

Creating Standards of Response Coverage for Fire Incidents

EXECUTIVE LEADERSHIP

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ABSTRACT

Standards of response coverage are a tool used to distribute and concentrate the resources of a fire department to fulfill its goals and objectives. They are created by performing a risk-assessment of the community and allocating resources based on the probability and consequences of a fire occurring.

The problem is the Hartford Emergency Services Department does not have standards of response coverage for fire incidents. The purpose of this applied research project is to create standards of response coverage for fire incidents. This applied research project used action research to answer the following questions:

1. What criteria are used on a national level for standards of response coverage for fire incidents?
2. What criteria are used on a state level for standards of response coverage for fire incidents?
3. What approaches do fire departments use to create standards of response coverage for fire incidents?

Standards of response coverage are a concept introduced in the last 10 years by the Committee on Fire Accreditation International (CFAI). This concept was compared to *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*, *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*, and the *ISO grading schedule*. The fire response practices of combination fire departments in Vermont and San Diego County (CA) and the methodology used to create them were also reviewed.

Standards of response coverage were created using a template designed by the Oregon Fire Chiefs Association. This template uses the probability and consequences of an incident and identifies personnel and resources necessary to perform critical tasks.

The results of this Applied Research Project revealed that the CFAI's method of creating standards of response coverage was the most scientific and followed the principles typically associated with risk management.

The NFPA has two standards for fire protection in fundamental conflict with one another. *NFPA 1710* is the standard for substantially career fire departments. It mandates staffing levels and response objectives because a fire department has career members. *NFPA 1720* is the standard for substantially volunteer fire departments. It mandates fire departments to perform a risk analysis and develop resources to meet the results of the risk analysis. A department can comply with *NFPA 1710* by meeting the standards or by eliminating its career members. A volunteer department that performs the risk assessment required by *NFPA 1720* and identifies a need for career personnel finds itself judged against a different standard. The *ISO grading schedule* is one of the oldest methods of allocating and distributing fire department resources. The ISO readily admits that its goal is to evaluate a fire department's capabilities to keep a fire from reaching catastrophic proportions.

Most fire departments have staffing and resources based on an historical level of funding. It has been a "here's your budget, do the best you can" approach.

This Applied Research Project recommends a more scientific approach. It has created standards of response coverage considering the needs of the community, the service level desired, the resources currently available, and future resources needed to serve the community.

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INTRODUCTION

Standards of response coverage are a tool used to distribute and concentrate the resources of a fire department to fulfill its goals and objectives. They are created by performing a risk-assessment of the community and allocating resources based on the probability and consequences of a fire occurring. This is a new concept promoted by the Committee on Fire Accreditation International as a scientific method for allocating department resources. The fire service has used the *Insurance services office grading schedule*, *NFPA 1710*, *NFPA 1720*, as planning tools. This ARP evaluates these documents and examines historical/traditional approaches to fire department resource allocation.

The problem is the Hartford Emergency Services Department does not have standards of response coverage for fire incidents. The purpose of this applied research project is to create a standard of response coverage to fire incidents.

This ARP uses action research to answer the following questions:

1. What criteria are used on a national level for standards of response coverage for fire incidents?
2. What criteria are used on a state level for standards of response coverage for fire incidents?
3. What approaches do fire departments use to create standards of response coverage for fire incidents?

BACKGROUND AND SIGNIFICANCE

The Hartford Emergency Services Department is a combination department (19 career and 12 call firefighters) that provides fire protection, emergency medical services, and technical rescue services for the Town of Hartford. Hartford is located in south central Vermont on the eastern border. The town is 38 miles and has a population of 10,000. Most of the town is rural in nature but there is a

built-up central business district. Two interstate highways intersect in Hartford and are accompanied by the “sprawl” (motels, fast food restaurants, and gas stations) typically found at most major interchanges. There are five unincorporated villages in town, Hartford, Quechee, West Hartford, White River Jct., Wilder. Hartford Village and Wilder are predominantly suburban villages with a mix of 100-year old building and new single-family dwellings and small apartment buildings. White River Jct. is the central business district in town. It is comprised of small three-story masonry buildings and old wood-frame buildings. Quechee was transformed into a resort community 25 years ago. Approximately 600 condominium units and 500 single-family dwellings surround two golf courses, a ski area and a lake.

Hartford has grown considerably over the past 20 years. There has been tremendous growth in single-family and multi-family residential buildings. Much of the new construction has been in the rural areas of the community. The Department has worked with the Hartford Planning Commission to address fire protection concerns for new developments. The Hartford Planning Commission and developers both decried the lack of uniform standards. The Department addressed these concerns by revising its section in the Town’s master plan (Appendix D). The proposed revision establishes service level objectives based on resources and community risk. Standards of response coverage are the means to meet the service level objectives. The problem is the Hartford Emergency Services Department does not have standards of response coverage for fire incidents. The Department has been level funded for the past 12 years. Prior to that career personnel had been added to reduce overtime costs. The Department basically functioned as best it could within the confines of its budget. The purpose of this ARP is to create a standard of response coverage to fire incidents. This is but one step in a process to create a realistic fire protection plan for the community. The next step is formal adoption of the revised master plan (Appendix D) and implementation of the standards of

response coverage. The skills learned in the National Fire Academy's *Executive Leadership Course* were valuable in the creation of the standards of response coverage. The units on decision making, influencing, power, networking and negotiation will be particularly valuable during the adoption and implementation phase of the community's fire protection plan.

LITERATURE REVIEW

Standards of response coverage are an integral part of strategic planning for fire protection. They are the allocation and distribution of resources to meet the goals and objectives of a community's master fire protection plan (CFAI 1997-2000). The Committee on Fire Accreditation International (CFAI) believes that a community should first determine the levels of service it wishes to provide and then develop standards of response coverage to provide that level of service (CFAI 1997-2000). The CFAI (1997-2000) further asserts that the modern (last 10 years) fire service, collectively, has not established levels of service but rather provides services based on available resources. This type of change has to be accomplished using influence rather than power (National Fire Academy, 2000). The International City Management Association (ICMA) gives an overview of NFPA and ISO requirements and encourages communities to evaluate these requirements and use this evaluation as part of their master planning (Byran & Picard, 1979).

Research Question 1:

What criteria are used on a national level for standards of response coverage for fire incidents?

The National Fire Protection Association (NFPA) and the Insurance Services Office (ISO) have criteria for the distribution and concentration of fire department resources. The CFAI does not have specific criteria for the distribution and concentration of fire department resources other than

stating each department should have sufficient resources to achieve the level of service established in the community's master plan (CFAI 1997-2001).

National Fire Protection Association

The NFPA has published two standards that are relevant to standards of response coverage. These are, *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* (2001a) 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* (2001b). The NFPA uses the term standard to refer to a document that uses the word "shall" to designate compliance with mandatory provisions (NFPA 2000).

NFPA 1710 applies to fire departments that are substantially staffed by career members. This standard establishes service delivery objectives for alarm processing time, turn out time, response time and staffing levels for initial fire attack and a full alarm assignment. The mandatory provisions of *NFPA 1710* (with respect to fire suppression) prescribe:

- Alarm processing within one minute.
- Turnout time within one minute.
- Response time of the first engine within 4 minutes.
- Response of a first alarm assignment within eight minutes.
- Staffing levels of at least four on-duty members for engine and ladder companies and more five or six on-duty members in high hazard areas. A full first alarm assignment must have a minimum of 15 members (NFPA 2001a).

A fire department that can meet the standards listed above 90 percent of the time complies with *NFPA 1710*.

NFPA 1720 applies to fire departments that are staffed by substantially volunteer members. This standard sets staffing levels and number of apparatus based on risk analysis and pre-fire planning. There are time-based standards for tactical deployment but not for response to the scene (NFPA 2001b).

The mandatory provisions of *NFPA 1720* (with respect to fire suppression) prescribe:

- Apparatus response based on a community risk management plan in conjunction with pre-fire planning.
- Staffing levels determined by the fire department to ensure safe operations.
- The use of an incident command system that uses an incident commander to manage the scene and company officers to direct teams of firefighters.
- Safely beginning initial operations within two minutes after the arrival of resources at the scene. This must be accomplished at 90 percent of the fire incidents the department responds to.
- The presence of four firefighters before entry to a building to perform interior firefighting. Interior firefighting must be done in teams of at least two firefighters and two firefighters must remain outside to rescue the interior team(s).

