City of Marlborough
Office of the Mayor

140 Main Street
Marlborough, Massachusetts 01752
508.460.3770 Fax 508.460.3698 TDD 508.460.3610
www.marlborough-ma.gov

Arthur G. Vigeant
MAYOR

Kate Flanagan
EXECUTIVE AIDE

Patricia Bernard
EXECUTIVE SECRETARY

REPORT AND RECOMMENDATIONS OF THE MARLBOROUGH FIRE STATION STUDY COMMITTEE

City of Marlborough
Office of the Mayor

140 Main Street
Marlborough, Massachusetts 01752
508.460.3770 Fax 508.460.3698 TDD 508.460.3610
www.marlborough-ma.gov

Arthur G. Vigeant
MAYOR

Kate Flanagan
EXECUTIVE AIDE

Patricia Bernard
EXECUTIVE SECRETARY

SECTION

1

City of Marlborough
FIRE DEPARTMENT
215 MAPLE STREET
MARLBOROUGH, MASSACHUSETTS 01752

KEVIN J. BREEN
FIRE CHIEF

PHONE: (508) 624-6986
FAX: (508) 460-3795

REPORT & RECOMMENDATIONS OF THE MARLBOROUGH FIRE STATION STUDY COMMITTEE

The Marlborough Fire Station Study Committee was formed under the direction of the Mayor Arthur G. Vigeant and Marlborough City Council President Edward J. Clancy in early 2018. The preliminary charge of this committee included the following:

- Evaluate/recommend location(s) for a new fire station located west of Route 495
- Establish/review required programming for a new station
- Evaluate space needs and determine size requirements
- Consider/evaluate four stations versus three stations configurations in the city
- Review comparable projects in other communities
- Evaluate potential for joint public/private ventures
- Evaluate associated costs
- Recommend suitable design(s) to achieve satisfactory integration in chosen neighborhood

Committee members:

Kevin J. Breen, Fire Chief, Chairman
David A. Giorgi, Police Chief
Theodore L. Scott, P.E., Assistant Commissioner Operations, DPW
Peter J. Juaire, City Councilor, Firefighter (Ret.)
J. Christian Dumais, City Councilor
David J. Walton, Co-Owner, Patriot Ambulance
Richard Fredette, Natick Fire Chief (Ret.)
Robert T. Dolan Jr., Firefighter

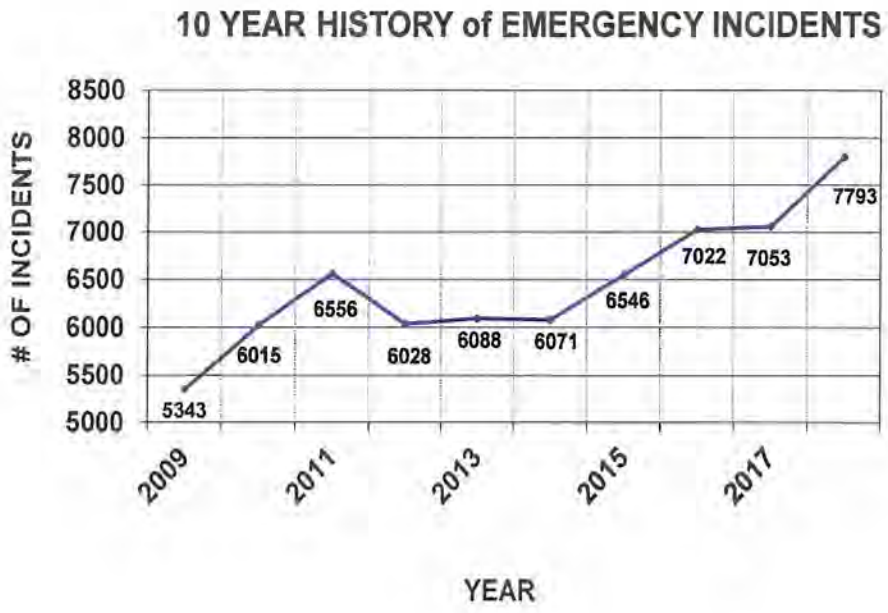
Committee meetings occurred on the following dates:

April 30, 2018
June 25, 2018
September 5, 2018
October 12, 2018
December 13, 2018
January 11, 2019
January 25, 2019

The committee considered many factors in determining the need for a fire station in the western part of the city. First and foremost is the unprecedented growth in terms of commercial and residential expansion in this area of the city. Nine hundred new housing units have been built in the last seven years and another 700+ units are planned for construction in the Simarano Drive and Ames Street area.

Statistically, Marlborough Fire Department set a record in terms of calls for service in 2018. In 2017, MFD responded to 7,053 emergency incidents. In 2018, MFD responded to 7,793 emergency incidents. This represents an increase of 10.49% in just one year.

The following graph details increasing call volumes particularly in the last four years.



It is also important to note the trend for increasing demands for service over a ten-year period. In ten years, Marlborough Fire Department has experienced a **45%** increase in the number of emergency incidents.

The following map identifies the boundaries for each of our three, existing fire station response districts. Fire Station #1, also known as Headquarters at 215 Maple Street, is in the middle of the city and is labeled District #1. Fire Station #2, 98 Pleasant Street, is situated to the west and is labeled as District #2. Fire Station #3, 268 Boston Post Road EAST, is situated to the east and is labeled as District #3.

Marlborough, MA

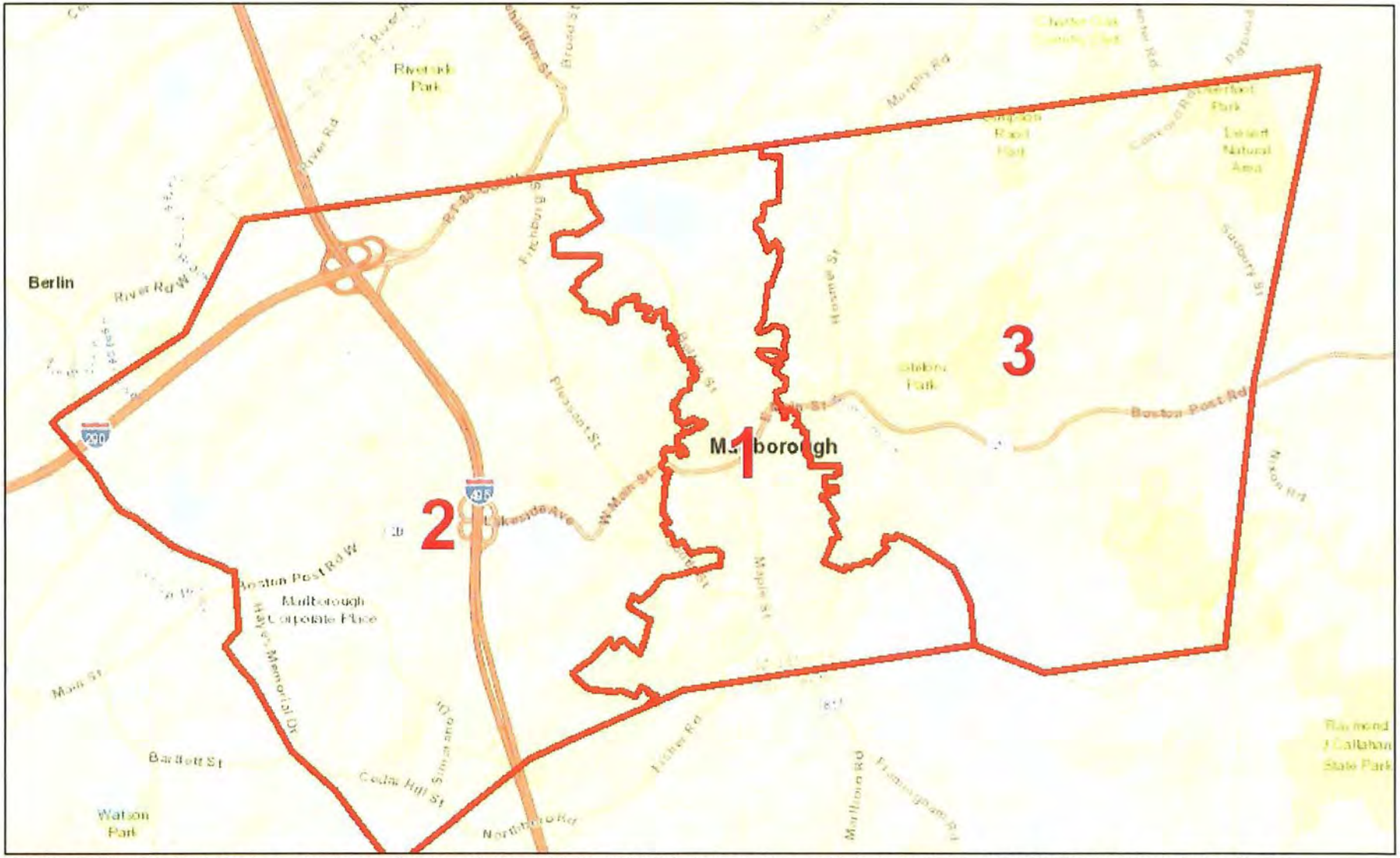
January 28, 2019

1 inch = 4302 Feet

0 4302 8604 12907

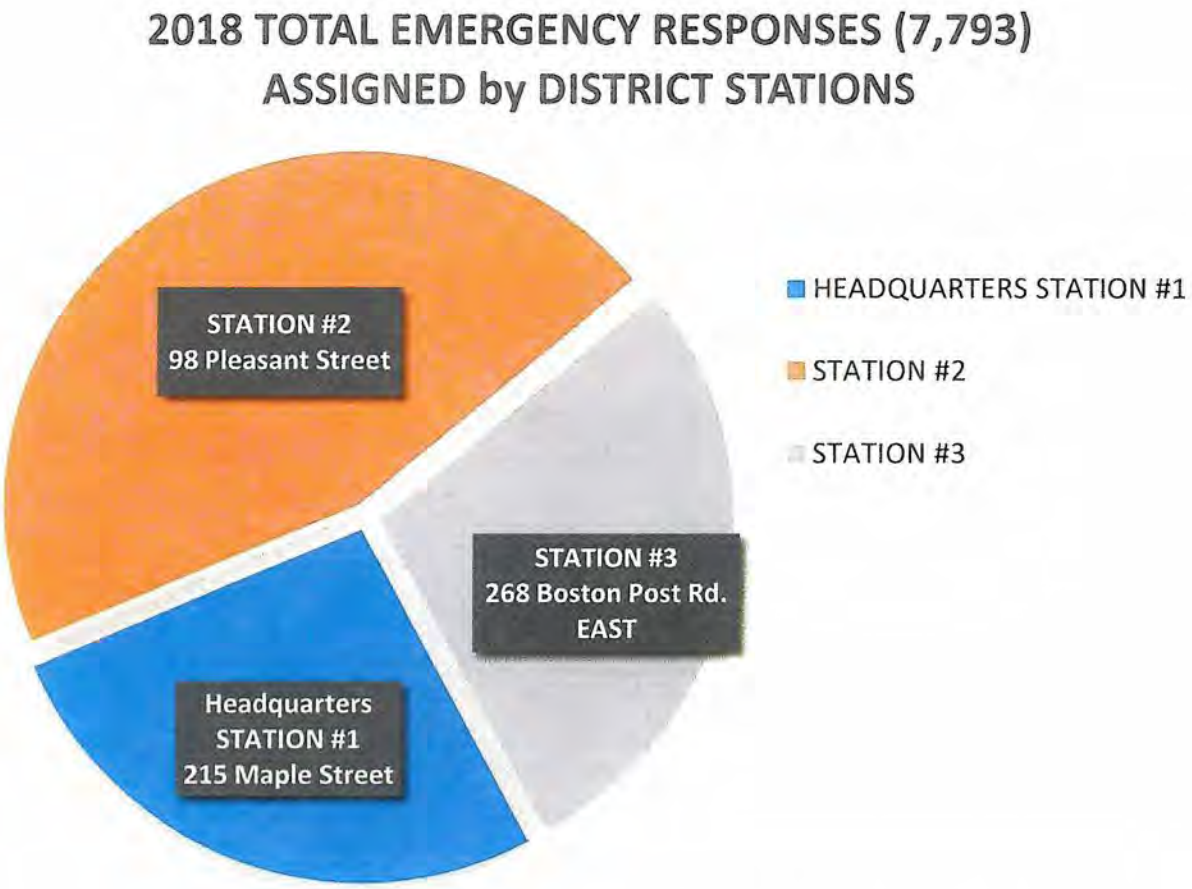
CAI Technologies

www.cai-tech.com



Data shown on this map is provided for planning and informational purposes only. The municipality and CAI Technologies are not responsible for any use for other purposes or misuse or misrepresentation of this map.

The following pie chart identifies the individual stations/districts where the 7,793 emergency incidents originated in 2018.



Marlborough Fire Department responded to 7,793 incidents in 2018

Headquarters/Station #1, 215 Maple Street
2,059 emergency incidents (26.42%) occurred in Headquarters/Station #1's district

Station #2, 98 Pleasant Street
3,535 emergency incidents (45.36%) occurred in Station #2's district

Station #3, 268 Boston Post Road EAST
2,199 emergency incidents (28.22%) occurred in Station #3's district

The committee began its work discussing how a fire station should reflect a municipality's commitment to quality public safety services for its citizens and visitors. Ideally, a new fire station should be designed to serve a community for the next fifty years for multiple users and as a multi-purpose asset. Of course, when planning to locate a fire station, the primary focus must be on acceptable response times in the geographical region it serves. Currently, the city does not have any fire or EMS units situated/staffed in the city west of Route 495. This hampers the fire department's ability to deploy emergency fire suppression and EMS units in a timely manner in this region. There are three main factors used to determine the deployment of fire suppression and EMS resources; response time, travel distance, and call volume.

Response Time

Beginning with response time, it is important to understand the various time segments associated with responding to emergencies. These individual time segments, when added together, contribute to the overall time it takes for a responding unit to finally arrive at the reported location where help is requested.

The first response time segment to review is "**alarm processing**" time. This is the time it takes once a dispatcher/fire alarm operator answers the telephone and speaks to the person (citizen) requesting assistance from a Public Safety Answering Point (PSAP). This time segment ends when a dispatcher activates an alert tone and verbalizes the dispatch information to responders alerting them to the emergency at hand. We call this the **"alarm time"**.

There is a professional standard outlining these activities (NFPA 1221) and this standard sets a quality benchmark of having 90% of calls received at a PSAP for emergency assistance to be "handled/processed" by dispatch personnel in fewer than 64 seconds.

The next response time segment is "**turnout**" time. This segment is defined as the time it takes for response personnel (firefighters) to acknowledge the official dispatch once a dispatcher/fire alarm operator has concluded the "alarm handling" time by officially dispatching or announcing the call type and details, the appropriate unit(s) to respond and finally, the location of the emergency (alarm time). Responders next begin to move to apparatus, don their protective clothing, climb aboard the apparatus and fasten their seat belts before leaving the station. This is the explanation for what is called "**turnout**" time.

The professional standard (NFPA 1710) sets benchmarks for turnout times for both fire responses and EMS responses. For fire responses, the benchmark is 90% of all calls having a turnout time fewer than **80 seconds.** For EMS responses, the benchmark is 90% of all calls having a turnout time fewer than **60 seconds**.

The difference of twenty seconds is due to the additional and unique protective clothing (structural firefighting ensembles) that must be donned by firefighters before they climb aboard fire apparatus, properly secure themselves in their designated riding positions and fasten their seat belts. Once completed, the driver operator of an emergency response vehicle is permitted to drive forward and begin the next time segment, "**wheel time**".

The last time segment to explain is **"wheel time"** and this is the time it takes for the fire apparatus and/or ambulance to move towards and then stop at the location of the emergency

incident. Please note this segment is typically reported and ends when the emergency vehicle arrives on scene. It does not consider or reflect the additional time it takes to access tools, equipment, medical kits and the time it takes to travel from the parked vehicle to the actual location of the person(s) requesting assistance generally found/located inside a structure.

Travel distance from a municipal fire station to the scene of an emergency whether it be for a medical call or fire or hazardous condition is clearly linked to overall response times. Communities strive to locate fire stations to insure acceptable travel distances to keep response times fewer than four minutes.

Another aspect of any response that is often overlooked, but indeed relevant, is the time it takes for any reporting party to become aware of an emergency prior to initiating or taking any action to request help. This is relevant as an undetected fire, having sufficient time to grow and spread, can quickly destroy property and threaten the lives of both occupants and responding firefighters.

Structural firefighting is an inherently dangerous job and has become particularly challenging as new synthetic materials are being used for building construction materials and home furnishings and décor. These materials ignite quickly and contain more fuel (BTU's) than ordinary wood-based products. Ultimately, this translates to fires that burn faster and hotter. Responding firefighters face an increased likelihood of flashover conditions. Simply stated, flashovers occur when all the combustibles in a room reach their ignition temperature and ignite simultaneously. The result is a room that is untenable and deadly to any firefighter or civilian still present in a room when flashover occurs. Flashover conditions can occur in a very short amount of time after the incipient stage of a growing fire (5 to 7 minutes) dependent on materials burning and interior conditions.

Emergency Medical Services (EMS) responses also require speedy responses. Specifically, patients experiencing cardiac or cerebral vascular events (strokes) are less likely to make a full recovery if EMS care/treatment is delayed. Lost minutes due to increased response times or other delays, can result in irreversible brain damage and biological death in as few as four minutes. It is critical that response times city-wide are consistently evaluated and improved to save lives.

Capacity vs. Capability

Finally, the last factor used to determine the deployment of fire suppression and EMS resources is a department's call volume. There are two concepts useful in evaluating the delivery of fire suppression and EMS services within a community. The first is capability and the second is capacity. Capability refers to a fire department's response within a short period of time with sufficient trained personnel and equipment to perform related tasks such as medical treatments, rescue, confining fires to rooms of origin and the eventual extinguishment of all fires. Capacity refers to a department's ability to respond adequately to either multiple-alarm fire incidents (for a sustained fire attack) or simultaneous calls (multiple fire and/or EMS calls at once). Published in 2001, the National Fire Protection Association released NFPA 1710. It is titled, "Standard for the Organization and Deployment of Fire Suppression, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments". This standard serves as a benchmark for fire department effectiveness and quality. It sets forth a minimum requirement that career fire departments be staffed and organized to deliver a first-arriving fire suppression or

an emergency medical services unit on scene within four (4) or fewer minutes to ninety percent (90%) of all responses in a community. We must continue to strive for compliance with this important standard calling for 90% of all responses to be within four or fewer minutes. This is important to track because it is a prime indicator of whether a community should increase its on-duty shift strength adding more firefighters. In the MRI report, completed in 2014, the data related to response times indicate Marlborough is operating far below expectations set forth in NFPA's 1710 standard. This is even more troubling as the fire department's call volume has increased twenty-eight percent (28%) since the report was published.

Every year, fires take the lives of thousands of our citizens here in the United States. At risk populations that are most affected by the threat of building fires include the aged, young and disabled. **Reducing notification time, alarm handling time, turnout time and response time is worthy or our best effort and should be embraced by all.** NFPA 1710 also requires fire chiefs to report the predictable consequences of not achieving compliance with the response portions of this standard.

Marlborough Fire Stations

The locations of our three existing fire stations are not ideal when studying call volumes, locations of emergency events and historical response times. The situation is further exacerbated when examining the potential for Marlborough's future growth/expansion particularly in the western part of our city. The primary objective of risk assessment is to determine whether firefighters should intervene, and what strategic objectives and tactical options they should pursue. The committee has determined there is sufficient risk associated with not having a fire station situated west of route 495. The increasing demands for service and the continuing commercial and residential growth in this area of the city, coupled with response times that exceed national standards prompts immediate action.

The committee deliberated each of the following questions pertaining to fire department services and fire station locations:

QUESTIONS

Why do we need a new fire station?

A: Addressing the deficiencies at our current Station #2 are long overdue. This station was built more than 100 years ago and was not designed to house motorized fire apparatus. The city has been experiencing commercial and residential growth particularly in the west for years. A new, properly situated fire station, west of Route 495, would improve response times while enhancing the department's ability to deliver services, city-wide, on a fair and equitable basis. Existing fire stations were constructed to protect what was once the most developed areas of the city. As the city continues to develop and expand outward from its center core, particularly to the west and west of I-495, the city's fire protection systems have not made the adjustments necessary to keep up with this growth. One method of determining the appropriate placement of fire stations is to follow the Insurance Services Office (ISO) recommendations. ISO recommends the first due engine be within 1.5 miles of travel distance to every location in their response area. A ladder truck should be no more than 2.5 miles from every location in their response area. Marlborough's current fire station locations provide excellent coverage to the

center of the city with significant overlap of coverage between the existing three stations as currently situated. However, most of the city west of I-495 is outside of the recommended 1.5-mile travel distance from existing stations. (MRI Report, Page 47).

What are the advantages of a new station?

A: A new fire station would insure we could house modern fire apparatus in contrast to existing Station #2 (Pleasant Street) where space constraints limit choices. A new station would be constructed to modern building standards and would include safety systems such as fully automatic fire and sprinkler systems. A new station would permit the reallocation of existing resources to include personnel and apparatus to better serve the city.

How large of a fire station is needed?

A: The city has consulted with an architectural firm (Context Architecture) and performed a space needs study. The most recent recommendation is a fire station that would be about 20,000 square feet. This would include five drive-through bays and attached living quarters.

Has the City considered rehabilitating existing stations?

A: Yes. Existing fire stations have been reviewed and numerous modifications have been made. Nevertheless, a full renovation of Station #2 is not feasible due to the site, cost and operational constraints. Station #2 at Pleasant Street resides on a very small parcel of land. It has limited parking, limited access and is an aged facility that is not compliant with today's modern building codes. It is not realistic to expect any major rehabilitation could be completed without relocating personnel for a period that would impact delivery of fire protection services. This facility is far too small to expect it can continue to serve as a base of fire service delivery for this area of the city looking forward.

What is the expected cost of a new fire station?

A: Costs for a new station are expected to be approximately $10M. This assumes a 20,000 square foot facility with construction costs estimated to be between $450-500 per square foot with a three to four percent annual escalation.

If a new station is built, do we have to keep the Pleasant Street station open?

A: A new station properly located in the western portion of Marlborough may improve response times in this area of the city while also maintaining acceptable response times to the area(s) currently served by Station #2 on Pleasant Street. For this reason, if a new station is built, the city may wish to close Station #2 on Pleasant Street.

Should the City consider opening/extending Glen Street at Ames Street to insure optimal response times?

A: This option should be reviewed but is dependent on where a new station is located and whether access through this area will improve response times to the southwest corner of Marlborough.

Can we use existing fire apparatus and equipment?

A: Yes. Existing fire apparatus can be relocated to the new station and overall, the department will reevaluate our deployment options to decide what other fire apparatus should be positioned in a new station.

Will there be any additional meeting space for civic groups?

A: Yes. Many new fire stations being designed today include meeting space that is multi-purposed and can be used for training rooms, emergency operation centers and civic/community meeting rooms.

Why build now?

A: Construction costs continue to rise and are predicted to escalate 3-4% per year. Additionally, interest rates for public projects are relatively low and the city is financially sound and could capitalize on these historic low rates.

What will happen to the existing fire stations?

A: Existing stations would continue to function as designed but there would likely be a relocation of some existing fire apparatus and personnel to distribute resources city-wide based upon call volume and response times. The closure of Station #2 should also be considered if the new location maintains acceptable response times to the "French Hill" area in accordance with NFPA 1710.

What happens if the city takes no action?

A: The city will continue to operate from the three existing fire stations. However, it is predicated that response times will lengthen as call volumes increase and services will deteriorate.

Will a new fire station affect response times?

A: Yes. A new fire station, properly located, will improve response times to the western part of the city where some areas are seeing unacceptable response times now more than eight minutes. Further, a new station will permit relocation of existing assets to address call volume in this region.

What is an appropriate timeline for constructing a new station?

A: A realistic timeline of approximately three years would incorporate a phased approach including land acquisition, associated infrastructure/engineering/site work, design and architectural services, bid and project award followed by construction.

What criteria should be evaluated as the city formulates a plan to build a new fire station?

A: There are many factors to consider as part of a fire station construction project. The committee recommends a space needs analysis, a plan to improve delivery of fire protection services, use of LEEDS, and an efficient and economical use of public resources and an expectation that a new design will serve our citizens and visitors for the next fifty years.

What is the estimated cost to taxpayers?

A: The cost to taxpayers will include monies for land procurement, engineering and site work, design and architectural services, building construction, project management and all soft costs. A realistic total cost will be near $12M

COMMITTEE RECOMMENDATIONS:

The committee worked collaboratively reaching consensus to forward these recommendations:

- The City of Marlborough should proceed, without delay, to construct a new fire station within the western portion of the city.
- Toward this end, the committee supports a sequenced, phased approach incorporating land acquisition, associated infrastructure/engineering/site work, design and architectural services, bid and project award followed by construction.
- The committee recommends selecting a site that is five (5) acres in size as recommended by the architect.
- The committee recommends selecting a site that would insure acceptable response times to the area(s) currently served by fire engine #2 positioned in the Pleasant Street fire station (Station #2).
- The committee reviewed and is including as part of this report several locations shown on various maps (see attachments) discussed for situating a fire station west of Route 495.
- The committee supports constructing a fire station with an adequate number of drive through apparatus bays to meet the needs of the city for the next 50 years.
- The committee supports a 3-station configuration if the location selected for a new station, west of Route 495 or near Route 495, will not diminish overall response times as outlined in NFPA 1710, with the closing of the Pleasant Street station.
- The committee recommends the establishment of a new, additional fire suppression/EMS company (Engine/Ladder) to handle existing and future demands for service.
- The committee also supports a comprehensive review of existing resources and response times to determine whether reallocation of existing fire suppression and EMS resources is consistent with and in support of the benchmarks set forth in NFPA 1710.

COMMITTEE RECOMMENDATIONS: (Cont.)

- The committee supports a station that embraces LEEDS (Leadership in Energy and Environmental Design) features.

- The committee recommends consideration be given to transferring the following existing or future functions into any new public safety facility (NFPA 1221 compliant communications center, training room capability, community room, emergency operations center/emergency management space, police substation capability, vehicle repair/maintenance and outdoor/indoor training props.

- The committee has reviewed cost estimates from similar projects and recommends a minimum of ten million dollars ($10,000,000) be secured, through bonding, to cover anticipated costs for constructing a fire station. (Please note this does NOT include land acquisition costs. This estimate assumes a 20,000 square foot facility and an approximate cost of $450-$500 per square foot with a three to four percent annual escalation assuming the project is completed in the next three years.

Respectfully Submitted,

Kevin J. Breen
Fire Chief

W/Attachments

NFPA 1710, Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments

NFPA 1221, Installation Maintenance and Use of Emergency Services Communications Systems

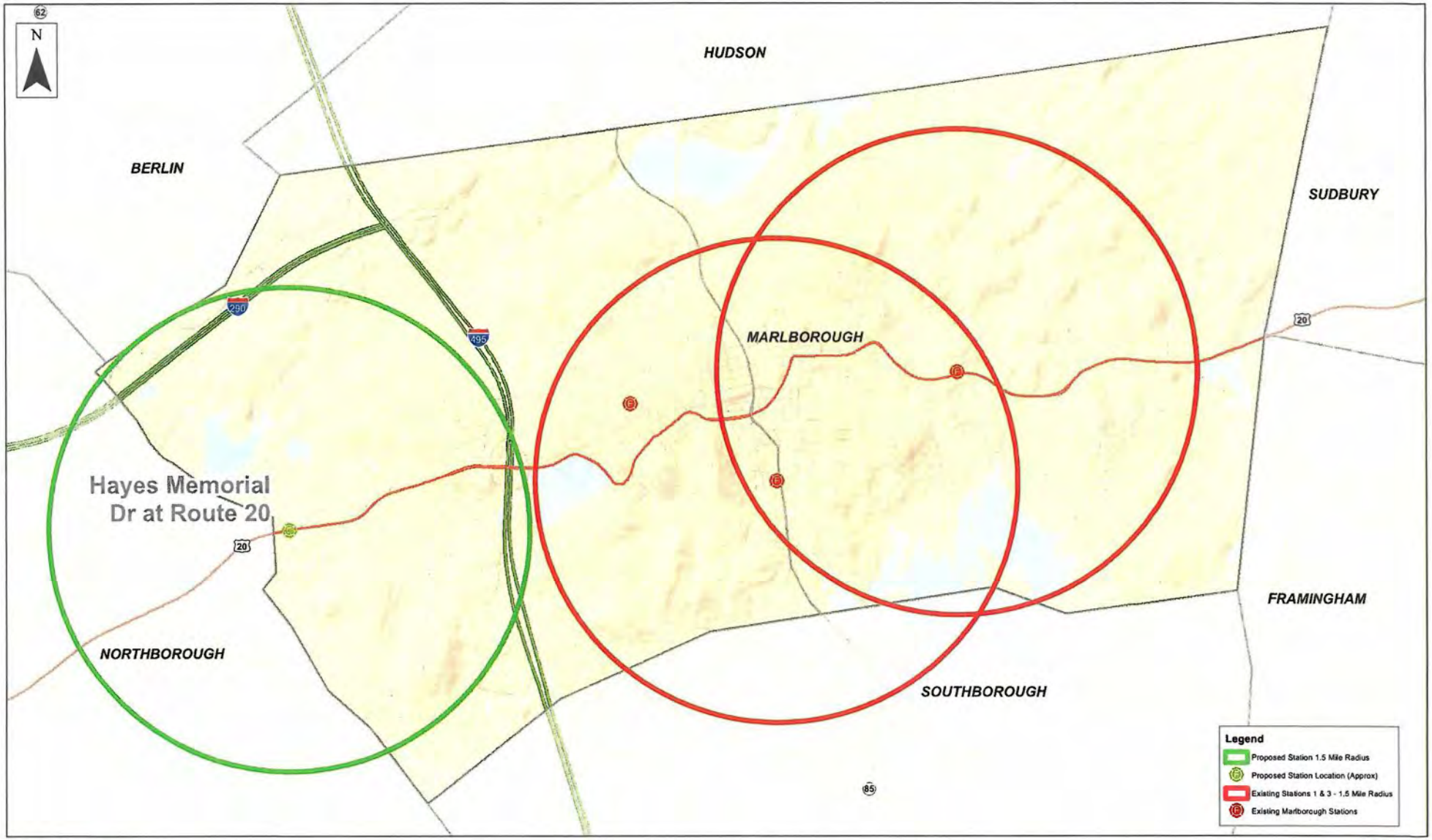
MRI Report Excerpts

Marlborough Fire Station Space Needs Analysis by Context Architecture

City GIS Maps - Potential Fire Station Locations
Current Fire Station Locations
Hayes Memorial Drive @ Route 20
Glen Street @ Ames Street
Ames Street @ Route 20
Northborough Road @ Dudley Street
Felton Street @ Elm Street
Felton Street @ Landry Drive

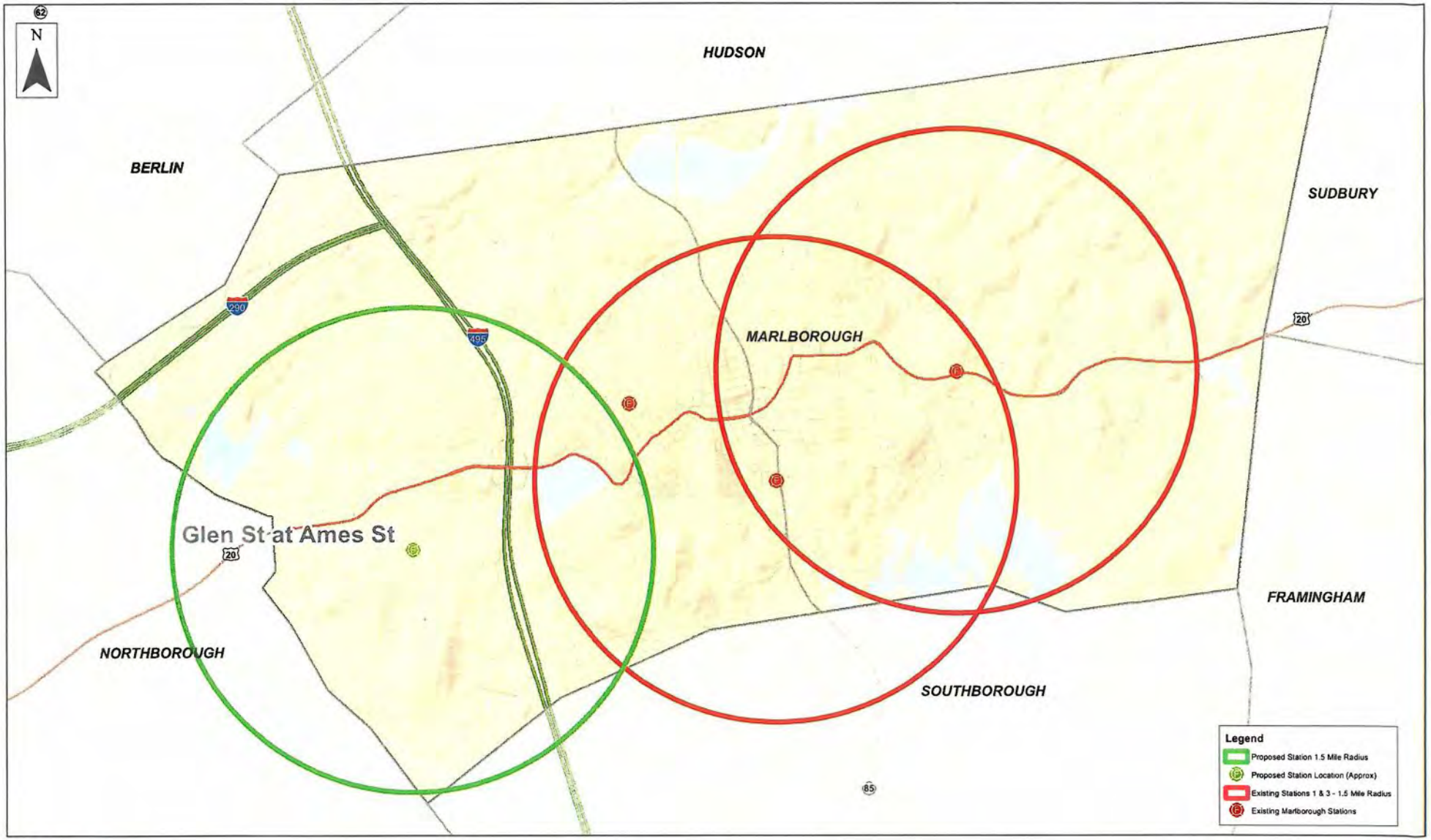
City GIS Maps Identifying Existing Parcels of "Vacant" Land (3, 4, 5 Acres)

Current Marlborough Station Locations



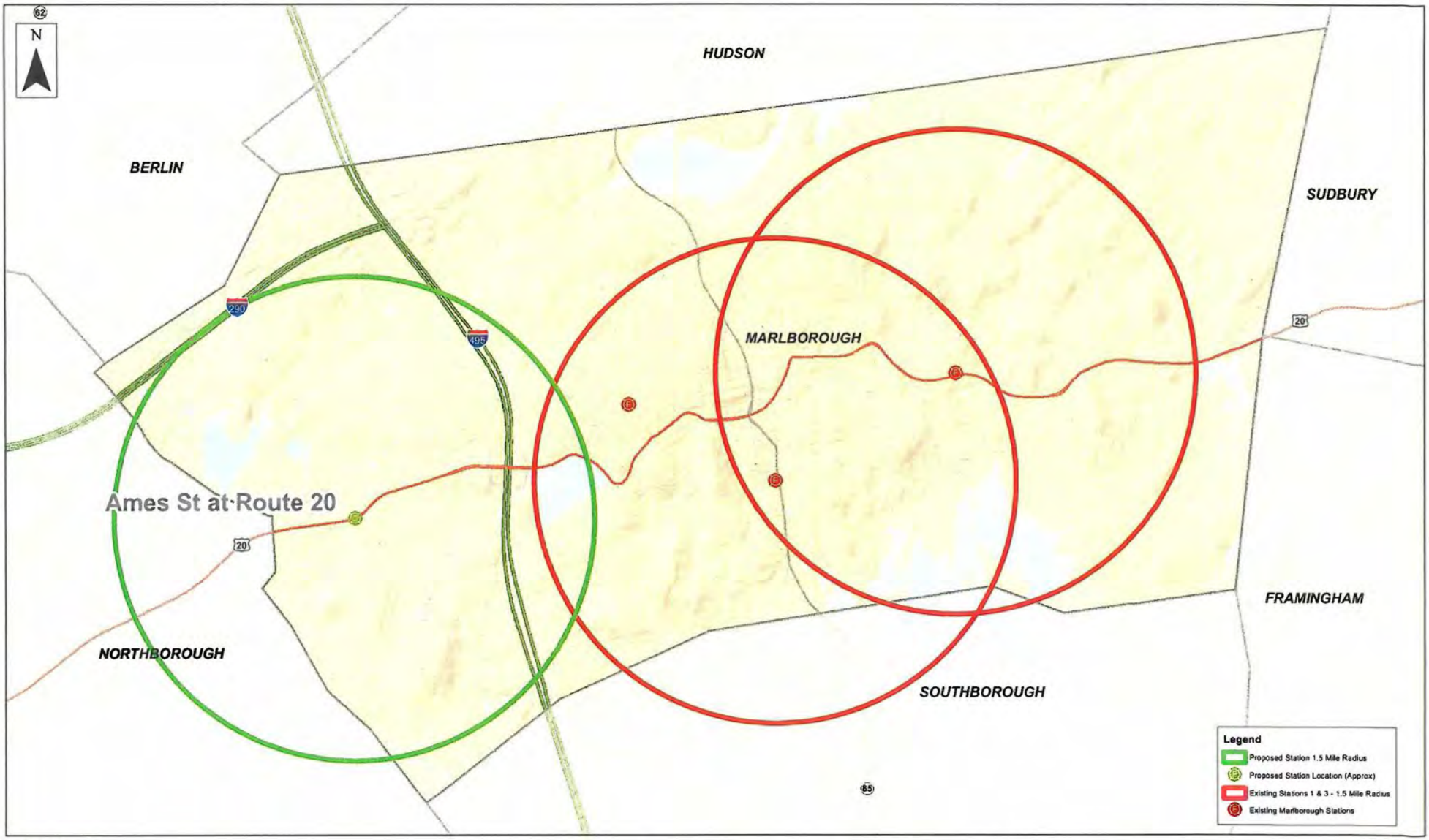
City of Marlborough GIS

Current and Proposed Station Location

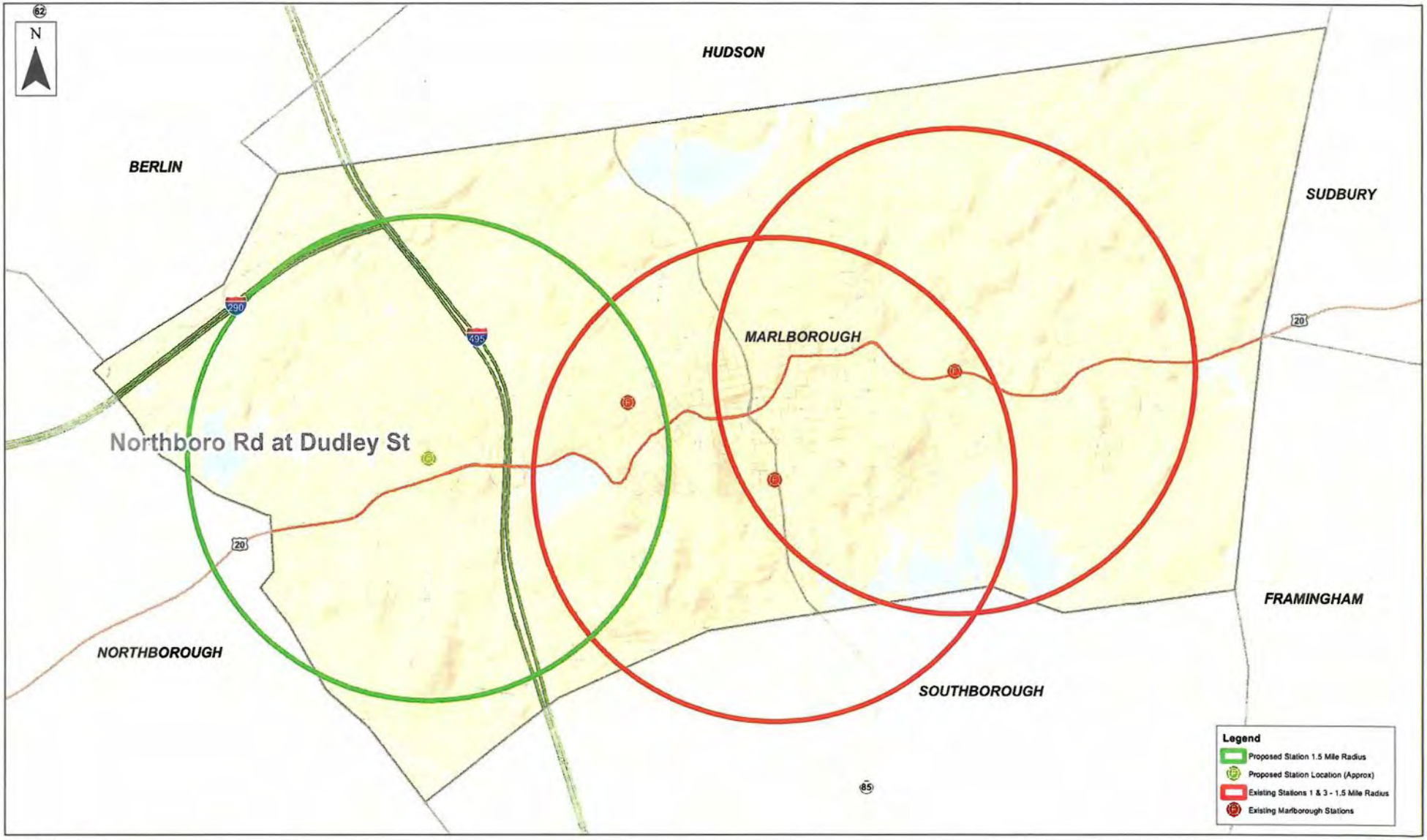


City of Marlborough GIS

Current and Proposed Station Location

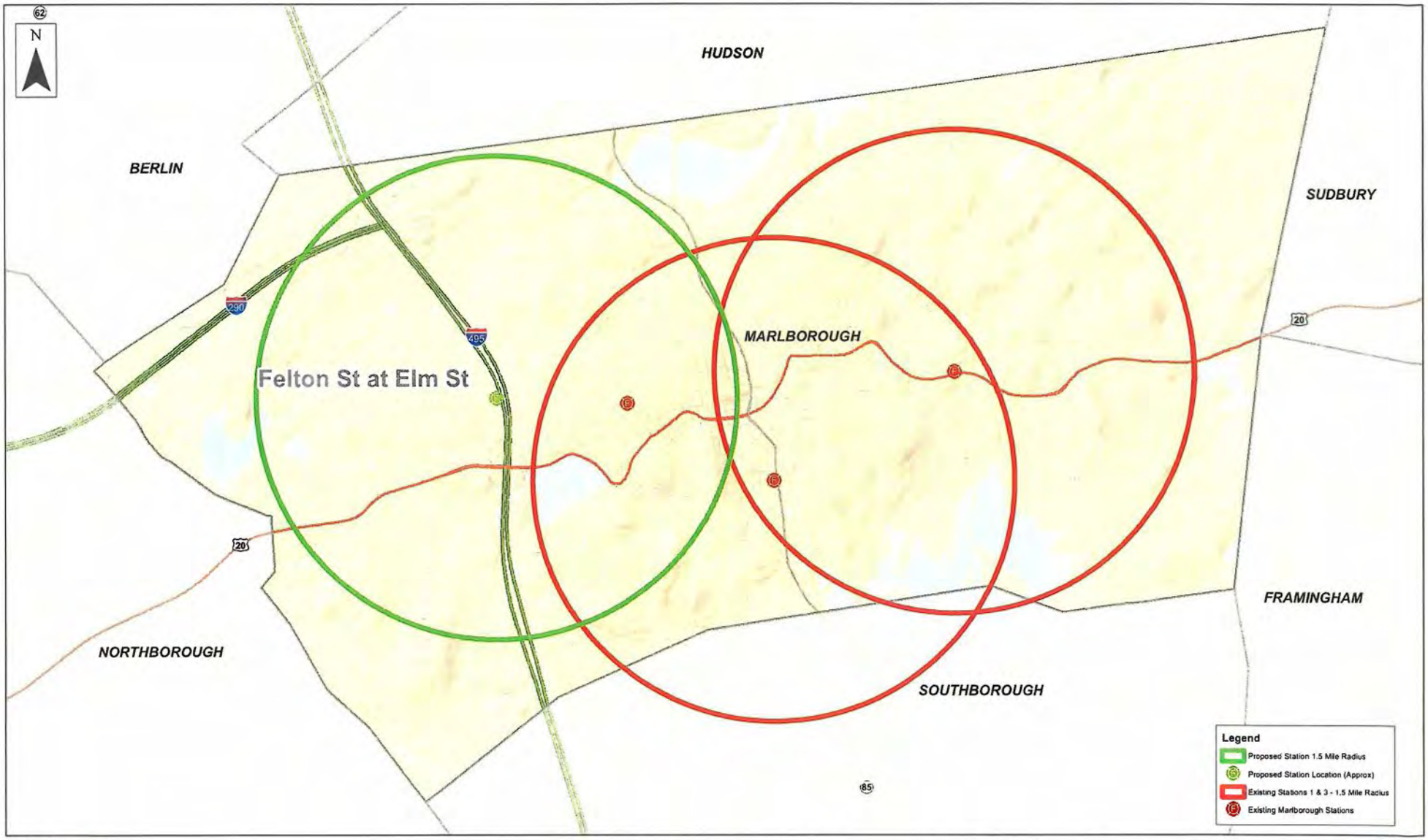


Current and Proposed Station Location

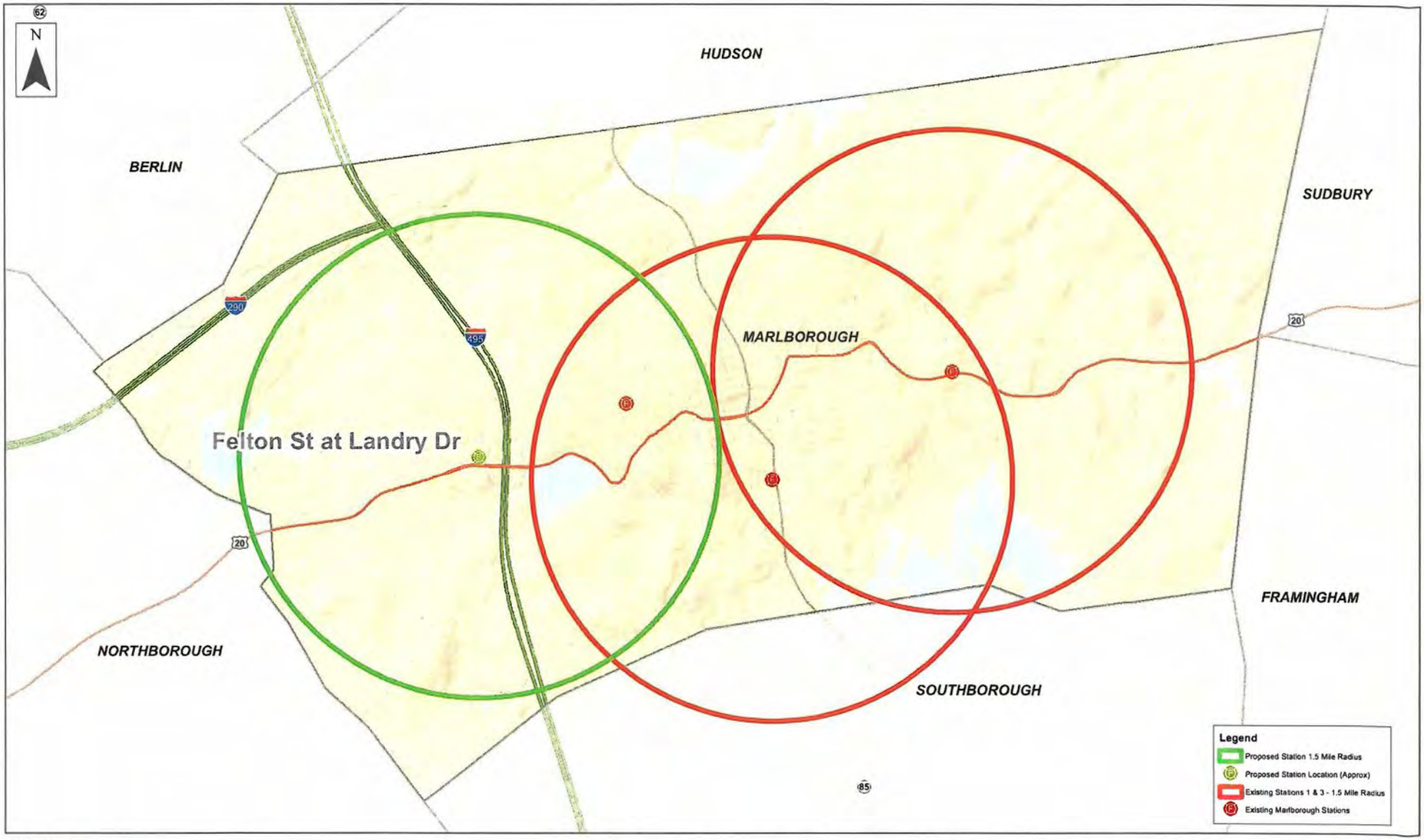


City of Marlborough GIS

Current and Proposed Station Location



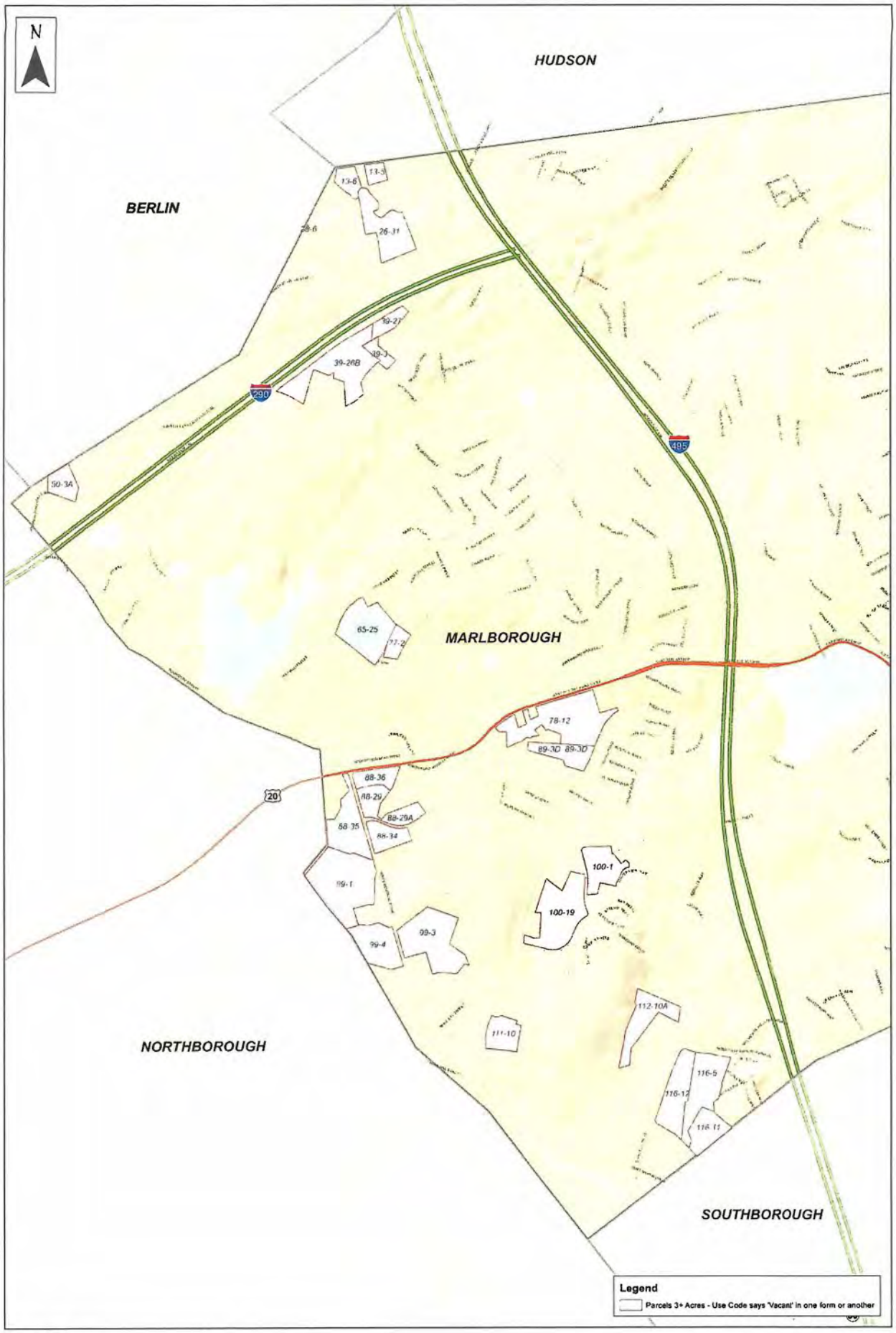
Current and Proposed Station Location



City of Marlborough GIS

0 0.25 0.5 1 1.5 2 Miles

Current and Proposed Station Location

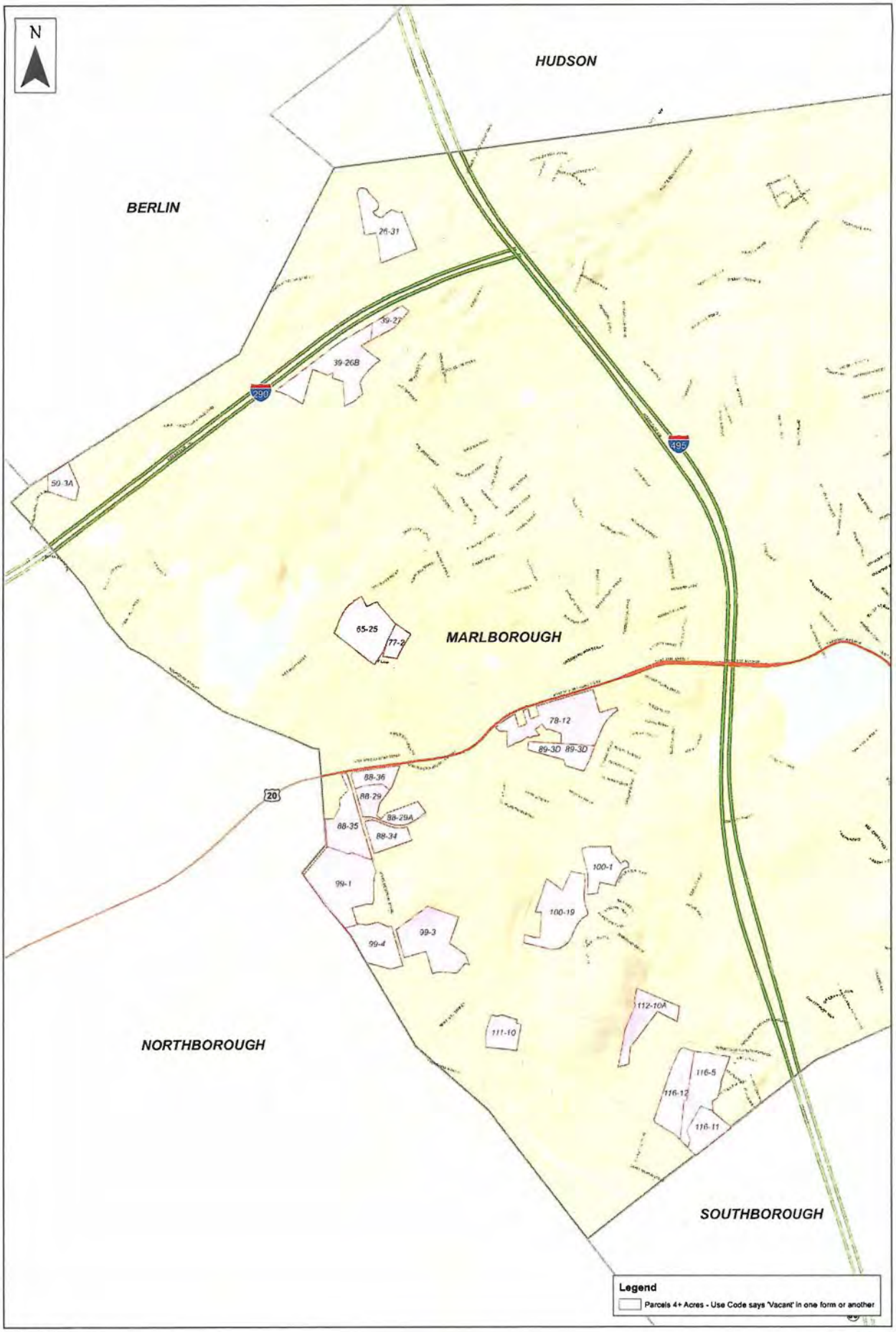


City of Marlborough GIS

'Vacant' Parcels >= 3 Acres

0 0.25 0.5 1 Miles

This is for informational purposes only. Please verify any property classifications with the Assessor's Office prior to making any decisions.

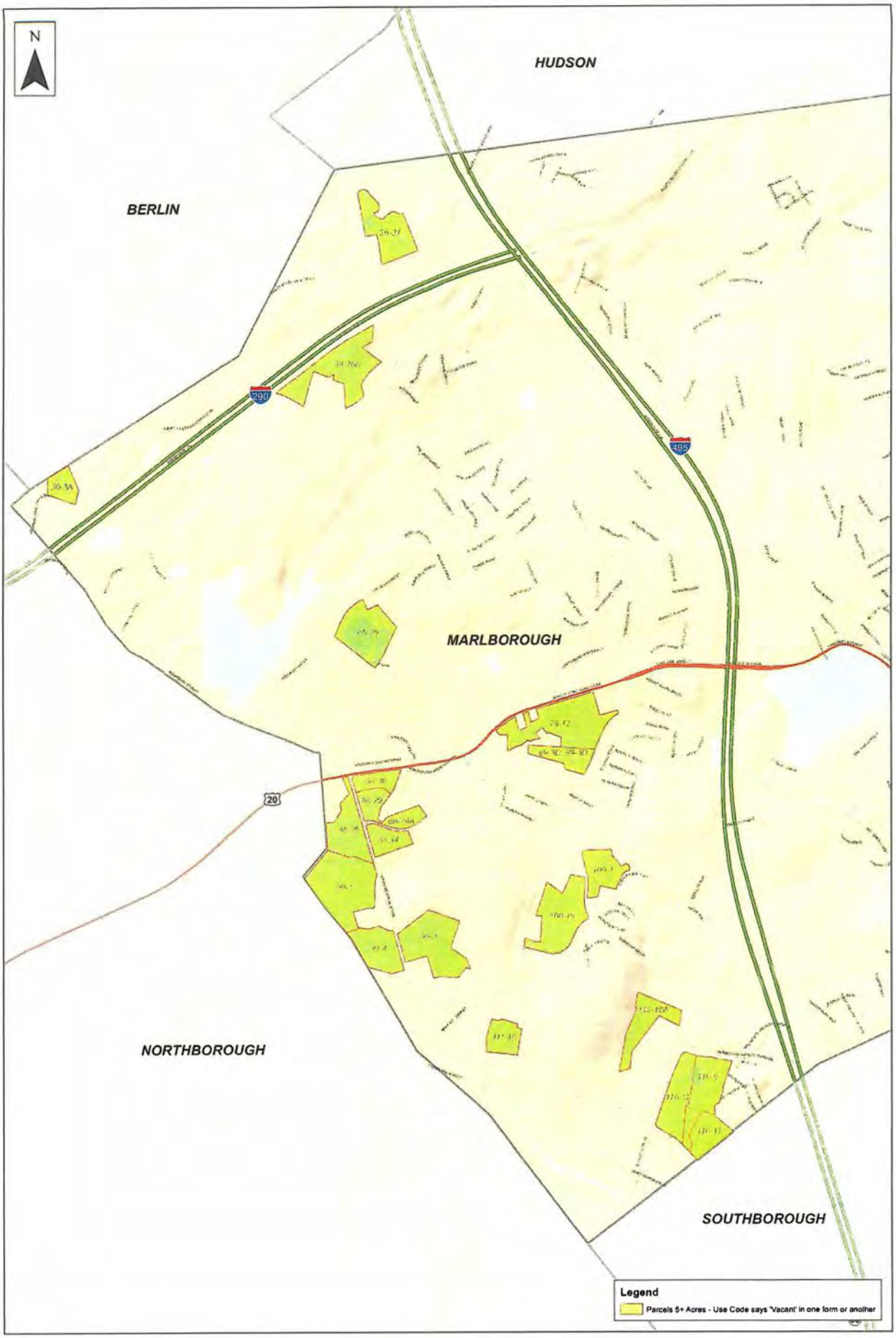


City of Marlborough GIS

'Vacant' Parcels >= 4 Acres

0 0.25 0.5 1 Miles

This is for informational purposes only. Please verify any property classifications with the Assessor's Office prior to making any decisions.



City of Marlborough GIS

'Vacant' Parcels >= 5 Acres

0 0.25 0.5 1 Miles

This is for informational purposes only. Please verify any property classifications with the Assessor's Office prior to making any decisions.

SECTION

2

NFPA® 1221

Standard for the

Installation, Maintenance, and Use of Emergency Services Communications Systems

2019 Edition

This edition of NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, was prepared by the Technical Committee on Public Emergency Service Communication. It was issued by the Standards Council on May 4, 2018, with an effective date of May 24, 2018, and supersedes all previous editions.

This edition of NFPA 1221 was approved as an American National Standard on May 24, 2018.

Origin and Development of NFPA 1221

NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, dates back to 1898. Originally, it was part of a general standard on signaling systems, but the material on municipal fire alarm systems was separated from the general standard in 1911. This standard has been revised and reissued in editions dated 1904, 1911, 1926, 1934, 1940, 1941, 1946, 1948, 1949, 1950, 1952, 1954, 1955, 1956, 1962, 1963, 1964, 1967, 1973, 1975, 1978, 1980, 1984, 1988, 1991, 1994, 1999, 2002, and 2007.

The 1999 edition of NFPA 1221 was a result of very hard work by committee members, especially the previous chairman, Evan E. Stauffer, Jr. The goal of the committee was to completely rewrite the standard to reflect an emergence of joint communications centers, the increase in technology-based information systems that assist users in both the communications center and the field of operations, and the role communications play in emergency scene operations within the Incident Command System. To reflect the fact that NFPA 1221 applies to all emergency responders, not just the fire service, the title was changed from *Standard for the Installation, Maintenance, and Use of Public Fire Service Communication Systems* to *Standard for the Installation, Maintenance, and Use of Emergency Communication Systems.*

The 2002 edition of this document continued to enhance the capabilities of personnel assigned to communications centers as well as the interoperability of systems. Because technology is continually changing, committee members began to assess potential changes to the next edition of this standard. It was recognized that it is incumbent on both users and enforcers of this standard to understand the impact of the standard, both in the area of service delivery and in the safety of those emergency response personnel delivering services.

