or elevating platform fire apparatus to have access to the exterior of the building in at least one location if aerial operations should become necessary. The required access in 6.1.2 can serve as this access if it extends to within 30 ft (9 m) of the building.

A.6.3 See B.2.1 for a partial list of codes and standards that might be used.

A.7.1.3 The AHJ should consider the fire-hydrant-to-building proximity in determining the location of the fire department connection pursuant to enforcement of this section. Fire hydrants should be located no closer than 50 ft (15.2 m) to the building being protected by the sprinkler system. This can be accomplished by locating the fire department connection away from the building.

A.7.2.1.4 The AHJ should consider the fire-hydrant-to-building proximity in determining the location of the fire department connection pursuant to enforcement of this section. Fire hydrants should be located no closer than 50 ft (15.2 m) to the building being protected by a standpipe system. This can be accomplished by locating the fire department connection away from the building.

A.7.2.2 This requirement can be met by providing one multipurpose dry chemical fire extinguisher or one Class A and one Class B:C fire extinguisher. The reasoning behind the requirement to locate these extinguishers in the dwelling unit is to prevent theft.

A.8.1.4.5 See NFPA 1963, *Standard for Fire Hose Connections*.

A.8.2 It is assumed that water from a municipal-type water system will be immediately available. When a municipal-type water system is not available, NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*, requires that water delivery rate be established within 5 minutes of arrival at the incident.

A.8.3.4 It is anticipated that a stub and valve with box will be installed and left for connection of future fire hydrants

A.8.3.8 See AWWA Manual 31, *Distribution System Requirements for Fire Protection,* for guidance on pipe sizing.

A.11.1 If it is recognized that the land use change will have significant impact on the fire protection demand, outside assistance might be required to perform the assessment. The AHJ might want to pass the cost of this assessment on to the developer.

A.11.2 Examples of possible solutions include expanding mutual aid or automatic aid agreements, requiring the developer to provide on-site facilities, requiring the developer to fund the augmentation of services, and requiring more built-in fire protection. For larger developments, regional planning for providing fire protection and EMS services can often identify better methods of providing the additional services needed than individualized local planning.

Annex B Informational References

B.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

B.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems,* 2007 edition.

NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting,* 2007 edition.

NFPA 1963, *Standard for Fire Hose Connections,* 2003 edition.

B.1.2 Other Publications.

B.1.2.1 AWWA Publications. American Water Works Association, 6666 West Quincy Avenue, Denver, CO 80235.

AWWA Manual 31, *Distribution System Requirements for Fire Protection,* 1998.

B.1.2.2 Other Publications.

Cova, Thomas J., "Public Safety in the Urban–Wildland Interface: Should Fire-Prone Communities Have a Maximum Occupancy?" *Natural Hazards Review*, Vol. 6, No. 3, August 1, 2005.

The Influence of Traffic Calming Devices on Fire Vehicle Travel Times, Portland Bureau of Fire, Rescue and Emergency Service and Portland Office of Transportation, January 1996.

B.2 Informational References. The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.

B.2.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1, *Uniform Fire Code*™, 2006 edition.

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, 2007 edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection*, 2003 edition.

NFPA 70, *National Electrical Code®*, 2008 edition.

NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures*, 2007 edition.

NFPA 82, *Standard on Incinerators and Waste and Linen Handling Systems and Equipment*, 2004 edition.

NFPA *101®*, *Life Safety Code®*, 2006 edition.

NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel–Burning Appliances*, 2006 edition.

NFPA 220, *Standard on Types of Building Construction*, 2006 edition.

NFPA 600, *Standard on Industrial Fire Brigades*, 2005 edition.

NFPA 601, *Standard for Security Services in Fire Loss Prevention*, 2005 edition.

NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, 2007 edition.

NFPA 5000®, *Building Construction and Safety Code®*, 2006 edition.

Brannigan, Francis L., *Building Construction for the Fire Service*, 1992.

Fire Protection Handbook, 19th edition, 2003.

Kimball, Warren Y., *Fire Attack I,* 1966.

Kimball, Warren Y., *Fire Attack II,* 1966.

NFPA Fire and Life Safety Inspection Manual, 8th edition, 2002.

B.2.2 Insurance Services Offices Publications. Insurance Services Offices, Inc., 545 Washington Blvd., Jersey City, NJ 07310-1686.

Fire Suppression Rating Schedule, 2003.

Guide for Determination of Needed Fire Flow, 2005.

B.2.3 Other Information Sources. American Institute of Architects Research Corporation, 1735 New York Avenue, Washington, DC 20006.

American Insurance Service Group, 85 John Street, New York, NY 10038.

International City/County Managers' Association, 777 N. Capitol Street, Washington, DC 20002.

International Code Council, 5203 Leesburg Pike, Suite 600, Falls Church, VA 22041-3401

International Fire Marshals Association, c/o NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471.

B.3 References for Extracts in Informational Sections. (Reserved)

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