Examining the Ventura County Fire Protection District's Response to Structure Fires

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CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, idea, expression, or writings of others.

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Abstract

The Ventura County Fire Protection District (VCFPD) responds to over 450 structure fires every year. While the percentage of structure fire responses has remained the same for the past twenty five years, the total number of structure fire responses has increased. The problem is that the Ventura County Fire Protection District has not adjusted its initial response to structure fires in twenty five years. The purpose of this Applied Research Project (ARP) is to examine the current methodology the VCFPD utilizes for structure fire response times and personnel staffing within its areas of responsibility utilizing the descriptive research method. Research questions included: "On what criteria does the VCFPD base its staffing and response to structure fires?", "How does VCFPD staffing and response times to structure fires compare with recommended standards?", "What recommendations can be found for responses to structure fires?", and "What structural firefighting resources are available to the VCFPD from Mutual Aid, Automatic Aid, and contract agreements?" The procedures utilized to answer these questions included literature review, questionnaires, and personal interviews.

Results of this research included: VCFPD utilizes parts of the criteria set forth in National Fire Protection Association (NFPA) 1710 to achieve appropriate staffing and apparatus when responding to structure fires. The VCFPD also utilizes a "convergent response" model which maximizes the distance between units and the time it takes to arrive at a given location when selecting responding units. The VCFPD's average response time for the first unit to arrive on-scene of structure fires is 05:04 with a median response time of 04:37. In 59% of responses to structure fires, the first apparatus arrived on-scene within five minutes. Further, in 90% of structure fire responses, the first apparatus arrived on-scene within 07:18. On average, it takes the VCFPD seventeen minutes to assemble a complete initial alarm at a structure fire, and thirty-

two minutes to assemble the NFPA recommended number of personnel to operate on structure fires 90% of the time.

NFPA 1710 is the most widely utilized standard concerning structure fire response. The International Association of Fire Fighters (IAFF) and International Association of Fire Chiefs (AIFC) also make recommendations for apparatus staffing which are in close alignment with the NFPA. Although National Institute for Occupation Safety and Health (NIOSH) does not make direct recommendations, they refer to the NFPA standards for safe operations at structure fires. Occupational Safety and Health Administration (OSHA) implies minimum staffing to accomplish interior structure firefighting through their "two-in/two-out policy.

The VCFPD has Automatic Aid agreements, Mutual Aid agreements, and contract agreements with all operational area cooperators and those departments that are adjacent to the VCFPD. Responses dispatched by the VCFPD Fire Communications Center (FCC) utilize the "closest resource" concept regardless of jurisdiction.

This study identified potential areas which should be targeted for review as they pertain to structure fire response. All operational policies should be reviewed for currency and applicability. Additional areas for review, updating, and study are identified, including establishing a metrics for structure fire response times, tracking injuries which occur during structure fire operations by occupancy type, tracking personnel hours by structure fire occupancy type, reviewing alternate staffing and response models for structure fires, reviewing alternate staffing and response models for all response types, establishing a County Operational Agreement which includes dispatching, and conducting cost analysis versus call types (specific medical dispatch reason, public service, fire, hazardous conditions) studies.

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Introduction

The Ventura County Fire Protection District (VCFPD) takes pride in protecting the citizens of the County and providing the safest working conditions possible for its employees. As technologies have changed, the VCFPD has engaged in research and development to determine the best use of these technologies, how to budget for them, how to train with them, and eventually how they would be deployed. This process has served VCFPD well for material items such as hose, thermal imaging cameras, and Computer Automated Dispatching computers in the apparatus; however, they struggle keeping pace with changes in technologies when they apply to tactics and strategies. These types of changes require "cultural changes" that are often overlooked or ignored because they are difficult to manage.

"Cultural change" is defined by Merriam-Webster as "modification of a society through innovation, invention, discovery, or contact with other societies" (Merriam - Webster, 2015). These types of changes are arguably the most difficult to manage because they force personnel to adapt or change without seeing a clear outcome or benefit (Heifetz & Linsky, 2002). Changes in structure fire tactics and strategies fall into a category of adaptive cultural change. Although there is science that supports the need to make changes, the organizational culture can be slow to react. Studies show that the materials burning in today's structure fires burn hotter, produce toxic gases, have structural failure sooner, and require different strategic and tactical approaches than fires from fifty years ago (NIST, 2010).

The problem is that the Ventura County Fire Protection District has not adjusted its initial response to structure fires in twenty five years. The purpose of this Applied Research Project (ARP) is to examine the current methodology the VCFPD utilizes for structure fire response

times and personnel staffing within its areas of responsibility. A descriptive research method was utilized to answer the following questions:

1) On what criteria does the VCFPD base its staffing and response to structure fires?
2) How does VCFPD staffing and response times to structure fires compare with recommended standards?
3) What recommendations can be found for responses to structure fires?
4) What structural firefighting resources are available to the VCFPD from mutual aid, automatic aid, and contract agreements?

