IDENTIFYING FIRE RESPONSE SYSTEM OPTIONS

Identifying Fire Response System Options for the City of Owasso (OK) that Meet Staffing and Response Time Criteria Established in NFPA 1710

Christopher A. Garrett

Owasso Fire Department, Owasso, Oklahoma

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, ideas, expressions, or writings of another.

Signed:_____

Abstract

The Owasso Fire Department (OFD) sought to have a positive impact on the community by making a difference in the outcome at fire and emergency medical incidents. To facilitate a successful outcome, OFD had to determine what factors were vital to making a difference. OFD identified response time and fireground staffing as frequently used performance indicators for the fire service. For career fire departments, NFPA 1710 was the industry standard. The problem was that OFD's performance did not appear to meet met the criteria established in the standard. The purpose of this applied research was to identify the optimum response system for ensuring effective fire protection by comparing OFD's staffing and response time performance to the criteria in NFPA 1710, and develop a proposed solution that would reduce or eliminate the deficits identified in the comparison.

Descriptive research was used to answer six questions related the department's performance in the areas of response time and staffing, alternative response systems in use by other departments, and characteristics of shared resource systems. The research was dependent upon information collected through literature, OFD records and reports, and supported by a questionnaire. The research determined that: (1) the criteria identified in the standard is well founded in science; (2) OFD's performance did not meet the standard in either area; (3) deploying more resources across the city would address the problem; (4) a shared resource system will help address the problem; and (5) neighboring fire departments would support sharing resources. Automatic Aid and consolidation were two shared resource options identified. Benefits of these systems were primarily improved services and relatively level costs, while the challenges were political, social, and bureaucratic. A "hybrid" system—Automatic Aid and

OFD's growth—was determined the most appropriate option, and recommendations were made to move that process forward.

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Identifying Fire Response System Options for the City of Owasso (OK) that Meet Staffing and Response Time Criteria Established in National Fire Protection Association Standard 1710

Introduction

There has been a focus on identifying the appropriate fire department response time, in terms of effectiveness and efficiency, for decades (Carlson, J., Sockwell, R., & Tiedeman, T., 1979). This researcher has been in the fire service for more than thirty years, and recalls the benchmark response time for fire departments was an average of four minutes or less.

It does not require detailed research to have an awareness of the relationship between response time and outcome. Basic physical science clarifies the logical correlation between longer response time and increased fire-related property damage, injury, and mortality. America Burning (National Commission on Fire Prevention and Control, 1973) and America Burning Revisited (USFA, 1987) clearly described the trending fire problem in the United States, and reinforce that every year, lives and property are lost to preventable fires. The National Fire Academy (NFA) course on community risk reduction—Executive Analysis of Community Risk Reduction—stresses the importance of the emergency response and engineered solutions that reduce the impact of fires, including fires in residential dwellings and other structures (FEMA, 2009, p.SM 3-37).

Along with the emphasis on response time, there has been much attention given to the minimum number of firefighters—on the apparatus and on the fireground—required to effectively and safely perform fire suppression activities at structure fires. While research was

conducted to identify the minimum number of firefighters for safe, effective fireground operations, the debate between those that do the work (labor) and those that control the budgets (management) remained unsettled. Like the relationship between response time and fire-related losses, the relationship between the number of firefighters performing fire suppression activities and the time it takes to control and suppress a fire seems logical; the more firefighters on scene doing the work, the quicker the work gets done.

In 2001, representatives from labor and management, along with a host of other stakeholders met and developed the first version of NFPA 1710 *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the public by Career Fire Departments* (NFPA, 2010). The standard established criteria for response times, deployment capabilities, and apparatus staffing levels, and was viewed as a benchmark document for career fire departments across the country (NFPA, 2010). The standard has been revised twice, with the most current version being the 2010 Edition.

The Owasso Fire Department (OFD) seeks to have a positive impact on the outcome of fires and medical emergencies by delivering the level of services that reasonably could be expected if the criteria set forth in NFPA 1710 were met and/or exceeded; however, over the last twenty years, the city has experienced a rate of growth in population and land size that continues to challenge the fire department. OFD provides fire protection and advanced life support ambulance service to the City of Owasso and the unincorporated areas surrounding the city with a daily staff of 14 Firefighter/Paramedics operating out of three fire stations (Garrett, 2009). The problem is that the current response system does not appear to meet national response criteria identified in NFPA 1710; leaving the community vulnerable to unnecessary losses due to fire.

The purpose of this applied research was to identify the optimum response system for ensuring effective fire protection to the City of Owasso, excluding any unincorporated areas, based on national response criteria set forth in NFPA 1710. Descriptive research was utilized for the project as the principal issue dealt with comparing current fire protection capabilities to criteria established in the NFPA standard, and comparing identified system deficits with alternative systems or methods intended to reduce or eliminate those deficits—to include, but are not limited to, mutual aid, automatic aid, and a unified response system. Research questions included: (a) In Owasso, how many personnel and how much equipment responds on a first alarm to a structure fire?, (b) In Owasso, how long does it take for the first unit to arrive on scene, and for the entire first alarm assignment to arrive on scene at a structure fire?, (c) What impact does OFD's EMS mission have on responses to, and staffing at, structure fires?, (d) What are the deficits in OFD's current response performance when compared to the national response criteria set forth in NFPA 1710?, (e) What system or method could be used to reduce or eliminate those deficits?, and (f) What characteristics of a shared-resource system are important to its success?

Research was conducted to identify current NFPA standards (related to response times to structure fires, apparatus staffing at structure fires, and fireground capability and deployment at structure fires), compare current performance level to NFPA standards to identify deficits, and identify alternate response systems. Research involved a review of literature related to the research subject, review of fire incident reports and computer-aided dispatch (CAD) reports, and questionnaires completed by key stakeholders.

Background and Significance

Located just north of Tulsa, Oklahoma, the City of Owasso is a growing community, with a city population of around 30,000, and an incorporated land area of approximately 15 square miles. Because of the growth rate the city has experienced over the last two decades—both in people and land size through annexation—the actual size of the city in terms of people and square miles is very dynamic; thus, it is common practice in Owasso for officials to offer estimated figures for population and land size (Garrett, 2009).

Established just after the start of the Twentieth Century, Owasso remained a small rural community for more than half of the century, when, about mid-century, the city began to develop into more of a bedroom community for Tulsa; though, the size and population of Owasso remained relatively unremarkable. Over the past 20 years, Owasso gained notice and popularity by establishing itself as a self-supporting, full-service city with suburban characteristics (Garrett, 2009).

Owasso is a City of Character. The community is known for its small-town feel, award-winning schools, and low crime. People began moving to Owasso to raise their families in an environment where they felt safe, healthy, and happy. As one would expect, the growth rate in population and land size is higher than the growth rate in city services; thus, the ability to maintain the level of city services that they require and expect, including fire protection and ambulance service, has already been lost (Garrett, 2009).

OFD is a career department with an authorized strength of 47 uniformed firefighters and one civilian. Of the 47 uniformed firefighters, five serve in executive or administrative

capacities, with the remaining 42 personnel working in operations. The department provides fire protection and advanced life support ambulance service to the city and its environs. The fire response district encompasses approximately 48 square miles, while the ambulance district includes approximately 70 square miles. The city operates from three fire stations, with each fire station housing a pumper or quint, an advanced life support ambulance, and a wildland vehicle/brush truck. The headquarters station (Station #1) also houses the shift commander's vehicle, reserve pumper, and reserve ambulance.

There are 14 positions assigned to each of the three shifts. The shift commander is quartered at Station #1, along with one captain, one driver, and three firefighter/paramedics. Stations #2 and #3 each have one captain, one driver, and two firefighter/paramedics assigned. For the three station department, minimum on-duty staffing is ten. The minimum staffing as identified in the collective bargaining agreement between the city and IAFF Local 2789 is three personnel at each station (one captain, one driver, and one firefighter/paramedic) and one shift commander (City of Owasso, 2009). Current policy allows for members to work out of class in the next highest position—a captain can work as a shift commander, a driver can work as a captain, and a firefighter/paramedic can work as a driver (City of Owasso, 2009).

According to the department's staffing plan (Appendix A), whenever the department is operating with maximum staffing of 14, Station #1 assigns three personnel to the engine and two personnel to the ambulance, and Stations #2 and #3 assign two personnel to the engine or quint and two personnel to the ambulance. This policy creates system vulnerability by staffing pumping apparatus with two firefighters rather than three or four firefighters. While the engine (or quint) and ambulance crews respond and function together as a four-person team, the

vulnerability exists when the ambulance crew is unavailable due to a previous call for service, and the engine or quint crew is forced to operate with just two personnel.

As has been OFD's practice, whenever the department is operating with minimum staffing, it must employ an "either/or" response protocol from each of the three stations to maximize operational flexibility. This protocol dictates that if a call for service is received which requires a fire apparatus to handle, the personnel at the station respond in the pumper (or quint), and the ambulance at that station becomes unavailable. Likewise, if the nature of the call for service is medical, the personnel respond in the ambulance, and the pumper (or quint) at that station becomes unavailable. Additionally, OFD protocol requires that the last available station serve as fire protection only, so that when the shift is operating with minimum staffing, anytime a third medical incident is received and only one station is available, mutual aid is requested from a private ambulance service or another fire department. Because OFD provides both fire protection and ambulance service, and the call volume is approaching 4,000 responses annually, the department is to a point where mutual aid assistance is frequently required to respond to medical incidents that OFD is unable to cover (Garrett, 2009).

The shift schedule is 24 hours on/48 hours off. According to department policy, as of March 1, 2010, three personnel are allowed off duty on vacation leave each shift, regardless of other circumstances. (See Appendix B) This policy leaves one additional firefighter on duty to cover any vacancy created by sick leave before overtime has to be used to meet minimum staffing requirements.

At present, the department utilizes the Overstaffing Model to maintain minimum staffing requirements, with four additional positions (over the minimum staffing of 10) per shift to cover

vacation and sick leave. The Constant Staffing Model was studied in 2009 because of the potential for future costs savings by only employing the number of personnel necessary to meet minimum daily staffing obligations and by paying off-duty personnel overtime to fill staffing shortages as they arise (Garrett, 2009).

OFD is dispatched by the City of Owasso Public Safety Answering Point (PSAP), which is an organizational component of the Owasso Police Department. Calls for service initiated from within city limits are routed directly to the Owasso PSAP, whereas calls originating from outside the city limits route through the respective county PSAP—Tulsa County or Rogers County—and then to the Owasso PSAP for processing and dispatch. According to Bill Allen (personal communication, December 1, 2010), Owasso's PSAP supervisor, the city's dispatch center is understaffed based on industry standards, and the on-duty telecommunicators must assume additional duties, such as serving as jailers.

As was noted previously, OFD's fire district encompasses approximately 48 square miles, of which approximately 15 square miles is incorporated city limits. Through annexations, Owasso city limits have added response district to the North—German Corner, Country Estates, Coffee Creek, and Lake Valley—and to the Southeast—Stone Canyon. The most recent addition to OFD's response system was Fire Station #3—opened in June 2008—to provide better protection to the East and Northeast areas of the response district—Coffee Creek and Lake Valley. The remaining areas—German Corner, Country Estates, and Stone Canyon—continue to go without fire protection that meets current response time standards.

OFD's neighboring fire departments include the City of Tulsa Fire Department (to the South), Sperry Fire Department (to the West), Limestone Fire Protection District (to the East),

and Collinsville Rural Fire Protection District (to the North). OFD has an informal working relationship with its neighboring fire departments, in that there are no formal written mutual aid agreements between the City of Owasso and the neighboring fire departments; however, no department has refused to aid a neighboring department if their respective resources are available.

Tulsa Fire Department (TFD) is a career department of approximately 700 firefighters operating from 30 fire stations. The closest TFD fire station to Owasso city limits is Station #31, which is located approximately five miles South of the incorporated area.

Sperry Fire Department (SFD) is a volunteer department of approximately 15 members who operate out of one fire station. SFD's fire station is located approximately seven miles away from the most Western portion of Owasso city limits.

Limestone Fire Protection District (LFPD) is a volunteer department of 30 members, who operate out of three fire stations. The department is supported by four career personnel who work Monday through Friday, from 8 AM to 5 PM. These personnel are divided between two of the three stations—two firefighters at Station #1 and two firefighters at Station #3 (not accounting for annual leave). Two of LFPD's three fire stations—Stations #2 and #3—are built on the dividing line between the two fire response districts, and LFPD Station #1 is within two and one-half miles of OFD's fire response district. LFPD Station #2 is approximately two miles from Owasso city limits, and LFPD Station #3 is directly across the street from Stone Canyon, and adjacent to areas difficult for OFD to effectively protect (within the parameters of NFPA 1710) from its existing fire stations.