Exceptions are made for situations where immediate action can save a life.

A fire department that can meet the standards listed above 90 percent of the time complies with *NFPA 1720* (NFPA 2001b).

Insurance Services Office.

The ISO (2001) uses a grading schedule to evaluate a community's fire suppression resources. The ISO rating is based on the principle of placing sufficient fire apparatus on the scene in a short time period with an adequate water supply to contain a fire to the building of origin (ISO 2001). Communities are given a score (one through nine, one is the best) based on the fire department (50 percent), the water system (40 percent) and the communications and dispatch system (10 percent). This score, known as the Public Protection Classification (PPC), is one factor used by the ISO to establish insurance rates for commercial buildings (ISO 2001). The ISO (2001) cautions that the PPC is not meant as an all-inclusive evaluation of a community's fire protection resources.

The major components of the PPC are measured by:

- Determining the fire flow [quantity of water expressed in gallons per minute (GPM)] needed to extinguish a building fire based on the size, construction type, and proximity to other buildings.
- Requiring one engine for fire flows up to 1250 GPM, two engines for fire flows 1250 GPM to 2500 GPM and three engines for fire flows 2500 –3500 (the maximum) GPM. The first responding engine must be located within 1½ miles of the building.
- Requiring one ladder company for any fire management area that has five or more buildings greater than three stories tall or five or more buildings with a fire flow of 3500 GPM. The ladder company must be located within 2 ½ miles of the building.
- Requiring a water distribution system to deliver the needed fire flows.
- Requiring a dispatch and communications center based on the population of the community.

- Creating a numerical credit based on the number of personnel available to respond to an alarm. Five on-duty members for each engine and ladder company earn the maximum credit. The formula gives full credit for on-duty personnel and one-third credit for volunteer (or off-duty career) personnel (ISO 2001).

Components that do not meet ISO's standards are either assessed penalty (minus) points or point values below the norm.

Research Question 2:

What criteria are used on a state level for standards of response coverage for fire incidents?

Vermont statutes enumerate the powers of fire departments and authorize their existence (Municipal and county government, 1992). The statutes do not mandate any levels of response or distribution of resources (1992). There are thirteen fire departments in Vermont with career firefighters. None of these departments are accredited or enrolled in the accreditation process. Twelve of these are combination departments and one is a career department. Four of the combination departments are similar to Hartford in that they provide fire and ambulance service. Three of those four, Barre City, Montpelier, and Springfield, have similar number of personnel and population (approximately 10,000).

Barre City Fire Department

The Barre City Fire Department has an on-duty force of three career members (24 hours per day 7 days per week). There is a Chief and Deputy Chief who work days (Monday-Friday). They have one centrally located fire station with three engines, one tower ladder, and two ambulances. Deputy Chief J. Black (personal communication, September 4, 2002) reports that they do not have

written standards of response coverage. He based his answers to questions regarding standards of coverage on his experience (25 years).

- Alarm processing within one minute. William John, a dispatcher, believed this was accurate (personal communication, September 5, 2002).
- Turnout time within one minute.
- Response time of the first engine to the furthest point in the city is less than 4 minutes.
- Response of a first alarm assignment within six minutes.
- Initial response to all buildings is a still alarm. The response is one engine with two on-duty members and one tower ladder with one firefighter. Chief officers respond at their discretion.
- Staffing levels of at least four off-duty members for the other two engines. Another 8 to 12 members respond in personal vehicles.
- First alarm personnel and apparatus arrive on scene in five to eight minutes.
- The number of on-duty members has been reduced from five to three over the past 20 years in order to minimize tax increases.
- The response is the same for all risk categories. (J. Black, personal communication, September 4, 2002)

Montpelier Fire Department

The Montpelier Fire Department has an on-duty force of four career members (24 hours per day 7 days per week). There is a Chief and Deputy Chief who work days (Monday-Friday). They have one centrally located fire station with three engines, one ladder, and two ambulances. Chief N. Lewis (personal communication, August 21, 2002) reports that they do not have written standards of

response coverage. He based his answers to questions regarding standards of coverage on his experience, standard operating procedures and records kept by the department.

- Alarm processing time within one minute.
- Department standard operating procedures require a turnout time of less than one minute.
- Response time of the first engine to the furthest point in the city is less than 4 minutes.
- Response of a first alarm assignment in seven to nine minutes.
- Initial response to all buildings is called a first alarm. One engine and one ladder with two on-duty members on each piece respond to the scene along with three to seven call firefighters who respond directly to the scene in personal vehicles. Chief officers respond at their discretion. A second alarm summons off-duty members to the station. They respond with apparatus as directed by the Incident Commander. Staffing levels are at least five members for the second engine and a minimum of two for the ladder.
- First alarm personnel and apparatus arrive on scene (built up areas of town) in five to eight minutes.
- The number of on-duty members has been reduced from four to three over the past 15 years in order to minimize tax increases and reduce the average number of hours in a firefighter's workweek.
- One engine, one ambulance and one rescue are added to the first alarm assignment for high risk occupancies (N. Lewis, personal communication, August 21, 2002).

Springfield Fire Department

The Springfield Fire Department has an on-duty force of two career members (24 hours per day 7 days per week). There is a Chief and Deputy Chief who work days (Monday-Friday). They

have one centrally located fire station with three engines, one ladder, one rescue, one tanker and two ambulances. Chief E. Lamphere (personal communication, August 20, 2002) reports that they do not have written standards of response coverage. He based his answers to questions regarding standards of coverage on his experience (over 35 years) and records kept by the department.

- Alarm processing and turnout time within two minutes.
- Response time of the first engine to the built up area of the town is less than one minute. There are rural areas where the response time can be as high as ten minutes.
- Initial response to all buildings is a first alarm (two engines and one ladder). Two on-duty members respond with the first engine. Off-duty members report to the station within five minutes and respond with an additional engine and one ladder. Chief officers (both off and on-duty) respond directly to the scene.
- Staffing levels are at least five members for the second engine and a minimum of two for the ladder.
- First alarm personnel and apparatus arrive on scene (built up areas of town) in five to eight minutes.
- The number of on-duty members has remained constant for the past 20 years. Attempts to add personnel have been unsuccessful due to a reluctance to raise taxes.
- The first alarm assignment for high risk occupancies adds one engine, one ambulance and one rescue. (E. Lamphere, personal communication, August 20, 2002).

The Vermont Occupational Safety and Health Administration (VOSHA) safety standards apply to career and combination fire departments (VOSHA, 1998). These regulations require a minimum of four members on scene before personnel enter a toxic atmosphere. Members shall not work alone in toxic atmosphere and there must be a standby crew of two people. This safety standard

is commonly known as the “two in, two out” rule. The exception to the “two in, two out rule” is when action(s) can be taken to save life. Even in these situations, members cannot work alone in a toxic atmosphere (VOSHA, 1998). This is the only VOSHA regulation relevant to the deployment of fire department resources (VOSHA, 1998).

Research Question 3:

What approaches do fire departments use to create standards of response coverage for fire incidents?

The Santee (California) Fire Department chose to create standards of response coverage and researched what 23 other departments in San Diego County (California) were using and why they were using them (Rayon, 2001). Rayon (2001) determined that standards of response coverage should be based on risk analysis. The results of the risk analysis should determine staffing levels and resource allocation. Rayon (2001) concluded that *NFPA 1710* did not scientifically address fire protection needs. His view was that the International Association of Fire Fighters (a labor union) dominated the NFPA’s consensus making process and transformed *NFPA 1710* from a planning and deployment tool into a job protection tool (Rayon, 2001). Rayon’s (2001) research yielded the following results:

- Ninety percent of the engine companies are staffed with three career members.
- One hundred percent of the ladder companies are staffed with at least three members. The average staffing for all ladder companies was 3.5 career members.
- The average initial response time was five to six minutes.
- There were no standards for first alarm assignments.

Rayon (2001) did not research alarm processing or turnout time. He did research the basis used to create standards of response coverage and determined that

- Historical/traditional was the basis used by 12 departments.
- A collective bargaining agreement was the basis used by six departments.
- A master plan was the basis used by three departments.
- The “Two in two out” rule was the basis used by two departments.