Competing interests and priorities in a communications center need to be addressed by the authority having jurisdiction to develop standard operating procedures on how calls for service are processed, dispatched, and tracked. The mission of the communications center should be to serve as a conduit between those requesting services and those providing the services. This standard with its current revisions provides the requirements to accomplish that mission.

The 2007 edition of NFPA 1221 was a complete revision incorporating the requirements of the *Manual of Style for NFPA Technical Committee Documents.* As part of the 2007 revision, the committee restructured several chapters and added a new chapter on data network security and several new sections. Subsequently, all chapters were renumbered to accommodate those changes. The entire document was reviewed and editorially updated to clarify requirements and ambiguous language. In addition, the title of the document was again changed, to *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems.*

The 2010 edition of NFPA 1221 added requirements to include an emergency fire plan to safeguard personnel and minimize disruption of vital public safety communications. New communication centers and the buildings in which they are located were now required to be

protected from the approach of unauthorized vehicles or to have the building designed to be blast resistant. The committee also addressed the need for reliable in-building tactical emergency communications by developing performance requirements for two-way radio communication enhancement systems.

The 2013 edition of NFPA 1221 added a section on retroactivity that allowed the authority having jurisdiction to require the application of any provision of the document. The committee also addressed an important alarm processing issue. NFPA staff had been receiving frequent calls from emergency services about alarm processing times that exceeded the time allotted in the standard. These alarm calls required more time to process because dispatchers and call takers were required to gather additional information before dispatching the appropriate resources. The committee addressed the issue by including six categories of calls that require additional time to process within the standard.

The 2016 edition of NFPA 1221 included requirements regarding two-way radio communications enhancement systems and pathway survivability from *NFPA 72®, National Fire Alarm and Signaling Code®*, that the committees of both standards felt were more appropriate to NFPA 1221. Additionally, call processing times were revisited, resulting in a change to the emergency call processing timeline in the alarm processing section to include verification. The change addressed improvements to the technologies whereby telecommunicators receive emergency calls and the time it takes to verify the location of the emergency before processing. A requirement that two telecommunicators be on duty in the communications center at all times was another change made to the 2016 edition. Two additional categories of calls requiring additional time to process at the public safety answering point (PSAP) also were added.

For the 2019 edition, the committee made a global change in using the word *event* instead of *alarm* to recognize the many ways calls for service are processed by emergency communications centers. The committee updated extracts and definitions for the revised document. The committee evaluated call processing time benchmarks and updated as appropriate. Multi-line telephone system challenges were addressed in response to a tentative interim amendment (TIA) issued for the 2016 edition. Requirements regarding two-way radio communications enhancement systems were changed to incorporate the TIA filed for the 2016 edition and eliminate the need for pathway survivability for antenna cables. The committee addressed data security needs for communication systems.

Technical Committee on Public Emergency Service Communication

Stephen Verbil, *Chair*
Connecticut Department of Emergency Services & Public Protection, CT [E]

Douglas M. Aiken, Lakes Region Mutual Fire Aid, NH [U]
Rep. International Municipal Signal Association
William Ambrefe, City of Beverly, MA [E]
Charles M. Berdan, Smokeater Consulting, CA [SE]
Christopher Carver, National Emergency Number Association, OH [U]
Rep. National Emergency Number Association
Thomas DiBernardo, Seminole Tribe Fire Rescue, FL [E]
Jay Dornseif, III, Priority Dispatch Corporation, UT [SE]
Jerry Eisner, RedSky Technologies Inc., IL [IM]
John A. Facella, Panther Pines Consulting, LLC, ME [SE]
Kevin J Fosso, Dane County Public Safety Communications, WI [U]
Debbie Fox, Louisville KY EMA Metrosafe, KY [U]
Jonathan Franklin, Signal Communications LLC, FL [IM]
Mark Krizik, Motorola, Inc., IL [M]
Steve Leese, APCO International, FL [U]
Rep. Association of Public-Safety Communications Officials International Inc.
Minfei M. Leng, Bird Technologies Group, NY [M]
Scott Lheureux, Purvis Systems Inc., RI [M]
Kenneth J. Link, Jr., U.S. Department of Homeland Security, NJ [SE]
Christopher H. Lombard, Seattle Fire Department, WA [U]
Scott McCauley, Siemens Building Technologies, TX [M]
Rep. National Electrical Manufacturers Association
Nathan D. McClure, III, AECOM Building Engineering, VA [SE]
Carolina Y. Milan, Vandenberg AFB Emergency Communication Center, CA [U]
Charles Packard, ITS, TX [IM]
Thomas J. Parrish, Telgian Corporation, MI [SE]
Randy Richmond, Zetron, Inc., WA [M]
Timothy Ruiz, Code Consultants Inc., MO [SE]
Toivo Sari, Cypress Creek Emergency Medical Services, TX [U]
Keith D. Simpkins, County of Chester, PA [U]
Evan E. Stauffer, Jr., Upper Chichester, PA [SE]
Rex Strickland, III, Fairfax County Fire & Rescue Department, VA [L]
Rep. International Association of Fire Fighters
William J. Watters, Verisk Analytics/Insurance Services Office, Inc., NJ [I]

Alternates

Warren Burns, Telgian Corporation, AZ [SE]
(Alt. to Thomas J. Parrish)
Jeffrey G. Knight, City of Newton Fire Department, MA [U]
(Alt. to Douglas M. Aiken)
Benjamin Mellon, Seattle Fire Department, WA [U]
(Alt. to Christopher H. Lombard)
Daniel A. Morelos, Tucson Airport Authority, AZ [U]
(Alt. to Steve Leese)
Raymond Patterson, Siemens Building Technologies, TX [M]
(Alt. to Scott McCauley)
Ty Wooten, National Emergency Number Association, VA [U]
(Alt. to Christopher Carver)

Robert Fash, NFPA Staff Liaison

This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

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 relating to the operation, installation, and maintenance of public emergency services communications systems.

Contents

NFPA 1221

Standard for the

Installation, Maintenance, and Use of Emergency Services Communications Systems

2019 Edition

IMPORTANT NOTE: This NFPA document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading "Important Notices and Disclaimers Concerning NFPA Standards." They can also be viewed at www.nfpa.org/disclaimers or obtained on request from NFPA.

UPDATES, ALERTS, AND FUTURE EDITIONS: New editions of NFPA codes, standards, recommended practices, and guides (i.e., NFPA Standards) are released on scheduled revision cycles. This edition may be superseded by a later one, or it may be amended outside of its scheduled revision cycle through the issuance of Tentative Interim Amendments (TIAs). An official NFPA Standard at any point in time consists of the current edition of the document, together with all TIAs and Errata in effect. To verify that this document is the current edition or to determine if it has been amended by TIAs or Errata, please consult the National Fire Codes® Subscription Service or the "List of NFPA Codes & Standards" at www.nfpa.org/docinfo. In addition to TIAs and Errata, the document information pages also include the option to sign up for alerts for individual documents and to be involved in the development of the next edition.

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 C. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. 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 C.

Chapter 1 Administration

1.1 Scope.

1.1.1 This standard shall cover the installation, performance, operation, and maintenance of public emergency services communications systems and facilities.

1.1.2 This standard shall not be used as a design specification manual or an instruction manual.

1.2 Purpose. The purpose of this standard shall be as follows:

(1) To specify operations, facilities, and communications systems that receive events from the public
(2) To provide requirements for the retransmission of such events to the appropriate emergency response agencies
(3) To provide requirements for dispatching of appropriate emergency response personnel
(4) To establish the required levels of performance and quality of installations of emergency services communications systems

1.2.1 Public fire alarm systems and fire alarm systems on private premises from which signals are received directly or indirectly by the communications center shall be in accordance with *NFPA 72*.

1.2.2 Emergency reporting systems that are not covered by this standard shall be in accordance with *NFPA 72*.

1.3* Application. This standard shall apply to publicly and privately owned communications systems that include, but are not limited to, the following:

(1) Computer aided dispatching systems
(2) Telephone systems
(3) 9-1-1 systems
(4) Next Generation 9-1-1 systems
(5) Multi-line telephone systems (MLTS) used to access the Enhanced 9-1-1 systems
(6) Telematics
(7) Emergency response facility alerting systems
(8) Public and private alarm reporting systems
(9) One-way and two-way radio systems

N 1.3.1 The communication systems listed in Section 1.3 shall provide the following functions:

(1) Communication between the requester and emergency response agencies
(2) Communication within the emergency response agency under emergency and nonemergency conditions
(3) Communication among emergency response agencies

1.4 Retroactivity.

1.4.1 Unless otherwise noted, it is not intended that the provisions of this document be applied to facilities, equipment, structures, or installations that were existing or approved for construction or installation prior to the effective date of the document.

1.4.2 In those cases where it is determined that the existing situation involves a distinct hazard to life or property, the authority having jurisdiction shall be permitted to require retroactive application of any provisions of this document.

1.4.3 The portions of this standard that shall be applied retroactively are listed in Table 1.4.3, Retroactivity.

1.5 Equivalency. 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 over those prescribed by this standard.

1.5.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.5.2 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

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.

N Table 1.4.3 Retroactivity

Chapter	Retroactive
1	N/A
2	N/A
3	Yes
4	4.1, 4.5.1, 4.5.2, 4.5.5–4.5.7
5	No
6	No
7	Yes
8	Yes
9	No
10	No
11	Yes
12	Yes
13	Yes
14	No

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

NFPA 1, *Fire Code*, 2018 edition.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2018 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2019 edition.

NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, 2018 edition.

NFPA 54, *National Fuel Gas Code*, 2018 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2017 edition.

NFPA 70®, National Electrical Code®, 2017 edition.

NFPA 72®, National Fire Alarm and Signaling Code®, 2019 edition.

NFPA 75, *Standard for the Fire Protection of Information Technology Equipment*, 2017 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 2018 edition.

NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*, 2018 edition.

NFPA *101®, Life Safety Code®*, 2018 edition.

NFPA 110, *Standard for Emergency and Standby Power Systems*, 2019 edition.

NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, 2019 edition.

NFPA 220, *Standard on Types of Building Construction*, 2018 edition.

NFPA 731, *Standard for the Installation of Electronic Premises Security Systems*, 2017 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems*, 2017 edition.

NFPA 1061, *Standard for Public Safety Telecommunications Personnel Professional Qualifications*, 2018 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety*, 2014 edition.

NFPA 1600®, Standard on Disaster/Emergency Management and Business Continuity/Continuity of Operations Programs, 2016 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus*, 2016 edition.

NFPA 5000®, Building Construction and Safety Code®, 2018 edition.

2.3 Other Publications.

2.3.1 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2016.

N **2.3.2 FCC Publications.** Federal Communications Commission, 445 12th Street SW, Washington, DC 20554.

FCC 13-21, *Use and Design of Signal Boosters Report and Order*, 2013.

2.3.3 IEEE Publications. IEEE, 3 Park Avenue, 17th Floor, New York, NY 10016-5997.

IEEE C2, *National Electrical Safety Code*, 2017.

2.3.4 IESNA Publications. Illuminating Engineering Society of North America, 120 Wall Street, Floor 17, New York, NY 10005.

HB-9-00, *Lighting Handbook*, 9th edition, 2009.

N **2.3.5 NENA Publications.** National Emergency Number Association, 1700 Diagonal Road, Suite 500, Alexandria, VA 22314

NENA-ADM-000.21-2017, *NENA Master Glossary of 9-1-1 Terminology*, August 8, 2017.

NENA/APCO ANS 2.105.1-2017, *NG9-1-1 Emergency Incident Data Document (EIDD)*, 2017.

2.3.6 TIA/EIA Publications. Telecommunications Industry Association/Electronic Industries Alliance, 1320 North Courthouse Road, Suite 200, Arlington, VA 22201.

ANSI/TIA-102.BAAA, *FDMA Common Air Interface*, 1998.

TIA-102.BBAB, *Project 25 Phase 2 Two-Slot Time Division Multiple Access Physical Layer Protocol Specification.*

TIA-102.BBAC, *Project 25 Phase 2 Two-Slot TDMA Media Access Control Layer Description.*

TIA-603-D, *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards*, 2010.

2.3.7 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 752, *Standard for Bullet-Resistant Equipment*, 2005, Revised 2015.

2.3.8 Other Publications.

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

2.4 References for Extracts in Mandatory Sections.

NFPA 70®, National Electrical Code®, 2017 edition.

NFPA 72®, National Fire Alarm and Signaling Code®, 2019 edition.

NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, 2019 edition.

NFPA 1000, *Standard for Fire Service Professional Qualifications Accreditation and Certification Systems*, 2017 edition.

NFPA 1005, *Standard for Professional Qualifications for Marine Fire Fighting for Land-Based Fire Fighters*, 2014 edition.

NFPA 1021, *Standard for Fire Officer Professional Qualifications*, 2014 edition.

NFPA 1061, *Standard for Public Safety Telecommunications Personnel Professional Qualifications*, 2018 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. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

Δ **3.3.1* Alarm.** A signal or message from a device indicating the existence of an emergency or other situation that requires action by an emergency response agency.

Δ **3.3.1.1* *Alarm Data.*** Digital information related to an alarm that contains the physical location of the alarm and other explanatory information.

3.3.2 Alert Data Message (ADM). An analog or digital signal containing instructions for how a public alerting system alerting appliance (PASAA) is to deliver and, if capable, to acknowledge a public alert.

3.3.3 Alphanumeric Devices. Used as a part of a radio alerting system, paging receivers that provide an audible alert and a text message to the user and that do not have the ability to provide voice messages.

3.3.4 Alternate Communications Center. A designated communications center capable of assuming the functions normally performed at the primary communications center.

N **3.3.5 Annunciator.** A unit containing one or more indicator lamps, alphanumeric displays, or other equivalent means in which each indication provides status information about a circuit, condition, or location. [72, 2019]

3.3.6 Antenna. A device connected to a radio receiver, transmitter, or transceiver that radiates the transmitted signal, receives a signal, or both.

N **3.3.7 Automatic Call Distributor (ACD).** Equipment that automatically distributes incoming calls to available PSAP attendants in the order the calls are received, or queues calls until an attendant becomes available.

3.3.8* Automatic Location Identification (ALI). The automatic display at the PSAP of the caller's telephone number, the address/location of the telephone, and supplementary emergency services information of the location from which a call originates.

3.3.9* Automatic Number Identification (ANI). A series of alphanumeric characters that informs the recipient of the source of an event.

N **3.3.10* Backbone.** A communications cable in an in-building radio enhancement system that carries wideband signals important to the entire building, from the donor antenna, through the amplifiers, and to distribution antenna lines.

3.3.11 Band. A range of frequencies between two defined limits.

3.3.12 Base Station. A stationary radio transceiver with an ac or dc power supply or power supply module.

* **3.3.13 Cable.** A factory assembly of two or more conductors having an overall covering. [70, 800.2]

* *N* **3.3.14 Call.** A generic term used to include any type of request for emergency assistance (RFEA), and is not limited to voice.

N **3.3.15 Call Answer.** The condition when a call is delivered to and acknowledged by a telecommunicator (or an auto greeting) and two-way communication can begin.

N **3.3.16 Call Answer Interval.** The elapsed time between call arrival and call answer.

N **3.3.17 Call Arrival.** The condition when a call is presented to the PSAP customer premises equipment (CPE), which can include acknowledgement by an auto attendant.

3.3.18 Call Detail Recording (CDR). A system that provides metadata for each call, including automatic number identification (ANI), trunk number, and answering attendant number, and the time of seizure, answer, and disconnect/transfer.

3.3.19* Call Server. A system of electrical, mechanical, and computer components the function of which is to process incoming and outgoing telephone calls.

3.3.20 Certification. An authoritative attestment; specifically, the issuance of a document that states that an individual has demonstrated the knowledge and skills necessary to function in a particular fire service professional field. [1000, 2017]

3.3.21 Channel Access Time. The time lapse from activation of a radio transmitter's push-to-talk (PTT) switch to an acknowledgment from the system and commencement of transmission.

3.3.22* Circuit. The conductor or radio channel and associated equipment that are used to perform a specific function in connection with an alarm system.

3.3.23 Coded Receivers. Used as a part of a radio alerting system, paging receivers that respond only to messages directed to the specific unit or to units in an assigned group.

3.3.24 Common Battery. The battery used to power recorders, transmitters, relays, other communications center equipment, and alternate communications center equipment.

3.3.25* Communications Center. A building or portion of a building that is specifically configured for the primary purpose of providing emergency communications services or public safety answering point (PSAP) services to one or more public safety agencies under the authority or authorities having jurisdiction.

3.3.26* Communications Officer. The individual responsible for development of plans to make the most effective use of incident-assigned communications equipment and facilities, installation and testing of all communications equipment, supervision and operation of the incident communications center, distribution and recovery of equipment assigned to incident personnel, and maintenance and on-site repair of communications equipment.

3.3.27* Communications System. A combination of devices, networks, applications, computers, and services.

3.3.28* Comprehensive Emergency Management Plan (CEMP). A disaster plan that conforms to guidelines established by the authority having jurisdiction and is designed to address natural, technological, and man-made disasters.

3.3.29* Computer-Aided Dispatch (CAD). A combination of hardware and software that provides data entry, makes resource recommendations, and notifies and tracks those resources before, during, and after events, preserving records of those events and status changes for later analysis.

3.3.30 Control Console. A wall-mounted or desktop panel or cabinet containing controls to operate communications equipment.

3.3.31 Conventional Radio. A radio system in which automatic computer control of channel assignments is not required or used, system-managed queuing of calls is not provided, and channels are selected manually by the users.

3.3.32 Coordinated Universal Time. A coordinated time scale, maintained by the Bureau International des Poids et Mesures (BIPM), which forms the basis of a coordinated dissemination of standard frequencies and time signals.

3.3.33 Critical Operations Power Systems (COPS). Power systems for facilities or parts of facilities that require continuous operation for the reasons of public safety, emergency management, national security, or business continuity. [70:708.2]

3.3.34 Customer Premise Equipment (CPE). Equipment for the reception and origination of telephone calls located at a PSAP.

N **3.3.35 Cyber Security.** The vulnerability of any computing system, software program, or infrastructure to resist intentional interference, compromise, or incapacitation through the misuse of the Internet or public or private telecommunications systems, or similar conduct that harms interstate commerce or threatens public health or safety.

N **3.3.36 Data Security.** Protection of the integrity of an organization's data resources to insure that they are available to support the mission and that the data is not compromised.

3.3.37* Delivered Audio Quality (DAQ). A measure of speech intelligibility of land mobile radios.

3.3.38 Denial-of-Service Attack. An attack on a computer system or network with the objective of causing a loss of service to some or all users, by saturating the system or network with useless traffic, making it impossible for legitimate users of the system to use the facility.

3.3.39 Digital Radio System. A radio system that uses a binary representation of audio from one radio to another.

3.3.40 Direct Exterior Window. A window in a communications center that faces an area that is not part of the secure area assigned solely to the communications center or that is accessible to the public.

3.3.41* Dispatch Circuit. A circuit over which a signal is transmitted from the communications center to an emergency response facility (ERF) or emergency response units (ERUs) to notify ERUs to respond to an emergency.

3.3.42 Dispatcher. See 3.3.107, Telecommunicator.

3.3.43 Dispatching. See 3.3.50, Emergency Event Processing/Dispatching.

3.3.44 Display Screen. An electronic device that is capable of displaying text, video, and graphics.

N **3.3.45 Distribution Antenna.** A radio antenna that is specifically designed to radiate RF energy into a building area, and is typically non-descript in appearance so as not to disturb the décor of the area.

N **3.3.46* Distribution Antenna Cable.** A communications cable that carries RF energy in both directions along its length to distribution antennas in one or more places in the building.

3.3.47 Donor Antenna. Antennas used with two-way radio communications enhancement systems that provide the connection between the wide-area communications system of interest and the in-building system.

3.3.48 Donor Site. The specific wide-area communications site from which the donor antenna acquires services.

3.3.49* Emergency. A condition that is endangering or is believed to be endangering life or property; an event that requires the urgent response of an emergency response agency.

3.3.50* Emergency Event Processing/Dispatching. A process by which an event answered at the communications center creates a call for service and is transmitted to emergency response facilities (ERFs) or to emergency response units (ERUs) in the field.

3.3.51 Emergency Dispatch Protocol. A standard sequence of questions used by telecommunicators that provides post-dispatch or pre-arrival instructions to callers.

3.3.52* Emergency Response Agency (ERA). Organizations providing law enforcement, emergency medical, fire, rescue, communications, and related support services.

3.3.53* Emergency Response Facility (ERF). A structure or a portion of a structure that houses emergency response agency equipment or personnel for response to events.

3.3.54 Emergency Response Unit (ERU). Personnel who respond to fire, medical, law enforcement, and other emergency situations for the preservation of life and safety.

3.3.55 Enhanced 9-1-1. Emergency telephone service that provides selective routing and both automatic number identification (ANI) and automatic location identification (ALI) of the calling party.

N **3.3.56* Event.** An emergency or other situation that requires action by an emergency response agency.

N **3.3.57* Event Data.** Information related to an event that contains the physical location of the event, callback number of the reporting party/system, and other explanatory information.

N **3.3.58 Immediately Dangerous to Life or Health (IDLH).** Any condition that would pose an immediate or delayed threat to life, cause irreversible adverse health effects, or interfere with an individual's ability to escape unaided from a hazardous environment. [1005, 2014]

3.3.59 Incident Management System. A plan that defines the roles and responsibilities to be assumed by personnel and the operating procedures to be used in the management and direction of emergency operations.

N **3.3.60 Information Communication Technology (ICT) Security.** Security of the integrity of the organization's data within the organization's normal use of that data as well as in preventing unauthorized external parties from attempting access or damage to the data using cyber attack techniques.

3.3.61 Instant Recall Recorder. A device that records voice conversations and provides a telecommunicator with a means to review such conversations in real time.

3.3.62 Intelligent Transportation System. A means of electronic communications or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system.

3.3.63* IP-Enabled Device. A data-centric device that uses Internet protocol (IP) as a means of communication.

3.3.64* Logging Recorder. A device that records event and dispatch information.

3.3.65 Master Time Source. A system providing time information to connected PSAP equipment that is traceable to Coordinated Universal Time (UTC).

3.3.66 Microwave. Radio waves with frequencies of 1000 MHz and higher.

3.3.67 Modem (Modulator/Demodulator Unit). A device that converts data that is compatible with data-processing equipment to a form that is compatible with transmission equipment, and vice versa.

3.3.68 Monitor. To listen to or observe message traffic without transmitting a response.

3.3.69 Monitoring for Integrity. Automatic monitoring of circuits and other system components for the existence of defects or faults that interfere with receiving or transmitting data related to an event.

3.3.70* Multi-Line Telephone System (MLTS). A system designed to aggregate more than one incoming voice communication channel for use by more than one telephone. This includes network- and premises-based systems.

N **3.3.71 Next Generation 9-1-1 (NG9-1-1).** NG9-1-1 is an Internet Protocol (IP)–based system comprised of managed emergency services IP networks (ESInets), functional elements (applications), and databases that replicate traditional E9-1-1 features and functions and provide additional capabilities. NG9-1-1 is designed to provide access to emergency services from all connected communications sources and provide multimedia data capabilities for public safety answering points (PSAPs) and other emergency service organizations. [NENA Master Glossary of 9-1-1 Terminology]

3.3.72* Notification. The time at which an event or alarm is received and acknowledged at a communications center.

3.3.73 Numeric Receivers. Used as a part of a radio alerting system, paging receivers that provide an audible alert and a numeric message to the user and that do not have the ability to provide text or voice messages.

3.3.74 Operations Room. The room in the communications center where events and alarms are received and processed and communications with emergency response personnel are conducted.

3.3.75 P.01 GOS. A probability statement for grade of service that no more than 1 call out of 100 attempts made during the average busy hour will receive a busy signal.

3.3.76 Pager. A compact radio receiver used for providing one-way communication or limited digital/data two-way communication.

3.3.77 Path (Pathways). Any circuit, conductor, optic fiber, radio carrier, or other means connecting two or more locations. [72, 2019]

Δ **3.3.78 Permanent Visual Record (Recording).** An immediately readable, not easily alterable record of all occurrences of status change.

3.3.79 Portable Radio. A battery-operated, hand-held transceiver.

3.3.80 Power Source. The power obtained from a utility distribution system, an engine-driven generator, or a battery.

3.3.81* Private Branch Exchange (PBX). A system designed to connect to a local exchange carrier (incumbent or competitive) to allow telephone calls to be distributed to extensions and extensions to use a set of voice communication channels to make outbound calls. A PBX also allows extension-to-extension telephone calls without connecting to the public switched telephone network.

3.3.82 Public Alarm Reporting System. A system of alarm-initiating devices, receiving equipment, and connecting circuits, other than a public telephone network, used to transmit alarms from street locations to the communications center.

3.3.83 Public Alerting System (PAS). A system that creates, transmits, and displays a public alert message or sounds a signal, or both, that is intended to alert the public to situations that could result in loss of life, endanger their health, or destroy property.

3.3.84 Public Alerting System Alerting Appliance (PASAA). A device that receives a signal from a public alerting system (PAS) and broadcasts an audible and visual alarm that could be in the form of text or speech.

3.3.85 Public Safety Agency/Public Safety Organization. See 3.3.52, Emergency Response Agency (ERA).

3.3.86 Public Safety Answering Point (PSAP). A facility in which 9-1-1 calls are answered.

N **3.3.87* Public Safety Emergency Communications System.** A communications system dedicated to the receipt of events, the coordination and dispatch of first responder resources, and the management of resources and activities post-dispatch.

N **3.3.88 Radiating Cable.** A coaxial cable that distributes small amounts of RF energy along its length by means of periodic breaks in the shield surrounding the center conductor.

3.3.89* Radio Channel. A band of frequencies of a width sufficient to allow its use for radio communications. [72, 2019]

3.3.90 Radio Control Station. A mobile or base station radio in a fixed location (often on a desktop or in a dispatcher's console) that operates on a radio frequency configuration so that it can access a land mobile radio-fixed repeater station or fixed trunking station to gain access to the communication system. A radio control station is often used in a 9-1-1 center to provide a backup means to access the public safety communications system.

3.3.91* Radio Frequency. The number of electromagnetic wave frequency cycles transmitted by a radio in 1 second.

3.3.92 Radio Licensing Authority. The government authority in a country that issues licenses for use of radio frequencies by authorized agencies and individuals.

3.3.93* Remote Communications Facility. A normally unattended facility, remote from the communications center that is used to house equipment necessary for the functioning of a communications system.

3.3.94 Repeater. A device for receiving and re-transmitting one-way or two-way communication signals.

N **3.3.95 Requester.** Any person, device, machine, or system observing and reporting an event requiring an emergency response.

3.3.96* Response Unit. A vehicle, equipment, or personnel identified by the AHJ for dispatch purposes.

3.3.97 RF-Emitting Device. An active device that emits a radio frequency signal as part of a two-way radio communications enhancement system.

3.3.98 Security Vestibule. A compartment provided with two or more doors where the intended purpose is to prevent continuous and unobstructed passage by allowing the release of only one door at a time.

3.3.99 Simplex Radio Channel. A radio channel using a single frequency that, at any one time, allows either transmission or reception, but not both, by a particular radio.

3.3.100* Standard Operating Procedures (SOPs). Written organizational directives that establish or prescribe specific operational or administrative methods that are to be followed routinely for the performance of designated operations or actions.

3.3.101 Stored Emergency Power Supply System (SEPSS). A system consisting of a UPS, a rectifier plant, or a motor generator powered by a stored electrical energy source; a transfer switch designed to monitor preferred and alternate load power source and provide desired switching of the load; and all necessary control equipment to make the system functional. [111, 2019]

3.3.102 Subscriber. A mobile radio, portable radio, or radio control station operated by a user in a wireless communications system on a radio frequency configuration so that it can access a land mobile radio fixed repeater station or fixed trunking base station to gain access to the communication system.

3.3.103 Supervisor. An individual responsible for overseeing the performance or activity of other members. [1021, 2014]

3.3.104 Tactical Interoperable Communications Plan (TICP). A document used to clearly define the breadth and scope of interoperable assets available in the area and how those assets are shared and how their use is prioritized, and the steps individual agencies should follow to request, activate, use, and deactivate each asset.

3.3.105 Talkgroup. A group of radios addressed as a single entity by the system and functionally equivalent to a conventional repeater channel.

3.3.106 TDD/TTY. A device that is used in conjunction with a telephone to communicate with persons who are deaf, who are hard of hearing, or who have speech impairments, by typing and reading text.

3.3.107 Telecommunicator. An individual whose primary responsibility is to receive, process, or disseminate information of a public safety nature via telecommunication devices. [1061, 2018]

N **3.3.108 Telematics.** The combination of communications and information systems used to provide information and/or communications from a vehicle to a PSAP through a telematics service provider. Vehicle systems can include GSM, GPRS, SMS, GPS, and vehicle telemetry.

3.3.109 Tie Circuit. A circuit that connects a communications center with an alternate communications center or with a public safety answering point (PSAP).

3.3.110 Transceiver. A combined transmitter and receiver radio unit.

3.3.111 Trouble Signal. A signal initiated by a dispatch system or device indicative of a fault in a monitored circuit or component.

3.3.112 Trunked Radio. A radio system that uses computer control to automatically assign channels from an available pool of channels to users and groups of users.

3.3.113* Two-Way Alphanumeric Devices. Used as a part of a radio -alerting system, paging transceivers that provide an audible alert and a text message to the user and that have the ability to acknowledge messages received back to the control point.

3.3.114 Two-Way Radio Communications Enhancement System. A combination of components, RF-emitting devices, antennas, cables, power supplies, control circuitry, and programming installed at a specific location to improve wireless communication at that location.

3.3.115* Uninterruptible Power Supply (UPS). A system consisting of a stored energy source, designed to continuously provide a clean, conditioned sinusoidal wave of power under normal conditions and for a finite period of time upon loss of the primary power source. [111, 2016]

3.3.116* Voice Communication Channel. A single circuit for communication by spoken word that is distinct from other circuits for communications.

3.3.117 Wired Circuit. A metallic or fiber-optic circuit, leased to or owned by a jurisdiction, that is dedicated to a specific alarm or communication system under the control of that jurisdiction.

Chapter 4 Communications Centers

4.1 General.

4.1.1* Communications centers and alternate communications centers shall comply with Chapter 4.

N **4.1.2*** A comprehensive emergency management plan (CEMP) shall be in place for each communications center.

N **4.1.2.1** The CEMP shall comply with the applicable requirements of *NFPA 1600* and additional requirements specified in this document.

N **4.1.2.2** The AHJ shall review the CEMP for currency and applicability annually.

4.1.3 When provided, remote communications facilities shall comply with Section 4.10.

4.1.4 Communications equipment shall be kept in working order at all times.

4.1.5 Each center shall be provided with a designated primary means of communication that shall be compatible with the designated primary means of communication provided at the Emergency Response Facilities (ERFs).

4.1.5.1 Each center shall be provided with an alternate means of communication that is compatible with the alternate means of communication provided at the ERFs. The alternate means shall be readily available to the telecommunicator in the event of failure of the primary communications system.

4.1.6* Each jurisdiction shall maintain an alternate communications center that meets the criteria in 4.1.6.1 and 4.1.6.2.

4.1.6.1 The alternate communications center shall be capable, when staffed, of performing the emergency functions performed at the primary communications center.

4.1.6.2* The alternate communications center shall be separated geographically from the primary communications center at a distance that ensures the survivability of the alternate center.

4.1.6.3 Each jurisdiction shall develop a formal plan to maintain and operate the alternate communications center.

4.1.6.3.1 The plan shall include the ability to reroute incoming event and alarm traffic to the alternate center and to process and dispatch events at that center.

4.1.6.3.2* The plan shall be included in the Comprehensive Emergency Management Plan (CEMP).

4.1.6.4* When operations are from the alternate communications center, receipt, transfer, processing, and dispatching of alarms and events in accordance with the requirements of this standard shall not be dependent on the functioning of any equipment at the primary communications center.

4.1.7* The communications center shall be capable of continuous operation long enough to enable the transfer of operations to the alternate communications center in the event of fire or other emergency in the communications center or in the building that houses the communications center.

4.1.8 Systems that are essential to the operation of the communications center shall be designed to accommodate peak workloads as determined by the authority having jurisdiction (AHJ).

4.1.9* Communications centers shall be designed to accommodate the staffing level necessary to operate the center as required by Chapter 7.

4.1.10 The design of the communications center shall be based on number of personnel needed to handle peak workloads as determined by the AHJ.

4.2 Exposure Hazards.

4.2.1 Where the building that houses a communications center is adjacent to another structure, the exposed walls shall be protected in compliance with *NFPA 5000* or in compliance with the building code legally in effect, whichever is more restrictive.

4.2.2* When the building that houses a communications center is located within 150 ft (46 m) of the potential collapse zone of a taller structure, the roof shall be designed to resist damage from collapse of the exposing structure.

4.2.3* The lowest floor elevation of the communications center shall be above the 100-year flood plain established by the Federal Emergency Management Agency.

4.3 Construction.

4.3.1 Communications centers shall be located in buildings of Type I or Type II construction as defined by NFPA 220.

4.3.2 Buildings that house communications centers shall have Class A roof coverings.

4.3.3 Communications centers shall be separated from other portions of buildings occupied for purposes other than emergency communications by fire barriers having a fire resistance rating of 2 hours.

4.3.4 Fire barriers shall comply with NFPA *101* Section 8.3.

4.3.5* Communications centers shall not be located below grade unless the elevation of the lowest floor in the facility is above the 500-year flood plan. Communications centers located below grade shall comply with 11.7.3 of NFPA *101* and be specifically designed for the location.

4.3.6 The exposed surfaces of interior walls and ceilings shall have a flame spread index of 25 or less and a smoke development index of 50 or less when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials.*

4.3.7 Interior floor finish shall comply with the requirements of NFPA *101* interior floor finish testing and classification and shall be Class I as established by NFPA *101* or shall have a minimum critical radiant flux of 0.1 W/cm^2.

4.3.8 The operations room shall be equipped with a toilet facility and a lunch area that are directly accessible to the telecommunicators within the secured area as required by Section 4.6.

4.3.8.1* Communications centers shall be provided with backup facilities for sanitation and drinking water to provide for the health and safety of employees during extended periods of failure of public water or sewer systems.

4.3.9 The communications center or that portion of a building to be utilized as a communications center shall be protected against seismic damage in accordance with *NFPA 5000* or the building code legally in effect.

4.4 Climate Control.

4.4.1 Heating, ventilating, and air-conditioning (HVAC) systems shall be provided in accordance with NFPA 90A and NFPA 90B.

4.4.1.1 HVAC systems shall be designed to maintain temperature and relative humidity within limits specified by the manufacturers of the equipment critical to the operation of the communications center as determined by the AHJ.

4.4.1.1.1* Separate temperature and humidity controls shall be provided for each equipment room, for the operations room, for office areas, and for other spaces designated by the AHJ.

4.4.1.2* HVAC systems shall be independent systems that serve only the communications center.

4.4.1.3* HVAC system intakes for fresh air shall be arranged to minimize smoke intake from a fire inside or outside the building and to resist intentional introduction of irritating, noxious, toxic, or poisonous substances into the HVAC system.

4.4.1.4 Emergency controls shall be provided in the operations room to permit closing of outside air intakes.

4.4.1.5* Backup HVAC systems shall be provided for the operations room and other spaces housing electronic equipment determined by the AHJ to be essential to the operation of the communications center.

4.4.1.6 Backup or redundant HVAC units shall be capable of receiving power from all power sources required by Section 4.7.

4.4.1.7* HVAC systems shall be designed so that the communications center is capable of uninterrupted operation with the largest single HVAC unit or component out of service.

4.4.1.8* Primary and backup HVAC systems shall be capable of operating from the normal power source required by 4.7.2 and the alternate power source required by 4.7.3.

4.4.1.9* Primary and backup/redundant HVAC units shall be located to prevent tampering, vehicle impact, or introduction of hazardous/noxious chemicals or odors.

4.4.2 Penetrations into the communications center shall be limited to those necessary for the operation of the center.

4.5 Fire Protection.

4.5.1 The communications center shall be provided with fire extinguishers that meet the requirements of NFPA 10.

4.5.2 The communications center and spaces adjoining the communications center shall be provided with an automatic fire detection, alarm, and notification system in accordance with *NFPA 72.*

4.5.2.1 The alarm system shall be monitored in the operations room.

4.5.2.2 Operation of notification appliances shall not interfere with communications operations.

4.5.3 The building that houses the communications center shall be protected throughout by an approved, supervised automatic sprinkler system that complies with NFPA 13.

4.5.4 Supervision shall be in accordance with 9.7.2 of NFPA *101.*

4.5.5 Electronic computer and data processing equipment shall be protected in accordance with NFPA 75.

4.5.6* Emergency Fire Plan. There shall be a management-approved, written, dated, and annually tested emergency fire plan that is part of the CEMP.

4.5.7* Damage Control Plan. There shall be a management-approved, written, dated, and annually tested damage control plan that is part of the CEMP.

4.5.8* Each jurisdiction shall develop a tactical interoperable communications plan (TICP) utilizing TIA-603-D, *Land Mobile FM or PM Communication Equipment Measurement and Performance Standards,* or a similar reference.

4.5.9 The TICP shall be included in the comprehensive emergency management plan (CEMP).

4.6 Security.

4.6.1 The communications center and other buildings that house essential operating equipment shall be protected against damage from vandalism, terrorism, and civil disturbances.

4.6.2 Entry to the communications center and other buildings and structures that contain equipment essential to the operation of the communications systems shall be restricted to authorized persons.

4.6.2.1 Potential points for unauthorized entry as determined by the AHJ shall be protected by an electronic intrusion detection system.

4.6.2.2 The intrusion detection system shall be annunciated in the operations room and at another location designated by the AHJ.

4.6.3* Entryways to the communications center shall be protected by a security vestibule.

4.6.3.1 Door openings shall be protected by listed, self-closing fire doors that have a fire resistance rating of not less than 1 hour.

4.6.3.2 Door openings shall be protected by listed, self-closing doors that are rated for bullet resistance to Level 4 as defined in ANSI/UL 752, *Standard for Bullet-Resistant Equipment.*

4.6.4 Where a communications center has windows, the requirements of 4.6.4.1 through 4.6.4.5 shall apply.

4.6.4.1 Window sills on all direct exterior windows shall be a minimum of 4 ft (1.2 m) above floor level or 4 ft (1.2 m) above finished grade, whichever is higher.

4.6.4.2 Direct exterior windows shall be rated for bullet resistance to Level 4 as defined in ANSI/UL 752, *Standard for Bullet-Resistant Equipment.*

4.6.4.3 Direct exterior windows that are not bullet resistant shall be permitted, provided that they face a secured area that cannot be accessed or viewed from outside the secured perimeter of the communications center.

4.6.4.4 Direct exterior windows that are required to be bullet resistant shall be configured so that they cannot be opened.

4.6.4.5* Direct exterior windows shall be arranged so that it is not possible to view the interior of the communications center from outside the secured perimeter.

4.6.5* Perimeter walls shall be designed and constructed to provide the same level of ballistic protection as that required for windows.

4.6.6 Means shall be provided to prevent unauthorized vehicles from approaching the building housing the communications center to a distance of no less than 82 ft (25 m).

4.6.7* As an alternative to 4.6.6, unauthorized vehicles shall be permitted to approach closer than 82 ft (25 m) if the building has been designed to be blast resistant, as approved by the AHJ.

4.7 Power.

Δ 4.7.1 General. Each communications center shall be provided with a critical operations power system in compliance with *NFPA 70.*

4.7.1.1 Designated critical operations areas (DCOAs) shall include the operations room, information technology (IT) rooms, telephone rooms, electrical equipment rooms, mechanical equipment rooms, fire protection equipment rooms, sanitary facilities, and other spaces and equipment designated by the AHJ as requiring critical operations power.

4.7.1.2 At least two independent and reliable power sources shall be provided, one primary and one emergency, and each shall be of adequate capacity for operation of the communications center.

4.7.1.3 Power sources shall be monitored for integrity, with annunciation provided in the operations room.

4.7.1.4 In addition to the two power sources required by 4.7.1.2, a means for connecting a portable or vehicle-mounted generator shall be provided.

4.7.1.5* The means shall include an outdoor weatherproof power connector and a manual disconnecting means for the power connector. The disconnecting means shall connect to the center's power system on the load side of the automatic transfer switch required by 4.7.3.2.

Δ 4.7.1.6* Wiring methods for feeders, branch circuits, and any control wiring utilized in the delivery of power for the operation of the communications center shall be designed in accordance with *NFPA 70.*

4.7.2 Primary Power Source. One of the following shall supply primary power:

(1) A feed from a commercial utility distribution system
(2) An approved engine-driven generator installation or equivalent under the control of communications center staff, designed for continuous operation, and with a person specifically trained in its operation on duty at all times
(3) An approved engine-driven generator installation or equivalent under the control of communications center staff, arranged for cogeneration with commercial light and power, and with a person specifically trained in its operation on duty at all times

4.7.3 Emergency Power Supply System.

N 4.7.3.1 The emergency power supply system shall consist of one or more engine-driven generators installed in accordance with *NFPA 70.*

4.7.3.2 Upon failure of primary power, transfer to the standby emergency supply system shall be automatic.

4.7.4* Engine-Driven Generators.

4.7.4.1 Engine-driven generators shall conform with the provisions of Chapter 4 of NFPA 37 and with NFPA 110.

4.7.4.2 Engine-driven generators shall conform with the provisions of NFPA 110, Type 10, Level 1, Class 72.

4.7.4.2.1 The authority having jurisdiction shall be permitted to require a higher class if necessary to comply with the CEMP.

4.7.4.3* Engine-driven generators shall be sized to supply power for the operation of all functions of the communications center and for any additional loads determined by the AHJ.

4.7.4.4 When installed indoors, engine-driven generators shall be located in a ventilated and secured area that is separated from the communications center by fire barriers having a fire resistance rating of 2 hours.

4.7.4.5 Fire barriers shall comply with NFPA *101*, Section 8.3.

4.7.4.6 When installed outdoors, engine-driven generators shall be located in a secure enclosure concealed from public view and accessible only to authorized personnel.

4.7.4.6.1 The enclosure shall be capable of resisting the entrance of precipitation at the maximum wind velocities referenced in *NFPA 5000* or in accordance with the building code legally in effect, whichever is more restrictive.

4.7.4.6.2 The enclosure shall be capable of resisting penetration by small arms fire. Doors, and windows if provided, shall be rated for bullet resistance to Level 4 as defined in ANSI/UL 752, *Standard for Bullet-Resistant Equipment.*

4.7.4.6.3 The enclosure shall be equipped with an intrusion detection system complying with NFPA 731 that shall be monitored in the operations room and at another location designated by the AHJ.

4.7.4.7 The area that houses an engine-driven generator shall not be used for storage other than spare parts or equipment related to the generator system.

4.7.4.8 Liquid fuel shall be stored in accordance with NFPA 37.

4.7.4.9 Liquid fuel for engine-driven generators shall not use a gravity-fed system.

4.7.4.10 Natural gas installations shall comply with NFPA 54.

4.7.4.11 Liquefied petroleum gas (LPG) installations shall comply with NFPA 58.

4.7.4.12* Fuel to operate an engine-driven generator for 72 hours at full load shall be available on site.

4.7.4.12.1* Diesel fuel shall be maintained and tested at regularly scheduled intervals as determined by the AHJ.

4.7.4.12.2 Fuel tank levels shall be monitored electronically in the operations room. A low-fuel supervisory alert shall be annunciated when the fuel level in a tank drops to two-thirds rated capacity. The AHJ shall be permitted to designate additional levels for tank level annunciation.

4.7.4.12.3 A dedicated fuel tank shall be provided for each engine.

4.7.4.13 Equipment essential to the operation of the generator shall be supplied with standby power from the generator.

4.7.4.14 Generators shall not use the public water supply for engine cooling.

4.7.4.15 The engine conditions requiring remote audible annunciation for Level 1 systems in NFPA 110, Table 5.6.5.2, shall be individually visually annunciated in the operations room.

4.7.4.15.1 In addition to the visual annunciation, an audible signal common to all annunciated signals shall be provided.

4.7.4.15.2 A silencing switch for the audible signal in the operations room shall be permitted on the condition that when all supervisory signals have cleared, the silencing circuit will automatically reset or the audible alert will re-sound as a reminder to restore the switch to normal.

4.7.5 Power Circuits. Power circuits, together with their associated motors, generators, rectifiers, transformers, fuses, and controlling devices, shall be installed in accordance with *NFPA 70* and the requirements of this subsection.

4.7.5.1 Primary power shall be obtained from the line side of the main service disconnect switch of the connection to a commercial utility distribution system or to the main conductors from an isolated power plant that is located on the premises.

4.7.5.2 Power shall be permitted to be obtained from the load side of the main service disconnect switch only when the building is used exclusively for housing of emergency communications facilities.

4.7.5.3 Power circuit conductors shall not be installed in conduit that is used for other circuits.

4.7.5.4 The power circuit disconnecting means shall be installed so that it is accessible only to authorized personnel.

4.7.6 Surge Arresters.

Δ 4.7.6.1* Surge arresters shall be provided in accordance with *NFPA 70.*

Δ 4.7.6.2 Transient voltage surge suppression (TVSS) shall be provided in accordance with *NFPA 70* for protection of telecommunications equipment, two-way radio systems, computers, and other electronic equipment determined by the AHJ to be essential to the operation of the communications center.

Δ 4.7.7* Single-Point Facility Grounding System. Telecommunications equipment, two-way radio systems, computers, and other electronic equipment determined by the AHJ to be essential to the operation of the communications center shall be bonded to the single-point facility ground system in accordance with *NFPA 70.*

4.7.8 Uninterruptible Power Supply (UPS) and Battery Systems.

4.7.8.1* In addition to the required engine-driven generators, an uninterruptible power supply system shall be provided. It shall comply with the requirements of 4.7.8 and *NFPA 70.*

4.7.8.2 The UPS shall provide conditioned, uninterrupted power to telecommunications equipment, two-way radio systems, IT equipment, and other sensitive electronic equipment determined by the AHJ to be essential to the operation of the emergency communication systems.

4.7.8.3* The UPS shall be sized to carry the connected load for the length of time required to transfer operations to the alternate communications center as determined by the AHJ in connection with the CEMP, but in no case less than 15 minutes (Class 0.25.)

4.7.8.4 The UPS shall provide performance equivalent to Type O or Type U stored emergency power supply system (SEPSS) as specified in Table 4.2.2 of NFPA 111.

4.7.8.5 The UPS shall meet the SEPSS requirement for Level 1 as defined by NFPA 111.

4.7.8.6 Each UPS shall be provided with a bypass switch that maintains the power connection during switchover and that is capable of isolating all UPS components while allowing power to flow from the source to the load.

4.7.8.7 The following UPS conditions shall be annunciated in the operations room:

(1) Source power failure, overvoltage, and undervoltage
(2) High and low battery voltage
(3) UPS in bypass mode

4.8 Lighting.

4.8.1 General.

4.8.1.1 Artificial lighting shall be provided to enable personnel to perform their assigned duties.

4.8.1.2 Lighting intensity shall be in accordance with IESNA HB-9-00, *Lighting Handbook*.

4.8.1.3 Lighting circuits, together with their associated motors, generators, rectifiers, transformers, fuses, and controlling devices, shall be installed in accordance with *NFPA 70*.

4.8.2 Emergency Lighting.

4.8.2.1 The communications center shall be equipped with emergency lighting that illuminates automatically within 15 seconds of failure of normal lighting power.

4.8.2.1.1 Illumination levels shall be sufficient to allow all essential operations.

Δ 4.8.2.2 In addition to the requirement of 4.8.2.1, the operations room shall be equipped with redundant emergency lighting provided by individual unit equipment in accordance with *NFPA 70*.

4.8.2.3 Individual unit equipment emergency lighting shall be provided at locations of communications equipment situated outside the operations room and at the locations of engine-driven generators.

4.9* Lightning. Buildings that house communications centers shall have lightning protection that complies with NFPA 780.

4.10 Remote Communications Facilities.

4.10.1 General.

4.10.1.1 Remote communications facilities, where provided, shall comply with Section 4.10.

4.10.1.2 Equipment essential to the operation of a remote communications facility shall be kept in working order at all times.

4.10.1.3 Equipment that is essential to the operation of a remote communications facility shall be designed to accommodate peak loads as determined by the AHJ.

4.10.2 Exposure Hazards.

4.10.2.1 Where the building that houses a remote communications facility is adjacent to another structure, the exposed walls shall be protected in compliance with *NFPA 5000* or in accordance with the building code legally in effect, whichever is more restrictive.

4.10.2.2* Where the building that houses a remote communications facility is located within 150 ft (46 m) of the potential collapse zone of a taller structure, the roof shall be designed to resist damage from collapse of the exposing structure.

4.10.2.3 In climates where communications towers are subject to accumulation of ice, roofs of communications equipment enclosures located within the falling ice danger zone shall be designed to resist damage from falling ice.

4.10.2.4* Remote communications facilities shall be located above the 100-year floodplain established by the Federal Emergency Management Agency.

4.10.3 Construction.

4.10.3.1 Where located inside buildings, remote communications facilities shall be located in buildings of Type I, Type II, or Type III construction as defined by NFPA 220.

4.10.3.2 Buildings that house remote communications facilities shall have Class A roof coverings.

4.10.3.3 Remote communications facilities shall be separated from other portions of buildings occupied for purposes other than emergency communications by fire barriers having a fire resistance rating of 2 hours.

4.10.3.4 Fire barriers shall comply with NFPA *101*, Section 8.3.

4.10.3.5* Remote communications facilities shall not be located below grade unless the elevation of the lowest floor in the facility is above the 500-year floodplain. Facilities located below grade shall comply with NFPA *101*, Section 11.7, "Underground and Limited Access Structures," and shall be specifically designed for the location.

4.10.3.6* The exposed surfaces of walls and ceilings inside a remote communications facility shall have a flame spread index of 25 or less and a smoke development index of 50 or less when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*.

4.10.3.7* Interior floor finish inside a remote communications facility shall be of noncombustible material or shall comply with the requirements of NFPA *101* interior floor finish testing and classification and shall be Class I as established by NFPA *101* or shall have a minimum critical radiant flux of 0.1 W/cm^2.

4.10.3.8 The AHJ shall determine whether anti-static flooring is required for protection of sensitive electronic equipment.

4.10.3.9 Remote communications facilities shall be protected against seismic damage in accordance with *NFPA 5000* or in accordance with the building code legally in force, whichever is more restrictive.

4.10.4 Climate Control.

4.10.4.1 Heating, ventilating, and air-conditioning (HVAC) systems shall be provided in accordance with NFPA 90A or NFPA 90B.

4.10.4.1.1 HVAC systems shall be designed to maintain temperature and relative humidity within limits specified by the manufacturers of the equipment critical to the operation of the remote communications facility as determined by the AHJ.

4.10.4.1.2 HVAC systems shall be independent systems that serve only the remote communications facility.

4.10.4.1.3 HVAC system intakes for fresh air shall be arranged to minimize smoke intake from a fire inside or outside the building and to resist intentional introduction of irritating, noxious, toxic, or poisonous substances into the HVAC system.

4.10.4.1.4 Backup HVAC systems shall be provided for spaces and enclosures housing electronic equipment determined by the AHJ to be essential to the operation of the remote communications facility.

4.10.4.1.5 HVAC systems shall be designed so that the remote communications facility is capable of uninterrupted operation with the largest single HVAC unit or component out of service.

4.10.4.1.6 Upon failure of the primary HVAC system, the backup system shall come on-line automatically.

4.10.5 Fire Protection.

4.10.5.1 Remote communications facilities shall be provided with clean-agent fire extinguishers that meet the requirements of NFPA 10.

4.10.5.2 A remote communications facility and building spaces adjoining that facility shall be provided with an automatic fire detection and alarm system in accordance with *NFPA 72*.

4.10.5.2.1 The alarm systems shall be monitored in the communications center's operations room in accordance with *NFPA 72*.

4.10.5.3 Where the remote communications facility equipment is housed in a building, the building shall be protected throughout by an approved, supervised automatic sprinkler system that complies with NFPA 13.

4.10.5.4* Remote communications facilities not housed in buildings shall not be required to have automatic sprinkler protection.

4.10.5.5 Penetrations into remote communications facilities shall be limited to those necessary for the operation of the facilities.

4.10.5.6* Facilities that can be exposed to uncontrolled wildfires shall comply with NFPA 1, Chapter 17, Wildland Urban Interface.

4.10.6 Security.

4.10.6.1 Remote communications facilities shall be protected against damage from vandalism, terrorism, and civil disturbances.

4.10.6.2 Entry into remote communications facilities shall be restricted to authorized persons.

4.10.6.3 Doors furnishing access shall be protected by listed, self-closing fire doors that have a fire resistance rating of not less than 1 hour or by doors that are rated for bullet resistance to Level 4 as defined in ANSI/UL 752, *Standard for Bullet-Resistant Equipment*. The AHJ shall determine which type of door is most appropriate for each location.

4.10.6.4* A remote communications facility shall not have windows in exterior walls.

4.10.6.5* Exterior walls shall provide resistance to direct small arms fire equivalent to Level 4 as defined in ANSI/UL 752, *Standard for Bullet-Resistant Equipment*.

4.10.6.6* Means shall be provided to prevent unauthorized vehicles from approaching the structure housing the remote communications facility to a distance of no less than 82 ft (25 m).

4.10.6.7* As an alternative to 4.6.6, unauthorized vehicles shall be permitted to approach closer than 82 ft (25 m) if the building has been designed to be blast resistant, as approved by the AHJ.

4.10.6.8* An electronic intrusion detection system shall be provided. The system shall be monitored for alarm and trouble signals in the communications center or by a listed central station, as determined by the AHJ. The system shall comply with NFPA 731.

4.10.7 Power.

Δ 4.10.7.1 General. Each remote communications facility shall be provided with a critical operations power system that complies with *NFPA 70*.

4.10.7.1.1 Primary and emergency power sources shall be provided, each of which shall be of adequate capacity for operation of the facility.

4.10.7.1.2 Power sources shall be monitored for integrity, with annunciation provided in the operations room.

4.10.7.2 Primary Power Source. One of the following shall supply normal power:

(1) A feed from a commercial utility distribution system
(2) An approved engine-driven generator installation or equivalent under the control of the AHJ, designed for continuous operation and with a person specifically trained in its operation on duty at all times
(3) An approved engine-driven generator installation or equivalent under the control of the AHJ, arranged for cogeneration with commercial light and power, and with a person specifically trained in its operation on duty at all times

4.10.7.3 Emergency Power Source.

Δ 4.10.7.3.1 The emergency power source shall consist of one or more engine-driven generators installed in accordance with *NFPA 70*.

4.10.7.3.2 Upon failure of the normal source, transfer to the alternate source shall be automatic.

4.10.7.4 Stored Emergency Power Supply System (SEPSS). In addition to the alternate source, a stored emergency power supply system (SEPSS) shall be provided. It shall comply with the requirements of 4.7.4.

4.10.7.5* Engine-Driven Generators. Engine-driven generators shall comply with the requirements of NFPA 110 and the requirements of 4.7.4.

4.10.7.6* Power Circuits. Power circuits, together with their associated motors, generators, rectifiers, transformers, fuses, and controlling devices, shall be installed in accordance with *NFPA 70* and the requirements of 4.7.5.

4.10.7.7 Surge Arresters.

Δ 4.10.7.7.1 Surge arresters shall be provided in accordance with *NFPA 70*.

Δ 4.10.7.7.2* Transient voltage surge suppression (TVSS) shall be provided in accordance with *NFPA 70* for protection of telecommunications equipment, two-way radio systems, computers, and other electronic equipment determined by the AHJ to be essential to the operation of the remote communications facility.

Δ 4.10.7.8* Single-Point Facility Grounding System. Telecommunications equipment, two-way radio systems, computers, and other electronic equipment determined by the AHJ to be

essential to the operation of the remote communications facility shall be bonded to the single-point facility grounding system in accordance with *NFPA 70*.

4.10.8 Lighting.

4.10.8.1 General.

4.10.8.1.1 Artificial lighting shall be provided to enable authorized personnel to safely perform tasks necessary for equipment maintenance.

4.10.8.1.2* Lighting intensity shall be in accordance with IESNA HB-9-00, *Lighting Handbook*.

4.10.8.1.3 External lighting shall be provided as directed by the AHJ in accordance with the security plan for each facility.

4.10.8.1.4 Lighting circuits, together with their associated motors, generators, rectifiers, transformers, fuses, and controlling devices, shall be installed in accordance with *NFPA 70*.

4.10.8.2 Emergency Lighting.

4.10.8.2.1 The remote communications facility shall be equipped with emergency lighting that illuminates automatically upon failure of normal lighting power.

4.10.8.2.1.1 Illumination levels shall be sufficient to allow troubleshooting and emergency maintenance during a power outage.

4.10.8.2.2 Individual unit equipment emergency lighting shall be provided at the locations of engine-driven generators.

4.10.9* Lightning Protection. Remote communications facilities shall have lightning protection that complies with NFPA 780.

Δ 4.10.9.1 Remote communications facilities not housed in buildings shall have lightning protection that complies with NFPA 780 and *NFPA 70*.

Chapter 5 Communication and Signal Wiring

5.1 Circuit Construction and Arrangement.

5.1.1* Installation shall be in accordance with *NFPA 70*.

5.1.2 As an alternative to 5.1.1, installation of outdoor circuitry shall be in accordance with IEEE C2, *National Electrical Safety Code*, where approved by the AHJ.

5.1.3 Circuits shall be routed so as to avoid damage due to mechanical injury, fire, falling walls, floods, corrosive vapors, and other risks that are identified in the CEMP.

5.1.3.1 Alternate communications centers shall comply with the requirements of Chapter 4.

5.1.4 All circuits shall be routed to allow circuits to be traced.

5.1.5 Record drawings shall be provided as required by Chapter 12.

5.1.6 Circuits shall not pass over, pass under, pass through, or be attached to buildings or property that is not owned by, or under the control of, the AHJ or the entity that is responsible for maintaining the system.

5.1.7 Alarm instruments installed in buildings not under control of the AHJ shall be on separate dedicated circuits.

5.1.8 The combination of public emergency services communication and signaling (C&S) circuits in the same cable with other circuits shall comply with 5.1.8.1 and 5.1.8.2.

5.1.8.1 Other municipally controlled C&S circuits shall be permitted.

5.1.8.2 Circuits of private signaling organizations shall be permitted only by permission of the AHJ.

5.2 Circuit Conductors.

5.2.1 Wires, conductors and fiber-optic strands shall be terminated in order to prevent breaking due to vibration or stress.

5.2.2 Circuit conductors and fiber-optic cables on terminal racks shall be identified and isolated from conductors of other systems wherever possible and shall be protected from mechanical injury.

5.2.3 Fiber-optic cables containing metallic protection or strength members shall be grounded and protected in accordance with *NFPA 70*.

5.2.4 Wiring for control equipment shall be not smaller than 24 AWG.

5.2.5 Unsupported wires and wires that are subject to vibration shall be not smaller than 18 AWG.

5.2.6 The insulation and outer jacket of cables and wiring shall be flame retardant and moisture resistant.

5.2.7 Exterior metallic, fiber-optic cables and wires shall conform to International Municipal Signal Association (IMSA) specifications or an approved equivalent, except where circuit conductors or fiber-optic strands are provided by a public utility on a lease basis.

5.3 Underground Cables.

5.3.1 Underground metallic and fiber-optic communication and signal cables in ducts or of the direct burial type shall be permitted to be brought above ground only at locations approved by the AHJ.

5.3.1.1 Protection from physical damage or heat incidental to fires in adjacent buildings shall be provided.

5.3.2 Underground cables installed in ducts, vaults, and manholes shall comply with 5.3.2.1 through 5.3.2.2.

5.3.2.1 Metallic and fiber-optic communication and signal cables shall be permitted to be located only in duct systems, manholes, and vaults that contain low-voltage C&S system conductors, secondary power cables not exceeding 600 volts nominal, or both.

5.3.2.2 Where located in duct systems or manholes that contain conductors of other circuits operating in excess of 250 volts to ground, metallic and fiber-optic communication and signal cables shall be located as far as possible from such power cables and shall be separated from them by a noncombustible barrier or other means approved by the AHJ to protect the communication and signal cables from physical damage.

5.3.3 All cables that are installed in manholes, vaults, handholes, and other enclosures shall be racked and marked for identification.

5.3.4 All raceways or ducts entering buildings from underground duct systems shall be effectively sealed with an identi-

fied sealing compound or other means acceptable to the AHJ to prevent moisture or gases from the underground duct system from entering the building.

5.3.5 Cable splices, taps, and terminal connections shall be located only where accessible for maintenance and inspection and where the AHJ has determined that no potential for damage to the cable due to falling structures or building operations exists.

5.3.6 Cable joints shall be made to provide and maintain conductivity, optical continuity for fiber-optic cable insulation, and protection that is at least equal to that afforded by the cables that are joined.

5.3.7 Cable ends shall be sealed against moisture.

5.3.8 Direct-burial cable, without enclosure in ducts, shall be laid in grass plots, under sidewalks, or in other places where the ground is not likely to be opened for other underground construction.

5.3.8.1 Where splices are made, such splices shall be accessible for inspection and tests.

5.3.8.2 Such cables shall be buried at least 24 in. (609 mm) deep.

5.3.8.2.1 Where crossing streets or other areas likely to be opened for other underground construction, cables shall be installed through solid wall duct or conduit.

5.3.8.2.2 Detectable warning tape shall be buried 12 in. (304 mm) deep above all direct buried cables.

5.4 Aerial Cable and Wire Construction.

5.4.1 Aerial C&S circuit cables and wires shall be run under all power wires but shall not be required to run under other communication wires.

5.4.2 Protection shall be provided where cables and wires pass through trees, under bridges, and over railroads, and at other locations where damage or deterioration is possible.

5.4.3 Wires and cables shall not be attached to a crossarm that carries electric light and power wires.

5.4.4 Support of aerial cables shall comply with 5.4.4.1 and 5.4.4.2.

5.4.4.1 Aerial cable shall be supported by messenger wire that is designed for the application or shall conform to one of the following:

(1) IMSA specifications as a self-supporting cable assembly or an approved equivalent
(2) Fiber-optic cable with integral supporting means or all-dielectric self-supporting (ADSS) type

5.4.4.2 Span lengths shall not exceed the wire or cable manufacturer's recommendations.

5.4.4.3 Single wire shall meet IMSA specifications and shall not be smaller than No. 10 Roebling gauge if of galvanized iron or steel; 10 AWG if of hard-drawn copper; 12 AWG if of approved copper-covered steel; or 6 AWG if of aluminum. Span lengths shall not exceed the manufacturer's recommendations.