The need for safe, efficient, and economical structure fire operations cannot be overstated. It is incumbent upon the Fire Service to provide the safest work environment possible for every employee. It is also essential that the best possible equipment and training be provided so that structure fire operations are efficient. The associated economic costs of supplying structure fire operations is minimized when safety, technology, and training are maximized. By providing a "safety culture", up-to-date equipment, and continual training, structure firefighting hazards can be reduced. Periodic reviews of how the VCFPD responds to structure fires will help minimize the hazards its firefighters face

Background and Significance

In May, 1928, the need to battle large, economically devastating brush fires was addressed in Ventura County by establishing the VCFPD. As the county developed, and the population grew, the need for other essential services such as structure firefighting, emergency medical services, hazardous materials response, and technical rescue became apparent; as a result, the VCFPD's mission incorporated these new disciplines. Today, the VCFPD is an all-

risk, full service fire department composed of over 550 men and women. VCFPD proudly provides fire protection, medical aid, rescue, hazardous materials response, and a variety of other services to the public. The VCFPD's mission statement now reads "The Ventura County Fire Department anticipates and responds to the dynamic public safety needs of a diverse community" (Ventura County Fire Protection District, 2010).

VCFPD covers 848 square miles and serves more than 480,000 constituents in the unincorporated areas of Ventura County and six of its cities: Ojai, Port Hueneme, Moorpark, Camarillo, Simi Valley, and Thousand Oaks.

VCFPD partners with the community to identify risks and provides its staff with the tools to prepare and protect themselves and those they serve. VCFPD responds to more than 37,000 incidents each year. All personnel in the 32 fire stations and Wildland Division are trained to provide the highest level of firefighting and emergency medical care to the citizens of Ventura County.

In addition to fighting fires, VCFPD responds to medical emergencies, traffic accidents, land and water rescues, hazardous materials calls, and a variety of public service needs. Last year, it responded to over 26,000 emergency medical calls, 1,300 fires, 26,000 rescue calls, 3,800 public service calls, 1,600 alarms, and 740 calls involving hazardous materials. It responds to more than 100 calls per day.

VCFPD prioritizes communications with the public through the Fire Communications Center (FCC), which handles more than 575 citizen calls a day. The public information office ensures that information is disseminated to the public during emergency activities, as well as for

everyday business. The VCFPD Fire Prevention counter helps people determine how to protect their homes, property, and businesses against fire (Milkovich, 2014).

Although structure fire responses only account for 1.2% of total emergency responses, they require a large number of available resources and a 3.2% commitment of overall personnel time (Ventura County Fire Protection District, 2015). Structure fire responses pose an increased risk to VCFPD employees due to the nature of the work in an uncontrolled environment (Kerber, 2011).

Current research shows that structure fires behave differently due to numerous factors (Kerber, 2011). Fire suppression and alarming systems have allowed for changes in construction methods and materials, leaving buildings vulnerable to early failure under fire conditions. The materials utilized for the content of structures has also radically changed. Hydrocarbon-based materials such as neoprene foam, polymer fibers, and plastics are found in most carpets, furniture, clothing, and electronics. These types of products burn differently and impact tactics and strategies utilized during structure fire operations.

This ARP is designed to provide the VCFPD with information on structure fire responses times and personnel deployed these incidents. It will also clearly identify how the VCFPD established structure fire response staffing to meet operational objectives and how mutual and automatic aid and contract agreements are utilized to augment structure fire responses.

This Applied Research Project is conducted in conjunction with the National Fire Academy Executive Fire Officer Program (EFOP) "Operations" course. As leaders in the Fire Service, EFOP students must be able to identify operational needs, analyze pertinent data, formulate

strategies to address those needs, and present the information in a professional format. This research also meets the United States Fire Administrations operational goal to "Improve the fire and emergency services' capability for response to and recovery from all hazards" (United States Fire Administration, 2010).

Literature Review

The literature review for this ARP included magazines, books, manuals and other materials found at the National Fire Academy Learning Resource Center, California State University at Northridge library, personal interviews, surveys, and electronic sources.

Convergency in the marketing business utilizes a combination of the newest technologies to reach as many customers as possible. "Bringing facts and data together from various sources and then applying logic and knowledge to solve problems, achieve objectives or to make informed decisions is known as thinking convergently" (Problem-Solving-Techniques.com, 2015). This method of marketing identifies a new type of consumer named "Centaur"; a consumer with new expectations (Wind & Mahajan, 2001). Convergence marketing shows what today's customers can do, what they are choosing to do and how they do it. Businesses that do not follow the trends of this classification of customer limit their ability to deliver services. VCFPD seeks to utilize convergent methodologies in its deployment of available to serve its diverse communities.