Kipp and Loflin (1996) believe in the systematic management of risk. They propose a sequential process that begins with hazard identification and analysis, continues with the selection and implementation of hazard mitigation techniques and concludes with an evaluation of the effectiveness of the techniques and the accuracy of the original analysis (Kipp & Loflin, 1996).

NFPA 1710 and *NFPA 1720* are valid standards for measuring a department’s capability or determining performance goals (Fuller, 2001). Fuller (2001) also believes that distributing resources by response time and staffing apparatus based on *NFPA 1710* is appropriate. Fuller’s (2001) reasoning is that *NFPA 1710* is a consensus standard created for public safety and the interests of all affected parties are addressed. He cites an “equivalency clause” in *NFPA 1710* that permits a jurisdiction to find other methods or techniques to meet or exceed *NFPA 1710* standards (Fuller, 2001).

A community must start with risk assessment followed by a determination of acceptable outcome(s) based on a self-determined acceptable level of risk (Gary, 2001). A community may wish to maintain a sufficient firefighting force to confine a fire to the room of origin in the moderate to high risk sections of the community but would accept containing a fire to the building of origin in the rural risk sections of the community Gary (2001). Coleman (2001) reiterates the need to perform risk assessment first and create standards of response coverage based on local determination.

The *ISO grading schedule* focuses on property protection. The grading schedule assesses a department’s ability to suppress building fires before they damage valuable property. The size and

value of a building are heavier weighted components of the grading schedule than life safety components (Larson, 1995). Larson (1995) cautions that the basic mission of the fire service, to save lives and property, is not congruent with the *ISO grading schedule*.

The first steps to create standards of response coverage are to identify risks and establish service level objectives to alleviate the risks. Risk must be assessed based on the probability and consequences of a fire occurring. These steps are used as the basis for the distribution and concentration of resources. The final steps are monitoring the reliability and performance of the resources for compliance with the service level objectives (CFAI, 1997-2001). Standards of response coverage are a new concept to the fire service and will not be unilaterally accepted by communities and interest groups within the fire service (CFAI, 1997-2001).

The *Deployment standard worksheet* is a guide for departments to use in developing standards of response coverage (Oregon Fire Chiefs Association, 2001). This document establishes a methodology for creating standards of response coverage and is modeled after the *Fire and emergency service self-assessment manual*. The section of the *Deployment standard worksheet* that pertain to fire incidents are:

- Introduction
- Mission statement
- Community risk assessment
- Time and on-scene performance
- Critical tasks and an effective response force

The *Deployment standard worksheet* weights two factors with respect to fire incidents. They are the possibility of an incident occurring and the consequences of an incident occurring (Oregon Fire Chiefs Association, 2001).

The Hartford Planning Commission (1998) calls for the department to add personnel and equipment on an as needed basis. The plan does not define “as needed” nor does it enumerate specific criteria for adding or relocating resources.

PROCEDURES

The purpose of this applied research project is to create standards of response coverage to fire incidents. Action research is used to answer the three research questions. This paper is formatted using the *Fourth edition publication manual of the american psychological association* except where modified by the *Executive fire officer program applied research guidelines*.

The problem is the Hartford Emergency Services Department does not have standards of response coverage for fire incidents.

Research Question 1:

What criteria are used on a national level for standards of response coverage for fire incidents?

This author was familiar with the ISO, NFPA, and CFAI. These organizations and the phrase “standards of response coverage” were used as “keywords” to begin the literature review. The references used in each of the documents associated with the “keywords” were examined for links to other organizations that have prescribed standards of response coverage. This search did not discover any other organizations.

Research Question 2:

What criteria are used on a state level for standards of response coverage for fire incidents?

This author has been a member of the Vermont Career Fire Chiefs’ Association for sixteen years and has numerous contacts in each of the 11 combination departments in the state. Telephone

interviews were conducted with chief officers in each of the 11 combination departments. The information gleaned from the departments with similar demographics to Hartford was used in the ARP.

Research Question 3:

What approaches do fire departments use to create standards of response coverage for fire incidents?

Standards of response coverage are a key component of the accreditation process. A list of CFAI accredited departments was obtained from the CFAI's web site. A database was created that included the type of department, population, and services provided. A questionnaire (Appendix B) was sent to each of the 24 departments with a population under 40,000 people. Eleven responses were received but the responses received were from departments considerably larger than Hartford. There was only one combination department that provided emergency medical service and served a community in the same population range as Hartford (10,000 to 20,000). This department did not respond to the request. The fruitlessness of this research caused a reexamination of the methodology used to answer this question. This gave rise to the realization that accredited departments would have followed the methodology listed in the *Fire and emergency service self-assessment manual* and therefore their staffing levels and resource allocation would be based on their community's risk assessment. Research for this question was redirected to processes used by other fire departments in the United States.

Standards of Response Coverage for the Hartford Emergency Services Department:

The Standards of Response Coverage (Appendix A) were created using the methodology specified in the *Fire and emergency service self-assessment manual*. The Hartford Emergency

Services Department has enrolled in the CFAI Accreditation program. A three-member committee is in the process of performing an evaluation and self-assessment of the Department. Standards of response coverage are one of the initial steps in the self-assessment process. A template created by the Oregon Fire Chiefs Association was used to present the standards of response coverage. The Hartford Select Board must formally adopt the Standards of Response Coverage (Appendix A). This will have to be accomplished with influence. Section Eight of the *Executive leadership* manual (National Fire Academy 2000) contains a model for influencing others. The Hartford Emergency Services Department will have to build a constituency to support the adoption and will have to contend with the inevitable political realities.

Limitations:

Standards of response coverage are as indigenous to accredited departments as they are foreign to other departments. This limited the scope and depth of the research. Many of the references used linked directly to the *Fire and emergency service self-assessment manual*.

The Hartford Dispatch Center does not record all data elements required to monitor the goals and objectives established in the standards of response coverage.

NFPA 1710 and *NFPA 1720* are applied to departments based on their being “substantially career” or “substantially volunteer”. The application of this definition to a combination department is open to debate. A formal interpretation by the NFPA is anticipated but has not been released as this paper is being written.

Standards of response coverage cannot be created until a community has set service goals and objectives. The Town of Hartford does not have any fire protection goals in its current master plan (Appendix C) other than a generic statement that personnel and apparatus are to be added on an “as needed basis”. The revision of the master plan (Appendix D) has to precede the creation of

standards of response coverage. A revised master plan (Appendix D) has been submitted to the Hartford Select Board (governing body) for review, revision and adoption. The standards of response coverage created in this ARP are based on the service level objectives established in that document as submitted. Standards of response coverage cannot be finalized until ratification of the Town's master plan (Appendix D).

The *ISO grading schedule* uses distance as its criteria for engine and ladder company locations. These distances were converted to time based on average response times of the Department.

Definition of Terms:

Alarm Processing Time: The length of time it takes a dispatch center to identify the type and location of an emergency, and notify apparatus to respond. Alarm processing time begins when a call is received and ends when responding apparatus has been notified.

Call Firefighter: A person employed as a firefighter on a part-time or paid per call basis.

Career Fire Department: A fire department consisting of all career members (excluding support personnel).

Career Firefighter: A person employed as a firefighter on a full-time (35 hours per week or more) basis.

Combination Fire Department: A fire department consisting of career, call, and volunteer members.

Company: One or more fire department members with a piece of apparatus.

Fire Management Zone: A risk management tool that sub-divides a community into geographic areas based on risk categories.

First Alarm: The resources necessary for a sustained fire attack.

High Hazard Risk: An area with a concentration of large buildings that pose a high risk to life and property or have a high economic value to the community. For example; hospitals, nursing homes, schools, and industrial occupancies using high-hazard processes, or large quantities of hazardous materials.

Initial Attack: Fire suppression actions performed by the first arriving company before the arrival of additional apparatus.

Low Risk: Small commercial buildings over fifty feet away from other buildings, and out buildings.

Member: A career, call or volunteer firefighter.

Moderate Risk: An area with a concentration of buildings where loss of life and property usually are limited to the building of origin and the building is of a size and configuration to permit the use of pre-connected hose lines. For example, single-family dwellings, apartment buildings (less than 12 units), commercial buildings less than 10,000 square feet without heavy fuel loads.

