U.S. Fire Administration
Working for a fire-safe America

Safety and Health Considerations for the Design of Fire and Emergency Medical Services Stations

May 2018

FEMA

Chapter 3: Site Selection

It has been said that these are the two most difficult things about fire stations:

1. Trying to put a station in a community.
2. Trying to take a station out of a community.

Site selection can be a challenge to any organization. There are multiple considerations for selecting a site. The two up-front considerations are finding a site location that optimizes the response time and service delivery, and getting community acceptance. Poor site selection can result in poor service delivery and additional costs that could be applied to aiding the organization's most valuable asset — its members, specifically their safety and health.

Response time and service delivery

In almost all cases, service delivery is the fundamental concern of any site selection. Response time is always a concern if a community is experiencing any of the following:

❯ Expanding or filling in its geographical area.
❯ Adding an in-fill station to take a workload off existing station(s).
❯ Relocating an existing station.

Fire and emergency services organizations have two methods for justifying the need for a new station that are based on service delivery and response time. The first method is time and distance. A common response benchmark is for an organization to respond to 90 percent of emergency calls within eight minutes. Using response time data, the department can identify where it is not able to meet this benchmark, and it can therefore justify the need for an additional facility.

There are several software packages available on the market which measure and show response distances on maps. Typically, the software integrates with existing Geographic Information Systems (GISs) to create maps. Response time software varies from being general and relatively cheap to expensive and very specific. While these are very valuable tools for developing qualitative data, there is no substitute for a fire and emergency services leader's knowledge of their jurisdictions.

If software is not an option, the manual method may work quite well. Response time is calculated by multiplying the average speed of fire apparatus by the distance being traveled. For example, traveling 4 miles at 30 miles per hour equals an eight-minute response time. Fire and emergency services organizations can do GIS functions by hand with a large-scale map, a measuring wheel, and a few highlighters. Either way, a map showing response problems is a valuable tool.

The second method for justifying the need for a fire station is to establish a criterion on the number of calls to an area within a given time — say, when there are more than two calls per day in an area, a station will be required. Workload criteria may backfire, however, if a problem arises from a long response into a remote area.

Standards

The ISO Public Protection Classification (PPC™) is an evaluation program that classifies public fire protection on a scale of one to 10. Some areas of the country, and some insurance companies, use past losses in the region to base their fire insurance fees. However, there are over 50,000 protection areas in the U.S. that use the ISO PPC classification rating.

Departments are strongly advised to check the requirements of the two deployment standards from the NFPA. While NFPA standards are not law, and their adoption is up to the authority having jurisdiction, they are considered a standard level of care and can be used for or against fire and emergency services organizations.

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*, covers career departments, and NFPA 1720, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Volunteer Fire Departments,* covers volunteer departments.

Insurance Services Office Public Protection Classification™ rating

An excellent ISO PPC rating, especially a rating of one, not only reduces fire insurance rates for many in the country, but it is also a sign of an organization that provides a high level of protection, and is a source of pride for the community and the organization. Organizations that receive a rating of one almost always proudly display this rating on their facilities, their fleet, and other items, such as letterheads, uniforms, etc.

ISO PPC determines the classification of a fire department through field visits to assess the fire protection infrastructure. They rely heavily on nationally recognized standards, such as:

- The NFPA.
- American Water Works Association (AWWA).
- Association of Public-Safety Communications Officials.

The classification system is based on points, with the maximum number of points being 105.5. The allocation of points is broken down into the following areas:

- Fire department — 50 points:

  - The first-alarm response, such as number of firefighters, number of engines, number of ladders, number of service companies.
  - Use of automatic aid.
  - Equipment carried on apparatus.
  - Pumping capacity.
  - Reserve apparatus.
  - Training.
  - Operational considerations.

- Water supply — 40 points:

  - Community water supply system.
  - Hydrant placement.
  - Hydrant size, type and placement.
  - Hydrant maintenance.

- Emergency communications systems — 10 points:

  ▸ Communications facilities.
  ▸ Support for the system.

- Community risk reduction — 5.5 points:

  ▸ Fire prevention code adoption.
  ▸ Fire prevention code enforcement.
  ▸ Public safety education.
  ▸ Fire investigation.

National Fire Protection Association 1710

NFPA 1710 for career departments has more stringent requirements than does NFPA 1720 for volunteer departments **(see Figure 3.1)**.

NFPA 1710 requires the following:

- Turnout time for fire responses — 80 seconds.

- Turnout time for emergency medical responses — 60 seconds.

- For the arrival of the first engine at a fire-suppression incident — 240 seconds or less.