5.4.5 Aerial wires and cables connected to buildings shall contact only intended supports.

5.4.6 Aerial circuits shall enter through an approved weatherhead or sleeves slanting upward and inward.

5.4.7 Drip loops shall be formed on wires and cables prior to entering buildings.

5.4.8 Aerial cables extending down poles shall comply with 5.4.8.1 through 5.4.8.4.

5.4.8.1 Aerial cables extending down poles shall be protected against mechanical damage.

5.4.8.2 Any metallic covering of the aerial cables extending down pole(s) shall form a continuous conducting path to earth ground.

5.4.8.3 The installation shall prevent water from entering the conduit.

5.4.8.4 Aerial cables extending down poles shall have 600-volt insulation that is approved for wet locations, as defined in *NFPA 70*.

5.5 Wiring Inside Buildings.

5.5.1 At the communications center, all conductors, cables, and fiber-optic cables shall extend to the operations room in conduits, ducts, shafts, raceways, or overhead racks and troughs that are listed or identified as suitable to provide protection against physical damage.

5.5.1.1 Where fire survivability is required, a listed electrical circuit protective system or a fire-rated cable that is listed to maintain circuit integrity shall be used.

5.5.2* Where installed in buildings, conductors and fiber-optic cables shall be installed in accordance with *NFPA 70* in any one of the following wiring methods:

(1) Electrical metallic tubing
(2) Intermediate metal conduit
(3) Rigid metal conduit
(4) Surface metal raceways
(5) Reinforced thermosetting resin conduit (RTRC)
(6) Metallic cable trays

5.5.2.1 Rigid polyvinyl chloride conduit shall be permitted where approved by the AHJ.

Δ 5.5.3 Wire, conductors, and metallic and fiber-optic cables shall have approved insulation in accordance with *NFPA 70*.

Δ 5.5.4 The insulation, cable sheath or jacket for wire, conductors, and fiber-optic cables shall have an approved insulation in accordance with *NFPA 70*.

5.5.5 Conductors and fiber-optic cables shall be installed as far as possible without splices or joints.

5.5.5.1 Splices or joints shall be permitted only in listed junction terminal boxes, enclosures, or other approved termination devices.

5.5.5.2 Wire and fiber-optic terminals, terminal boxes, splices, and joints shall conform to *NFPA 70*.

5.5.5.3 Communications and signal circuits shall be identified by the use of a distinctive color on covers or doors.

5.5.5.4 The words "emergency communication-signal circuit" shall be clearly marked on all terminal and junction locations to prevent unintentional interference.

5.5.6 Conductors that are installed in a vertical riser that connects two or more floors shall meet the requirements of riser-rated cable and installation in accordance with *NFPA 70*.

5.5.7 Metallic and fiber-optic cable terminals and cross-connecting facilities shall be located either in or adjacent to the operations room.

5.5.8 At the communications center, metallic and fiber-optic cable terminals and cross-connecting facilities shall be located either in or adjacent to the operations room.

5.5.9 Where signal conductors, non-dielectric fiber-optic cables, and electric light and power wires are run in the same shaft, they shall be separated by at least 2 in. (51 mm), or each system shall be encased in a noncombustible enclosure.

5.5.10 All wired dispatch circuit devices and instruments whose failure can adversely affect the operation of the system shall be mounted in accordance with the following:

(1) On noncombustible bases, pedestals, switchboards, panels, or cabinets
(2) With mounting designed and constructed so that all components are readily accessible

5.6 Circuit Protection.

5.6.1 Circuit protection required at the communications center shall be provided in all buildings that house communications center equipment.

5.6.1.1 All surge arresters shall be connected to the single-point facility ground in accordance with *NFPA 70*.

5.6.2 The protective devices shall be located in proximity to or shall be combined with the cable terminals.

5.6.3 All protective devices designed and approved for the purpose shall be installed at a location accessible only to qualified persons, marked with the name of the manufacturer and the model designation, and shall be accessible for maintenance and inspection.

5.6.4* Wired communications circuits shall have fast-acting surge suppression installed at the point of entrance to the communications center.

5.6.5 Surge arresters shall be designed and listed for the specific application.

5.6.6 Each conductor that enters a communications center from a partially or entirely aerial line shall be protected by a surge arrester.

5.6.7 At the junction points of open aerial conductors and cable, each conductor shall be protected by a surge arrester in accordance with 5.6.7.1 and 5.6.7.2.

5.6.7.1 The surge arrester shall be weatherproof or protected from the weather.

5.6.7.2 A connection shall be provided between the surge arrester ground and any metallic sheath and messenger wire.

5.6.8 Aerial open wire and non-messenger-supported, two-conductor cable circuits shall be protected by surge arresters at intervals of approximately 2000 ft (610 m).

5.6.9 Wired portions of a radio dispatch circuit shall be protected in a manner that is consistent with the provisions of Sections 5.1 through 5.8.

5.6.10 Buildings that house communications equipment shall have lightning protection that complies with NFPA 780.

5.7 Fuses.

5.7.1 All fuses, fuseholders, and adapters shall be clearly marked with their ampere rating.

5.7.2 All fuses that are rated over 2 amperes shall be of the enclosed type.

5.7.3 Fuses shall be located only at the power source.

5.8 Grounding.

Δ 5.8.1* Sensitive electronic equipment determined by the AHJ to be essential to the operation of telecommunications and dispatching systems shall be connected to the single-point facility ground in accordance with *NFPA 70*.

5.8.2 Listed isolated ground receptacles in accordance with *NFPA 70* shall be provided for all cord-and-plug-connected essential and sensitive electronic equipment.

5.8.3 Where required by the AHJ, unused wire or cable pairs shall be grounded.

5.8.4 Ground connection for surge suppressors shall be made to the single-point facility ground system in accordance with *NFPA 70*.

5.9 Access. All equipment shall be accessible for the purpose of maintenance.

Chapter 6 Emergency Response Facilities

6.1 General. A primary and a secondary means of dispatch notification shall be provided at the ERF and comply with 6.1.1 and 6.1.2.

6.1.1 The primary means of dispatch notification at the ERF shall be compatible with the primary means of dispatch notification that is provided at the communications center.

6.1.2 The secondary means of dispatch notification at the ERF shall be compatible with the secondary means of dispatch notification that is provided at the communications center.

6.1.3 Dispatch notification equipment shall be kept in working order at all times.

6.1.4 A publicly accessible means for reporting events to the communications center shall be provided on the exterior of the ERF.

6.2 Commercial Telephone.

6.2.1* A commercial telephone shall be provided at each emergency response facility.

6.2.2* When no other means of voice communication between the communications center and an ERF is provided, the telephone at the ERF shall be arranged so that it cannot be used by the public.

6.3 Fire Protection. Fire protection shall be provided as required by *NFPA 5000* or in accordance with the building code legally in force, whichever is more restrictive.

6.3.1 Sprinkler systems shall comply with NFPA 13.

6.3.2 Fire alarm systems shall comply with *NFPA 72*.

6.4 Power. Two independent and reliable power sources shall be provided, each of which shall be of adequate capacity for operation of the communications equipment.

6.5 Lighting.

6.5.1 Lighting shall be provided to enable personnel to operate communications equipment that is used for the receipt of alarms and events.

6.5.2 Emergency lighting shall be provided in accordance with NFPA *101*, Section 7.9.

6.6* Communications Conductors. Communications conductors in an ERF shall be installed in accordance with *NFPA 70*.

6.6.1 Circuit protection shall be in accordance with Section 5.6.

6.6.2 Lightning protection shall be in accordance with Section 4.9.

Chapter 7 Operations

7.1 Management.

7.1.1 All system operations shall be under the control of a manager, director, or supervisor of the jurisdiction served by the system.

7.1.1.1 Emergency services dispatching entities shall have trained and qualified technical assistance available for trouble analysis and repair by in-house personnel or by authorized outside contract maintenance services.

7.1.1.1.1 All maintenance records shall be maintained in accordance with the requirements of the AHJ.

7.1.1.2 Where maintenance is provided by an organization or person other than an employee of the jurisdiction, complete written records of all installation, maintenance, test, and extension of the system shall be forwarded to the responsible employee of the jurisdiction.

7.1.1.3 Maintenance performed by an organization or person other than an employee of the jurisdiction shall be by written contract that contains a guarantee of performance as approved by the AHJ.

7.1.2* All equipment shall be accessible to the AHJ for the purpose of maintenance.

7.1.3 Personnel in supervisory roles shall receive supervisory training as defined by the AHJ.

7.1.4 The AHJ shall be responsible for initial and ongoing training in supervisory skills for personnel in supervisory roles.

7.2 Telecommunicator Qualifications and Training.

7.2.1 Telecommunicators shall meet the qualification requirements of NFPA 1061 as appropriate for their position.

7.2.2* Telecommunicators shall be certified in the knowledge, skills, and abilities related to their job-related function.

7.2.2.1 The certification program shall have a skill maintenance component for recertification as defined by the certifying organization.

7.2.3 Telecommunicators shall be trained in general emergency service operations and shall have access to information regarding the following:

(1) Locations of streets
(2) Locations of important structures, including schools, hospitals, and other buildings with a high life hazard
(3) Locations of congested or hazardous areas

7.2.4 Telecommunicators shall have operational knowledge of the functions of communications equipment, systems, and networks in the communications center.

7.2.5 Telecommunicators shall know the rules and regulations that relate to equipment use, including those of the Federal Communications Commission that pertain to emergency service radio use.

7.2.6 The AHJ shall be responsible for providing training to maintain the skill levels of telecommunicators to the level appropriate to their position as identified in NFPA 1061 and Section 7.2.

7.2.7 Telecommunicators shall be trained in TDD/TTY procedures, with training provided at a minimum of every 6 months.

7.2.8 Telecommunicators shall receive training on the CEMP, including the TICP, at least annually.

7.3 Staffing.

7.3.1 There shall be a minimum of two telecommunicators on duty and present in the communications center at all times.

7.3.1.1* The AHJ shall ensure that there are sufficient telecommunicators available to effect the prompt receipt and processing of alarms and events needed to meet the requirements of Section 7.4.

7.3.1.2* Where communications systems, computer systems, staff, or facilities are used for both emergency and nonemergency functions, the nonemergency use shall not degrade or delay emergency use of those resources.

7.3.1.3 A communications center shall handle emergency calls for service and dispatching in preference to nonemergency activities.

7.3.2* When requested by the incident commander, a telecommunicator shall be dedicated to the incident and relieved of other duties within the communications center.

7.3.3 The AHJ shall establish standard operating procedures to identify the circumstances under which a telecommunicator will be assigned to the incident and how that will be accomplished.

7.3.4* Supervision shall be provided when more than two telecommunicators are on duty.

7.3.4.1 Supervision shall be provided by personnel located within the communications center who are familiar with the operations and procedures of the communications center.

7.3.4.2 The supervisor shall be allowed to provide short-term relief coverage for a telecommunicator, provided that the telecommunicator does not leave the communications center and is available for immediate recall as defined in the policies and procedures of the AHJ.

7.4 Operating Procedures.

Δ 7.4.1* Ninety- percent of events received on emergency lines shall be answered within 15 seconds, and 95 percent of alarms shall be answered within 20 seconds. *(For documentation requirements, see 12.5.2.)*

7.4.1.1 Compliance with 7.4.1 shall be evaluated monthly using data from the previous month.

Δ 7.4.2* Call processing time shall include the time from call answer to initial notification of the responding ERU(s).

Δ 7.4.3* Emergency alarm processing for the highest prioritization level emergency events listed in 7.4.3.1 through 7.4.3.2 shall be completed within 60 seconds, 90 percent of the time.

N 7.4.3.1 The following types of calls where there is an imminent threat to life shall be included in the highest prioritization level:

(1) Trauma (penetrating chest injury, GSW, etc.)
(2) Neurologic emergencies (stroke, seizure)
(3) Cardiac-related events
(4) Unconscious/unresponsive patients
(5) Allergic reactions
(6) Patient not breathing
(7) Choking
(8) Other calls as determined by the AHJ

N 7.4.3.2 The following types of calls where significant property loss/damage is likely or actively occurring shall be included in the highest prioritization level:

(1) Fire involving or potentially extending to a structure(s)
(2) Explosion
(3) Other calls as determined by the AHJ

N 7.4.3.3 The following types of calls shall be exempted from the requirements of 7.4.3:

(1) Joint responses with law enforcement (involving weapons)
(2) Hazardous materials incidents
(3) Technical rescue

N 7.4.3.4 The following types of mitigating circumstances shall be exempted from the requirements of 7.4.3:

(1) Language translation
(2) TTY/TDD
(3) Incomplete location
(4) SMS message to 9-1-1
(5) Calls received from outside the normal area of responsibility and/or service area
(6) Calls requiring use of a PSAP registry or similar tool to determine the appropriate PSAP and/or transfer location
(7) Calls received during a significant disaster that severely and significantly depletes available resources, impacts local infrastructure, and could result in changes to normal dispatcher procedures (disaster mode)

7.4.4* For law enforcement purposes, the AHJ shall determine time frames allowed for completion of dispatch.

Δ 7.4.5* For medical calls where a patient is determined to be unconscious/unresponsive and not breathing, bystander CPR shall be confirmed or telephone CPR shall be initiated by a telecommunicator qualified in emergency medical dispatch and continued until emergency responders arrive at the patient.

7.4.6 All alarms, including requests for additional resources, shall be transmitted to the identified emergency response units over the required dispatch systems.

7.4.7 An indication of the status of all emergency response units shall be available at all times to telecommunicators who have dispatching responsibility.

7.4.8* Records of the dispatch of emergency response units to events shall be maintained in accordance with the records retention policy of the AHJ and shall identify the following:

(1) Unit designation for each emergency response unit (ERU) dispatched
(2) Time of dispatch acknowledgment by each ERU responding
(3) Enroute time of each ERU
(4) Time of arrival of each ERU at the scene
(5) Time of patient contact, if applicable
(6) Time each ERU is returned to service

7.4.9* Where voice transmission is used as a dispatch method, the announcement for the emergency response shall be preceded by an audible warning or alerting signal that differentiates the emergency from routine radio traffic.

7.4.10 The first emergency response unit that arrives at the location of the event shall provide a brief preliminary report on observed conditions to the communications center.

7.4.11* A communications officer shall be assigned at major incidents.

7.4.12* All emergency response agencies that interact shall use common terminology and integrated incident communications.

7.4.12.1 Integrated incident communications shall include a plan that provides for on-demand interoperability of communication methods among emergency response agencies.

7.4.12.2* The plan shall identify the communications links and protocols to be used among emergency response agencies at incidents, including the following:

(1) Type 5 incidents (local, discipline specific) as defined in NFPA 1561
(2) Type 4 incidents (local, jurisdiction specific) as defined in NFPA 1561
(3)* Type 3 incidents (regional or state, multi-agency and multi-discipline specific) as defined in NFPA 1561

7.4.12.3 The plan shall be written, distributed to all agencies identified in the plan, and reviewed at least annually by each agency identified.

7.4.13 The communication equipment involved in each alarm shall be restored promptly after each alarm.

7.4.14 When the device monitoring the system for integrity indicates that trouble has occurred, the telecommunicator shall act as follows:

(1) Take appropriate steps to troubleshoot and repair the fault according to the policies and procedures of the AHJ.
(2) Isolate the fault and notify the official responsible for maintenance as soon as practical.

7.4.15 Standard operating procedures shall include but not be limited to the following:

(1) All standardized procedures that the telecommunicator is expected to perform without direct supervision
(2) Implementation plan that meets the requirements of 4.1.6.3
(3) Procedures related to the CEMP
(4) Emergency response personnel emergencies
(5) Activation of an emergency distress function
(6) Assignment of incident radio communications plan matrix
(7) Time limit for acknowledgment by units that have been dispatched
(8) Methods for call trace
(9) Methods for caller location determination
(10) Procedures for handling non-voice emergency events

7.4.16* Every communications center shall have a comprehensive regional emergency communications plan as part of the CEMP.

7.4.16.1* The emergency communications plan shall provide for real-time communications between organizations responding to the same emergency incident.

7.4.16.2* This plan shall be exercised at least once a year.

7.4.17 A distinctive alert tone signal shall precede the transmission of emergency message traffic.

7.4.17.1 A separate and unique alert tone shall be operated for emergency evacuation orders.

7.4.18 In the event that an ERU(s) has not acknowledged its dispatch/response within the time limits established, the telecommunicator shall perform one or more of the following:

(1) Attempt to contact the ERU(s) by radio
(2) Redispatch the ERU(s) using the primary dispatch system
(3) Dispatch the ERU(s) using the secondary dispatch system
(4) Initiate two-way communication with the ERU's supervisor
(5) If the SOP time for dispatch has elapsed, initiate dispatch of backup ERU

7.4.19* The AHJ shall develop and implement standard operating procedures for responding to and processing TDD/TTY calls.

7.4.20 Calls received as an open-line or "silent call" shall be queried as a TDD/TTY call if no acknowledgment is received by voice.

7.5 Time.

7.5.1 All systems shall have the ability to interface with a master time source and to synchronize the time clocks of all appliances, devices, computers, and servers.

7.5.2 All systems shall have the ability to automatically update the time clocks of all appliances, devices, computers, and servers without the intervention of the AHJ.

7.5.3 All systems shall have the ability to automatically update the time clocks of all appliances, devices, computers, and servers to adjust from standard time to daylight savings time and from daylight savings time to standard time without the intervention of the AHJ.

7.5.4 All timekeeping devices not capable of being synchronized with the master time source shall be maintained within 60 seconds of the master time source.

7.6 Recording.

7.6.1 Communications centers shall have a logging voice recorder with one channel for each of the following:

(1) Each transmitted or received radio channel or talkgroup
(2) Each voice dispatch alarm circuit
(3)* Each telecommunicator telephone

7.6.2 All logging recording equipment shall have the ability to associate the date, time, and channel designation with each transmission.

7.6.2.1 All logging recording equipment connected to a Next Generation 9-1-1 ESInet shall have the ability to record logging events data.

7.6.3 Each telecommunicator position shall have the ability to instantly recall telephone and radio recordings from that position.

7.6.3.1 All recordings, including transmissions and data, shall be maintained in accordance with the records retention policies of the AHJ.

7.6.4 Events that are transmitted over the required dispatch circuit(s) shall be automatically recorded, including the dates and times of transmission.

7.6.4.1 The recording device shall be networked with the master time source.

7.7* Quality Assurance/Improvement. Communications centers shall establish a quality assurance/improvement program to ensure the consistency and effectiveness of event processing.

Chapter 8 Telephones

8.1* Telephone Receiving Equipment. The provisions of Chapter 8 shall apply to facilities and equipment that are needed to receive events.

8.2 Directory Listing.

8.2.1 Where 9-1-1 service is not provided, all of the following requirements shall be met:

(1) A specific telephone number shall be assigned for calls requesting emergency services.
(2) The telephone number shall be publicized as such.
(3) A separate number shall be assigned for business (nonemergency) use.

8.2.1.1 A separate telephone line with a number that is not listed shall be maintained for communication with other emergency service agencies and receipt of central station alarms.

8.2.1.2* A separate number shall be assigned for business (nonemergency) use.

8.2.2 Where 9-1-1 service is provided, the telephone directory listings shall indicate that 9-1-1 is the number to call for all emergencies.

8.2.3 Telephone directory listings shall be as specified in 8.2.3.1 through 8.2.3.5.

8.2.3.1 The text and symbols shown in Figure 8.2.3.1(a) through Figure 8.2.3.1(c) shall appear on the inside front cover or the page facing the inside front cover of the white pages directory.

FIRE

[FIRE NUMBER]

or, where available,

FIRE

9-1-1

FIGURE 8.2.3.1(a) Telephone Directory Listing for Fire Department.

POLICE

[POLICE NUMBER]

or, where available,

POLICE

9-1-1

FIGURE 8.2.3.1(b) Telephone Directory Listing for Police Department.

EMERGENCY MEDICAL SERVICES

[EMERGENCY MEDICAL SERVICES NUMBER]

or, where available,

EMERGENCY MEDICAL SERVICES

9-1-1

FIGURE 8.2.3.1(c) Telephone Directory Listing for Emergency Medical Services.

8.2.3.2 The emergency services listing shall appear in the directory under the name of the jurisdiction, including government listings, and under the headings for police, fire, and ambulance where provided.

8.2.3.3 The following listings and telephone numbers shall appear as follows in the white pages directory:

(1) Fire department
   (a) To report an emergency [fire number] or, where available, 9-1-1
   (b) Nonemergency purposes [business number]
(2) Police department
   (a) To report an emergency [police number] or, where available, 9-1-1
   (b) Nonemergency purposes [business number]
(3) Emergency medical services
   (a) To report an emergency [emergency medical number] or, where available, 9-1-1
   (b) Nonemergency purposes [business number]

8.2.3.4 If the directory covers an area that is protected by more than one emergency service, each agency or district shall appear in the listing as specified in 8.2.3.1.

8.2.3.5 If the emergency service protects an area that is covered by more than one directory, each directory shall list the agency or district as specified in 8.2.3.1 through 8.2.3.3.

8.2.3.6* Where an ERF that is not continuously staffed by trained telecommunicators is listed in the telephone directory, callers shall be provided with a recorded message that refers them to the appropriate emergency number when calls to the listed number are not answered.

8.3 Equipment and Operations. At the communications centers, telephone lines shall be provided as follows:

(1)* At least two telephone lines shall be assigned exclusively for receipt of emergency calls.
(2) Additional emergency lines shall be provided as required for the volume of calls handled to provide P.01 GOS.
(3) Additional telephone lines shall be provided for the normal business (nonemergency) number(s) as needed.
(4) At least one outgoing-only line shall be provided.
(5) A separate telephone line shall be provided as required in 8.2.1.1.

8.3.1 The AHJ shall ensure that the published emergency lines are answered prior to nonemergency lines.

8.3.1.1 When all emergency lines are in use, emergency calls shall hunt to other predetermined lines that are approved by the AHJ.

8.3.1.2 Calls to the business number shall not hunt to the designated emergency lines.

8.3.2 When a PSAP receives an emergency call for a location that is not in its jurisdiction or a call for an agency not under the control of the PSAP, the PSAP shall transfer the call directly to the responsible communications center, when possible.

8.3.2.1 The PSAP shall remain on the line until it is certain that the transfer has been made.

8.3.2.2 The transfer procedure shall not rely on the PSAP personnel relaying the information to the responsible communications center.

8.3.3 All incoming calls on designated emergency lines shall be recorded in accordance with this standard.

8.3.4* If an incoming call on any designated emergency line is not answered within 60 seconds, an alarm indication shall be automatically transmitted to a location approved by the AHJ.

8.3.5* Where the AHJ permits the communications center to receive automated voice alarms, the following requirements shall apply:

(1) A separate, unlisted telephone line(s) shall be provided to receive such alarms.
(2) Such voice alarms shall not be permitted to connect to the telephone lines required by 8.2.1 and Section 8.3.

8.3.6 Where the communications center is permitted to receive automated data alarms through dial-up telephone service, the following requirements shall apply:

(1) A separate, unlisted telephone line(s) shall be provided to receive such alarms.
(2) Such data alarms shall not be permitted to connect to the telephone lines required by 8.2.1 and Section 8.3.

8.3.7 Published emergency numbers shall meet the requirements of Section 8.5.

8.3.8 All telecommunicator positions that are available for receiving emergency calls shall be equipped with TDD/TTY equipment.

N 8.3.9* The communication center shall accept non-voice emergency events from sources approved by the AHJ.

8.4 Universal Emergency Number 9-1-1 Service.

8.4.1 General. Universal emergency number 9-1-1 service shall meet the minimum requirements as specified in Section 8.4.

8.4.2 Reliability.

8.4.2.1 The universal emergency number service equipment shall be designed so that no single point of failure can prevent calls from being answered.

8.4.2.2 Under failure conditions, the full-feature complement shall not be required to be maintained but the calling party shall be able to communicate with the telecommunicator.

8.4.3 Circuits.

8.4.3.1* At least two 9-1-1 call delivery paths with diverse routes arranged so that no single incident interrupts both routes shall be provided to each communications center.

8.4.3.2* Where multiple communications centers that serve a jurisdiction are not located in a common facility, at least two circuits with diverse routes, arranged so that no singular incident interrupts both routes, shall be provided between communications centers.

8.4.4 Where enhanced 9-1-1 services are provided, the communications center shall be capable of receiving automatic number information and automatic location information (including Wireless Phase II data) from sources identified in Section 8.1.

8.5 Published Emergency Number Alternative Routing.

8.5.1* Communications centers shall maintain a plan as part of the CEMP for rerouting incoming calls on emergency lines when the center is unable to accept such calls.

8.5.2 Where the AHJ requires that overflow calls to emergency lines be routed to alternative telephone lines within the PSAP, the alternative telephone lines shall be monitored for integrity and recorded as required by this standard.

8.5.3 Where a PSAP operates on a part-time basis, an automatic alternative routing plan shall be put in place that ensures the rapid transfer of calls to the designated backup PSAP, even if the transfer switch, where provided, is not turned on.

8.5.4 Any call that has not been answered after 20 seconds shall be automatically routed as required by one of the following:

(1) A designated alternate PSAP
(2)* A holding queue
  (a) When in queue, the callers shall receive a recorded message informing them that they have reached the PSAP, including a TDD/TTY recorded message.
  (b) The system shall periodically remind callers to the PSAP who are in queue that they are connected during their wait.
  (c) There shall be an audible and visual indication within the operations room that unanswered calls are waiting in the queue.

8.6 Multiple Line Telephone Systems (MLTS).

8.6.1* Every MLTS shall be designed to allow any extension to dial 9-1-1 without the need to dial any digit to obtain PSTN dial tone.

8.6.2* The MLTS shall outpulse or signal the public switched telephone network with a dialable telephone number that, when dialed, will reach the original 9-1-1 caller.

8.6.3* The owner or entity responsible for the operation of the MLTS shall cause the location of the 9-1-1 caller to be made available to the public safety answering point telecommunicator in those jurisdictions where the enhanced 9-1-1 features ANI and ALI are available and in use.

8.6.3.1* The ALI associated with the ANI used by the MLTS extension shall be sufficient to direct a response to the 9-1-1 caller in an efficient manner and include, at a minimum, the civic address, building number, and floor, except as provided in 8.6.3.2.

8.6.3.2* Paragraph 8.6.3.1 shall not apply to any MLTS serving a facility of less than 7000 ft^2.

N 8.6.4 An MLTS manager shall not install, configure, or maintain an MLTS to engage in local termination of 9-1-1 calls except as permitted by the AHJ and 8.6.4.1.

N 8.6.4.1 The facility and operation answering a diverted 9-1-1 call from an MLTS shall adhere to the requirements within NFPA 1221.

Chapter 9 Dispatching Systems

9.1 Fundamental Requirements of Events Dispatching Systems.

9.1.1* General.

9.1.1.1 An event dispatching system shall be designed, installed, operated, and maintained to provide for the receipt and retransmission of events.

9.1.1.2 The transmission of any trouble signal shall not interfere with the transmission and receipt of alarms.

9.1.1.3 The required number of dispatching circuits shall be in accordance with 9.1.1.3.1 through 9.1.1.3.3.

9.1.1.3.1 Jurisdictions that receive 730 events or more per year shall provide two separate and dedicated dispatch circuits as follows:

(1) Separate primary and secondary dispatch circuits shall be provided for transmitting events.
(2) The failure of any component of the primary circuit shall not affect the operation of the secondary circuit and vice versa.

9.1.1.3.2* Jurisdictions that receive fewer than 730 events per year shall provide a minimum of one dedicated dispatch circuit for transmitting alarms.

9.1.1.3.3* A circuit that terminates at a telephone handset only shall not be considered as fulfilling the requirements for a dispatch circuit. *(See 9.2.2.2.)*

9.1.1.4 The primary dispatch circuit shall be provided with one of, or a combination of, the following:

(1) Wired circuit, monitored for integrity in accordance with 9.1.2 through 9.1.2.4.3
(2)* Nontrunked voice radio channel with duplicate system elements, with the following features:
  (a) Monitored for integrity as required by 9.1.2.6
  (b) In the event of a failure of the primary system, a means to switch to the secondary system that is immediately available to the telecommunicator
(3) Microwave carrier channel, monitored for integrity in accordance with 9.1.2 through 9.1.2.5.2, with the following features:
  (a) Redundant transceivers at both ends of each microwave path
  (b) Automatic switchover to the second transceiver if the first transceiver fails during operation
(4) Polling or self-interrogating digital data radio channel with the following features:
  (a)* Redundant transceivers at each installed location
  (b) Monitoring for integrity in accordance with 9.1.2 through 9.1.2.5.2
  (c) Automatic switchover to the second transceiver if the first transceiver fails during operation
(5) Dedicated telephone circuit that is monitored for integrity in accordance with 9.1.2 through 9.1.2.4.3, excluding the following:
  (a) Telephone connection through a public-switched telephone network
  (b) Nondedicated phone lines
(6) Trunked radio system in compliance with 9.1.1.4(2) or 9.1.1.4(4)

9.1.1.5 The secondary dispatch circuit shall not be required to be monitored for integrity.

9.1.1.5.1 The secondary dispatch circuit shall be provided with one of, or a combination of, the following:

(1) A wired circuit
(2)* A designated radio channel
  (a)* If radio is used for both the primary and secondary dispatch circuits, the following shall apply:
    (i) The primary dispatch circuit shall comply with 9.1.1.4.
    (ii) The secondary dispatch circuit shall consist of a separate radio system operating on a separate channel with a separate receiver for the secondary circuit at each ERF.
(3) An approved dedicated telephone circuit
  (a)* Where a telephone dispatch circuit is used as a primary dispatch circuit, a telephone circuit shall not be used as the required secondary dispatch circuit.
    (i) The dispatch signal circuit path for the secondary dispatch circuit specified in 9.1.1.5.1(3)(a) shall be separate and independent of the dispatch signal circuit path of the primary dispatch circuit from the dispatch console to separate control/relay switching equipment connection ports at the ERF.
    (ii) A telephone connection through a public-switched telephone network via a regular dial-up modem and nondedicated telephone line shall not be considered to be an approved dispatch circuit.

9.1.1.6* Where voice transmission is used as a dispatch method, the announcement for the emergency response shall be preceded by an audible warning or alerting signal that differentiates the emergency from routine voice traffic.

9.1.1.7 Events shall be retransmitted to ERFs or to ERUs in the field from the location at which events are received.

9.1.1.7.1 Events transmitted from the communications center shall be automatically received at ERFs and ERUs.

9.1.1.7.2 Dispatch methods shall provide for the operation of houselights or other auxiliary functions at the ERF as required by the AHJ.

9.1.1.8 Events that are transmitted over the required dispatch circuit(s) shall have the dates and times of transmission automatically recorded at the communications center.

9.1.1.9 Audible devices shall be installed throughout the ERF to ensure that all emergency response personnel are alerted to events.

9.1.1.10 Equipment shall be provided to allow personnel to alert all other personnel in the ERF.

9.1.1.11 A means of acknowledging receipt of an event from the emergency response personnel to the telecommunicator shall be provided.

9.1.2* **Monitoring for Integrity.** Primary dispatch circuits and devices upon which transmission and receipt of events and alarms depend shall be monitored constantly to provide prompt warning of trouble that impacts operation.

9.1.2.1* A polling or self-interrogating radio system shall be monitored hourly for integrity to ensure system reliability.

9.1.2.2 The primary and secondary power sources supplied to all required circuits and devices of the system shall be monitored for integrity.

9.1.2.3 Trouble signals shall actuate an audible device and a visual signal located at a constantly attended location.

9.1.2.4 The audible alert trouble signals from the fault and failure monitoring mechanism shall be distinct from the audible alert emergency alarm signals.

9.1.2.4.1 The audible trouble signal shall be permitted to be common to several monitored circuits and devices.

9.1.2.4.2 A switch for silencing the audible trouble signal shall be permitted if the visual signal continues to operate until the silencing switch is restored to the designated normal position.

9.1.2.4.3 The audible trouble signal shall respond to faults that occur on all other circuits prior to the restoration of the silencing switch to the "normal" position.

9.1.2.5 Where dispatch systems use computer diagnostic software, monitoring of the primary dispatch circuit components shall be routed to a dedicated terminal(s) that meets the following requirements:

(1) It shall be labeled and identified as "dispatch circuit integrity status."
(2) It shall be located within the communications center.
(3) It shall not be used for routine dispatch activities.

9.1.2.5.1 The computer diagnostic software shall be capable of displaying and testing each circuit that can be electronically monitored from the dispatch console to the station control unit or junction relay switching equipment in the ERF.

9.1.2.5.2 Any fault or failure condition within the dispatch circuit path shall be displayed on the dedicated terminal screen in a prominent (highlighted) fashion that satisfies the visual trouble signal requirement, and with an audible trouble signal, referenced in 9.1.2.4 through 9.1.2.5.2, that actuates and sounds in accordance with the type of dispatch circuit that is being monitored.

9.1.2.6* The radio communications system shall be monitored in the following ways:

(1) Monitoring for integrity shall detect faults and failures in the radio communications system.
(2) Detected faults and failures in the radio communications system shall cause audible and visual indications to be provided to the telecommunicator and radio system manager at the time of signal activation.

9.1.2.6.1 Monitoring for integrity of portable radios and radio equipment installed in an ERF and in emergency response vehicles shall not be required.

9.2 Wired Dispatching Systems.

9.2.1 Wired Circuits — General.

9.2.1.1* A separate tie circuit shall be provided from the communications center to each alternate communications center or a PSAP.

9.2.1.2 Equipment shall be designed and installed so that it is capable of performing its intended function over the range of 85 percent to 110 percent of its rated voltage.

9.2.1.3 The normal operation of the system shall not require the use of a ground return to provide any essential function.

9.2.1.3.1 Circuits that extend outside the communications center shall test free of grounds.

9.2.1.3.2 The ground connection shall be permitted to be used to provide function under abnormal line conditions where such use would not prevent the reception or transmission of a signal under normal conditions if the circuit were accidentally grounded.

9.2.1.4 A public alarm reporting system circuit that enters an ERF and that is connected to automatic recording and sounding equipment shall be permitted to be one of the two required dispatch circuits.

9.2.1.5 In jurisdictions where fewer than 730 events per year are received or where all stations have recording and sounding devices that respond to each public reporting circuit, the second dispatch circuit shall not be required; only the circuit that is monitored for integrity shall be required.

9.2.1.6 The following requirements shall apply to systems in which an alarm from a fire alarm box is automatically transmitted to fire stations and, if used, is transmitted to supplementary alerting devices (Type B system):

(1) Equipment shall be installed to automatically transmit alarms that are received from any public reporting circuit to all emergency response facilities and, where employed, to outside sounding devices.
(2) Control equipment shall allow any or all circuits to be individually connected to or disconnected from the repeating mechanism.
(3) Coded transmitting devices that use metal conductors shall be provided with a means to transfer the signal from one dispatch circuit to another.

9.2.1.7 A wired dispatch circuit that is part of a public alarm reporting system shall meet the requirements of *NFPA 72*.

9.2.1.8 A wired circuit shall not be connected to alarm instruments in more than five emergency response facilities.

9.2.1.9 Coded signals shall be transmitted as follows:

(1) At a minimum rate of two strokes per second
(2) Over separate circuits at a rate that is suitable for such devices where outside alerting devices are employed

9.2.1.10 Where wired voice dispatch circuits are used, each circuit shall be dedicated to each emergency response facility.

9.2.1.11 For coded and telegraphic systems, a permanent record that indicates the exact location from which the alarm is being received and an audible signal shall be required to indicate the receipt of an alarm.

9.2.1.12 Where telegraphic retransmission is used, the telecommunicator shall be permitted to enter dates and times manually where approved by the AHJ.

9.2.2 Telephone Circuits.

9.2.2.1 A telephone circuit that is used as one of the dispatch circuits shall meet the requirement in 9.1.1.4.

9.2.2.2 Where the primary or secondary dispatch circuit is a telephone dispatch circuit, it shall have voice amplification with the following capabilities:

(1) It shall be equipped with a loudspeaker(s).
(2) The use of a handset shall automatically disconnect the loudspeaker(s) from the circuit(s).

9.3 Radio Dispatching Systems.

9.3.1 General.

9.3.1.1* All radio communications shall comply with the rules and regulations governing wireless communications in the country of operation.

9.3.1.2 The communications center shall be equipped for radio communications with ERUs using subscriber radios.

9.3.1.2.1 Radio communication systems shall be designed to provide no less than 95 percent coverage of the jurisdictional area as defined by the AHJ, 95 percent of the time, with a 95 percent confidence factor.

9.3.1.2.2* Radio system outdoor coverage shall be sufficient to provide a delivered audio quality (DAQ) of 3.0 for analog or digital systems.

9.3.1.3* A communications radio channel, separate from the radio dispatch channel, shall be provided for on-scene tactical communications.

9.3.1.4* At a minimum, the tactical communications channel identified in 9.3.1.3 shall be capable of operating in analog simplex mode.

9.3.1.5* Trunked system talk groups shall be permitted to be used to provide on-scene tactical communications if desired by the AHJ, but the provisions of 9.3.1.3 and 9.3.1.4 shall still apply.

9.3.1.6* Communications system design shall be such that a portable radio is capable of operating within the dispatch area outside of buildings without the use of mobile radio frequency (RF) amplifiers.

9.3.1.7 If the radio includes scanning capability, it shall have an automatic priority feature that causes the radio receiver to revert automatically to its primary channel when the primary channel is being used.

9.3.1.8 A visual indication shall be provided indicating that the subscriber radio equipment is turned on.

9.3.1.9 With the exception of mobile and portable radios, radio antenna systems shall include surge arresters.

9.3.1.10 Radio communications equipment shall be capable of transmitting a distinctive alert tone for emergency traffic as required in NFPA 1561.

9.3.2 Signaling and Control Systems.

9.3.2.1 Signaling and control systems that are used to alert a specific ERF(s) shall initiate distinctive announcement tones for various voice alarms.

9.3.2.2 Signaling and control systems shall use both polling and automatic transmission communications methods and shall support redundant designs as required in 9.1.1.4.

9.3.2.3 If used for signal and control systems, Internet protocol (IP) wide-area networks shall comply with the following:

(1) They shall comply with the communication methods of 9.3.2.2.
(2) If the primary network connection fails during operations, switchover to the second network connection shall be automatic, with audible and visual indicators to the telecommunicator.
(3)* The network path used shall be under the control of the AHJ.

9.3.3 Conventional Two-Way Voice Systems.

9.3.3.1* Analog System Requirements. Systems shall be equipped with a coded squelch system to minimize the reception of out of system on-channel signals interference.

9.3.3.2 Digital Conventional System Requirements. Digital conventional systems shall comply with ANSI/TIA-102.BAAA, *FDMA Common Air Interface.*

9.3.3.3 Call Indicator. A call indicator shall be provided for each conventional channel controller from the control center console to indicate when the channel is busy.

9.3.4 Trunked Two-Way Voice Systems.

9.3.4.1* Signaling Channel Concept.

9.3.4.1.1 The trunked system shall operate using a dedicated signaling control channel protocol concept embodied in either a distinct RF channel used for control signaling only or embedded control signals in the voice channels such that a dedicated RF channel for control signaling is not necessary but the same result is affected.

9.3.4.1.2 System control messages and calls and mobile requests for service shall be transmitted to and from the system on the signaling channel.

9.3.4.1.3 Each unit shall send its unique discrete address identification to the system each time the unit transmits, regardless of whether the system is operating in the message trunking mode or transmission trunking mode.

9.3.4.1.4 Mobile and portable units shall be capable of operating on at least five radio channels.

9.3.4.1.5* Mobile and portable units shall be capable of scanning trunked talkgroups and conventional channels with a user-selectable priority.

9.3.4.1.6 A system controller shall automatically assign all channels so that all system users (field units and console dispatchers) shall have access to all voice channels via a system priority protocol.

9.3.4.1.7 Channel access time in single-site systems, assuming a channel is available, shall be less than 0.5 second.

9.3.4.1.8* Priority Levels.

9.3.4.1.8.1 A minimum of eight levels of operational talkgroup priority shall be incorporated into the system.

9.3.4.1.8.2 Dispatch consoles shall be capable of elevating the operational priority of a talkgroup by one increment to facilitate channel assignments in critical situations.

9.3.4.1.9* Emergency Priority.

9.3.4.1.9.1 All field units in the system shall be capable of gaining access to the system within 0.5 second of activation of an instantaneous emergency switch.

9.3.4.1.9.2 When a field unit activates the emergency function of the radio unit, the field unit ID shall be displayed at the dispatch terminal, console, or both, and an audible alert shall be activated.

9.3.4.1.10* Failure of Trunking System.

9.3.4.1.10.1 If the trunking system control fails, the system, at a minimum, shall revert to conventional repeater operation while in failover mode.

9.3.4.1.10.2 ERUs that share trunked radio systems with other emergency or nonemergency services shall operate on a channel that is not shared with nonemergency users.

9.3.4.1.10.3 Standard operating guidelines shall be written to explain to field units, first responders, and radio dispatchers on the trunked radio system how to detect that the system is in failover mode and what revised operational procedures they are to adopt when the trunked system is in failover mode.

9.3.4.1.11* Queuing of Request for Voice Channel.

9.3.4.1.11.1 If all available talking channels are assigned, the second- and lower precedence–level requests for a talking channel shall be placed in a queue according to the priority levels involved.

9.3.4.1.11.2 The queue shall cause the system to assign talking channels as they become available on a priority-level basis.

9.3.4.1.11.3 If multiple talkgroups with the same priority are in the queue, they shall be assigned a channel on a first-in-first-out (FIFO) basis.

9.3.4.1.11.4 The queuing protocol shall process and assign channels to requesting units that have been involved in recent conversations before processing and assigning channels to units not involved in any recent conversations, assuming both talkgroups have equal priorities.

9.3.4.1.12 When any unit is placed into a system-busy queue, the unit requesting the channel shall be notified automatically by the system when it assigns a channel to the unit.

9.3.4.1.13 All units operating within the same talkgroup shall receive both sides of every conversation addressed to or from the talkgroup.

9.3.4.1.14 Where required by the AHJ for mobile or portable units, the system shall provide a means for selectively alerting one unit from another unit or from a dispatch location.

9.3.4.1.15 Continuous Talkgroup Affiliation Notification.

9.3.4.1.15.1 The system shall broadcast a continuous update of the talkgroup channel assignments to all field units whose radios are turned on and are within the system's coverage area.

9.3.4.1.15.2 Units that become activated during an ongoing talkgroup conversation, or units that leave the system coverage and return, shall use the continuous update to immediately affiliate with their assigned talkgroup.

9.3.4.1.16* Whenever a field unit leaves the coverage of the signaling channel and attempts to access the system using the push-to-talk (PTT) button, a distinctive audible alert shall be sounded so that the user knows that they are outside the system's coverage area.

9.3.4.1.17* Individual Unit Disable.

9.3.4.1.17.1* Hardware and software that allow disablement of any mobile or portable unit(s) currently operating on the system shall be provided for the system security in case units become lost or stolen.

9.3.4.1.17.2 Disablement of such a unit(s) shall be possible even if the system manager terminal or the console is inoperative.

N 9.3.4.1.17.3 Hardware and software that allow re-enablement of a disabled mobile or portable radio unit(s) currently operating on the system shall be provided.

9.3.4.1.18* The system shall allow AHJ authorized personnel to initiate a change in the operating talkgroup of any field unit from a system manager terminal.

9.3.4.1.19* Where telephone interconnect has been provided as a part of the system, the system shall be configured so that no telephone call prevents or delays any dispatch communications required by the AHJ.

9.3.4.1.20 Monitoring for Integrity.

9.3.4.1.20.1 A subsystem dedicated to monitoring the trunked system infrastructure backbone shall be provided.

9.3.4.1.20.2 Fault and status information, including information on the condition of base station repeaters and controllers, shall be accessible from a system manager terminal.

9.3.4.1.20.3 A means shall be provided that is capable of recording system problems as they occur, including type of problem, date, and time.

9.3.4.1.21 Console Call Indicator.

9.3.4.1.21.1 A call indicator shall be provided for each talkgroup controlled from the control center console.

9.3.4.1.21.2 When a channel is selected, the call indicator shall flash when audio is being received from a field unit.

9.3.4.1.22 When required by the AHJ, the console shall operate in the full duplex mode so that a telecommunicator can simultaneously transmit to a trunked talkgroup and receive their response without releasing the PTT button.

9.3.4.1.23 Console Trunked Busy Indication.

9.3.4.1.23.1 If the telecommunicator attempts to make a call and all trunked channels are busy, a visual alert shall be initiated at the console.

9.3.4.1.23.2 When the channel becomes available, the console shall automatically alert the telecommunicator with an audible tone and "hold" the channel for the telecommunicator for 2 seconds to 4 seconds to allow the telecommunicator time to activate a PTT for the appropriate talkgroup.

9.3.4.1.24* Console Dispatch Preemption.

9.3.4.1.24.1 The system shall be configured so that no "busy" indication is received by a telecommunicator attempting to access a talkgroup required for dispatch of an event.

9.3.4.1.24.2 If necessary, the requirement of 9.3.4.1.24.1 shall be met by preemption of the lowest-priority communication on the system at the time of attempted access to the talkgroup.

9.3.4.1.25 The telecommunicator shall have the following capabilities:

(1) The telecommunicator shall be able to designate a higher tactical priority for certain talkgroups that are controlled at their workstation.

(2) Designation of higher tactical priority shall be achieved by means of a switch on that talkgroup appearance.

9.3.4.2* Digital Trunked System Requirements. Digital trunked systems shall comply with ANSI/TIA-102.BAAA, *FDMA Common Air Interface*, or TIA-102.BBAB, *Project 25 Phase 2 Two-Slot Time Division Multiple Access Physical Layer Protocol Specification*, and with TIA-102.BBAC *Project 25 Phase 2 Two-Slot TDMA Media Access Control Layer Description*, and shall meet the requirements in 9.3.4.1.

9.3.5* Two-Way Mobile Equipment.

9.3.5.1 All emergency response units shall be equipped with a two-way mobile radio that is capable of communicating with the communications center.

9.3.5.2 Mobile radios shall be equipped with a visual transmit indicator.

9.3.5.3 All mobile radios shall be equipped with a carrier control timer that disables the transmitter and signals the operator with a distinctive tone after a time predetermined by the AHJ.

9.3.5.4 Mobile radios and associated equipment shall be manufactured for the environment in which they are to be used.

9.3.5.5 Mobile radios shall be capable of multiple-channel operation to enable on-scene simplex radio communications that are independent of dispatch channels to meet the requirements of 9.3.1.3.

9.3.5.6 Spare mobile radio units shall be provided for emergency response units as follows:

(1) Minimum of one spare unit for each model not directly interchangeable
(2) Minimum of one spare unit for each 20 units, or fraction thereof, in service

9.3.6* Two-Way Portable Equipment.

9.3.6.1 All ERUs shall be equipped with a portable radio that is capable of two-way communication with the communications center.

9.3.6.2 Portable radios shall be manufactured for the environment in which they are to be used and shall be of a size and construction that allow their operation with the use of one hand.

9.3.6.3 Portable radios that are equipped with key pads that control radio functions shall have a means for the user to disable the keypad to prevent inadvertent use.

9.3.6.4 All portable radios shall be equipped with a carrier control timer that disables the transmitter and signals the operator with a distinctive tone after a time predetermined by the AHJ.

9.3.6.5 Portable radios shall be capable of multiple-channel operation to enable on-scene simplex radio communications that are independent of dispatch channels to meet the requirements of 9.3.1.3.

9.3.6.6 Portable radios shall be designed to allow channels to be changed and other radio functions controlled while emergency response personnel are wearing gloves of the type used in emergency response functions. The glove size tested shall be large.

9.3.6.7 Single-unit battery chargers for portable radios shall be capable of fully charging the radio battery while the radio is in the receiving mode.

9.3.6.8 Battery chargers for portable radios shall automatically revert to maintenance charge when the battery is fully charged.

9.3.6.9 Battery chargers shall be capable of charging batteries in a manner that is independent of and external to the portable radio.

9.3.6.10 Spare batteries shall be maintained in quantities that allow continuous operation as determined by the AHJ.

9.3.6.11 A minimum of one spare portable radio shall be provided for each 10 units, or fraction thereof, in service.

9.3.6.12* Portable radios used by first responders who might encounter hazardous locations because of the presence of explosive gas or explosive dust atmospheres shall be rated as intrinsically safe for operation in such atmospheres by a nationally recognized testing laboratory, if determined necessary by the AHJ.

9.3.7* Mobile Command Vehicles. Vehicles that are used in command or communications functions shall meet the requirements of NFPA 1901.

9.3.8 Backhaul Microwave Systems.

9.3.8.1 General Requirements. Microwave radio systems used for backhaul shall meet the following minimum requirements:

(1) The microwave radio shall be suitable for two-frequency, full-duplex operation.
(2)* The microwave radio shall be suitable for operating in network configurations offering ring or star protection.
(3) The microwave radio shall include a transmitter, a receiver, a modem, a power supply, an automatic switching device, a multiplexer, service channels/orderwire, and all associated interconnections.
(4) The microwave radio shall allow full access to all modules for normal system maintenance.
(5) All replaceable/plug-in modules shall be accessible.
(6) Each microwave hop shall be designed to meet or exceed a one-way end-to-end annual quality performance of 99.995 percent at the required capacity.
(7) Each microwave hop shall be designed to meet or exceed a one-way end-to-end annual reliability performance of 99.999 percent at the required capacity.

9.3.8.2 Recovery and Protection.

9.3.8.2.1 Receivers shall provide both manual and fade initiated automatic errorless switching.

9.3.8.2.2 Recovery of a system from RF signal loss shall take place within 250 milliseconds after a valid signal is restored.

9.3.8.2.3 The system shall be designed so that protection circuits and units not in service or operation can be tested and repaired without affecting on-line system operation.

9.3.8.2.4 Partial or complete failure of protection control or switching equipment shall not render the microwave link inoperable.

9.3.8.3 Electromagnetic Interference.

9.3.8.3.1 The microwave equipment shall be operationally compatible with public safety communications equipment co-located in the same equipment location.

9.3.8.3.2* The microwave equipment shall be capable of meeting full specifications when operating in the vicinity of commercial AM and FM radio and TV transmitters.

9.3.8.4 Environmental Considerations. Microwave systems equipment shall function properly in the environmental conditions and at altitudes in which it is installed.

9.3.8.5 Microwave System Network Management.

9.3.8.5.1* General. The microwave system shall have sufficient alarm, control, and metering capabilities to detect defective or failing components.

9.3.8.5.2 Fault and Failure History Log.

9.3.8.5.2.1 The microwave radio shall maintain an electronic file that records the date, time, and type of fault/action of all fault and failure conditions and switching actions.

9.3.8.5.2.2 The file shall be downloadable for on-site review and for electronic communication to others at remote locations.

9.3.8.5.3 Fault and Failure Indications. Fault and failure conditions shall be displayed at the site and at a remotely monitored location.

9.3.8.5.4* External Alarms. Each microwave radio assembly shall accommodate at least four external site/housekeeping alarm inputs.

9.4 Radio Alerting Systems.

9.4.1 General.

9.4.1.1 Radio alerting systems shall include one or more of the following:

(1) Voice receivers
(2) Coded receivers
(3) Noncoded receivers
(4) Numeric receivers
(5) Alphanumeric devices
(6) Two-way alphanumeric devices

9.4.1.2 Where radio home alerting receivers, portable radios, pagers, and similar radio devices are used to receive events or are used on-scene, they shall conform to the requirements of this standard.

9.4.1.3 Where portable two-way radio equipment is used to receive events, such units shall be equipped to receive a coded alert.

9.4.2 Radio Paging Systems and Pagers.

9.4.2.1* The paging system shall be under the direct control of the AHJ where used as a method of emergency dispatch.

9.4.2.2 No part of the paging system shall utilize the public Internet for any portion of its operation when used as a method of emergency dispatch.

9.4.2.3 Page-encoding equipment, where used as a method of emergency dispatch, shall be located in the communications center or an associated public safety radio system site.

9.4.2.4 The paging system shall comply with the general requirements for radio systems as outlined in this document.

9.4.2.5 Pagers shall audibly indicate a low-battery condition.

9.4.2.6 Alphanumeric pagers shall support the maximum text message that can be sent from the communications center.

9.4.2.7* Coded receivers shall audibly indicate the presence of an unacknowledged message.

9.4.2.8 Alphanumeric devices and two-way alphanumeric devices shall audibly indicate the presence of an unread message.

9.4.2.9 Two-way alphanumeric devices shall automatically transmit an acknowledgment when the device has received and stored a message.

9.4.2.10 Two-way alphanumeric devices shall automatically transmit an acknowledgment when the responding user has read the message.

9.4.2.11* Two-way alphanumeric devices shall be capable of providing and transmitting multiple-choice replies, manually selected by the user.

9.4.2.12* Status of the two-way alphanumeric devices, including messages sent and acknowledged, shall be monitored in the operations room.

9.4.3* Alerting Receivers. Where radio alerting receivers are used to receive emergency dispatch messages, they shall be provided with two sources of power.

9.5 Outside Audible Alerting Devices.

9.5.1 Outside audible alerting devices used to indicate an emergency shall be located to alert all emergency response personnel expected to respond.

9.5.2 Coded alerting devices shall operate at speeds of at least one actuation per second, with three or four rounds of coded signals required where outside alerting devices are operated for summoning emergency personnel.

Δ 9.5.3 Compressed air alerting devices shall have a distinctive tone. If coded, the duration of the blast shall be neither less than 0.5 second nor longer than 1.5 seconds, with silent intervals of 1 to 1.5 times the blast duration.

9.5.3.1 Storage tanks shall meet the following criteria:

(1) Storage tanks shall comply with ASME specifications for unfired pressure vessels.
(2) Storage tanks shall be equipped with safety relief valves.
(3) Storage tank size shall be such that, at 85 percent of working pressure, eight times the largest number of blasts assigned to any signal but not fewer than 50 blasts shall be capable of being sounded.

9.5.4 Compressors shall have the capacity to fill storage tanks to working pressure within 30 minutes.

9.5.4.1 Piping of ferrous materials shall be provided with scale traps that are accessible for cleaning.

9.5.4.2 All piping shall be arranged to allow inspection and repair.

9.5.5 IP Devices. Where adopted by the AHJ, IP-enabled devices (e.g., smartphones, tablets, laptops) shall comply with the

rules and regulations governing wireless communications in the country of operation.

9.5.5.1 The communications center shall be equipped for IP-enabled two-way communications with the ERUs using IP-enabled devices as determined by the AHJ.

9.5.5.2 IP-enabled devices shall be capable of fully charging the battery while in use.

9.6 Two-Way Radio Communications Enhancement Systems.

9.6.1 General. All system components shall be designed, installed, tested, inspected, and maintained in accordance with the manufacturers' published instructions and the requirements of Section 9.6.

Δ 9.6.2 Approval. Where a two-way radio communications enhancement system is used, the design of the system shall be approved by the AHJ.

Δ 9.6.2.1 The backbone, antenna distribution, radiating, or any fiber-optic cables shall be rated as plenum cables.

Δ 9.6.2.2 The backbone cables shall be connected to the antenna distribution, radiating, or copper cables using hybrid coupler devices of a value determined by the overall design.

9.6.2.3 Backbone cables shall be routed through an enclosure that matches the building's fire rating.

Δ 9.6.2.4 The connection between the backbone cable and the antenna cables shall be made within an enclosure that matches the building's fire rating, and passage of the antenna distribution cable in and out of the enclosure shall be fire-stopped.

9.6.3* Lightning Protection. Systems shall have lightning protection that complies with NFPA 780.

Δ 9.6.4 Testing Requirements. Systems that are used to comply with the requirements of Section 9.6 shall be tested in accordance with 11.3.9 and 11.3.9.1.

9.6.5 Non-Interference and Non-Public Safety System Degradation.

9.6.5.1 No amplification system capable of operating on frequencies or causing interference to frequencies assigned to the jurisdiction by the licensing authority of the country of jurisdiction shall be installed without prior coordination and approval of the AHJ.

9.6.5.2 The building manager/owner shall suspend and correct equipment installations that degrade the performance of the public safety radio system or public safety radio enhancement system.

9.6.5.3 Systems that share infrastructure with non-public safety services shall ensure that the coverage and performance of the public safety communications channels are not degraded below the level of performance identified in 9.6.7 and 9.6.8, regardless of the amount of traffic carried by the non-public safety services.

9.6.6 Approval and Permit.

9.6.6.1 Plans shall be submitted for approval prior to installation.

9.6.6.2 At the conclusion of successful acceptance testing, a renewable permit shall be issued for the public safety radio enhancement system where required by the AHJ.

9.6.7* Radio Coverage.

Δ 9.6.7.1 Radio coverage shall be provided throughout the building as a percentage of floor area as specified in 9.6.7.3 and 9.6.7.4.

9.6.7.2 The system shall adhere to the maximum acceptable propagation delay standard provided by the AHJ.

9.6.7.3 Critical areas, including fire command centers, fire pump rooms, exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ, shall be provided with 99 percent floor area radio coverage.

9.6.7.4 General building areas shall be provided with 90 percent floor area radio coverage.

9.6.7.5 Buildings and structures that cannot support the required level of radio coverage shall be equipped with a system that includes RF-emitting devices that are certified by the radio licensing authority to achieve the required adequate radio coverage.

N 9.6.7.6 Radio enhancement systems shall be designed to support two portable radios simultaneously transmitting on different talk paths or channels, where the AHJ has required the radio enhancement system to support more than one channel or talk path.

9.6.8* Signal Strength.

9.6.8.1* Inbound.

N 9.6.8.1.1 A minimum inbound signal strength sufficient to provide usable voice communications, as specified by the AHJ, shall be provided throughout the coverage area.

N 9.6.8.1.2 The inbound signal level shall be sufficient to provide a minimum of DAQ 3.0 for either analog or digital signals.

9.6.8.2* Outbound.

N 9.6.8.2.1 A minimum outbound strength sufficient to provide usable voice communications, as specified by the AHJ, shall be provided throughout the coverage area.

N 9.6.8.2.2 The outbound signal level shall be sufficient to provide a minimum of DAQ 3.0 for either analog or digital signals.

9.6.9 Donor Antenna. If a donor antenna exists, isolation shall be maintained between the donor antenna and all inside antennas to a minimum of 20 dB above system gain.

9.6.10 Frequencies. The public safety radio enhancement system shall be capable of transmitting all radio frequencies, as required by the AHJ assigned to the jurisdiction, and be capable of using any modulation technology in current use by the public safety agencies in the jurisdiction.

9.6.10.1 List of Assigned Frequencies. The AHJ shall maintain a list of all inbound/outbound frequency pairs for distribution to system designers.

9.6.10.2* Frequency Changes. Systems shall be upgradeable to allow for instances where the jurisdiction changes or adds system frequencies to maintain radio system coverage as it was originally designed.

9.6.11 System Components.

9.6.11.1* Component Approval.

N 9.6.11.1.1 RF-emitting devices and cabling used in the installation of the public safety two-way radio communications enhancement systems shall be approved by the AHJ.

N 9.6.11.1.2 All RF-emitting devices shall have the certification of the radio licensing authority of that country and be suitable for public safety use prior to installation.

9.6.11.2 Component Enclosures.

N 9.6.11.2.1 All repeater, transmitter, receiver, signal booster components, optical-to-RF and RF-to-optical converters, external filters, batteries, and battery system components shall be contained in a NEMA4- or NEMA4X-type enclosure(s).

N 9.6.11.2.2 Batteries that require venting shall be stored in NEMA3R-type enclosures.

9.6.11.3 RF-Emitting Devices. RF-emitting devices shall meet the following requirements in addition to any other requirements determined by the AHJ:

(1) RF-emitting devices shall have the certification of the radio licensing authority prior to installation.
(2) All RF-emitting devices shall be compatible with both analog and digital communications, as required to be used by the radio licensing authority and the AHJ, simultaneously at the time of installation.

9.6.12 Power Sources. At least two independent and reliable power sources shall be provided for all RF-emitting devices and any other active electronic components of the system: one primary and one secondary.

9.6.12.1 Primary Power Source. The primary power source shall be supplied from a dedicated branch circuit and comply with *NFPA 72*.

9.6.12.2 Secondary Power Source. The secondary power source shall consist of one of the following:

(1) A storage battery dedicated to the system with 12 hours of 100 percent system operation capacity
(2) An alternative power source of 12 hours at 100 percent system operation capacity as approved by the AHJ

9.6.12.3 Monitoring Integrity of Power Sources. Monitoring the integrity of power sources shall be in accordance with 9.1.2.2.

9.6.13 System Monitoring.

Δ 9.6.13.1 Fire Alarm System. The system shall include automatic supervisory signals for malfunctions of the two-way radio communications enhancement systems that are annunciated by the fire alarm system in accordance with *NFPA 72* and shall comply with the following:

(1) Monitoring for integrity of the system shall comply with Chapter 10 of *NFPA 72*.
(2) System supervisory signals shall include the following:
    (a) Donor antenna malfunction
    (b) Active RF-emitting device failure
    (c) Low-battery capacity indication when 70 percent of the 12-hour operating capacity has been depleted
    (d) Active system component failure
(3) Power supply supervisory signals shall include the following for each RF-emitting device and active system components:
    (a) Loss of normal ac power
    (b) Failure of battery charger
(4) The communications link between the fire alarm system and the two-way radio communications enhancement system shall be monitored for integrity.

9.6.13.2 Dedicated Annunciation.

N 9.6.13.2.1 A dedicated annunciator shall be provided within the fire command center to annunciate the status of all RF-emitting devices and active system component locations. This device shall provide visual and labeled indications of the following for each system component and RF-emitting device:

(1) Normal ac power
(2) Loss of normal ac power
(3) Battery charger failure
(4) Low-battery capacity (i.e., to 70 percent depletion)
(5) Donor antenna malfunction
(6) Active RF-emitting device malfunction
(7) Active system component malfunction

N 9.6.13.2.2 The communications link between this device and the two-way radio communications enhancement system shall be monitored for integrity.

9.6.14 Technical Criteria.

N 9.6.14.1 The AHJ shall maintain a document of technical information specific to its requirements.

N 9.6.14.2 Technical information documents shall be kept in a secure place accessible to maintenance personnel but not accessible to the public.

N 9.6.14.3 Technical information documents shall contain, as a minimum, the following:

(1) Frequencies required for the in-building enhancement system
(2) Location and effective radiated power (ERP) of radio sites used by the public safety radio enhancement system
(3) Maximum propagation delay — in microseconds
(4) List of specifically approved system components
(5) Other supporting technical information necessary to direct system design

Chapter 10 Computer-Aided Dispatching (CAD) Systems

10.1 General.

10.1.1* Computer-aided dispatching (CAD) systems, when required by the AHJ, shall conform to the items outlined in this chapter.

10.1.2* Where a CAD system is used for emergency dispatch service operations, and an enhanced 9-1-1 emergency number telephone system is in use, the CAD system shall contain all hardware and software components necessary for interface with the 9-1-1 system.