The VCFPD deploys its resources and staffs its apparatuses to maximize response capabilities in the most cost efficient manner. It leverages available technologies to provide its employees with the most up-to-date training and equipment (Ventura County Fire Protection District, 2010). The VCFPD also reaches out to its "Centaur" constituency through community

education, community participation, inspection programs, and the internet to maintain a connection with and view trends of the community.

The VCFPD is a participant in the National Fire Incident Reporting System (NFIRS) program (Ventura County Fire Protection District, 2014). They utilize the Flexible Data Management companies Records Management System (FDM RMS) software as the platform to comply with reporting requirements. As a required part of the NFIRS program, specific information must be reported, and the VCFPD utilizes an interface that makes use of information gathered during the dispatch process and automatically transfers this data to the FDM RMS reporting program (Milkovich, 2014). This automatic transfer includes information such as address, general nature of the response, structure type, fire suppression systems, fire alerting systems, and information about the responding resources. Other information is collected by VCFPD Emergency Dispatchers while on the telephone with the reporting party of the given emergency.

Additional information is available and collected through VCFPD's Tactical Pre-Plans and Supplemental Maps program. Information collected by field units is placed within the CAD system and is available for review as "Premise Information" on every units Mobile Data Communication device (MDC). This pre-loaded information is specific to the occupancy being responded to and includes the following (Ventura County Fire Protection District, 2014):

Installed fire protection systems

Construction features

Access issues

Identification of fire suppression and alerting systems

Fire suppression challenges

Presence of hazardous materials

Other safety conditions which would impact operations

The goals of the VCFPD's Fire Safety Inspection Program (FSIP) is to verify that the targeted occupancies within the program afford the safest environment possible for our citizens. Some of these goals are:

> "Reduce the frequency and severity of incidents at buildings and facilities (other than dwelling units) that cause loss of life or significant injury.
> Reduce the frequency and severity of potential incidents that cause significant property loss.
> Minimize socioeconomic loss to a community by reducing the frequency and severity of potential incidents that cause significant loss of employment.
> Provide an opportunity to Emergency Services personnel for tactical planning and review of buildings, occupancies, and facilities as needed that present a significant risk or challenge in order to meet Fire District operational objectives.
> Collect information to update mapping and other documents that will improve operational readiness.
> Comply with California Health and Safety Code for required inspections"
> (Ventura County Fire Protection District, 2014).

Implementation of the FSIP is accomplished by utilizing limited resources efficiently which allows VCFPD to gain the greatest benefit for the protection of the community. The FSIP is a centralized program that utilizes fire companies as one element of available resources to meet the objectives. This approach also allows for individual fire companies to perform elements of the VCFPD Tactical Pre-Planning and Supplemental Maps program while at the targeted occupancy (Ventura County Fire Protection District, 2014).

The International Association of Fire Chiefs (IAFC) recognizes the need for minimum staffing on fire apparatus for safe fireground operations. The IAFC states that the minimum staffing for engine and ladder companies should be five personnel. The IAFC also noted that the

trend of reducing the number of personnel per unit and the overall reduction of apparatus deployed 'has reached dangerously low levels' and that it would be "inappropriate" to accept or support further reductions (International Association of Fire Chiefs, 2005).

The International Association of Fire Fighters (IAFF) states that "inadequate staffing and crew size [are] contributing factors to line of duty deaths (LODDs) and advocates maintaining adequate staffing as proposed in NFPA 1710" (Moore-Merrell, McDonald, Zhou, & et al, 2006).

The Occupational Safety and Health Administration (OSHA) does not directly specify structure fire staffing levels, but a reference to staffing is contained within OSHA 29 CFR 1910.134. This regulation is intended to provide firefighter safety while working in an atmosphere which is immediately dangerous to life and health. It mandates that before interior structure fire operations are initiated, a workforce of at least four personnel are present. This concept is commonly referred to as "two-in/two-out" (Occupational Health & Safety Administration, 2011). OSHA specifically notes that "the 'two-in/two-out' provision is not intended as a staffing requirement, but is a requirement for worker safety in fighting interior structural fires" (Occupational Safety & Health Administration, 1998).

National Institute of Standards and Technology (NIST) performed extensive studies in 2010 regarding fireground operations. This study was unique, as NIST details that, "for the first time, this study investigates the effect of varying crew size, first apparatus arrival time, and response time on firefighter safety, overall task completion, and interior residential tenability using realistic residential fires" (Averill, et al., 2010). This report clearly identifies the efficiencies of different staffing models.

The National Fire Protection Association's (NFPA) stated mission is to "reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating

consensus codes and standards, research, training, and education" (National Fire Protection Association, 2015). The NFPA develops, publishes and disseminates over 300 consensus codes and standards (National Fire Protection Association, 2015).