- For a high-rise response — 480 seconds or less for the first full-alarm assignment for a fire-suppression incident.

- For high-rise fire incidents — 610 seconds or less for the first full-alarm assignment.

- For a unit with an automatic external defibrillator (AED) — 240 seconds or less.

- For an advanced life support unit, provided the organization has a responder with an AED or a basic life support on the scene within 240 seconds — 480 seconds or less.

The number of personnel required to mitigate an incident is based on a task analysis as described in the standard. Fire and emergency services organizations are strongly advised to get a copy of NFPA 1710 for complete details and explanatory language of the standard's requirements.

National Fire Protection Association 1720

NFPA 1720 contains the following requirements for volunteer departments **(see Figure 3.2)**:

- For urban areas, there must be minimum available staff of 15 people to respond, with a response time of nine minutes, which is met 90 percent of the time.

- For suburban areas, there must be a minimum available staffing of 10 people to respond, with a response time of 10 minutes, which is met 80 percent of the time.

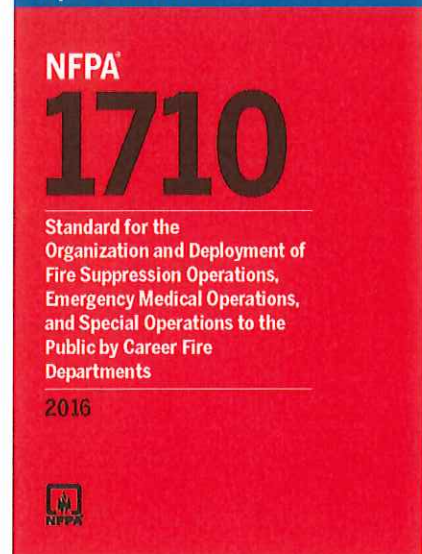**Figure 3.1 — NFPA 1710 sets requirements for career fire departments.**

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

Photo courtesy of Yvonne Smith, NFPA.

Figure 3.2 — NFPA 1720 sets requirements for volunteer fire departments.

NFPA® 1720
Standard for the
Organization and Deployment of
Fire Suppression Operations,
Emergency Medical Operations,
and Special Operations to the
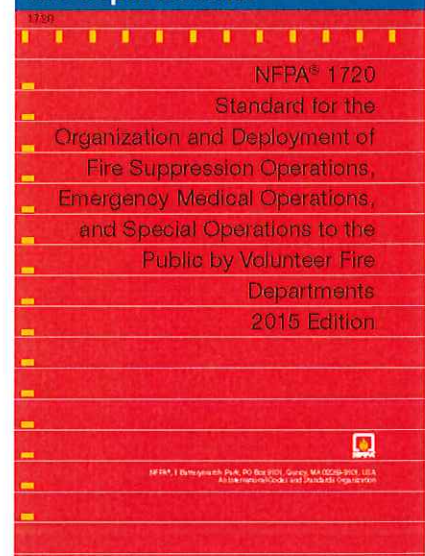Public by Volunteer Fire
Departments
2015 Edition

Photo courtesy of Yvonne Smith, NFPA.

❯ For rural areas, there must be a minimum available staffing of six people to respond, with a response time of 14 minutes, which is met 80 percent of the time.

❯ For remote areas, there must be a minimum available staffing of four people to respond, with a response time strictly dependent on the travel distance, which is met 90 percent of the time.

The response time requirements of these standards will assist the department in assessing and clarifying its needs. The standard applies to both fire and EMS responses. Fire and emergency services organizations are strongly advised to get a copy of the appropriate standard for their type of department for complete details and explanatory language of the standard's requirements. The standards may also be viewed online, free of charge, at www.nfpa.org.

Demographics

The demographics of a community can play a role in site selection. Population density typically has a direct bearing on the number of responses an organization will have from a designated site. For example, multifamily housing areas will create a higher number of responses than single-family housing areas.

Hospitals, nursing homes, assisted living centers, and other facilities with special life-safety hazards must factor into an organization's site selection. Other factors:

❯ Heavy-rail and light-rail lines that might disrupt an organization's response.
❯ Drawbridges that might disrupt an organization's response.
❯ Rush-hour traffic.
❯ Interstate highway access.
❯ Special community events.
❯ Seasonal population variances.
❯ One-way streets.
❯ Bridges with low-weight capacity.

Fundamental criteria

A fire and emergency services station is a major investment. It must function and serve the community for decades **(see Figure 3.3)**. Since a station is a visible and long-term statement of the community's commitment to the safety and well-being of its members, it should be designed to fit into the community and be highly functional.

Figure 3.3 — There are basic fundamental criteria that apply to any new fire station that is being considered.