Collinsville Rural Fire Protection District (CRFPD) is a volunteer department of 26 members who operate from one fire station. The department is supported by three career personnel who work rotating 24-hour shifts—24 hours on/48 hours off—resulting in one career firefighter on duty at all times (not accounting for annual leave). CRFPD's fire station is located approximately one and one-half miles from Country Estates and two miles from German Corner—areas difficult for OFD to effectively protect (within the parameters of NFPA 1710) from its existing fire stations.

As the city continues to grow, arguably at the end of a recession, city leaders and fire administrators must work to identify the most appropriate way to improve service delivery as expediently as possible. In 2009, this researcher identified that the need for additional resources (staffed fire stations) was the fundamental solution to the service delivery problems; however, as the problem statement in the previous section identified, what has yet to be identified at present is the most appropriate response system to meet the national standards. In particular, is adding the necessary resources to the current system a reasonable solution, or should the city move toward a shared-resource system to meet the standards?

The research presented in this paper directly relates to EAFSOEM and the goals of the U.S. Fire Administration in several ways. The purpose of this applied research is to identify the optimum response model for ensuring effective fire protection based on existing industry standards. The effort to identify a response system for the City of Owasso that ensures the timely arrival of enough firefighters and apparatus to safely and successfully effect the rescue of occupants and contain fires to the rooms of origin meets USFA's mission identified in the Forward section of the student manual (FEMA, 2009b, p. SM iii). The assessment of local and

regional capabilities meets two of the five Enabling Objectives identified in Unit 4 (FEMA, 2009b, p. SM 4-1). Lastly, by identifying a response system capable of meeting national staffing and response time criteria, the research addresses USFA's goals regarding local planning and preparedness, and capability for response to and recovery from all hazards (USFA, 2009, p. 13).

Literature Review

A literature review was conducted to answer or aid in answering the six research questions introduced earlier in the paper. To gain an appreciation for the various aspects of the research, such as the role of standards in the fire service, the impact of time and people on fire loss, and the opportunities and challenges of working together, the scope of literature reviewed was broadened. As a logical progression of the literature reviewed, information related to standards, fire department staffing, fire department response times, shared-resource systems, and collaborative behavior were collected and examined. The results of the review established a better frame of reference for the readers to use during their assessment of the research.

Research questions (a), (b), (c), and (d) are specific to the current policies and/or performance of the OFD response system, and as such, information obtained to answer those four questions is identified throughout the Procedures and Results sections. The literature review was instrumental in answering research questions (e) What systems or methods could be used to reduce or eliminate those deficits? and (f) What characteristics of a shared resource system are important to its success? The insight gained from this research practice was used extensively in the Discussion section, and served as the foundation for developing recommendations.

Standards

According to the National Institute of Standards and Technology (NIST), standards are common and repeated use of rules, conditions, guidelines, or characteristics for products, processes, methods, or management system practices, and are established to identify the minimum level of expectation for the given product, process, or practice (Standards.gov, n.d., Alabama Municipal Insurance Corporation, n.d.). Of particular interest to the fire service are NFPA standards, which are "consensus standards" that are developed by a committee of stakeholders from within a particular industry or discipline, or have a vested interest in that industry, in an effort to self-regulate (Alabama Municipal Insurance Corporation, n.d., NFPA, 2010).

The NFPA standard development process has evolved over time, and now utilizes reasonably balanced memberships to eliminate any inequity in the proceedings; though, as the research identified, this has not always been the case (Cheit, 1990). As one could predict, the process of writing industry standards has the potential to be used by some to gain an unfair competitive advantage; thus, the process required statutory oversight to prevent such practices, and is now regulated by U.S anti-trust legislation. Over the years, there have been several legal cases involving anticompetitive action. In *Allied Tube and Conduit Corp. v. Indian Head*—a case that directly involved NFPA's standard development process—the issue of unfair practices was put to rest by the U.S. Supreme Court in 1988 when they ruled that a producer of steel conduit engaged in unfair corporate practices by strategically packing an NFPA meeting in order to control the outcome of the vote, and ultimately keep PVC from becoming an accepted substitute under the National Electric Code (486 U.S. 492 [1988], Cheit, 1990). In an action to

prevent any single group from dominating the process, NFPA has modified its procedures to prohibit code text being written from the convention floor—a standard development method currently approved by ANSI (NFPA, 2010, Cheit, 1990).

Standards can be voluntary, which pose no obligation for others to use, or mandatory, which places a regulatory requirement on those individuals or organizations covered by the standard (Standards.gov, n.d.). NFPA (2010) reinforced its existence as a voluntary standard in the Disclaimer section of each document when it wrote: "Use of NFPA documents for regulatory purposes should be accomplished through adoption by reference," and "Users of these documents should consult applicable federal, state, and local laws and regulations. NFPA does not, by the publication of its codes, standards, recommended practices, and guides intended to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so."

The original version of NFPA 1710 was published in 2001, and represented the fire service's "first organized approach to defining levels of service, deployment capabilities, and staffing levels" for career departments (NFPA, 2010, p. 1). Like any new standard, NFPA 1710 was destined to face opposition, if, for no other reason, because of its challenging criteria. In a memorandum to the College Station (TX) City Council, Fire Chief David Giordano requested that the city council pass a resolution opposing the adoption of NFPA 1710 by the Texas Fire Commission (College Station, 2001). In his memo, Chief Giordano noted several reasons to oppose adopting the standard including the loss of local control, increased costs to comply, and increased liability for failing to comply (College Station, 2001). While the search for opposition

literature was unsuccessful, the rationale behind Chief Giordano's opposition—loss of control and inability to comply—seems reasonable.

While cognizant of the legal requirements, the Alabama Municipal Insurance Corporation (n.d.) warns that regardless of a standard's statutory status, criteria identified in the standard may be considered the standard of care, and one's failure to meet the criteria deemed a negligent act. In his book on strategic planning, Mark Wallace referred to NFPA standards as informal mandates, and noted that if a case involving a department's failure to follow the standard develops into legal action, then the standard would likely be used "as the measure by which judgment will be made" (1998, p. 69). That was the case in the State of New York when, in 2002, Alan G. Baird, III, First Assistant Chief of the Lairdsville Fire Department, was found guilty of criminally negligent homicide in the death of a firefighter during a training evolution, and was incarcerated for his crime (Supreme Court of the State of New York [*People of the State of New York v. Alan G. Baird, III 1619.1, KA 02-02557*], 2003). The courts found that Chief Baird did not follow safe training practices for live fire burns as established in NFPA 1403, the national standard for such training events (Supreme Court of the State of New York, 2003).

For much the same reasoning as that established in the Baird case, a civil case was brought against the Kingdom of Thailand and others, including the U.S. National Oceanic and Atmospheric Administration (NOAA), for failing to disseminate prompt warnings prior to the tsunami making landfall in 2004. The case involving the Kingdom of Thailand and NOAA is another example of a voluntary standard becoming the community's expectation, and, in this case, the legal argument built upon the belief that the Kingdom of Thailand (and others) had a

duty to follow the criteria set forth in NFPA 1600 *Standard on Disaster/Emergency Management and Business Continuity Programs* (Nicholson, 2005).

Staffing

Determining a national standard for fire department staffing levels will always be filled with debate and opposition for any number of reasons; but, particularly for those offered by Chief Giordano in 2001—cost and local control. The minimum number of firefighters assigned to fire apparatus is not an arbitrary number; it is the number of personnel that municipal governments can afford, or are willing to fund (Garrett, 2009). The annual cost of a Firefighter/Paramedic in Owasso, including salary and benefits, is $71.361, which equates to almost $250,000 to increase staffing in one company by one firefighter per shift (Garrett, 2009). Given the fiscal challenges every community faces, municipal councils and boards must find the balance between what they know they need and what they know they can afford (Sanford, 2008).

In a questions and answers document about NFPA 1710, the Powell River Firefighters Association (n.d.) offered some insight into how NFPA arrived at the four-person minimum. In the document, they note that the standard's technical committee concluded that several previous studies on staffing conducted between 1967 and 2000 demonstrated that four firefighters were needed to operate safely, effectively, and efficiently (Powell, n.d.). The studies referred to in the document included independent research by the insurance industry, municipal government, professional organizations—ICMA, IAFC, IAFF, NFPA—and individuals, and each offers a common theme that fire companies staffed with four firefighters operate at an optimum level when performing fireground tasks (Powell, n.d.).

In addition to operational efficiency, the four-firefighter minimum is essential for meeting the Occupational Safety and Health Administration (OSHA) respiratory protection standard 29 CFR 1910.134, commonly referred to in the fire service as the "Two-in/Two-out" rule (Sanford, 2008). This rule requires that before interior operations can commence: (a) four personnel must be assembled on site, (b) the personnel must be divided in to teams of two personnel—one team for inside operations and one team to conduct a rescue if the interior team requires such, and (c) the two personnel outside of the hazardous atmosphere must have respiratory protection (ready, but not in use) and prepared to initiate a rescue (Sanford, 2008). In their report for the U.S. Fire Administration (USFA), Hall, Karter, and Whitney (2006) noted the impact of the "Two-in/Two-out" rule on fire departments with minimum staffing of less than four when they identified that in many fire departments, the "first arriving complement of firefighters" is below the four personnel required; thus, causing a delay in the commencement of interior firefighting operations. In an interview with the NFPA's Carl Peterson about NFPA 1710, Peterson noted the "Two-in/Two-out" rule is a government requirement, and that the rule was used to reinforce the decision to set the minimum standard at four firefighters (Nadile, 2008).

In 2010, NIST, with funding through the Assistance to Firefighters Grant (AFG), conducted a quantitative evaluation of fireground tasks for residential structure fires comparing the impact of crew size on task time. The study analyzed 22 firefighting and rescue tasks performed with 2-, 3-, 4-, and 5-person crews, and, according to NIST Group Leader Jason Averill, provided a technical foundation for NFPA 1710—a primary goal of the study (Durso, 2010, NIST, 2010). Representatives from NIST, IAFC, IAFF, CFAI, Worcester Polytechnic Institute, Montgomery County (MD) Fire and Rescue, and Fairfax County (VA) Fire and Rescue

were involved in the study. Averill pointed out that the make up of the group was important, in that the individuals and agencies involved brought "something to the table", and the collaborative effort ensured that no independent agenda was advanced (Durso, 2010).

The study group concluded that four-person crews were able to complete all of the fireground tasks 30% faster than two-person crews and 25 % faster than three-person crews; however, there was no statistical difference between four-person crews and five-person crews (NIST, 2010). Findings related to critical fire ground tasks, such as putting water on the fire, conducting a primary search, and laddering and ventilating the structure were reported as (a) four-person crews were able to put water on the fire 10% faster than two-person crews and 6% faster than three-person crews, but were 6% slower than five-person crews in this task, (b) there was no notable difference between the performance of four- person crews and five-person crews in conducting a primary search; however, four-person crews were able to complete a primary search 25% faster than two-person crews and 6% faster than three-person crews, and (c) four-person crews were able to complete laddering and ventilation operations 30% faster than two-person crews and 25% faster than three-person crews (NIST, 2010). While the quantification of the relationship of crew size to task time is vital to the fire service, the relationship between time-to-task completion and risk (NIST, 2010) is fundamental for both fireground tactical planning and organizational strategic planning.

Response Times

There is a wealth of literature related to fire department response times. With regard to structure fires, response time is an aspect of fire department performance that is built upon the physical science of fire development (ESRI, 2007, Benichou, Kashef, and Hadjisophocleous, 2002, Provincial Government of Ontario, 1998). With the inclusion of EMS as a component of

most fire departments' core mission, response time also has a fundamental relationship with morbidity and mortality (ESRI, 2007, Pons, P., Haukoos, J., Bludworth, W., Cribley, T., Pons, K., Markovchick, V, 2005, Felder and Brinkmann, 2001). Identifying the appropriate response time requires indentifying the point in the development cycle when a fire is likely to create an untenable environment, or, in the case of medical incidents, the time at which permanent physiological damage is expected to occur (ESRI, 2007, Pons, et al., 2005, Benichou et al., 2002).

The point at which a structure fire reaches the flashover stage and begins its extension beyond the room of origin is also the point at which victim rescue and property conservation become unlikely (Benichou et al., 2002). In his research, Sanford (2008) found that when the fire extends beyond the room of origin, the possibility for civilian death, civilian injury, and property damage increases by eight and one-half times, three times, and seven times respectively. As fire grows exponentially, the rate of fire growth is a relatively uncontrollable factor in the time between ignition and intervention in the absence of any automated fire control devices (ESRI, 2007). ESRI (2007) reports that factors such as room size and contents play a role in limiting the exact predictability of time to flashover; however, they list a time frame of four to ten minutes once the fire grows to the free burning stage. Other literature supports a slightly narrower time frame of six to ten minutes to flashover, with all other factors being equal (NIST, 2010, NFPA, 2010, Vestal and Bridge, 2010, Sanford, 2008, Benichou et al., 2002, Johnston,1999).