It is important to note that the NFPA has no power to police or enforce the content of their standards. "NFPA codes, standards, recommended practices, and guides ('NFPA Standards') of which the document contained herein is one, are developed through a consensus standards development process approved by the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus on fire and other safety issues. While the NFPA administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in NFPA Standards" (National Fire Protection Association, 2015).

The NFPA,'s Standard 1710 entitled **"**Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments" addresses the minimum staffing required to safely operate on the structure fireground (National Fire Protection Association, 2010).

The National Institute for Occupational Safety and Health (NIOSH) recommends adequate staffing and references the NFPA 1710. A typical finding in LODDs made by the NIOSH reads, "The National Fire Protection Association (NFPA) 1710 Standard identifies the minimum resources for an effective firefighting force to perform critical tasks" (National Institute for Occupational Safety and Health, 2012).

Upon an insurer's request, Insurance Services Offices (ISO) will supply the underlying data that goes into developing the Building Code Effectiveness Grading Schedule (BCEGS)

classification which may affect insurance rates in an area. ISO will also provide insurers with details on staffing, training and certification, type of construction projects, and volume and value of construction are just as valuable as the classification itself (Insurance Services Office Inc, 2008).

ISO also offers the Public Protection Classification (PPC™) program. This program provides information about municipal fire protection services in community. The ISO collects information and analyzes the data ultimately assigning a Public Protection Classification. ISO's scale ranges from 1 to 10 with Class 1 representing "superior" fire protection. Conversely, a Class 10 rated fire service indicates that the area's fire suppression program does not meet ISO's minimum criteria. The ISO states "most U.S. insurers of home and business properties use ISO's PPC in calculating premiums. In general, the price of insurance in a community with a good PPC is lower than in a community with a poor PPC, assuming all other factors are equal" (Insurance Services Office, 2015).

ISO does not establish a set number for staffing. To receive the highest rating, ISO factors many items which results in a maximum of fifteen points out of 100 towards a fire agencies final rating (Insurance Services Office, 2015).

The VCFPD responds to over 37,000 calls per year. Of these calls in 2014, it experienced 166 structure fires that constituted a "working fire" (Ventura County Fire Protection District, 2015). A working fire describes the degree of commitment of resources and is not related to the intensity and or magnitude of the fire (VCFPD, 2005). Structure fire responses attributed to 1.2% of total responses and 3.3% of personnel time. On-scene personnel time for working structure fires averaged 2:08:24 (Ventura County Fire Protection District, 2015).

VCFPD structure fire responses are configured to meet the intent of NFPA 1710 in the most efficient manner possible. An initial response to structure fires is comprised of one Battalion Chief, three engine companies staffed with three personnel and one support (commonly referred to as a "truck") company staffed with four personnel, and one squad with two personnel. This configuration delivers sixteen personnel to the fire ground. If the on-scene report declares that the fire is "working", an additional two engines, one Battalion Chief, one Fire Cause Investigator, one Safety Officer and one Public Information Officer are dispatched to augment the response. This augmentation delivers an additional nine safety personnel to the fire ground for a total of twenty five personnel (Ventura County Fire Protection District, 2011).

When a second alarm structure fire is declared, one additional support company, one engine, one "light & air" unit with three personnel, and one Division Chief are dispatched to the fire scene. This response assures eleven additional safety personnel to the fire ground with a total number of responding personnel thirty six (Ventura County Fire Protection District, 2011).

The use of Mutual Aid within the state of California is governed by the Governor's Office of Emergency Services. The "California Fire Service and Rescue Emergency Mutual Aid Plan" (California Office of Emergency Services, 2014) defines how this system is administered. It provides authority, establishes Regions and Operational Areas, and the mechanism to order resources. It also explains the responsibilities of agencies who participate in or receive help from the system (California Office of Emergency Services, 2014).

Automatic aid agreements and contract agreements are established between two entities on a "quid pro quo; something that is given to you or done for you in return for something you have given to or done for someone else" (Merriam - Webster, 2015) status. These agreements

can cover any needed service. Contractual agreements are defined as "an agreement with specific terms between two or more persons or entities in which there is a promise to do something in return for a valuable benefit known as consideration" (The Free Dictionary by Farlex, 2015). The difference between contract agreements and Automatic aid agreements for the VCFPD is that for contract agreements, there is an expectation that the service is delivered and measurable; and in most cases paid for. It is also expected that is service is not delivered than benefit is not paid (Lorenzen, 2015). Automatic Aid agreements made between the VCFPD and other agencies have no monetary bonds. The services rendered and received in these agreements are based on availability at the time of request; in essence, they are no penalties or enforcements if services are unavailable (Lorenzen, 2015).

Procedures

The literature review was conducted at the National Fire Academy's Learning Resource Center, Emmitsburg, MD between May 15 and May 30, 2014. This search focused on Applied Research Projects that addressed Fire Service responses to structure fires.