On-Duty Member: A firefighter staffing a fire station available to respond to emergency incidents.

Off-Duty Member: A firefighter not staffing a fire station that responds to emergency incidents.

Response Time: Response time begins when apparatus and personnel are moving toward the incident and ends when they arrive at the incident location or a designated staging area.

Risk Categories: The hazards a fire poses based on the probability and consequences of a fire occurring and the impact of the fire on life and property. The categories are; worst, high, special, moderate, low and rural (isolated).

Risk Management: A means for treating hazards that involves analysis and identification of the hazard, selection of technique(s), implementation of technique(s) and evaluation of the results of using the technique(s).

Rural Risks: Remote or isolated areas without moderate risk buildings and with little low risk buildings. For example, forests, remote parks or recreation areas.

Special Risk: An area with a building that greatly exceeds the predominant risks of that area or a facility that uses or stores substantial quantity of hazardous materials. For example, flammable liquid or gas storage and distribution facilities, correctional facilities, and a large nursing home in a predominantly residential fire management zone.

Standards of Response Coverage: This Applied Research Project (ARP) uses The CFAI's (1997-2000) definition of standards of response coverage. "... The distribution and concentration of fixed and mobile resources of an organization." (p. 3.8). Distribution refers to the location and deployment of resources and concentration refers to the quantity of resources. Standards of response coverage apply to all emergency calls a fire department responds to. However, the scope of this ARP is standards of response coverage for fire incidents only. Therefore, in this ARP the term, "Standards of Response Coverage" is limited to fire incidents only.

Still Alarm: The resources necessary for an initial attack.

Sustained Attack: Fire suppression actions to control a fire beyond the capabilities of the company performing the initial attack.

Turnout Time: Turnout time begins when alarm processing time ends and when apparatus and personnel are moving toward the incident location.

Volunteer Fire Department: A fire department consisting of only call and/or volunteer firefighters.

Volunteer Firefighter: A person who performs the duties of a firefighter without monetary compensation.

Worst Risk: An area with a concentration of large buildings without automatic fire sprinkler systems that pose a high risk to life and property or have a high economic value to the community. For example, residential high rise buildings, buildings over 10,000 square feet occupied by people who need assistance evacuating the building, and shopping malls. The size of these buildings and the lack of an automatic fire sprinkler system distinguish these buildings from high hazard buildings.

RESULTS

Tables 1, 2 and 3 contain summaries of the standards of response coverage criteria used by the NFPA, ISO, Barre City, Montpelier, Springfield and San Diego County.

Research Question 1:

What criteria are used on a national level for standards of response coverage for fire incidents?

The NFPA determines standards of response coverage based on the type of fire department in the community. The NFPA has two standards of response coverage. One is for substantially career fire departments and the other is for substantially volunteer departments. The criteria for career departments are very specific. The criteria for volunteer departments are subject to local determination based on risk assessment. The *ISO grading schedule* has specific criteria but its resource allocation is based primarily on minimizing property loss. The ISO bases risk on the needed fire flow to extinguish a fire. The ISO uses the PPC as a means to set insurance premiums for commercial buildings.

Research Question 2:

What criteria are used on a state level for standards of response coverage for fire incidents?

The Barre City, Montpelier, and Springfield Fire Department are similar to the Hartford Emergency Services Department. Each of these departments has on-duty personnel for the initial response. This response ranges from two to five members with one or two pieces of fire apparatus. These departments staffing levels are based on a fiscal basis. That is, the respective communities have chosen to level-fund or minimize increases to the tax rate. Barre City and Montpelier have both seen a reduction in personnel through attrition and/or a reduction in the number of hours in a firefighter's average workweek. Barre City and Montpelier meet *NFPA 1710* standards of response coverage. The number of on-duty members, the ability to recall off-duty and call firefighters and the small geographic (1.5 and 6.75 square miles respectively) area they serve enable them to meet the first alarm and response time standards. Springfield does not meet *NFPA 1710* standards of response coverage because they cannot place four personnel on scene within four minutes. The Springfield Fire Department (like the Hartford Emergency Services Department) protects a 40 square mile area.

The staffing level of these Vermont fire departments is deficient when measured with the *ISO grading schedule*.

Research Question 3:

What approaches do fire departments use to create standards of response coverage for fire incidents?

There are several approaches to creating standards of response coverage. Fire departments have based their standards of response coverage on:

- History/tradition
- Collective bargaining agreements
- Master planning

- OSHA Regulations (“Two in two out”)
- CFAI Accreditation Model

The history/tradition approach is generally governed by available revenue. A fire department is allocated a sum of money and is expected to operate within the confines of that allocation. This is the most common approach used to develop standards of response coverage. Collective bargaining agreements seek to maintain minimum staffing levels but do not typically address distribution and concentration of resources. OSHA regulations mandate minimum staffing before operations can begin. Some communities have used this as justification for staffing levels. Master planning and the CFAI accreditation process are similar in that they use a systematic risk management plan. The CFAI process has been completed by 51 fire departments in the United States. The CFAI determines risk by considering the probability and consequences of a fire incident. Figure 1 is a matrix that displays this principle.

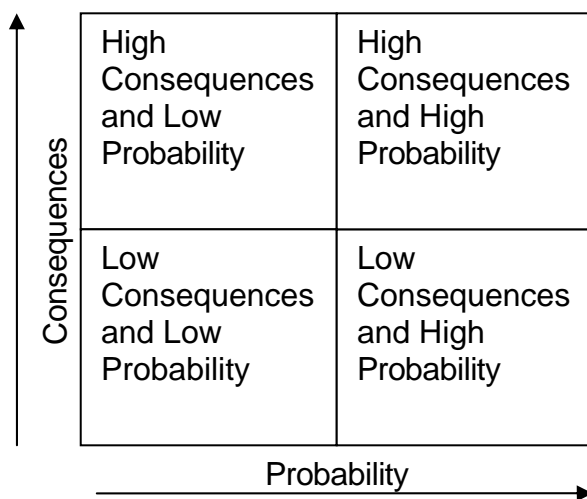


Figure 1. The consequences and probability of a fire. For example, a fire in a hospital would have high consequences but a low probability of occurring. An outside rubbish fire has a high probability but low consequences.

standards of response coverage.

Table 1

Response Times and Service Level Goals

Standard/Dept.	Alarm Processing Time	Turnout Time	1 ST Unit Response Time	Full Alarm Response Time	Service Level Goal
<i>NFPA 1710</i>	≤ 1:00	≤ 1:00	≤ 4:00	≤ 8:00	90%
<i>NFPA 1720</i>	No Requirement	No Requirement	No Requirement	No Requirement	90%
ISO ^a	No Requirement	No Requirement	3:00 ^b	5:00	100%
Barre City	1:00	1:00	< 4:00	<6:00	100%
Montpelier	1:00	1:00	< 4:00	7:00 to 9:00	100%
Springfield	No	2:00 ^c	1:00	5:00 to 8:00	100%
Springfield (rural)	Requirements	2:00 ^c	8:00 to 10:00	12:00 to 17:00	100%
San Diego County	No Data	No Data	5:00 to 6:00	No Data	100%
20 Dept. Average					

Note. Response times are in minutes and seconds. ^a Distance has been converted to time based on Hartford Emergency Services Dept. response times. ^b Response time includes turnout time. ^c Alarm processing and turnout time are combined

Table 2

Minimum Staffing Levels of Apparatus

Standard or Dept.	First Engine		Second Engine		Third Engine		Ladder		Chief		Other	
	On duty	Off Duty	On duty	Off Duty	On duty	Off Duty	On duty	Off Duty	On duty	Off Duty	On duty	Off Duty
<i>NFPA 1710</i>	4		4		1		4					
<i>NFPA 1720</i>		4		1		1		1			1	
ISO ^a	5		5		5		5		1			
Barre City	2		4		4		1	1				8-12
Montpelier	2		2		2	2		2				3-7
Springfield	2		5				2	1				5-12
San Diego	3		3		3		3.5		No			
County 20 Dept.										data		
Average												

Note. On duty = Any member (career, call or volunteer) staffing the station. Off duty = Any member (career, call or volunteer) responding. ^aThis is for maximum credit.