There is a chart in the Annex section of NFPA 1710 (Cascade of Events Chart) that illustrates what part of the fire event's time continuum involves local PSAP and fire department interaction, as well as how much time can elapse between the time the fire starts and the time the

fire is reported to the PSAP (NFPA, 2010). This chart, along with other similar charts offered in the literature, clearly show the pivotal role response time plays in initiating intervention actions before a fire reaches flashover stage (NIST, 2010, ESRI, 2007, Benichou et al., 2002). What is alarming about the relationship between response time and the fire growth cycle is that the six minutes and twenty seconds response time standard—from 911 to first unit arriving on scene—established in NFPA 1710 places the first arriving firefighters on scene about the same time flashover is likely to occur; a situation that places the responding personnel and any trapped occupants at greater risk (NIST, 2010, NFPA, 2010). In a 2005 article in the *Boston Globe*, reporter Bill Dedman wrote of an incident in Ipswich (MA) where a young mother and her two small children died in a fire because the engine (staffed with one firefighter) arrived at the fire too late to make a difference (Dedman, 2005). While, tragically, the Ipswich incident was not uncommon, it initiated a closer investigation by the newspaper into response time impact and compliance. Dedman (2005) reported statistics indicated that, on average, someone in the U.S. dies every day because firefighters arrive too late, and that in 2002 (the last year with complete data before the article was written), only 54 % of fire departments across the Commonwealth of Massachusetts met the national response time standard. Dedman (2005) did note that Massachusetts' 54% compliance rate was better than the national average of 35%.

Response time has actually increased in certain areas. In San Diego (CA), the city has implemented a policy of temporarily closing fire stations on a rotating basis in order to cut overtime costs, which resulted in a drop in that department's response time compliance rate (Crowe, 2010). England's national fire service has identified an 18% increase in response time over the last ten years; an increase that is blamed on increases in traffic and call volume and a decrease in the number or available resources caused by reductions in force (Communities and

Local Government, 2009). In their report *Review of Fire and Rescue Service Response Times*, the Communities and Local Government group (2009) noted that the impact of the increased response times was a slight increase in civilian fatalities occurring in dwelling/building fires and in traffic collisions, and an increase in fire loss of £85 million, the equivalent of $135 million U.S. dollars (Communities and Local Government, 2009). The Provincial Government of Ontario recommends that communities consider less obvious impacts of fire, such as lost tax assessment, lost jobs, and the psychological effects major losses have on individuals directly and indirectly impacted by the loss (Ontario, 1998).

Based on the literary research, it is evident that time is the enemy when an unintentional fire starts or a life-threatening medical event occurs; thus, to maximize the effectiveness of fire protection and pre-hospital clinical care, fire stations should be strategically placed and adequately staffed and equipped to meet the fire service industry's minimum standards. According to the literature, this fundamental philosophy is easier said than done. In fact, research indicates that NFPA 1710 is a planning document and not intended as an enforcement document (NFPA, 2010). In a study of Bellevue (WA) Fire Department's *Standards of Response Coverage Report*, the department uses NFPA 1710 as their goals, and sets its performance objectives at a lower level where there is a reasonable expectation of success (Bellevue, 2008). In an article in the *Tulsa World*, editor Gavin Off reported that only one of Tulsa Fire Department's thirty fire stations was in compliance with the national standard; though, five of the department's thirty fire stations come within two percent of the standard (Off, 2010). Off interviewed Tulsa Fire Chief Allen LeCroix, who stated: "As we got to the outlying areas, the city didn't have the funding to continue building fire stations and house firefighters…It's a never ending race" (Off, 2010).

Determining how many fire stations a community will build and operate, and where those stations will be located are decisions that will establish response time and, in some part, staffing capabilities. In her report on fire service performance measures, Jennifer Flynn noted that citizens understand that faster responses result in reduced fire losses, and that "citizens see fire department response ultimately as the responsiveness of the government and indicative of their own security" (Flynn, 2009, p. 16). Neilsen (2009) and Felder and Brinkmann (2001) iterate the need to include the community in decisions involving their fire department's response capabilities to either gain their support or manage their expectations; though Benichou et al. (2002) caution that response times are not as predictable as one may reason because of dynamic physical barriers and human behaviors. Felder and Brinkmann (2001) and Johnston (1999) offer that one of the first decisions to make is whether the response system will be designed based on equity—the entire community shares the same response capability, such as a seven minute response time from the closest fire station—or the greatest good for the greatest number of people—the more densely populated areas of the community can expect a four minute response from their closest fire station, but those in the less populated outlying areas must endure an eight minute response time from their closest station.

Shared Resources

The most direct solution to bridging gaps in response times and staffing is to build more fire stations and hire more firefighters until (a) each engine or ladder company is staffed with at least one officer/supervisor and three firefighters, and (b) the department can assemble the first company on scene within 320 seconds from the time of dispatch and the entire first alarm assignment—to consist of no less than 14 people (15 if the aerial ladder will be operationally deployed)—within 560 seconds from the time of dispatch at least 90% of the time. As budget

shortfalls have municipalities struggling to maintain the current level of services, it seems unreasonable to expect added resources.

A literature search for information related to sharing resources was relatively successful. Sharing resources through basic mutual aid agreements has been a part of the fire service for many years; with one department coming to the aid of another when the incident became too big for the department to manage on its own (Prillaman, 2010, Loboschefski, 2009). Prillaman (2010) noted that a response must be front loaded with resources to make a difference; leading readers to believe that the flaw in a traditional mutual aid system is that the incident is already unmanageable before assistance is requested, thus, leaving no opportunity to improve the outcome. Information offered by Robert Rielage in his article is in line with Prillaman's philosophy. Rielage (2010) offered that there was a growing practice in his region of using automatic aid on structure fires and other large assignments to meet national staffing standards.

Of the literature reviewed, almost all placed great emphasis on automatic aid response systems and/or a philosophy of sending the closest appropriate unit regardless of what department it comes from and into whose district it responds (Prillaman, 2010, Loboschefski, 2009, Nielsen, 2009, Dedman, 2005, City of Pinole [CA], 2009, Silverfarb, 2010, Sendelbach, 2009, City of Sonoma [CA], n.d.). Sendelbach (2009, p. 12) offered that the fire service prides itself on "fast and effective response", yet enables a failure of our core mission—saving lives and protecting property—by operating in systems that do not dispatch the closest available unit. A shared resource system used in the Upper Midwest is the Mutual Aid Box Alarm System (MABAS). MABAS is a shared resource response system which utilizes automatic aid and closest unit response, but is designed to operate in a manner that does not fully deplete the resources from any neighboring department (Prillaman 2010, Nielsen, 2009). The success of

MABAS is evident, as the system originated in the late 1960s in the Chicago area, and has grown to include approximately 1200 fire departments across five states—Illinois, Wisconsin, Missouri, Indiana, and Iowa (Nielsen, 2009).

The lack of funding seems to be the reason so many fire departments have considered or are considering a shared resource response system (Silverfarb, 2010, Pinole, 2009, Carter, 2010, Sonoma, n.d.). With fire departments facing increasing calls for service, and a lack of resources or the lack of funding to obtain the resources, the elimination of duplicated resources and better use (sharing) of existing resources are two ways that fire departments can gain efficiency while either maintain or improving service delivery (Carter, 2010, Pinole, 2009, Pickstone, 2003, McCormick, 2000). There are occasions when, through annexation or other circumstance, municipal corporate limits are expanded beyond the effective reach of the municipality's resources, but close to the resources of others (Nielsen, 2009, Rule, 1992). McCormick (2000) believes that it is opportunities like those that demonstrate the benefit of a shared resource system.

Research yielded two examples of the impact of not having the closest station respond because the incident was outside of the station's response district. In his applied research paper, Nielsen (2009) cited an incident in Spokane (WA) where a discarded cigarette ignited an apartment fire in a recently annexed portion of the city. The incident grew to three alarms, caused over one million dollars in damage, and left twenty-nine residents without a home. Nielsen (2009) pointed out that the closest fire station was just over a mile away from the incident; however, that station was a fire district station, not a city fire station, and, through three alarms, was never utilized. Dedman (2005b) reported on a fatal residential fire in Massachusetts where the nearest station was two minutes closer than the station that was dispatched. Dedman

(2005b) stated that border barrier situations were common across the Commonwealth where, at the time the article was printed, there were 351 cities and towns and 365 separate fire departments.

Prillaman (2010) believes that fire departments and municipal leadership need to embrace a system that sends the closest unit because in the midst of an emergency "Mrs. Smith" does not care about the color of the fire truck or what name is on the door. Sendelbach (2009) and Rielage (2010) agree with Prillaman in that citizens have little to no concern about where help comes from; they merely want well-trained, well-equipped individuals to arrive in a timely manner and make their emergency go away. However, Sendelbach references the political and sometimes personal history that often stands in the way of collaboration when he wrote: "The defined barriers of emergency response districts throughout the country are oftentimes hardened by emotional scars, territorial battles and political agendas that in many cases predate and extend beyond a sitting administration" (2009, p.12).

Along with mutual aid, automatic aid, and MABAS, the process of consolidation or some other form of permanent unification of two or more departments is gaining momentum. Some departments are looking to consolidate or merge with other departments to quickly, if not immediately, eliminate costs associated with duplicated jobs and services (Silverfarb, 2010, Spector, 2010, Carter, 2010). In the Indianapolis (IN) region, fire departments in smaller communities are consolidating with the Indianapolis Fire Department (IFD) in an effort to maintain services and reduce costs (TheIndychannel.com, 2010). Lawrence Township (IN) Fire Department consolidated with IFD, and in the process retained only 18 out of 127 positions, or 14% of the department's staff (TheIndychannel.com, 2010).

Like merging fire departments, consolidating dispatch services into one regional dispatch center is another popular means of cost-cutting, as these centers save tax dollars and provide a more coordinated regional response. Joseph Kitchen, Fire Chief in Bath Township (OH), was part of a project to implement centralized dispatching within the region around his community. Chief Kitchen stated that dispatch centers are one area where communities can make efficient use of tax dollars, and that their efforts (in Bath Township) were an example of local agencies handing over control to obtain the benefits (Blake, 2010).

The information reviewed frequently noted that stepping away from independent operations and moving toward some form of a shared resource system was initiated by the departments; however, several of the literature sources noted that government at all levels is looking at shared resources as a means to weather the fiscal storm (Silverfarb, 2010, Carter, 2010, Pinole, 2009, Pickstone, 2003, Sonoma, n.d.). While the U.S. federal government has not moved to force regional collaboration, Canadian and British fire services are seeing forced mandates to develop more efficient systems using shared resources (Pickstone, 2003).

State and local governments are becoming increasingly involved in finding alternatives to independent fire protection systems. Silverfarb (2010) reported that cities in San Mateo County (CA) were being forced toward consolidation by the San Mateo County Civil Grand Jury in order to save tax dollars, and Carter (2010) noted in his article that the State of New Jersey has openly encouraged sharing services and municipal consolidations. Carter (2010, p.1) also wrote that New Jersey was joining the rest of the nation "in their search to deliver fire protection services in a more cost-effective manner"; an effort that Carter states is well-supported by the media. In 2002, the City of Sonoma (CA) reached out to a neighboring fire district in an effort to "eliminate duplication of equipment, personnel and resources, control costs and provide higher

levels of fire and rescue services to both communities", and formed the Sonoma Valley Fire and Rescue Authority through a Joint Powers Agreement (Sonoma, n.d.). Pinole (CA) is already part of a shared resource system; however, after forecasting the community's fiscal future, Pinole city leaders realized that the current model would become unsustainable, and therefore was forced to consider alternative response models involving additional partner communities (Pinole, 2009).

Collaboration

In a report written for Rodney Ray, Owasso's City Manager, John Feary and this researcher studied and reported on the works of Joseph Priestly; a Colonial Era scientist, political theorists, and minister whose actions over the course of his life epitomized knowledge sharing and collaborative action for the greater good of society. In the Executive Summary section of the report, Feary and this researcher wrote:

> Collaboration can offer greater access and a more powerful vehicle for change. For the community or organization, individual participation often results in better decisions and a better decision making process. Throughout history, progress and even survival, have at times depended on collaboration. When environmental (including economic) conditions, competition, or other circumstances have made life more difficult or resources scarce, people unite for a common purpose. Greatness and progress often accompany a unified group of people through adverse circumstances. When creativity, skills, self-efficacy, and motivation, accompany collaborative action, capacity is expanded, and success is more often realized. (2009, p. 2).