Searches were performed at the California State University at Northridge library, Northridge, CA between September 2014 and February 2015. These searches targeted "responses to structure fires", "organizational change" and "convergent methods".

Additionally, on-line searches were performed utilizing "Google" as a search engine. These searches identified response standards and personnel staffing to safely operate at structure fires.

Searches were conducted on VCFPD databases. These searches targeted actual response times for apparatus responding to structure fires. They also identified the number of personnel hours for these types of responses.

The data collected was limited to January 2007 through December 2014. A longer data collection period would allow for more accuracy and would allow for tracking trends with regards to structure fire response.

Personal contact was made with the VCFPD Assistant Chief in charge of the Emergency Services Bureau. Discussion included VCFPD response protocols, Operational Area Cooperator agreements, convergent response methodology, and closest response concept. Current response levels as well as potential changes in response due to automatic and mutual aid resources were also discussed. Discussion of changing structure fire response protocols and the effect on staffing and apparatus placement was also discussed.

This study did not capture information from Ventura County Operational Area Cooperators regarding time lost due to injuries sustained while operating on the scene of structure fires. There were also HIPPA concerns regarding sharing medical information without impacting staff time to remove this guarded information.

Results

On what criteria does the VCFPD base its staffing and response to structure fires?

The VCFPD bases its staffing on a convergent response model and NFPA standards. Primary response resources are dispatched based upon the closest available resource with the

desired capability as determined by CAD and DVCFPD policy (Ventura County Fire Protection District, 2011).

The VCFPD deploys its personnel and resources in a manner intended to meet its adopted standard response criteria to urban, suburban, and rural populated areas. Resource deployment is dependent upon several factors but the intent is to deliver a capable firefighting force to safely mitigate the emergency encountered.

Units are concentrated in such a way that response staffing and response time standards can be met in the urban/suburban areas and the rural areas that border them. These standards are for the first unit to be on-scene within six minutes in urban areas and twelve minutes in suburban areas. There is no standard set for rural areas.

The VCFPD strives to get the minimum resources needed on-scene in the shortest possible time. This is so that occupant rescue and initial suppression activity can occur with the greatest possible potential for successful outcomes.

Overlapping coverage areas are desirable and simultaneous calls in coverage areas are considered for engine placement. Specialty resources, such as trucks, rescue squads, light and air units, and Urban Search and Rescue (USAR) are centrally deployed because of their limited number and capability.

Traffic patterns, travel distances, and community densities are all considerations and programmed into the VCFPD's Computer Aided Dispatch (CAD) system. Deployment modeling follows established strategic priorities on every structure fire. These priorities can be grouped as follows:

Life Safety:

Active, immediate rescue need (active rescue mode)

Preparedness to intercede quickly

Fire Control:

Exposure protection

Confinement

Extinguishment

Property Conservation:

Salvage

Overhaul

The VCFPD utilizes NFPA 1710 as a guide for staffing and response comparison. This standard is not strictly followed due to many factors. The VCFPD deployment model considers the economic impact of staffing and the reality of a very diverse community layout.

As with all agencies, the VCFPD is limited by its approved budget. Our budget is primarily derived from property taxes and was over 132 million dollars in 2014. During this period, our labor costs accounted for 80% of the budget, leaving approximately $26 million for all other expenses. With the current economy, and a slow-down in the real estate market, we do not anticipate growth in our funding in the near future. This also limits our ability to increase staffing.

Our constituency lives in very diverse communities. We have two large cities with populations over 100,000 people and we have enclaves of homes, ten to fifty, nestled in our mountains. We consider the whole county when placing apparatuses with the understanding that the outlying areas of the county will have longer response times than the densely populated areas. Conversely, we consider placement of apparatuses within the densely populated areas so that they are available for response to the suburban and rural areas around them.

The VCFPD has adopted the Incident Command System (ICS) by the National Incident Management System (NIMS) to ensure that identifiable and continuous command is maintained throughout the duration of all incidents. The first-arriving resource establishes an identifiable command utilizing ICS on all emergency incidents within the VCFPD's jurisdiction. If that member is not an officer, then the first-arriving officer assumes incident command. Command is retained until transferred or assumed by a chief officer.

VCFPD Incident Commanders are expected to establish a command structure to meet the needs of the incident and afford safe operations for personnel. The primary tactical elements, groups established to perform pre-established tasks, of a structure fire response are the following and the minimum staffing needed are:

Command:	One Chief Officer
Fire Attack:	One engine company with a Captain assigned as the group supervisor
Tactical Support:	One support/truck company with a Captain assigned as the group supervisor
Rapid Intervention:	One engine company with a Captain assigned as the group supervisor

Given these tactical elements, the VCFPD dispatches one Battalion Chief, three engine companies, one support/truck company, and one para-medic squad as initial responding units to all structure fire. This allows for two engine companies to be assigned to the tactical elements as deemed needed by the Incident Commander.