Site Selection

Site Characteristics
- Accessibility in & out of site.
- Size & shape of property.
- Site distance at entrance drive.
- Sun exposure (sun angles).
- Prevailing Breezes (cross ventilation).
- Need for clearing.
- Permanent trees and cover.
- Ground Forms and Gradients.
- Soils.
- Adjacent Structures.
- Cost & Ownership.
- Proximity to Utility Leads.
- Visual impact of neighboring uses.
- Visual impact upon neighboring uses.
- Major Detractions.
- Exceptional Features.
- Security Issues.
- Free land is never free

BARRON ROAD

Photo courtesy of Jennifer Bettiol and Ray Holliday, BRW Architects.

The following fundamental criteria will provide guidance in site assessment and selection:

- Size.
- Public water or well.
- Public sewer or septic system.
- Power availability (three-phase versus single-phase).
- Communication service lines.
- Storm water.
- Clearing/Demolition.
- Natural gas.
- Road access.
- Grading/Topography.
- Wetlands.
- Approvals/Permitting.

Size

An acre for every 5,000 square feet of building is a general rule of thumb. This will allow enough room for on-site rainwater retention, parking for employees and visitors, and turning radius for drive-through bays. However, there are many variables to this rule of thumb. Parking is often an overlooked consideration when selecting a site. The following criteria should be used in determining parking spot allocations:

- Additional spaces to accommodate shift change if the station is to be fully staffed 24 hours a day.

- Additional spaces if there is a community room.

- Additional spaces if functions other than response staffing are to be located at the station (such as investigators, public educators, permitting, administrative staff, and other community agencies).

- If off-site parking is required, what is the distance, and what is the long-range commitment of the off-site parking area to the organization?

Additional space might be needed if exterior training evolutions are to be conducted on site. Also, there should be space allocated for additional apparatus to stage for joint meetings and training.

If a dumpster is going to be located on the site, there must be space allocated for it. Space will also be required to allow the waste management vehicle to safely access and empty the dumpster, to turn around, and to safely exit the property. Keep in mind the inside turning radius of a tandem axle apparatus or service truck is 35 feet.

Public water or well

While this might be a given for most available sites, it can be a big issue. Municipal and urban fire and emergency services organizations are often looking for new sites to provide service to an expanding response footprint. This typically comes through annexation. There have been many cases where a department is required to provide emergency response services before public water has been provided. This requires drilling a well that will hopefully provide enough flow and storage to satisfy the facility's needs. If the station is to be staffed 24 hours a day, the water demands are typically much higher than a normal single-family dwelling.

Public sewer or septic system

As with public water or a well, this is likely a given for most sites. Likewise, municipal and urban fire and emergency services organizations are often looking for new sites to provide service to an expanding response footprint. This typically comes through annexation. There have been many cases where a department is required to provide emergency response services before a public sewer system has been installed. If the station is to be staffed 24 hours a day, the sewage output is much higher than a normal single-family dwelling. This will overwhelm a septic system. On occasions where this has occurred, the organization must contract with a septic pumping service company and set up pumping on a weekly basis.

Electric power availability (three-phase versus single-phase)

Most sites have electric power capabilities to one extent or the other. It is important to know if the power source can supply the unique needs of a fire and emergency services organization. Another consideration is whether power can be fed underground to the facility. Underground is preferred to minimize power disruptions due to storms, motor vehicle accidents, and acts of civil unrest.

Communications service lines

Communications service has become increasingly important with the need for communication beyond just a telephone line. Cable lines for internet access are second only to power lines as a basic need for a functional fire station. In addition, there might be a need for television service through a cable line.

Storm water (regional)

Storm water runoff is a major concern that local and regional governments are addressing. When assessing a site, it is important to get the big picture of how storm water might impact the site in the event of sudden, heavy downfalls, as well as prolonged steady rain or snow-melt events. Equally important is the impact of the new facility on storm water for the community and the region. In many jurisdictions, a retention area is required to maintain and control storm water.

Clearing/Demolition

Most potential station sites will require varying degrees of clearing and/or demolition. These are costs that have increased in most areas because of local codes impacting the disposal of cleared vegetation or demolished building materials. In addition to the cost of having to segregate materials for disposal, there can always be disposal fees associated with removal of vegetation.

Natural gas

Access to a natural gas line will lower the operating costs of a fire and emergency services facility. Natural gas burns cleaner than other fossil fuels, producing half the carbon dioxide as coal and about a third less than oil. It also emits fewer amounts of toxic chemicals like nitrogen oxides and sulfur dioxide. In the U.S. market, it is an abundant resource, and it is currently the cheapest source of electrical power. It costs less than coal, hydroelectricity and solar.