The literature reviewed for this research project seems to support the need to unite for the common purpose of providing critical services, such as fire protection, in the midst of difficult economic conditions. In his article on benefits and barriers to regionalism, John Ouellette quoted

William Scanlon, President of the Massachusetts Municipal Association as saying: "In these very difficult times, with local aid being cut so drastically, regionalization really rises to the top as something that we've got to pursue." (Oullette, 2010, p. 1). As the previous literature identified, Scanlon's opinion is shared by many communities across the United States, as well as other countries; thus, the concept and the need are not in question. A closer look at literature that offers insight into what it takes to collaborate and what gets in the way of collaborative action was more meaningful in the scope of this project.

Legitimate collaboration is most often voluntary behavior that is based on one or more common goals, needs, values, or interests (Feary & Garrett, 2009). In a presentation on collaborative education opportunities, Lesley Bainbridge affirmed this position by describing collaboration as "a process through which parties who see different aspects of a problem can constructively explore their differences and search for solutions that go well beyond their own vision of what is possible" (Bainbridge, n.d., p.11). That sentiment was echoed by Kenneth Crow (2002) who opined that the capacity of a group of people working together was greater than the same people working individually.

Some of the roots of collaborative behavior are found in natural skills development as children; thus, the process of collaboration should be easily understood and practiced (Feary & Garrett, 2009). Cooperative behaviors that (assumedly) were taught and reinforced through childhood are the foundation for collaborative interaction in the adult environment (Feary & Garrett, 2009). Specific to professional interaction, Bainbridge noted that "collaboration implies interdependence among stakeholders, constructive handling of differences, joint ownership of decisions and collective responsibility for outcomes" (Bainbridge, n.d., p. 12). Bainbridge (n.d.) collectively mentioned seven things that are critical to successful collaboration, including (a)

shared goals and expectations, (b) clear project purpose and scope, (c) belief of equality among members of the team, (d) respect for others opinions, (e) clear communication, (f) preparation for compromise, and (g) trust. Trust was mentioned last because Jacoby (2009) believes that collaboration breeds trust, and that trust is often an unreasonable expectation when groups initially form.

Logically, the seven items noted as critical to successful collaboration are potential vulnerabilities as well. The opportunity for success in any collaborative endeavor is immediately challenged if the goals, expectations, purpose, and scope are not clear and shared amongst the members (Feary & Garrett, 2009). When focusing specifically on collaborative actions within the fire service, the literature indicates politics and bureaucracy play a pivotal role in slowing down or miring the process (Martini, 2010, Prillaman, 2010, Ouellette, 2010, Sendelbach, 2009, Dedman, 2005b). Other challenges for collaboration include logistical and administrative issues related to the project (Johnson, L., Zorn, D., Tam, B., LaMontagne, M., & Johnson, S, 2003). Ouellette (2010), McCormick (2000), and Johnson et al. (2003) pointed out the difficulties related to human resource matters—collective bargaining agreements, salaries and benefits, and civil service rules—operational policies, and project timelines. Lastly, Carter (2010b) noted that human variables—organizational culture and the fear of change—are factors in the success or failure of a collaborative project. Carter (2010b) added that there would be individuals within the organization(s) who would never agree with the project, and would serve as persistent obstacles to the project's success.

The importance of collaboration runs common throughout the literature. The various communities identified collaboration as the solution to their respective problem; thus, their need to be successful is paramount. Yet, while their need is important, and, in some cases vital, their

willingness to cooperate, compromise, and serve the greater good is their means to attainment. Voith (1996) wrote of the difficulties urban centers experienced with the shift of population and wealth from the larger cities to the suburbs, and explored the use of regionalized services to restore urban stability. Voith (1996) noted that there was "accumulating evidence" that there was an interdependence of one community on another, an opinion shared by Ray. In an article in the *Tulsa World*, Ray (2010) compared the collective reliance of the communities in the Tulsa Metropolitan Region to Alexander Graham Bell's belief that great discoveries involve the cooperation of many minds. Ray (2010) provided a brief, yet detailed overview of regional interdependence, and made it clear that those who believe that the difficulties of one community results in a windfall for another have misunderstood the fundamental importance of collaborative government. According to Ed Peterson, Chairman of the Denver Regional Council of Governments, "If metropolitan areas are to remain viable centers of commerce and sustainable economic engines, it will require vision, leadership and cooperation." (McFarland and Brooks, 2009, p.1).

Summary of Literature Review

Standards are developed to establish a minimum level of expectation for products, processes, and procedures; most often written and published by an industry to self-regulate that industry. NFPA standards are consensus standards that are crafted by a committee of stakeholders from within the industry, as well as stakeholders directly vested in the outcome. The process is governed by federal anti-trust statutes, and oversight is provided by the American National Standards Institute. NFPA standards are voluntary standards, and only become regulatory when adopted and codified by state or local government; however, adopted or not,

case law indicates their acceptance by the judicial system as the basis from which judgments are rendered.

The literature on staffing revealed the debate in the minimum number of firefighters required for each apparatus has been going on for decades. Since the 1960s, various studies on minimum staffing have been conducted by the fire service, the insurance industry, and municipal governments; each of which concluded that four was the minimum number of firefighters each apparatus should be staffed with in order to conduct safe, efficient, and effective fireground operations. NFPA used this research as the basis of staffing standards set forth in NFPA 1710. The most recent study conducted by NIST in 2010 provided quantitative data on the efficiency of 2-, 3-, 4-, and 5-person crew size. This study demonstrated that 3-person crews were more efficient than 2-person crews, and that 4-person crews were more efficient that 3-person crews; however, with the exception of a couple of fireground tasks, there was no statistical difference in the efficiency between 4-person crews and 5-person crews.

The literature also identified the reality of local-level funding challenges. In spite of the wealth of data supporting a minimum staffing of four firefighters, municipalities can only field the number of firefighters that their respective budget allocations will support.

Most of the literature related to fire department response times centers around the scientific relationship between time and the impact of the event. In the case of fire, the time it takes for a fire to grow from ignition to flashover—the point at which victim rescue and fire containment are unlikely—is the fire department's only opportunity to successfully intervene. In the case of a serious medical emergency, the critical time period begins with the start of the event and ends at the point where permanent physiological damage—from a lack of oxygen to the

tissues—is likely to occur. In both situations, six to ten minutes was identified at the time frame in the event sequence that a positive outcome becomes doubtful. NFPA 1710 established the following response time criteria: (a) the PSAP will receive, handle, and dispatch the call for service within 60 seconds, 90% of the time, (b) fire personnel will turnout—move to the apparatus, don their gear, and mount the apparatus—within 60 seconds on EMS incidents, and within 80 seconds on fire incidents, 90% of the time, (c) the first apparatus will travel to and arrive at the dispatched address within 240 seconds (4 minutes) from the time the apparatus initiated its travel, 90% of the time, and (d) on structure fires, all apparatus initially assigned to the structure fire will travel to and arrive at the dispatched address within 480 seconds (8 minutes) from the time the apparatus initiated its travel, 90% of the time.

As was summarized regarding the affordability of staffing, public policy is driven by what can be afforded rather than what should be afforded. Logically, the number and distribution of fire stations will determine a community's response capability; thus, along with identifying how many fire stations a community can afford to build and staff, the location of those stations will determine whether the entire community has an equal share of the available fire protection, or if the areas with the greatest risk can expect greater protection.

The emphasis on sharing resources was common throughout the literature reviewed. Given the fiscal challenges almost every community has faced over the past few years, and will continue to face in the foreseeable future, the interest in sharing what resources already exist or consolidating and eliminate duplicate resources is reasonable. In the cases reviewed, some communities were trying to reduce costs, some were trying to maintain service levels, and others were trying to improve services without increasing costs.

There were numerous shared resource response systems identified in the literature. Mutual aid systems are designed to send additional resources when they are requested. Automatic aid and Mutual Aid Box Alarm Systems (MABAS) are designed to send additional resources as part of the initial dispatch, and many of these systems operate as borderless systems where the closest available unit is dispatched. Other systems involve more permanent action, such as consolidations, mergers, authorities, and joint powers agreements/intergovernmental agreements. These systems go beyond sharing resources in that they involve (in varying degrees) becoming a new organization, which is where most communities recognize cost savings. However, establishing a new organization is a much greater challenge than developing cooperative agreements. The literature pointed out that the implementation of these systems is packed with human, logistical, and administrative barriers to success.

Paraphrased, collaboration is when two or more individuals work together toward a common goal. The literature noted that the social behaviors and skills that are part of collaborative action were introduced and reinforced as children. The ability to share, respect, work together, and communicate are fundamental aspects of a professional skill set, and are vital for working collaboratively. The literature identified seven things needed for successful collaboration, including shared goals, clear purpose and scope, equality among members, respect, clear communication, compromise, and trust; however, these seven are potential vulnerabilities as well. Challenges for collaboration among fire departments and municipal government include politics and bureaucracy, logistical and administrative issues, and human variables, such as a fear of change. While the challenges are many, the literature recognized the interdependence among municipalities, and the role collaboration plays in the health and prosperity of those communities.

Procedures

This section of the paper outlines how a descriptive research method was developed and applied to identify reasonable options for OFD to explore, which would ensure effective fire protection to the City of Owasso based on NFPA 1710 criteria for staffing and response times. The topic of the research and the related research questions were selected because the city limits have expanded beyond the response time capabilities of the fire department, and the current staffing model is highly vulnerable to shifts in available staffing due to the department's dual mission of fire protection and ambulance service. Research for the project included a literature review to determine the importance of industry standards to OFD, the role staffing and response time play on the outcome of an emergency, the identification of alternative response systems in use across the U.S., and the characteristics of shared resource response systems and collaborative government. Research also involved the comparative analysis of historical data related to OFD's response performance (staffing and response time) to structure fires over a three year period against specific staffing and response criteria identified in NFPA 1710, and questionnaires from key individuals regarding alternative response systems and sharing resources.

Data analysis involved a review of fire department responses over a three-year period to identify only those records that met the research criteria—structure fires, inside the city limits, full assignment responded and arrived, and complete data. Staffing and response times were evaluated against established criteria to determine deficits, and information obtained through the literature review was used to develop alternatives to reduce or eliminate the deficits in the current staffing and response model.

Procedures for Literature Review

The principle issue for the applied research is the failure of OFD's current staffing and response model to provide effective fire protection to the citizens of Owasso, based on the criteria that NFPA established as the minimum standard. Of the six research questions developed to better define and address the problem, four of the six questions were directly tied to OFD's level of performance; thus, as expected, the literature review was not effective in answering Research Questions (a), (b), (c), and (d). The scope of the literature search was expanded to included information about industry standards, staffing and response time studies, shared resource response systems, and collaborative behaviors.

The literature review included resources obtained through the Learning Resource Center, the Internet, and OFD's fire training library. Relevant to the research was information pertaining to the impact of maintaining the current level of service—what are the implications and risks if OFD continues to arrive later and with fewer firefighters than the national standard recommends?—since taking no action is often an option.

Procedures for Data Analysis

The initial action for the data analysis was to build a master file of aggregate data that would facilitate the evaluations required in questions (a), (b), (c), and (d). A review of OFD's Staffing Plan provided information about the distribution of staff when 10, 11, 12, 13, and 14 personnel report for duty. A review of OFD Standard Operational Guideline #3002 provided information about the department's standard response to structure fires. (See Appendix C)

Research Question (a) requires data associated with staffing and apparatus that responded to structure fires inside the city limits. A list of fire incident reports over a three-year period—from December 1, 2007 through November 30, 2010—was extracted from the department's records management systems. The three-year time frame was selected to provide enough data to validate the work. The analysis began on December 2, 2010, so the date range offered the most up-to-date information. That list was filtered several different times:

1. Original list was filtered to identify only those incidents classified as a building fire.
2. Resulting list was filtered to identify only those incidents occurring within Owasso city limits.
3. Resulting list was filtered to identify only those incidents where the full assignment responded.
4. Resulting list was filtered to identify only those records with complete CAD data.
5. Resulting list was filtered to identify only those incidents where the full assignment arrived.

The incidents that remained following the fifth filtering process were used as the data source for the research analysis. The fire incident report for each of the remaining incidents was reviewed to determine the number of personnel and the number and types of apparatus that responded to each incident; the results of which answer Research Question (a). Because the number of staff responding fluctuated based on the number of staff available when each call was dispatched, an average number of responding personnel was identified for comparison purposes.

The final list of structure fire incidents was used to access the corresponding CAD reports to obtain the most detailed times available. The CAD report associated with each structure fire incident was reviewed and the following times were recorded for analysis:

1. Time the 911 call was received in the PSAP.
2. Time the PSAP dispatched the call.
3. Time the first fire unit went enroute.
4. Time the last fire unit went enroute.
5. Time the first pumping apparatus arrived on scene.
6. Time the last initial response unit arrived on scene.