How does VCFPD staffing and initial response times to structure fires compare with NFPA recommended standards?

The VCFPD constantly staffs thirty two fire stations. Minimum daily staffing for these stations includes:

	Engine Companies	Support/Truck Companies	Para-Medic Squad Companies	Battalion Chief	Division Chief	Totals
Number of VCFPD Personnel Assigned	3	4	2	1	1	N/A
NFPA 1710 Staffing Standard	4	5 or 6 See 5.2.2.2.2	N/A	2	N/A	N/A
VCFPD Number of Units	32	6	2	5	3	48
Total Daily Staffing	96	24	4	5	3	132

In comparison with the NFPA standard for apparatus staffing, the VCFPD is understaffed in three categories. VCFPD engine companies run one person below NFPA standards, support/truck companies are one to two persons below standard and Battalion Chiefs should have an aide.

Staffing levels for initial structure fire responses can be summarized as follows:

	Engine Company	Support/Truck Company	Para-Medic Squad	Battalion Chief	Division Chief	Total Personnel
VCFPD First Alarm Staffing	9	4	2	1	0	16
NFPA Initial Alarm Staffing	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	18

The VCFPD does not meet the NFPA 1710 standard of 18 responding to an initial structure fire alarm. VCFPD responds sixteen personnel on an initial structure fire alarm and relies on the first arriving units to upgrade the alarm.

The VCFPD delineates three types of areas when responding to structure fires: urban, suburban, and rural. Response times are calculated utilizing computer modeling. Many factors are included in these calculations including distance, posted road speeds, road conditions and electronic signal control to name a few.

Urban areas include area where the first responding apparatus has an estimated response time of under six minutes. These areas are generally within one of the six cities that the VCFPD delivers service to by contract or the adjacent areas around these cities. The VCFPD's average structure fire response times for these areas is 05:04 with the median response time of 04:37. The average time it takes for the complete structure fire alarm to arrive on scene is 09:13.

Suburban areas include areas where the first responding apparatus has an estimated response time of under twelve minutes. These areas generally are found outside of city limits and are characterized by low density populations in agricultural or mountainous areas. The average structure fire response time for these areas is 11:43 with the median response time of 11:31. The average time it takes the VCFPD to have a complete first alarm on scene of structure fires in suburban areas is 17:05.

Rural areas include within the VCFPD jurisdiction are characterized by very low densities in remote areas. These areas include small enclaves of homes in mountainous areas, structures within the Los Padres National Forest that structure fire protection is the responsibility of the VCFPD, and hard to reach areas due to roads with structures interspersed within a

wildland area. They have response times for the first arriving unit of over eighteen minutes and well over thirty minutes to assemble a complete first alarm response.

VCFPD does don't meet the NFPA standard of the first fire unit arriving within four minutes 90% of the time. VCFPD does not place all initially dispatched units on-scene within eight minutes. Finally, VCFPD does not provide the NFPA standard of 18 personnel arriving on the structure fireground within eight minutes 90% of the time.

The VCFPD is able to deliver additional alarms and personnel per NFPA with on-duty personnel. We are also able to call on our Operational Cooperators and neighboring jurisdictions for mutual and automatic aid.

What recommendations can be found for staffing of apparatus for structure fires?

There are a number of organizations that recommend staffing for apparatus that respond to structure fires.

The International Association of Fire Chiefs (IAFC) recognizes the need for minimum staffing on fire apparatus. The IAFC states that a minimum of five personnel should be staffed on engines and trucks for safe fireground operations (International Association of Fire Chiefs, 2005).

The International Association of Fire Fighters (IAFF) endorses the NFPA 1710 recommendation of minimum staffing to include four personnel on all engine companies and five to six personnel on truck companies (Moore-Merrell, McDonald, Zhou, & et al, 2006).

The National Fire Protection Association's (NFPA) 1710 standard clearly outlines staffing for structure fire operations. Its standard calls for four person staffing on engine

companies and six person staffing on truck companies. The standard also address other specialty equipment staffing.

The National Institute for Occupational Safety and Health (NIOSH) recommends adequate staffing and references the NFPA 1710 standard.

What structural firefighting resources are available to the VCFPD from mutual aid, automatic aid and contract agreements?

The VCFPD works collaboratively with County officials to place pre-incident conditions on the developed environment that prevent loss of life, property, or natural resources through regulations on building systems, community infrastructure, and interface vegetation (Ventura County Fire Protection District, 2010). Appropriate command, control, and communication systems are provided for quick and effective response to regularly occurring emergencies, rarely occurring incidents, and natural disasters.