10.1.2.1* The CAD interface shall accept a transfer of 9-1-1 emergency call data from the customer premise equipment (CPE) to the CAD system.

10.1.2.2 The CAD system shall be capable of populating a call-for-service data entry form with the 9-1-1 data provided by the CPE.

10.2* Secondary Dispatch Method. Where a CAD system is used for emergency services dispatch operations, a secondary dispatch method shall be provided and shall be available for use in the event of a failure of the CAD system.

10.3 Security.

10.3.1 CAD systems shall utilize different levels of security to restrict unauthorized access to sensitive and critical information, programs, and operating system functions.

10.3.2 The AHJ shall have the ability to control user and supervisor access to the various security levels.

10.3.3 Physical access to the CAD system hardware shall be limited to authorized personnel as determined by the AHJ.

10.3.4 Operation of the CAD system software shall be limited to authorized personnel by log-on/password control, workstation limitations, or other means and audited as required by the AHJ.

10.3.5* CAD systems shall provide network isolation necessary to preserve bandwidth for the efficient operation of the system and processing of events.

10.3.5.1 The CAD system shall provide measures to prevent denial-of-service attacks and any other undesired access to the CAD portion of the network.

10.3.5.2 CAD systems shall employ antivirus software where necessary to protect the system from infection.

10.4 Event Data Exchange.

10.4.1 The CAD system shall have the capability to allow event data exchange between the CAD system and other CAD systems.

N 10.4.1.1 The method for data exchange shall be the NENA/APCO emergency incident data document (EIDD) 2.105.1-2017.

N 10.4.1.2* It shall be up to the AHJ to decide whether or not to use or display this information.

N 10.4.1.3 The sending dispatchers shall be able to send and receive administrative (not tied to an incident) messages to the receiving dispatchers.

10.4.2 The CAD system shall have the capability to allow event data exchange between the CAD system and supervising stations.

10.4.3 The CAD system shall have the capability to allow event data exchange between the CAD system and 9-1-1 databases.

10.4.4* The CAD system shall have the capability to allow event data exchange between the CAD system and other systems as required and approved by the AHJ.

10.4.5 CAD systems that are connected to third-party systems to receive events directly shall have agreements in place with the third-party providers to monitor the system for integrity.

10.5 CAD Capabilities.

10.5.1 The installation of a CAD system in emergency service dispatching shall not negate the requirements for a secondary dispatch circuit.

10.5.2 Computer hardware provided as a part of the CAD system shall be of a quality and reliability sufficient to meet the requirements of the AHJ.

10.5.3 All components that are required for the operation of the CAD system ("critical loads") shall be supplied with electrical power through an approved SEPSS *(see 4.10.7.4)*.

10.5.3.1 The SEPSS shall be capable of supporting the critical loads for no less than 60 minutes.

10.5.3.2* The SEPSS shall receive its power from circuit(s) that are automatically connected to the emergency generator, as specified in 4.7.3, in the event of a power failure or insufficiency.

10.5.4 All characters shall be visible in a lighted room without being affected by the glare of ambient lighting.

10.5.5 Printers.

10.5.5.1 The system shall support as many printers as the AHJ deems necessary for its operation.

10.5.5.2 Logging or utility functions shall be assignable to any printer under system control.

10.5.5.3 A spare printer shall be available.

N 10.5.5.4 Printers located in an ERF as a part of the dispatch system shall be capable of printing a completed emergency message in less than 30 seconds.

10.5.6* Software that is a part of the CAD system shall provide data entry; provide resource recommendations, notification, and tracking; store records relating to all events and all other calls for service and status changes; and track those resources before, during, and after events, preserving records of those events and status changes for later analysis.

10.5.6.1* The AHJ shall put in place safeguards to preserve the operation, sustainability, and maintainability of all elements of the CAD system in the event of the demise or default of the CAD supplier.

10.5.6.2 The system applications shall function under the overall control of a standard operating system that includes support functions and features as required by the AHJ.

10.5.7 Where the CAD system is a primary or secondary dispatch circuit for ERFs and ERUs, it shall provide an audible notification of events and shall be permitted to provide a visual notification of events and other calls for service.

10.5.7.1 If voice announcement is used, it shall be preceded by an audible warning or alerting signal that differentiates the event or emergency from any other voice messages carried by the system.

10.5.7.2* If text messages are used, they shall be accompanied by audible warning or alerting signal(s) that notify ERF or ERU personnel that an event or emergency message has been transmitted.

10.6 Performance.

10.6.1* The system shall accommodate the call volume, call types, and other sizing parameters required by the AHJ.

10.6.2 The system shall recommend units for assignment to calls.

10.6.2.1 The system shall ensure that the optimum response units are selected.

10.6.2.2 The CAD system shall allow the telecommunicator to override the CAD recommendation for unit assignment.

10.6.2.2.1 The CAD system shall automatically log that the recommendation was overridden manually by the telecommunicator.

10.6.2.3 The CAD system shall have the ability to prioritize all system processes so that emergency operations take precedence.

10.6.3 The system shall detect faults and failures.

10.6.3.1 The system shall automatically perform all required reconfiguration as a result of the faults or failures.

10.6.3.2 The system shall queue a notification message to the supervisor and any designated telecommunicator positions.

10.6.4* Under all conditions, the system response time shall not exceed 2 seconds, measured from the time a telecommunicator completes a keyboard entry to the time of full display of the system response at any position where a response is required.

10.6.5 The system shall be available and fully functional 99.95 percent of the time, excluding planned maintenance.

10.6.6* The system shall include automatic power-fail recovery capability.

10.7* Backup. The system shall include a data backup system, utilizing either removable media or independent disk storage arrays dedicated to the backup task.

10.8 Redundancy.

10.8.1 The failure of any single component shall not disable the entire system.

10.8.1.1 The CAD system shall provide automatic switchover in case of failure of the required system component(s).

10.8.1.2 Manual intervention by telecommunicators or others shall not be required.

10.8.1.3 Notwithstanding the requirements of 10.8.1.1, the system shall provide the capability to manually initiate switchover.

10.8.1.4* Systems that utilize redundant server and workstation configurations shall continue from the point where the primary server stopped without requiring a restart of the CAD system or re-entry of the calls in the system at the time of the switchover.

10.8.1.5 Systems that utilize distributed processing, with workstations in the operations room also providing the call processing functions, shall be considered to meet 10.8.1.4, as long as all such workstations are continually sharing data and all data necessary to pick up at the point where the failed workstation stopped are available to all other designated dispatch workstations.

10.8.1.6* CAD systems that are connected to third-party systems to receive alarms directly into the CAD shall have an alternate method of receiving these alarms.

10.8.2 Monitoring for Integrity.

10.8.2.1 The system shall continuously monitor the CAD interfaces for equipment failures, device exceptions, and time-outs.

10.8.2.2 The system shall, upon detection of faults or failures, send an appropriate message to the supervisor and designated telecommunicator positions, accompanied by visual and audible indications.

10.8.3* The system shall log system messages and transactions.

10.8.4 Logs of system messages shall not be modified or erased during the period required by the records retention policy set by the AHJ as defined in Section 12.7.

10.8.5* A spare display screen, pointing device, and keyboard shall be available in the communications center for immediate change-out for every three workstations, or fraction thereof, up to a maximum of three spare display screens, pointing devices, and keyboards.

10.9 Storage Network.

10.9.1* The system shall provide on-line storage that meets all of the functional and performance requirements of this standard for programs and data.

10.10 Information Transmittal.

10.10.1 Wired data communications systems that connect ERFs and administrative sites with the system shall communicate at a minimum rate of 56,000 bits per second.

10.10.2 Wireless data communications systems that connect ERFs and administrative sites with the system shall communicate at a minimum rate of 56,000 bits per second.

10.10.3 Mobile units shall communicate with the CAD system at a minimum rate of 9600 bits per second.

10.10.4 The transmission of computer information to mobile units or fixed locations that are associated with emergency operations shall be in accordance with the applicable government rules and regulations for the type of service being used.

10.11 Mobile Data Computers (MDCs).

10.11.1* MDCs and associated equipment shall be manufactured for the environment in which they are to be used.

10.11.2 System Availability.

10.11.2.1 Data communications between CAD and MDCs shall provide the following indications:

(1) Indicate to the telecommunicator that the MDC system is operational
(2) Indicate to the telecommunicator the failure of any message to an MDC
(3) Indicate to the ERU the failure of any message to CAD

10.11.2.2* If communication between MDCs and CAD has failed, messages in transit shall not be lost.

10.11.3 Emergency messages to MDCs shall take priority over other messages.

10.11.3.1 The MDC shall immediately display an indication of an emergency message.

10.11.3.2 The emergency message shall be accompanied by an audible indication from the MDC of sufficient volume to overcome ambient noise.

10.11.3.3 Vehicles equipped with printers shall have the capability to print emergency messages.

10.11.3.4 Displayed emergency messages shall not be automatically replaced by other messages.

10.11.3.5 The MDC shall display emergency information with a minimum use of multipage display.

10.11.4 Nonemergency Messaging.

10.11.4.1 A manual acknowledgment feature shall be provided to indicate that a message sent from the operations room has been viewed.

10.11.4.2 An MDC shall display vehicle status as currently registered within the CAD system.

10.11.5 Equipment and Operation.

10.11.5.1 The MDC shall not require external power to maintain programmed functions.

10.11.5.2 Required connections between the MDC and other essential system components shall be fastened so as to not come loose under normal operating conditions.

10.11.5.3 The MDC shall allow a single action by the operator to initiate an emergency response status change.

10.11.5.4* The MDCs shall provide the following functionality:

(1) The ability to power on and off
(2) A visual indication that the unit is energized
(3) The ability to adjust display intensity
(4) An emergency alert button that transmits a distress signal to the operations room

10.11.5.5 The MDCs shall have a last-in-first-out (LIFO) feature that allows the user to recall the last 10 messages received.

10.11.5.6 Each MDC shall be capable of receiving single, group, or all-call messages.

10.11.5.7 Keyboard.

10.11.5.7.1 The bottoms of detachable keyboards shall have nonskid surfaces.

10.11.5.7.2 The illumination of the keyboard shall be adjustable by the user.

10.11.5.7.3 The keyboard design shall prevent malfunction caused by foreign materials.

10.11.5.7.4 Keyboard malfunctions shall not adversely affect the MDC, the MDC system, the MDC interface, or the CAD system.

10.11.5.8 Display Screens.

10.11.5.8.1 All information shall be visible in direct sunlight conditions.

10.11.5.8.2 The display screen shall be stable and free of unintentional motion.

10.11.5.8.3 Characters shall have a uniform appearance on all parts of the screen.

10.11.5.9 Mobile printers shall provide the following functionality:

(1) The ability to power on and off
(2) A visual indication that the unit is energized

10.12 Integrated Mapping Interface.

10.12.1* The CAD system shall have the ability to interface with a map display system.

10.12.2 The map display system interface shall have the ability to accept spatial positioning data for calls for service and units from CAD.

10.12.3 The map display system interface shall have the ability to position an indicator on the map based on the provided spatial information.

Chapter 11 Testing

11.1 General.

11.1.1 Tests and inspections shall be made at the intervals specified in this standard.

11.1.2 All equipment shall be restored to operating condition after each test or alarm for which the equipment functioned.

11.1.3 Where tests indicate that trouble has occurred anywhere on the system, one of the following shall be required:

(1) The telecommunicator shall take steps to repair the fault.
(2) If repair is not possible, action shall be taken to isolate the fault and to notify the official responsible for maintenance.

11.1.4 Procedures that are required by other parties and that exceed the requirements of this standard shall be permitted.

11.1.5 The requirements of this chapter shall apply to both new and existing systems.

11.2 Acceptance Testing.

11.2.1 New equipment shall be provided with operation manuals that cover all operations and testing procedures.

11.2.2 All functions of new equipment shall be tested in accordance with this chapter and the manufacturers' specifications before being placed in service.

11.2.3 All cables shall be tested in accordance with this chapter where installed with all taps and splices made.

11.2.3.1 Before connection to terminals, cables shall be tested for insulation resistance.

11.2.3.2 Resistance tests shall demonstrate an insulation resistance of at least 200 megohms per mile between any one conductor and all other conductors, the sheath, and the ground.

11.2.4 The frequency, modulation, power output, and receiver sensitivity and selectivity shall be tested and recorded when any radio is installed or repaired.

N 11.2.5 Microwave acceptance testing shall be performed.

11.3 Operational Testing.

11.3.1 Wired Dispatch Circuits. Manual test of wired dispatch circuits shall be as follows:

(1) A test shall be performed and recorded at least once every 24 hours.
(2) Circuits for transmission of graphic signals shall be tested by a message transmission.

11.3.2 Power Supply for Wired Dispatch Circuits. Manual tests of the power supply for wired dispatch circuits shall be made and recorded at least once during every 24 hours and shall include the following:

(1) The current strength of each circuit shall be tested, and changes in the current of any circuit that amount to 10 percent of normal current shall be investigated immediately.
(2) The voltage across terminals of each circuit inside terminals of protective devices shall be tested, and changes in the voltage of any circuit that amount to 10 percent of normal voltage shall be investigated immediately.
(3) The voltage between ground and circuits shall be tested as follows:
    (a) Where the test indicates a reading in excess of 50 percent of that shown in the test specified in 11.3.2, the trouble shall be located immediately and cleared.
    (b) Readings in excess of 25 percent shall be given early attention.
    (c) Systems in which each circuit is supplied by an independent current source shall require tests between ground and each side of each circuit that are performed with a voltmeter of not more than 100 ohms resistance per volt.
(4) A ground current reading shall be permitted in lieu of the test specified in 11.3.2, and all grounds that indicate a current reading in excess of 5 percent of the normal line current shall be given immediate attention.
(5) The voltage across common battery terminals on the switchboard side of fuses or circuit breakers shall be tested.
(6) The voltage between common battery terminals and ground shall be tested and abnormal ground readings investigated immediately.
(7) If more than one common battery is used, each common battery shall be tested.

11.3.3 Alerting Means. Outside audible alerting devices, radio, telephone, or other means for alerting emergency response personnel shall be tested as required by the AHJ.

11.3.4 Radio and Voice Amplification Circuits. All primary and secondary radio and voice amplification circuits shall be subjected to a voice test twice daily.

11.3.5 Public Safety Answering Point (PSAP) Telephone Testing. All emergency phone circuits of a PSAP shall be tested daily in accordance with the requirements of the AHJ.

11.3.6 Emergency Lighting. Emergency lighting shall be tested in accordance with NFPA *101*.

11.3.7 Stored Emergency Power Supply System/Uninterruptible Power Supply (SEPSS/UPS). An SEPSS/UPS shall be tested in accordance with NFPA 111.

11.3.8 TDD/TTY. The TDD/TTY system shall be tested daily.

11.3.9* Test and Inspection of In-Building Two-Way Radio Enhancement Systems. Where two-way radio communications enhancement systems are installed, a system test shall be conducted, documented, and signed by a person approved by the AHJ upon system acceptance and once every 12 months.

11.3.9.1 Initial Acceptance Test Requirements.

N 11.3.9.1.1 All new systems shall be initially acceptance tested to verify that the system as installed meets the performance requirements of Section 9.6.

N 11.3.9.1.2 Qualifications of testing personnel shall be submitted to the AHJ for approval and acceptance.

N 11.3.9.1.3 All systems initial acceptance testing documentation shall include a listing of the following:

(1) All system equipment utilized
(2) Manufacturer's data sheets
(3) Installation, testing, and maintenance documentation
(4) As-built drawings showing all equipment locations
(5) Written documentation acceptable to the AHJ of the initial system testing, including the DAQ measured at all locations in the building or areas covered by the installed system
(6) Secondary power calculations
(7) List of assigned frequencies

N 11.3.9.2 Periodic Visual Inspection of Systems.

N 11.3.9.2.1 All systems that are connected to fire alarm systems that are not monitored for alarm, supervisory, and trouble conditions off site as defined by *NFPA 72* shall be visually inspected weekly for the following conditions:

(1) Normal ac power
(2) Loss of normal ac power
(3) Battery charger failure
(4) Low battery capacity
(5) Donor antenna malfunction
(6) Active RF-emitting device malfunction
(7) Active system component malfunction
(8) Loss of communication with the fire alarm control panel

N 11.3.9.2.2 All systems that are connected to fire alarm systems that are monitored for alarm, supervisory, and trouble conditions off site as defined by *NFPA 72* shall be visually inspected semiannually for the following conditions:

(1) Normal ac power
(2) Loss of normal ac power
(3) Battery charger failure
(4) Low battery capacity
(5) Donor antenna malfunction
(6) Active RF-emitting device malfunction
(7) Active system component malfunction
(8) Loss of communication with the fire alarm control panel
(9) Signs of physical damage to components that could affect proper system operation

N 11.3.9.2.3 Periodic Testing of Systems.

N 11.3.9.2.3.1 All systems shall be operationally tested at least annually to confirm system operation during normal operations.

N 11.3.9.2.3.2 At least every five years systems shall be quantitatively tested to ensure that the system still provides the required DAQ values in accordance with Section 9.6.

N 11.3.9.2.3.3 The five-year test shall also confirm that there has been no deviation of coverage more than 5 percent from the initial installation documentation.

N 11.3.9.2.4 Deviation of more than 5 percent shall result in additional evaluations to determine if any system modifications are required to bring the system into conformance with the coverage required in Section 9.6.

N 11.3.9.2.5 The five-year test shall confirm that there have been no changes in the frequencies utilized for the proper operation of the system.

N 11.3.9.2.6 The AHJ can require additional testing if the system fails to operate during normal operations at frequencies shorter than five years or if radio system conditions change.

N 11.3.9.2.7 Inspection and Testing Documentation.

N 11.3.9.2.7.1 All visual inspection and testing reports shall be documented in a format acceptable to the AHJ in writing.

N 11.3.9.2.7.2 All reports shall be retained for the life of the system in either paper or electronic form and be made available to the AHJ upon request.

N 11.3.10 Periodic microwave systems testing shall include throughput and reliability.

11.4 Power.

11.4.1 Emergency and standby power systems shall be tested in accordance with NFPA 110.

11.4.2 Weekly discharge tests of the emergency battery power systems shall be performed for 30 minutes to ensure that the batteries are capable of supplying the system with power.

11.4.3 To maximize battery life, the battery voltage for lead acid cells shall be maintained within the limits specified in Table 11.4.3.

11.4.4 To maximize battery life, the following battery-charging voltages shall be used:

(1) Float voltage: 1.42 V/cell ± 0.01 V
(2) High-rate voltage: 1.58 V/cell + 0.07 V – 0.00 V

Δ Table 11.4.3 Battery Maintenance Voltage

Float Voltage	High-Gravity Battery (Lead Calcium)	Low-Gravity Battery (Lead Antimony)
Maximum	2.25 V/cell	2.17 V/cell
Minimum	2.20 V/cell	2.13 V/cell
High-rate voltage	2.33 V/cell	—

Note: High- and low-gravity voltages are +0.07 V and –0.03 V, respectively.

Chapter 12 Records

12.1 General. Complete records to ensure operational capability of all dispatching system functions shall be maintained.

12.2 Installation.

12.2.1 Wired Circuits. Records of wired dispatch circuits shall include the following:

(1) Outline plans that show all terminals in sequence
(2) Diagrams of office wiring
(3) Materials used, including trade name, manufacturer, and year of purchase or installation

12.2.2 Radio Channel. Records of radio dispatch channels and any associated wired circuits shall include the following:

(1) Outline plans that show transmitters and receivers
(2) Diagrams of interconnecting office wiring
(3) Materials used, including trade name, manufacturer, and year of purchase or installation

12.2.3 Changes and Additions. Changes or additions shall be recorded in accordance with 12.2.1 and 12.2.2.

12.3 Acceptance Test Records/As-Built Drawings. After completion of acceptance tests that have been approved by the AHJ, the following shall be provided:

(1) A set of reproducible, as-built installation drawings
(2) Operation and maintenance manuals
(3) Written sequence of operation
(4) Results of all operational tests and values at the time of installation

12.3.1 For software-based systems, access to site-specific software shall be provided to the AHJ.

12.3.2 The AHJ shall be responsible for maintaining the records for the life of the system.

12.3.3 Paper or electronic media shall be permitted.

12.4 Training Records. Training records shall be maintained for each employee as required by the AHJ.

12.5 Operational Records.

12.5.1* Call and dispatch performance statistics shall be compiled and maintained in accordance with Section 7.4.

12.5.2 Statistical analysis for call and dispatch performance measurement shall be done monthly and compiled over a 1-year period.

12.5.2.1 A management information system (MIS) program shall track incoming calls and dispatched events and provide real-time information and strategic management reports.

12.5.3 Records of the following, including the corresponding dates and times, shall be kept by the jurisdiction:

(1) Test, alarm, and dispatch signals
(2) Circuit interruptions and observations or reports of equipment failures
(3) Abnormal or defective circuit conditions indicated by test or inspection

12.6 Maintenance Records.

12.6.1 Records of maintenance, both routine and emergency, shall be kept for all alarm-receiving equipment and alarm-dispatching equipment.

12.6.2 All maintenance records shall include the date, time, nature of maintenance, and repairer's name and affiliation.

12.7 Retention of Records.

12.7.1 Records required by Sections 12.2, 12.3, 12.5, and 12.6 shall be maintained for the life of the affected equipment.

12.7.2 Records that are required by Sections 7.4, 7.6, 11.3, and 12.5 shall be maintained for 2 years or as required by law or by the AHJ.

12.7.3 Where call detail recording (CDR) is provided, records shall be maintained for 2 years or as required by law or by the AHJ.

N 12.7.4 Capacity shall be provided for the storage of a minimum of 100 days of history log data.

N 12.7.4.1* History log data shall be deleted or overwritten based on a policy established by the AHJ.

Chapter 13 ICT Security

13.1* Information Communication Technology (ICT) Security Plan. Communications centers shall develop, implement, and utilize a comprehensive defense in depth process and plan to ensure total data security. The defense in depth approach shall encompass people, technology, and operations and shall provide a framework for safeguarding the vital mission of public safety communications centers, including the CAD systems and IP-based NG9-1-1 systems, and the public safety wireless networks used by first responders, including any IP-enabled wireless devices, whether used on public safety or public wireless carrier networks.

13.1.1 The plan shall include the items required by 13.1.2 through 13.1.12.

13.1.2 The plan shall include a policy statement from the AHJ detailing the requirements and goals of the plan.

13.1.3* The plan shall require the assignment of responsibilities for the performance of security functions.

13.1.4* The plan shall specify training and education requirements for employees and shall include a continuing education plan component.

13.1.5* The communications center shall implement control provisions for access to physical premises, access to radio subscriber units into the radio system, and personnel access to various portions of the networks and computers.

13.1.6* The communications center shall implement network security provisions to prevent unauthorized persons from gaining access to the public safety IP network, the public safety phone network, the land mobile radio network, and any other networks that operate within or under the control of the communications center that are required for the receipt or processing of events and to prevent unauthorized use of public safety handheld IP-enabled devices used on either a public safety network or a public wireless carrier network.

13.1.7* The communications center shall implement computer security provisions to prevent attacks on the center's computers and servers.

13.1.8* The communications center shall implement software patch management provisions to ensure that all software is maintained with all updates released and recommended by the system manufacturer to facilitate improved security and in accordance with the AHJ's patch management policy.

13.1.9* The AHJ shall implement data disaster recovery procedures to ensure rapid recovery of databases, servers, and similar equipment used in the communications center, in the public safety wireless network, and for local storage of important information.

13.1.10* The communications center shall implement logging and auditing provisions to allow for the investigation of security or operational problems.

13.1.11* The AHJ shall implement a vulnerability management process to assess periodically the ability of the public safety communications systems, including communications centers, wireless networks, and wired IT networks.

13.1.12* The communications center shall implement environmental and physical security provisions to ensure that it can monitor various physical aspects of the public safety communications system at all locations, such as physical entry, fire or smoke, power supply performance, base radio performance, and other parameters as judged necessary by the AHJ.

13.2* Testing Security. The plan shall include methods and procedures, including schedules, for testing of the system for security breaches or failures, with the frequency of testing to be determined by the AHJ.

13.3 Testing Records. Testing records of the plan shall be maintained in accordance with Section 12.7.

N 13.4 Cyber Security Measures. New systems or upgrades to existing systems shall be designed and implemented using a "security-by-design" process to incorporate cyber security measures as part of the system.

Chapter 14 Public Alerting Systems

14.1 General. Public alerting systems (PASs) shall meet the requirements specified in this chapter.

14.1.1 All PASs and related components shall comply with national, state, provincial, and local rules and regulations governing PASs and related system components.

14.1.2 The AHJ shall develop and maintain standard operating procedures for when and how the systems are to be used.

14.1.3 A PAS that utilizes a communications network(s) developed and used for the purposes of alerting the public shall be engineered to work within the capacity of the network(s).

14.1.4* A PAS utilizing a public alerting system alerting appliance (PASAA) that is part of a communications network used to deliver messages of a nonemergency nature shall be engineered to give priority to the PAS.

14.1.5 An upgrade installed to a PAS shall be backward compatible with existing systems.

14.2 Security.

14.2.1 The AHJ shall develop and enforce security procedures that are consistent with any national, state, provincial, tribal, or local rules and regulations to prevent unauthorized use of the PAS.

14.2.2 The AHJ shall enforce security procedures to prevent the misuse of sensitive information.

14.3* Permitted Uses. Systems shall be used for alerting the public to natural and man-made events, including tornadoes, hurricanes, floods, fire, and chemical releases, that can be expected to result in loss of life, endanger public health, or destroy property.

14.4 Permitted Systems.

N 14.4.1 The following types of systems shall be permitted:

(1) Automated telecommunications dial-out systems delivering recorded voice messages
(2) Automated telecommunications dial-out systems with signals transmitted to a PASAA
(3)* Radio broadcast systems and tone alert systems using a PASAA
(4) Wireless systems with a PASAA
(5) Paging systems with a PASAA
(6) Siren systems with loudspeakers
(7) Integrated public alert and warning system (IPAWS)

N 14.4.2 The AHJ shall be permitted to use alternate communications systems that meet the immediate need for communicating with the public.

14.5* Public Alerting System Alerting Appliances (PASAAs). PASAAs shall be capable of the following:

(1) Receiving an alert data message (ADM) from a PAS
(2) Providing an audible alert in response to an ADM that meets the audible characteristics of an alarm as defined in *NFPA 72*
(3) Providing a visual alert signal in response to an ADM that meets the following requirement:
    (a) The signal shall be a flashing light that is red, clear, amber, or blue in color.
(4) Providing a local trouble signal in response to a low-battery condition that meets the following conditions:
    (a) The trouble signal shall not use lights of the same color used for other purposes.
    (b) The trouble signal shall have a battery source of power that can serve as either the primary or secondary power supply.
(5) Providing a local visual and/or audible trouble alert that is distinctly different from that used with an ADM, if the PASAA is capable of detecting loss of service or functions

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.

N A.1.3 Telematics provide emergency communications from either a person requesting emergency assistance or an autonomous request such as an automatic crash notification (ACN). The communication request is routed to a PSAP from a third-party telematics service provider. The TSP can contact the PSAP through dedicated 9-1-1 trunk or ALI-supported telephone system. Communications types to the PSAP could include automatically generated incident location, automatically generated incident location with data, or voice communications with automatically generated incident location with data.

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.

Δ A.3.3.1 Alarm. Alarms are events received by electronic signal — that is, fire alarm boxes, central station alarms, and automatic crash notifications.

A.3.3.1.1 Alarm Data. Other explanatory information can include, but is not limited to, sensor types, alarm types, and access information.

A.3.3.8 Automatic Location Identification (ALI). Automatic location identification is typically associated with an enhanced 9-1-1 telephone call. ALI can include the civic street address, building, floor, and room numbers and/or the latitude and longitude.

A.3.3.9 Automatic Number Identification (ANI). Automatic number identification is typically used in two disparate systems in emergency communications. First, ANI is a telephone number associated with the access line from which a call originates. Second, in two-way radio communications, ANI can be associated with the radio device that is active on the voice communication channel.

N A.3.3.10 Backbone. Damage to a backbone cable will disable the radio enhancement system through much or all of the building, and as a result it should be identified and protected. The backbone could be fiber-optic, copper, or coaxial cable, but it does not radiate RF energy along its path.

A.3.3.19 Call Server. *Call server* is a generic term for a centralized, computer application–based telephone system. Call servers are the next generation of private branch exchange (PBX) systems. There are many advantages to using a call server over a legacy PBX, including the ability to add features via modification to the application code and the ability to add extensions using either physical telephones or computer-based clients.

A.3.3.22 Circuit. Specific types of circuits include dispatch, local, and tie circuits.

A.3.3.25 Communications Center. Examples of functions of a communications center are as follows:

(1) Communications between the public and the communications center
(2) Communications between the communications centers, the emergency response agency (ERA), and emergency response facilities (ERFs)
(3) Communications within the ERA and between different ERAs

A.3.3.26 Communications Officer. The position is a function that falls under the logistics section of the incident command system (ICS).

N A.3.3.27 Communications System. Devices can include telephones, radios, sensors, cameras, and any other instrument capable of capturing and communicating data. Networks can include both hard-wired and wireless infrastructure. Applications can include computer programs that collect, aggregate, and disseminate information. Computers can be in any form factor including personal devices, tablets, laptops, desktops, servers, clusters, and main frame servers. Services can include private and commercially available voice and data transmission capabilities and applications as a commercially available service. A communications system can include multiple interconnected and integrated communication systems.

A.3.3.28 Comprehensive Emergency Management Plan (CEMP). In some jurisdictions a CEMP could also be known as a disaster management plan.

A.3.3.29 Computer-Aided Dispatch (CAD). CAD systems have become the preferred method of providing dispatching services. These requirements are intended to ensure that these critical resources are secure, reliable, and redundant.

A.3.3.37 Delivered Audio Quality.

(1) DAQ 1 Unusable: Speech present but not understandable
(2) DAQ 2 Speech understandable with considerable effort: Requires frequent repetition due to noise/distortion
(3) DAQ 3 Speech understandable with slight effort: Requires occasional repetition due to noise/distortion
(4) DAQ 3.4 Speech understandable without repetition: Some noise/distortion present
(5) DAQ 4 Speech easily understood: Occasional noise/distortion present

A.3.3.41 Dispatch Circuit. A dispatch circuit was formerly called an alarm circuit.

N A.3.3.46 Distribution Antenna Cable. It is typically a coax cable or radiating cable, and it is outside of the heat and fire protection provided by any firewalls or other means.

A.3.3.49 Emergency. The AHJ of the responding agency can determine which types of events qualify as an emergency.

A.3.3.50 Emergency Event Processing/Dispatching. This term includes caller interrogation and resource selection [determination of which emergency response unit (ERU) will respond] up to the start of the ERF notification process.

A.3.3.52 Emergency Response Agency (ERA). An ERA includes any public, governmental, private, industrial, or military organization that engages in the operations specified in the definition.

A.3.3.53 Emergency Response Facility (ERF). Examples of ERFs include a fire station, a police station, an ambulance station, a rescue station, a ranger station, and similar facilities.

N A.3.3.56 Event. All incoming calls on designated emergency telephone lines should be considered emergency events until answered by a telecommunicator. If a telecommunicator determines that the reason for the call is not an emergency as defined in 3.3.48, the call will not count against the performance requirements of 7.4.2. A trouble or supervisory signal is not an indication of an event. *(See also 3.3.111, Trouble Signal.)*

N A.3.3.57 Event Data. Other explanatory information can include, but is not limited to, sensor types, alarm types, and access information.

A.3.3.63 IP-Enabled Device. An IP-enabled device is not a land mobile radio narrowband device; examples include smart phones, tablets, and laptop computers.

N A.3.3.64 Logging Recorder. Event and dispatch information could include voice, ANI, ALI, dispatch records, date, time, and other incident specific details. A logging recorder is normally a multichannel device that keeps a semi-permanent record of all data and media associated with an event.

Δ A.3.3.70 Multi-Line Telephone System (MLTS). The term *multi-line telephone system* refers to any solution, independent of the technology used, that allows an entity to use a group of voice communication channels from an exchange carrier to connect a multiplicity of end users for inbound, outbound, and intersystem telephone calls. An MLTS includes both PBX-based and call server–based solutions, including network-based and premises-based systems (e.g., Centrex, VoIP, as well as PBX, hybrid, and key telephone systems, as classified by the FCC under Part 68 requirements).

A.3.3.72 Notification. Notification can be made by either electronic or mechanical means.

Δ A.3.3.81 Private Branch Exchange (PBX). The PBX system was first developed to allow a private entity to connect the telephone company to many users, breaking the one phone–to–one phone line ratio. Originally, this process was a manual one, in which a switchboard operator would answer an incoming call and, using a physical patch cord, connect the incoming caller to the desired extension. When users wanted to make either an outbound or intersystem call, they first had to notify the switchboard operator and verbally explain their request. As technology progressed, switchboard operators were replaced first by mechanical devices that could interpret a rotary dial

and later by dual tone multifrequency (DTMF) "Touch Tone®".

N **A.3.3.87 Public Safety Emergency Communications System.** A public safety emergency communications system consists of any technology or system utilized for the reporting, detection, coordination, dispatch, monitoring, or tracking of emergency incidents, emergency response resources, and/or the support of related activities.

A.3.3.89 Radio Channel. The width of the channel depends on the type of transmissions and the tolerance for the frequency of emission. Channels normally are allocated for radio transmission in a specified type for service by a specified transmitter. [72, 2019]

A.3.3.91 Radio Frequency. The present practicable limits of radio frequency (RF) are roughly 10 kH to 100,000 MHz. Within this frequency range, electromagnetic waves can be detected and amplified as an electric current at the wave frequency. *Radio frequency* usually refers to the *RF* of the assigned channel.

A.3.3.93 Remote Communications Facility. Remote communications facilities might be housed in buildings under the control of the AHJ, in buildings not under the control of the AHJ, on high land forms such as mountaintops, and at other locations as necessary to ensure operation of a communications system over a geographic area designated by the AHJ. Remote transmitters, receivers, repeaters, and their associated antennas are frequently found at such facilities. When not housed in a building, equipment is usually located in prefabricated enclosures to provide weather protection.

A.3.3.96 Response Unit. Some examples of response units include patrol car, ambulance, rescue vehicle, pumper, ladder truck, elevating platform, service vehicle, marine unit, supervisor's vehicle, tow truck, motor assistance vehicle, construction equipment, mass transit vehicles, and personnel assigned a unique identification number or name used for dispatches.

A.3.3.100 Standard Operating Procedures (SOPs). In some jurisdictions, SOPs are also known as standard operating guidelines (SOGs).

A.3.3.113 Two-Way Alphanumeric Devices. Two-way alphanumeric devices do not have the capability of providing voice messages.

A.3.3.115 Uninterruptible Power Supply (UPS). A UPS is a solid-state system relying solely on battery power as an emergency source. A static UPS consists of a rectifier (a device for converting ac to dc), an inverter (a device for converting dc to ac, and an energy storage medium, for example, batteries. The inverter in the static UPS also includes components for power conditioning.

A.3.3.116 Voice Communication Channel. The voice communications channel can be physically switched, as with wired circuits, wirelessly switched, as with radio channels; or virtually switched, as with circuits created for voice over Internet protocol (VoIP) network-based circuits.

A.4.1.1 Uninterrupted operation of emergency communications systems is critical to the safety and security of the community at large. In the event of a major natural or man-made disaster, the continued operation of the communications center will be an essential element in maintaining the continuity of government, thereby lessening loss of life and preventing the breakdown of law and order.

Most NFPA documents are written to furnish minimum requirements for the safety to life and property in any given individual building. However, survival and continued functioning of emergency services communications systems are necessary for the health and safety of the entire community. The emergency services communications systems infrastructure needs to be able to withstand the effects of hurricanes, earthquakes, terrorism, wildfires, blizzards, tsunamis, and other disasters of similar scale. Because of that need, this document contains requirements that in some cases are more stringent than those for an otherwise similar business occupancy.

N A.4.1.2 The CEMP should be exercised on a regular basis to ensure that the plan is workable and that employees are familiar with the procedures. The local emergency planning committee (LEPC) comprises emergency response agency representatives, local government, schools, emergency management personnel, other governmental agencies, and the private sector. The CEMP is developed by this committee and used as part of the planning process in emergency management. *NFPA 1600* also outlines the requirements for emergency planning. The communications center is a critical component of any emergency plan and serves as a link between the emergency operations center (EOC) and ERAs. Where there is no local CEMP, or are no CEMPs applicable to the PSAP, the PSAP would need to develop its own.

A.4.1.6 One means of meeting this requirement could be a mutual-aid agreement with another jurisdiction to use its communications center as the alternate center. This is dependent on whether the other communications center has enough capacity to handle the added call volume and enough work stations to accommodate personnel relocated from the evacuated center. It also is heavily dependent on the ability of another jurisdiction's center to transmit and receive on the dispatch frequencies in use at the primary center. Such an agreement should be made in writing.

A.4.1.6.2 The alternate communications center should not be located in close proximity to the primary center. In determining the minimum geographical separation required between the primary communications center and the alternate communications center, the AHJ should evaluate the potential for a single disaster (terrorist attack, flood, tornado, etc.) to render both the primary and alternate centers inoperable. When preparing evacuation and continuity of operations plans, the AHJ should also consider the length of time it will take center personnel to travel under adverse conditions to an unstaffed alternate center and place it in operation.

A.4.1.6.3.2 The CEMP should be exercised on a regular basis to ensure that the plan is workable and that employees are familiar with the procedures. The local emergency planning committee (LEPC) comprises emergency response agency representatives, local government, schools, emergency management personnel, other governmental agencies, and the private sector. The CEMP is developed by this committee and used as part of the planning process in emergency management. *NFPA 1600* also outlines the requirements for emergency planning. The communications center is a critical component of any emergency plan and serves as a link between the emergency operations center (EOC) and ERAs.

A.4.1.6.4 This requirement is intended to ensure that emergency communications systems will continue to operate, even if the primary communications center is completely destroyed.

A.4.1.7 The decision to evacuate or to not evacuate the communications center in the event of a fire or threat of fire is not simple. It involves moving the telecommunicators to a backup dispatch center or to a cooperating agency in a nearby jurisdiction. The communications center should be assigned dedicated fire suppression resources in the event of a fire in the communications center or a fire in the building housing the communications center. Decisions that involve continued operation or evacuation of the center should be made by the fire suppression officer and the telecommunicator supervisor.

A.4.1.9 During the planning and design phases, it is essential that sufficient space be allotted for both personnel and equipment, to enable telecommunicators and supervisors to work efficiently. It is very important to include the users of the facility(ies) in the planning process from its inception. These users include telecommunicators, supervisors, and representatives of each emergency response agency to be dispatched from the center. Fact-finding visits to centers in other jurisdictions should be undertaken. The number of personnel that must be accommodated within the center will be determined by the AHJ in accordance with the requirements of this standard and other factors. Prior to design, a detailed analysis of the tasks to be performed in the operations room is essential. Since electronic equipment will be replaced periodically throughout the life of the center, "swing space" needs to be provided to enable new equipment to be installed and commissioned before older equipment is decommissioned and removed.

A.4.2.2 Consideration should also be given to hazards associated with falling trees, antennas, or other similar structures.

A.4.2.3 When siting communications centers, AHJs should consider increasing this requirement, to above the 500-year floodplain. Over time, 100-year floodplains have tended to expand, and "freak" storms that exceed the 100-year intensity have become more frequent. Therefore, depending on the flood danger in the area, it would be wise to choose a site significantly above the 100-year floodplain elevation.

A.4.3.5 Design consideration for belowgrade centers should include the following:

(1) Special requirements for means of egress
(2) Depth of the local water table relative to the floor elevation
(3) Humidity control
(4) Sumps and pumps having the capacity to prevent flooding under the heaviest possible rainfall
(5) Smoke removal or control systems
(6) Additional backup power needs
(7) Employee morale
(8) Other pertinent issues

A.4.3.8.1 Such facilities can include an on-site drilled water well with pumping facilities provided with both primary and secondary power, and a septic system or adequately sized effluent holding tank. For small centers with few employees, the AHJ might determine that a chemical toilet and adequate stocks of bottled water are sufficient. When relying on bottled water, consideration should be given to the fact that bottled water has an expiration date; therefore, stocks must be renewed accordingly.

A.4.4.1.1.1 The cooling and heating loads of a communications center typically vary significantly, depending on the functions performed in each individual space. Computers, radio equipment, uninterruptible power supplies, and similar equipment typically found in modern communications centers generate a significant amount of heat that needs to be removed to prevent the equipment from overheating and shutting down. On the other hand, that same amount of cooling provided to the operations room, break room, conference rooms, and general office areas will make employees in those normally occupied rooms uncomfortable.

When humans are uncomfortable due to room temperature, their first reaction is to adjust the thermostat. If the same thermostat also controls the amount of cooling provided to sensitive electronic equipment, equipment will overheat and systems failure may result. Therefore, for the reliable operation of the communication systems (as well as comfort and morale of employees), it is essential that individual space temperature controls be provided.

A.4.4.1.2 For communications centers located in multi-use buildings, it is important to avoid drawing contaminants (including smoke from a fire) from other parts of the building into the center. For these and other reasons, it is necessary to provide the communications center with independent HVAC systems.

A.4.4.1.3 U.S. Army Technical Manual TM 5-602-01, *Utility Systems Terrorism Countermeasures for Command, Control, Communications, Computer, Intelligence, Surveillance, and Reconnaissance (C4ISR) Facilities*, furnishes additional guidance, which the AHJ might want to consider when planning a new communications center.

A.4.4.1.5 A backup heating, ventilating, and air-conditioning (HVAC) system is needed for use during routine maintenance of the primary system and in the event of a primary system failure.

When HVAC systems fail and no backup is provided, the first casualty is usually security. Doors or windows that are required to be closed are opened, often without the knowledge or consent of the AHJ.

A.4.4.1.7 Examples of equipment include packaged cooling systems and components such as chillers, compressors, condensers, supply air fans, and return air fans.

A.4.4.1.8 HVAC systems that cool essential electronic equipment are equally essential, as loss of cooling will cause equipment to shut down or fail outright. Therefore, backup power needs to be provided for both primary and backup HVAC systems that cool this equipment.

A.4.4.1.9 Air intakes should be installed and maintained in accordance with NIOSH *Guidance for Protecting Building Environments from Airborne Chemical, Biological, or Radiological Attacks*, DHHS (NIOSH) Pub No. 2002-139.

A.4.5.6 A written emergency fire plan should be prepared and posted that assigns specific responsibilities. This plan should be coordinated with all responding emergency agencies. Personnel should receive continuing instructions in at least the following:

(1) Evacuation of personnel and designated assembly area
(2) The operations of all fire-extinguishing and automatic fire detection systems

(3) The use of portable fire extinguishers

A.4.5.7 A damage control plan should provide guidance for the following:

(1) Preventing or minimizing damage to electronic equipment
(2) Preventing or minimizing damage to other operations and equipment

For example, whenever electronic equipment or any type of record is wet, smoke damaged, or otherwise affected by the results of a fire or other emergency, it is vital that immediate action be taken to clean and dry the electronic equipment. If the water, smoke, or other contaminations are permitted to remain in the equipment longer than absolutely necessary, the damage can be grossly increased.

In addition, a means should be provided for preventing water damage to electronic equipment. The proper method of doing this will vary according to the individual equipment design.

(3) Identifying procedures for a return to normal operations

A.4.5.8 Tactical Interoperable Communication Plan (TICP) templates are available at www.safecomprogram.gov.

A.4.6.3 This requirement previously read "Entryways to the communications center that lead directly from the exterior shall be protected by a security vestibule." However, when the center occupies just a portion of a mixed-use building, and the building as a whole provides a lower level of security than required by this standard, it will be necessary to establish a security boundary within the building around the communications center. Therefore the requirement for security vestibules applies to all entrances into the center regardless of whether they are indoor or outdoor entrances. Note that doors that are provided for emergency egress only and cannot be opened from outside the center should not be considered entrances and therefore need not be provided with security vestibules. Also, when the whole building envelope provides the level of security required by this standard, the AHJ might determine that internal security vestibules are not required.

A.4.6.4.5 For instance, a window facing a break area within the secure area assigned solely for the use of the communications center does not require bullet-resistant glass as long as a block wall surrounds the break area.

A.4.6.5 This applies whether the wall in question is provided with windows or not.

A.4.6.7 Refer to the Department of Defense Unified Facilities Criteria (UFC) 4-010-01, *Minimum Antiterrorism Standards for Buildings*; UFC 4-022-02, *Selection and Application of Vehicle Barriers*; UFC 4-023-03, *Design of Buildings to Resist Progressive Collapse*; UFC 4-023-07, *Design to Resist Direct Fire Weapons Effects*; and UFC 4-024-01, *Security Engineering: Procedures for Designing Airborne Chemical, Biological, and Radiological Protection for Buildings*, for additional guidance.

A.4.7.1.5 This connection provides a quick and safe way to provide power to the communications center during a worst-case scenario power failure. The socket should be physically located to allow easy access for a trailer-mounted generator that would be pulled to the site. The disconnect switch should be of the make-break-make (center-off) type and lockable. Connecting the wiring from the socket between the automatic transfer switch and the electrical distribution panel for the communications center provides a means to get power to the center in case of failure of the transfer switch. When the COPS is supplied by a single generator, all wiring and equipment should be of sufficient ampacity to handle the entire critical load of the center, as determined by the AHJ in accordance with the requirements of Chapter 4.

A.4.7.1.6 An example of control wiring that would be required to receive COPS treatment would be the remote generator annunciation wiring.

A.4.7.4 Engine-driven generators should be sized to supply power for the operation of all critical operating functions of the remote communications facility and for any additional loads determined by the AHJ.

A.4.7.4.3 For large communications centers, a spare generator should be provided so that the center can operate with the largest single generator out of service. This will allow one generator to be taken off line for maintenance and testing without degrading the reliability of the overall system, as well as prevent degradation of communications center function in the event a generator fails during an extended commercial power outage. For smaller centers where this is not practicable as determined by the AHJ, an exterior weatherproof connection for connection of a mobile (trailer or truck mounted) generator should be provided.

A.4.7.4.12 This is a minimum requirement. The AHJ should consider common local power failure scenarios and historical data on the length of power outages in the jurisdiction to determine if additional fuel storage is required. The possibility of extended power outages due to hurricanes, tornadoes, blizzards, earthquakes, wildfires, and other natural disasters should be considered. As part of the CEMP, the AHJ should evaluate the effect of natural disasters on the ability to resupply fuel tanks during such disasters to determine if additional fuel for operation for more than 72 hours needs to be stored on site. Recent disasters such as Hurricane Katrina have shown that in some cases it could be necessary for communications facilities to operate for a week or more before primary power is restored. In the aftermath of such disasters, roads may be impassable and fuel delivery trucks may have been damaged beyond immediate repair. Under such conditions, it could take many days to resupply fuel.

A.4.7.4.12.1 Commercial distillate fuel oils used in modern diesel engines are subject to various detrimental effects. The origin of the crude oil, refinement processing techniques, time of year, and geographical consumption location all aid in the determination of fuel blend formulas. Sulfur, naturally occurring gums, waxes, soluble metallic soaps, water, dirt, and temperature all begin to degrade fuel as it is handled and stored. These effects begin at the time of fuel refinement and continue until consumption. Proper fuel storage is critical to engine start-up, efficiency, and longevity. Storage tanks should be kept water free and have provisions for drainage on a scheduled basis. Water can contribute to steel tank corrosion and the potential development of microbiological growth where fuel and water interface. Copper and its alloys, along with zinc or zinc coatings, should be avoided in fuel-handling systems. These elements can react with fuel to form certain gels or organic acids, resulting in clogging of filters or further system corrosion. Stable storage temperatures are conducive to fuel health. Tanks that are aboveground and subject to extreme daily temperature variations cause fuel to degrade more

rapidly. This is further exacerbated with large aboveground tanks that are less than full. Airspace allows for condensation that can add to the contaminant levels. Reflective exterior tank coatings reduce but do not eliminate the solar heating effect.

Scheduled fuel maintenance and testing help to reduce or nearly eliminate fuel contamination. Fuel maintenance filtration can remove contaminants and water and return fuel to the condition in which it will provide reliability and efficiency for standby generators when in emergency conditions. Fuel maintenance and testing should begin the day of installation and first fill to establish a benchmark guideline for further comparison. Fuel monitoring and testing services are available nationwide from many companies.

A.4.7.6.1 In addition to normal surge protection from electrical and lightning surges that can disrupt the operations of a communications center, other electromagnetic disruptions can also occur. Communications centers that protect very large urban or regional population centers could become a target of enemy military or terrorist attack and might want to consider taking additional measures to protect against an electromagnetic pulse (EMP) event, which could occur as a result of detonation of a nuclear device in the atmosphere. An EMP will create transient high induced surge currents in wires and cables leading into a communications center and could even induce damaging currents inside electronic equipment that is not suitably shielded, such that the equipment will fail. Additional information can be found in a U.S. Army Technical Manual TM 5-690, *Grounding and Bonding in Command, Control, Communications, Computer, Intelligence, Surveillance, and Reconnaissance (C4ISR) Facilities*, at http://140.194.76.129/publications/armytm/tm5-690/c-5.pdf, The Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack, *Executive Report*, or at other sources.

A.4.7.7 Additional guidance can be obtained from U.S. Army Technical Manual TM 5-690, *Grounding and Bonding in Command, Control, Communications, Computer, Intelligence, Surveillance, and Reconnaissance (C4ISR) Facilities.*

A.4.7.8.1 Storage batteries preferably should be located on the same floor as the operating equipment.

A.4.7.8.3 When sizing a UPS, consideration should be given to the potential for increased electrical loads as the center grows over time.

A.4.9 U.S. Army Technical Manual TM 5-811-3, *Electrical Design: Lightning and Static Electricity Protection*, provides additional guidance.

A.4.10.2.2 Consideration should also be given to hazards associated with falling trees, antennas, and other similar structures.

A.4.10.2.4 When siting remote communications facilities, AHJs should consider increasing this requirement to above the 500-year floodplain. Over time, 100-year floodplains have tended to expand, and "freak" storms that exceed the 100-year intensity have become more frequent. Therefore, depending on the flood danger in the area served by the communications center, it might be wise to choose a site above the 500-year floodplain elevation.

A.4.10.3.5 Design consideration for belowgrade facilities should include the following:

(1) Special requirements for means of egress
(2) Depth of the local water table relative to the floor elevation
(3) Humidity control
(4) Sumps and pumps having the capacity to prevent flooding under the heaviest possible rainfall
(5) Other pertinent issues

A.4.10.3.6 A common example of such material is gypsum wallboard.

A.4.10.3.7 Examples of noncombustible floor materials are concrete, aluminum, and steel.

A.4.10.5.4 An example of such a facility is a free-standing, prefabricated or site-built enclosure that houses communications system equipment to protect it from precipitation, extremes in temperature, and vandalism.

A.4.10.5.6 FM Global Property Loss Prevention Data Sheet 9-19, *Bushfire Exposure*, provides additional engineering guidance.

A.4.10.6.4 Such locations could include interior courtyards, light wells, and the like.

A.4.10.6.5 Department of Defense UFC 4-023-07, *Design to Resist Direct Fire Weapons Effects*, provides useful guidance.

A.4.10.6.6 Department of Defense UFC 4-022-02, *Selection and Application of Vehicle Barriers*, provides additional guidance.

A.4.10.6.7 Department of Defense UFC 4-023-03, *Design of Buildings to Resist Progressive Collapse*, provides additional guidance.

A.4.10.6.8 For the more information on central stations, refer to *NFPA 72*. For guidance on intrusion detection systems (IDS) see Department of Defense UFC 4-021-02NF, *Security Engineering Electronic Security Systems.*

A.4.10.7.5 If the public water supply is used for engine cooling, interruption of the supply will cause overheating of the engine and failure of the generator.

A.4.10.7.6 Examples are motorized intake air louvers, fans supplying cooling or combustion air, fuel transfer pumps, and coolant pumps.

A.4.10.7.7.2 Refer to A.4.10.5.4.

A.4.10.7.8 Additional guidance is contained in U.S. Army Technical Manual TM 5-693, *Uninterruptible Power Supply System Selection, Installation, and Maintenance for Command, Control, Communications, Computer, Intelligence, Surveillance, and Reconnaissance (C4ISR) Facilities.*

A.4.10.8.1.2 During the design of a lighting system for a normally non-staffed facility, consideration should be given to the fact that it is customary for maintenance personnel to bring portable lights with them.

A.4.10.9 U.S. Army Technical Manual TM 5-811-3, *Electrical Design: Lightning and Static Electricity Protection*, provides additional guidance that the AHJ might want to consider.

Δ A.5.1.1 Refer to *NFPA 70* for examples of installations that are and are not covered by *NFPA 70.*

A.5.5.2 Environmental conditions could exist that necessitate the use of rigid nonmetallic conduit.

A.5.6.4 Examples of fast-acting surge suppression criteria for power lines can be found in the Telcordia Technologies publication TR-NWT-001011, *Generic Requirements for Surge Protective Devices (SPDs) on AC Power Circuits.* Examples of fast-acting surge suppression criteria for telephone lines can be found in the Telcordia Technologies publication TR-NWT-001361, *Generic Requirements for Gas Tube Protector Units (GTPUs).*

A.5.8.1 Sensitive electronic equipment includes computers, telecommunications equipment, and two-way radio systems.

A.6.2.1 The ability to have access to a telephone system not maintained and operated by the AHJ allows for continuity of communication with ERFs. An AHJ's internal telephone system, using a system such as private branch exchange (PBX), is not considered a commercial telephone system.

A.6.2.2 Such an arrangement is not meant to apply to the office of the chief and other executive officers or to the communications center, which can be housed in an ERF.

A.6.6 Local area network (LAN) computer and telephone cable are examples of communications conductors.

A.7.1.2 In the case of equipment such as repeaters, transmitters, towers, and generators, access needs to be available at all times.

A.7.2.2 The AHJ can develop a certification program or use the certification programs of others. Examples of other certification programs are Associated Public Safety Communications Officials International, International Municipal Signal Association, and National Academies of Emergency Dispatch and Power Phone.

A.7.3.1.1 In jurisdictions receiving fewer than 730 alarms per year (an average of two alarms per 24-hour period), provision of a dedicated telecommunicator might not be necessary where alternate means approved by the AHJ can affect the prompt receipt and processing of alarms in accordance with Section 7.4. Telecommunicator staffing is an important issue in achieving prompt receipt and processing of events. Consider the following two concepts of communications center operations:

(1) *Vertical Center.* A single telecommunicator performs both the call-taking and dispatching functions.
(2) *Horizontal Center.* Different telecommunicators perform the call-taking and dispatching functions.

Telecommunicators working in a vertical center are known to engage in multitasking that can inhibit their ability to perform assigned job functions. Routine evaluation of telecommunicator staffing, number of inbound emergency and nonemergency calls, and other operational statistics are necessary to allow a prompt receipt and processing of events.

A.7.3.1.2 The processing of N-1-1 calls or other nonemergency 7- or 10-digit calls should not degrade or delay the processing of any emergency calls.

A.7.3.2 The issue of communication capabilities and/or failures is cited by the National Institute for Occupational Safety and Health (NIOSH) as one of the top five reasons for fire fighter fatalities. The importance of an assigned telecommunicator for specific incidents is a critical factor in incident scene safety. The assignment process should be outlined in specific SOPs within each agency represented in the communications center. This assignment process is further assisted when a command/communications vehicle is being staffed at the incident scene.

A.7.3.4 The supervisor position(s) in the communications center are provided in addition to the telecommunicators positions. Although supervisory personnel are intended to be available for problem solving, the supervisor position is permitted to be a working position.

A.7.4.1 Statistical analysis for performance measurement should be completed over a period of 1 month as shown in Figure A.7.4.1(a) and Figure A.7.4.1(b).

A.7.4.2 PSAPs, 9-1-1 authorities, and responder agencies should look at the processing times in a comprehensive manner. Transfers, especially multiple transfers, have the impact of making compliance with the overall processing time standard nearly impossible. Given the life safety implications for critical incidents, PSAPs should make every effort to reduce/eliminate transfers, thereby reducing the amount of time required to answer, process, transfer, and dispatch alarms. Potential strategies to reduce transfers include consolidation, either physical or virtual, CAD to CAD integrations, improved wireless call routing, and improved compliance with call answering standards. See Figure A.7.4.1(a).

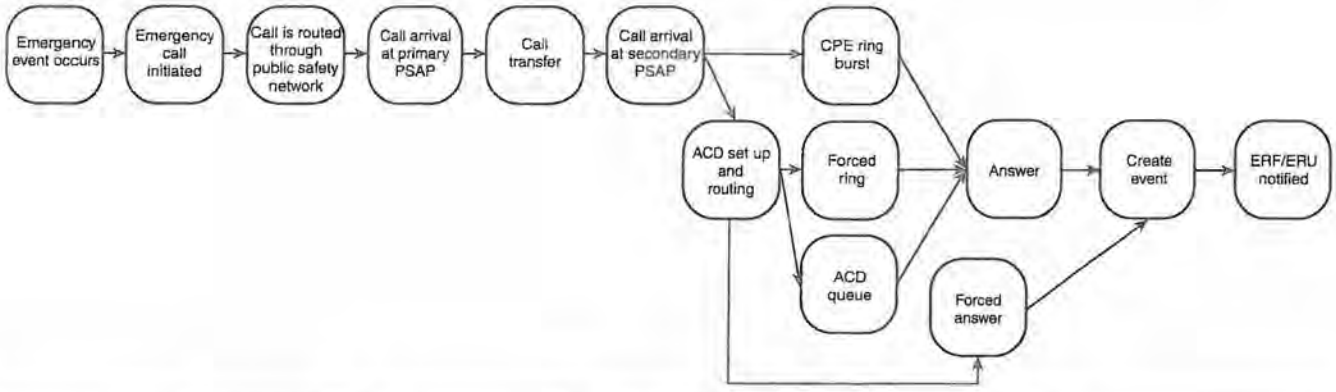
N A.7.4.3 Events should be retransmitted to emergency response personnel as soon as the location and general nature of the emergency have been ascertained by the telecommunicator. However, for some events involving criminal activity, the safety of emergency response personnel could require the telecommunicator to ascertain additional information from the caller, such as a description(s) of the suspect(s), a description(s) of the vehicle(s), the direction of travel, and the weapon(s) involved, which could make compliance with the 60-second time limit impractical. Therefore, the AHJ for each law enforcement agency served by the communications center should establish time frames for the dispatch of law enforcement personnel in accordance with the corresponding agency's SOPs.

N A.7.4.4 The following types of calls where there is an imminent threat to public safety should be included in the highest prioritization level:

(1) Active shooter/hostile event
(2) Domestic violence with weapons
(3) Officer-involved shooting
(4) Robbery in progress
(5) Other calls as determined by the AHJ

A.7.4.5 See Figure A.7.4.1(b).

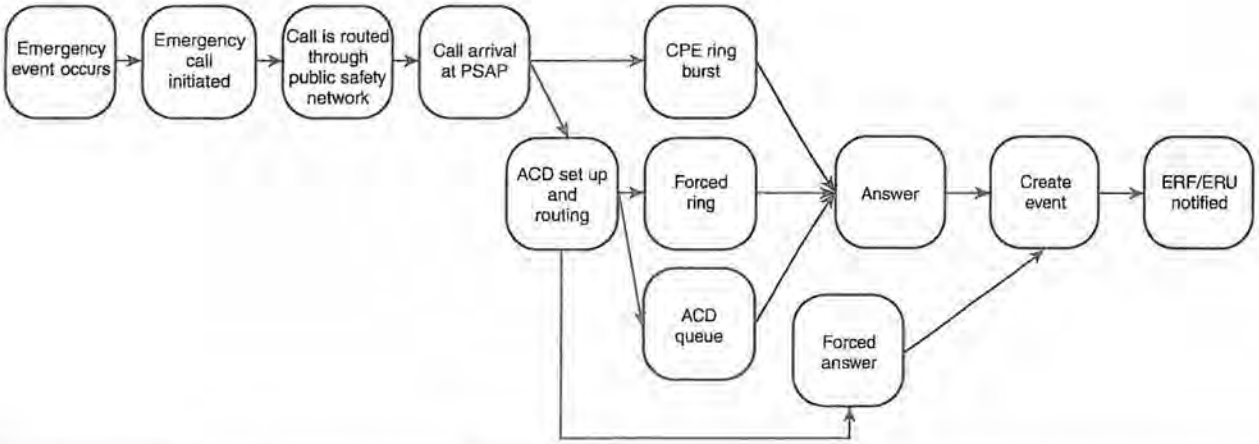
A.7.4.8 The first unit to arrive at an emergency incident is responsible for notifying the communications center by radio of its arrival and for providing a brief description of the conditions observed and the precise location of the incident. The responding officer should report arrival and should establish the initial command post at the emergency. As soon as conditions allow, the incident commander should report supplementary information to the communications center and should make additional progress reports if operations keep the units at the emergency longer than a few minutes. An extended or complex emergency incident can necessitate the use of a communications unit for effective coordination, command, and control.



Detection	Transmission	Transfer	Time to answer	Event processing
Varies	≤4 seconds	≤30 seconds 90%	≤15 seconds 90% ≤20 seconds 95%	≤60 seconds 90%

Notes:
Alarm sounds are audible or visual annunciation, or both
CC: Communications center
TC: Telecommunicator
IAW: In accordance with
Alarm processing begins when the emergency call for service is created and ends at the beginning of ERF/ERU notification

Δ **FIGURE A.7.4.1(b) Event Timeline Where Primary PSAP Is Other Than Communications Center.**



Detection	Transmission		Time to answer	Event processing
Varies	<1 second	<3 seconds	≤15 seconds 90% ≤20 seconds 95%	≤60 seconds 90%

Notes:
Alarm sounds are audible or visual annunciation, or both
CC: Communications center
TC: Telecommunicator
IAW: In accordance with
Alarm processing begins when the emergency call for service is created and ends at the beginning of ERF/ERU notification

Δ **FIGURE A.7.4.1(a) Event Timeline Where Primary PSAP Is Communications Center.**

A.7.4.9 The audible warning or signal is typically a distinctive tone.

A.7.4.11 The assignment of a communications officer/unit leader to incidents that are more complex ensures that adequate communication is achieved using available telephone and radio systems. Such an assignment also ensures that the availability of existing frequencies or networks is maximized and that system overloading is minimized. An assigned communications officer can be particularly important and useful during multi-agency fires and other incidents. It can be necessary to establish specific nets and monitoring systems to guarantee communications in some situations. In complex incidents, communications discipline is critical in avoiding system overload.