The CAD data was analyzed to determine OFD response time performance. The first set of data collected (time call received) was not analyzed, as it was not necessary for the research; however, it is important information to have, and will be analyzed at a later date.

The first analysis performed and recorded for each incident was the time interval between the time the PSAP dispatched the call and the time the first unit was enroute to the call. The second analysis performed and recorded was the time interval between the time the PSAP dispatched the call and the time the last unit was enroute to the call. These analyses were used to determine OFD's performance with the national standard of a maximum of 80 seconds (for structure fires) from dispatch to enroute, 90% of the time.

The third analysis performed was the time interval between the time that the first unit was enroute to the call until the time the first pumping apparatus arrived on scene. This analysis was

used to determine the travel time of the first arriving pumping apparatus, and to evaluate OFD's performance compared to the national standard of a maximum of 240 seconds of travel time (from enroute to arrival of the first engine company), 90% of the time. The data included OFD Ladder 2 as a pumping apparatus. Ladder 2—a 75' Quint apparatus—is typically deployed as an engine with aerial capability, but can be used either as a ladder or an engine. The data excluded ambulances, the battalion chief vehicle, and other support vehicles.

The fourth analysis performed was the time interval between when the first unit was enroute until the time the last unit arrived on scene. This analysis was used to determine the travel time of the entire first alarm assignment, and to evaluate OFD's performance compared to the national standard of a maximum of 480 seconds of travel time (from enroute to arrival of the last unit of the first alarm assignment), 90% of the time.

The review of fire incident reports and CAD records, and the subsequent data analyses of travel time provided the results necessary to answer Research Question (b). Based on the opportunity at the time, the amount of research data collected and analyzed was expanded, and will be used for other analysis when appropriate.

CAD records used for the response time analysis were referenced to identify and study CAD activity for the two-hour period prior to the dispatch of each structure fire. Analysis of the CAD history was used to determine whether or not one or more OFD ambulances were already assigned to an incident (therefore unavailable) when the structure fire was dispatched. The results of this analysis were cross-referenced with the staffing and response data to determine if OFD's EMS mission has an impact on the department's response to, and staffing at, structure fires. The department's minimum staffing policy of ten firefighters was used in the analysis to

avoid the consideration of other variables, and to demonstrate a clear causal relationship between unavailable units, response, and staffing. The results of this analysis answered Research Question (c).

To identify the performance gap, NFPA 1710 was reviewed. From the review, criteria related to the scope of this research were identified for comparative analysis, and the remaining parts of the standard were no longer considered relevant to the current research effort. The criteria established in NFPA 1710 were compared to OFD's performance over the three-year period to determine the department's level of compliance with the standard, and the extent of any deficit. The results of this exercise answered Research Question (d).

Questionnaires

Results from the data analysis and information identified in the literature review were used to craft three options for reducing or eliminating the deficits identified in the research. A short (6 question) questionnaire was developed to determine the respondents' views on which option they believed appropriate for OFD, and their opinions on the benefits and challenges of a shared resource response system. These six questions were:

1. How many firefighters does your department have?
2. About how many firefighters respond to structure fires during the weekday?
3. About how many firefighters respond to structure fires at nights and on the weekends?

4. The research identified three different options for a shared resource response system in Owasso:

    a. Automatic Aid with closest unit response

    b. Growing OFD and Automatic Aid with closest unit response

    c. Consolidation of OFD, CRFPD, and LFPD

    Which, if any, do you believe is the most appropriate option for the City of Owasso and the greater Owasso region, and why?

5. What do you see as the benefits, if any, of your department's participation In a shared resource response system?

6. What do you see as the challenges, if any, to implementing a shared resource response system?

The individuals selected to participate were Bradd Clark, Fire Chief, OFD, Jim Wilson, Fire Chief, CRFPD, and Robert Goode, Deputy Fire Chief, LFPD. These three individuals represented key decision-makers for their organization, and their responses were considered valid indicators of their staff's attitude and concerns related to resource sharing. The results of those questionnaires are noted in the Results and Discussion sections, and were used in the development of the recommendations.

Summary of Procedures

The Procedures section outlined how the descriptive research method was developed and applied to identify response system options for OFD to consider. Procedures included a

literature review, data analysis, and questionnaires. The literature review was used to identify information related to the development of standard, previous research related to response times and fire department staffing, and alternative options already in use across the U.S.

Data analysis involved collecting and filtering aggregate information from fire incident reports and CAD records for structure fires over a three-year period to establish a data set that offered minimal variability. NFPA 1710 was reviewed to determine which part(s) were applicable to the scope of the research. The structure fire data was then compared to criteria set forth in NFPA 1710 to answer the first four research questions.

The questionnaires were written following the development of alternative options. One key player from OFD and one key player from any neighboring fire department located in close enough proximity to positively impact response time or fireground staffing within Owasso city limits was asked to participate. The results from the questionnaires established the local perspective on the viability of the options, and aid in the development of recommendations.

Results

Results of the Literature Review

The results of the literature review were covered in that section's Summary; however, for the purpose of reiterating, some of the information is reported here as well.

The literature supported the use of industry standards to set a minimum level of safety, quality, or expected performance. Standards can be mandatory or voluntary; though, case law indicated that the criteria set forth in voluntary standards, while not statutory, can be used as the basis from which judgments are made.

NFPA 1710 is the industry standard for staffing and response for career fire departments. The criteria within the standard were originally developed in 2001 using fire service studies conducted over the previous thirty years. The staffing recommendation of a minimum of four firefighters per apparatus was established from those studies; almost all of which indicated that four firefighters was the optimum crew size for efficient, effective operations. The comprehensive study on crew size conducted by NIST in 2010 reaffirmed the benefit of a four-person crew over 2-person and 3-person crews, and identified that there was no significant difference between a 5-person crew and a 4-person crew.

The role response time plays in the outcome of a structure fire or critical medical event was identified and affirmed in the literature. The basis of response time criteria is the relationships between time and fire development and time and tissue death. Response time—traveling from the starting point to the scene—is only one part of a fire's or medical emergency's sequence of events, and each part consumes time between the start of the event and the point at which fire conditions become untenable or a patient's condition becomes irreversible. As an effort to allow enough time for personnel to successfully intervene, NFPA 1710 recommends a maximum travel time for the first arriving apparatus of 240 seconds (four minutes) to 90% of the calls.

Operating within a shared resource response system occurs commonly across the U.S. The need to reduce costs, maintain the current level of service, or improve the level of service were all reasons communities opted to partner with neighboring communities in providing fire protection and other public services. Some shared resource systems, such as mutual aid, automatic aid, and MABAS, provide one another resources when needed. Mutual aid systems

send resources when they are requested, while automatic aid systems and MABAS include additional resources on the initial dispatch to avoid lag time, and often operate a borderless system where the closest available unit is dispatched. Other systems involve more permanent measures such as consolidation, merger, and creation of joint fire districts or fire authorities. These systems offer the same benefits as automatic aid systems, as well as providing partner communities with the most expedient cost savings; however, these systems face more obstacles along the way because they require more political and bureaucratic action to implement.

Results of the Data Analysis

The results from the original search of fire incident reports yielded a total of 3,251 reports. This information was used to establish the aggregate data set, which was required to answer Research Questions (a), (b), (c), and (d).

The first filtering process eliminated all but 84 reports. The second filtering process eliminated 29 incidents, leaving 55 reports. The third filtering process eliminated seven incidents, leaving 48 incidents. The fourth and fifth filtering processes eliminated three incidents and six incidents respectively. The final list consisted of 39 structure fire incidents that occurred over the three-year period and met all of the criteria for data analysis.

Analysis of the responding staff data for the 39 incidents determined that the number of personnel responding to structure fires ranged from 4 to 17. According to the data: four personnel responded 1 time; 7 personnel responded six times; 8 personnel responded 2 times; 9 personnel responded 1 time; 10 personnel responded 8 times; 11 personnel responded 8 times; 12 personnel responded 7 times; 13 personnel responded 3 times; 16 personnel responded 2 times;

and 17 personnel responded 1 time. (See Appendix D) The incident where four personnel responded was included because the fire incident report indicated it was a legitimate structure fire that required the full assignment, and the CAD record indicated that personnel and apparatus at other stations were unavailable at the time this incident was dispatched.

Additional analysis determined that the average number of firefighters responding was 10, and the number of firefighters responding was between 10 and 12 on almost 60% of the structure fires, which is in line with OFD's average of 11 firefighters on-duty each day (Garrett, 2008). A review of the three incidents where the number of personnel responding exceeded OFD's maximum daily staffing indicated that daytime staff officers responded to the incident to assist the line staff with fireground operations.

Analysis of responding apparatus data for the 39 incidents determined that at least one pumping apparatus responded on all 39 structure fires. According to the data: 1 engine/quint responded 3 times; 2 engines/quints responded 25 times; 3 engines/quints responded 11 times; no ambulances responded 8 times; 1 ambulance responded 23 times; 2 ambulances responded 6 times; 3 ambulances responded 2 times; no command/support vehicles responded 3 times; 1 command/support vehicle responded 31 times; 2 command/support vehicles responded 2 times; and 3 or more command/support vehicles responded 3 times. (See Appendix E)

Additional analysis determined that: at least an engine, a quint, and a command vehicle responded to structure fires 20 times, or 51% of the 39 incidents studied; at least an engine, a quint, an ambulance, and a command vehicle responded to structure fires 13 times, or 33% of the incidents; and there is a direct correlation between incidents with 3 or more command/support

vehicles responding and the incidents where the number of responding personnel exceeded the maximum daily staffing.

Analysis of response time data determined: the first arriving pumping apparatus arrived on scene in 240 seconds or less (from the time the unit initiated travel to the address) 24 times; the first arriving pumper apparatus arrived on scene between 241 seconds and 480 seconds 15 times; the complete first alarm assignment arrived on scene in 480 seconds or less (from the time the first unit initiated travel to the address until the last unit arrived) 30 times; the complete first alarm assignment arrived on scene between 481 seconds and 600 seconds 5 times; and the complete first alarm assignment arrived on scene after 600 seconds 4 times. (See Appendix F)

Additional analysis of response time data indicated that on 19 incidents, the first arriving pumping apparatus arrived on scene in 240 seconds or less (from the time the first unit initiated travel to the address) and the complete first alarm assignment arrived on scene in 480 seconds or less (from the time the first unit initiated travel to the address until the last unit arrived), and on 30 incidents, the first arriving pumping apparatus arrived on scene in 240 seconds or less (from the time the first unit initiated travel to the address) or the complete first alarm assignment arrived on scene in 480 seconds or less. A review of the notes for each incident further indicated that two of the structure fire incidents occurred during severe weather events, and response times for the first arriving unit and the complete first alarm assignment were extended. Both of these incidents account for two incidents in the latter response time category of each grouping.

Analysis of the CAD history prior to each structure fire incident determined that firefighters assigned to OFD ambulances were already assigned to an incident when a structure fire was dispatched 12 times, or 31%. There are two parts to the research question related to the

impact of the EMS mission—impact on response time and impact on staffing. The analysis indicated that there was some relationship between unavailable ambulances, response time, and staffing. A study of the data revealed that on 8 out of 12 incidents (67%) either the first arriving unit failed to arrive within 240 seconds after initiating travel to the address or the complete first alarm assignment failed to arrive within 480 seconds of the first unit initiating travel to the address, and on 9 out of the 12 incidents (75%), the loss of staffing reduced the number of personnel on scene to less than OFD's minimum staffing of 10. (See Appendix G)

The last component of the data analysis involved the comparison of OFD performance to selected criteria from NFPA 1710. As was noted in the Procedures section, NFPA 1710 was reviewed to determine which criteria were appropriate to use in the context of the research. It was determined that the following nine criteria would be used: 4.1.2.1 (3); 4.1.2.4; 5.2.2; 5.2.3.1.1; 5.2.3.2.1; 5.2.4.1.2; 5.2.4.2.2; 5.2.4.2.3; and 5.2.4.3.1.