The VCFPD's fire and rescue protection staffing and strategically placed stations are efficient and cost-effective through coordination with other public safety agencies using cooperative and Automatic Aid agreements, the state Master Mutual Aid System and contract agreements. Agreements, operational plans, disaster plans, and resource directories are created, organized, and reviewed annually to ensure emergency preparedness and consistent interagency cooperation. This provides for maximum capabilities when needed and ensures, within legal and financial constraints, that the nearest capable, available resources respond to an incident regardless of jurisdiction or boundary.

The VCFPD participates in the State of California Mutual Aid System and will dispatch resources to any and all of our operational area cooperators upon notification (Lorenzen, 2015).

VCFPD will also supply resources to other fire agencies within the state. This aid is not limited to fires, but encompasses all risks including brush fires, hazardous material incidents, Urban Search and Rescue (USAR), medical emergencies, and structure fires to name a few. This system provides nearly unlimited resources but can takes hours or even days to receive. The benefit for initial alarm structure fires is negligible.

VCFPD also provides and receives Automatic Aid with our Operational Area Cooperators (OAC) (Lorenzen, 2015). It has individual agreements in place with all of the OACs to increase response capabilities and lessen the impact of an emergency on one agency. These agreements apply to all responses including structure fires. Each individual agency has pre-committed to supplying units for structure response. Some agencies have limited ability to send all equipment types and may only send one unit, while others may send three or four. This system is used for initial response to structure fires and significantly reduces the total response times to incidents. On average, the inclusion of one OAC to a structure response will decrease the on-scene time of the complete alarm by over three minutes (Ventura County Fire Protection District, 2015).

The VCFPD also has contract agreements in areas that are best served by another agency due to geographic location (Lorenzen, 2015). Remote areas at our northern border are serviced by Kern County Fire Depart and the community of Bell Canyon is served by the Los Angeles City Fire Department (Ventura County Fire Protection District, 2014). In both cases, the citizens of these areas are better served by having the closest available resources responding to their needs. Initial response in these areas is provided in whole or part by these agencies. VCFPD will send the appropriate resources to replace or augment that initial response per the agreement.

Discussion

The purpose of this research was to identify the current methodology the VCFPD utilizes for structure fire response times and personnel staffing. VCFPD uses a system of convergent response, NFPA1710 standards, available budget, and other information including county demographics to determine apparatus placement and staffing needs. The goal of the VCFPD is to respond the appropriate resources in a timely manner for the safety of the citizens of the county and the safety of its first responders.

As expected, the VCFPD does not meet the standards set forth in NFPA 1710 (Ventura County Fire Protection District, 2015). Fiscal restraints as well as the County's geographic lay-out does not allow for compliancy to the NFPA standard. In some areas, the first responding unit may have response times that range from a few minutes to over an hour. The convergent response model meets many of our needs, especially for emergency medical responses which make up nearly 80% of total call types (Ventura County Fire Protection District, 2006). These limitations will not change significantly in the near future, but the number of personnel deployed to structure fires can. Changes in apparatus staffing and the number of units responding to structure fires will require the need to consult with our OACs and negotiate with labor groups.

Although policies and procedures are reviewed continually, the VCFPD's initial responses to structure fires has remained the same for over twenty five years. In 1998 when the OSHA respiratory protection standard required two-in/two-out, the VCFPD addressed this new tactical element and required Incident Commanders to establish what has come to be known as a Rapid Intervention Crew (RIC) (Ventura County Fire Protection District, 2014). At that time, there was no adjustment in the initial response to structure fires. In 2009, the operational policy for structure fire operations was re-written and formally included firefighter rescue capabilities.

At that time, RIC was formally included as a tactical element and was mandated to be addressed by Incident Commanders. Although the staffing, capabilities, and utilization of RIC was clearly stated in policy, no additional resources were deployed on the initial response. Later, with the addition of paramedic squads, these units became part of structure fire responses for the safety of on-scene fire personnel. Although they are a fire resource, there inclusion was intended for advanced life support (ALD). As an alternative to increasing the number of initial responding units, the VCFPD opted to add two additional engine companies upon the first arriving unit's on-scene report. The augmented response was triggered by the use of the key "Working Fire" (Ventura County Fire Protection District, 2014). Additional resources could also be requested by declaring a "second alarm" or by the Incident Commander asking for specific resources. This is the current system utilized by the VCFPD. This method does not address delivering the NFPA recommended number of personnel to a structure fire within the first eight minutes. Also, this approaches does not address the NFPA recommended response times for first arriving units or times for the entire alarm to arrive.

The VCFPD's approach to initial structure fire responses does not take into account the occupancy type, building content, or fire suppression and alerting systems. These and other factors should be considered when deploying the appropriate resources, response times, and number of personnel needed at the incident. The VCFPD responds the same alarm size and configuration regardless of the above mentioned factors.