Another consideration for assessing natural gas is the growing market for natural gas driven vehicles. Emergency response vehicles are easily suited for this application because the need to refuel is almost always at the same place — the station.

Road access

Road access involves several facets to assess:

- ❯ Line of sight — Can the driver/operator of emergency vehicles get a good field of vision to access the road without creating a hazard to motoring public or the emergency response vehicles?

- ❯ Returning to the station — If the vehicles are to be backed into the station, can this be done without having to stop traffic on the road?

- ❯ Extremely busy roads — Will the site require traffic signals to stop traffic so the responding apparatus can safely/quickly enter the road? Many departments have opted to put facilities on adjacent or side streets to avoid having to access busy roads.

- ❯ Responding uphill — If the responding apparatus must start out by climbing a grade, their response time will be negatively impacted. Sites at the bottom of a hill should be avoided, and sites located along an inclined road should receive careful assessment.

Grading/Topography

Grading can be a major expense for a fire and emergency services facility. Foremost, how much soil will need to be brought in, or how much soil will need to be removed? How far will the soil need to be transported if it is brought in or removed? If soil must be brought in, it will need to be compacted. Conversely, existing soil may require additional compaction.

The architect used a creative design to fit this mountain fire station into the sloping lot. The two-story work and living spaces are offset at an angle from the apparatus bay **(see Figure 3.4)**.

Figure 3.4 — This station being built on a hilltop is an example of a special construction consideration.

Photo courtesy of Robert Tutterow, F.I.E.R.O.

Grading also entails diverting storm water away from the parking lot and facility. In many cases, it involves the construction of a retention pond. In mountainous areas, grading may require blasting to break through stone to provide space for a facility.

Wetlands

In general, wetlands should be avoided. However, there are cases where it might be unavoidable. Environmental concerns may put fire and emergency services organizations at odds with their members and organizations within the community. These issues get sorted out by the local body of politics. It is imperative that emergency response agencies state their position in a clear and transparent manner.

If a facility must be built in an area subject to possible flooding, consideration should be given to designing a two-story facility, so that the lower floor can be quickly evacuated with minimal property loss.

Permitting and approvals

Permitting and approvals vary from community to community. Fire and emergency services must be aware of all required permits and approvals, and must be sure they can be obtained before purchasing a site. It is also incumbent upon the organization to understand the time allotment needed to obtain approvals and permits. It is not unusual for local citizens (especially neighbors to the site) or community organizations to use permitting and approvals as a tool to keep the organization from constructing a facility on a potential site. As in all situations where there are neighbors and community concerns, it is imperative that the organization state its interests in a factual and transparent way.

Organizations must also be aware of any zoning requirements, as well as homeowner association implications for the proposed site. Some communities have height restrictions. Municipalities and county governments may have art or landscaping ordinances for all public facilities.

Condemned property

Occasionally, a fire and emergency services organization may need to work with their local government to condemn a property to obtain a site. Condemnations are not free. For example, there could be any of the following factors:

❯ Court costs.
❯ Legal fees.
❯ Relocation costs.
❯ Lost business reimbursement costs.
❯ Cost of the land.

Many times, organizations may not be allowed to pay more than the assessed valuation of a property without some special effort.

Beware of free sites

In lieu of the above, beware of free sites! It is not uncommon for a citizen or developer to offer a free site to fire and emergency services organizations. However, past experiences have shown that often a free site can be an extremely expensive site. Key questions to ask:

> Is the location too much of a compromise to provide the response service?

> What does the person/company/developer offering the site expect in return?

> Are there site issues that would add significant additional construction expenses for the project?

> Is the site possibly contaminated?

Future growth

It is always a sound decision to find a site that allows for future growth. This can include population growth in the response area, as well as added services provided by the fire and emergency services organization.

No one can predict the future with 100 percent certainty. However, local community leaders, especially planners, can provide valuable insight into the probable changes in the community. This can include land development, road networks, mass transportation, etc.

Other cautions about site selection

There are several issues in site selection that must be considered for fire and emergency services organizations. These include, but are not limited to the following:

> Avoid property adjacent to a hazardous materials area. (The emergency response agency does not need to be the victim.)

> If near an airport, be sure antenna are within Federal Aviation Administration regulations.

> Check all records to make certain the site has not been a burial ground.

> Check all records to make certain the site has not been used for hazardous waste disposal.

Never hesitate to hire an outside expert to conduct a site design feasibility study. It could be the best money you will ever spend.