The criteria for 4.1.2.1 (3) and 4.1.2.4 are standards for travel time. Evaluation of OFD's travel time performance as compared to the standard indicated that OFD met the standard 19 out of 39 incidents (49%). 4.1.2.4 Requires that emergency service agencies meet the criteria with an efficiency rate of 90% or greater. The comparative analysis determined that OFD failed to meet the criteria for travel time and efficiency. (See Appendix H)

The criterion in 5.2.2 recommends that the number of on-duty staff be sufficient to conduct the necessary firefighting operations. The criterion for 5.2.4.2.2 recommends that a minimum of 14 personnel respond as part of the first alarm assignment to a low-hazard residential structure fire, and a minimum of 15 personnel should be on scene if an aerial ladder is in operation. Analysis of the minimum and maximum on-duty staffing and the average number

of on-duty staff indicates that OFD's daily staffing range is 10 to 14 personnel (depending on annual leave taken), with an average daily staffing of 11 personnel. The data further indicates that OFD does meet the criteria in 5.2.2 and 5.2.4.2.2 when all personnel are on duty and available to respond; however, taking into consideration the average daily staffing and the impact of the EMS mission on staffing, that staffing condition should not be considered the norm. (See Appendix I)

The criterion in 5.2.3.1.1 recommends that a minimum of four personnel be assigned to an engine company. The criterion for 5.2.3.2.1 recommends that a minimum of four personnel be assigned to a ladder/truck company. In comparing OFD's staffing policies to the criteria established in 5.2.3.1.1 and 5.2.3.2.1, the department's staffing practices do not meet the standards. Even when stations are staffed with four personnel, the practice is to assign two personnel to the engine or quint, and two personnel to the ambulance. While the personnel operate as a four-person company on the fireground, they can be assigned separate incidents at any time, and, therefore, cannot be considered a four-person company. As it is standard operational practice to operate the quint as either an engine company or a ladder company, consideration of 5.2.3.4.1 was viewed as unnecessary. (See Appendix I)

OFD's capability to establish an initial rapid intervention crew on the fireground was evaluated based on the ability to respond at least four firefighters with respiratory protection to the scene. OFD policies require that no less than three personnel shall staff any fire station, and that the department shall maintain the availability of personnel at one fire station to respond to fire incidents regardless of ongoing or pending EMS activity. These three personnel along with the shift commander make up the four personnel OSHA requires for "Two-in/Two-out";

however, the standard requires the first arriving apparatus to have such capability, therefore, OFD does not meet the criteria identified in 5.2.4.1.2. (See Appendix I)

OFD's ability to assign additional resources to target hazards and other addresses with increased risk on the initial alarm as specified in 5.2.4.2.3 was determined by comparing OFD's available resources to the department's operational guideline for responding to structure fires. The analysis determined that all available resources were already being deployed on the initial assignment; thus, there are no additional resources to assign. OFD does not have an automatic aid agreement with any of its neighboring fire departments; therefore, OFD is not able to meet the criteria set forth in the standard. (See Appendix I)

Analysis of OFD's ability to meet the criteria in 5.2.4.3.1 was performed by comparing the department's current practices to the standard. The analysis revealed that OFD does not have the capability to immediately respond additional alarm assignments to fire incidents; however, the department is capable of mustering additional staff and apparatus by calling back off-duty personnel and by requesting mutual aid from neighboring fire departments. While the practice meets the standard in definition, the uncertainty of what resources will respond and when they will arrive makes the practice unreliable. (See Appendix I)

Questionnaire

The three respondents completed their questionnaires following a brief overview of the research process and findings up to that point. Analysis of the first three questions of the questionnaire indicated: that there are 103 firefighters between the three departments (47 in OFD, 26 in CRFPD, and 30 in LFPD); the collective number of firefighters available to respond

to structure fires during the weekdays is 25 to 30 (based on each department's average number of firefighters that respond to structure fires during the weekday—10 in OFD, 5 in CRFPD, and 10-15 in LFPD); and the collective number of firefighters available to respond to structure fires at night and on the weekends is 32 to 37 (based on each department's average response to structure fires at night and on the weekends—10 in OFD, 12 in CRFPD, and 10-15 in LFPD). CRFPD reported a fluctuation in its responding personnel between weekday and night/weekend structure fire responses based on the firefighters' full-time work schedules (J. Wilson, personal communication, January 11, 2011). While LFPD responded to both questions with a range of "10-15", the indication is that their number of personnel responding is not impacted by time of day or day of week. (See Appendix J)

All three respondents answered b. Growing OFD and Automatic Aid and closest unit response for Question 4. Clark added that OFD has a legal obligation to provide paramedic ambulance to the citizens in that part of the city. Goode noted that OFD must grow to continue serving its citizens, and that Automatic Aid with closest unit response adds additional staff to incidents without adding costs. Wilson added that if the city grows then OFD must grow too. Wilson continued with Automatic Aid does a better job at serving the public than mutual aid, and closest unit response makes sense if you are trying to take care of your citizens. (See Appendix K)

The results of Question 5 point to a common understanding of what a shared resource response system can offer communities. Common responses between Clark, Goode, and Wilson were: additional people; additional/diverse equipment; no additional costs. Clark added that this type of system reduces the likelihood that a department would be depleted of all of its resources,

and that it would eliminate having to backfill stations with overtime personnel. Goode noted the possibility of multi-department training, and Wilson included the confidence and focus gained from knowing that enough firefighters are responding to the incidents. (See Appendix L) In a personal communication with Chief Wilson, he reaffirmed his opinion that the departments around Owasso need to come together because it just makes sense, and he added that every department has something to gain (J. Wilson, personal communication, January 11, 2011). Chief Wilson indicated that fire departments all around the Tulsa area seem to understand how beneficial running an Automatic Aid system would be, but no one wants to feel like they are giving something up, even when it is in the best interest of the public (J. Wilson, personal communication, January 11, 2011).

Common responses for Question 6 were radio systems and communication. Wilson and Goode also noted procedures, but Wilson added that those challenges can be overcome. Clark mentioned training equivalencies and equipment, and Goode mentioned Incident Command. Clark's last challenge to implementation was cultural difference. Wilson noted the same challenge, but went into greater detail about firefighters not being so territorial, and to get along better. (See Appendix M) Chief Wilson's comments during this researcher's personal communication with him revealed his support for putting an Automatic Aid system in place, but indicated that personnel issues between the three departments would make the transition time very challenging, especially for those who would have to deal with the conflicts when they come up (J. Wilson, personal communication, January 11, 2011).

Summary of Results

The search for literature related to industry standards, fire department response times and staffing levels, shared resource response systems, and collaboration were very successful. There was sufficient information available to develop a foundational knowledge of why standards are important, what information was used to determine the current criteria in NFPA 1710, the impact of not meeting the current criteria, and what other departments across the country are doing to manage the same issues. The response time and fireground staffing criteria is established to place enough resources on the scene in time to take action before the fire or medical emergency reaches the point where a positive outcome is unlikely. Most departments identified in the literature reviewed have participated in some form of shared resource response system to save money or improve service delivery. Of the models studied, Automatic Aid, consolidation, and OFD growth with Automatic Aid were the three likely options.

Data analysis started with 3,251 incidents that occurred over a three year period. That list was filtered five times, which resulted in a final list of 39 structure fire incidents that met the scope of the study. Those records, along with the corresponding CAD records were used to identify OFD's performance related to response times and number of firefighters responding. A review of NFPA 1710 determined that nine performance criteria fit within the research objectives: 4.1.2.1 (3); 4.1.2.4; 5.2.2; 5.2.3.1.1; 5.2.3.2.1; 5.2.4.1.2; 5.2.4.2.2; 5.2.4.2.3; and 5.2.4.3.1.

OFD performance data was compared to the nine NFPA criteria to identify deficits. The analysis indicated that OFD met response time criteria 19 out of 39 times (49%), and, therefore, did not meet NFPA 4.1.2.1 (3) or 4.1.2.4. OFD's daily staffing range of 10-14 results in the

department meeting NFPA 5.2.2 and 5.2.4.2.2 only when all assigned personnel have reported to work and not otherwise committed to another incident. The current staffing model makes it highly unlikely that four firefighters will be assigned and responding on an engine or ladder; therefore, OFD does not meet NFPA 5.2.3.1.1 or 5.2.3.2.1. For the same reason, OFD does not meet NFPA 5.2.4.1.2 by having enough personnel responding on the first arriving apparatus to establish an IRIC. As OFD responds all of its available resources on the initial alarm, and there are no automatic aid agreements in place, there are no additional assets to send to target hazards and other such incidents identified in NFPA 5.2.4.1.2; therefore, the department does not meet the standard. Lastly, the department is capable of meeting 5.2.4.3.1 by calling back off-duty personnel and through mutual aid with neighboring departments; though, the delay and lack of reliability of the additional resources limits their impact on the incident's outcome.

All of the questionnaires distributed were completed and returned. The information provided by the respondents supports the research findings—a hybrid shared resources response system is the best option for the City of Owasso. Collectively, among the three fire departments, there are 103 firefighters, the average response to fires during the weekdays is 25-30 firefighters, and the average response to fires at night and on the weekends is 32-37 firefighters. All respondents indicated there were operational and fiscal benefits from sharing resources, but there were administrative, operational, and social challenges that must be overcome to successfully implement such a system.

Limitations of Applied Research

Because the focus of the applied research was on Owasso Fire Department's capabilities and deficits, a majority of the research was performed as part of the data analysis. Literature

specific to the research questions was limited, so the literature search was expanded to include enlightening, but less-specific information. The literature search was helpful in establishing an understanding of why it is important to meet industry standards, how the criteria were established, how other departments have overcome similar issues, and what challenges OFD faces to bridge the gaps in performance.

The data analysis component of the research used response data and operational policies to determine OFD's level of operational performance. These figures were then used to determine the local level of compliance with NFPA 1710. The data used in the analysis was drawn from official fire department incident reports and City of Owasso CAD records, and is assumed to be accurate. While the subject matter or research literature may be relevant to other departments, users of this applied research project may not find the analytical methodologies used in this research useful or applicable.

Discussion

The City of Owasso is a typical small city. It lies on the outskirts of the metro's urban center, and serves as one of a half-dozen suburb cities that feeds and houses the metro's workforce, educates the workers' children, and strives to provide the highest quality of life the tax revenues will afford. Like its characteristics, the challenges Owasso faces are typical as well. The community is popular, so it has grown faster than the government that services it.

The fire department is appreciated by the community, and respected by the neighboring departments and hospitals. The community's growth started after building and fire codes developed into documents that made a difference, so the occurrence of fire in Owasso is

uncommon. The department is very well equipped and uses some of the most progressive medical protocols in its delivery of pre-hospital medical care.

So why is it important to find a solution to something that no one has pointed out is broken? That no one has pointed out that it's broken is not an indicator that it isn't broken; it is a better indicator that nothing bad enough has happened yet to raise the issue. The criteria established in NFPA 1710 appear valid. Research indicates that the criteria are based on past and present studies on fireground efficiencies, physical and physiological science, and logical reasoning, all of which culminate into a rudimentary understanding that (when it relates to uncontrolled fire and life- and limb-threatening medical emergencies) bad things happen around a certain time in the event, and, if you want to make a difference in the outcome, you have to get there and do something before the bad thing happens.

This researcher believes that it is harder to find a fire department that does meet NFPA 1710 criteria, than it is to find one that does not meet the standard. The literature review included story upon story of fire departments that needed help meeting the needs of the community, but no articles were found that heralded fire departments that met or exceeded the criteria. This researcher further believes that cost is the principal reason communities cannot provide the level of fire protection that NFPA points out is the minimum level of service delivery if fire departments expect to make a difference. Three different schools of thought on standards of coverage exist in the fire service industry today: time is the "key"; distance is the "key"; and risk assessment is the "key". By applying all three "keys", any fire department can develop a standards of coverage plan that provides impeccable fire protection to their respective community; but, can the community afford it?

Here are some things to consider about fire protection in and around Owasso, Oklahoma. OFD provides a level of fire protection to the community that is better than many, but not as good as others. The Limestone Fire Protection District (LFPD) can assemble 10-15 firefighters for structure fire, but how long does it take to get them there? Collinsville Rural Fire Protection District (CRFPD) seems to have trouble assembling enough personnel, regardless of the type of call or time of day (J. Wilson, personal communication, January 11, 2011). LFPD has two stations that are literally located on the border between its response district and Owasso's fire response district, and one of the two stations was built on Owasso's side on the line. CRFPD's station is almost one and one-half miles closer to a densely populated part of the city than OFD's closest station.

With all of the resources in place to help each other out, the movement toward a shared resource response system seems a rational opportunity for all three departments; however, there may be many barriers to such an opportunity. Among these three departments, there is a history of bad feelings that predates almost everyone working in the system today; thus, the literature was correct when it indicated that politics and bureaucracy play a pivotal role in obstructing collaborative success (J. Wilson, personal communication, January 11, 2011, Martini, 2010, Prillaman, 2010, Ouellette, 2010, Sendelbach, 2009, Dedman, 2005b).

Across the U.S., communities have a lot of pride in their local fire departments, and those departments take pride in protecting their communities; so to expect these communities to readily admit that they need help from their neighbors seems either naïve or optimistic. Right or wrong, there is an expectation that government will protect its citizens, and the difficulty of a community admitting it needs help in providing that protection is equal to any head of a

household admitting that he or she cannot provide for their family. Most recently, however, there appears to be guarded interest when the subject of some type of combined response system is brought up among the three departments, which leads this researcher to believe that such an opportunity is not out of the realm of possibility.