Table 3

Initial Response to Building Fires by Risk Category

Organization	Worst	High	Special	Moderate	Low	Rural	Personnel	Car.	Vol.
<i>NFPA 1710^a</i>							12		
Engines	2	2	2	2	2	2			
Ladders	1	1	1	1	1	1			
Chief	1	1	1	1	1	1			
<i>NFPA 1720^b</i>									
ISO								16-	
Engines	3	3	2	2	2	2		20 ^c	
Ladders	1	1	1	1	1	1			
Chief	1	1	1	1	1	1			
Barre City								3	16-20
Engines	1	1	1	1	1	N A			
Ladders	1	1	1	1	1				
Chief	1	1	1	1	1				

Table 3 (continued)

Organization	Worst	High	Special	Moderate	Low	Rural	Personnel	
							Car.	Vol.
Montpelier							4	12-19
Engines	1	1	1	1	1	1		
Ladders	1	1	1	1	1	1		
Chiefs	1-2	1-2	1-2	1-2	1-2	1-2		
Amb.								
Springfield	1						2	18
Engines	3	3	2	2	2	2		
Ladders	1	1	1	1	1	1		
Chief	1	1	1	1	1	1		
Tanker							1	
Amb.	1	1						
Rescue	1	1						
San Diego Co.	No	No	No Data	No Data	No	No	No	No
23 Dept. Avg.	Data	Data			Data	Data	Data	Data

Note. ^a Additional apparatus may be added based on pre-fire planning. ^b Response based on risk assessment performed by individual community. ^c This is for maximum credit.

DISCUSSION

The distribution and concentration of fire department resources has been based on politics, special interests, and science. The NFPA's position is that there are two standards for fire protection.

NFPA 1710, and *NFPA 1710*. These two standards are in fundamental conflict with one another. A substantially career department has clearly defined staffing requirements without consideration to risk categories. A department can comply with *NFPA 1710* by meeting the response standards or by reducing or eliminating its career personnel. A department that performs the community risk assessment specified in *NFPA 1720* and determines the need for career personnel in sections of the community may find itself within the scope of, and non-compliant with *NFPA 1710*. *NFPA 1710* has evolved into a political document (Rayon, 2001) that, arguably, is about preserving and/or creating jobs. Fuller's (2001) faith in the equivalency concept of *NFPA 1710* is only valid if you believe that there should be two distinct standards for fire protection. *NFPA 1720* believes fire protection is a local issue and levels of service should be determined by risk analysis. Coleman (2001) and Kipp and Loflin (1996) are in support of this position. *NFPA 1720* has a more sound scientific basis than *NFPA 1710* but is vulnerable to political manipulation by an under assessment of risk. Gary, (2001) expresses the outcomes of standards of response coverage in simple and accurate terms. His example of confining a fire to the room of origin in the moderate risk section of a community and to the building of origin in the rural risk section of the community is an excellent application of an acceptable risk policy. His example could also be non-compliant with both *NFPA 1710* and *NFPA 1720*.

Rayon (2001) determination that standards of response coverage are most likely based on a historical/traditional basis helps explain the political motivations in *NFPA 1710*. The staffing levels in Barre City, Montpelier, and Springfield (Black, Lewis, and Lamphere, personal communications) validate the theory that staffing is based on dollars divided by career firefighters. Barre City and Montpelier each reduced staffing to comply with a collective bargaining agreement to reduce the number of hours in the average firefighter's workweek.

The *ISO grading schedule* has been used as the “default” method of determining standards of response coverage by many fire departments. This is done in spite of the fact that the ISO never intended the Public Protection Classification as an all-inclusive evaluation of a community’s fire protection resources (ISO, 2001). Larson (1995) is correct in reminding the fire service that a fire department’s capability to protect property is the driving force behind the *ISO grading schedule*. Life safety is given consideration only when accompanied by a high potential for property loss. An improvement in a community’s PPC leads to a reduction in insurance premiums for commercial buildings but does not affect premiums for single-family dwellings. The *ISO grading schedule* only considers the consequences of a fire when it involves a large loss of property and does not consider the probability of an incident occurring. Bryan and Picard (1979) writing for the ICMA suggest the *ISO grading schedule* be given consideration during master planning for fire protection. The use of distance by the *ISO grading schedule* instead of time is inappropriate. The use of technological advancements to improve alarm processing and turnout time, and traffic management devices to facilitate response in heavy traffic areas are but two examples of improvements that enhance fire protection but are not rewarded by the *ISO grading schedule*.

The *Fire and emergency service self-assessment manual* strikes a balance between *NFPA 1710*, *NFPA 1720*, and the *ISO grading schedule*. It places risk assessment and service level objectives on the local level but compels a department to analyze and devote resources towards critical tasks. The critical task analysis reduces the possibility of a department unrealistically assessing its capabilities and mandates documentation of a department’s performance. Furthermore it stresses the importance of considering the probability and consequences of a fire occurring.

Conclusion

A community must first establish its service level objectives for fire protection. These objectives must establish an acceptable level of risk. This serves as the initial premise for developing standards of response coverage. Standards of response coverage then become the means to fulfill the initial goals. The CFAI accreditation process and the *Deployment standard worksheet* utilize this methodology. *NFPA 1710* is weak as a planning document because it applies resources without first defining the problem. *NFPA 1720* places a premium on defining the problem but does not have an adequate system of checks and balances. The goal of the insurance companies is to reduce the probability of high-value property loss. The *ISO grading schedule* is the insurance industry's standards of response coverage for meeting that goal. Their goal does not coincide with the fire services' goal to save lives and property. It is somewhat surprising that none of the fire departments contacted used the *ISO grading schedule* as a basis for creating standards of response coverage. It is possible that the staffing levels and concentration of resources required makes it an unachievable goal.

Service level objectives accompanied with standards of response coverage can be used proactively and reactively. There will be development that will exceed the standards of response coverage capabilities in a fire management zone. A community can choose between adding resources to improve suppression capabilities or reducing the risk. Fire sprinkler systems in single-family dwellings and small apartment buildings are proven means of saving lives and property. This proactive approach addresses fire protection concerns by reducing the probability of a fire occurring.

The purpose of this applied research project is to create standards of response coverage to fire incidents. These have been created. The next step in the process is to "sell" this concept to the people affected by it. This is a task that will have to be accomplished by creating a strategy for influencing

others. This strategy will have to combine networking, constituency building, and negotiating; all the while considering the inevitable political realities. The adoption of standards of response coverage will place the Town of Hartford in a select group of communities that have analyzed their fire protection need and have taken steps to address those needs.

RECOMMENDATIONS

It is recommended that the Town of Hartford take the following actions to enhance fire protection in the community.

1. Formal adoption of a master plan (Appendix D) for fire protection that defines service level objectives and acceptable level of risk.
2. Implement standards of response coverage to achieve the service level objectives specified in the master plan (Appendix D).
3. Use proactive approaches to reduce the probabilities and consequences of fires.
 - 3.1. Require fire sprinkler systems in new residential properties.
 - 3.2. Require water supply for fire protection for commercial properties in rural areas.
 - 3.3. Perform fire inspections and public education to reduce the probability of a fire occurring.
4. Improve alarm processing, initial, and first alarm responses by purchasing a computer assisted dispatching (CAD) program that can customize responses based on fire management zone, and individual building risk category.
 - 4.1. The CAD program must also contain all data elements necessary to monitor and evaluate the effectiveness of the standards of response coverage.
5. Create standards of response coverage for emergency medical services, technical rescue and hazardous materials incidents.

6. Install traffic signal intervention devices to reduce response time and improve safety of responding apparatus.
7. Improve first alarm assignment capabilities using automatic mutual aid and expanded use of the call force.
8. Create an implementation plan for the adoption of the standards of response coverage.

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APPENDIX A (Standards of Response Coverage for Fire Incidents)

HARTFORD EMERGENCY SERVICES STANDARDS OF RESPONSE COVERAGE

SECTION ONE: Introduction

Overview & Legal Jurisdiction:

Date: September 12, 2002

Governance: Town Meeting, Select Board, and Town Manager

Budget process: Line Item, approval at annual town meeting.

Senior Management: Five member Select Board, Town Manager, Fire Chief, Police Chief, Public Works Director, Planning Director, Finance Director and Recreation Department Head.

Emergency Services Department personnel: Career Personnel; 1 Fire Chief, 1 Assistant Fire Chief, 4 Captains and 12 firefighters. Call Personnel; 12 call firefighters.