Community acceptance

Fire departments must be professional in their request and justification for a new station, and in their site selection. It is imperative that they stick to the facts and always be transparent in justifying their needs. Fire departments should keep the station location process practical and out of politics as much as possible. They must also be open to elected officials and the public, and they must keep everyone apprised of what is occurring. "Selling" the need for a new station at a particular location is truly where the rubber meets the road. This is where departments should have their relationships with their stakeholders in good shape, so that they can be successful in their quest.

Gaining community acceptance is a 24/7 process. Successful campaigns in the past have noted that it is easy to be against things (e.g., facilities), but a lot more difficult to be against people (e.g., first responders). Therefore, emergency responders must be in front of the community at every opportunity with a positive look and positive message.

A case study of a northwestern-based fire and emergency services organization revealed that the key to their success was a quarterly newsletter sent to their citizens. The full-color newsletter was loaded with pictures of the organization's members providing service to the community. Not only were there emergency scene photos, but there were photos of smoke detector installations, blood pressure checks, fire extinguisher training, CPR training, home safety training, and other activities showing the members serving their community.

When initiating a campaign for community support, include the following:

- Careful planning.
- Educating the organization.
- Increasing the knowledge base.
- Educating the public.
  - Station tours.
  - Conduct community meetings.
- Continuing information.
- Creating a "tool chest" (who, what, when, where, why, and how much).
- Developing an action plan that includes the following:
  - Defining organization (and community) needs.
  - Knowing the tax burden and benefits.
  - Establishing media contacts.
  - Sharing your financial information in a clear and concise order.
  - Communicating a cohesive message.
  - Dispelling or confirming rumors with facts.

Don't expect everyone to buy in immediately. What is cost effective to one person, might be a waste of money to another person. Don't ever assume the public knows the scope of an organization's service capabilities, or the resources and training to deliver that service.

As was stated at the beginning of this section, it is often said that the following are the two most difficult things about fire and emergency services facilities:

1. Trying to get one in a community.
2. Trying to take one out of a community.

Gaining community requires a 24/7/365 commitment by the organization to be totally transparent with its customers. It must be understood that many people are basically suspicious of the government. So, soliciting funding for a new fire and emergency services facility can be an uphill battle. Sound marketing principles are critical for gaining community support.

Successful marketing by fire and emergency organizations to gain community support for a new or renovated facility includes elements, such as:

- The need must be clearly identified.

- The need must be clearly communicated to the community.

- Be transparent. Transparency equals honesty.

- Be involved in as many community events as possible — always smiling.

- Create an on-going newsletter. This can be monthly or quarterly. With a newsletter, the organization controls the message. Color works better than black and white. Use lots of photos.

- Celebrate your members.

- Create a logo for brand recognition.

- Create a phrase to communicate the organization's service. (Shorter is better.)

- Communicate the organization's value to the community. Quantifiable value is stronger than qualitative value.

- Become active in civic organizations.

- Embrace public speaking, as well as private speaking.

- Offer free services: blood pressure readings, CPR lessons, fire extinguisher training, smoke detector installation, etc.

- Let the public be involved in the exterior appearance of the facility. A good rule of thumb: The interior of the facility belongs to the members; the exterior belongs to the community.

- Opportunities for marketing vary from community to community. It is essential to take advantage of every available opportunity.

Remember, it is easy to vote against things. It is difficult to vote against people. Be sure the community knows that the organization's most valuable asset is its members.

Once a site is secured

Once a site has been approved, fire and emergency services organizations should stake their claim by posting a sign. This will generate questions from citizens about the progress toward building and opening "their" new facility **(Figure 3.5).** Proclaiming the coming facility is a public relations tool to generate goodwill that departments should not miss.

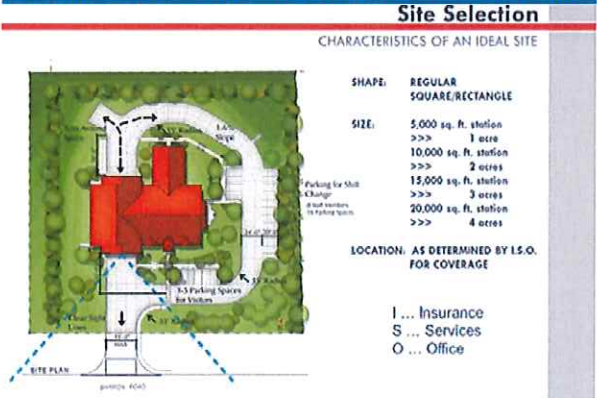**Figure 3.5 — This shows some overall considerations for fire station site selection.**

Photo courtesy of Jennifer Bettiol and Ray Holliday, BRW Architects.