A.7.4.12 The common emergency organization, that is, the incident management system (IMS), includes two important communications concepts as follows:

(1) *Common Terminology.* All participating departments and agencies use clear text and established standard terms and phrases. In multi-agency emergencies, it is extremely difficult to guarantee that all agency and department codes represent identical meanings. To avoid potential misunderstandings between telecommunicators, the IMS requires clear text or plain language for all radio messages. Although this is a significant departure from public safety agency tradition, it has been found to be efficient in actual practice.
(2) *Integrated Incident Communications.* Participating departments and agencies plan in advance for the use of integrated radio frequencies to tie together all tactical and support units assigned to an incident. To ensure the best possible use of all participating department and agency radios at major incidents, an Incident Radio Communications Plan matrix is developed. The matrix lists all available radio systems on an incident and aids in assigning them to provide command, tactical, and logistical coverage for a complete operation.

Preparation of the matrix necessitates training and a knowledge of cooperating department and agency frequencies and radio components. Use of the matrix is greatly enhanced by the existence of a frequency-sharing agreement. *(See Annex B.)*

The Federal Communications Commission (FCC) has no prohibition against public agencies sharing frequencies during emergencies, provided that the responsible agency has granted permission to assisting agencies to do so. The agreement specifies the mutual permission of participating agencies to use other agency frequencies when providing assistance. The agreement lists the terms and conditions of use by others and includes all frequencies that can be made available under critical conditions. Such agreements facilitate better multiagency dispatching and incident communications and can be prepared by groups or agencies who work together frequently.

A.7.4.12.2 These communications links can include but are not restricted to a number of methodologies, including radio, data communication, face-to-face, satellite communication, or telephone. Such communication links permit units from multiple agencies to interact with one another and to exchange information according to a prescribed method in order to achieve predictable results. These links permit communications between agencies when needed but not necessarily with every unit involved at an incident at all times.

A.7.4.12.2(3) Extended operations can include long-term disaster recovery, security at major events, or criminal justice surveillance.

Δ A.7.4.16 Effective communication among emergency response personnel during the initial response to any major incident and throughout its extended operations has a significant impact on the rapid mitigation to the affected population.

A plan should lend itself to rapid activation in case of an incident. These incidents include major storms, conflagrations, hazardous materials incidents, wildland fires, mass transit accidents, domestic terrorism, and other incidents that can overwhelm the agencies serving the community and their normal resources.

The plan should include all agencies that normally would be utilized to mitigate any major incident. The plan should also include the communication integration of all agencies into a command structure. Additionally, the plan should include the communications path for transition to the next level of support.

The plan should include SOPs that outline the following:

(1) Activation of such plan
(2) Radio systems to be utilized
(3) Assigned radio frequencies and bandwidth for conventional or trunked systems
(4) Talkgroups
(5) Unit/agency designations
(6) Talk paths to be utilized (e.g., gateway, cross band repeaters, and telecommunicator assisted)

The plan should define applicable continuous tone-coded squelch system (CTCSS) codes, in compliance with TIA-603-D, *Land Mobile FM or PM — Communications Equipment — Measurement and Performance Standards,* for analog channels designated for interoperability.

The plan should define interoperability channels designated for digital operation. These channels should be compliant with ANSI/TIA/-102.BAAA, *FDMA Common Air Interface.*

A.7.4.16.1 The key to the successful operation of the various resources into a region depends heavily upon the ability of all public safety agencies to communicate effectively with each other in real time. At a minimum, interoperability should be supported at the command level. It is not required that every responder have total interoperability with every other responder.

A.7.4.16.2 Exercising this plan identifies areas that need improvement.

A.7.4.19 Procedures for handling telecommunication relay services (TRS) calls should be included in the SOPs.

A.7.6.1(3) Recording by telecommunicator position, rather than by line, allows all telephone lines that are used in the communications center to be taped using a minimum of recorder resources.

A.7.7 The purpose of the quality assurance program is to follow up and review calls with communications center employees, improve procedures, and make the corrections needed to improve service and response. Generally accepted statistical methods should be used when selecting calls for review.

A.8.1 Cellular or Internet personal communications services (PCS) systems include such devices as personal digital devices, advanced voice and data devices, and other cellular-based wireless systems. Text messaging, Internet access, cable modems, and other devices using wireless fidelity (WiFi) all use voice over Internet protocol (VoIP).

A.8.2.1.2 The separate business number listed in the telephone directory and used for nonemergency purposes should terminate at a location where personnel are on duty at least 40 hours per week, Monday through Friday.

A.8.2.3.6 A telephone line terminating at an unstaffed ERF and provided with a recorded message should not be used to meet the intent of the business line (nonemergency) listed in the directory and assigned for business (nonemergency) use as specified in 8.2.3.4.

A.8.3(1) In no case is it ever recommended that the telephone system be designed at less than P.01 GOS. An industry standard traffic study should be conducted that meets the public safety requirements of the AHJ.

A.8.3.4 The monitoring service is to be provided by the 9-1-1 vendor. Monitoring at the communications center itself is not sufficient, since a failure at the communications center can also involve a failure of the monitoring and also does not cover situations where 9-1-1 calls are not completed due to cable failure or intermediate central office failure.

A.8.3.5 Automated voice alarms, by their design, repeat their message many times and, therefore, can monopolize an inbound line for a considerable time. Therefore, they are not permitted to connect with published emergency numbers, and their use is not encouraged. Many state and local statutes prohibit such connections to designated emergency lines or to 9-1-1.

N A.8.3.9 There are 38 million people with hearing-related disabilities that depend on non-voice communications, such as SMS messaging, to access emergency services and others who utilize this method of communication.

A.8.4.3.1 Call delivery paths can include analog as well as IP call delivery.

A.8.4.3.2 Two circuits run in the same conduit, duct bank, or trench or run on the same pole line do not provide the level of safety intended by the committee.

A.8.5.1 See *NFPA 1600* for additional guidance.

A.8.5.4(2) The AHJ can approve a queuing system for calls on emergency lines. Such systems often require the additional approval of regional, county, or state authorities.

A.8.6.1 The MLTS must be programmed to allow a user to dial 9-1-1 without first having to dial 9 or any other number to reach the public switched telephone network. For example, 9-9-1-1 is not permissible.

A.8.6.2 The dialable number is used by the Public Safety Answering Point to call the 9-1-1 caller back in the event more information is needed or a call is dropped before sufficient information is obtained to initiate a dispatch.

A.8.6.3 There are multiple methods to meet this requirement. Incumbent and competitive local exchange carriers offer private switch ALI, commonly known as PS/ALI services. PS/ALI allows the MLTS owner to manage the location associated with the extension's telephone number. In addition, commercial services are available to both automate and act as an MLTS agent in providing and maintaining ALI for extensions that have both static and dynamic locations.

A.8.6.3.1 This matches the location granularity stated within the proposed model MLTS legislation in NENA 06-750 v3, "NENA Model Legislation E9-1-1 for Multi-Line Telephone Systems."

A.8.6.3.2 This matches the location granularity exception stated within the proposed model MLTS legislation in NENA 06-750 v3, "NENA Model Legislation E9-1-1 for Multi-Line Telephone Systems."

A.9.1.1 Communications centers that dispatch for volunteers or paid-call personnel have the responsibility of summoning such personnel at any hour of the day or night. Personnel can be summoned by the use of the telephone or radio, supplementing sirens or horns that provide an outside alarm. Events can be telephoned to the central telephone office where the telephone telecommunicator can start a siren or operate an air horn to indicate that there is an event. In areas where a communications center is not attended 24 hours a day, telephone companies can provide a telephone line that connects to special telephones that are located in places of business or residences selected by the jurisdiction. The jurisdiction then arranges to activate the telephone lines. In emergency response agencies that have an emergency response facility desk attendant, the telephone central telecommunicator can call the ERF, and the attendant can sound the outside alarm to call volunteers. If there is a code-sounding siren or air horn, coded signals can be sent. Usually a transmitting apparatus is used to send out the code.

If radio equipment is used, a receiver with selective calling equipment can be placed in the home of each volunteer or call person. Selective signaling is accomplished on a group-call principle, allowing the volunteer or call forces to be divided into several groups that can be summoned as a whole or as individual groups to handle a particular incident. Pagers are commonly used for this purpose, since they can be carried anywhere. Pagers can include either a tone alarm, a voice receiver, or a digital display.

A.9.1.1.3.2 In jurisdictions receiving fewer than 730 events per year (average of two events per 24-hour period), a second dedicated dispatch circuit might not be necessary.

A.9.1.1.3.3 When an event is transmitted to an ERF, it should be audible throughout the ERF, without the time delay caused by a responder going to a telephone instrument, picking up the handset, and then relaying the information to other affected responders.

A.9.1.1.4(2) System elements can include but are not limited to transmitters, transceivers, repeaters, receivers and receiver comparators (where required), microphones, encoders, control circuitry, antennas, and appropriate ancillary devices to constitute a complete radio system. Audible monitoring for integrity can be accomplished by a receiver in the operations room operating on the dispatch channel providing side tone audio. Visual monitoring for integrity can be accomplished by receiver module indication(s) of audio on the dispatch channel. It is not the intent of this requirement to require duplicate equipment at each ERF for a voice radio primary dispatch circuit.

A.9.1.1.4(4)(a) It is not the intent of this requirement to require a redundant digital data radio transceiver at each ERF, unless the ERF is a location that retransmits the signal to other ERF receivers, transceivers, or pagers. Transceivers designed for wide area coverage do not necessarily meet requirements for redundant transceivers.

A.9.1.1.5.1(2) Where the primary dispatch circuit is provided through a radio system, regardless of whether the system is a conventional radio, a trunked radio, or a microwave radio, the system cannot also be used to provide the secondary means of dispatch.

A.9.1.1.5.1(2)(a) In 9.1.1.5.1(2)(a)ii, a separate receiver is not required for each ERU.

A.9.1.1.5.1(3)(a) In 9.1.1.5.1(2)(a)(i), the separate control/relay switching equipment connection ports in the ERF are permitted to connect common audio alerting devices and auxiliary equipment such as audio amplifiers and loudspeakers, ERF response lights, and printer equipment.

A.9.1.1.6 The audible warning or signal is typically a distinctive tone.

A.9.1.2 Portions of any dispatch system circuit can need a metal wire connection, such as a wired cable from a microphone to the transmitter/receiver equipment of a microwave/radio dispatch circuit. Such wired circuit connections in a portion of a radio or telephone dispatch circuit do not constitute a wired dispatch circuit where all transmitting facilities are local to the communications center. Where such connections are between the communications center and one or more remote transmitting or repeater facility sites, a connection between the communications center and the remote facility site does constitute a wired dispatch circuit, requiring monitoring for integrity fault or failure trouble signal annunciation if signal transmission failure occurs.

A.9.1.2.1 Polling or self-interrogation is one of many methodologies that can monitor a dispatch circuit to determine its integrity. Polling allows for remote and automatic querying of dispatch channel elements to verify their functionality periodically when the elements have not otherwise reported a fault or failure. The self-interrogation feature of polling equipment allows the overall system to determine and verify its own integrity.

A.9.1.2.6 Audible and visual indications of faults or failures annunciated to an off-site vendor support center and pager signals of fault conditions to field technicians are ancillary to fault and failure indications being received at the communications center for the telecommunicator and any other location for the AHJ radio system manager, such as a county or regional microwave and radio system operations facility.

Δ A.9.2.1.1 This refers to a Type B Automatic Telegraph System where several box/alarm circuits come into a remote location and pass through concentrator/identifier-like equipment. The signal is sent on to the communications center via a separate tie circuit. It eliminates having to run all box/alarm circuits back to the communications center. (Refer to 27.5.2 of *NFPA 72*).

A.9.3.1.1 Frequencies, their assignment, and the widths of channels are regulated throughout the world. In the United States, the FCC provides this regulation through allocation, licensing, and rules for all except federal government allocations. In Canada, the comparable regulating agency is Industry Canada. The National Telecommunications Information Administration (NTIA), under the U.S. Department of Commerce, performs functions similar to the FCC, but only for federal agencies. Wire, line, and radio communications are subject to FCC rules and regulations, which govern many areas of radio usage known as *service*. Of primary concern to emergency communications systems users are the public safety radio services, which provide for the use of radio communications systems by nonfederal governmental entities.

A.9.3.1.2.2 It is recommended that the system be designed for DAQ of 3.4.

A.9.3.1.3 The communications center should have the ability to monitor all radio communications, including those communications on tactical radio communications channels, where practical. The AHJ should carefully evaluate the various communication solution alternatives available, providing the incident commanders with the appropriate mix of communications capabilities to address their specific scenarios, ranging from a small rural residence to a mammoth concrete and steel structure in an urban downtown area. The AHJ should provide a simplex radio communications channel for use in locations outside the coverage area of any installed radio infrastructure.

If the simplex frequencies selected for tactical use are the same as the output frequencies of any repeaters used by the system, a method of positive lockout of automatic system use of that frequency should be provided, controlled from the responsible telecommunicator workstation.

A.9.3.1.4 The AHJ should provide at a minimum a simplex radio communications channel for use in locations outside the coverage area of any installed radio infrastructure or for off-network operations such as incident tactical communications (e.g., "fireground"). Various communication solution alternatives are available for on-scene tactical communications. If a solution other than simplex analog communications is determined by the AHJ to best address that agency's needs, requiring a simplex analog channel requirement provides a secondary communications choice if for some reason the preferred alternative becomes unusable. This requirement also allows for incidents such as mutual aid scenarios, when responding agencies might utilize a different methodology in their own day-to-day operations. Additionally, the communications center should have the ability to monitor all radio communications, including those communications on tactical radio communications channels, where practical.

Δ A.9.3.1.5 The intent of 9.3.1.5 is to provide flexibility to the AHJ to use trunking, if desired, on the tactical on-scene channel, but there must be the provision of using simplex direct analog mode for any reason it might be required.

A.9.3.1.6 This does not prohibit the use of field-deployed portable repeater systems.

A.9.3.2.3(3) The public Internet is not acceptable because it is not under the control of the AHJ. The use of a commercially available network is acceptable if the network is dedicated to public safety or government-only use.

A.9.3.3.1 Coded squelch systems could utilize a specific tone or digital code, transmitted continuously, simultaneous with the desired message traffic. Examples of such a tone or code are a continuous tone-coded squelch system (CTCSS) and a continuous digital-coded squelch system (CDCSS). Analog

trunked radio systems utilize a digital code for system access, specific to that analog trunked system, which accomplishes the same goal.

A.9.3.4.1 In a digital access radio system, all units turned on and unassigned within the radio system coverage area monitor the signaling channel. Talkgroup assignments, emergency assignments, individual signaling calls, and special signal calls are broadcast to all monitoring units on the signaling channel. Requests for service (e.g., talkgroup calls, emergency calls, selective alerting) from unassigned units are transmitted by the requesting unit, as data bursts, to the system on the signaling channel.

A.9.3.4.1.5 While it is possible to find units that will scan both trunked talkgroups and conventional channels simultaneously, there are operational issues that must be understood in such operations. Anytime a mobile or portable unit scans off its home trunked talkgroup to other conventional channels or other trunking talkgroups, the radio runs the risk of missing some or all of new transmissions on the home talkgroup during the time that the radio is off the home trunked talkgroup. For that reason, if user radios cannot afford to miss transmissions on the home trunked talkgroup, either scanning should not be used, or a separate radio should be provided to allow one radio to scan and the other radio to remain on the home trunked talkgroup.

A.9.3.4.1.8 A system manager terminal allows the system supervisor to assign individual or talkgroup priority levels, or both, to all field units. The signaling language is structured so that access to the system is in accordance with the level of priority involved.

A.9.3.4.1.9 The emergency level of priority is intended for use only when immediate communications are necessary to preserve safety or protect life.

A.9.3.4.1.10 Trunked radio systems often are configured with many more talkgroups than can be accommodated by available voice channels. During a system controller failure, radios devolve to particular repeater channels and operate conventionally, which could result in overcrowding or busy channels. The AHJ should require emergency services units to devolve to channels reserved specifically for emergency dispatch.

A.9.3.4.1.11 Handling requests by units that have been involved in recent conversations before processing and assigning channels to units not involved in any recent conversations is intended to keep current conversations from becoming fragmented by any delays that could be caused by a new user request for a channel.

A.9.3.4.1.16 The alert should have a different sound from any other audible alert capable of being generated by the field unit. This enables the end user to determine that the unit is out of contact with the system.

A.9.3.4.1.17 The disabling of a field unit should prevent the unit from monitoring any voice communications on any channel or talkgroup in the system. A disabled unit should not be able to transmit or otherwise join into any voice conversation on the system. This disabling function occurs while the field unit is on the system anywhere within RF coverage. The system should have the capability to automatically search for the unit multiple times, if so requested by the telecommunicator, and indicate when it succeeds in disabling the unit.

N A.9.3.4.1.17.1 Several reasons for disablement can be a stuck microphone, the unit is out of frequency, or the unit is lost.

A.9.3.4.1.18 Remote talkgroup assignment is also known as dynamic regrouping. The system should include the ability to perform this function manually, as well as with a stored software plan, to allow for the automatic programming of many units into predetermined talkgroups. This preprogramming allows the saved plan to be initiated by the telecommunicator at any future time.

A.9.3.4.1.19 Telephone interconnect, while a popular selling point for trunked radio systems, represents a significant load on the system because it monopolizes one RF channel of the trunked system for the duration of the call. Multiple telephone calls can cause two-way voice users to receive busy indications from the system.

A.9.3.4.1.24 In the design and operation of a trunked radio system, dispatching of events has to have priority over all other communications and is equal in priority to emergency messages from the field. For this reason, when units are dispatched over radio, the necessary priority is high enough to require "ruthless preemption," which is the seizure and re-use of channels already in use by other conversations previously defined as lower in priority.

A.9.3.4.2 Digital trunked system subscriber units operating in the United States on the 700-MHz narrowband public safety spectrum and complying with ANSI/TIA-102.AABF-A, *Link Control Word Formats and Messages New Technology Standards Project — Digital Radio Technical Standards*, and TIA-102.BBAC, *Two-Slot TDMA MAC Layer*, must also comply with ANSI/TIA-102.BAAA, *FDMA Common Air Interface*, in order to operate on the required designated nationwide 700-MHz narrowband interoperability channels.

A.9.3.5 The NFPA 1221 committee is monitoring the development of the nationwide FirstNet project. FirstNet development was established by Congress when it enacted the Middle Class Tax Relief and Job Creation Act of 2012. This act required the development of a nationwide interoperable broadband network to enable all emergency service agencies to have improved data communications utilizing the new LTE broadband commercial technology. At the time this edition of NFPA 1221 was being revised, the development of the FirstNet system was in the preliminary stages. The committee will monitor the development of FirstNet for future inclusion in this standard.

A.9.3.6 The NFPA 1221 committee is monitoring the development of the nationwide FirstNet project. FirstNet development was established by Congress when it enacted the Middle Class Tax Relief and Job Creation Act of 2012. This act required the development of a nationwide interoperable broadband network to enable all emergency service agencies to have improved data communications utilizing the new LTE broadband commercial technology. FirstNet has a website: www.ntia.doc.gov/category/firstnet

A.9.3.6.12 Intrinsic safety (IS) is a protection concept associated with the rating of equipment for operation in potentially hazardous atmospheres. IS ratings take into account the nature of the explosive atmosphere encountered — Class I being explosive gas atmospheres and Class II being explosive dust atmospheres — and the frequency or interval of the presence of such explosive atmosphere — continuously, intermittently,

or abnormally. The frequency or interval of the presence of the explosive atmosphere determines the proper division (Division 1 or Division 2) or zone (Zone 0, Zone 1, or Zone 2) classifications that are applied to a particular IS rating. To determine the appropriate IS rating for portable radios, the AHJ identifies the expected explosive atmospheres likely to be encountered and the expected frequency or interval of the presence of such expected explosive atmospheres.

A.9.3.7 Emergency situations that result from large fires, transportation accidents, floods, severe storms, and other disasters often create a need for a temporary communications center to be located close to the scene of the disaster. Such a need is filled by a communications vehicle, sometimes called a mobile command post. The vehicle, which is a mobile command and control headquarters, serves as the hub from which the activities necessary to control an emergency situation can be directed and coordinated without dependence on the department's fixed communications center. Such activities for the control of emergencies include the efforts of local and outside departments and of other public safety organizations, such as police departments and emergency management agencies, in addition to public utilities. Proximity to the site of the disaster provides communications vehicle personnel and those in command with immediate access to the latest information in situations where changes occur rapidly. In addition, the ready availability of communications provides the means to call for additional help or to inform other jurisdictions of the situation. A communications vehicle should carry a variety of equipment that allows communication with other emergency response agencies, public safety organizations, and utilities. Other equipment that can increase the flexibility of the system includes cellular telephones. Some vehicles can be equipped for mobile relay operation that allows them to pick up transmissions of mobile units and to retransmit them to the communications center at higher power levels or on different frequencies. The communications vehicle can provide the following:

(1) Ability to exchange data messages between vehicles and communications centers or ERFs
(2) Improved command and control by television transmission of emergency activity to communications centers or ERFs
(3) Facsimile transmission of maps, preplans, and other written data
(4) Vehicle tracking and geographical locations, which can include global positioning system (GPS) receivers

A.9.3.8.1(2) A star microwave system is a system in which one central site is common with all microwave paths to multiple locations. See Figure A.9.3.8.1(2)(a).

A ring microwave system is a system in which the individual sites are connected in a linear or circular pattern. See Figure A.9.3.8.1(2)(b).

A.9.3.8.3.2 The intent of this requirement is to ensure that the design of the microwave system takes into account the possible presence of commercial broadcast equipment in the vicinity of the proposed microwave location. The microwave equipment and the commercial broadcast equipment can be co-located on the same physical site with shared or independent antenna support structures. The microwave equipment and the commercial broadcast equipment also can be located in close physical proximity of each other, with independent antenna support structures. In either case, the design of the microwave system at the site has to account for possible interference to and from the commercial broadcast equipment.

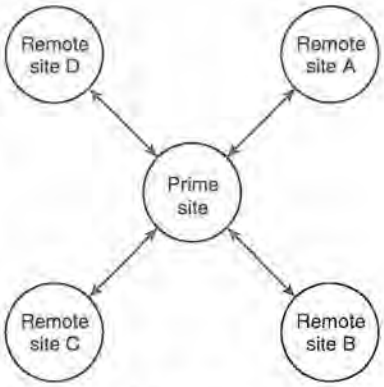


FIGURE A.9.3.8.1(2)(a) Star Microwave System.

A.9.3.8.5.1 *Components,* in this context, refers to modular elements such as transmitters, receivers, modems, power supplies, switching devices, multiplexers, and service channels/orderwire equipment.

N A.9.3.8.5.4 Examples of alarms are input power failure, transmitter RF output, radio off frequency, and excessive bit error rate.

A.9.4.2.1 Paging systems not under the direct control of the AHJ are permitted to be used for administrative purposes but are not considered acceptable for use as a required dispatch system. Third-party paging systems not under the control of the AHJ often do not have the redundant design architecture to comply with 9.1.1.4. Third-party paging systems often rely on satellite communications, which have proved faulty in the past. Third-party paging systems might also employ first-in-first-out (FIFO) hierarchy for message delivery that can cause significant delays during periods of high usage, which is not considered suitable for emergency services communication.

A.9.4.2.7 This feature is implemented with an acknowledge/silence button, so that a user who is not present when the initial alert is received by the device will be prompted regarding the call.

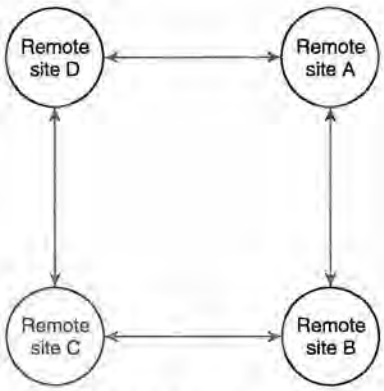


FIGURE A.9.3.8.1(2)(b) Ring Microwave System.

A.9.4.2.11 These pre-programmed pager buttons can be used to notify the operations room that the user is responding, on-scene, or in service following the call.

A.9.4.2.12 The operations room, as the control point for the pagers, should have the ability to monitor the performance of the paging system, as well as the ability to display the messages directed to the telecommunicators.

A.9.4.3 Alerting receivers, sometimes also known as home receivers, can occasionally also be found at emergency responders' places of business. They typically operate from standard wall plug 120 VAC. The devices should include an integral backup battery with charging circuit to maintain operation when normal ac power is interrupted.

A.9.6.3 U.S. Army Technical Manual TM 5-811-3, *Electrical Design: Lightning and Static Electricity Protection*, provides additional guidance.

A.9.6.7 The use of radio communication enhancement systems has become prevalent throughout the United States. Safety features and flexibilities of radio systems include the following:

(1) Full building coverage is allowed to facilitate communications from any point within the building, in case access to the wired two-way communications system is compromised.
(2) Communications can be conducted between emergency responders in the field to allow quicker dissemination of safety and emergency information.
(3) Emergency responders typically carry individual radios, allowing the responders to provide information or request assistance individually, which can be important if crew members become separated during an incident.
(4) Radio systems permit "fire fighter or public safety officer down" emergency calls in case of injury — by the push of a single button, a call is placed to a central location to initiate a roll call to determine which emergency responder has been injured and requires assistance. Radio systems can employ an emergency call where, by the push of a single button, an emergency responder call can be given prioritized system access to allow wide-range communication.
(5) The AHJ can determine whether the in-building coverage is for tactical on-site communications, for communications to an off-site dispatch center, or both.

A.9.6.8 Many radio systems are in use by public safety agencies in the United States. A number of them have different operational characteristics. A prescribed signal strength measurement might not produce usable voice communications for all systems (e.g., VHF, UHF, 700/800 MHz, analog, P-25, 4 slot TDMA, 2 slot TDMA, etc.). Requiring the AHJ to provide operational parameters required for usable voice communications for the systems in use eliminates possible confusion regarding the specified value, as determined by the AHJ. A better indicator of proper system performance and coverage is to use the DAQ audio quality measurement system whether the signals are either analog or digital.

A.9.6.8.1 Inbound (or downlink) is commonly referred to as base station to portable. It is recommended that systems be designed for DAQ 3.4.

N A.9.6.8.2 Outbound (or uplink) is commonly referred to as portable to base station.

A.9.6.10.2 There is an ongoing national effort to eliminate current interference issues between cellular carriers and public safety bands in the 800-MHz band. This effort could revise the actual frequencies for public agencies within this band. The public safety radio enhancement system design should be capable of being changed to accommodate updated frequencies to allow maintenance of the minimum system-design criteria. Two-way radio communication enhancement systems that are used to comply with the requirements of Section 9.6should be tested in accordance with 11.3.9 and 11.3.9.1. Also note that this is not easily done at VHF because of filters and non-standard Tx and Rx spacings.

A.9.6.11.1 Radio licensing authorities in some countries have distinctions between consumer-grade and industrial-grade two-way radio communications enhancement systems. The intent of these distinctions is to ensure that industrial grade devices are used in public facilities, instead of consumer devices, which are usually held to a lower technical standard, and cannot be required to be certified by or registered with the radio licensing authority. The AHJ should become cognizant of these differences operating in his or her country and jurisdiction, and be certain that the devices used in his or her system are suitable to the purpose of a system used and depended upon by public safety users. For example, in the United States, the FCC published *Use and Design of Signal Boosters Report and Order 13-21*, which took effect in March 2014, and established requirements for consumer-grade and industrial-grade signal boosters. Additionally, under FCC regulations, some industrial signal boosters are Part 90 signal boosters used for public safety land mobile radio systems — as opposed to those used for public cellular wireless carriers— which include type A signal boosters (i.e., channelized) and type B signal boosters (i.e., broadband). Type B devices must be registered with the FCC before being used because of the potential for broadband devices to cause interference if improperly installed.

A.10.1.1 The AHJ should consider the performance requirements of this standard, particularly the time requirements of Section 7.4, in their decision making regarding the use of CAD.

A.10.1.2 This will provide a seamless transition so that call tracking will be complete from the call receipt phase through the dispatch phase, permitting the performance objectives in Section 7.4 to be fully measured. The AHJ should work with the telecommunications providers to ensure that all data elements required by the CAD are provided by the 9-1-1 system.

A.10.1.2.1 The CAD system should be capable of accepting text-based emergency call data. Where such ability is provided, the CAD system should incorporate the text-based emergency call data into the CAD call-for-service record.

A.10.2 A secondary dispatch method can include a separate isolated system, a manual system, printed backup books, visual display boards, or other methods as approved by the AHJ.

A.10.3.5 There is a danger that routine traffic and unintended network faults can affect the ability of critical parts of the CAD system to communicate with each other, unless the CAD system and any other critical dispatch system components are segregated from the general network and a strict screening program is in place to protect the CAD.

N A.10.4.1.2 Other data elements that could be used, based on the functionality needed by the AHJ, are the following:

(1) Units responding from sending agency

(2) Status changes from units (ongoing)

A.10.4.4 Other systems could include intelligent transportation systems, SMART building management systems, pre-fire/pre-incident software systems, and so forth.

A.10.5.3.2 Insufficiency can be the result of a brownout (defined as a condition where the voltage supplied to the system falls below the specified operating range) or the loss of one or more but not all of the phases of the power supply.

A.10.5.6 Resources can include but are not limited to ERUs, individuals, equipment, or other assets.

A.10.5.6.1 Examples of safeguards include placing source code, documentation, and flow charts into escrow.

A.10.5.7.2 The requirements for audible notification for all text message activations regarding events apply even if there are other methods of notification installed and used at the ERF.

A.10.6.1 Memory storage, random access memory (RAM), network throughput, etc., should accommodate the call volume, call types, and other sizing parameters that are required by the AHJ.

A.10.6.4 The 2-second requirement envisions a worst-case scenario with a heavily loaded system during the busiest periods. Response time under average conditions should be much less.

A.10.6.6 A power-fail recovery capability is the ability of the system, upon restoration of power, to reboot and arrive at its previous state. This allows restoration of system function without requiring telecommunicators to leave their positions.

A.10.7 Backups can be accomplished on tape, DVD writer, or disk storage arrays in a redundant array of independent disks (RAID) configuration. The AHJ should establish a schedule for the routine backup of data as well as periodic testing of the stored data system for effectiveness and completeness. Incorporating multiple backup methods is preferred, augmented by off-site storage of backup files.

Sufficient testing should occur on the backup systems to verify the completeness and accuracy of the backup and recovery data and process, including switching back to the primary system.

N A.10.8.1.4 The AHJ should evaluate trends in the industry towards virtual environments. There are pros and cons to this approach that bear investigation. The CAD system can be designed to allow for the deployment of virtual servers, workstations, and storage at the discretion of the AHJ.

A.10.8.1.6 Examples are commercial alarm monitoring centers and telematics centers. An alternate method of receiving alarms is needed in the event the system fails. This can be a telephone, a memorandum of understanding (MOU) with another PSAP, or even a duplicate system within the PSAP.

A.10.8.3 The AHJ should determine the data required to be logged for use by the operations room.

A.10.8.5 For the purpose of this subsection, any administrative display screens and keyboards beyond those required for telecommunicator workstations that are not considered essential to the receipt and dispatch of emergencies could be considered as spare display screens and keyboards.

N A.10.9.1 The capability should exist to move data to alternate, long-term storage for retrieval. Access to the data should be restricted through security measures enabled by the AHJ.

N A.10.11.1 MDCs can include any IP-enabled device (e.g., smartphones, tablets, laptops).

A.10.11.2.2 Store and forward technology can provide this functionality.

A.10.11.5.4 Additional functionality could include the ability to download updates for the MDC operating system and applications using a wireless data communication system that is secure in accordance with the provisions of Chapter 13. The MDC should have the ability to present appropriate displays of daytime and nighttime for the protection of the user.

N A.10.12.1 Integrated mapping can be a function available to the MDC with similar functionality as a CAD workstation.

Δ A.11.3.9 **Test Procedures.** The test plan should ensure testing throughout the building. Test procedures should be as directed by the AHJ.

Note: Testing procedures typically are done on a grid system. A grid is overlaid onto a floor area to provide 20 grid cells. Grid cells are provided with definite minimum and maximum dimensions. For most buildings, using a minimum grid dimension of 20 ft (6.1 m) and a maximum grid dimension of 80 ft (24.4 m) will suffice to encompass the entire floor area. Where a floor exceeds 128,000 ft^2 (11,900 m^2), which is the floor area that can be covered by the maximum grid dimension of 80 ft (24.4 m), it is recommended that the floor be subdivided into sectors each having an area less than or equal to 128,000 ft^2 (11,900 m^2), and each sector be tested individually with 20 grid cells in each sector. Signal strength measurements should be taken at the center of each grid and should be performed using standardized parameters as specified in the notes of "Measurement Parameters" of this section. The delivered audio quality (DAQ) scale is a universal standard often cited in system designs and specifications, using the following measures:

(1) DAQ 1: Unusable, speech present but unreadable.
(2) DAQ 2: Understandable with considerable effort. Frequent repetition due to noise/distortion.
(3) DAQ 3: Speech understandable with slight effort. Occasional repetition required due to noise/distortion.
(4) DAQ 3.5: Speech understandable with repetition only rarely required. Some noise/distortion.
(5) DAQ 4: Speech easily understood. Occasional noise/distortion.
(6) DAQ 4.5: Speech easily understood. Infrequent noise/distortion.
(7) DAQ 5: Speech easily understood.

The DAQ scale comes from TIA TSB-88, *Wireless Communications Systems Performance in Noise and Interference-Limited Situations.* A DAQ test is preferred to absolute RF signal levels for two reasons: the DAQ test is easier to administer than RF signal levels, and DAQ is useful regardless of the type of modulation or system technology used (analog or digital). It measures what really matters — how the signal sounds to the user — regardless of manufacturer specifications.

The minimum allowable DAQ for each grid cell typically is three. Not more than two nonadjacent grid cells should be allowed to fail the test. In the event that three of the areas fail the test, or if two adjacent areas fail the test, in order to be

more statistically accurate the testing grid resolution should be doubled. This would require decreasing the size of the grids to one-half the dimension used in the failed test to a minimum of 10 ft (3 m) and a maximum of 40 ft (12.2 m). Further, to cover the same floor area, the number of grids is quadrupled to 80 grids. No more than eight nonadjacent and/or five adjacent grid cells should then be allowed to fail the test.

In the event that nine or more nonadjacent and/or six or more adjacent grid cells fail the test, consideration should be given to redesigning and reinstalling the public safety radio enhancement system to meet the minimum system design requirements. Failures should not be allowed in critical areas. Measurements should be made with the antenna held vertically at 3 ft to 4 ft (0.9 m to 1.2 m) above the floor. The DAQ readings should be recorded on small-scale drawings that are used for testing with the AHJ. In addition, the gain values of all RF-emitting devices and system components should be measured and the test measurement results should be kept on file with the building owner so that the measurements can be verified each year during annual tests.

Two Portable Testing. To test the in-building radio enhancement system with two portable radios, the following procedure can be used: One portable radio should be positioned no greater than 10 ft (3 m) from an indoor distribution antenna or leaky coaxial cable. The second portable radio should be positioned at a distance that represents the farthest distance possible in that location of the building from an indoor distribution antenna or radiating cable. Both portables should be simultaneously keyed up on different frequencies or talkgroups within the same radio band, and listeners on those different frequencies or talkgroups should verify that the voice messages received were intelligible to DAQ 3.0. It is useful when performing these tests to use unfamiliar words, such as from the Harvard Sentences list, when determining reception intelligibility.

Measurement Parameters. DAQ levels should be measured to ensure the system meets the criteria of 9.6.7 according to parameters as directed by the AHJ.

Note: Downlink measurements should be made with the following standardized parameters:

(1) Receive antennas of equal gain to the agency's standard portable radio antenna, oriented vertically, with a centerline between 3 ft to 4 ft (0.9 m to 1.2 m) above floor
(2) Levels recorded while walking an "X" pattern, with the center of the pattern located approximately in the center of each grid area
(3) The linear distance of each side of the "X" equal to at least 10 percent of the length of the grid's side and a minimum length of 10 ft (3 m)
(4) Measurements sampled in averaging mode to include a minimum of one sample per each 5 ft (1.5 m) traveled recorded with not less than five samples per measurement recorded per side of the "X."

Acceptance Test. An acceptance test of the two-way in-building wireless communication systems should be scheduled with the AHJ. Acceptance test procedures and requirements should be as directed by the AHJ.

Note: Typically, acceptance tests are required by the AHJ prior to building occupancy. As-built drawings should be provided including all system design parameters, other information required from the DAQ level and commissioning tests, including a full report with grid locations, DAQ measurements, and RF-emitting device or system component gain values. The acceptance test typically entails a random test by the AHJ of radio communication in various portions of the building, especially including the critical areas. The AHJ can review any test documentation and ensure that the findings of the commissioning test with respect to DAQ levels and gain values are supported by the acceptance test.

If RF-emitting devices are used in the two-way radio communications enhancement systems, a spectrum analyzer shall be used to ensure spurious oscillations are not generated nor are unauthorized carriers repeatedly in violation of radio licensing authority regulations. This testing should be conducted at time of installation and during subsequent inspections. Downlink and uplink spectrum should be recorded with a maximum-hold screen capture at the active system air interfaces with the system under normal load and at least one uplink carrier active on the indoor portion of the system. Measurements should be analyzed for correct gains on both uplink and downlink paths, noise floor elevation from active components, intermodulation, and other parameters determined necessary by the AHJ. Gain values of all RF-emitting devices and system components should be measured and the results kept on file with the building owner and the AHJ. In the event that the measurement results are lost, the building owner will need to repeat the acceptance test to re-establish the gain values.

Where the two-way radio communications enhancement system is shared with other non-public safety services, the testing of the public safety system should be made under simulated heavy traffic load conditions of the non-public safety services to ensure that the DAQ values, noise floors, intermodulation, and other parameters, as described by the AHJ for both in-bound and out-bound, are met for the public safety portion of the system.

Annual Tests. The AHJ should be notified in advance and should direct annual test procedures and requirements. Note: Typically, annual tests require several items to be checked. RF-emitting devices and system components should be tested to ensure that the gain is the same as it was at initial installation and acceptance. Backup batteries and power supplies should be tested under load for 1 hour to verify that they will operate properly during a power outage.

License or Certification of Personnel. All system designs, installation, testing, and maintenance should be conducted, documented, and signed by an acceptable manufacturer or person in possession of a current radio licensing authority license, industry certification, professional electrical engineering license, or as required by the AHJ.

Note: Many manufacturers of two-way in-building wireless communications systems provide certification programs for installing contractors. Local adopting jurisdictions could require certification of two-way in-building wireless communications system training for the installing contractors issued by a nationally recognized organization or school, or a certificate issued by the manufacturer of the equipment being installed.

N A.12.5.1 The CAD system should record a history (audit trail) of the following actions taken with the items:

(1) Creation
(2) Change, including modification, deletion, or supplementation
(3) Disposition, including close-out, archiving, and transfer

(4) Inquiry to external data sources

Each entry in the history should include the following:

(1) Coordinated universal time (UTC) of action
(2) Identification of the individual performing the action
(3) Identification of the device on which the action was performed
(4) Effects of action on the characteristics of the items

N A.12.7.4.1 The AHJ needs to look at federal and state guidelines for records retention and be cognizant of the balance between the cost of long-term records retention and the need for records to be available for possible future legal purposes.

A.13.1 Security issues for communications center data systems include the following:

(1) Security of data from outsiders
(2) Security of data from inappropriate access and modification from insiders
(3) Denial-of-service attacks
(4) Equipment and infrastructure failures that impede or prevent access to data

Many jurisdictions are providing public access to departmental records, some including CAD records, through web browser access. Such unprecedented live access to files presents security issues not previously considered, including but not limited to the following:

(1) Accidental release of privileged data, such as data protected by the Health Insurance Portability and Accountability Act (HIPAA) of 1996
(2) Deliberate or inadvertent impacts on the system that affect data availability to any of the users

Data systems give employees access to a wide variety of departmental data that were not easily available before. Agency rules and regulations should be modified to specifically address the misuse of data as a breach of the confidentiality agreement used by the agency. With the move to Internet protocol (IP)–based networks for both the core network for land mobile radio systems as well as IP-based telephony and IP-based Next Generation 9-1-1, it is important that a new holistic approach to data security be taken. "Defense in depth" is an approach in which security is not resolved purely on a technical level but is also addressed across personnel and operations in a holistic risk management methodology. Therefore it is imperative that agencies implement a layered defense that will span the entire enterprise and is not purely technology focused. These defense-in-depth strategies are outlined in Table A.13.1.

Critical communication systems have incorporated IP backbones and commercial-off-the-shelf (COTS) technologies. These recent changes from proprietary to open systems have had the following advantages:

(1) Frequent technology refreshes
(2) Integration with other IT applications
(3) Use of standard administrative skills
(4) Better customer pricing
(5) Improved product flexibility
(6) Reuse of existing fiber for backhaul

With these advantages comes the security disadvantage of openness. The protocols are widely documented, and the hardware is inexpensive and widely available. To mitigate the inherent vulnerabilities, steps should be taken in a layered defense-in-depth approach to address the risks to the communications center's systems.

Additional information relating to security issues can be found in Annex C.

A.13.1.3 All employees are responsible for maintaining security. Employment contracts, collective bargaining agreements, personnel manuals, and departmental directives should enforce this requirement. However, some personnel have primary responsibility for security, and these employee positions should be specified in the plan. Duties of these employees should include the following:

(1) Analyzing the agency's security exposure
(2) Regular and/or automatic monitoring for security compliance
(3) Routine auditing
(4) Archiving of security events or incidents for auditing or study

Δ Table A.13.1 Defense-in-Depth Strategies

Defense-in-Depth Strategies for		
People	Technology	Operations
Assignment of roles and responsibilities (administrator, console, etc.)	Defense in multiple places and layers	Continuity of operations and disaster recovery
Training of critical personnel (IA training class)	Passive attacks: encryption	Certifying and accrediting changes to the baseline (configuration management)
Personal accountability (logging)	Active attacks: firewalls	Managing the security posture (patch management)
Physical security and personnel security measures to control and monitor access to facilities and critical elements	Layered defenses (network firewall, host firewall)	Key management
	Role-based access Intrusion detection certified products	Incident response

A.13.1.4 Recent events have revealed that a common thread in many attacks the adversary gains the credentials (user name and password) of legitimate users and is able to gain unfettered access to the IT systems as a result. This is especially true of agencies that have experienced advanced persistent threats (APTs) from determined adversaries. The Department of Homeland Security (DHS) provides a user education program called "Stop. Think. Connect" (www.dhs.gov/stopthinkconnect), which can be used as a foundation for such user training.

A.13.1.5 The goal of any information system is to restrict access to the following persons:

(1) Those who are authorized to use the system
(2) Those who have a need to know
(3) Those who are responsible for auditing the system to ensure that policies and regulations are implemented appropriately
(4) Those who are accountable for the actions of users who use and administer the system

Access control seeks to ensure confidentiality of information and integrity of information with role-based access control. With the philosophy that access control should involve the implementation of least privileges with authentication, authorization, and accountability (AAA), it is imperative that agencies leverage products and services that assist with access control and provide a layered defense in addition to the system's physical and environmental security. For very sensitive access to the network or certain computers and databases, two-factor authentication (something you know and something that you possess) is recommended.

Comprehensive procedures for the maintenance of data security should include the following:

(1) Policies and procedures that specify the process and that authorize or deny access to the data system
(2) Policies for reviewing access to the system when employment status changes (promotion, demotion, discharge)
(3) Password security rules (aging, privacy, sharing issues)
(4) Differentiated access control within the system for different users
(5) Encryption and key control
(6) Maintenance of data security during disposal (paper shredding, hard disk destruction)

Encryption. As used in P25, land mobile radios should follow the guidelines outlined in the Department of Homeland Security (DHS) Office of Emergency Communications *Guidelines for Encryption in Land Mobile Radio Systems.* Use of proprietary forms of encryption, or analog encryption on analog radios, is not of sufficient strength to meet law enforcement or EMS HIPAA requirements.

Impersonation/Inappropriate Use. A key component within information assurance and access control is identity assurance, which addresses the risk associated with identity impersonation and inappropriate account use. The communications system should integrate authentication appliances and associated tokens to provide the confidence to system owners that users accessing the critical infrastructure or communicating remotely as in Virtual Private Network (VPN) Remote Access are trusted entities through the use of two-factor (or strong) authentication by which the user must provide three bits of information: account name, account password (something they know), and the token ID (something they have).

Additionally, the system should log all transactions and user activity, allowing administrators to utilize it as an auditing, accounting, and compliance tool.

Subscriber Unit Authentication. The authentication of subscriber units (radios) before being authorized access to the critical communication system is necessary for several reasons, the most significant being the primary method of communication and necessity of continuous availability, the wide geographical wireless mobility, and the use of data on today's land mobile radio systems. In the past, concern has focused on the ability of nonagency personnel monitoring communications, which has pushed the capability of encrypted voice communications, but it only addresses the risks associated with confidentiality and integrity to a small degree. Without ensuring that radios and their users are allowed to be on the network and the talkgroups assigned to them, the system responds with "denial of service" because a false radio is assuming a valid radio's identity (lack of availability), false information is being placed on a trusted network (lack of integrity), and data are being stolen remotely (lack of confidentiality). It is therefore necessary to authenticate radios to the wireless system at a minimum and that they be mutually authenticated with systems that have a high level of risk and/or interoperability.

A.13.1.6 The core of an information system is the network that permits the sharing of information between systems. This makes it a prime medium for infiltration but also an excellent source for preventing and detecting unauthorized behavior. It is critical to implement multiple components of network security to address the myriad risks associated with IP networks, including access control lists, perimeter firewalls, network intrusion detection, and link encryption. Many third-party integrated service routers are also capable of supporting advanced security operating systems that permit not only the link encryption but also a software-based full firewall for additional network security.

The use of IP-enabled devices has created a new class of threats to public safety because the devices can provide unprecedented access to sensitive data. They can introduce malware into a public safety IP-based system, causing numerous problems that affect the ability to dispatch efficiently, including denial-of-service attacks. As a result, IP-enabled public safety devices require user access controls to ensure only authorized use. Also, in the event that an IP-enabled public safety device is lost or stolen, that device needs to have provisions for disabling it, similar to those outlined in 9.3.4.1.18. Further, IP-enabled public safety devices used by law enforcement agencies must also adhere to federal standards for access to sensitive law enforcement databases.

A.13.1.7 Computer systems have become not only the primary resource for storing information but also the primary workhorse for users to perform their jobs; therefore they have also become a primary objective for intruders for either data gathering or destruction. This makes a computer system the end point for security, and it requires layers to be built around it to minimize the risks associated with intruders accessing the information contained within the computer or with the trusted capability placed at their disposal.

Host-Based Security. Host-based security consists of a suite of software or software functionality inside a single software that protects the host computer from malicious behavior. Antivirus software is a recommended minimum application to protect workstations and servers from malicious code, and it is one that

most individuals accept even for their home computers. However, it does not provide a complete solution for all the malicious behavior that can result from zero-day viruses, which are not found by antivirus software, intentional attacks through bugs, or even accidental user actions. A comprehensive host solution is necessary for ensuring proper protection from known attack vectors and unallowable behaviors to anomaly detection for incident handling and chain of events.

Firewalls. Firewalls provide protection to the information system by enforcing policies, preventing abnormal network behavior, and integrating high-performance security features, including application-aware firewall, secure socket layer (SSL) and internet protocol security (IPSec), VPN, intrusion prevention system (IPS), antivirus, anti-spam, anti-phishing, and Web-filtering services. These technologies deliver strong network and application-layer security, user-based access control, worm mitigation, malware protection, and improved employee productivity. Adaptive security appliances integrate industry-leading firewalls, unified communications security, VPN technology, intrusion prevention, and content security in a unified platform to carry out the following functions:

(1) Stop attacks before they penetrate the network perimeter
(2) Protect resources and data, as well as voice, video, and multimedia traffic
(3) Control network and application activity
(4) Reduce deployment and operational costs
(5) Have an adaptable architecture for rapid and customized security services deployment
(6) Provide advanced intrusion prevention services that defend against a broad range of threats
(7) Provide highly secure remote access and unified communications to enhance mobility, collaboration, and productivity

Network Intrusion Detection Systems (NIDS). In today's communications environment, where everything is highly dynamic with new technologies and increased evolving and sophisticated threats, networks need to implement security measures that are just as dynamic and adaptive. By placing network intrusion detection system (NIDS) in line with the network configurations, the system can act as a preventative measure — placing it on the spanning (or sniffer) port of a switch allows it to act as a detection system on all traffic on the switch, even the network traffic that is not being routed outside the local area network. An enterprise NIDS solution can analyze network traffic and prevent threats from damaging a network, including the following:

(1) Worms
(2) Trojans
(3) Backdoor attacks
(4) Spyware
(5) Port scans
(6) VoIP attacks
(7) Internet protocol version 6 (IPv6) attacks
(8) Denial-of-service (DoS) attacks
(9) Buffer overflows
(10) Statistical anomalies
(11) Protocol anomalies
(12) Application anomalies
(13) Malformed traffic
(14) Invalid headers
(15) Blended threats
(16) Rate-based attacks
(17) Zero-day threats
(18) TCP segmentation and IP fragmentation

Cloud-Based Services. Agencies large and small are turning to cloud-based repositories for software applications and file storage. The AHJ should ensure that any use of cloud-based services includes an encrypted virtual private network (VPN) connection to the cloud to prevent sensitive data from being read, copied, or changed. Further, the AHJ should ensure that the cloud services provider has adequate backup and restoration capabilities if real-time public safety data will be put into the cloud. Agencies should be aware that in recent years several significant outages of cloud-based services have left users of such services unable to operate properly for hours to days.

Emergency services agencies that include law enforcement should understand that the Department of Justice has specific requirements for information security with respect to criminal records, requiring that the cloud computing service provider be certified by IARC-JAXA Information System (IJIS).

Additional sources of information on cloud computing:

Cloud Computing Security Reference Architecture, NIST http://collaborate.nist.gov/twiki-cloud-computing/pub/CloudComputing/CloudSecurity/NIST_Security_Reference_Architecture_2013.05.15_v1.0.pdf

Cloud Computing Reference Architecture, NIST www.nist.gov/customcf/get_pdf.cfm?pub_id=909505

Guidelines on Security and Privacy in Public Cloud Computing, NIST SP 800-144. http://csrc.nist.gov/publications/nistpubs/800-144/SP800-144.pdf

Mitigating Risks in the Application of Cloud Computing in Law Enforcement, APCO International. http://psc.apcointl.org/2013/01/07/mitigating-risks-in-the-application-of-cloud-computing-in-law-enforcement-2

A.13.1.8 A common approach to gaining unauthorized access to systems is to leverage a known vulnerability within a software system, which is why it becomes important to ensure that the system is properly maintained throughout its life cycle with up-to-date software versions and patches that close vulnerabilities and bugs. To help prevent existing vulnerabilities from being exploited, it is important to regularly patch an IT infrastructure. Because patch application can sometimes negatively affect the performance of critical communications land mobile radio systems, security patches should be tested in a controlled environment prior to production rollout. Common software attacks can be divided into several flavors:

(1) Buffer overflows — an input is returned that is much larger than the variable that holds it and literally overwrites a portion of system memory.
(2) SQL injection — an input is returned that will be used in an embedded structured query language (SQL) statement. The input includes additional SQL such as "OR 1=1" that return more than the intended data.
(3) Authentication errors — applications accept incorrect user authentication or pass authentication credentials in clear text, which can be easily sniffed and reused.
(4) Privilege errors — applications give administrative privileges to regular user logins without requiring additional authentication.
(5) Abort errors — applications encounter processing errors that cause them to abort, but they leave the user logged

in with the enhanced service login privileges in which they were running.

It is therefore important to find an enterprise backup solution that has been tested against the information system.

A.13.1.9 To ensure continuity of services when the system data are corrupted or destroyed, or the center must relocate because of fire, explosion, or natural disaster, disaster recovery provisions need to be in place. System configuration, temporary data, and static data (such as voice traffic stored in a voice logging recorder) need to be retained. Data retention is needed for several purposes: for legal records (voice logging recorders), for training and maintenance purposes, and to allow system recovery if the primary databases are corrupted or destroyed. Data retention should be guaranteed even during catastrophic failures such as network errors, hard-drive crashes, component failure, and server room obliteration. Database backups should be stored at a physically separate location. Because much of the information might contain legal, criminal, or medical information, the backups must be physically locked and secured to prevent copying, reading, or tampering. For first responder mission-critical communications systems, the importance of quickly recovering systems to bring the users and the system functionality back to full operational status is a matter of life and death. It is therefore important to find an enterprise backup solution that has been tested against the information system.

Backup and disaster recovery can be an expensive and time-consuming process. It is not just a matter of making regular backups and taking them offsite. Having the equipment and space to restore the off-site backups is often overlooked.

Disaster recovery procedures include fire service building preplans, incident response run cards, EMS preplans for certain high-risk individuals in the served community, and local law enforcement records.

A.13.1.10 Many computer security references and standards suggest implementing logging and auditing functions on computer networks. Without logs, investigating security breaches and incidents is a frustrating experience because there are very few data with which to reconstruct the incident. Additionally, legal action is impossible without the necessary proof. But functions implementing logging thoughtlessly can cause its own problems. For instance, logs can overrun a computer, making it run slower and eventually stopping all processes. This can occur when the logs are allowed to get too large. The larger the underlying log file, the longer it takes to append data to the file; eventually, the delay can become noticeable. This can happen when the logs have taken all the available local hard drive space.

There are four approaches to prevent these self-inflicted DoS attacks. First, separate disk partitions can be established for the system and application logs. This will not prevent the logs from growing but will prevent them from interfering with the operating system. Although the solution seems obvious, interestingly enough, logs default to writing to the operating system partition.

Second, logs can be set up to overwrite on a regular basis, effectively reducing the amount of log data available. This approach sounds reasonable, except that it does not take into consideration the effect of a security attack and/or network failure. Generally, when hardware is failing and applications are not running properly, more logging is generated. So, right when logs are the most valuable, they will contain the least span of time because of the additional logging traffic being generated.

Third, logs can be manually removed from machines on a regular basis. This works well if implemented meticulously, but the weak link is the human interaction required. What happens when resources change, other tasks become a higher priority, or someone takes a vacation? Log removal needs to be automated.

Fourth, and finally, implementing automated log removal is the best — and the most expensive — approach. Basically, a system logging server that receives all the logs is added to the network. Then, each device (server, workstation, router, and switch) is set up to push logs to the new syslog server. In addition to centralizing the log data, this approach allows for reporting across log sources and correlating log data. It also prevents the logs from potentially compromised machines from being easily "doctored" by the attacker.

A.13.1.11 A key element of ensuring that the system maintains a proper security posture is the periodic auditing of the vulnerabilities inherent in the system to ensure that new vulnerabilities are being addressed and that previously closed vulnerabilities have not resurfaced as a result of changes made to systems during normal business operations. Auditing can be done by individually scanning every asset on the system with a vulnerability management tool, or it can be done automatically by a centralized appliance that is capable of scheduled scans. Both are available from industry leaders in the field. All vulnerability management tools should be used consistently to ensure baseline security compliance.

Vulnerability management processes are used to ensure the survival in various scenarios as appropriate to the jurisdiction, including major storms, floods, earthquakes, wildfires, security breaches, and civil disturbances.

A.13.1.12 Environmental and physical security is a keystone to any security plan, and it is critical that agencies have tools integrated into every system. The physical security system requires capabilities for alarm monitoring and reporting of critical network functions, and it is designed to handle a multitude of voltage and control alarms. The system should be used to monitor alarms or perform auxiliary voltage control functionality. The information collected should be forwarded for centralized monitoring and alarm notification with the capability of forwarding alerts to notify the appropriate personnel of the issue. The centralized system should be capable of monitoring basic alarms for dispatchers and supervisors to keep them aware of important information, which would including the following:

(1) Power failure
(2) Excessive base station transmitter voltage standing wave ratio (VSWR)
(3) Shelter door alarms
(4) Cabinet door alarms
(5) Line power failure
(6) UPS failure
(7) Generator failure
(8) Smoke detector
(9) Humidity detector
(10) HVAC failure
(11) Low generator fuel

(12) Low battery

A.13.2 The 9-1-1 centers and the communications systems that support them are critical infrastructure (CI). Therefore, it is recommended that emergency services agencies conduct annual security audits, following the guidelines of one of the references listed in Annex C. Such audits are, however, reactive in nature.

It is also recommended that emergency services agencies contract with a reputable outside expert service to conduct penetration testing. Such testing is best done annually or every 18 months. The purpose of such testing is to determine whether security procedures and controls are working against common types of cyberattacks. Without this information it is impossible to know if the preventive measures are working. A confidential report should be made and kept for senior management of the emergency services agency to assist in long-term improvements.

A.14.1.4 The education of the public and distribution of PASAAs need to be considered when planning or making a system improvement. The PAS should take into consideration the special needs of individuals in the community.

A.14.3 Alert systems are used to warn the public of dangers and to provide information and recommended actions to the public regarding events that can be expected to result in loss of life, endanger public health, or destroy property. These events could include, but are not limited to, tornadoes, hurricanes, floods, fire, and chemical releases.

A.14.4.1(3) Radio broadcast systems include systems identified as using public radio, private radio, television, cable, cellular, and pager technologies.

A.14.5 Reporting is an issue that varies greatly depending on the PAS solution used. A simple broadcast system could offer little to report, and a telecommunications-based system could offer the opportunity to identify specific locations or telephone lines to which a recorded message or an alert data message (ADM) was sent, as well as information that a PASAA, a telephone answering device, or a person has received the voice message or ADM.

Annex B Cyber Security

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

B.1 Where to Start. It is often difficult for agencies to decide where to start in cyber security. Here are three resources:

(1) Council on Cyber Security's Critical Security Controls. www.counciloncyber security.org/critical-controls. All agencies should strive to implement the top four controls as soon as possible because they represent the most common security threats and to implement the others as determined necessary by the AHJ.
(2) Stop.Think.Connect. (www.dhs.gov/stopthinkconnect) is a Department of Homeland Security campaign aimed at educating end users about phishing attacks.
(3) SANS Securing the Human (www.securingthehuman.org/resources) is another program aimed at educating end users. Many successful attacks are the result of phishing or similar techniques that lure users onto sites that infect their computers with malware and allow adversaries to steal legitimate user credentials.

B.2 Additional Information.

B.2.1 The International Association of Chiefs of Police (IACP) (www.theiacp.org/Technology/tabid/72/Default.aspx) has begun a major effort to disseminate information on cyber security and to combat cyberthreats. Emergency services agencies with a law enforcement presence should be able to gain access to these resources:

(1) The Law Enforcement Tech Minute video: "The Current Climate in Cyber Security"
(2) The Law Enforcement Cyber Security Center

B.2.2 The National Institute of Science and Technology (NIST) has been researching and issuing security standards for some time. Here is a partial list, with the most current first:

(1) Preliminary Cyber Security Framework (www.nist.gov/itl/upload/preliminary-cyber security-framework.pdf): useful mapping to previous security frameworks such as ISO 270001
(2) Security and Privacy Controls for Federal Information Systems and Organizations (http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-53r4.pdf)
(3) Minimum Security Requirements for Federal Information and Information Systems (http://csrc.nist.gov/publications/fips/fips200/FIPS-200-final-march.pdf)
(4) Federal Information Security Management Act of 2002 (FISMA), Title III—Information Security (http://csrc.nist.gov/drivers/documents/FISMA-final.pdf)

B.2.3 The National Emergency Number Association (NENA) has issued guidelines on cyber security that are useful for 9-1-1 centers:

(1) *Next Generation 9-1-1 Security (NG-SEC) Audit Checklist* (https://c.ymcdn.com/sites/www.nena.org/resource/resmgr/Standards/NENA_75-502.1_NG-SEC_Audit_C.pdf)
(2) *NENA Security for Next Generation 9-1-1 Standard (NG-SEC)* (http://c.ymcdn.com/sites/www.nena.org/resource/collection/2851C951-69FF-40F0-A6B8-36A714CB085D/NENA_75-001-v1_NG-Security.pdf)

B.2.4 The Association of Public Safety Communications Officials (APCO) has issued several guidelines, among them the following:

(1) *Telephony Denial of Services (TDOS) to Public Safety Communications Phone Service Recommended Best Practices Checklist* (http://psc.apcointl.org/2013/03/28/telephony-denial-of-services-tdos-to-public-safety-communications-phone-service)
(2) APCO International and the IJIS Institute Outline Information Sharing Priorities (http://psc.apcointl.org/2013/08/20/apco-international-and-the-ijis-institute-outline-information-sharing-priorities)

B.2.5 A cyberhealth pyramid can be found at www.state.nj.us/njinfosecure/home/Posters/2012_Pyramid_Poster.pdf

B.2.6 The FBI's Next Generation Cyber Initiative offers information here: www.fbi.gov/news/testimony/cyber-security-terrorism-and-beyond-addressing-evolving-threats-to-the-homeland, and a Cyber Shield Alliance offers information here: www.ise.gov/blog/ise-bloggers/fbis-guardian-portal-expands-cyber-threat-information

Annex C Informational References

C.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.

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

NFPA 70®, National Electrical Code®, 2017 edition.

NFPA 72®, National Fire Alarm and Signaling Code®, 2019 edition.

NFPA 1600®, Standard on Disaster/Emergency Management and Business Continuity/Continuity of Operations, 2016 edition.

C.1.2 Other Publications.

N C.1.2.1 APCO Publications. Association of Public-Safety Communications Officials International, Inc., 351 N. Williamson Boulevard, Daytona Beach, FL 32114-1112.

APCO, *APCO International and the IJIS Institute Outline Information Sharing Priorities*, 2013.

APCO, *Mitigating Risks in the Application of Cloud Computing in Law Enforcement*, 2013.

APCO, *Telephony Denial of Service (TDOS) to Public Safety Communications Phone Service*, 2013.

C.1.2.2 FM Publications. FM Global, 270 Central Avenue, P.O. Box 7500, Johnston, RI 02919.

FM Global Property Loss Prevention Data Sheet 9-19, *Bushfire Exposure.*

Δ C.1.2.3 NENA Publications. National Emergency Number Association, 1700 Diagonal Rd., Suite 500, Arlington, VA 22314.

NENA 06-750 v3, NENA Model Legislation E-9-1-1 for Multi-Line Telephone Systems, February 5, 2011.

NENA 75-001 v1, *NENA Security for Next-Generation 9-1-1 Standard*, February 6, 2010.

NENA 75-502 v1, *Next Generation 9-1-1 Security Auddit Checklist*, December 14, 2011.

N C.1.2.4 NIST Publications. National Institute of Science and Technology, 100 Bureau Drive, Stop 1070, Gaithersburg, MD 20899-1070.

NIST/CSRC Title III, *Federal Information Security Management Act of 2002*, 2002.

NIST *Improving Critical Infrastructure Cybersecurity Executive Order 13636, Preliminary Cybersecurity Framework*, 2013.

NIST *Minimum Security Requirements for Federal Information and Information Systems*, 2006.

NIST *Security and Privacy Controls for Federal Information Systems and Organizations*, 2013.

NIST SP 500-292, *NIST Cloud Computing Reference Architecture*, 2011.

NIST SP 500-299, *NIST Cloud Computing Security Reference Architecture*, 2011.