SECTION TWO: Mission, Goals, Objectives

Mission Statement:

The Hartford Emergency Services Department's mission is to save lives and protect property in order to provide a quality of life consistent with the requirements of the residents of the Town of Hartford.

The department shall respond and function with developed expertise, when directed, in the fields of suppression, prevention, emergency medical services, hazardous materials, multi-environment rescue and to assist those other agencies who might require its help within the mission scope.

Commanded by a Fire Chief, the department shall be comprised of sufficient career and paid/call personnel as necessary to meet mission needs.

Its members shall be physically, mentally and technologically prepared for meeting mission needs and shall maintain this level of readiness through regularly scheduled monthly drills and by taking advantage of such externally provided training as is applicable.

Goals and Objectives, Annual Performance Statements:

The Hartford Emergency Services protects the public from the hazards of fire through suppression and prevention activities. The Department operates two stations. Station 1 is staffed with career personnel and Station 2 is not staffed.

Suppression

The goal of the department is to have an initial crew ready to respond and perform initial fire attack to protect lives and property. The on-duty crew consists of a captain and three firefighters. This crew typically responds with one or two pieces of apparatus and forms the initial fire attack team. A four-person fire attack team can take actions to save lives and property. The Chief, Assistant Chief, and mechanic work weekdays and can respond to the initial alarm. Vacation, sick leave, and other absences can reduce the staffing. The minimum staffing level is three firefighters. At this level the department can respond with one piece of apparatus and perform initial attack to support rescue operations. State safety regulations prohibit the initial attack crew from performing interior firefighting operations to protect property with less than four firefighters. The ability to save lives and property is directly linked to the amount of time it takes the initial attack team to arrive on scene. The greatest effectiveness is when resources are on scene prior to flashover¹. This is typically three to five minutes after the fire is producing active flames. The department uses a standard of response coverage to express response time and resource allocation objectives commensurate with the risk of a particular occupancy. The level of risk is determined by considering the probability and consequences of a fire occurring and placing the risk in one of the following categories:

- Maximum/Worst Risks
- High Hazard Risks
- Special Risks
- Moderate Risks
- Low Risks
- Remote/Isolated Rural Risks

The Department's goal is to meet its standard of response coverage for 90 percent of the incidents in each category.

SECTION THREE: Risk Assessment; Community Risk Assessment Components:

Fire Management Zones:

ZONE 1: White River Junction, Hartford Village, and Wilder.

- Description: This is a hydrant area that contains many of the older buildings. The area is primarily residential but includes the central business district that has commercial properties.
- Risk Categories: The area is predominantly moderate risk due to the size of the buildings and separation between them,
 - High Risk: The Hotel Vermonter, a three-story hotel without sprinklers. Verizon Building, a four-story windowless building with offices and telephone switching center.
 - Special Risk: Veterans Medical Center and Hospital. This building has sprinklers but has large life and property consequences.

ZONE 2: Route 14 North of Hartford Village to Interstate 89 Bridge by John Hazen Lane; including Dothan and Jericho.

¹ Flashover is the stage of fire growth when a room becomes totally engulfed in flame. The chances of surviving a fire decline dramatically after flashover. Flashover typically occurs three to five minutes after visible flames are produced. Fire growth and spread after flashover progresses geometrically.

- Description: This is a rural area that is predominantly single-family dwellings. There are several small farms. There are no hydrants but there are several rural water supply sites.
- Risk Categories: Low and rural

ZONE 3: QUECHEE RURAL: Non-Hydrant Area From town line on Route 4 west to Route 4 at eastern most intersection of Center of Town Road. Includes all roads in Center of Town area Quechee/West Hartford Road up to Joe Ranger Rd.

- Description: This is a rural area that is predominantly single-family dwellings. Many of the buildings were constructed after 1970 and the presence of lightweight construction is likely. There are condominiums and large seasonal homes in this zone.
- Risk Categories:
 - Moderate due to condominium units. Lack of water supply makes the consequences of fires in these buildings greater than those in the hydrant area.
 - Low and rural in most areas.

ZONE 3A: QUECHEE HYDRANT AREA: 1119 Quechee Main St. (Marshland Farm) to 3755 Quechee Main St. (Coach Rd Condominiums) Willard Rd 1-653 (Quechee Hollow Condominiums), East and West Gilson Avenues, Sunrise Village and Quechee Hartland Rd to intersection of Cross St. River St. and vicinity (Lakeland Dr., Murphy Rd., Stephen Day Lane, Fox Hollow).

- Description: This is the central business area of Quechee and is the size of a small New England town. Nearly all buildings are 100-year old wood frame construction.
- Risk Categories:
 - Moderate risk due to age and density of residential buildings.
 - Special risk is Simon Pearce Glass Studio and Restaurant a mill-construction building with sprinklers that has high-value merchandise, a water-powered electric generating plant, and high occupant load during dining hours.
 - Special Risk: Quechee Inn at Marshland Farm, an historical building with 50 guestrooms. The building is code-compliant but does not have sprinklers.

ZONE 4: West Hartford: From I 89 Bridge on Route 14 by Hazens' to Sharon town line. Quechee/West Hartford Rd to Joe Ranger Rd. and Tigertown Area.

- Description: This is a rural area that is predominantly single-family dwellings. There are several small farms. There are no hydrants but there are several rural water supply sites. Response time to this section of the community is very long.
- Risk Categories: Low and rural in most areas.

ZONE 5: South of the White River and East of Center of Town Road and Smith Road; Route 5 South area and Connecticut River Road

- Description: This is a rural area that is predominantly single-family dwellings. There are several small motels and light industrial properties.
- Risk Categories:
 - Rural and low for most of this zone. The proximity to the fire station reduces response times.
 - High risk: Young's propane, gasoline and fuel oil distribution center. This facility does have a fire hydrant.

Topography:

Challenges to typical response: Steep and narrow driveways. Hills are slippery in the winter.

Primary topography: Rolling hills.

Plans to address challenges: All private roads must be built to Town standards. Grades over 10 percent are not permitted.

Transportation Networks:

Major thoroughfares: Interstates 89 and 91, US Routes 5 and 4 and State Route 14.

Airports: None. We are in the landing and take off area of Lebanon Municipal Airport (small commuter and private airplanes)

Waterways: Connecticut, Ottaquechee and White Rivers. Primarily used for recreation.

Rail: Major interchange for Vermont Railway and Central Vermont Railroad. Two passenger trains per day and two to four freight trains.

Challenges: Trains pass through remote areas. Topography can hinder access. Hazardous materials transportation accidents.

Development and Population Growth:

Current development and densities (by map coordinate or section): The central sections of each village are the densest but zoning requires a minimum 10-foot setback from the property line.

Anticipated growth: Most development is residential and is occurring outside the hydrant areas. A need for affordable housing has generated renovation of older buildings in the villages and is leading to gentrification. Homes are being built in rural areas to reduce land acquisition costs.

Personnel Resource Components:

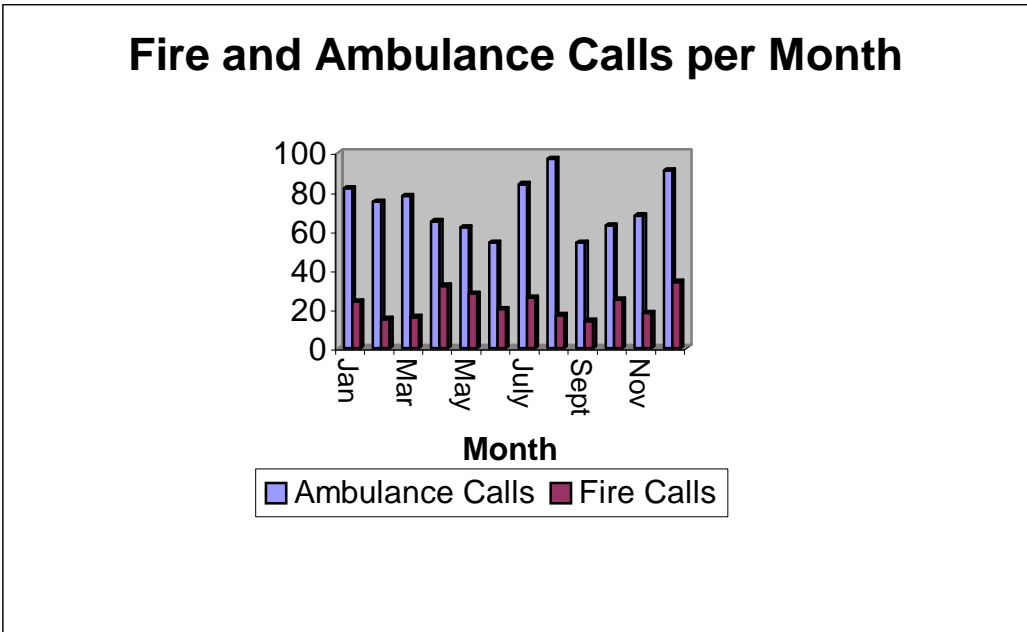
There are four career members assigned to each shift that staff Station 1. The Chief, Assistant Chief, and a mechanic work Monday-Friday. The present minimum staffing level is three career members. Vacation, sick leave, and other leave brings the average night and weekend staffing level is 3.6 members. The average weekday staffing level is 5.7.