As the purpose of the research is to identify the optimum model to ensure effective fire protection based on NFPA 1710 staffing and response time criteria, the attention must first be placed on developing a system that either reduces or eliminates the deficits identified through data analysis. Additionally, Owasso's economic outlook must always be a principal consideration. As the revenue pattern is expected to remain relatively flat for the next few years, large, recurring liabilities (such as personnel costs) will likely be avoided; though, capital expenditures (such as fire stations and apparatus) are expected to continue as necessary. Lastly, given the profiles of the two closest neighboring fire departments—LFPD and CRFPD—there is no reasonable expectation that a partnership alone will bridge OFD's response time and staffing gaps; thus, the alternatives developed for consideration might include some combination of organizational growth and shared resource partnership.

Five approaches were considered when developing the options: (a) do nothing; (b) grow the department enough to address the deficits; (c) use automatic aid and closet unit response; (d) consolidate the departments; and (e) grow the department and use automatic aid and closest unit response. Each approach was evaluated against its ability to address the deficits, costs, and barriers to implementation.

It was mentioned that doing nothing is often an option. Typically, doing nothing means nothing changes—service levels neither increase nor decrease. In today's economy, sometimes

doing nothing causes a reduction in services because communities cannot afford what they already have. This does not appear to be the case in Owasso; though, no one knows what the economy's impact will be in the future. There is no indication that taking no action will negatively impact the response system in Owasso. The slow increase in calls for service will eventually affect service delivery; so, maintaining the system in its current state will maintain a system that is better than many, but not as good as others.

The City of Owasso already has plans to grow OFD by two fire stations to serve the neighborhoods in the North and Southeast portions of the city, and an alternate staffing model for the department was studied to reduce personnel costs in the future (Garrett, 2009). The Constant Staffing Model avoids paying salaries and benefits to personnel only hired to cover temporary vacancies caused by annual leave, illness and injuries, and retirements. Neither the current staffing model, nor the Constant Staffing Model address increasing the numbers of personnel staffed at each station. If the department grows by two stations, and staffs those stations with three firefighters per shift to serve as the engine company and the ambulance crew, then the principal benefit will be experienced in reduced response times for the first due unit and full first alarm assignment. The department should also see an increase in compliance in fireground staffing; however, the minimum staffing for apparatus will remain the same as what the current system provides. The greatest challenge to this option is funding. The community and the city's leadership team already support the plan. There may be some questions raised about building a fire station in the Southeast portion of the city, since LFPD already has a station in that area. This issue has been addressed in the past by city leadership with the government interpretation that the city is legally responsible for providing city services to that area as part of the annexation

process. This option is already moving forward; though funding issues have removed any expectation of action in the near future.

The third approach is to use a system of automatic aid and closest unit response. In considering the profiles of CRFPD and LFPD, there is very little that either can do to reduce or eliminate the deficits. LFPD has four career staff on duty from 8 AM to 5 PM, Monday through Friday, and CRFPD has one career firefighter on duty 24/7. Both departments would be able to offer some impact in fireground staffing, and LFPD would be able to offer some help with response times in the Southeast area of the district during the weekdays; however, the delayed arrival of their volunteer firefighting force (because of added time to respond to the station) makes it unlikely that their added resources would have any effect on the incident outcome. The cost considerations with this option are primarily related to communications and interoperability. The political and bureaucratic issues are slightly more challenging. The governing bodies of each entity have to feel confident that they are not going to be an unequal partner, serving as free subsidization for the other departments. The communities have to feel confident that they are going to get equal or better service. And, lastly, department personnel must be willing work in a seamless response system by forgetting past relationship problems, and focusing on what is in the best interest of the citizens in the greater Owasso area.

The fourth approach is to merge or consolidate the three departments into one. Of the five approaches, this is probably the most difficult; though, it has the most to offer the entire region. This system provides the chance to develop a more effective strategic plan, offering latitude to build stations and deploy current and future staff in locations that effectively impact the deficit areas within each of the three districts. There are very few duplicated services from

which cost savings can be realized. Having a single dispatch center would reduce some costs; however, communications equipment purchases may void any anticipated fiscal benefit. While some of the districts' facilities are very well positioned to cover the combined area, they are not suited to house personnel 24/7; thus, in anticipation of increased staffing, these facilities would have to be renovated or rebuilt. The political, bureaucratic, and, in this case, human challenges would be the most difficult to overcome. In a consolidation, elected officials, members of each community, and firefighters from each department are asked to give up their fire department and embrace the new one. In the end, the old fire departments cease to exist, personnel lose positions of authority they once held, and the uniqueness of their organization's previous identity is lost forever.

The last approach is to develop a hybrid system that includes growing the department to bridge some of the performance gaps, thus, meeting the city's responsibility to protect its citizens, and implementing an automatic aid system that includes closest unit response. This approach capitalizes on the benefits offered by CRFPD and LFPD—increased fireground staffing and modestly reduced response times—while working toward reducing or eliminating the deficits through added resources. As was noted earlier, the costs associated with personnel are significant enough for city leadership to delay plans for the next two fire stations; therefore the implementation of an automatic aid response system immediately utilizes CRFPD and LFPD assets to initiate service improvements. Beyond costs, some of the challenges associated with this approach involve an equitable partnership among the three departments, and everyone's willingness to collaborate for the greater good. The questionnaire pointed out that this option also has logistical and administrative hurdles to overcome, such as radios/communications, operational policies, and training equivalencies.

The preceding identified five options for reducing or eliminating OFD's performance deficits when compared to the national standards set forth in NFPA 1710. Of the five options identified, the fifth option—organizational growth and an automatic aid system—seems the most reasonable, and, according to the results from the questionnaire, the three departments are in agreement. Owasso's current plan to add two additional fire stations will have a positive impact on response times and, to a more limited degree, staffing; however, those plans are delayed for an undetermined period of time, as are the impacts. Implementing an automatic aid system will harness the strengths of CRFPD and LFPD, and begin initiating some level of service improvement as soon as the system becomes operational. This option avoids anyone losing something in the process (other than some part of a response district that would be better served by the closest station), making the transition easier for stakeholders to embrace, and the system easier for administrators to implement.

As the literature has pointed out, more can be accomplished by a collective group than can be accomplished by each player independently. This "hybrid" option provides better service to the Owasso area by practicing smart, collaborative government during a time when sharing resources is a commonly used defense against fiscal realities.

Summary of Discussion

The research identified that the response time and staffing criteria are scientifically valid. There is a clear relationship between time and fire growth, and fire growth and outcome. If departments responsible for protecting their communities are going to have an impact, they either have to prevent fires from occurring, or arrive quickly and with enough people to intervene

before a fire reaches flashover. Thus, to be successful, communities must have enough resources and distribute them effectively to meet the criteria set forth in NFPA 1710.

As most every community experienced the strain of the economy, many found sharing resources as the means to improve or stabilize service delivery. The data analysis pointed out the deficits in OFD's response time and staffing performance as compared to the criteria in NFPA 1710. The geographic areas of the city experiencing the weakest coverage are areas close to CRFPD and LFPD stations. There are five options for dealing with the problem: (1) take no action; (2) grow the fire department enough to meet the standard; (3) use Automatic Aid; (4) consolidate all three departments into one new department; and (5) grow the fire department and use Automatic Aid.

Taking in to account the seriousness of not arriving in enough time or in enough force to keep an event from becoming tragic, the current economy, and the amount and location of OFD's, CRFPD's, and LFPD's assets, the option to grow the fire department and use Automatic Aid was the response system considered the most appropriate option. Though delayed by the economy, there are already plans in place to build and staff fire stations in the North and Southeast portion of the city. The implementation of Automatic Aid will yield service improvements almost immediately, and continue benefiting the system even after the new stations become operational.

The questionnaires indicated that the three respondents had similar views on what type of shared resource response system would work in Owasso, and were aware of the benefits and challenges of implementing such a system. As was pointed out in the questionnaires, the greatest challenge to overcome will be the social dimension of change.

Recommendation

Results from the literature review and the designed research indicated the need to improve service delivery in terms of improving response times to structure fires and increasing the number of on duty staff to provide the capability for safe, efficient, and effective fireground operations, irrespective of other mission-related obligations. The most common means to increase operational capacity identified in the research is some form of resource sharing between communities. The research identified the most appropriate option for Owasso is a hybrid system—the combination of growing the department and automatic aid with closest unit response. Given these results, there are six recommendations to reducing Owasso's response system deficits and consequential fire-related vulnerabilities:

The first recommendation is to visit with Owasso city leadership to review the research findings and determine if a shared resource response system with CRFPD and LFPD is an action that they wish to pursue. If city leadership desires to move forward, then OFD shall establish a team to represent the city's (and the department's) interest in the project, and to serve as initial project facilitators. If city leaders are not interested in that method of service delivery, then OFD modifies its future plans to include the resources necessary to meet current NFPA criteria.

The second recommendation, if necessary, is to meet with CRFPD and LFPD officials to discuss the opportunity and determine their level of interest. If the group is interested in moving forward with such an endeavor, then a list of critical and non-critical issues should be developed to guide further action. If there is no interest, then OFD modifies future plans to include the resources necessary to meet current NFPA criteria.

The third recommendation, if necessary, is to establish an implementation team comprised of individuals from the three departments and their respective governing bodies to craft the framework for the new system (such as central dispatch, closest unit response, and the need for an oversight committee), and to collaboratively develop a proposed implementation plan that addresses the legal, administrative, social, and logistical issues associated with implementing the system. The team should serve as the working group responsible for making the system operational. It is further recommended that this group be facilitated by someone with executive level experience in the fire service or public administration, but who has no vested interest in the project outcome.

The fourth recommendation, if necessary, is to develop a public education campaign using local media and town meetings to make the community aware of the benefits of sharing resources, and of any changes that may affect their expectations, such as closest unit response. This action has two strategic dimensions. First, educating the public makes the community more confident in the capabilities of the local fire protection services through the understanding that currently, the system is "us or them"; however, as of a specific date, the new system will be "us and them". Second, media coverage will facilitate respectful, collaborative interaction among team members and across departments, since no department wants to lose public support from having the media portray it as a bully or an obstructionist.

The fifth recommendation, if necessary, is to keep the members of each fire department informed of what has occurred and what is coming up for consideration. This group of stakeholders has insight to offer the implementation team. It also has the capacity to control the project's success or failure, and, therefore, should be included in the process as much as possible.

The sixth and final recommendation, if necessary, is to develop a plan for monitoring the impact and identifying problem areas associated with the system. Along with monitoring operational performance levels (response times and staffing), the plan must include a method for identifying the system's strengths and weaknesses, and the level of support and confidence from both internal and external stakeholders. As part of the plan, a team must be responsible for collecting, analyzing, and reporting the information no less than annually. It is further recommended that team members be changed annually; though, given the awareness of the process required to begin operating under the new system, it is recommended that the implementation team serve in this capacity through the first reporting period.

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Appendix A

Owasso Fire Department Staffing Plan

Working	Station 1		Station 2		Station 3	
14	Engine 1	3	Ladder 2	2	Engine 3	2
	Medic 1	2	Medic 2	2	Medic 3	2
	Battalion 1	1				
13 Option #1	Engine 1	3	Ladder 2	2	Engine/Medic 3	3
	Medic 1	2	Medic 2	2		
	Battalion 1	1				
13 Option #2	Engine 1	3	Ladder/Medic 2	3	Engine 3	2
	Medic 1	2			Medic 3	2
	Battalion 1	1				
12	Engine 1	3	Ladder/Medic 2	3	Engine/Medic 3	3
	Medic 1	2				
	Battalion 1	1				
11	Engine 1	2	Ladder/Medic 2	3	Engine/Medic 3	3
	Medic 1	2				
	Battalion 1	1				
10	Engine/Medic 1	3	Ladder/Medic 2	3	Engine/Medic 3	3
	Battalion 1	1				

Appendix B

OWASSO FIRE DEPARTMENT

ADMINISTRATIVE OPERATIONS: 1002- VACATION SCHEDULING

I. PURPOSE

The purpose of this policy shall be designed such that employees are granted the greatest variety of days from which to choose for personal leaves, but with the efficiency and effectiveness of the department in mind. Due to the expense of replacing employees when staffing levels fall below a safe number, every effort will be made to maintain a safe and efficient number of employees on duty for each shift.

II. SCOPE

The scope of the policy covers vacation leave and Trade-Out procedures.

III. POLICY

A. Vacation accumulation rates shall be consistent with the current year's Collective Bargaining Agreement.

B. A maximum of three personnel shall be allowed off duty on vacation leave at any given time. No other staffing factors shall be used when considering vacation leave requests (including vacant positions, or personnel on injury leave, sick leave, FMLA, or attending training classes).