NIST SP 800-144, *Guidelines on Security and Privacy in Public Cloud Computing*, 2011.

Δ C.1.2.5 TIA Publications. Telecommunications Industry Association, 1320 North Courthouse Road, Suite 200, Arlington, VA 22201.

ANSI/TIA 102.AABF-A, *Link Control Word Formats and Messages New Technology Standards Project — Digital Radio Technical Standards*, 2004.

ANSI/TIA-102.BAAA, *FDMA Common Air Interface*, 2003.

ANSI/TIA-102.BBAC, *Two-Slot TDMA MAC Layer*, 2010.

TIA-603-D, *Land Mobile FM or PM — Communications Equipment — Measurement and Performance Standards*, 2010.

TIA-TSB-88, *Wireless Communications Systems Performance in Noise and Interference-Limited Situations*, 2013.

C.1.2.6 U. S. Government Publications. U. S. Government Publishing Office, 732 North Capitol St. NW, Washington, DC 20401.

The Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack, Mail Stop T-2-3-1, 1710 SAIC Drive, McLean, VA 22102, *Executive Report*, Vol. 1, 2004.

Department of Health and Human Services (DHHS), The National Institute for Occupational Health and Safety (NIOSH). DHHS (NIOSH) Pub No. 2002-139, *Guidance for Protecting Building Environments from Airborne Chemical, Biological, or Radiological Attacks.*

Department of Homeland Security, SAFECOM, www.safecomprogram.gov.

Department of Homeland Security Office of Emergency Communications, *Guidelines for Encryption in Land Mobile Radio Systems.*

Federal Communications Commission, *Use and Design of Signal Boosters Report and Order 13-21*, March 2014.

Health Insurance Portability and Accountability Act (HIPAA), 1996.

C.1.2.7 U.S. Government/Army Publications. Army Publishing Directorate, Army Engineering Publications. Available online at http://www.apd.army.mil/.

U.S. Army Technical Manual TM 5-602-01, *Utility Systems Terrorism Countermeasures for Command, Control, Communications, Computer, Intelligence, Surveillance, and Reconnaissance (C4ISR) Facilities.*

U.S. Army Technical Manual TM 5-690, *Grounding and Bonding in Command, Control, Communications, Computer, Intelligence, Surveillance, and Reconnaissance (C4ISR) Facilities.*

U.S. Army Technical Manual TM 5-693, *Uninterruptible Power Supply System Selection, Installation, and Maintenance for Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) Facilities.*

U.S. Army Technical Manual TM 5-811-3, *Electrical Design: Lightning and Static Electricity Protection.*

C.1.2.8 U.S. Government/DOD UFC Publications. Department of Defense United Facilities Criteria (UFC). https://www.wbdg.org/ffc/dod.

UFC 4-010-01, *Minimum Antiterrorism Standards for Buildings.*

UFC-4-021-02NF, *Security Engineering Electronic Security Systems.*

UFC 4-022-02, *Selection and Application of Vehicle Barriers.*

UFC 4-023-03, *Design of Buildings to Resist Progressive Collapse.*

UFC 4-023-07, *Design to Resist Direct Fire Weapons Effects.*

UFC 4-024-01, *Security Engineering: Procedures for Designing Airborne Chemical, Biological, and Radiological Protection for Buildings.*

C.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.

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

NFPA 221, *Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls*, 2015 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 2013 edition.

C.2.2 Other Publications.

C.2.2.1 APCO International Publications. Association of Public-Safety Communications Officials International, Inc., 351 N. Williamson Boulevard, Daytona Beach, FL 32114-1112.

Project 16, "Application of the 900 MHz Band to Law Enforcement Communications — An Analysis of Technical and Regulatory Factors," 1985.

Project 16A, "The Identifications of the Specific Operational Capabilities That Should Be Incorporated in a Demonstration Trunked Communication System for Law Enforcement," 1985.

Project 16B, "Planning Guidelines for 900 MHz Trunked Communication Systems — Functional Requirements," 1985.

Project 16C, "System Implementation Plan for Digitally Addressed Trunked Communication Systems," 1985.

Project 16D, "National Public Safety Communications Plan," 1978.

N C.2.2.2 NENA Publications. National Emergency Number Association, 1700 Diagonal Road, Suite 500, Alexandria, VA 22314.

NENA-ADM-000.21-2017, *NENA Master Glossary of 9-1-1 Terminology*, August 8, 2017.

NENA-STA-010.2-2016, *Detailed Functional and Interface Standards for the NENA i3 Solution*, September 10, 2016.

NENA-03-002, *NENA Standard for the Implementation of Enhanced MF Signaling, E9-1-1 Tandem to PSAP*, January 17, 2007.

NENA-04-001, *NENA Recommended Generic Standards for E9-1-1 PSAP Equipment*, August 23, 2000.

C.2.2.3 FPRF Publications. Fire Protection Research Foundation, 1 Batterymarch Park, Quincy, MA 02169.

Quantitative Evaluation of Fire and EMS Mobilization Times, May 2010.

N C.2.2.4 IMSA Publications. International Municipal Signal Association, 597 Haverty Court, Suite 100 - Rockledge, FL 32955.

Official IMSA Wire and Cable Specifications Manual, 2012.

C.2.2.5 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capital Street, NW, Washington, DC 20401-0001.

Title 47 Code of Federal Regulations, Part 11, "Emergency Alert System."

Δ C.2.2.6 OASIS Publications. Organization for the Advancement of Structured Information Standards (OASIS), 35 Corporate Drive, Suite 150, Burlington, MA 01803-4238.

Common Alerting Protocol, Version 1.2.

Integrated Public Alert and Warning System (IPAWS) Profile, Version 1.0.

C.3 References for Extracts in Informational Sections.

NFPA 72®, National Fire Alarm and Signaling Code, 2019 edition.

Index

SECTION 3

NFPA® 1710

Standard for the

Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments

2016 Edition

This edition of NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*, was prepared by the Technical Committee on Fire and Emergency Service Organization and Deployment—Career and acted on by NFPA at its June Association Technical Meeting held June 22–25, 2015, in Chicago, IL. It was issued by the Standards Council on August 18, 2015, with an effective date of September 7, 2015, and supersedes all previous editions.

This edition of NFPA 1710 was approved as an American National Standard on September 7, 2015.

Origin and Development of NFPA 1710

In 2001, the first edition of NFPA 1710 was issued. The development of that benchmark standard was the result of a considerable amount of hard work and tenacity by the Technical Committee members and the organizations they represented. That standard was the first organized approach to defining levels of service, deployment capabilities, and staffing levels for substantially career fire departments. Research work and empirical studies in North America were used by the Committee as a basis for developing response times and resource capabilities for those services, as identified by the fire department.

Following the issuance of the first edition, the NFPA Standards Council asked the Technical Committee to begin the revision process for a 2004 edition of the standard. The Committee formed several Task Groups to look at various aspects of the document. However, recognizing that the standard had not been fully field tested, the extent of the changes proposed were minimal with a cleanup of definitions, the addition of wording regarding equivalency in the annex, and clarification that the discussion on rate of fire propagation in the annex involved unsprinklered rooms.

The 2010 edition of NFPA 1710 standardized and refined terminology and definitions used in the document. Particular attention was paid to terminology for time frames for the various events that occur from event initiation to the end of the fire department's involvement with the incident. This included recognition that there is a time interval to initiate action or intervene at the end of travel time and before control and mitigation actually begin. The requirements for time frames for alarm handling were revised to correspond to changes being made to NFPA 1221. The time allowance for turnout for fires and special operations was lengthened to 80 seconds, but the time measurement was defined to start at the beginning of the transmission of response data to the emergency response units or emergency response facilities. All times shown as both minutes and seconds were changed to seconds only because that is the level of precision in which the committee intends time to be measured. An application section was added in Chapter 1. The travel times for units responding on the first alarm were clarified to indicate the first unit must arrive within 4 minutes travel time and all units must arrive within 8 minutes travel time. The quadrennial report required to be provided to the AHJ in the previous edition was changed to an annual report.

The annex material related to the requirement stated for an initial full alarm assignment capability has been moved to the body of the standard to clarify that the requirement applies to a structure fire in a typical 2000 ft^2 (186m^2), two-story single-family dwelling without basement and with no exposures. In addition, wording was added to require additional resources be deployed on fires in occupancies that present hazards greater than the two-story single-family dwelling. The community-wide risk management model that has been in an annex to NFPA 1720 has been added as an annex to NFPA 1710.

The work done by the Committee provided the user with a template for developing an implementation plan on the standard. Most important, it provided the body politic and citizens a true picture of the risks in their communities and the fire departments' capabilities to respond to and manage those risks.

In the 2016 edition, the Committee has added three new occupancies and the appropriate response staffing levels for garden-style apartment, open-air strip mall, and high-rise occupancies. In addition, redundant text has been removed, and some language has been clarified.

Technical Committee on Fire and Emergency Service Organization and Deployment-Career

William W. Bryson, *Chair*
Pembroke Pines, FL [E]
Rep. Metropolitan Fire Chiefs-IAFC/NFPA

William L. Bingham, Galena, IL [U]
Rep. International Fire Marshals Association
Paul D. Brooks, Center for Public Safety Excellence, VA [SE]
Michael R. Brown, Washington State Association of Fire Chiefs, WA [E]
Rep. International Association of Fire Chiefs
Randy R. Bruegman, City of Anaheim Fire Department, CA [E]
Rep. International Association of Fire Chiefs
Alan V. Brunacini, Fire Command Seminars, AZ [SE]
John J. Caussin, Fairfax County Fire & Rescue Department, VA [E]
Robert J. Crawford, Municipality of Chatham-Kent, Canada [E]
Rep. NFPA Fire Service Section
Frank De Clercq, City of San Diego Fire-Rescue Department, CA [L]
Rep. International Association of Fire Fighters
Daniel J. Greensweig, League of Minnesota Cities, MN [C]
Rep. National League of Cities
Thomas Hanify, The Professional Firefighters Union of Indiana, IN [L]
Rep. International Association of Fire Fighters
Todd A. Harms, Phoenix Fire Department, AZ [E]
Jason M. Hoevelmann, Florissant Valley Fire Protection District, MO [U]
Thomas C. Jenkins, Rogers Fire Department, AR [E]
Kevin P. Kuntz, Insurance Services Office, Inc., NJ [I]
Cortez Lawrence, U.S. Department of Homeland Security, MD [SE]
Frank Lima, United Firefighters of Los Angeles City, CA [L]
Michael Merchan, City of Cape Coral Fire Rescue, FL [U]
Gary Rainey, Florida Professional Firefighters, FL [L]
David L. Rohr, City of Fairfax Fire Department, VA [E]
Chris Ross, Association des Pompiers de Montreal Inc., Canada [L]
Mark A. Sanders, Ohio Association of Professional Firefighters, OH [L]
Joseph Schulle, IAFF Local 22, PA [L]
Rep. International Association of Fire Fighters
James L. Silvernail, Metro West Fire Protection District, MO [U]
L. Charles Smeby, University of Florida, FL [SE]
Patrick N. Smith, U.S. Department of Energy, TN [U]
Catherine L. Spain, The Spain Group LLC, MD [C]
Rep. National League of Cities
Donald H. J. Turno, Savannah River Nuclear Solutions, LLC, SC [U]
J. Curtis Varone, Public Agency Training Council, RI [SE]

Alternates

Michael S. Digman, Metro West Fire Protection District, MO [U]
(Alt. to J. L. Silvernail)
Anne M. Finn, League of Minnesota Cities, MN [C]
(Alt. to D. J. Greensweig)
Anthony Gamboa, United Firefighters of Los Angeles City, CA [L]
(Alt. to F. Lima)
William A. Garrett, Fairfax County Fire & Rescue Department, VA [E]
(Alt. to J. J. Caussin)
Brian D. Goss, Brentwood Fire & Rescue Department, TN [E]
(Alt. to R. R. Bruegman)
Michael D. Masters, Oak Ridge National Laboratory (USDOE), TN [U]
(Alt. to P. N. Smith))
Kevin McDonald, Springdale Fire Department, AR [E]
(Alt. to T. C. Jenkins)
Patrick J. Morrison, International Association of Fire Fighters, DC [L]
(Alt. to T. Hanify)
Richard D. Riley, Clearwater Fire & Rescue, FL [E]
(Alt. to M. R. Brown)
Andrew J. Vita, City of Fairfax Fire Department, VA [E]
(Alt. to D. L. Rohr)
Jimm Walsh, Winter Park Fire Department, FL [U]
(Alt. to W. L. Bingham)
Thomas J. Wieczorek, International City/County Management Assn., DC [E]
(Voting Alt. to ICMA Rep.)

Steven F. Sawyer, NFPA Staff Liaison

This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

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 the organization, operation, deployment, and evaluation of substantially all career public fire protection and emergency medical services.

Contents

NFPA 1710

Standard for the

Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments

2016 Edition

IMPORTANT NOTE: This NFPA document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading "Important Notices and Disclaimers Concerning NFPA Standards." They can also be obtained on request from NFPA or viewed at www.nfpa.org/disclaimers.

UPDATES, ALERTS, AND FUTURE EDITIONS: New editions of NFPA codes, standards, recommended practices, and guides (i.e., NFPA Standards) are released on scheduled revision cycles. This edition may be superseded by a later one, or it may be amended outside of its scheduled revision cycle through the issuance of Tentative Interim Amendments (TIAs). An official NFPA Standard at any point in time consists of the current edition of the document, together with any TIAs and Errata in effect. To verify that this document is the current edition or to determine if it has been amended by any TIAs or Errata, please consult the National Fire Codes® Subscription Service or visit the Document Information (DocInfo) pages on the NFPA website at www.nfpa.org/docinfo. In addition to TIAs and Errata, the DocInfo pages also include the option to sign up for Alerts for each document and to be involved in the development of the next edition.

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 C. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. 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 C.

Chapter 1 Administration

1.1* Scope. This standard contains minimum requirements relating to the organization and deployment of fire suppression operations, emergency medical operations, and special operations to the public by substantially all career fire departments.

1.1.1 The requirements address functions and objectives of fire department emergency service delivery, response capabilities, and resources.

1.1.2 This standard also contains general requirements for managing resources and systems, such as health and safety, incident management, training, communications, and preincident planning.

1.1.3 This standard addresses the strategic and system issues involving the organization, operation, and deployment of a fire department and does not address tactical operations at a specific emergency incident.

1.2 Purpose.

1.2.1* The purpose of this standard is to specify the minimum criteria addressing the effectiveness and efficiency of the career public fire suppression operations, emergency medical service, and special operations delivery in protecting the citizens of the jurisdiction and the occupational safety and health of fire department employees.

1.2.2 Nothing herein is intended to restrict any jurisdiction from exceeding these minimum requirements.

1.3 Application.

1.3.1 This standard applies to the deployment of resources by a fire department to emergency situations when operations can be implemented to save lives and property.

1.3.2 The standard is a benchmark for most common responses and a platform for developing the appropriate plan for deployment of resources for fires in higher hazard occupancies or more complex incidents.

1.4* Equivalency. Nothing in this standard is intended to prohibit the use of systems, methods, or approaches of equivalent or superior performance to those prescribed by this standard, provided technical documentation is submitted to the authority having jurisdiction to demonstrate equivalency.

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 403, *Standard for Aircraft Rescue and Fire-Fighting Services at Airports*, 2014 edition.

NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2013 edition.

NFPA 1143, *Standard for Wildland Fire Management*, 2014 edition.

NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, 2016 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 2013 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety*, 2014 edition.

NFPA 1670, *Standard on Operations and Training for Technical Search and Rescue Incidents*, 2014 edition.

2.3 Other Publications.

2.3.1 U.S. Government Publications. U.S. Government Publishing Office, Washington, DC 20402.

Title 29, Code of Federal Regulations, Part 1910.120, "Hazardous Waste Operations and Emergency Response."

Title 29, Code of Federal Regulations, Part 1910.146, "Permit-Required Confined Space."

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 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2013 edition.

NFPA 1002, *Standard for Fire Apparatus Driver/Operator Professional Qualifications*, 2014 edition.

NFPA 1081, *Standard for Industrial Fire Brigade Member Professional Qualifications*, 2012 edition.

NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*, 2012 edition.

NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, 2016 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 2013 edition.

NFPA 1521, *Standard for Fire Department Safety Officer Professional Qualifications*, 2015 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety*, 2014 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus*, 2016 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 Shall. Indicates a mandatory requirement.

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

3.2.5 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 Advanced Life Support (ALS). See 3.3.36.1.

3.3.2 Aid.

3.3.2.1* *Automatic Aid.* A plan developed between two or more fire departments for immediate joint response on first alarms. [1142, 2012]

3.3.2.2 *Mutual Aid.* A written intergovernmental agreement between agencies and/or jurisdictions that they will assist one another on request by furnishing personnel, equipment, and/or expertise in a specified manner.

3.3.3 Aircraft Rescue and Fire Fighting. See 3.3.21.1.

3.3.4* Aircraft Rescue and Fire-Fighting (ARFF) Vehicle. A vehicle intended to carry rescue and fire-fighting equipment for rescuing occupants and combating fires in aircraft at, or in the vicinity of, an airport. [1002, 2014]

3.3.5* Alarm. A signal or message from a person or device indicating the existence of an emergency or other situation that requires action by an emergency response agency. [1221, 2016]

3.3.6 Alarm Answering Time. See 3.3.53.1.

3.3.7 Alarm Handling Time. See 3.3.53.2.

3.3.8 Alarm Processing Time. See 3.3.53.3.

3.3.9 Alarm Transfer Time. See 3.3.53.4.

3.3.10 Apparatus.

3.3.10.1 *Fire Apparatus.* A vehicle designed to be used under emergency conditions to transport personnel and equipment, and to support the suppression of fires and mitigation of other hazardous situations. [1901, 2016]

3.3.10.2 *Quint Apparatus.* A fire apparatus with a permanently mounted fire pump, a water tank, a hose storage area, an aerial device with a permanently mounted waterway, and a complement of ground ladders.

3.3.10.3 *Specialized Apparatus.* A fire apparatus or vehicle that is used for support or specialized equipment and services at emergency scenes for functions such as, but not limited to, command, technical rescue, hazardous materials mitigation, urban search and rescue, air supply, electrical generation and lighting, or transport of equipment and personnel.

3.3.11 Automatic Aid. See 3.3.2.1.

3.3.12 Basic Life Support (BLS). See 3.3.36.2.

3.3.13* Company. A group of members: (1) under the direct supervision of an officer; (2) trained and equipped to perform assigned tasks; (3) usually organized and identified as engine companies, ladder companies, rescue companies, squad companies, or multi-functional companies; (4) operating with one piece of fire apparatus (pumper, aerial fire apparatus, elevating platform, quint, rescue, squad, ambulance) except where multiple apparatus are assigned that are dispatched and arrive together, continuously operate together, and are managed by a single company officer; (5) arriving at the incident scene on fire apparatus. [1500, 2013]

3.3.14 Company Officer. See 3.3.40.1.

3.3.15 Crew. See 3.3.52, Team.

3.3.16 Emergency Incident. Any situation to which an emergency services organization responds to deliver emergency services, including rescue, fire suppression, emergency medical

care, special operations, law enforcement, and other forms of hazard control and mitigation. [1561, 2014]

3.3.17 Emergency Medical Care. The treatment of patients using first aid, cardiopulmonary resuscitation, basic life support, advanced life support, and other medical procedures prior to arrival at a hospital or other health care facility.

3.3.18 Emergency Operations. See 3.3.41.1.

3.3.19 Fire Apparatus. See 3.3.10.1.

3.3.20 Fire Department Member. See 3.3.38, Member.

3.3.21 Fire Fighting.

3.3.21.1* *Aircraft Rescue and Fire Fighting.* The fire-fighting actions taken to rescue persons and to control or extinguish fire involving or adjacent to aircraft on the ground. [1500, 2013]

3.3.21.2* *Marine Rescue and Fire Fighting.* The fire-fighting action taken to prevent, control, or extinguish fire involved in or adjacent to a marine vessel and the rescue actions for occupants using normal and emergency routes for egress.

3.3.21.3 *Structural Fire Fighting.* The activities of rescue, fire suppression, and property conservation in buildings or other structures, vehicles, rail cars, marine vessels, aircraft, or like properties.

3.3.22 Fire Protection. Methods of providing fire detection, control, and extinguishment.

3.3.23* Fire Suppression. The activities involved in controlling and extinguishing fires. [1500, 2013]

3.3.24* First Responder (EMS). Functional provision of initial assessment (i.e., airway, breathing, and circulatory systems) and basic first-aid intervention, including CPR and automatic external defibrillator (AED) capability.

3.3.25 Forcible Entry. Techniques used by fire personnel to gain entry into buildings, vehicles, aircraft, or other areas of confinement when normal means of entry are locked or blocked.

3.3.26* Hazard. A condition that presents the potential for harm or damage to people, property, or the environment.

3.3.27 Hazardous Material. A substance that is capable of creating harm to people, the environment, or property due to its toxicity, chemical reactivity, decomposition, or corrosivity; is capable of explosion or detonation; or presents etiological hazards, whether used for its intended purpose or as a weapon of mass destruction (WMD) or for illicit labs purposes, environmental crimes, or industrial sabotage.

3.3.28* High-Hazard Occupancy. An occupancy that presents a high life hazard or large fire potential due to its construction, configuration, or the presence of specific materials, processes, or contents.

3.3.29 Incident Commander. The member responsible for all incident activities, including the development of strategies and tactics and the ordering and the release of resources. [472, 2013]

3.3.30* Incident Management System (IMS). An organized system that defines the roles and responsibilities to be assumed by responders and the standard operating procedures to be used in the management and direction of emergency incidents and other functions.

3.3.31 Incident Safety Officer. See 3.3.40.2.

3.3.32 Initial Full Alarm Assignment. Those personnel, equipment, and resources ordinarily dispatched upon notification of a structure fire.

3.3.33 Initial Rapid Intervention Crew (IRIC). See 3.3.44.1.

3.3.34 Initiating Action/Intervention Time. See 3.3.53.5.

3.3.35 Intergovernmental Agreement. A written formal authorization for services between two or more jurisdictions.

3.3.36 Life Support.

3.3.36.1 *Advanced Life Support (ALS).* Emergency medical treatment beyond basic life support that provides for advanced airway management including intubation, advanced cardiac monitoring, defibrillation, establishment and maintenance of intravenous access, and drug therapy.

3.3.36.2* *Basic Life Support (BLS).* A specific level of prehospital medical care provided by trained responders, focused on rapidly evaluating a patient's condition; maintaining a patient's airway, breathing, and circulation; controlling external bleeding; preventing shock; and preventing further injury or disability by immobilizing potential spinal or other bone fractures.

3.3.37 Marine Rescue and Fire Fighting. See 3.3.21.2.

3.3.38* Member. A person involved in performing the duties and responsibilities of a fire department, under the auspices of the organization. [1500, 2013]

3.3.39 Mutual Aid. See 3.3.2.2.

3.3.40 Officer.

3.3.40.1* *Company Officer.* A supervisor of a crew/company of personnel.

3.3.40.2 *Incident Safety Officer.* A member of the command staff responsible for monitoring and assessing safety hazards or unsafe situations and for developing measures for ensuring personnel safety.

3.3.40.3* *Supervisory Chief Officer.* A member whose responsibility is to assume command through a formalized transfer of command process and to allow company officers to directly supervise personnel assigned to them.

3.3.41 Operations.

3.3.41.1 *Emergency Operations.* Activities of the fire department relating to rescue, fire suppression, emergency medical care, and special operations, including response to the scene of the incident and all functions performed at the scene. [1500, 2013]

3.3.41.2* *Special Operations.* Those emergency incidents to which the fire department responds that require specific and advanced training and specialized tools and equipment. [1500, 2013]

3.3.42 Public Safety Answering Point (PSAP). A facility in which 9-1-1 calls are answered. [1221, 2016]

3.3.43 Quint Apparatus. See 3.3.10.2.

3.3.44* Rapid Intervention Crew (RIC). A dedicated crew of fire fighters who are assigned for rapid deployment to rescue lost or trapped members.

3.3.44.1 *Initial Rapid Intervention Crew (IRIC).* Two members of the initial attack crew who are assigned for rapid deployment to rescue lost or trapped members.

3.3.45 Rescue. Those activities directed at locating endangered persons at an emergency incident, removing those persons from danger, treating the injured, and providing for transport to an appropriate health care facility. [1500, 2013]

3.3.46 Special Operations. See 3.3.41.2.

3.3.47 Specialized Apparatus. See 3.3.10.3.

3.3.48* Staff Aide. A fire fighter or fire officer assigned to a supervisory chief officer to assist with the logistical, tactical, and accountability functions of incident, division, or sector command.

3.3.49 Standard Operating Procedure. A written organizational directive that establishes or prescribes specific operational or administrative methods to be followed routinely for the performance of designated operations or actions. [1521, 2015]

3.3.50 Structural Fire Fighting. See 3.3.21.3.

3.3.51 Supervisory Chief Officer. See 3.3.40.3.

3.3.52 Team. Two or more members who have been assigned a common task and are in communication with each other, coordinate their activities as a work group, and support the safety of one another. [1081, 2012]

3.3.53 Time.

3.3.53.1 *Alarm Answering Time.* The time interval that begins when the alarm is received at the communication center and ends when the alarm is acknowledged at the communication center.

3.3.53.2 *Alarm Handling Time.* The time interval from the receipt of the alarm at the primary PSAP until the beginning of the transmittal of the response information via voice or electronic means to emergency response facilities (ERFs) or the emergency response units (ERUs) in the field.

3.3.53.3 *Alarm Processing Time.* The time interval from when the alarm is acknowledged at the communication center until response information begins to be transmitted via voice or electronic means to emergency response facilities (ERFs) and emergency response units (ERUs).

3.3.53.4 *Alarm Transfer Time.* The time interval from the receipt of the emergency alarm at the PSAP until the alarm is first received at the communication center.

3.3.53.5* *Initiating Action/Intervention Time.* The time interval from when a unit arrives on the scene to the initiation of emergency mitigation.

3.3.53.6* *Total Response Time.* The time interval from the receipt of the alarm at the primary PSAP to when the first emergency response unit is initiating action or intervening to control the incident.

3.3.53.7 *Travel Time.* The time interval that begins when a unit is en route to the emergency incident and ends when the unit arrives at the scene.

3.3.53.8 *Turnout Time.* The time interval that begins when the emergency response facilities (ERFs) and emergency response units (ERUs) notification process begins by either an audible alarm or visual annunciation or both and ends at the beginning point of travel time.

3.3.54 Total Response Time. See 3.3.53.6.

3.3.55 Travel Time. See 3.3.53.7.

3.3.56 Turnout Time. See 3.3.53.8.

Chapter 4 Organization

4.1 Fire Department Organizational Statement.

4.1.1* The authority having jurisdiction (AHJ) shall maintain a written statement or policy that establishes the following:

(1) Existence of the fire department
(2) Services that the fire department is required to provide
(3) Basic organizational structure
(4) Expected number of fire department members
(5) Functions that fire department members are expected to perform

4.1.2* The fire department organizational statement shall provide service delivery objectives, including specific time objectives for each major service component [i.e., fire suppression, emergency medical services (EMS), special operations, aircraft rescue and fire fighting, marine rescue and fire fighting, and/or wildland fire fighting] and objectives for the percentage of responses that meet the time objectives.

4.1.2.1 The fire department shall establish the following objectives:

(1) Alarm handling time to be completed in accordance with 4.1.2.3.
(2) 80 seconds turnout time for fire and special operations response and 60 seconds turnout time for EMS response
(3)*240 seconds or less travel time for the arrival of the first arriving engine company at a fire suppression incident
(4) For other than high-rise, 480 seconds or less travel time for the deployment of an initial full alarm assignment at a fire suppression incident
(5) For high-rise, 610 seconds or less travel time for the deployment of an initial full alarm assignment at a fire suppression incident
(6) 240 seconds or less travel time for the arrival of a unit with first responder with automatic external defibrillator (AED) or higher level capability at an emergency medical incident
(7) 480 seconds or less travel time for the arrival of an advanced life support (ALS) unit at an emergency medical incident, where this service is provided by the fire department provided a first responder with AED or basic life support (BLS) unit arrived in 240 seconds or less travel time

4.1.2.2 The fire department shall document the initiating action/intervention time.

4.1.2.3 Alarm Handling.

4.1.2.3.1 The fire department shall establish a performance objective of having an alarm answering time of not more than 15 seconds for at least 95 percent of the alarms received and not more than 40 seconds for at least 99 percent of the alarms received, as specified by NFPA 1221.

4.1.2.3.1.1 Any call not answered within 20 seconds shall be routed to a secondary answering (alternate) center if the primary center is full. An alarm should sound if a call is not answered (not processed, just answered) within 60 seconds.

4.1.2.3.2 When the alarm is received at a public safety answering point (PSAP) and transferred to a secondary answering point or communication center, the agency responsible for the PSAP shall establish a performance objective of having an alarm transfer time of not more than 30 seconds for at least 95 percent of all alarms processed, as specified by NFPA 1221.

4.1.2.3.3 The fire department shall establish a performance objective of having an alarm processing time of not more than 64 seconds for at least 90 percent of the alarms and not more than 106 seconds for at least 95 percent of the alarms, as specified by NFPA 1221.

4.1.2.3.3.1 Emergency alarm processing for the following call types shall be completed within 90 seconds 90 percent of the time and within 120 seconds 99 percent of the time:

(1) Calls requiring emergency medical dispatch questioning and pre-arrival medical instructions
(2) Calls requiring language translation
(3) Calls requiring the use of a TTY/TDD device or audio/video relay services
(4) Calls of criminal activity that require information vital to emergency responder safety prior to dispatching units
(5) Hazardous material incidents
(6) Technical rescue
(7) Calls that require determining the location of the alarm due to insufficient information
(8) Calls received by text message

4.1.2.4 The fire department shall establish a performance objective of not less than 90 percent for the achievement of each turnout time and travel time objective specified in 4.1.2.1.

4.1.2.5 Evaluations.

4.1.2.5.1* The fire department shall evaluate its level of service and deployment delivery and alarm handling time, turnout time, and travel time objectives on an annual basis.

4.1.2.5.2* The evaluations shall be based on emergency incident data relating to level of service, deployment, and the achievement of each time objective in each geographic area within the jurisdiction of the fire department.

4.1.2.6 The fire department shall provide the AHJ with a written report annually.

4.1.2.6.1 The annual report shall define the geographic areas and/or circumstances in which the requirements of this standard are not being met.

4.1.2.6.2 The annual report shall explain the predictable consequences of these deficiencies and address the steps that are necessary to achieve compliance.

4.2 Fire Suppression Services. The fire department organizational statement shall set forth the criteria for the various types of fire suppression incidents to which the fire department is required to respond.

4.3 Emergency Medical Services.

4.3.1 The fire department organizational statement shall set forth the criteria for the various types of emergency medical incidents to which the fire department is required and/or expected to respond.

4.3.2 The fire department organizational statement shall ensure that the fire department's emergency medical response capability includes personnel, equipment, and resources to deploy at the first responder level with AED or higher treatment level.

4.3.3 Where emergency medical services beyond the first responder with AED level are provided by another agency or private organization, the AHJ, based on recommendations from the fire department, shall include the minimum staffing, deployment, and response criteria as required in Section 5.3 in the following:

(1) The fire department organizational statement
(2) Any contract, service agreement, governmental agreement, or memorandum of understanding between the AHJ and the other agency or private organization

4.4 Special Operations.

4.4.1 The fire department organizational statement shall set forth the criteria for the various types of special operations response and mitigation activities to which the fire department is required or expected to respond.

4.4.2* The fire department organizational statement shall ensure that the fire department's hazardous materials response capability includes personnel, equipment, and resources to deploy at the first responder operational level as required by 29 CFR 1910.120.

4.4.3 The fire department organizational statement shall ensure that the fire department's confined space response capability includes personnel, equipment, and resources to deploy at the confined space operational level as required by 29 CFR 1910.146.

4.4.4 The fire department organizational statement shall set forth the criteria for the various types of fire department response during natural disasters or terrorism incidents, weapons of mass destruction incidents, or large-scale or mass casualty events.

4.5 Airport Rescue and Fire-Fighting Services. The fire department organizational statement shall set forth the criteria for the various types of airport rescue and fire-fighting incidents to which the fire department is required or expected to respond.

4.6 Marine Rescue and Fire-Fighting Services. The fire department organizational statement shall set forth the criteria for the various types of marine rescue and fire-fighting incidents to which the fire department is required or expected to respond.

4.7 Wildland Fire Suppression Services. The fire department organizational statement shall set forth the criteria for the various types of wildland fire suppression incidents to which the fire department is required and/or expected to respond.

4.8 Intercommunity Organization.

4.8.1* Mutual aid, automatic aid, and fire protection agreements shall be through a written intergovernmental agreement and shall address issues such as liability for injuries and deaths, disability retirements, cost of service, authorization to respond, staffing, and equipment, including the resources to

be made available, availability of interoperable communications, and the designation of the incident commander.

4.8.2 Procedures and training of personnel for all fire departments in mutual aid, automatic aid, and fire protection agreement plans shall be comprehensive to produce an effective fire force and to ensure uniform operations.

Chapter 5 Fire Department Services

5.1 Purpose.

5.1.1 The services provided by the fire department shall include those activities identified by the organizational statement developed as required by Chapter 4.

5.1.2 The procedures involved in providing these services, including operations and deployment, shall be established through written administrative regulations, standard operating procedures (SOPs), and departmental orders.

5.2* Fire Suppression Services.

5.2.1 Fire Suppression Capability.

5.2.1.1 Fire suppression operations shall be organized to ensure that the fire department's fire suppression capability encompasses deployment of personnel, equipment, and resources for an initial arriving company, the initial full alarm assignment, and additional alarm assignments.

5.2.1.2 The fire department shall be permitted to use established automatic aid and mutual aid agreements to comply with the requirements of Section 5.2.

5.2.2* Staffing. The number of on-duty fire suppression members shall be sufficient to perform the necessary fire-fighting operations given the expected fire-fighting conditions.

5.2.2.1 These numbers shall be determined through task analyses that take the following factors into consideration:

(1) Life hazard to the populace protected
(2) Provisions of safe and effective fire-fighting performance conditions for the fire fighters
(3) Potential property loss
(4) Nature, configuration, hazards, and internal protection of the properties involved
(5) Types of fireground tactics and evolutions employed as standard procedure, type of apparatus used, and results expected to be obtained at the fire scene

5.2.2.2* On-duty members assigned to fire suppression shall be organized into company units and shall have appropriate apparatus and equipment assigned to such companies.

5.2.2.2.1* The fire department shall identify minimum company staffing levels as necessary to meet the deployment criteria required in 5.2.4 to ensure that a sufficient number of members are assigned, on duty, and available to safely and effectively respond with each company.

5.2.2.2.2 Each company shall be led by an officer who shall be considered a part of the company.

5.2.2.2.3* Supervisory chief officers shall be dispatched or notified to respond to all full alarm assignments.

5.2.2.2.4 The supervisory chief officer shall ensure that the incident management system is established as required in Section 6.2.

5.2.2.2.5* Supervisory chief officers shall have staff aides deployed to them for purposes of incident management and accountability at emergency incidents.

5.2.3 Operating Units. Fire company staffing requirements shall be based on minimum levels necessary for safe, effective, and efficient emergency operations.

5.2.3.1 Fire companies whose primary functions are to pump and deliver water and perform basic fire fighting at fires, including search and rescue, shall be known as engine companies.

5.2.3.1.1 These companies shall be staffed with a minimum of four on-duty members.

5.2.3.1.2 In jurisdictions with a high number of incidents or geographical restrictions, as identified by the AHJ, these companies shall be staffed with a minimum of five on-duty members.

5.2.3.1.2.1 In jurisdictions with tactical hazards, high-hazard occupancies, or dense urban areas, as identified by the AHJ, these fire companies shall be staffed with a minimum of six on-duty members.

5.2.3.2 Fire companies whose primary functions are to perform the variety of services associated with truck work, such as forcible entry, ventilation, search and rescue, aerial operations for water delivery and rescue, utility control, illumination, overhaul, and salvage work, shall be known as ladder or truck companies.

5.2.3.2.1 These fire companies shall be staffed with a minimum of four on-duty members.

5.2.3.2.2 In jurisdictions with a high number of incidents or geographical restrictions, as identified by the AHJ, these fire companies shall be staffed with a minimum of five on-duty members.

5.2.3.2.2.1 In jurisdictions with tactical hazards, high-hazard occupancies, or dense urban areas, as identified by the AHJ, these fire companies shall be staffed with a minimum of six on-duty members.

5.2.3.3 Other Types of Companies.

5.2.3.3.1 Other types of companies equipped with specialized apparatus and equipment shall be provided to assist engine and ladder companies where necessary to support the fire departments' SOPs.

5.2.3.3.2 These companies shall be staffed with the minimum number of on-duty members required to deal with the tactical hazards, high-hazard occupancies, high incident frequencies, geographical restrictions, or other pertinent factors as identified by the AHJ.

5.2.3.4 Fire Companies with Quint Apparatus.

5.2.3.4.1 A fire company that deploys with quint apparatus, designed to operate as either an engine company or a ladder company, shall be staffed as specified in 5.2.3.

5.2.3.4.2 If the company is expected to perform multiple roles simultaneously, additional staffing, above the levels specified in 5.2.3, shall be provided to ensure that those operations can be performed as required.

5.2.4 Deployment.

5.2.4.1 Single-Family Dwelling Initial Full Alarm Assignment Capability.

5.2.4.1.1* The initial full alarm assignment to a structure fire in a typical 2000 ft^2 (186 m^2), two-story single-family dwelling

without basement and with no exposures shall provide for the following:

(1) Establishment of incident command outside of the hazard area for the overall coordination and direction of the initial full alarm assignment with a minimum of one member dedicated to this task
(2) Establishment of an uninterrupted water supply of a minimum of 400 gpm (1520 L/min) for 30 minutes with supply line(s) maintained by an operator
(3) Establishment of an effective water flow application rate of 300 gpm (1140 L/min) from two handlines, each of which has a minimum flow rate of 100 gpm (380 L/min) with each handline operated by a minimum of two members to effectively and safely maintain the line
(4) Provision of one support member for each attack and backup line deployed to provide hydrant hookup and to assist in laying of hose lines, utility control, and forcible entry
(5) Provision of at least one victim search and rescue team with each such team consisting of a minimum of two members
(6) Provision of at least one team, consisting of a minimum of two members, to raise ground ladders and perform ventilation
(7) If an aerial device is used in operations, one member to function as an aerial operator tomaintain primary control of the aerial device at all times
(8) Establishment of an IRIC consisting of a minimum of two properly equipped and trained members

5.2.4.1.2 When an incident escalates beyond an initial full alarm assignment, or when significant risk is present to the member due to the magnitude of the incident, the incident commander shall request an EMS crew consisting of a minimum of two members to provide treatment and transport for injured members and civilians.

5.2.4.1.3 When an incident escalates beyond an initial full alarm assignment or when significant risk is present to the members due to the magnitude of the incident, the incident commander shall upgrade the IRIC to a full rapid intervention crew (s) (RIC) that consists of an officer and at least three members who are fully equipped and trained in RIC operations.

5.2.4.2 Open-Air Strip Shopping Center Initial Full Alarm Assignment Capability.

5.2.4.2.1* The initial full alarm assignment to a structure fire in a typical open-air strip shopping center ranging from 13,000 ft^2 to 196,000 ft^2 (1203 m^2 to 18,209 m^2) in size shall provide for the following:

(1) Establishment of incident command outside the hazard area for the overall coordination, direction, and safety of the initial full alarm assignment with a minimum of two members dedicated to managing this task.
(2) Establishment of two uninterrupted water supplies at a minimum of 500 gpm (1892 L/min), with each supply line maintained by an operator.
(3) Establishment of an effective water flow application rate of 500 gpm (1892 L/min) from three handlines, each of which has a minimum flow rate of 150 gpm (568 L/min), with each handline operated by a minimum of two members to effectively and safely maintain each handline.
(4) Provision of one support member for each attack, backup, and exposure line deployed to provide hydrant hookup and to assist in laying of hose lines, utility control, and forcible entry.
(5) Provision of at least two victim search-and-rescue teams, each team consisting of a minimum of two members.
(6) Provision of at least two teams, each team consisting of a minimum of two members, to raise ground ladders and perform ventilation.
(7) If an aerial device(s) is used in operations, one member to function as an aerial operator and maintain primary control of the aerial device at all times.
(8) The establishment of an RIC consisting of an officer and at least three members who are fully equipped and trainedin RIC operations.
(9) The establishment of an initial medical care component consisting of at least two members capable of providing immediate on-scene emergency medical support and transport that provides rapid access to civilians or members potentially needing medical treatment. Where this level of emergency medical care is provided by outside agencies or organizations, these agencies and organizations shall be included in the deployment plan and meet these requirements.

5.2.4.3 Apartment Initial Full Alarm Assignment Capability.

5.2.4.3.1 The initial full alarm assignment to a structure fire in a typical 1200 ft^2 (111 m^2) apartment within a three-story, garden-style apartment building shall provide for the following:

(1) Establishment of incident command outside the hazard area for the overall coordination, direction, and safety of the initial full alarm assignment with a minimum of two members dedicated to managing this task.
(2) Establishment of two uninterrupted water supplies at a minimum of 400 gpm (1520 L/min), with each supply line maintained by an operator.
(3) Establishment of an effective water flow application rate of 300 gpm (1140 L/min) from three handlines, each of which has a minimum flow rate of 100 gpm (380 L/min), with each handline operated by a minimum of two members to effectively and safely maintain each handline.
(4) Provision of one support member for each attack, backup, and exposure line deployed to provide hydrant hookup and to assist in laying of hose lines, utility control, and forcible entry.
(5) Provision of at least two victim search-and-rescue teams, each team consisting of a minimum of two members.
(6) Provision of at least two teams, each team consisting of a minimum of two members, to raise ground ladders and perform ventilation.
(7) If an aerial device is used in operations, one member to function as an aerial operator and maintain primary control of the aerial device at all times.
(8) The establishment of an RIC consisting of an officer and at least three members who are fully equipped and trained in RIC operations.
(9) The establishment of an initial medical care component consisting of at least two members capable of providing immediate on-scene emergency medical support, and transport that provides rapid access to civilian or members potentially needing medical treatment. Where this level of emergency medical care is provided by outside agencies or organizations, those agencies and organizations must be included in the deployment plan and meet these requirements.

5.2.4.4* High-Rise Initial Full Alarm Assignment Capability.

5.2.4.4.1 Initial full alarm assignment to a fire in a building with the highest floor greater than 75 ft (23 m) above the

lowest level of fire department vehicle access shall provide for the following:

(1) Establishment of a stationary incident command post outside the hazard area for overall coordination and direction of the initial full alarm assignment with a minimum of one officer with an aide dedicated to these tasks. All operations shall be conducted in compliance with the incident command system.
(2) Establishment of an uninterrupted water supply to the building standpipe/sprinkler connection sufficient to support fire attack operations maintained by an operator. If the building is equipped with a fire pump, one additional member with a radio shall also be sent to the fire pump location to monitor and maintain operation.
(3) Establishment of an effective water flow application rate on the fire floor at a minimum of 500 gpm (1892 L/m) from two handlines, each operated by a minimum of two members to safely and effectively handle the line.
(4) Establishment of an effective water flow application rate on the floor above the fire floor at a minimum of 250 gpm (946 L/m) from at least one handline, with each handline deployed operated by a minimum of two members to safely and effectively handle the line.
(5) The establishment of an RIC consisting of four properly equipped and trained members to replace the IRIC two floors below the fire floor (non-IDLH atmosphere) or on the ground floor if the fire is on the second floor or below.
(6) Provision of two or more search-and-rescue teams consisting of a minimum of two members each.
(7) Provision of one officer, with an aide dedicated to these tasks, to establish oversight at or near the entry point on the fire floor(s) and on the floor above the fire.
(8) Provision of two or more evacuation management teams to assist and direct building occupants with evacuation or sheltering actions, with each team consisting of a minimum of two members.
(9) Provision of one or more members to account for and manage elevator operations.
(10) Provision of a minimum of one trained incident safety officer.
(11) Provision of a minimum of one officer two floors below the fire floor to manage the interior staging area.
(12) Provision of a minimum of two members to manage member rehabilitation. At least one of the members shall be trained to the ALS level.
(13) Provision of an officer and a minimum of three members to conduct vertical ventilation operations.
(14) Provision of a minimum of one officer to manage the building lobby operations.
(15) Provision of a minimum of two members to transport equipment to a location below the fire floor.
(16) Provision of one officer to manage external base operations.
(17) Provision of a minimum of two crews trained in emergency medical services with on-scene transport capability, each crew with a minimum of two members. At least one of the members shall be trained to the ALS level.

5.2.4.5 Additional Alarm Assignments.

5.2.4.5.1* Fire departments that respond to fires in occupancies that present hazards greater than those found in the occupancy described in 5.2.4.1 shall deploy additional resources on the initial alarm.

5.2.4.5.2* The fire department shall have the capability to deploy additional alarm assignments that can provide for additional command staff, members, and additional services, including the application of water to the fire; engagement in search and rescue, forcible entry, ventilation, and preservation of property; safety and accountability for personnel; and provision of support activities for those situations that are beyond the capability of the initial full alarm assignment.

5.2.4.5.3 An incident safety officer shall be deployed to all incidents that escalate beyond an initial full alarm assignment or when significant risk is present to members.

5.2.4.5.4 The incident safety officer shall ensure that the safety and health system is established as required in Section 6.1.

5.3* Emergency Medical Services (EMS). The purpose of this section shall be to provide standards for the delivery of EMS by fire departments.

5.3.1 The fire department shall clearly document its role, responsibilities, functions, and objectives for the delivery of EMS.

5.3.1.1 EMS operations shall be organized to ensure that the fire department's emergency medical capability includes members, equipment, and resources to deploy the initial arriving company and additional alarm assignments.

5.3.1.2 The fire department shall be permitted to use established automatic aid or mutual aid agreements to comply with the requirements of Section 5.3.

5.3.2* System Components.

5.3.2.1 Treatment Levels.

5.3.2.1.1 The basic treatment levels within an EMS system, for the purposes of this standard, shall be categorized as first responder, basic life support (BLS), and advanced life support (ALS).

5.3.2.1.2 The specific patient treatment capabilities associated with each level shall be determined by the AHJ based on the requirements for approval and licensing of EMS providers within each state or province.

5.3.2.2 Training Levels.

5.3.2.2.1 The minimal level of training for all members that respond to emergency incidents shall be to the first responder/AED level.

5.3.2.2.2 The AHJ shall determine if further training is required.

5.3.3 EMS System Functions.

5.3.3.1 The AHJ shall determine which of the following components of an EMS system the fire department shall be responsible for providing:

(1) Initial response to provide medical treatment at the location of the emergency (first responder with AED capability or higher)
(2) BLS response
(3) ALS response
(4) Patient transport in an ambulance or alternative vehicle designed to provide for uninterrupted patient care at the ALS or BLS level while en route to a medical facility
(5) Assurance of response and medical care through a quality management program

5.3.3.2 Staffing.

5.3.3.2.1 On-duty EMS units shall be staffed with the minimum members necessary for emergency medical care relative to the level of EMS provided by the fire department.

5.3.3.2.2 EMS staffing requirements shall be based on the minimum levels needed to provide patient care and member safety.

5.3.3.2.2.1 Units that provide emergency medical care shall be staffed at a minimum with members trained to the first responder/AED level.

5.3.3.2.2.2 Units that provide BLS transport shall be staffed and trained at the level prescribed by the state or provincial agency responsible for providing EMS licensing.

5.3.3.2.2.3 Units that provide ALS transport shall be staffed and trained at the level prescribed by the state or provincial agency responsible for providing EMS licensing.

5.3.3.3 Service Delivery Deployment.

5.3.3.3.1 The fire department shall adopt service delivery objectives based on time standards for the deployment of each service component for which it is responsible.

5.3.3.3.2 Personnel deployed to ALS emergency responses shall include a minimum of two members trained at the emergency medical technician–paramedic level and two members trained at the emergency medical technician–basic level arriving on scene within the established travel time.

5.3.4 Quality Management.

5.3.4.1 The fire department shall institute a quality management program to ensure that the service has met time objectives as required in 4.1.2 for all medical responses.

5.3.4.2 Fire Department Medical Personnel Review.

5.3.4.2.1 All first responder and BLS medical care provided by the fire department shall be reviewed by the fire department medical personnel.

5.3.4.2.2 This review process shall be documented.

5.3.4.3 Medical Director Review.

5.3.4.3.1 All fire departments with ALS services shall have a named medical director with the responsibility to oversee and ensure quality medical care in accordance with state or provincial laws or regulations.

5.3.4.3.2 This review process shall be documented.

5.3.4.4 Fire departments providing ALS services shall provide a mechanism for immediate communications with EMS supervision and medical oversight.

5.4 Special Operations Response. Special operations shall be organized to ensure that the fire department's special operations capability includes members, equipment, and resources to deploy the initial arriving company and additional alarm assignments providing such services.

5.4.1 The fire department shall be permitted to use established automatic aid or mutual aid agreements to comply with the requirements of Section 5.4.

5.4.2 The fire department shall adopt a special operations response plan and SOPs that specify the roles and responsibilities of the fire department and the authorized functions of members responding to hazardous materials emergency incidents.

5.4.3 All fire department members expected to respond to emergency incidents beyond the first responder operations level for hazardous materials response shall be trained to the applicable requirements of NFPA 472.

5.4.4 All fire department members expected to respond to emergency incidents beyond the confined space operations level for confined space operations shall be trained to the applicable requirements of NFPA 1670.

5.4.5 The fire department shall have the capacity to implement an RIC during all special operations incidents that would subject members to immediate danger or injury in the event of equipment failure or other sudden events, as required by NFPA 1500.

5.4.6 If a higher level of emergency response is needed beyond the capability of the fire department for special operations, the fire department shall determine the availability of outside resources that deploy these capabilities and the procedures for initiating their response.

5.4.7 The fire department shall limit its activities to only those specific special operations functions for which its members have been trained and are correctly equipped.

5.5 Airport Rescue and Fire-Fighting (ARFF) Services.

5.5.1 Airport fire departments shall adopt operations response plans and SOPs that specify the roles and responsibilities for nonaircraft incidents as required by 5.1.2.

5.5.2 ARFF operations shall be organized to ensure that the fire department's capability includes members, equipment, and resources to deploy the initial arriving company, the initial full alarm assignment, and additional alarm assignments as required in 5.2.4.

5.5.3 Airport fire departments shall have access to special tools, equipment, supplies, personal protective equipment (PPE), and other airport resources that are required to perform operations in their assigned roles and responsibilities.

5.5.4 Deployment.

5.5.4.1 The airport fire department shall deploy the required number of ARFF vehicles required for the airport's assigned category as established by NFPA 403.

5.5.4.2 Airport fire department companies equipped with specialized apparatus and equipment shall be provided to assist ARFF companies where deemed necessary as identified in 5.5.1.

5.5.4.3 Airport fire department companies that deploy to structure fire incidents on airport property shall meet the time objective requirements of 4.1.2.

5.5.4.4 Airport fire department companies that deploy to emergency medical incidents on airport property shall meet the time objective requirements of 4.1.2.

5.5.4.5 The airport fire department shall be permitted to use established automatic aid or mutual aid agreements to comply with the requirements of Section 5.5.

5.5.5 Staffing.

5.5.5.1 Airport fire department ARFF companies shall be staffed as required by NFPA 403.

5.5.5.2 Airport fire department companies that deploy to structure fire incidents on airport property shall meet the staffing requirements of 5.2.2.

5.5.5.3 Airport fire department companies that deploy to emergency medical incidents on airport property shall meet the staffing requirements of 5.3.3.2.

5.5.6 Emergency Operations.

5.5.6.1 At all emergency scene operations, an incident management system shall be used that meets the requirements of Section 6.2.

5.5.6.2* Incident command shall be established outside of the hazard area for the overall coordination and direction of the initial full alarm assignment.

5.5.6.3 An member shall be dedicated to the task of incident commander.

5.5.6.4 Incident Safety Officer.

5.5.6.4.1 An incident safety officer shall be deployed to all incidents that escalate beyond a full alarm assignment or when members face significant risk.

5.5.6.4.2 The incident safety officer shall ensure that the safety and health system is established as required in Section 6.1.

5.6* Marine Rescue and Fire-Fighting (MRFF) Services.

5.6.1 MRFF operations shall be organized to ensure that the fire department's marine capability includes members, equipment, and resources to deploy to the alarm assignments associated with a marine emergency incident.

5.6.2 Response Plan.

5.6.2.1 The fire department shall adopt a marine operations response plan and SOPs that specify the roles and responsibilities of the fire department and the authorized functions of members responding to marine emergencies.

5.6.2.2 Fire department marine operations response plans and SOPs shall be coordinated with the applicable agencies, such as the port or harbor authority and supporting agencies.

5.6.3 Marine fire departments shall have access to special tools, equipment, supplies, PPE, and other marine resources that are required to perform operations in their assigned roles and responsibilities.

5.6.4 Staffing.

5.6.4.1 Numbers of On-Duty Marine Personnel.

5.6.4.1.1 On-duty marine personnel shall consist of the number necessary for fire-fighting performance relative to the expected MRFF conditions.

5.6.4.1.2 On-duty marine members numbers shall be determined through task analyses as required for types of marine vessels and through additional task analyses that take the following factors into consideration:

(1) Life hazard to the populace protected
(2) Provisions of safe and effective fire-fighting performance conditions for the members
(3) Potential property loss
(4) Nature, configuration, hazards, and internal protection of the properties involved
(5) Types of tactics and evolutions employed as standard procedure, type of marine vessel used, and results expected to be obtained at the fire scene
(6) Requirements of the regulatory AHJs over navigable waters, ports, and harbors

5.6.4.2 Organization of On-Duty Members.

5.6.4.2.1 On-duty members assigned to marine fire fighting shall be organized into company units and shall have required vessels and equipment assigned to such companies.

5.6.4.2.2 Each marine company shall be led by an officer who shall be considered a part of the company.

5.6.5 Operating Units.

5.6.5.1* Fire companies whose primary function is to deliver and pump water and extinguishing agents at the scene of a marine incident shall be known as marine companies.

5.6.5.2 These companies shall be staffed with a minimum number of on-duty members as required by the tactical and occupancy hazards to which the marine vessel responds and by the regulatory AHJs over navigable waters, ports, and harbors.

5.7 Wildland Fire Suppression Services.

5.7.1 Wildland fire suppression operations shall be organized to ensure that the fire department's wildland fire suppression capability includes members, equipment, and resources to deploy wildland direct operations that can address marginal situations before they get out of control and wildland indirect fire-fighting operations that can be assembled and placed into operation against major wildland fires.

5.7.2 Organization.

5.7.2.1 Fire departments performing wildland operations shall adopt a wildland fire-fighting operations response plan and SOPs that specify the roles and responsibilities of the fire department and the authorized functions of members responding to wildland fire emergencies.

5.7.2.2 All wildland fire suppression operations shall be organized to ensure compliance with NFPA 1143.

5.7.3 Fire departments performing wildland operations shall have access to special tools, equipment, supplies, PPE, and other wildland resources that are required to perform operations in their assigned roles and responsibilities.

5.7.4 Staffing. The number of on-duty wildland fire-fighting personnel shall be sufficient to perform the necessary fire-fighting operations given the expected wildland fire-fighting conditions.

5.7.4.1 On-duty wildland fire-fighting members numbers shall be determined through task analyses that take the following factors into consideration:

(1) Life hazard to the populace protected
(2) Provisions of safe and effective fire-fighting performance conditions for the members
(3) The number of trained response members available to the department, including mutual aid resources
(4) Potential property loss
(5) Nature, configuration, hazards, and internal protection of the properties involved

(6) Types of wildland tactics and evolutions employed as standard procedure, type of apparatus used, and results expected to be obtained at the fire scene
(7) Topography, vegetation, and terrain in the response area(s)

5.7.4.2 On-duty personnel assigned to wildland operations shall be organized into company units and shall have required apparatus and equipment assigned to such companies.

5.7.4.2.1 The fire department shall identify minimum company staffing levels necessary to meet the deployment criteria to ensure that a sufficient number of members are assigned, on duty, and available to respond with each company.

5.7.4.2.2 Each company shall be led by an officer who shall be considered a part of the company.

5.7.4.2.3 Supervisory chief officers shall be dispatched or notified to respond to all full alarm assignments.

5.7.4.2.4 The supervisory chief officer shall ensure that the incident management system is established as required in Section 6.2.

5.7.5 Operating Units. Fire companies whose primary function is to deliver and pump water and extinguishing agents at the scene of a wildland fire shall be known as wildland companies.

5.7.5.1 These companies shall be staffed with a minimum of four on-duty members.

5.7.5.2 Engine and ladder (truck) companies that respond to wildland fire fighting and/or urban interface wildland fire fighting incidents shall be staffed as required by 5.2.3.

5.7.5.3 Other Types of Companies.

5.7.5.3.1 Other types of companies equipped with specialized apparatus and equipment for wildland fire fighting, including aircraft, heavy equipment, mini pumpers, and fast attack vehicles, shall be provided to assist wildland engine and ladder companies where deemed necessary as part of established practice.

5.7.5.3.2 These companies shall be staffed with a minimum number of on-duty personnel as required by the tactical, topographical, environmental, fuel (vegetation), and occupancy hazards.

5.7.6 Deployment.

5.7.6.1 Required Number of Vehicles.

5.7.6.1.1 The fire department shall deploy from its wildland resources the number of vehicles required for a direct and/or indirect attack.

5.7.6.1.2* Prior to the initiation of any wildland fire attack, the fire department shall have the capacity to establish a lookout(s), communications with all crew members, escape route(s), and safety zone(s) for vehicles and members.

5.7.6.2 Direct Attack.

5.7.6.2.1 The fire department shall have the capability to initiate a direct wildland attack within 10 minutes after arrival of the initial company or crew at the fire scene.

5.7.6.2.2 One member in the first arriving company or crew shall be assigned as the incident commander for the overall coordination and direction of the direct attack activities.

5.7.6.2.3 The direct wildland attack shall include the establishment of an effective water flow application rate of 30 gpm (114 L/min) from at least two 500 ft (150 m) 1½ in. (38 mm) diameter attack handlines from two engines.

5.7.6.2.4 Each attack handline shall be operated by a minimum of two members to deploy and maintain the line.

5.7.6.2.5 One operator shall remain with each fire apparatus supplying water flow to ensure uninterrupted water flow application.

5.7.6.2.6 A wildland crew leader or company officer shall be provided with each crew to be responsible for overall supervision of each of the crew and for maintaining personnel accountability and crew safety.

5.7.6.3 Indirect Attack.

5.7.6.3.1 The fire department providing wildland fire suppression operations shall have the capability to deploy an indirect attack, including application of water to the fire, engagement in search and rescue and preservation of property, accountability for personnel, and provision of support activities for those situations that are beyond the capability of the direct attack.

5.7.6.3.2 An incident safety officer shall be deployed to all incidents that escalate beyond a direct attack alarm assignment or when members face significant risk.

5.7.7 Non-Wildland Emergencies.

5.7.7.1 Wildland companies that deploy to structure fire incidents shall meet the time objective requirements of 4.1.2.

5.7.7.2 Wildland companies that deploy to emergency medical incidents shall meet the time objective requirements of 4.1.2.

Chapter 6 Systems

6.1 Safety and Health System. A fire-fighter occupational safety and health program shall be provided in accordance with NFPA 1500.

6.2* Incident Management System.

6.2.1 An incident management system shall be provided in accordance with NFPA 1561 to form the basic structure of all emergency operations of the fire department, regardless of the scale of the department or the emergency.

6.2.2* An incident management system shall be designed to manage incidents of different types, including structure fires, wildland fires, hazardous materials incidents, emergency medical operations, and other types of emergencies that could be encountered by the department.

6.3 Training Systems.

6.3.1 The fire department shall have a training program and policy that ensure that members are trained and competency is maintained to execute all responsibilities consistent with the department's organization and deployment as addressed in Chapters 4 and 5.

6.3.2 The agency must demonstrate in its annual report that it has ensured competency for necessary knowledge, skills, and abilities based on the community's specific hazards and risks, to include at least the hazards specifically addressed in

this standard, for each member that is considered part of the effective response force.

6.3.3 The agency must adopt training standards based on the sited hazards and risk, set appropriate objectives to achieve the standards, and demonstrate that it is meeting the objectives as part of demonstrating training and competency.

6.4 Communications Systems.

6.4.1 The fire department shall have a reliable communications system to facilitate prompt delivery of public fire suppression, EMS, and special operations.

6.4.2 All communications facilities, equipment, staffing, operating procedures, performance objectives, and reporting shall comply with NFPA 1221.

6.4.3 Operating procedures for radio communications shall provide for the use of standard protocols and terminology at all types of incidents.

6.4.4 Standard terminology, in compliance with NFPA 1561, shall be established to transmit information, including strategic modes of operation, situation reports, and emergency notifications of imminent hazards.

6.5* Pre-Incident Planning.

6.5.1 The fire department shall set forth operational requirements to conduct pre-incident planning.

6.5.2 Particular attention shall be provided to all target hazards.

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 The standard includes minimum requirements that are intended to provide effective, efficient, and safe protective services that operate on a sound basis to prevent fires, reduce risk to lives and property, deal with incidents that occur, and prepare for anticipated incidents. It sets minimum standards considered necessary for the provision of public fire protection by career fire departments. It addresses the structure and operation of organizations providing such services, including fire suppression and other assigned emergency response responsibilities, which include EMS and special operations.

A.1.2.1 A fundamental concept of fire risk is associated with modern society. Public fire service organizations are expected to reduce the risk within their areas of jurisdiction by taking measures to prevent the outbreak of fires, limit the extent and severity of fires, provide for the removal or rescue of endangered persons, control and extinguish fires that occur within the jurisdiction, and perform other emergency response operations and delivery of EMS.

The cumulative effects of preventive efforts, risk reduction and control, and fire suppression capabilities result in variable levels of risk to the jurisdictions and their residents.

The risk remaining after deducting the cumulative effect of the public fire service organization's efforts is the responsibility of each individual, including owners, operators, occupants, and casual visitors to properties. It should be noted that fire risk cannot be completely avoided or eliminated.

A.1.4 Nothing in this standard is intended to prohibit the use of systems, methods, or approaches of equivalent or superior performance to those prescribed by this standard. The equivalency statement contained in this standard allows jurisdictions to use other "systems, methods, or approaches" to meet requirements of the standard if they can validate and document in writing that such are equal or superior to the requirements contained in the standard. This equivalency statement is not intended to allow any jurisdiction or fire department to reduce the requirements in the standard and still claim compliance. Moreover, it specifically requires any jurisdiction relying on "equivalent" systems, methods, or approaches to validate, demonstrate, and document in writing that the standard is equal or superior to the requirements contained in this standard.

The authority having jurisdiction (AHJ) determines what systems, methods, or approaches are equivalent or superior in performance. The AHJ should approach the assessment by reviewing the overall public fire protection and EMS system performance.