The number of call firefighters has dropped from 20 to 12 over the past 10 years. The department relies heavily on callback of off-duty career members particularly weekdays. Station 2 is rarely able to staff an engine with more than two firefighters and often does not respond on weekdays.

Probability:

The 90th percentile mode number of fire calls per day is 2.

The 90th percentile mode number of ambulance calls per day is 6.



FREQUENCY OF FIRES

Structure	23
Automobile	10
Brush	22
Trash	7
Smoke/Good Intent	79
Building Fire Alarms	103
Misc.	82

Totals 326
Per Day Rate (average) .9

Mutual or Automatic Aid Agreements:

Calls out or jurisdiction:	10
Total Calls:	336

Date Range 1/1/01 to 12/31/01

Fire Responses to Buildings:

Single Family Residential	62
Multi-Family Residential	31
Places of Assembly	13
Offices	17
Educational Facilities	24

Fabrication & Manufacturing	1
Hazardous Materials	0
Health Care Facilities	14
Mercantile	6
Storage	8
Total	176

SECTION FOUR: Time and On-Scene Performance

Current Response Times:

The Hartford Dispatch Center does not have the capabilities to accurately record alarm processing and turnout time. These times are combined.

Alarm Processing and turnout time (emergency responses)

Mean 1:51 90th Percentile (mode) 3:07

Travel time (1st arriving company)

Mean 7:12 90th Percentile (mode) 3:00

Response Performance Analysis:

Response Time Goals

Response time goals (alarm processing plus turnout plus travel time) shall be to have the first-in company arrive at 90 percent of all incidents in each response zone within the following intervals (time in minutes):

Zone 1	3:00
Zone 2	5:00
Zone 3	5:00
Zone 3A	4:00
Zone 4	5:00
Zone 5	4:00

Rural

Response time goals (alarm processing plus turnout plus travel time) shall be to have the first-in company arrive at 100 percent of all incidents in buildings without sprinklers in each rural response zone within the following intervals (time in minutes):

Zone 2	8:00
Zone 3	8:00
Zone 4	9:00

Zone 5

7:00

Standard First Alarm Response, Moderate Risk Residential

A minimum effective initial response force, based on fire flow capabilities and critical fire-ground tasks consists of two engine companies (minimum fire flow capacity 500 GPM), one ladder company, one rescue company, one chief and one ambulance.

Rural/Non-Hydrant Area Response, Moderate Risk

A minimum effective initial response force, based on fire flow capabilities and critical fire-ground tasks consists of three engine companies (minimum fire flow capacity 500 GPM), two tankers, one ladder company, one rescue company, one chief and one ambulance.

SECTION FIVE: On-Scene Operations, Critical Tasks, and Establishing an Effective Response Force

Critical tasks are those that must be conducted in a timely manner by firefighters at structure fires in order to control the fire prior to flashover or to extinguish the fire in a timely manner. The Department is responsible for assuring that responding companies are capable of performing all of the described tasks in a prompt and proficient manner.

Initial Attack

The initial fire-ground actions begin with the arrival of the first-arriving company and continue, sequentially or in parallel, as tasks are completed and additional resources arrive. For example, tasks on a typical residential offensive fire attack include the following:

<u>Critical Task</u>	<u>Number Personnel</u>
Size up and command	1
Pump operations	1
Forcible entry, initial attack lines, water supply	2
TOTAL	4

Initial Support

Initial support functions occur slightly later in time than initial attack functions. Typically (but by no means always) an assigned ladder company, rescue, additional engine(s), and/or ambulance provides them.

<u>Critical Task</u>	<u>Number Personnel</u>
2nd attack/backup line	2
Search & rescue, ventilation	4
RIT team	2
EMS	2
Safety	1
TOTAL	11

Secondary Support

Initial response personnel (after rehabilitation) may perform secondary support functions after the completion of an initial assignment or by units special called for those purposes when dictated by the situation (e.g., extremely hot weather). Secondary support functions include salvage, overhaul, staffing of the Rehab sector, air supply, etc.

As shown, using offensive tactics, 15 personnel are needed to accomplish the critical tasks necessary to control a typical residential fire in an efficient and effective manner.

The fire scene is unpredictable in many ways. While it is possible to state what critical tasks must be accomplished in order to extinguish the fire, it is not always possible to predict how many fire fighters it will take to accomplish those tasks. The number of personnel and the amount of equipment necessary to accomplish the critical tasks listed will vary due to the following factors:

- a.) delayed response;
- b.) building construction;
- c.) number of occupants;
- d.) physical and emotional condition of occupants;
- e.) extent of fire upon arrival (flashover);
- f.) built-in fire protection;
- g.) area of fire involvement;
- h.) firefighter or civilian injuries; and
- i.) equipment failure.

Establishment of an Effective Response Force

Once critical tasks have been identified and defined, an effective response force can be established. This force is defined as the amount of equipment and personnel that must reach an incident in a specific response zone (location) within the maximum response time. An effective response force should be able to handle fires reported shortly after they start. In order to accomplish this units must be located close enough to the incident to arrive within the maximum prescribed response time for the full assignment of fire companies according to the risk level of the structure.

The risk of fire, medical emergency, or other emergency event cannot be held to zero. Thus, the objective of this standard of coverage study is to identify a balance among distribution, concentration, and reliability that will keep fire risk at a reasonable level while yielding the maximum savings of life and property.

Call Types and Effective Response Force

The use of a computer aided dispatching (CAD) system enables us to assign effective response forces on a per building basis (as opposed to a geographic area). It is hoped that CAD will identify the risk category of a property. For example, a fire in a sprinkled hotel would be classified in a lower risk category than a hotel without sprinklers. Now that critical tasks have been determined and an effective response force has been defined, a review of dispatch call types can be conducted.

Call Types

Public Service:

Automatic Alarm System Activation:

Structure Fires:

Brush Fire

Assigned Apparatus

Still alarm. Duty officer to assign resources.

First Alarm except for Low Risk and sprinkled buildings.

First Alarm

First Alarm unless call-taking information indicates contained or small fire.

APPENDIX C (EXCERPTS FROM TOWN OF HARTFORD CURRENT MASTER PLAN)

EMERGENCY SERVICES

The main Hartford Emergency Services Station is located on the VA Cut-off Road in White River Junction on a 2.2 acre site. The one-story building (with two stories on the south end) is of cement block construction with brick veneer and was built in 1978. The building has a forced hot water heating system and is insulated.

The station provides 13,456 square feet of space. There are five bays provided for fire engines. The remainder of the station contains rooms for the Chief, Assistant Chief, a secretary, apparatus room, repair room, operations room, storage rooms and meeting and training rooms that are shared with the Police facility. A second unmanned station known as Hartford Station 2, or the Quechee substation, is located on Willard Road in Quechee.

There are currently sixteen career firefighter EMT's, one full-time mechanic, a full-time secretary and approximately thirty paid-on-call firefighters. Members are divided into five group levels, starting with the lowest: Cadet, Exterior Firefighters, Interior Firefighters, Driver/Operator and Permanent Monitor. After passing a written and hands-on exam, a member moves on to the next level of firefighting. A member can move all the way to the top level after passing exams at each level.