C. Vacation and Trade-Out shall be scheduled in no less than 1-hour increments. The vacation and trade out request form should be filled out completely and turned in to the Station Captain. The Captain will then forward it to the Battalion Chief for consideration.

D. Seniority shall be the determining factor for priority of leave requests. Seniority is based on hire date. If hired on or before 1-2-2007 and if the hire dates are the same, then seniority will be determined by application date. If hired after 1-2-2007 and if the hire dates are the same, then seniority is determined by entrance test ranking.

E. Firefighters should make all attempts to schedule leave at least one week in advance. Leave may be granted the same day as the leave request; however, there may exist a possibility of denial.

F. Trade-Out shall be another option for leave. Trade-Out shall be done with another member of the fire department holding the same rank, or one rank higher, or one rank lower. The fire department will not compensate employees working out of class due to a Trade-Out.

G. All Trade-Outs shall be submitted on the Vacation and Trade-Out form to the Captain, who will then submit the request to the Battalion Chief for approval.

H. Once a Trade-Out has been approved by the Battalion Chief, the agreed-upon dates are binding, and the employees involved are required to report for duty on the traded days. If an employee does not report for duty on the date that he agreed to work, then he shall face disciplinary action for being absent without leave. If an employee calls out sick on the date that he agreed to work, then he shall be charged sick time for the hours involved, and the other party in the agreement is still obligated to meet the terms of the Trade-Out.

Appendix C

OWASSO FIRE DEPARTMENT

EMERGENCY OPERATIONS: 3002- EMERGENCY RESPONSE

I. PURPOSE

The purpose of this policy is to provide uniform response protocols to various emergency and non-emergency calls for service.

II. SCOPE

The scope of this policy covers response time, response assignments, and response safety.

III. POLICY

A. General

1. Response to emergencies, non -emergencies, and other operations shall endeavor to conform to those policies and procedures contained herein.

2. It shall be the goal of this department to answer all emergency incidents inside the city limits within five (5) minutes of receiving an alarm ninety (90) percent of the time.

3. In non-emergency situations the department shall endeavor to handle these situations as quickly as time, equipment, and resources allow.

4. A Quint can be used in place of an Engine on any assignment where at least one Engine is assigned.

5. The on-duty Battalion Chief shall have the authority to increase or decrease the number and type of apparatus responding to an incident, and/or the level of response (emergency vs. non-emergency) whenever appropriate.

B. Classification of Alarms

1. Box Alarms (multiple apparatus)

a. Anytime the first arriving Officer or on-duty Battalion Chief feels the alarm should be a full response.

b. Any fire reported within a structure including chimney fires. (2 Engines, 1 Medic, Battalion Chief)

c. Any fire reported adjacent to a structure. (2 Engines, 1 Medic, Battalion Chief)

d. Any smoke/fire alarm device sounding for structure. (2 Engines, 1 Medic, Battalion Chief)

e. Building collapse. (2 Engines, 1 Medic, Battalion Chief)

f. Any gas leak inside of a structure. (2 Engines, 1 Medic, Battalion Chief)

g. Brush or grass fires with/without exposures. (1 Engine, 1 Grass Truck, Battalion Chief)

h. Any odor of smoke inside a structure. (2 Engines, 1 Medic, Battalion Chief)

i. Lockout with food on the stove. (1 Engine and Battalion Chief)

j. Elevator entrapment. (1 Engine and Battalion Chief)

k. Any vehicle extrication. (1 Engine, 1 Medic, Battalion Chief)

l. Any Hazardous Material incidents. (2 Engines, 1 Medic, Battalion Chief)

m. Carbon monoxide alarm activation with symptomatic patients. (1 Engine, 1 Medic, Battalion Chief)

n. Emergency medical calls where one or more of the medical complaints listed below exist. (1 Engine, 1 Medic)

1) Cardiac Arrest

2) Respiratory Arrest

3) Unconsciousness

4) Person down/unknown problem

5) Shootings or stabbings

6) Any incident with reported entrapment

2. Single Alarms (single apparatus)

a. Vehicle fires with no exposures.

b. Investigations.

c. Any Gas Leak outside a structure.

d. Tree fire.

e. Utility shut off.

f. Lockout (vehicle) with children inside or the engine is running.

g. Emergency medical calls not identified in Section B.1.n.

3. Special Alarm (single apparatus/non-emergency)

a. Service calls with no hazards.

b. Carbon Monoxide alarms with no patients.

c. Animal trapped or stuck in a tree.

d. Details (wash downs, water problems, etc.)

e. Public assists with no medical complaints

f. Automobile accident with no injuries.

C. Response Safety

1. All apparatus shall proceed to emergency alarms with all available emergency warning devices operating (Sirens, lights, horns).

2. All apparatus shall stop at all red traffic signals and stop signs.

3. All apparatus drivers shall operate emergency vehicles in a safe manner taking into account traffic conditions and weather conditions.

4. All personnel shall wear seat belts while apparatus is in motion.

5. Multiple responding apparatus shall communicate prior to approaching common intersections.

Appendix D

Reference table illustrating OFD performance relating to the number of firefighters responding to structure fires (that met the criteria for analysis) from December 1, 2007 through November 30, 2010.

Number of Firefighters Responding	Number of Incidents	Percentage of Total Responses
4	1	2.50%
7	6	15.40%
8	2	5.00%
9	1	2.50%
10	8	20.75%
11	8	20.75%
12	7	17.90%
13	3	7.70%
16	2	5.00%
17	1	2.50%

Appendix E

Reference table illustrating OFD performance relating to the number and type of apparatus responding to structure fires (that met the criteria for analysis) from December 1, 2007 through November 30, 2010.

Number of Engines/Quints Responding	Number of Incidents	Number of Ambulances Responding	Number of Incidents	Number of Command and Support Vehicles Responding	Number of Incidents
0	0	0	8	0	3
1	3	1	23	1	31
2	25	2	6	2	2
3	11	3	2	3+	3

Appendix F

Reference table illustrating OFD performance relating to response time to structure fires (that met the criteria for analysis) from December 1, 2007 through November 30, 2010.

Turnout Time (Dispatch to Last Unit Enroute)	Number of Incidents	1st Unit Travel Time (1st Unit Enroute to 1st Unit Arrival)	Number of Incidents	1st Alarm Travel Time (1st Unit Enroute to Last Unit Arrival)	Number of incidents
≤ 80 seconds	7	≤ 240 seconds	24	≤ 480 seconds	30
81-120 seconds	7	241-480 seconds	15	480-600 seconds	5
> 120 seconds	25	> 480 seconds	0	> 600 seconds	4

Appendix G

Reference table illustrating OFD performance relating to the impact of unavailable ambulances at the time structure fires were dispatched (that met the criteria for analysis) from December 1, 2007 through November 30, 2010.

Ambulances Unavailable at Dispatch	Staff on Scene	1st Unit Travel Time (in seconds)	1st Alarm Travel Time (in seconds)	Staffing Impacted by Unavailable Ambulance	Response Impacted by Unavailable Ambulance
2	4	112	393	Yes	No
1	12	120	543	No	Yes
1	7	85	169	Yes	No
1	11	456	576	No	Yes
1	10	376	393	No	Yes
1	7	267	308	Yes	Yes
1	7	223	241	Yes	No
1	8	30	137	Yes	No
1	9	318	397	Yes	Yes
1	7	281	281	Yes	Yes
1	7	90	631	Yes	Yes
1	8	285	435	Yes	Yes

Appendix H

Reference table illustrating OFD 3-year performance relating to NFPA 1710 response time criteria.

NFPA Standard	Number of structure fire responses within the city limits where the standard was met	Number of structure fire responses within the city limits where the standard was not met	4.1.2.4 Did fire department meet 90 % performance objectives specified in 4.1.2.1?
4.1.2.1(2) The fire department shall establish the following objectives: 80 seconds for turnout time for fire and special operations response and 60 seconds turnout time for EMS response	7/18%	32/82%	No
4.1.2.1(3) The fire department shall establish the following objectives: 240 seconds or less travel time for the arrival of the first arriving engine company at a fire suppression incident and 480 seconds or less travel time for the deployment of an initial full alarm assignment at a fire suppression incident	19/49%	20/51%	No

Appendix I

Reference table illustrating OFD 3-year performance relating to NFPA 1710 staffing criteria.

NFPA Standard	Inside City Limits			
	Minimum	Maximum	Average	Standard Met?
5.2.2 Staffing. The number of on-duty fire suppression personnel shall be sufficient to perform the necessary fire-fighting operations given the expected fire-fighting conditions.	10	14	11	Sometimes
5.2.3.1.1 These companies (engine companies) shall be staffed with a minimum of four on-duty personnel.	2	4	3	No
5.2.3.2.1 These companies (ladder/truck companies) shall be staffed with a minimum of four on-duty personnel.	2	4	3	No
5.2.4.1.2 Personnel assigned to the initial arriving company shall have the capability to implement an initial rapid intervention crew (IRIC)	2	4	3	No
5.2.4.2.2 The initial full alarm assignment to a structure fire in a typical 2000 square foot, two-story single-family dwelling without basement and with no exposures shall provide for the following: (the standard identified eight fireground operational tasks required to handle this type of fire, and which required a minimum of 14 personnel to complete--15 personnel if the aerial ladder is in operation).	4	14	9	Sometimes
5.2.4.2.3 Fire departments that respond to fires in high-, medium-, or low-hazard occupancies that present hazards greater than those found in the low-hazard occupancy described in 5.2.4.2.2 shall deploy additional resources on the initial alarm.	N/A	N/A	N/A	No
5.2.4.3.1 The fire department shall have the capability to deploy additional alarm assignments that can provide for additional command staff, personnel, and additional services, including the application of water to the fire; engagement in search and rescue, forcible entry, ventilation, and preservation of property; safety and accountability for personnel; and provision of support activities for those situations that are beyond the capability of the initial full alarm assignment.	Minimum and maximum are unknown. Additional alarm responses are initiated through call back of off-duty career personnel and mutual aid requests to neighboring fire departments.			Yes; however, additional resources have a significantly delayed response.

Appendix J

Reference table illustrating responses to Questions #1 through #3 on the research questionnaire.

	OFD	LFPD	CRFPD
1. How many firefighters does your department have?	47	30	26
2. About how many firefighters respond to structure fires during the weekdays?	10	10 to 15	5
3. About how many firefighters respond to structure fires at night and on the weekends?	10	10 to 15	12

Appendix K

Reference table illustrating responses to Question #4 on the research questionnaire.

	Question 4: Which, if any, do you believe is the most appropriate option for the City of Owasso and the greater Owasso region?
Clark/OFD	Growing OFD and Automatic Aid with closest unit response. Still have an obligation to provide paramedic ambulance and city services per state law.
Goode/LFPD	Growing OFD and Automatic Aid with closest unit response. OFD needs to continue growth for the citizens they protect and serve. At the same time, CRFPD and LFPD have their own sources of funding separate from OFD so Automatic Aid with closest unit response is most beneficial on a monetary level for OFD. With each organization having their own staffing, there is no additional manning cost to OFD.
Wilson/CRFPD	Automatic aid does a better job at serving the public than mutual aid. As the city grows, the fire department has to grow along with it. Sending the closest unit makes sense, too; because if you really want to take care of your citizens, you need to send the closest station. When the people want help, they don't care where it comes from.

Appendix L

Reference table illustrating responses to Question #5 on the research questionnaire.

	Question 5: What do you see as the benefits, if any, of your department's participation in a shared resource response system?
Clark/OFD	Sharing resources offers many financial benefits, including reduced array of equipment/apparatus needed, reduced need for auxiliary/reserve pieces, and reduced likelihood of depleting all resources, and/or need to re-staff with overtime.
Goode/LFPD	More manning with minimal cost to each department. More equipment, also diversity of equipment. Possibility of multi-department training.
Wilson/CRFPD	You get the benefit of the extra people and trucks with out having to spend more money. Most fire departments can't afford to hire enough people, build more stations, and buy enough equipment to comply with the national standards. There's a lot of benefit to knowing that help is already on the way. It helps the incident commander when he can focus on the incident rather than wondering if enough people will show up. Winter travel is slow and dangerous for fire trucks. It's better to have more stations responding to a fire just in case something happens to one of the trucks on the way.

Appendix M

Reference table illustrating responses to Question #6 on the research questionnaire.

	Question 6: What do you see as the challenges, if any, to implementing a shared resource response system?
Clark/OFD	Common radio/communication, training equivalencies, cultural differences, equipment synchronization.
Goode/LFPD	Incident Command, radio systems, and guidelines.
Wilson/CRFPD	It would be nice if we were all one department, but there are too many hurdles, like different laws governing fire protection districts and cities. People have to stop being so territorial. They have to learn to get along better. Radios and procedures and stuff can be worked out without too much problem, but the people are going to have to change the way the think.