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.3.3.2.1 Automatic Aid. Automatic aid is established through a written intergovernmental agreement that provides for the simultaneous dispatch of a predetermined response of personnel and equipment to a neighboring jurisdiction upon receipt of an alarm and is included as part of a communication center's dispatch protocols.

A.3.3.4 Aircraft Rescue and Fire-Fighting (ARFF) Vehicle. The apparatus is typically equipped with a large water tank [commencing at 1000 gal (3800 L) and extending to over 6000 gal (22,800 L)]; a supply of fire-fighting extinguishing agents; remote-controlled large roof turret(s), extendable turret nozzle(s), and bumper turret(s) (ground sweep nozzles) that are used for the discharge of extinguishing agent; and pre-connected handlines.

A.3.3.5 Alarm. In some jurisdictions, an alarm is referred to as an incident or call for service.

A.3.3.13 Company. For fire suppression and other emergency operations, in some jurisdictions, the response capability of the initial arriving company is configured with two apparatus operating together. This can be a result of apparatus not being configured with seated and belted positions for four members, therefore requiring a second vehicle to carry additional personnel. It can also be the result of the fire department's SOPs, which require two apparatus operating together to complete the operational procedures. The objective is to ensure that a minimum of four personnel are assigned to and deployed as a company. The two (or more) pieces of apparatus would always be dispatched and respond together as a single company. Some examples of this include the following:

(1) A pumper and tanker/tender that would be responding together outside a municipal water district
(2) A multiple-piece company, specified as such in a fire department's SOPs, such as an engine or ladder company that responds with a rescue unit, water tender, or other type of apparatus
(3) A company that consists of a pumper with an additional vehicle as a personnel carrier
(4) A pumper and an ambulance or rescue unit that always respond together

A.3.3.21.1 Aircraft Rescue and Fire Fighting. Such rescue and fire-fighting actions are performed both inside and outside of the aircraft.

A.3.3.21.2 Marine Rescue and Fire Fighting. Marine companies can be utilized for special operations, including a platform for dive and scuba operations and for providing a secure water supply for land-based operations.

A.3.3.23 Fire Suppression. Fire suppression includes all activities performed at the scene of a fire incident or training exercise that expose fire department members to the dangers of heat, flame, smoke, and other products of combustion, explosion, or structural collapse. [1500, 2013]

A.3.3.24 First Responder (EMS). A first responder also assists higher level EMS providers.

A.3.3.26 Hazard. Hazards include the characteristics of facilities, equipment systems, property, hardware, or other objects; and the actions and inactions of people that create such hazards.

A.3.3.28 High-Hazard Occupancy. These occupancies include schools, hospitals, and other special medical facilities, nursing homes, high-risk residential occupancies, neighborhoods with structures in close proximity to one another, high-rise buildings, explosives plants, refineries, and hazardous materials occupancies.

A.3.3.30 Incident Management System (IMS). The system should be consistent with NIMS and the National Response Framework. The system is also referred to as an incident command system (ICS).

A.3.3.36.2 Basic Life Support (BLS). Basic life support could also include expediting the safe and timely transport of the patient to a hospital emergency department for definitive medical care.

A.3.3.38 Member. A fire department member can be a full-time or part-time employee or a paid or unpaid volunteer, can occupy any position or rank within the fire department, and can engage in emergency operations. [1500, 2013]

A.3.3.40.1 Company Officer. This person can be someone appointed in an acting capacity. The rank structure could be either sergeant, lieutenant, or captain.

A.3.3.40.3 Supervisory Chief Officer. The position of supervisory chief officer is above that of a company officer, who responds automatically and/or is dispatched to an alarm beyond the initial alarm capabilities, or other special calls. In some jurisdictions, this is the rank of battalion chief, district chief, deputy chief, assistant chief, or senior divisional officer (U.K. fire service).

A.3.3.41.2 Special Operations. Special operations include water rescue, extrication, hazardous materials, confined space entry, high-angle rescue, aircraft rescue and fire fighting, and other operations requiring specialized training. [1500, 2013]

A.3.3.44 Rapid Intervention Crew (RIC). The RIC reports directly to the incident commander or operations chief. This dedicated crew is not to be confused with the IRIC.

A.3.3.48 Staff Aide. This member is assigned to a supervisory chief officer who assists at incident scene operations, which can include personnel accountability, communications, and other logistical and administrative support. In addition, this member can assist in coordinating training activities, respond to citizen inquiries, coordinate staffing issues and sick leave follow-up, and assign resource allocations for facilities and apparatus under the supervisory chief officer's jurisdiction. Staff aides can be known as field incident technician, staff assistant, battalion fire fighter, or battalion adjutant.

A.3.3.53.5 Initiating Action/Intervention Time. A benchmark time frame isn't set to initiate a mitigating action or take other steps to intervene in resolving the issue that created the incident. Fire departments should track these times based on their SOPs and evaluate the data based on the nature of the incident.

A.3.3.53.6 Total Response Time. A "cascade of events" chart, shown as Figure A.3.3.53.6, is provided to assist understanding the relationship between NFPA 1221, NFPA 1710, and Initiating Time/Intervention Time (currently not addressed by a single NFPA standard). Three phases are included in total response time. They are as follows:

(1) Phase One — Alarm Handling Time, which includes alarm transfer time, alarm answering time, and alarm processing time (addressed by NFPA 1221)
(2) Phase Two — Turnout Time and Travel Time (addressed by NFPA 1710)
(3) Phase Three — Initiating Action/Intervention Time

A.4.1.1 The AHJ generally has the responsibility to determine the following:

(1) Scope and level of service provided by the fire department
(2) Necessary level of funding
(3) Necessary level of personnel and resources, including facilities

To provide service, the AHJ should have the power to levy taxes or solicit funding, to own property and equipment, and to cover personnel costs. The authority necessary is conveyed by law to a local jurisdiction.

In addition, the governing body also should monitor the achievement of the management goals of the department,

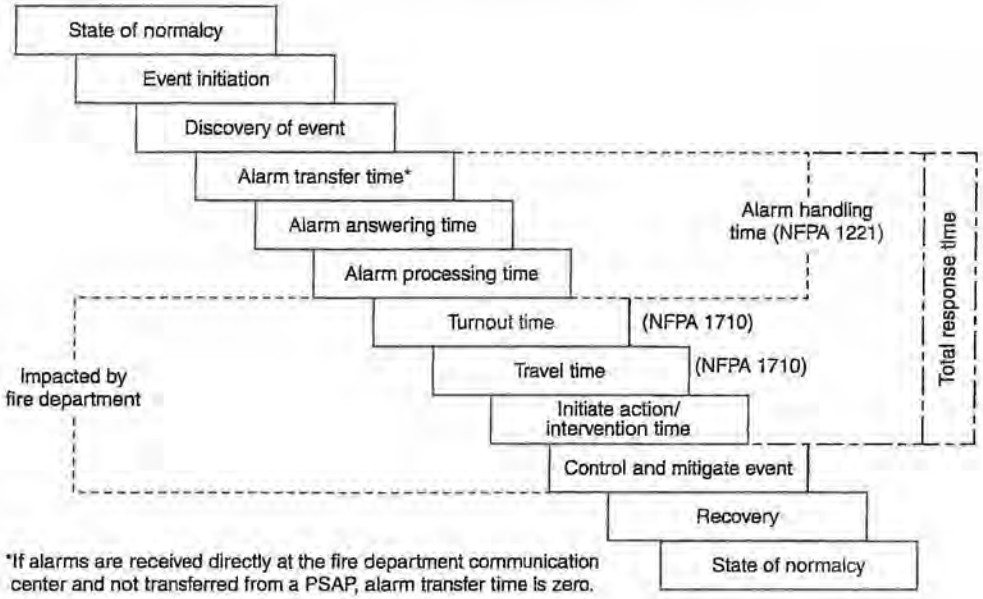


FIGURE A.3.3.53.6 Cascade of Events Chart.

such as fire prevention, community life safety education, fire suppression, employee training, communications, maintenance, and department administration.

The organizational statement is a very important basis for many of the provisions of this standard. The statement sets forth the legal basis for operating a fire department, the organizational structure of the fire department, number of members, training requirements, expected functions, and authorities and responsibilities of various members or defined positions.

A key point is to clearly set out the specific services the fire department is authorized and expected to perform. Most fire departments are responsible to a governing body. The governing body has the right and should assert its authority to set the specific services and the limits of the services the fire department will provide. It also has the responsibility to furnish the necessary resources for delivery of the designated services. The fire department should provide its governing body with a specific description of each service, with options or alternatives and an accurate analysis of the costs and resources needed for each service.

Such services could include structural fire fighting, wildland fire fighting, airport/aircraft fire fighting, emergency medical services, hazardous materials response, high-angle rescue, heavy rescue, and others.

Spelling out the specific parameters of services to be provided allows the fire department to plan, staff, equip, train, and deploy members to perform these duties. It also gives the governing body an accounting of the costs of services and allows it to select those services it can afford to provide. Likewise, the governing body should identify services it cannot afford to provide and cannot authorize the fire department to deliver, or it should assign those services to another agency.

The factors that should be included in the AHJ's risk assessment process include adopted building codes, required fire/life safety related engineering controls, accepted service delivery performance objectives, complexity of facilities, and occupancy hazards (low, medium, and high) within the jurisdiction.

The fire department should be no different than any other government agency that has the parameters of its authority and services clearly defined by the governing body.

Legal counsel should be used to ensure that any statutory services and responsibilities are being met.

The majority of public fire departments are established under the charter provisions of their governing body or through the adoption of statutes. These acts define the legal basis for operating a fire department, the mission of the organization, the duties that are authorized and expected to be performed, and the authority and responsibilities that are assigned to certain members to direct the operations of the fire department.

The documents that officially establish the fire department as an identifiable organization are necessary to determine specific responsibilities and to determine the parties responsible for compliance with the provisions of this standard.

In many cases, these documents can be part of state laws, a municipal charter, or an annual budget. In such cases, it would be appropriate to make these existing documents part of the organizational statement, if applicable.

A.4.1.2 There can be incidents or areas where the response criteria are affected by circumstances such as response personnel who are not on duty, unstaffed fire station facilities, natural barriers, traffic congestion, insufficient water supply, and density of population or property. The reduced level of service should be documented in the written organizational statement by the percentage of incidents and geographical areas for which the total response time criteria are achieved.

Additional service delivery performance objectives should be established by the AHJ for occupancies other than those identified within the standard for benchmark single-family dwellings. Factors to be considered include specific response areas (i.e., suburban, rural, and wilderness) and occupancy hazards.

A.4.1.2.1(3) This service delivery requirement is intended to have a fire department plan and situate its resources to consistently meet a 240-second travel time for the initial company fire suppression response; for other than high-rise, a 480-second travel time for the full alarm fire response assignment; and for high-rise, a 610-second travel time for the full alarm fire response assignment.

A.4.1.2.5.1 The evaluation of the fire department's provided level of service needs to be performed against the AHJ's established service delivery performance objectives. These objectives should be based on a jurisdictional risk assessment. The objectives established within this standard are based on a 2000 ft^2 (186 m^2), two-story, single-family home without a basement and having no exposures. The AHJ's response objectives should be established based on numerous factors such as the circumstances affecting response personnel, adopted building codes, required fire/life safety-related engineering controls, accepted turnout/travel times, complexity of facilities, and occupancy hazards within the jurisdiction.

A.4.1.2.5.2 The collection of data is required to determine the organization's ability to meet its locally determined objectives and the performance objectives contained in the standard with regard to emergency incidences (warning lights and sirens). Organizations respond to numerous types of emergency and nonemergency incidents. While the collection and analysis of all of the response data is important, attainment of the 90 percent objective is only to be evaluated against emergency incident responses.

A.4.4.2 Occupational Safety and Health Administration (OSHA) regulations require that all fire departments be trained to respond to hazardous materials incidents at the first responder operations level.

Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA), known as the Emergency Planning and Community Right-to-Know Act, established requirements for federal, state, and local governments and industrial facilities regarding emergency planning for spills or other releases, community right-to-know, and reporting of hazardous and toxic chemicals.

The Emergency Planning and Community Right-to-Know Act covers the following four major areas that provide the fire service and communities with a broad perspective on the chemical hazards within the local area and those at individual facilities:

(1) Sections 301 through 303 — emergency planning
(2) Section 304 — emergency release notification
(3) Sections 311 and 312 — community right-to-know reporting requirements
(4) Section 313 — toxic chemical release inventory

A.4.8.1 Where appropriate, the mutual aid agreement should include automatic responses on first alarms (automatic aid). This concept contemplates joint response of designated apparatus and personnel on a predetermined running assignment basis.

Mutual aid concepts should be considered on a regional basis. In an effective mutual aid arrangement, each fire department should retain reserves of personnel and apparatus. Traditionally and legally, overall command of the incident is vested with the senior officer of the jurisdiction experiencing the emergency.

Some areas use consolidated dispatching to coordinate the response of fire companies to assist an outside fire department. The management of responses can be made easier by utilizing computerization, "running cards," and other advance planning.

A.5.2 Suppression capability is an expression of how much fire-fighting power can be put into action when there is a fire. It includes the amount of apparatus, equipment, and personnel available; the time needed to respond and place equipment in action; the water supply; the application of strategy and tactics; the level of training; and all of the components that add up to effective fireground operations.

A.5.2.2 For more information, see NFPA 1250; FEMA, National Fire Academy, "Fire Risk Analysis: A Systems Approach"; and Phoenix, AZ, Fire Department, "Fire Department Evaluation System (FIREDAP)."

A.5.2.2.2 For further information on companies, see 3.3.13 and A.3.3.13.

A.5.2.2.2.1 An early, aggressive, and offensive primary interior attack on a working fire, where feasible, is usually the most effective strategy to reduce loss of lives and property damage. In Figure A.5.2.2.2.1, the line, which combines temperature rise and time, represents a rate of fire propagation in an unsprinklered room and roughly corresponds to the percentage of property destruction. At approximately 10 minutes into the fire sequence, the hypothetical room of origin flashes over. Extension outside the room begins at that point.

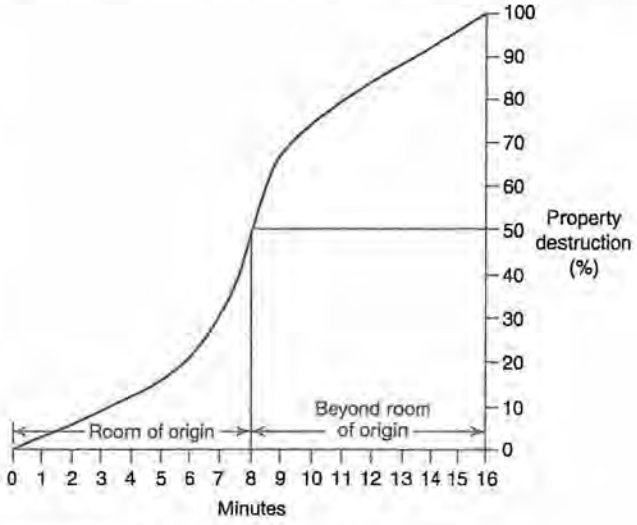


FIGURE A.5.2.2.2.1 Fire Propagation Curve.

Consequently, given that the progression of a structure fire to the point of flashover (i.e., the very rapid spreading of the fire due to superheating of room contents and other combustibles) generally occurs in less than 10 minutes, two of the most important elements in limiting fire spread are the quick arrival of sufficient personnel and equipment to attack and extinguish the fire as close to the point of its origin as possible. For more information, refer to *Fire Service Today*, "Reduced Staffing: At What Cost," and NIST, "Hazard I Fire Hazard Assessment Method." Also, refer to National Fire Academy, "Fire Risk Analysis: A Systems Approach," and Office of the Ontario Fire Marshal, *Shaping the Future of Fire Ground Staffing and Delivery Systems Within a Comprehensive Fire Safety Effectiveness Model.*

The ability of adequate fire suppression forces to significantly influence the outcome of a structure fire is undeniable and predictable. Data generated by NFPA and used by the committee in developing this standard provide empirical data that rapid and aggressive interior attack can substantially reduce the human and property losses associated with structure fires *[see Table A.5.2.2.2.1(a) and Table A.5.2.2.2.1(b)]*.

The NFPA Fire Analysis and Research Division provided the data in Table A.5.2.2.2.1(b) as an update of Table A.5.2.2.2.1(a).

Table A.5.2.2.2.1(a) Fire Extension in Residential Structures, 1994–1998

	Rate per 1000 Fires		
Extension	Civilian Deaths	Civilian Injuries	Average Dollar Loss per Fire
Confined to room of origin	2.32	35.19	$3,185
Beyond the room but confined to floor of origin	19.68	96.86	$22,720
Beyond floor of origin	26.54	63.48	$31,912

Note: Residential structures include dwellings, duplexes, manufactured homes (also called mobile homes), apartments, row houses, townhouses, hotels and motels, dormitories, and barracks.
Source: NFPA Annual Fire Experience Survey and National Fire Incident Reporting System (NFIRS).

A.5.2.2.2.3 The assignment of specific response districts to command officers should be based on the number of companies, workload, and response distances. Department administrative procedures should indicate clearly the jurisdiction of command officers.

A.5.2.2.2.5 For further information on staff aides, see 3.3.48 and A.3.3.48.

A.5.2.4.1.1 The hazards presented by this scenario are not unusual, as all communities respond to fire incidents in this type of structure on a regular basis.

A.5.2.4.2.1 The open-air strip shopping center represents more than 67 percent of types of shopping centers, as described by the International Council of Shopping Centers (ICSC). The ICSC describes these centers as "usually configured in a straight line as a strip, or may be laid out in an L or U shape, depending on the site and design. They consist of an attached row of stores or service outlets managed as a coherent retail entity, with on-site parking usually located in front of the stores. Open canopies may connect the store fronts, but a strip center does not have enclosed walkways linking the stores. The open air strip shopping center may contain between five and 40 stores of varying occupancy types and hazards with three or more being larger, anchor stores such as a discount store, supermarket, drug, or large specialty discount store."

A.5.2.4.4 See "Report on High-Rise Fireground Field Experiments," NIST, April 2013, for more information.

A.5.2.4.5.1 Other occupancies and structures in the community that present greater hazards should be addressed by additional fire fighter functions and additional responding personnel on the initial full alarm assignment. The NFPA *Fire Protection Handbook* categorizes occupancies in three broad groups:

(1) High-hazard occupancies: schools, hospitals, nursing homes, explosives plants, refineries, high-rise buildings, and other high life hazard or large fire potential occupancies
(2) Medium-hazard occupancies: apartments, offices, mercantile, and industrial occupancies not normally requiring extensive rescue or fire-fighting forces
(3) Low-hazard occupancies: one-, two- or three-family dwellings and scattered small businesses and industrial occupancies. The NFPA 1710 benchmark occupancy fits into this low-hazard category.

In determining the initial responding force to these occupancies, AHJs must consider the additional potential of fire

Table A.5.2.2.2.1(b) Fire Extension Home Structure Fires, 2006–2010 Rate per 1000 Fires

	Rate per 1000 Fires		
Flame Spread	Civilian Deaths	Civilian Injuries	Average Dollar Loss per Fire
Confined fires or contained fire identified by incident type*	0.000	10.29	$212
Confined fire or flame damage confined toobject of origin	0.65	13.53	$1,565
Confined to room of origin, including confined fires and fires confined to object	1.91	25.32	$2,993
Beyond the room but confined to floor of origin	22.73	64.13	$7,445
Beyond floor of origin	24.63	60.41	$58,431

* NFIRS 5.0 has six categories of confined structure fires: cooking fires confined to the cooking vessel, confined chimney or flue fires, confined incinerator fires, confined fuel burner or boiler fires or delayed ignitions, confined commercial compactor fires, and trash or rubbish fires in a structure with no flame damage to the structure or its contents.
Note: Homes include one- and two-family homes (including manufactured housing) and apartments or other multifamily housing. These statistics are national estimates based on fires reported to U.S. municipal fire departments and so exclude fires reported only to federal or state agencies. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Property damage has not been adjusted for inflation.
Source: NFPA Annual Fire Experience Survey and National Fire Incident Reporting System (NFIRS).

spread, types of combustibles, increased life hazard, and various tasks that must be accomplished to achieve their mission.

A.5.2.4.5.2 Once units arrive, or a determination is made that other resources are required, additional alarms should be called for and dispatched. Departments should have predetermined procedures for additional alarms. Many departments send the same number and type of units on the second alarm as on the first alarm. Incident commanders can always request unique resources when required. Many departments will only be able to handle additional alarms through automatic or mutual aid agreements that have been previously established.

A.5.3 An EMS system is defined as a comprehensive, coordinated arrangement of resources and functions that are organized to respond in a timely, staged manner to medical emergencies, regardless of their cause. The term *system* can be applied locally or at the state, provincial, or national level. The fundamental functions of an EMS system are the following:

(1) System organization and management
(2) Medical direction
(3) Human resources and training
(4) Communications
(5) Emergency response
(6) Transportation
(7) Care facilities
(8) Quality assurance
(9) Public information and education
(10) Disaster medical services
(11) Research
(12) Special populations

A.5.3.2 The following four functions do not necessarily exist as separate elements in a particular system:

(1) The first responding unit can be an advanced life support (ALS) ambulance that can provide ALS treatment and ambulance transportation.
(2) The first responding unit can be a fire suppression unit that can provide both initial and advanced-level medical care.
(3) ALS can be provided by the ambulance or by an additional fire suppression unit or a unit that is dedicated to ALS response only.
(4) The system might not have ALS treatment capability — only a fire apparatus with fire fighters trained as first responder AED can respond.

A.5.5.6.2 The U.S. Air Force has defined the areas involved in the emergency within 75 ft (23 m) of the aircraft as immediately dangerous to life and health (IDLH).

A.5.6 For additional information on marine fire fighting, see NFPA 1405.

A.5.6.5.1 For additional information on marine rescue and fire-fighting vessels, see NFPA 1925.

A.5.7.6.1.2 A system developed by Chief Paul Gleason of the United States Forest Service addresses specific mandatory fire orders in a system termed *LCES*, which stands for lookout(s), communication(s), escape route(s), and safety zone(s). These four items are to be implemented as an integrated system by a single resource unit, a strike team, or a full assignment. The implementation of LCES is a minimum safety requirement prior to the initiation of any wildland fire-fighting operations.

A.6.2 Emergency incidents can involve operations that vary considerably in their complexity and scale. The control of these incidents depends on the planned, systematic implementation of an effective fireground organization to accomplish identified objectives. Every fire department, regardless of size, needs a proper system to regulate and direct emergency forces and equipment at both routine and major incidents. The incident management system forms the basic structure of operations, regardless of scale. An effective system is designed to manage incidents of different types, including structure fires, wildland fires, hazardous materials incidents, and medical and other emergencies.

A.6.2.2 Unlike fire incidents where command is normally predicated by rank structure, EMS patient care is based on statutory recognition of the member with the highest level of medical certification. The recommendation is that departments adopt protocols that define the degree of both member and nonmember involvement in direct patient care based on local standards, medical control, and statutory requirements.

A.6.5 For additional information, see NFPA 1620.

Annex B Community-Wide Risk Management Model

This annex is not a part of the requirements of this NFPA document but is included for information purposes only.

B.1 This model is an example of how a community-wide risk management plan can be used to protect both citizens and property. While NFPA 1710 is scoped to focus strictly on deployment, staffing, and service levels, it is one component of a total community fire protection planning process. An AHJ can determine other components that could reduce the risks of fire and adopt stronger building and fire prevention codes, enforce those more vigorously, and enhance public life safety education components. This model is included for that purpose. Figure B.1 illustrates a fire department process map.

NFPA 1730, Chapter 5 establishes a process to identify and analyze community risks to assist in the development and implementation of a community risk reduction (CRR) plan. Detailed guidance on conducting a CRR plan is provided in Annex B of NFPA 1730.

For other documents on community risk assessment and community risk reduction, see: *Fire Service Deployment: Assessing Community Vulnerability*, Urban Fire Forum; *ISO Fire Suppression Rating Schedule*; *CPSE Standard of Cover*; *IFE V2020 CRR 2009 Project Report*; *IFE V2020 CRR Symposium Report*; and *Washington Association of State Fire Marshals CRR Project Report*.

B.1.1 This annex addresses the need for fire departments to develop an overall "defense-in-depth" strategy for the delivery of fire services. The development of such a strategy should include an assessment of the tools available to the fire service for accomplishing the goals of fire safety.

B.1.2 Fire safety objectives can be defined as those ideas that a department aspires to deliver. For example, fire department objectives could include such statements as "Maintain injuries and life/property losses as low as reasonably achievable (community and department)." The accomplishment of this objective should not be left to fire-fighting operations alone. See Figure B.1.2 for fire safety concepts.

B.1.3 Fire prevention is not simply preventing fire. It is the systematic application of codes, standard, engineering principles, and an understanding of human behavior to achieve the objective of limiting the loss of life and property.

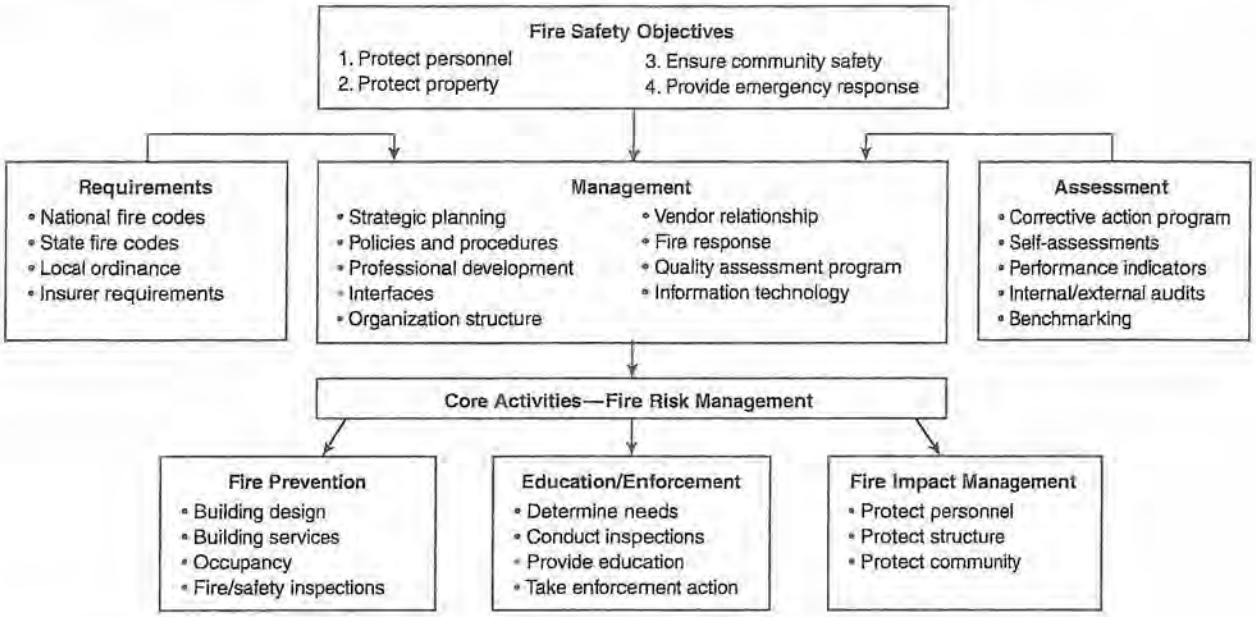


FIGURE B.1 Fire Department Process Map.

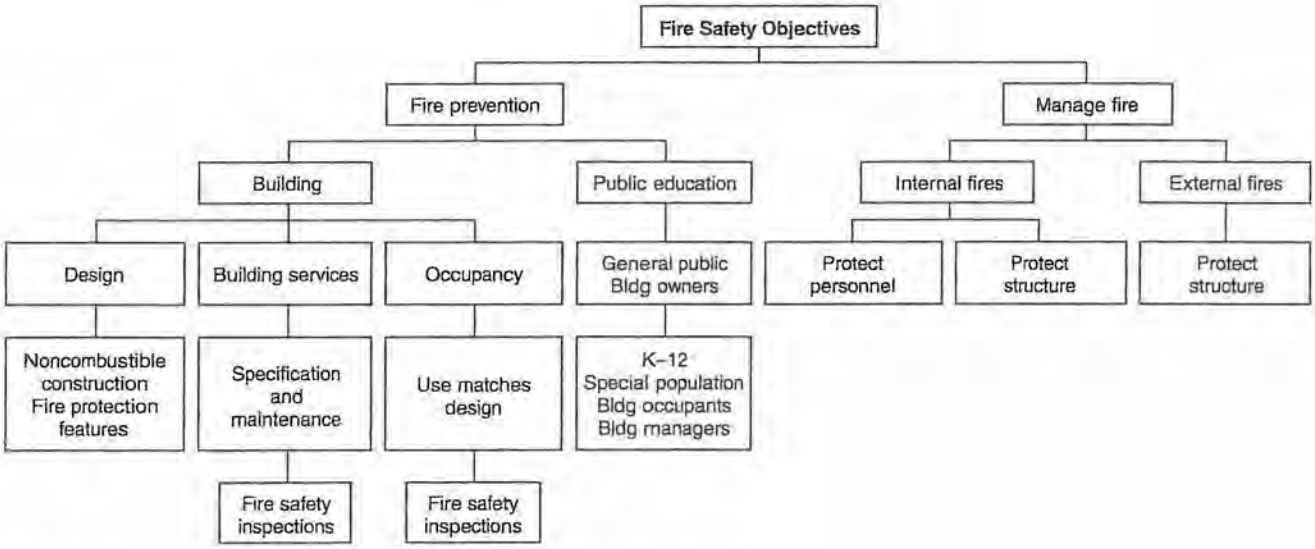


FIGURE B.1.2 Fire Safety Concepts for Fire Department Operations.

B.1.3.1 As outlined in NFPA 1, fire prevention includes egress, construction design, building services, fire protection, and occupancy. All of these elements work together to provide the occupants and fire department personnel with a level of fire safety not otherwise available.

B.1.3.2 By ensuring that each of these elements is balanced, the fire department can maintain a reasonable level of risk for the community and the department.

B.1.3.3 To provide risk management, the fire department must utilize all of the tools available. In order of preference, those tools are as follows:

(1) Fire-safe design and construction
(2) Suppression systems
(3) Detection systems
(4) Occupant fire prevention practices
(5) Fire department-conducted fire-safety inspections
(6) Fire rescue response

B.1.3.4 A structure designed and constructed to withstand the effects of fire is the most important asset in achieving fire risk management. A structure relying solely on fire rescue response offers the greatest challenge to the occupants and fire department personnel.

B.1.4 Fire impact management is the ability to manage the impact of a fire on occupants and structures. The participation of the fire department in the design, construction, maintenance, and use of a structure provides defense-in-depth against fire losses.

B.1.4.1 Structures that are designed with noncombustible construction, are protected with fire protection systems, and are routinely inspected to ensure appropriate occupant use are most likely to provide the lowest risk levels and therefore are the least difficult to manage.

B.1.4.2 Fire-fighting operations on fully compliant structures for which the fire fighters know the occupancy conditions can be conducted with a plan that commits resources only as necessary to accomplish the pre-established goals.

B.1.4.3 Pre-established goals for each structure define the commitment of resources in order to limit risk to occupants, the structure, and fire department personnel.

Annex C Informational References

C.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.

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

NFPA 1, *Fire Code*, 2015 edition.

NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, 2016 edition.

NFPA 1250, *Recommended Practice in Fire and Emergency Service Organization Risk Management*, 2015 edition.

NFPA 1405, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, 2016 edition.

NFPA 1620, *Standard for Pre-Incident Planning*, 2015 edition.

NFPA 1730, *Standard on Organization and Deployment of Fire Prevention Inspection and Code Enforcement, Plan Review, Investigation, and Public Education Operations*, 2016 edition.

NFPA 1925, *Standard on Marine Fire-Fighting Vessels*, 2013 edition.

Fire Protection Handbook, 20th edition, 2008.

"Reduced Staffing: At What Cost?" *Fire Service Today*, September 1981.

C.1.2 Other Publications.

C.1.2.1 AMA Publications. American Medical Association, 515 North State Street, Chicago, IL 60610.

"Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiac Care." 1992. *Journal of the American Medical Association*, 268(16) (October 28).

C.1.2.2 FEMA Publications. Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472.

"Fire Risk Analysis: A Systems Approach," NFA-SM-FRAS, National Emergency Training Center, National Fire Academy, July 20, 1984.

C.1.2.3 NIST Publications. National Institute of Standards and Technology, 100 Bureau Drive, Bldg. 820, Rm. 164, Gaithersburg, MD 20899.

"Hazard I Fire Hazard Assessment Method," U.S. Department of Commerce, June 1991.

"Report on High-Rise Fireground Field Experiments," April 2013.

C.1.2.4 U.S. Government Publications. U.S. Government Publishing Office, Washington, DC 20402.

Title 42, U.S. Code, Chapter 116, Emergency Planning and Community Right-to-Know Act, 1986.

C.1.2.5 Other Publications. "Basic Trauma Life Support for Paramedics and Other Providers," American College of Emergency Physicians, John Campbell (ed), 1997.

Shaping the Future of Fire Ground Staffing and Delivery Systems within a Comprehensive Fire Safety Effectiveness Model, Office of the Ontario Fire Marshal, 1993.

"Pre-Hospital Trauma Life Support," American College of Surgeons, Paturaas, Wertz and McSwain (eds), 1999.

"Pediatric Advanced Life Support," American Heart Association, Besson (ed), 1997.

"Fire Department Evaluation System (FIREDAP)," Phoenix, AZ Fire Department, December 1991.

"Emergency Care and Transportation of the Sick and Injured," American Association of Orthopedic Surgeons, Browner (ed), 1999.

C.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.

C.2.1 CPSE Publications. Center for Public Safety Excellence, 4501 Singer Court, Suite 180, Chantilly, VA 20151.

Fire and Emergency Service Self Assessment Manuals, National Fire Service Accreditation Program. 8th edition, Commission on Fire Accreditation International, 2009.

Commission on Fire Accreditation International *Standard of Cover*, 5th edition, 2008.

C.2.2 Government Accounting Standards Board. Government Accounting Standards Board, 401 Merritt 7, P.O. Box 5116, Norwalk, CT 06856-5116.

C.2.3 IAFC/IAFF Publications. International Association of Fire Chiefs/International Association of Fire Fighters. International Association of Fire Chiefs, 4025 Fair Ridge Drive, Suite 300, Fairfax, VA 22033-2868. International Association of Fire Fighters, 1750 New York Avenue, NW, Washington, DC 20006.

"NFPA 1710 Implementation Guide," August 2002.

C.2.4 IAFF Publications. International Association of Fire Fighters, 1750 New York Avenue, NW, Washington, DC 20006.

Department of Research and Labor Issues, "Effectiveness of Fire-Based EMS," 1995.

Department of Research and Labor Issues, "Safe Fire Fighting Staffing," 1993.

Department of Emergency Medical Services, "Emergency Medical Services Performance Objectives," 2002.

C.2.5 IFSTA/FPP Publications. IFSTA/FPP, 930 N. Willis, Stillwater, OK 74078.

"Systems Approach to Managing Fire and Life Safety Services," Dennis Compton.

C.2.6 Insurance Services Office Publications. ISO Customer Service Division, 545 Washington Blvd., Jersey City, NJ 07310-1686.

"Public Protection Classification Service"; Fire Suppression Rating Schedule.

C.2.7 International City/County Management Association Publications. 777 N. Capitol Street, Washington, DC 20022.

"Managing Fire and Rescue Services," June 2002.

"Interim Report of the Tricom Consortium."

C.2.8 U.S. Government Publications. U.S. Government Publishing Office, Washington, DC 20402.

Title 29, Code of Federal Regulations, Part 1910.120, "Hazardous Waste Operations and Emergency Response," 1986.

Title 29, Code of Federal Regulations, Part 1910.156, "Fire Brigades," 1998.

C.2.9 Other Publications. "Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiac Care," *JAMA*, August 2000.

"Performance Measurement and Benchmarking Project," Office of the Ontario Fire Marshal, 2003.

C.3 References for Extracts in Informational Sections. NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 2013 edition.

Index

SECTION 4

FINAL REPORT

MARLBOROUGH, MA

ASSESSMENT OF THE ORGANIZATION
AND
MANAGEMENT OF THE
MARLBOROUGH FIRE DEPARTMENT

NOVEMBER 2014

Prepared by:
Municipal Resources, Inc.
120 Daniel Webster Highway
Meredith, NH 03253
603-279-0352
866-501-0352 Toll Free
603-279-2548 Fax
all@municipalresources.com
www.municipalresources.com

Municipal
Resources

TABLE OF CONTENTS

Municipal
Resources
Inc.

TABLE OF CONTENTS

Municipal Resources

APPENDICES

FINAL REPORT

Municipal Resources Inc.

MARLBOROUGH, MA

ASSESSMENT OF THE ORGANIZATION AND MANAGEMENT OF THE MARLBOROUGH FIRE DEPARTMENT

NOVEMBER 2014

CHAPTER 1

EXECUTIVE SUMMARY

OVERVIEW

The purpose of the executive summary is to offer a brief synopsis of the key issues and recommendations found in the study as an overview of the complete report. It is not intended to provide the reader with a detailed analysis of the results in a few pages; nor is it intended to direct attention to certain issues, or suggest that others, developed in more detail in the main body of the report, are less important. The complete report should be read, in all of its detail, to gain a full understanding of the issues facing the Marlborough Fire Department as evaluated by Municipal Resources, Inc. (MRI).

The department has the potential to resolve the internal conflicts and cultural attitudes, many of which are self-imposed, that have seriously affected its standing in the community and in the region. The MRI study team believes that the Marlborough Fire Department has the skills and capabilities to become an effective, highly trained, and motivated organization that meets or exceeds nationally recognized standards for operational readiness. However, there will need to be an infusion of strong leadership at the top of the department and a simultaneous change in

Municipal Resources

attitude and loyalty by the members of the department. The challenges are many, but as will be seen, many of the recommendations can be accomplished within existing budgetary restrictions.

MRI has identified a number of areas that require improvement within the Marlborough Fire Department. Although many practices do meet contemporary standards for municipal fire and EMS agencies, there are numerous ones that need improvement. Many of the issues in the fire department are the result of a lack of consistent, strong leadership within the department, caused primarily by the frequency with which the city's fire chief has changed. The lack of a fire chief with an extended tenure has resulted in no sense of vision or long-term direction for the department. This situation has also provided an opportunity for the union to step in and fill the leadership void, resulting in a significant percentage of the department's members being more loyal to the union than they are to the department or the city. The fire chief has also been an island with absolutely no support staff or team, which severely hampers his ability to lead and manage the department. In addition, the line between management rights and union authority has become blurred over the years. As a result, the fire chief must consult or negotiate with the collective bargaining unit before making operational changes that benefit the department and the community. On a positive note, there is a solid foundation of members of the department who are hungry for change and want the department to move forward.

The mission performed by the fire department is one of the fundamental functions of government: to ensure the safety and protection of its residents and visitors. The expectations for the quality and quantity of fire and emergency services must come from its residents and other taxpayers. There is no "right" amount of fire protection and EMS delivery. It is a constantly changing level based on the expressed needs of the community. It is the responsibility of elected officials to translate community needs into reality through direction, oversight, and the budgetary process. It is their unenviable task to maximize fire, EMS, and other services within the reality of the community's ability and willingness to pay, particularly in today's economic environment.

KEY AREAS OF MAJOR CONCERN

1. Lack of consistent leadership and an inadequate organizational/management oversight structure

2. Incomplete and inadequate department policies, procedures, and rules resulting in a lack of discipline

3. Obsolete and seriously code deficient Fire Station 2

4. Service gaps and response time/distance concerns in west end of city

5. Lack of a formal training program and performance improvement system

6. Inadequate fire prevention program

A brief narrative on each concern can be found in the following pages.

LACK OF CONSISTENT LEADERSHIP AND AN INADEQUATE ORGANIZATIONAL/MANAGEMENT OVERSIGHT STRUCTURE

Effective management and oversight of the fire department is essential to ensure that the department maintains a strong and progressive vision, attains its goals, and delivers high quality services to the citizens of Marlborough. The current management team of the fire department is solely comprised of the fire chief, who is the only non-union member of the department. In essence, this makes the chief an island who has no support staff or "team". He/she needs assistance and a team to support them. Complicating this critical issue is the fact that the frequent turnover of fire chiefs has caused a lack of leadership consistency with a corresponding absence of vision and long-term direction for the department. The union has managed to fill this leadership vacuum and exerts undue influence in the department and its operations. As a result, a number of the department's officers are more loyal to the union than they are to the department and the city.

The deputy fire chiefs, who are nominally the shift commanders, do not work the same rotation/shift as the other personnel. In addition, when there is no deputy chief on duty, the shift commander vehicle is not staffed 24/7. The department has not fully embraced the implementation of a strong incident command system (ICS) as required under the National Incident Management System (NIMS). This creates issues with incident command, management, and control. There is also a lack of consistency and accountability in the management of the department in areas such as training, performance improvement, and employee accountability.

A mission critical related issue is the establishment of the role of safety officer to monitor conditions at incident scenes to ensure the appropriate safety procedures are being followed. The Marlborough Fire Department has not instituted a formal safety officer program as of the time this report was developed. Written procedures concerning operational safety are either outdated or non-existent.

All ranks, firefighter to deputy chief, are in the same union/bargaining unit which creates the potential for split loyalties and conflicts of interest related to supervision, management, and discipline. Some officers informed the study team that they were concerned that if they raise an issue or implement discipline, that they might not be supported by administration. MRI believes strongly that the next fire chief must come from outside the department, be carefully chosen, and be a proven leader with a record of success as a change agent.

Concurrently, the City of Marlborough should reorganize the fire department's management structure. The position of deputy chief should be eliminated through attrition and retirements. The captains should be reclassified as shift commanders. MRI recommends that the City of Marlborough fill the existing assistant fire chief positions, and, if necessary, increase the number of authorized positions to three for the Marlborough Fire Department. They should ensure that these positions are executive management positions that are exempt from civil service and the firefighters collective bargaining unit. The fire chief should delegate significant management responsibility and authority to the three assistant fire chiefs commensurate with their demonstrated knowledge, skills, and abilities. MRI has identified the following assignments as one possible approach, but it is not our intent to limit the flexibility of the fire chief to develop a management structure that is most appropriate for the needs of the department. From MRI's perspective, the responsibilities of the three assistant fire chiefs *could* be divided as follows:

1. Assistant Chief for Operations: Second-in-command of the department ("executive officer"), responsible for the direct supervision of the fire captains, daily operational activities, personnel management, facilities, apparatus, and equipment. He/she will directly supervise the four platoon commanders.

2. Assistant Chief for Support Services: Third-in-command of the department, responsible for administration, training (fire & EMS), and safety.

3. Assistant Chief for Fire Prevention: Fourth-in-command of the department, responsible for all fire prevention and code enforcement activities.

In order to assure that the important position of overall incident commander is filled, and that there is mission critical command continuity and consistency on the emergency scene, the Marlborough Fire Department should take whatever steps are necessary to staff the department's command vehicle on a 24/7 basis. The department should develop formal procedures for implementing an ICS system that is compliant with the National Incident Management System (NIMS). ICS procedures should be aggressively enforced so that they become a routine component of any emergency response. The department should also establish a fireground/incident safety officer program that includes mandating that all department officers receive safety officer training and obtain safety officer certification. Safety should be the highest priority for all operational policies, procedures, and training activities.

The department has sufficient overall staffing to operate and staff per recommended standards. However, an overly generous labor contract allows 50% of scheduled staff off at any time, making it difficult to maintain adequate on duty staffing. On duty staffing should be increased to fifteen from the current thirteen. A lieutenant should be assigned to Engine 1

when the captain goes into the car as the shift commander. A lieutenant should be assigned to Ladder 1 to provide supervision. This will increase staffing on this unit to three.

INCOMPLETE AND INADEQUATE DEPARTMENT POLICIES, PROCEDURES, AND RULES, RESULTING IN A LACK OF DISCIPLINE

The use of rules and regulations, operational procedures, guidelines, and various other forms of written communications are vital parts of a fire department's overall operations. Rules and regulations establish expected levels of conduct and general obligations of department members, identify prohibited activities, and provide for the good order and discipline necessary for the credible operation of a modern emergency services organization. Operational procedures and guidelines ensure the consistent, effective, efficient, and safe operation of various aspects of the department's operations, both emergency and routine.

The Marlborough Fire Department does not have a stand-alone rules and regulations document. It has adopted a limited number of standard operating procedures (SOPs) that cover certain areas concerning field operations and safety. This includes some rules and regulations interspersed throughout. The SOP manual is by no means complete, as many important procedures are missing. Many of the existing procedures are outdated. None of them appear to have been reviewed, revised, or updated. The lack of rules, regulations, and comprehensive SOPs has contributed to an overall lack of discipline within the department.

The Marlborough Fire Department should form a committee to develop a stand-alone rules and regulations document, which sets accepted standards of behavior and conduct and also identifies prohibited behaviors. The rules and regulations should then be formally adopted by the city.

A complete revision of the department's SOPs will improve operational efficiency, establish measureable performance and evaluation criterion, and will improve employee performance and morale by establishing defined expectations. An internal committee or process should be developed that includes input and participation from all levels of the department, the documented receipt by each employee, a process for regular review and updating, and training for all personnel on policies and procedures. It is important to note that it is fully appropriate to use policies and procedures from other fire departments or fire organizations as a template for Marlborough's efforts. A disciplinary policy/procedure should also be developed in conjunction with the city's personnel and legal departments. The required mandatory plans should be developed as soon as possible.

OBSOLETE AND CODE DEFICIENT FIRE STATION 2
SERVICE GAPS AND RESPONSE TIME/DISTANCE CONCERNS IN WEST END OF CITY

The adequacy, quality, and appearance of fire station facilities have a great impact on the performance of the department as a whole. Attractive, functional, clean, and well-designed quarters contribute substantially to the morale, productivity, and operational effectiveness of the agency, as well as to its public image, dignity, and prestige. Well-designed fire and EMS facilities enable staff to perform their duties efficiently and effectively. As a facility ages, it may no longer meet the needs of an evolving department, thus negatively affecting morale, efficiency, safety, security, technology, and overall efforts to provide quality fire, rescue, and emergency medical services. Old and obsolete facilities are also expensive to maintain due to inefficient energy systems.

In MRI's opinion, there are two issues that while different, are somewhat related, and share a common recommended solution. First, the current Fire Station 2 is old, and while still marginally adequate, has really outlived its usefulness. Apparatus floor space, door dimensions, and the property upon which it is situated are all barely adequate for modern-day fire apparatus and operations. Crew quarters are deficient and do not meet current fire safety codes.

The second issue is the continued significant growth in the west end of the city, which has been unmatched by the city's fire protection system. At the present time, there is no fire station located west of I-495 where there is major growth still occurring. This situation creates longer travel distances, which results in longer response times, and a corresponding lower level of service to customers in that area. Although certain response statistics were difficult to obtain, and appeared to be inconsistent, resulting in questionable accuracy, Marlborough achieves the recommended five minute response time benchmark (which includes one minute for personnel to turnout) from incident dispatch to first unit on location just 70.4% of the time, well below the NFPA recommended standard of 90%.

Short-term, the city should immediately address the most serious fire code and life safety issues in all the stations, particularly Fire Station 2. Beyond that, we strongly recommend that the city begin the process of designing and constructing a new Fire Station 2. The station should be relocated west of I-495 to provide coverage that is more effective, reduce travel distances, and improve response times. The facility should also be constructed with capabilities to serve as a training facility for the department. MRI believes the city should consider the feasibility of this being a joint police/fire facility. Patriot Ambulance would also be interested in deploying an ambulance from this location for all the same service improvement reasons that support this move for the fire department. The city should explore the possibility that developing this facility could be an excellent joint public/private partnership opportunity.

LACK OF A FORMAL TRAINING PROGRAM AND PERFORMANCE IMPROVEMENT SYSTEM

Training is, without question, one of the most important functions that a fire department should be performing on a regular basis. A department that is not well trained, prepared, and operationally ready, will be unable to effectively, efficiently, and safely fulfill its emergency response obligations and mission. A comprehensive, diverse, and on-going training program is absolutely critical to the fire department's level of success.

At the present time, the Marlborough Fire Department has no real formal training program. Other than required EMS training, very little training gets done. The chief does issue a monthly training schedule, but it was reported that compliance with it is very limited, at best. Training is nominally coordinated on a part-time basis by a fire captain who serves as the training officer as an ancillary duty. There is little overall coordination between platoons, and training is often interrupted by emergency calls. There appears to be little consistency between platoons concerning the frequency and types of training that is offered. The department has no requirement for additional training/certification beyond Firefighter I. There are currently no annual proficiency evaluations. There is clearly a need for daily, documented, training that is based on formal lesson plans.

Training needs to be designated as a high priority for the department. MRI has made a series of recommendations concerning the establishment of a comprehensive, formal training program, and a formal performance improvement program for all department operations. Training should occur every day and all training should be documented. Annual proficiency evaluations should be implemented. All officers should be required to obtain fire instructor and fire officer certifications. The proposed assistant fire chief for support services would be responsible for overseeing and coordinating these activities.

INADEQUATE FIRE PREVENTION AND PRE-FIRE PLANNING PROGRAMS

Fire prevention should be promoted as a key component of the vision of the Marlborough Fire Department and should be a major aspect of its primary mission. Aggressive fire prevention programs are the most cost efficient and cost effective way to reduce fire risks, fire loss, and fire deaths and injuries in the community. Every member of the department should have a responsibility for fire prevention.

Despite the size of the City of Marlborough, and amount of continued commercial growth and development, at the time of this assessment there is no one dedicated full-time to fire prevention activities. Deputy chiefs perform fire prevention duties in addition to their shift/operations duties. The in-service companies assist in a limited manner. However, the system seems to be primarily reactive rather than proactive. This creates a high probability of issues falling through the cracks.

One of the most effective tools the fire department has to assist them with handling fires and other emergencies in commercial and industrial facilities are pre-fire plans. The purpose of a fire pre-planning program is to allow firefighters to become familiar with buildings and/or facilities within their response area prior to an emergency, alert them to on site hazards and risks, and develop a detailed fire response plan for them that includes specific tactics that will be required to mitigate fires or other emergencies. A comprehensive pre-fire plan includes as much data about the building as possible. It was reported to the MRI study team that the Marlborough Fire Department has done some limited pre-planning on some of the major target hazards in the city. This data is accessible by use of the mobile data terminals, but the fire department does not use the ones they have to access this information on scene. Lack of a pre-fire plan was one of the contributing factors in the six alarm fire in April 2012 at the Lake Williams Condos.

Fire prevention should be a high priority for the Marlborough Fire Department especially with the current commercial and industrial base and continued development. One of the new assistant chiefs should be dedicated to fire prevention full-time. There should be at least one full-time fire inspector to assist the chief with the multitude of fire prevention activities that need to be performed. An expanded and robust fire prevention program may provide opportunities for revenue enhancements, as well as the formation of public/private partnerships.

The Marlborough Fire Department should establish a formal in-service inspection program. On duty and in-service companies should conduct regular fire safety inspections of buildings within their respective response districts. The purpose of these inspections is to: a) identify and mitigate fire hazards and fire code violations; b) enable firefighters to become thoroughly familiar with buildings, including the design, layout, structural conditions, building systems, hazards, and challenges to firefighting operations; c) educate property owners and occupants on good fire safety practices; and d) establish a positive relationship with property owners and occupants.

The department should also enhance its existing limited pre-fire planning program into a comprehensive one for all structures other than one and two family dwellings. Pre-fire plans should be reviewed, and updated, regularly. They should be tested and validated by tabletop exercises and on-site drills. Appropriate pre-planning software should be obtained and installed in mobile data terminals (MDTs) in all apparatus and command/staff vehicles.

ADDITIONAL CONCERNS

The MRI study team identified several other issues that have a significant impact on the Marlborough Fire Department and its operations, and ultimately, the city and its taxpayers. First, is a labor contract that is overly generous in certain benefits and has ceded too many management rights. The fire chief has very limited flexibility to assign personnel based upon

the needs of the department and best interests of the city. In addition to 50% of on duty staffing being permitted off on scheduled leave at any time, there is no requirement that supervisors or management approve leave requests.

The Massachusetts collective bargaining environment appears to be tilted to heavily (and unfairly) in favor of labor. As a result, chiefs and municipalities are forced to impact bargain virtually every change in policy, procedure, the way things are done, etc. The arbitration process is tilted far too heavily toward labor, rather than the stewards of public funds, management. There is too much emphasis on past practice.

The City of Marlborough needs to exercise the management rights that are already in place. They need to negotiate to regain other rights through the collective bargaining process. The city also needs to actively work with the Massachusetts Municipal Association (MMA) to lobby the state legislature to modify the arbitration process so the playing field is more level for the cities and towns. They should also work with MMA to enact legislation to eliminate or at least minimize the importance of past practice.

IN CONCLUSION

The full body of this report contains 173 recommendations in 18 chapters. The report should be studied in its entirety to gain a complete picture of MRI's recommendations. There are a large number of very significant (and some serious) issues that are confronting the Marlborough Fire Department. These areas that require attention and improvement are by no means insurmountable or beyond the city administration's ability to deal with them. However, it will require a strong commitment to changing the status quo and making necessary changes for the common good...that of the citizens of Marlborough... rather than narrowly focused special interests.

In spite of the issues identified in this report, the citizens of Marlborough should feel confident that the Marlborough Fire Department is a professional public safety organization that is capable of satisfactorily handling the majority of incidents that it is called upon to mitigate. We appreciate the high level of support and cooperation that we received from all of the department's stakeholders during our evaluation of the department. We encourage them to work cooperatively to implement the recommendations in this report. We commend Mayor Vigeant, his staff, and the city council for their willingness to address these very complex issues in an open and positive manner.

For most evaluations, response time is the most critical factor for both fires and emergency medical incidents. It is not just a cliché that during critical life threatening situations, minutes and even seconds truly do count.

Heart attack and stroke victims require rapid intervention and care, and transport to a medical facility. The longer the time duration without care, the less likely the patient is to fully recover. Numerous studies have shown that irreversible brain damage can occur if the brain is deprived of oxygen for more than four minutes. In addition, the potential for successful resuscitation during cardiac arrest decreases exponentially with each passing minute that cardio-pulmonary resuscitation (CPR) or cardiac defibrillation is delayed.

Structural firefighting has become far more challenging and dangerous in the last thirty years with the introduction of significant quantities of plastic and foam based products into homes and businesses (*e.g.*, furnishings, mattresses, bedding, plumbing and electrical components, home and business electronics, decorative materials, insulation, and structural components). These materials ignite and burn quickly and produce extreme heat and toxic smoke. If firefighters cannot arrive in a timely manner and attack the fire quickly, a strong possibility exists that a dangerous flashover (simultaneous ignition of the all combustible materials in a room) will occur. Flashover can occur within five to seven minutes of fire ignition, and is one of the most dangerous events that a firefighter can face. When a flashover occurs, initial firefighting forces are generally overwhelmed and will require significantly more resources to affect fire control and extinguishment. As was discussed above, Marlborough achieves the recommended response time benchmarks for first unit on scene between 70.4% and 71.6% of the time, both well below the 90% target for an urban community.

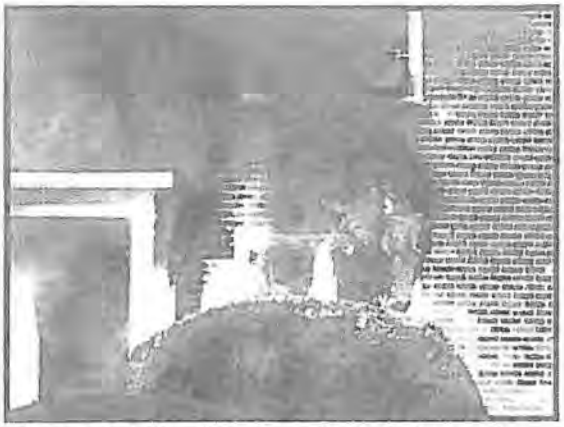


Figure 4-11: Structure fire prior to flashover. A primary goal of the fire department is to arrive on the scene of a structure fire and commence fire extinguishment prior to flash over occurring.

Figure 4-12: Structure fire after flashover has occurred.

Municipal Resources

Another method of determining the appropriate deployment of resources is the fire company travel distance model employed by the Insurance Services Office (ISO) to assist them with determining the Public Protection Classification (PPC) rating that is utilized for determining fire insurance rates by participating insurance companies. Under the ISO deployment and coverage model, in order to obtain maximum point value for this particular component of an evaluation, the first due engine company should be within 1.5 miles travel distance of every location within their first due response area. The first due ladder company should have a travel distance of no more than 2.5 miles. Travel distance is one of several factors that can have an impact on response time and is usually the most significant.

When analyzing the locations of Marlborough's current fire stations, it is easy to see that they were constructed to protect what was then the developed area of Marlborough. As the city has continued to develop and expand outward from its center core, particularly to the west, and west of I-495, the city's fire protection system has not made the adjustments necessary to keep up with that growth and expansion. It is also important to keep in mind that early fire stations were constructed much closer together as is evidenced by the close proximity of the old central station and Station 2 to each other. Advances in technology and equipment have made it possible for stations to be located much farther apart and still provide appropriate levels of protection.

As illustrated in Figure 4-13 below, Marlborough's current fire station locations provide excellent coverage to the center of the city with significant overlapping of coverage between the three stations as they are currently deployed. There is an area in the center of the city where all three stations are within the 1.5 mile travel distance. However, most of the area of the city west of I-495 is outside of the recommended 1.5 distance from the nearest station. There are also some areas in the north side of the city, as well as the northeast and southeast corners of the city that are outside of the 1.5 mile travel distance.

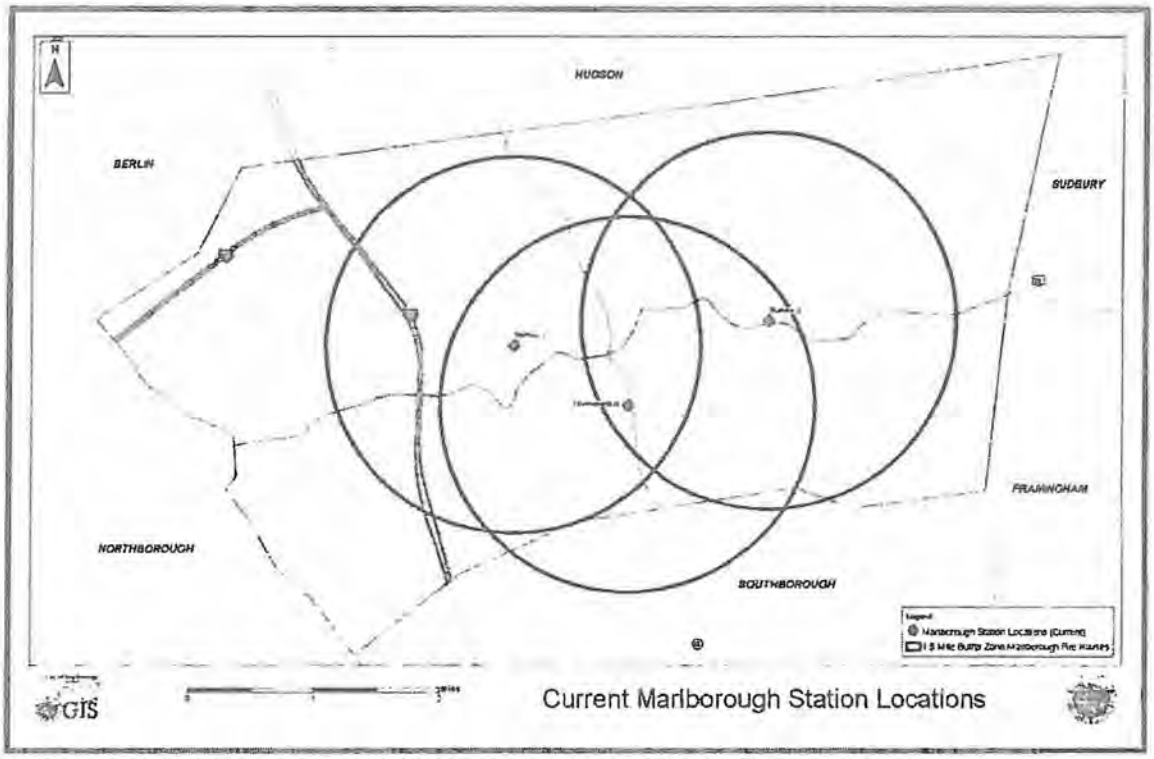


Figure 4-13: Existing Marlborough fire station locations with 1.5 mile travel distance.

Figure 4-14 shows that none of Marlborough's surrounding mutual aid departments provide any real assistance with the travel distance concerns. Although Hudson Station 2 shows potential coverage into an area in the far north of Marlborough, this station is not staffed and is used for equipment storage only, not emergency responses. Hudson Station 1, in downtown Hudson, while outside of the 1.5 mile travel distance, does appear to be closer to the Solomon Pond Mall area and has a fairly straight response route which can assist with reducing response times to that area.

Municipal Resources

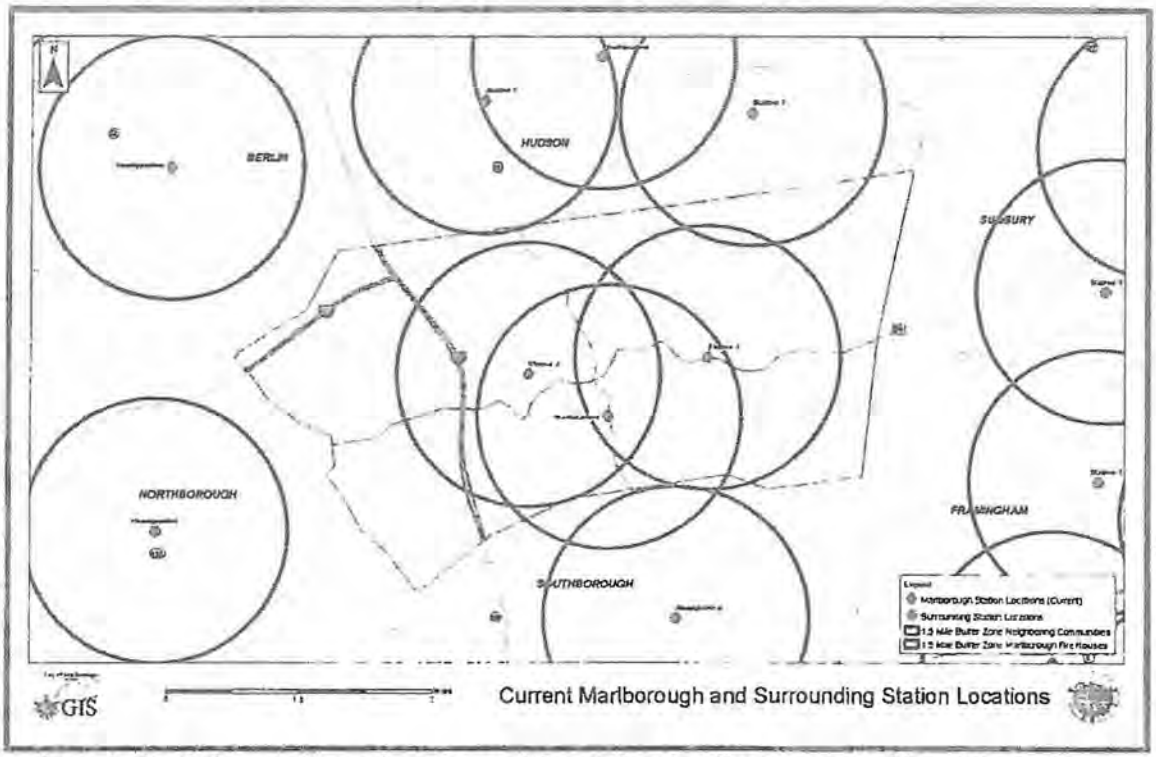


Figure 4-14: Existing Marlborough stations and fire stations in adjacent communities with 1.5 mile travel distance.