Hartford's firefighting services are regional in scope. The Department participates in the Upper Valley Mutual Aid program, which includes Hartford, Lebanon, South Royalton, Hartland, Sharon, Woodstock, South Woodstock, Windsor, Pomfret, Hanover, Enfield, Canaan, Grantham, and Plainfield.

The Department also operates rescue functions, with the Fire Chief acting as Emergency Management Director and Director of Emergency Medical Services.

The Fire/Ambulance emergency responses increased by 70 percent from 1985 to 1995. Table VI-2 indicates an increase of 34 percent in responses from 1985 to 1992. However, a 25 percent increase in responses occurred from 1992 to 1995. The last four years indicate the greatest increase in emergency responses.

The Department maintains a variety of vehicles and equipment, which are reviewed annually for upgrading and replacement.

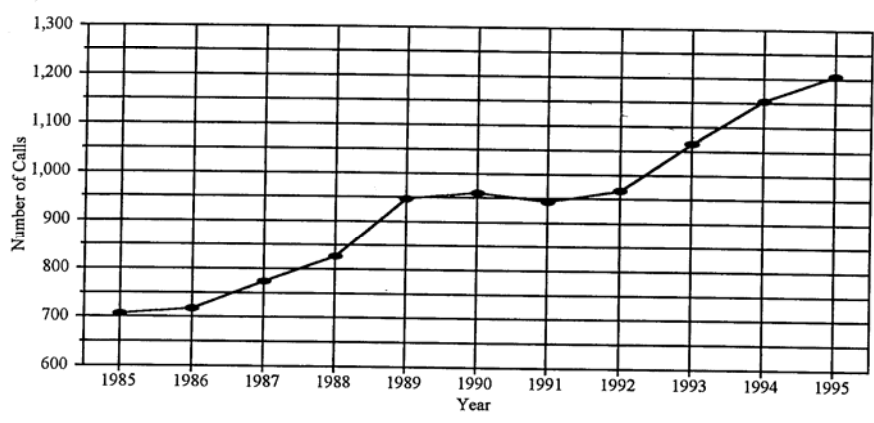
TABLE VI-2
SUMMARY OF EMERGENCY SERVICES CALLS 1985-1995
Hartford, VT

<u>YEAR</u>	<u>TOTAL FIRE/AMBULANCE CALLS</u>
1985	707
1986	717
1987	774
1988	826
1989	947
1990	960
1991	943
1992	967
1993	1,065
1994	1,154
1995	1,206

Source: Hartford Emergency Services, Hartford Town Reports, 1985-1995

See Chart VI-1 for visual representation of these figures.

CHART VI-1
SUMMARY OF HARTFORD FIRE/AMBULANCE CALLS: 1985 - 1995



Source: Hartford Town Reports and Hartford Emergency Services

Community Safety

7. Provide Police foot or bike patrols (vs. car and parking) in the village centers as needed.
8. Expand the present Police patrol force to meet the needs of the community as warranted.
9. Maintain an effective system of public safety by appropriate repair and replacement of necessary emergency equipment.
10. Hire additional personnel for the Emergency Services Department as warranted by additional growth.
11. Continue to enforce the State fire prevention and life safety code (BOCA).
12. Continue to require conditions on development that are needed to address fire hazard and safety issues.
13. Continue to maintain and upgrade the municipal water system. Adequate water flows are essential for sound fire protection in the Town.
14. Continue public education fire safety programs such as Fire Protection Week, lectures/demonstrations in schools, programs for senior citizens and media exposure.
15. Continue to conduct training programs for the Emergency Services Department and fire inspection programs. Periodic fire inspections of existing structures help the Town and property owners identify and correct existing fire hazards and prevent fires from occurring.
16. Encourage funding of the capital improvement plan for firefighting equipment to avoid major budget jumps for new equipment by anticipating these costs and spreading them evenly over time.
17. Require the use of fire ponds, dry hydrants and sprinkler systems for fire protection in rural areas, as appropriate. Residential fire sprinklers are the best protection from fire and should be used in rural areas.

APPENDIX D (PROPOSED REVISIONS TO TOWN OF HARTFORD MASTER PLAN)

Mission, Vision, and Values Statement

The Hartford Emergency Services Department's mission is to save lives and protect property in order to provide a quality of life consistent with the requirements of the residents of the Town of Hartford.

The department shall respond and function with developed expertise, when directed, in the fields of suppression, prevention, emergency medical services, hazardous materials, multi-environment rescue and to assist those other agencies who might require its help within the mission scope.

Commanded by a Fire Chief, the department shall be comprised of sufficient career and paid/call personnel as necessary to meet mission needs.

Its members shall be physically, mentally and technologically prepared for meeting mission needs and shall maintain this level of readiness through regularly scheduled monthly drills and by taking advantage of such externally provided training as is applicable.

Major Goals and Objectives

Fire

The Hartford Emergency Services protects the public from the hazards of fire through suppression and prevention activities. The Department operates two stations. Station 1 is staffed with career personnel and Station 2 is not staffed.

Suppression

The goal of the department is to have an initial crew ready to respond and perform initial fire attack to protect lives and property. The on-duty crew consists of a captain and three firefighters. This crew typically responds with one or two pieces of apparatus and forms the initial fire attack team. A four-person fire attack team can take actions to save lives and property. The Chief, Assistant Chief, and mechanic work weekdays and can respond to the initial alarm. Vacation, sick leave, and other absences can reduce the staffing. The minimum staffing level is three firefighters. At this level the department can respond with one piece of apparatus and perform initial attack to support rescue operations. State safety regulations prohibit the initial attack crew from performing interior firefighting operations to protect property with less than four firefighters. The ability to save lives and property is directly linked to the amount of time it takes the initial attack team to arrive on scene. The greatest effectiveness is when resources are on scene prior to flashover². This is typically three to five minutes after the fire is producing active flames. The department uses a standard of response coverage to express response time and resource allocation objectives commensurate with the risk of a

² Flashover is the stage of fire growth when a room becomes totally engulfed in flame. The chances of surviving a fire decline dramatically after flashover. Flashover typically occurs three to five minutes after visible flames are produced. Fire growth and spread after flashover progresses geometrically.

particular occupancy. The level of risk is determined by considering the probability and consequences of a fire occurring and placing the risk in one of the following categories:

- Maximum/Worst Risks
- High Hazard Risks
- Special Risks
- Moderate Risks
- Low Risks
- Remote/Isolated Rural Risks

The Department's goal is to meet its standard of response coverage for 90 percent of the incidents in each category.

Prevention

Prevention is the proactive portion of fire protection. Prevention activities consist of Education, Enforcement, and Engineering. These are known as the Three E's.

1. Education works on the premise that people must have knowledge of the dangers of fire and how to react when a fire occurs. The Department's goal is to provide basic fire education to all elementary school age children, and to provide specific education programs to target groups such as the elderly.
2. Enforcement uses the approach that mandates safety standards. Fire Codes are the most prominent form of enforcement. The Department has a contract with the State of Vermont to enforce the State Fire Prevention Code. This code applies to all public buildings but does not apply to owner occupied single-family dwellings. Inspection goals are to:
 - 2.1. Inspect all apartment and condominium buildings.
 - 2.2. Inspect all new public buildings.
 - 2.3. Inspect all hotels and motels every four years.
 - 2.4. Perform other inspections based on reported hazards or risk history.
 - 2.5. The Planning Commission has authority over site development plans and subdivisions of property. The Emergency Services Department makes recommendations to the Planning Commission regarding fire protection in these projects. The Planning Commission has adopted and enforces a fire protection policy based on these recommendations.

3. Engineering uses equipment or technology to solve a fire protection problem. Engineering requires varying degrees of human intervention. These degrees range from active to passive. The active side of the scale requires a higher degree of human participation than the passive side.
 - 3.1. Promote the installation of smoke alarms in all single-family dwellings.
 - 3.2. Promote the installation of residential sprinkler systems in new single-family dwellings.
 - 3.3. Develop water supply for fire protection by expanding the municipal water system and/or installing rural water supply sources.
 - 3.4. The State Fire Prevention Code and the Hartford Planning Commission have regulations that require the installation of fire protection equipment in certain occupancies.

Each of the three “E”s must be considered when assessing a fire protection problem and developing solutions. Merging the strengths of education, enforcement and engineering has a synergistic effect that will yield better results.