The 2010 NIST "Report on Residential Fireground Field Experiments" utilized verifiable, scientifically collected data to compare different staffing levels and different response times as they applied to critical tasks performed at residential structure fires (NIST, 2010). Although limited in its scope, clear correlations can be made to all structure types. More

personnel delivered in the quickest manner is the safest, most efficient way to combat structure fires.

Fire suppression and alerting systems should also be considered when deploying units to a structure fire. VCFPD has a strong Fire Prevention Bureau which leads the industry in many areas. Ordinance 25 was adopted in May, 2007. This ordinance required sprinklers to be installed in all new buildings throughout Ventura County, with some exceptions for utility structures (e.g., barns, garages, carports, sheds and some agricultural buildings) (Ventura County Fire Protection District, 2007). The Ordinance also applies to certain additions to existing buildings. Although there is no mechanism to give first responders sprinkler information at this time, the tools are available, in the form of engine CAD systems to deliver it in the future. Existing systems are currently in place; they are used for target hazard occupancies but could be leveraged for this additional information.

Occupancy type should also be considered when planning structure fire responses. A 75,000 square foot, concrete tilt-up construction, hazardous materials processing business receives the same response as a 2000 square foot single story, single family dwelling. Multi-story buildings that require ladder trucks to access the roof should have additional resources with those capabilities dispatched on the initial response. Hazard assessments should be an integral part of the response criteria to structure fires. These types of reviews are already utilized for targeted structures, and with increasing computer technologies and capabilities, these programs can expand to include all structures (Lorenzen, 2015).

Knowledge of response areas enables VCFPD to plan accordingly for emergency needs. Pre-attack planning provides information to develop strategies should a fire or other emergency occur. VCFPD evaluates demographics, occupancy, and other constituent information for service

areas. Service metrics, response data, resource allocation, and other internal information are continuously monitored and evaluated for efficiency. Gathered intelligence is incorporated into continuous one- and five-year planning cycles to prescribe and plan future means and methods of service delivery (Ventura County Fire Protection District, 2010).

Mutual Aid, Automatic Aid and contract agreements should be considered when evaluating structure fire response. Mutual Aid in California is a voluntary system which allows participants to access resources that they cannot staff. It can be viewed as a "ready reserve" for incidents that would normally overwhelm a participant. There are limitations to this system. The resources a participant may receive is limited to "like" resources that they are able to supply. The resources are also requested though a centralized point which delays their response. This system works well for extended incidents but does not work well for initial responses. It is not a viable mechanism to supplement initial responses to structure fires.

Automatic Aid are agreements between agencies to cover identified deficiencies. They can be utilized for both operational and administrative needs and there are no costs involved. These types of agreements are not limited to "like" resources and can exchange different services. In Ventura County, one agreement allows an exchange of engine coverage for dispatching. Automatic Aid agreements can be, and should be explored for both administrative and operational gaps with an agency. Automatic Aid is a practical way to augment and/or supplement initial response to structure fires.

Contract agreements between agencies, like Automatic Aid, is a means to fill an identified deficiency. As implied, contract agreements require an exchange of money for the desired service. They can be utilized for administrative and operational needs. The VCFPD has

contract agreements with numerous OAC and adjacent agencies to deliver coverage in areas that those agencies can access more readily. As with Automatic Aid Agreements, contract agreements can be, and should be utilized for both administrative and operational service deficits within an agency. They are a useful approach to augment and/or supplement initial response to structure fires.

Increased responses to any call type have short-term and long-term impacts on the VCFPD. Since structure fire responses account for a large commitment of resources and have a higher risk for serious injuries, there are both operational and fiscal effects that must be addressed. Short-term changes in staffing patterns, sector coverage, and material costs need to be addressed. Long-term impacts include staffing, resource placement, additional facilities, and fiscal impact to name a few (Milkovich, 2014).

Recommendations

This study showed that the VCFPD does not meet the recommendations established in NFPA 1710. It also revealed information that should be utilized when reviewing staffing and response times to structure fires.

The VCFPD should conduct a complete review of its response to structure fires. This review should consider different deployment models, alternate staffing levels, safe operating procedures, reducing on-scene times, and delivering the appropriate resources and personnel to safely operate on the structure fireground.

Continued progress towards a County wide operational agreement which would deliver the closest available, appropriate fire resources should be a high priority. To achieve this objective, all OAC should be dispatched by a VCFPD FCC or a direct communications link

should be established between dispatch centers. Currently, this agreement is in place for specialized responses, but should include all response types.

Further areas of study should be identified and data collection techniques can be utilized to extract valuable information. Some subjects of possible study include:

Establishing a metrics for structure fire response times

Tracking injuries which occur during structure fire operations by occupancy type

Tracking personnel hours by structure fire occupancy type

Review alternate staffing and response models for structure fires

Review alternate staffing and response models for all response types

Establish a County Operational Agreement which includes dispatching

Cost analysis versus call types (specific medical dispatch reason, public service, fire, hazardous conditions)

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