If the City of Marlborough were to relocate the existing Station 2 to a new location west of I-495 (the MRI study team used Boston Post Road and Northborough Road as a reference point), the coverage provided by that station would be significantly improved, now placing most of the city's west end within the 1.5 mile travel distance. As Figure 4-15 Indicates, while there are some areas that are now within the 1.5 mile distance that will fall outside of it with this revised deployment model, overall, the level of coverage will be significantly improved. If Patriot Ambulance were to share the same facility, EMS response times should show a significant decrease as well. Marlborough Police may also be interested in sharing the facility for use as a sub-station.

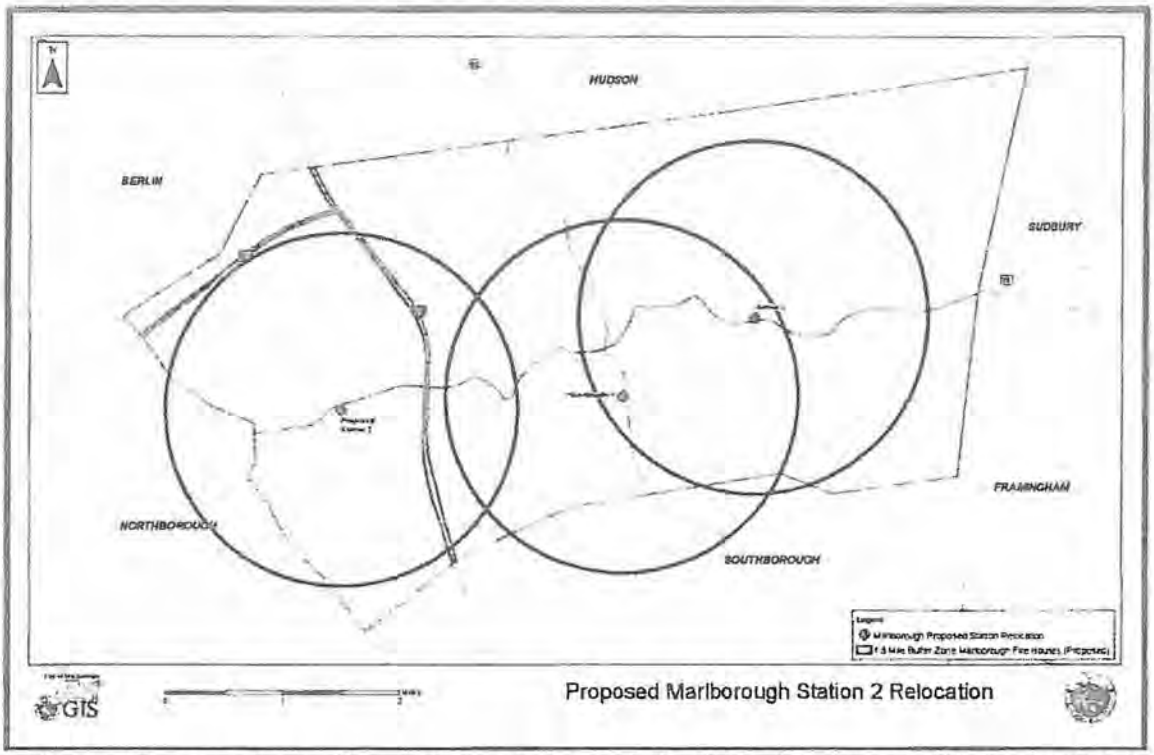


Figure 4-15: Proposed relocation of existing Marlborough Fire Station 2 to the area of Boston Post Road and Northborough Road with 1.5 mile travel distance. This location provides much improved coverage and it would be anticipated, response times, to the west end of the city.

It is important to note that performing an in depth analysis of potential fire station locations is outside the scope of this study. However, performing this type of analysis would be an important part of the process to select a new station and may determine more appropriate locations for the relocation of this facility. There are many factors that go into site selection beyond just picking the best location from a response time/coverage/travel distance perspective. Chief among these is the availability of suitable sites. In a utopian world, in addition to relocating Station 2, the central station would be moved north on Bolton Street (the location of the old central station was actually a better location than the current one) and Station 3 would be moved a few blocks east on Route 20.

Anticipating potential opposition to its relocation from those who live near the existing Station 2, the MRI study team was asked by some members of the council about the need for a fourth station. It is the opinion of the team that adding a fourth station, as opposed to relocating the existing station, would provide unnecessary, and potentially costly, overlapping of primary response areas.

The final criterion that is frequently evaluated with regard to resource deployment is incident volume specifically related to incident type, and the number and/or percentage of times there

are simultaneous and/or overlapping incidents. Every emergency service organization periodically experiences simultaneous or overlapping incidents. Whether they are handled by that department themselves, or through automatic/mutual aid, provisions need to be made to insure that these incidents are also handled effectively, efficiently, and in a timely manner. However, as the number of simultaneous, or overlapping, incidents increases, that community and/or department can no longer rely on their neighboring communities/departments to handle an ever increasing percentage of their incidents.

RECOMMENDATIONS

4.1 ***The department should develop formal procedures for implementing an ICS system that is compliant with the National Incident Management System (NIMS). ICS should be implemented during every response. This is truly a mission critical and incident safety requirement necessary for the effective and efficient provision of modern day emergency services. The use of ICS on the incident scene should be expanded to encompass Command, Safety, Operations, and functional groups and divisions as outlined within NIMS. ICS procedures should be aggressively enforced so that they become a routine component of any emergency response.***

4.2 ***In order to assure that the important position of overall incident commander is filled, and that there is mission critical command continuity and consistency on the emergency scene, the Marlborough Fire Department should take whatever steps are necessary to staff the department's command vehicle on a 24/7 basis. This should be done as soon as possible.***

4.3 ***The Marlborough Fire Department should establish a fireground/incident safety officer program. All department officers should receive safety officer training, obtain safety officer certification, and an operational procedure should be implemented that results in a guaranteed response of at least one chief officer (in addition to the on duty shift commander) for every reported structure fire, and at least one additional chief officer on every working/all hands incident.***

4.4 ***Consideration should be given to increasing the minimum shift staffing level from thirteen to fifteen. In conjunction with the automatic response of the duty chief officer on any reported structure fire, the city will be able to achieve initial compliance with NFPA 1710. This recommendation can be achieved without the need for additional staffing provided the number of personnel permitted off at any given time is reduced. If shift staffing is above fifteen, the additional personnel can be added to the ladder and/or Engine 2 and Engine 3.***

4.5 ***In acknowledgement of the fact that they frequently operate in a minimal staffing mode, and recognizing the potential for rapid fire spread in a densely developed urban***

community, the Marlborough Fire Department should equip all of their apparatus, and develop standardized tactical operations that will enable them to quickly develop, and place in service, high volume fire flows.

4.6 *The Marlborough Fire Department should enhance its existing limited pre-fire planning program into a comprehensive one for all structures other than one and two family dwellings. Appropriate pre-planning software should be obtained and installed in mobile data terminals (MDTs) in all apparatus and command/staff vehicles.*

4.7 *One of the next fire chief's first priorities should be to take tangible steps to change the perception of the Marlborough Fire Department among its mutual aid partners and restore the confidence of their chiefs in Marlborough's operational and command consistency.*

4.8 *The fire department should continue to be an active participant in the fire and EMS mutual aid system. Multi-city training evolutions (drills and exercises) should be conducted on a regular basis. Fire chiefs and command staff from neighboring communities should meet regularly to discuss strategies for broader regional sharing of resources.*

4.9 *In consultation with the fire chiefs in adjacent communities, Marlborough should identify any areas where those departments may be closer and/or can respond quicker to emergency incidents. Automatic aid (Line boxes) initiating response by both departments should be re-implemented for those locations.*

4.10 *The fire department should establish a formal "performance improvement" process for fire suppression operations. The process should include the adoption of performance standards such as NFPA 1710[31], the creation of a formal review and critique process for all incidents, and a process for modifying SOPs, training priorities, and equipment as determined by the performance improvement program.*

4.11 *Emergency medical dispatch (EMD) should be utilized as a tool to screen medical calls based on severity. Once severity has been established, a response of the appropriate resources should be initiated. In conjunction with the emergency medical dispatch (EMD) system in the city communications center, and in consultation with Patriot Ambulance and the medical director, the department should establish dispatching protocols to determine the appropriate level of response. The medical director should approve the response matrix.*

[31] For example, NFPA 1710 establishes performance goals for turnout time and response times for fire and EMS emergency calls.

The practice of dispatching a fire engine company to all medical calls should be discontinued and should be limited to critical, potentially life threatening emergencies, such as cardiac events, respiratory distress, unconscious patients, allergic reactions, severe bleeding, head injuries, vehicle crashes, and technical rescues. An engine company should also be dispatched if an ambulance response is delayed. If additional personnel are needed for lifting non-critical patients, the EMS crew can request that an engine company respond to assist. For these events, time is generally not a factor and the engine company can often respond without emergency lights and siren.

4.12 *The City of Marlborough should give serious consideration to starting the process of relocating the existing Fire Station 2 to a location west of I-495. A complete fire station location analysis should be performed to select the optimal site for this new station. Opportunities may exist for a public/private partnership regarding the location of the new station.*

4.13 *Utilizing appropriate plotting and modeling technology, the Marlborough Fire Department should evaluate the projected benefits along with any potential impacts, and perform a risk/benefit analysis, upon response times that may result from a relocation of the existing Fire Station 2 from its present location to a new location west of I-495. Patriot Ambulance should be included in this process, as the possibility of them co-locating a unit in a relocated station will in all probability result in significantly improved response times for their units also.*

4.14 *The Marlborough Fire Department should work with TriTech, the city's IT department and the dispatch center director to make it possible for the department to easily extract information from their database to track and analyze important statistics such as individual unit response times, NFPA 1710 full alarm response compliance, number of structure fires dispatched, and number of simultaneous incidents.*

4.15 *Working in conjunction with the city's IT department and the dispatch center director, the Marlborough Fire Department should implement a quality control monitoring procedure to insure that all response times and statistics are fully accurate and present a valid and reliable portrait of the department's response performance.*

CHAPTER 5

ORGANIZATIONAL STRUCTURE, STAFFING, AND SCHEDULING

OVERVIEW

The organizational structure of any organization or entity, whether public or private, establishes and illustrates the important heirarcial relationships between various people, supervisors/ subordinates, levels, divisions, and bureaus within the organization that allow it to function properly, operate effectively and efficiently in its daily operations, or the pursuit of its mission. It also helps to clearly define the organizational chain of command from top to bottom, an especially important consideration in a quasi-military public safety organization such as the fire department where everyone from the highest rank to the lowest is subject to receiving orders, and, with the exception of the lowest rank, also issues them. Effective communications in any organization, but especially public safety agencies, are an essential and cohesive chain of command allowing everyone to know excactly who they report to, and/or who reports to them.

The organizational structure of the Marlborough Fire Department is an area of significant concern to the mayor and city council, and has been for several years. This concern has been magnified with the pending departure of another fire chief.

The issue of fire department staffing has, over the past three decades, become one of the most widely and frequently debated topics in fire service history. This debate has intensified over the past several years as tax collection revenues have declined precipitously in many communities and governmental entities seek to reduce expenses. Although Marlborough is a financially stable community compared to many in the commonwealth, the city is still sensitive to identifying cost savings where possible.

Personnel costs account for the largest percentage of the operating budgets of career fire departments. In many cases, this one line item is 90% or more of the total budget. The debate becomes intense when the discussion turns to how many firefighters are necessary to provide adequate levels of service, fulfill the department's core mission(s), and how those firefighters are deployed. This is a basic risk assessment and management decision. Ultimately, determining the acceptable level of risk they are willing to assume for the citizens they represent is a key decision that is made by the mayor and city council.

The fire service has experienced tremendous technological advances in equipment, procedures, and training, over the past fifty years. Improved personal protective equipment (PPE), the mandatory use of self-contained breathing apparatus (SCBA), large diameter hose, better and lighter hose lines and nozzles, and thermal imaging cameras are just a few of the numerous advances in equipment that have enabled firefighters to perform their duties more effectively,

efficiently, safely, and with fewer personnel. However, the fact still remains that emergency scenes present a dynamic, dangerous, frequently unpredictable, and rapidly changing environment where conditions can deteriorate very quickly and place firefighters in extreme personal danger.

The operations necessary to efficiently and safely extinguish a structure fire require a carefully coordinated and controlled plan of action. Simultaneous operations that must be carried out with a high degree of precision and timing include forcible entry, initial fire attack, search and rescue, ventilation, and the establishment of incident command. If there are not enough personnel on the incident initially to perform all of the critical tasks, some of these tasks will be delayed. This can result in an increased risk of serious injury, or death, to building occupants and firefighters, as well as increased property damage.

The National Fire Protection Association (NFPA) Standard 1710 – *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments* (2010 Edition), is the nationally recognized consensus standard on staffing and deployment for career fire departments.[32]

Some of the key provisions of NFPA 1710 are as follows:

- Paragraphs 5.2.3.1.1 and 5.2.3.2.1 state that engine companies and truck companies respectively shall be staffed with a minimum of four on duty personnel.

- Paragraph 4.1.2.1 states that the first arriving engine company shall arrive at the scene of a fire suppression incident within four minutes or less and/or the entire full first alarm response should arrive on scene within eight minutes. For EMS incidents a unit with first responder or higher level (EMT-Basic, Intermediate, or Paramedic) trained personnel should arrive within four minutes, and an Advanced Life Support (ALS) unit should arrive on scene within eight minutes. Paragraph 4.1.2.2 requires the establishment of a 90% performance objective for these response times.

- Paragraph 5.2.4.2.2 establishes the following <u>minimum</u> personnel requirements on the full first alarm assignment which should arrive on scene within eight minutes of dispatch:

[32] It is important to note that compliance with NFPA 1710 has not been mandated in the Commonwealth of Massachusetts or by the federal government. It is considered to be a "best practice" that fire departments strive to achieve.

TASK	# Personnel
Incident Commander	1
Attack engine driver/operator	1
Water supply engine driver/operator	1
Two handlines with two personnel each	4
Support/back-up Firefighter for each handline	2
Search & rescue team	2
Ventilation team	2
Ladder company driver/operator	1
Rapid intervention team (RIT)	2
TOTAL MINIMUM NUMBER OF PERSONNEL	**16**

These numbers reflect personnel needs for a fire involving several rooms, in a 2,000 square foot, one-family residential occupancy. These are the proverbial "bread and butter" structural fire incidents that fire departments respond to and, are by far, the most common type of structure fire, accounting for around 70% of those types of incidents. These incidents tend to be more complex in a more densely developed urban area such as Marlborough due to the inherent exposure problems during fire situations created by closely spaced, primarily wood frame structures. Personnel requirements for fires involving large, more complex structures, such as commercial or industrial facilities or multi-family residential occupancies, will require a significantly greater commitment of personnel. MRI is not suggesting that Marlborough staff sixteen firefighting personnel on duty at all times (although with implementation of recommended reductions in the number of personnel permitted off at the same time they will be very close) or staff all apparatus with four personnel. NFPA 1710 does permit fire departments to use established automatic aid and mutual aid agreements to comply with the staffing and response requirements. These types of agreements are mission critical to the Marlborough Fire Department being able to handle fires in anything more than a single-family dwelling.

Note: *While the NFPA standards are nationally recognized consensus standards, it is still the responsibility of the local jurisdiction to determine the acceptable level of risk and corresponding fire protection/EMS services. When applying any standard, including the NFPA standards, it is important to apply the document in its entirety. One should not selectively extract requirements to the exclusion of others or take a requirement out of context. For example, while NFPA 1710 establishes requirements for the minimum number of on-scene personnel, it also requires fire departments and firefighters to comply with NFPA 1500, Standard on Firefighter Occupational Health and Safety Program (National Fire Protection Association, Quincy MA, 2013 edition)*[33].

[33] As with NFPA 1710, NFPA 1500 has not been adopted as a mandatory regulation by the Commonwealth or by the federal government. It is a nationally recognized "best practice" standard for fire department risk management.

Among other requirements, NFPA 1500 requires personnel to be medically evaluated and to be evaluated annually for their physical performance capabilities.

The NFPA *Fire Protection Handbook*, 20th edition (2008), recommends that, "Not fewer than fourteen firefighters, one chief officer, a safety officer, and a rapid intervention team should respond to low hazard occupancies (one-, two-, or three-family dwellings and scattered small businesses and industrial occupancies).

One key provision of NFPA 1500 is known as the "Two-In/Two-Out" rule. In brief, this requirement specifies that "in the initial stages of an incident where only one crew is operating in the hazardous area at a working structural fire, a minimum of four individuals shall be required, consisting of two members working as a crew in the hazardous area and two standby members present outside this hazardous area available for assistance or rescue at emergency operations where entry into the danger area is required." (NFPA 1500, §8.8.2). The rule does not apply in emergency rescue situations where a person is visible and in need of immediate rescue, or where there is credible and reasonable information that potentially viable victims are still in need of rescue. Within certain limitations that are defined in NFPA 1500, one standby member may perform other duties outside the hazardous area, such as apparatus operator, incident commander, or technician or aide, provided constant communication is maintained between the standby member and the members of the crew (NFPA 1500, §8.8.2.4).

Beyond the NFPA standard(s), which as standards do not carry the weight of regulation or law is the Occupational Safety and Health Administration (OSHA) Respiratory Protection Standard – CFR 1910.134, which does carry the weight and force of regulation, thus making compliance mandatory. In the critical safety area of respiratory protection, the OSHA Respiratory Protection Standard mandates compliance with "Two-In/Two-Out".

The National Institute for Occupational Safety and Health (NIOSH) report on the death of a Kansas Firefighter nearly twenty years ago cited a number of "preventable events" that contributed to the firefighter's death, not the least of which was an inadequate number of personnel on the initial response and the lack of additional adequate safety procedures. Among other things the report stated, "A two firefighter engine is, at minimum, 50% under-staffed and increases the work effort of the two firefighters by a factor of 3". Almost every NIOSH line-of-duty death report recommends that fire departments "provide adequate firefighter staffing to ensure safe operating conditions".

Research on the effects of various staffing levels consistently confirms that company efficiency and effectiveness decrease substantially and injuries increase when company staffing falls below four personnel. The *Multi-phase Study on Firefighter Safety and the Deployment of Resources*, completed by the National Institute of Standards and Technology (NIST) and Worcester Polytechnic Institute (WPI), evaluated the performance of fire department crews at residential fires, which is where the majority of fire injuries and fatalities occur. The study

concluded that the size of firefighter crews has a substantial effect on a fire department's ability to protect lives and property in residential fires and occupancies. Several key findings of the study include:

- Four-person firefighting crews were able to complete twenty-two essential firefighting and rescue tasks in a typical residential structure thirty percent (30%) faster than two-person crews and twenty-five percent (25%) faster than three-person crews.

- The four-person crews were able to deliver water to a similar sized fire fifteen percent (15%) faster than the two-person crews and six percent (6%) faster than three-person crews, steps that help to reduce property damage and reduce danger/risks to firefighters.

- Four-person crews were able to complete critical search and rescue operations thirty percent (30%) faster than two-person crews and five percent (5%) faster than three-person crews.

All of these factors must be taken into consideration as Marlborough reaches consensus on the acceptable community fire safety risk level, affordable levels of expenditure for fire protection, and appropriate levels of staffing.

The MRI study team evaluated the Marlborough Fire Department's overall organizational and command structure, on duty emergency response staffing levels, administrative service capabilities, and shift work schedule. Staff positions provide important administrative support duties, and manage critical support functions such as fire prevention, fire training, emergency management, vehicle maintenance, facility maintenance, personnel administration, and budget development and implementation. We also examined the department's succession planning.

OBSERVATIONS

Organizational Structure

As currently configured, the Marlborough Fire Department is headed by a fire chief who is the department's highest ranking officer and serves as the adminsitrative and operational head of the department. The current formal table of organization for the department specifies four deputy fire chiefs assigned as platoon commanders, one for each of the department's four platoons. The deputy chiefs still work a 10 hour day, 14 hour night shift schedule as opposed to the 24 hour schedule worked by captains and below. This was done in an attempt at increasing administrative productivity from the deputy chiefs. The chiefs also only work with "their own" platoon a limited amount of times during each rotation. Different chiefs are on duty the remainder of the time as their schedules dictate. In theory, this system would appear to be

beneficial. However, in reality it causes continuity of operations problems as each shift ends up working at various times under the direction of three of the four deputies. In addition, if a deputy chief is off on any type of leave, the position is left vacant and not backfilled by either another chief, or by elevating the captain to deputy chief. This situation creates a significant, and potentially dangerous, gap in command continuity that will be discussed in detail later in this chapter. At one time the department had two assistant fire chiefs, but they have not been filled since the creation of the position of deputy fire chief in the late 1980s. However, it is our belief that these positions still exist and are authorized within the Marlborough Fire Department.

The department is currently authorized a total of four captains and eight lieutenants who are assigned as supervisors on each of the four platoons. The captains are assigned as the company commander of Engine 1 at Fire Headquarters/Station 1. In addition to the firefighters assigned to Engine 1, they are also responsible for supervising the firefighters assigned to Ladder 1 and Rescue 1, neither of which have officers. Engine 2 at Station 2 and Engine 3 at Station 3 are each commanded by a lieutenant. The captain and lieutenants serve as the department's first line supervisors, providing critical direction and direct oversight to the firefighters assigned to that platoon in each station. If the captain is off duty on any type of leave, the senior lieutenant is detailed to Station 1 to serve as an acting captain. When this situation occurs, or when the lieutenant(s) are off for any reason, those positions are then filled by a firefighter serving as an acting lieutenant. There must be one sworn officer (lieutenant or higher) on duty at all times. Some, but not all of the officers have ancillary duties they have been assigned that assist with coordinating or managing various aspects of the department's operations.

There are sixty authorized firefighter positions, fifteen on each of the four platoons. These personnel perform a range of fire, rescue, and EMS duties and responsibilities. A few participate in specialized regional teams and operations and perform various additional duties for the department. With the recent hire of four personnel and the pending appointment of one additional firefighter, the department will be at its full authorized strength for the first time in several years.

Two civilian clerical positions perform administrative functions for the departmant. One serves as the full-time as the secretary/administrative assistant to the fire chief, and one serves part-time as the clerical assistant for fire prevention.

All uniformed personnel, other than the fire chief, are represented in collective bargaining by Marlborough Fire Fighters Local 1714 of the International Association of Fire Firefighters (IAFF). The current representation arrangement where rank and file firefighters, supervisors (lieutenants and captains), and mid-level management (deputy fire chiefs) are all in the same union creates problems and conflicts of interest within the department, particularly when it comes to the administration of discipline. All uniformed positions, except the fire chief, are classified in the Massachusetts civil service system. Under the civil service system, the city

must adhere to specific requirements for recruiting, hiring, promoting, disciplining, and terminating fire department employees.

The management structure of the Marlborough Fire Department is extremely limited. The fire chief is the only non-union, executive management position. This position is appointed by the mayor and approved by the city council as outlined by the city charter. The chief does not have a management and support team that can share responsibilities for confidential personnel matters, supervision, handling grievances or potential grievances, administering the collective bargaining agreement, overseeing budgetary expenditures, assisting with the development of policies and procedures, and the myriad of administrative and management tasks that are associated with running a significant sized, modern, full service emergency services provider. In the absence of the fire chief, the city is without a member of the executive management team to oversee a critical public safety agency. The critical need for the fire chief to have a strong management and support team to assist him/her was something the MRI study team heard numerous times during our interviews and analysis of the department.

The following table depicts the current organizational structure of the Marlborough Fire Department:

SECTION

5

MARLBOROUGH
FIRE STATION
SPACE NEEDS STUDY

MARLBOROUGH, MA

APRIL 3, 2018

context
ARCHITECTURE
66 HARRISON AVENUE BOSTON, MA 02111
TEL 617.423.1400 WEB CONTEXTAPC.COM

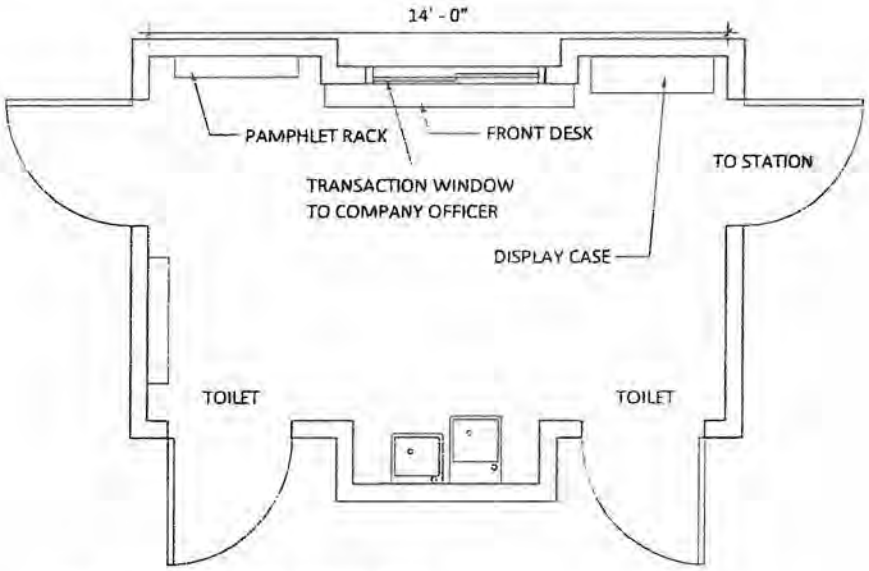
Contents

SPACE NEEDS SUMMARY

Item No.	Space Type / Description	Needed Space Size Qty	Length	Width	Tot. Needed NASF	Floors First	Second
1.0	**Public**						
1.1	Public Vestibule	1	7	7	49	49	
1.2	Public Lobby	1	8	14	112	112	
1.3	Public Toilets	2	7.5	7	105	105	
2.0	**Administration**						
2.1	Battalion Chief	1	10	12	120	120	
2.2	Company Office /Report Writing	1	14	14	196	196	
2.3	Training (EOC)	1	26	30	780	780	
2.4	Training Storage	1	8	8	64	64	
3.0	**Apparatus & Support**						
3.1	Apparatus Room	1	80	54	4,320	4,320	
3.2	Turnout Gear	1	16	18	288	288	
3.3	Hose Storage Alcove	1	8	3	24	24	
3.4	Decontamination (Decon) Room	1	10	8	80	80	
3.5	EMS Supplies	1	8	12	96	96	
3.6	Air Supply	1	8	16	128	128	
3.7	Washer/Extractor & Dryer (contaminated)	1	6	9	54	54	
3.8	Firefighter Toilet	1	9	7	63	63	
3.9	Equipment Storage	1	12	10	120	120	
4.0	**Firefighter Quarters**						
4.1	Kitchen / Dining	1	18	26	468		468
4.2	Day Room	1	15	20	300		300
4.3	Shower Rooms	2	8	10	160		160
4.4	Firefighter Dorm Rooms	6	11	10	660		660
4.5	Washer/Dryer Closet	1	4	6	24		24
4.6	Storage & Supplies	1	10	7	70		70
4.7	Fitness Room	1	23	10	230	230	230
4.8	Fire Pole	1	4	8	32	32	32
5.0	**Building Maintenance & Supplies**						
5.1	Janitor's Closets	2	6	4	48	24	24
5.2	Outdoor Equipment	1	12	10	120	120	
6.0	**Building Support**						
6.1	Mechanical Room	1	12	16	192	192	
6.2	Electrical Room	1	12	10	120	120	
6.3	Emergency Generator Transfer Switch	1	5	4	20	20	
6.4	Server Room	1	8	10	80		80
	Subtotal				9,123	7,337	2,048
	Grossing Factor 35% (walls, corridors, chases, etc.)				3,193	2,568	717
	TOTAL SQUARE FOOTAGE				**12,316**	**9,905**	**2,765**

1.2 PUBLIC LOBBY

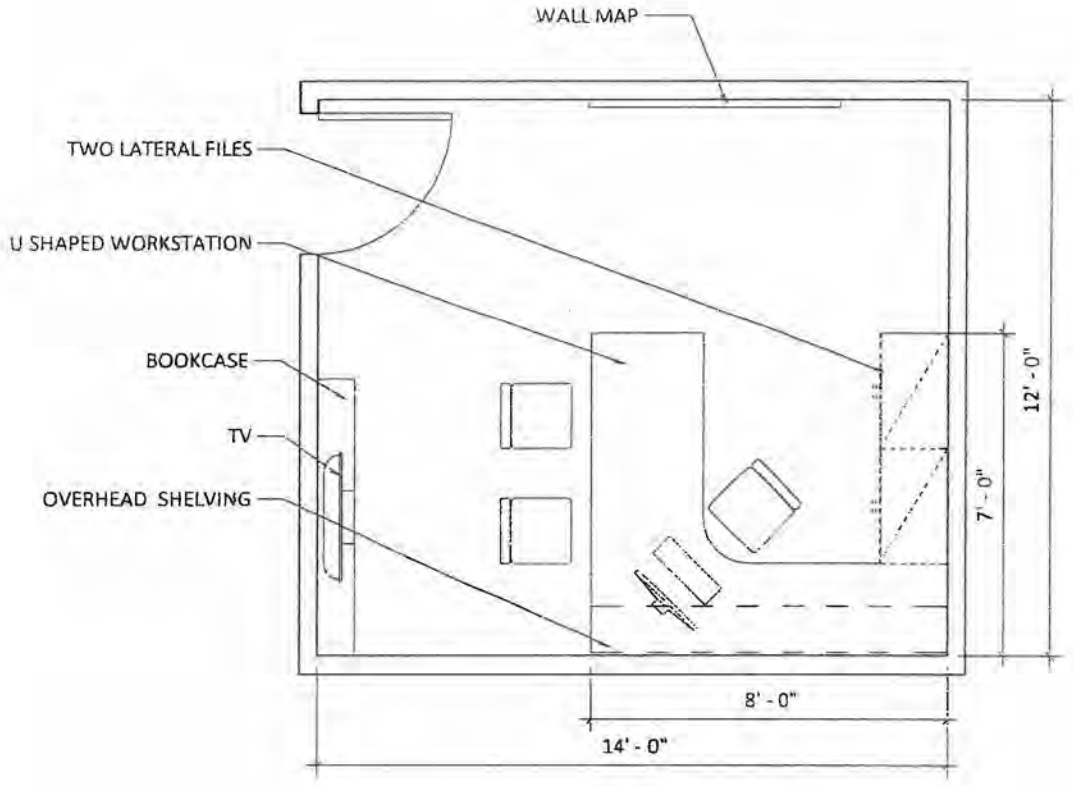
Adjacency Requirement	Adjacent to Company Officer, near administration area
Public Access	Full Access
Security Requirements	Moderate; controlled exit from Lobby to the rest of the building. All public must check in with first.
Contract Millwork / Equipment	Built-in bookcase for trophies and firefighter memorabilia.
Floor	Quarry tile or stone
Walls	GWB, painted & glazing
Ceiling	GWB, painted / ACT
Lighting / Electrical	Bright, indirect, LED lighting
HVAC / Plumbing	A/C, drinking fountain
Special Needs	N/A
Owner supplied Furn. / Equip.	N/A



PUBLIC LOBBY
1/4" = 1'-0"

2.1 BATTALION CHIEF

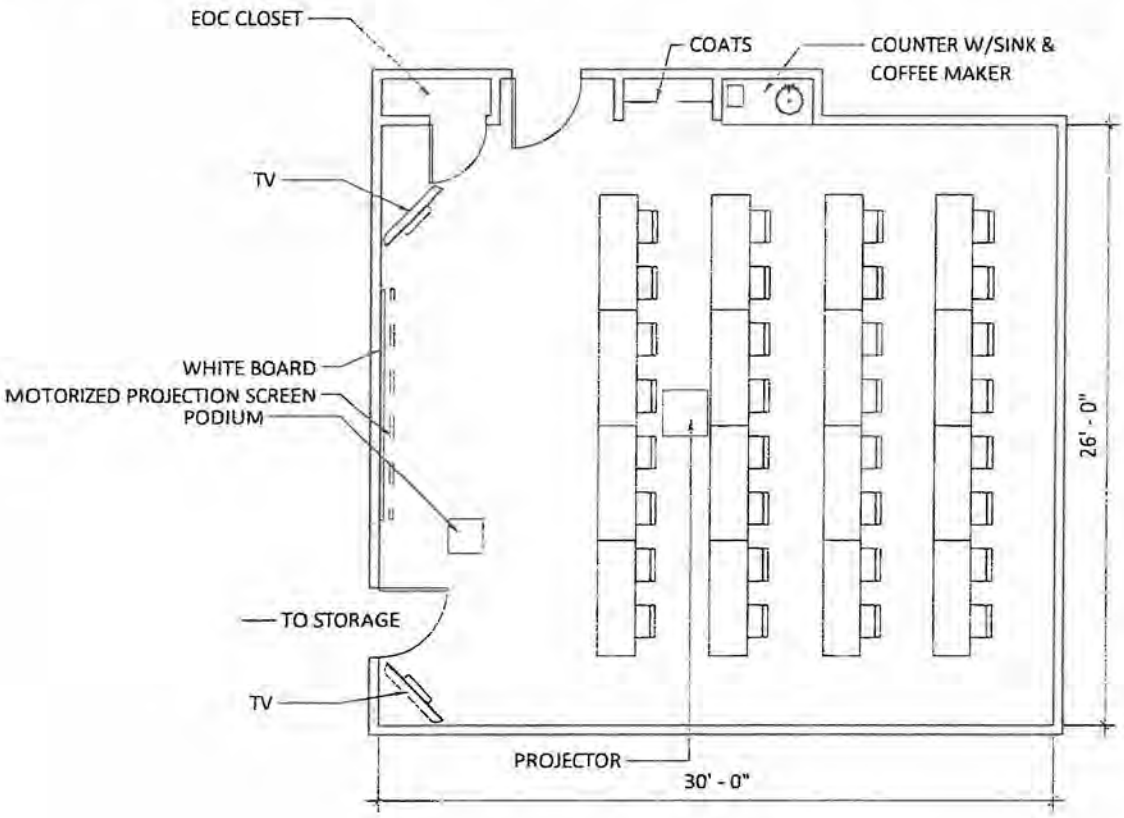
Adjacency Requirement	Adjacent to Company Officer/Report Writing
Public Access	Moderate
Security Requirements	Moderate, controlled
Contract Millwork / Equipment	N/A
Floor	Carpet tile
Walls	GWB, painted
Ceiling	ACT
Lighting / Electrical	LED
HVAC / Plumbing	A/C only
Special Needs	N/A
Owner supplied Furn. / Equip.	U shaped workstation with overhead shelving and two lateral files; desk chair; two guest chairs; one bookcase; wall map



BATTALION CHIEF
1/4" = 1'-0"

2.3 TRAINING ROOM

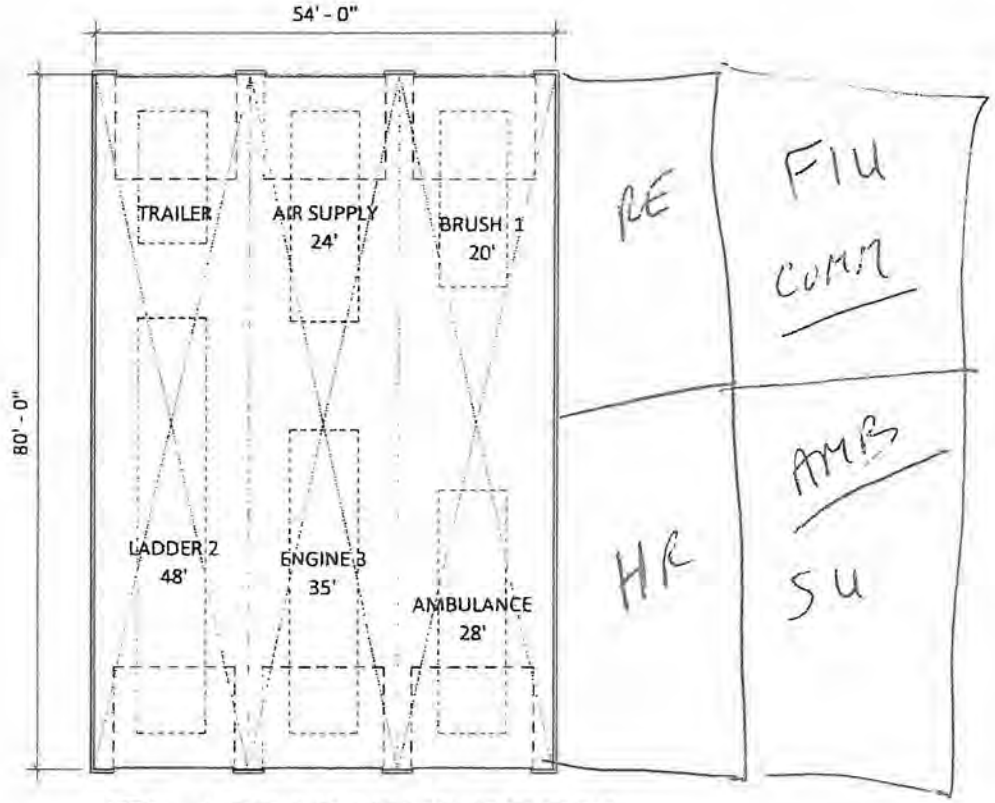
Adjacency Requirement	Easily accessible from Public Lobby. Good access to Apparatus Room.
Public Access	High
Security Requirements	Control the access from Company Office
Contract Millwork / Equipment	White board, fabric covered tackable surfaces, coat closet & shelf; counter top, coffee maker and under sink refrigerator
Floor	Carpet
Walls	GWB, painted & wall protection with chair rail
Ceiling	ACT upgrade, GWB above speaker area
Lighting / Electrical	LED lighting, glare free, dimmers, speaker system, numerous telephone & data outlets on walls, motorized projection screen
HVAC / Plumbing	A/C, good exhaust, sink
Special Needs	Backup EOC
Owner supplied Furn. / Equip.	(2) TV, podium, motorized projector screen, (16) tables and (32) chairs



TRAINING ROOM
1/8" = 1'-0"

3.1 APPARATUS ROOM

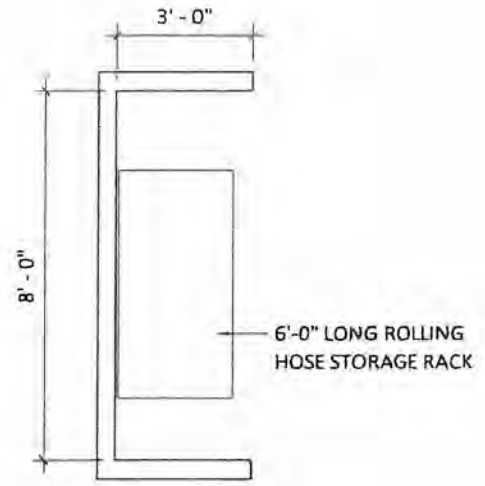
Adjacency Requirement	Adjacent to Firefigher's Quarters and support spaces.
Public Access	None
Security Requirements	Moderate
Contract Millwork / Equipment	N/A
Floor	Hardened, sealed concrete
Walls	CMU with epoxy paint
Ceiling	Painted exposed structure (19'-0" floor to deck structure)
Lighting / Electrical	LED; Low level night lighting; overhead power
HVAC / Plumbing	Heat only, provide vehicle exhaust system; overhead water fill; compressed air; sand/oil separator
Special Needs	Overhead doors (14' x 14'); overhead door operations at door jamb, report writing, and on apparatus vehicles; wide trench drains; bollards at each side of all overhead doors.
Owner supplied Furn. / Equip.	Trailer, Air Supply, Brush 1, Ladder 2, Engine 3, Ambulance



APPARATUS ROOM
3/64" = 1'-0"

3.3 HOSE STORAGE ALCOVE

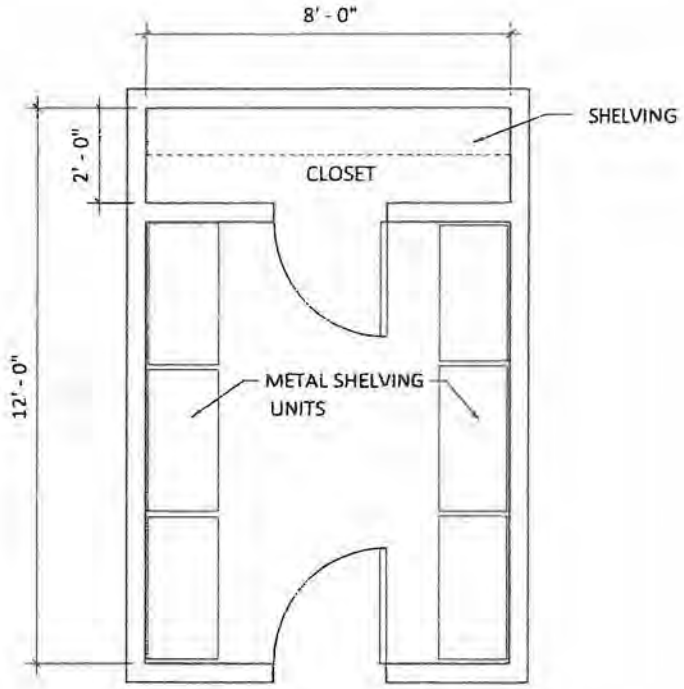
Adjacency Requirement	Adjacent to Apparatus Room
Public Access	None
Security Requirements	None
Contract Millwork / Equipment	None
Floor	Hardened, sealed concrete
Walls	CMU
Ceiling	GWB, painted
Lighting / Electrical	LED
HVAC / Plumbing	Heat only
Special Needs	N/A
Owner supplied Furn. / Equip.	Rolling hose storage rack



HOSE STORAGE ALCOVE
1/4" = 1'-0"

3.5 EMS SUPPLIES

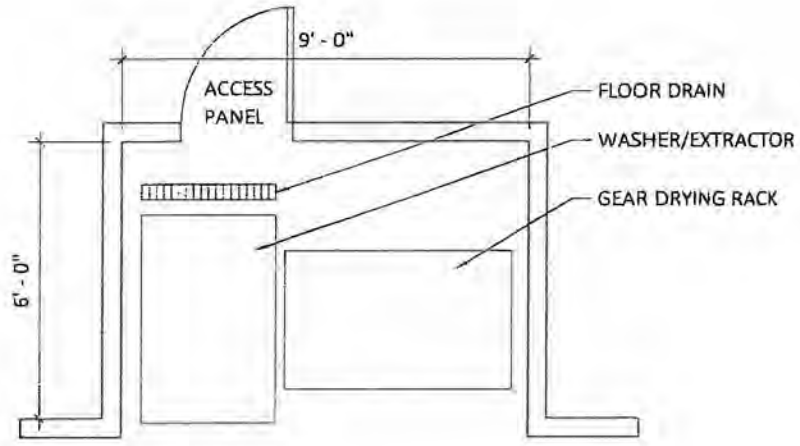
Adjacency Requirement	Near Apparatus Room
Public Access	None
Security Requirements	High; interior closet has separate card access
Contract Millwork / Equipment	Metal Wall shelving units in closet
Floor	Hardened, sealed conrete
Walls	CMU
Ceiling	GWB, painted
Lighting / Electrical	LED
HVAC / Plumbing	Heat, A/C, good ventilation
Special Needs	N/A
Owner supplied Furn. / Equip.	Metal shelving units.



EMS SUPPLIES
1/4" = 1'-0"

3.7 WASHER / EXTRACTOR & DRYER (CONTAMINATED)

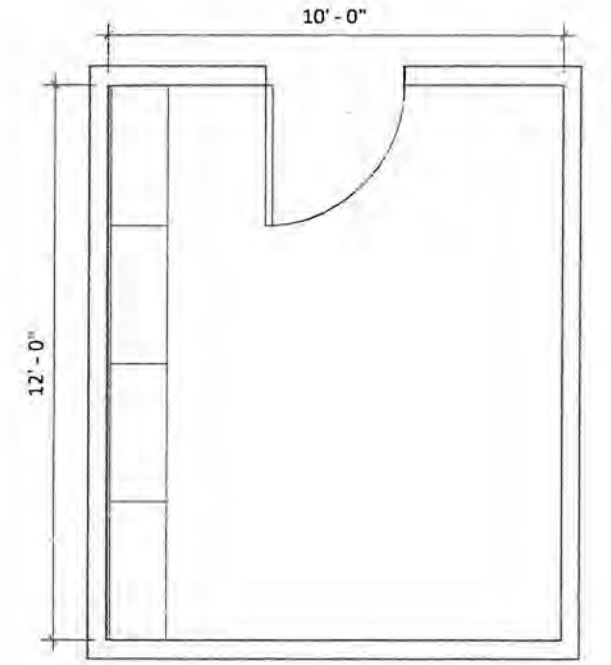
Adjacency Requirement	Adjacent to Apparatus Room
Public Access	None
Security Requirements	None
Contract Millwork / Equipment	Heavy-duty stainless steel, 45 lb. capacity washer extractor and dehydrator.
Floor	Hardened, sealed conrete (thickened slab or revised concrete pads below extractor/dryer)
Walls	CMU
Ceiling	GWB, painted
Lighting / Electrical	LED
HVAC / Plumbing	Floor drain, heat only, good ventilation, dryer vent
Special Needs	6" floor slab, gravity drain from extractor with air gap
Owner supplied Furn. / Equip.	N/A



WASHER / EXTRACTOR & DRYER (CONTAMINATED)
1/4" = 1'-0"

3.9 EQUIPMENT STORAGE

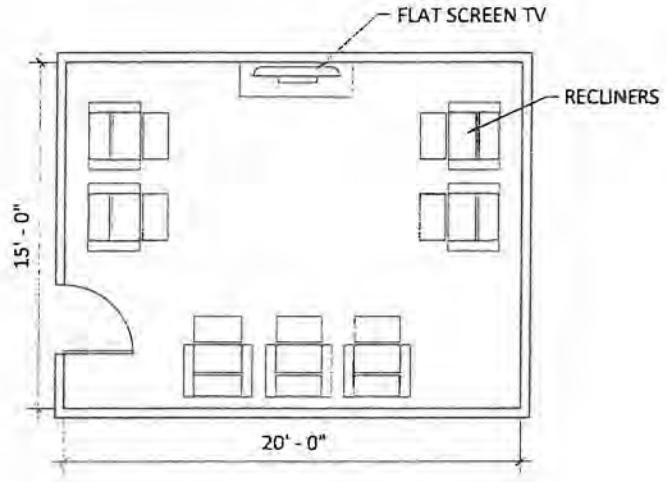
Adjacency Requirement	Adjacent to Apparatus Room, good access to exterior
Public Access	None
Security Requirements	Lockable room
Contract Millwork / Equipment	N/A
Floor	Hardened, sealed concrete
Walls	CMU
Ceiling	Painted exposed structure
Lighting / Electrical	LED
HVAC / Plumbing	N/A
Special Needs	N/A
Owner supplied Furn. / Equip.	Storage shelving units



EQUIPMENT STORAGE
1/4" = 1'-0"

4.2 DAY ROOM

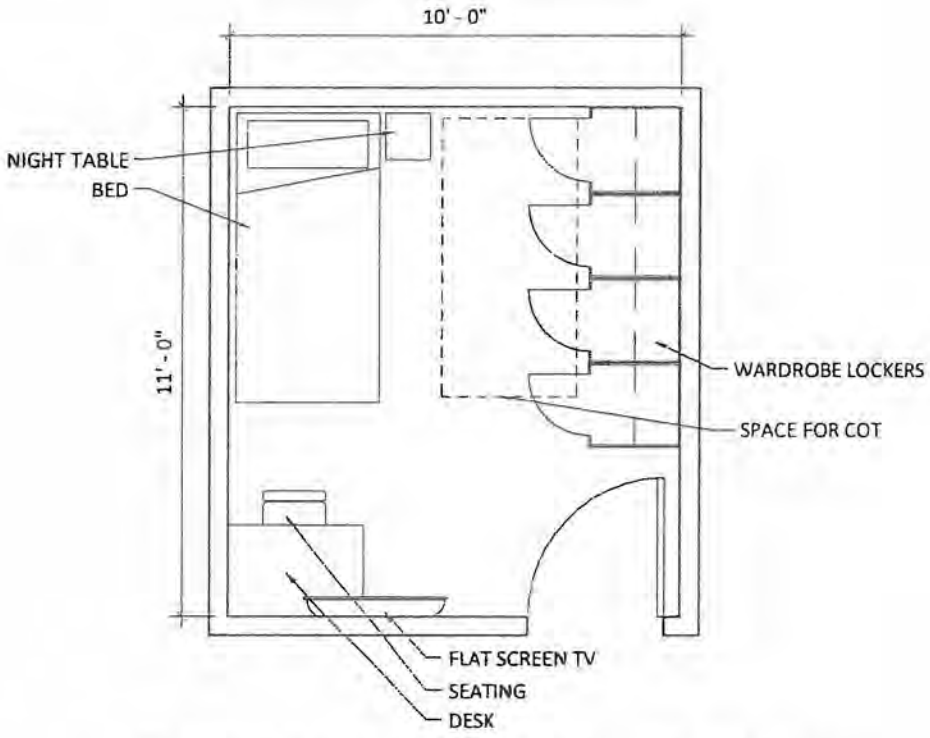
Adjacency Requirement	Good access to Apparatus Room, near Kitchen/Dining
Public Access	None
Security Requirements	None
Contract Millwork / Equipment	None
Floor	Resilient
Walls	GWB
Ceiling	ACT
Lighting / Electrical	LED, CATV, task lighting, power outlets on all walls
HVAC / Plumbing	Heat, A/C
Special Needs	Zetron speakers
Owner supplied Furn. / Equip.	Recliners/couch seating for (7), TV



DAY ROOM
1/8" = 1'-0"

4.4 FIREFIGHTER DORM ROOMS

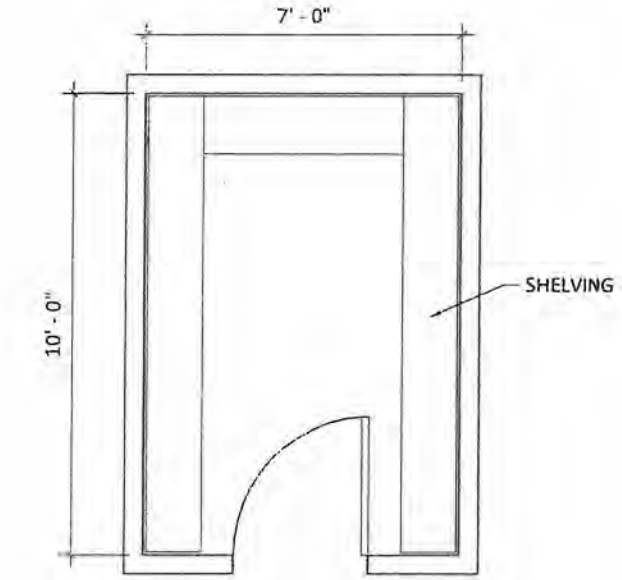
Adjacency Requirement	Good access to Apparatus Room. Adjacent to Toilet Rooms and Locker Rooms
Public Access	None
Security Requirements	Privacy
Contract Millwork / Equipment	None
Floor	Carpet tile
Walls	GWB
Ceiling	ACT
Lighting / Electrical	LED, 2 light levels, task lighting, provide (2) power, (2) data,
HVAC / Plumbing	Heat, A/C
Special Needs	Alerting system speaker in ceiling; darkening shades
Owner supplied Furn. / Equip.	Each room to have a chair, extra long twin bed, small built-in desk, lockers for linens (1 per shift); 22" X 24" wardrobe



FIREFIGHTER DORM ROOMS
1/4" = 1'-0"

4.6 STORAGE & SUPPLIES

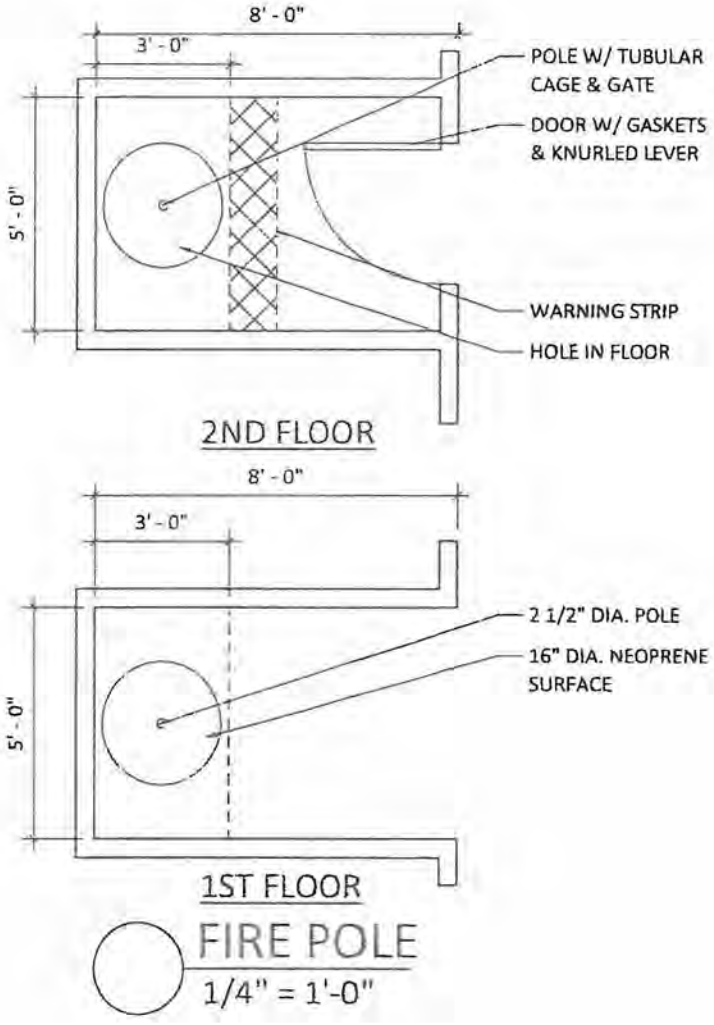
Adjacency Requirement	None
Public Access	None
Security Requirements	None
Contract Millwork / Equipment	None
Floor	VCT
Walls	GWB
Ceiling	ACT
Lighting / Electrical	LED
HVAC / Plumbing	Heat only
Special Needs	N/A
Owner supplied Furn. / Equip.	(3) rows of adjustable 18" deep wall shelves



STORAGE & SUPPLIES
1/4" = 1'-0"

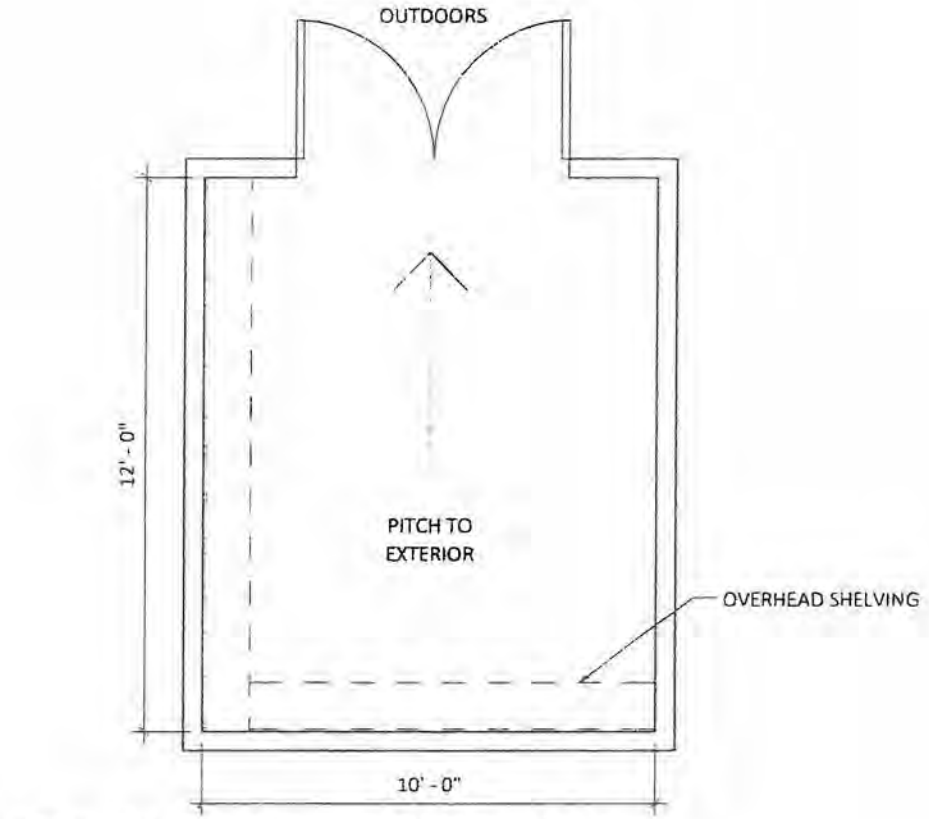
4.8 FIRE POLE

Adjacency Requirement	Direct access to living quarters
Public Access	None
Security Requirements	None
Contract Millwork / Equipment	N/A
Floor	Rubber, warning strip at 2nd floor
Walls	GWB
Ceiling	GWB, painted
Lighting / Electrical	LED lighting
HVAC / Plumbing	Heat only
Special Needs	Tactile grip on 2nd floor door hardware, pole w/ floor ring and cage, mat at 1st floor
Owner supplied Furn. / Equip.	N/A



5.2 OUTDOOR EQUIPMENT

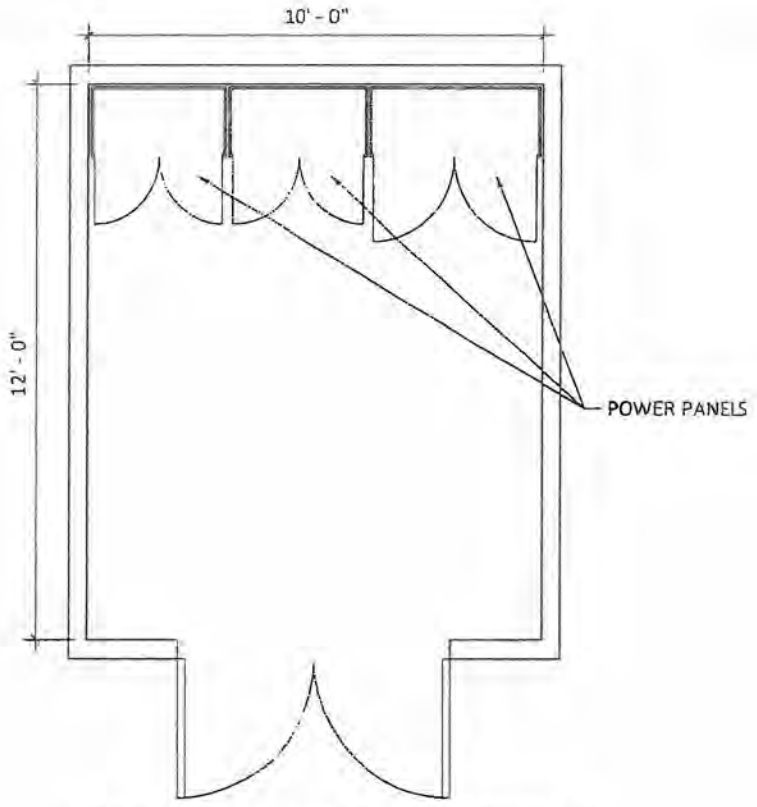
Adjacency Requirement	Adjacent to Apparatus Room and good access to exterior
Public Access	None
Security Requirements	Moderate
Contract Millwork / Equipment	Overhead shelving
Floor	Hardened, sealed concrete
Walls	CMU
Ceiling	Painted exposed structure
Lighting / Electrical	LED
HVAC / Plumbing	Heat only
Special Needs	N/A
Owner supplied Furn. / Equip.	N/A



OUTDOOR EQUIPMENT
1/4" = 1'-0"

6.2 ELECTRICAL ROOM

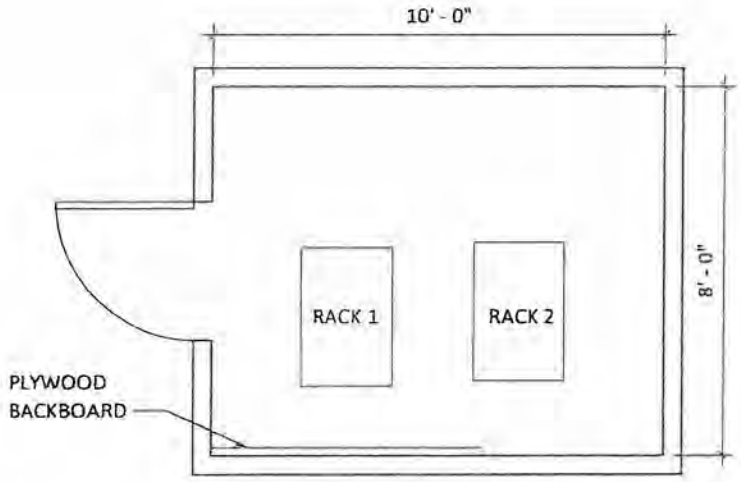
Adjacency Requirement	Locate near Server Room
Public Access	None
Security Requirements	None
Contract Millwork / Equipment	N/A
Floor	Sealed concrete
Walls	GWB, painted with plywood backboards on each wall
Ceiling	Exposed
Lighting / Electrical	LED lighting, power for equipment
HVAC / Plumbing	A/C only
Special Needs	N/A
Owner supplied Furn. / Equip.	N/A



ELECTRICAL ROOM
1/4" = 1'-0"

6.4 SERVER ROOM

Adjacency Requirement	Locate near Electrical Room. Accessed by Town IT Department staff
Public Access	None
Security Requirements	High
Contract Millwork / Equipment	N/A
Floor	Rubber or linoleum or hardened, sealed concrete
Walls	GWB, painted, plywood equipment panels
Ceiling	ACT
Lighting / Electrical	LED
HVAC / Plumbing	A/C only
Special Needs	N/A
Owner supplied Furn. / Equip.	2 Computer racks, server equipment



SERVER/TELEPHONE ROOM
1/4" = 1'-0"