ACHIEVING AND MAINTAINING LAS VEGAS FIRE AND RESCUE'S FIRE AND EMS FRACTAL RESPONSE TIMES AS REQUIRED FOR ACCREDITATION THROUGH THE COMMISSION ON FIRE ACCREDITATION INTERNATIONAL.

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CERTIFICATION STATEMENT

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

Signed: _____

ABSTRACT

The problem was that Las Vegas Fire & Rescue (LVFR) was not meeting fractal Fire and EMS response time targets necessary to maintain its accredited status through the Center for Public Safety Excellence (CPSE) Commission on Fire Accreditation International (CFAI). The purpose of this research project was for the author to analyze all factors affecting or contributing to the Department's fire and EMS response time performance and make recommendations to the Fire Chief that would improve response times.

The Evaluative Research Method was used to answer the following questions: How do Las Vegas Fire & Rescue's call-taking and dispatch procedures compare to those of other accredited fire departments? How do Las Vegas Fire & Rescue's response procedures compare to those of other accredited fire departments? How does Las Vegas Fire & Rescue's staffing model compare with those of other accredited fire departments? What impact does the scheduling and completion of non-emergency work by firefighters have on fire and EMS response times? What additional resources would be required for Las Vegas Fire & Rescue to achieve its fractal fire and EMS response times?

Research data was obtained through a literature review and telephone interviews with other comparable fire departments. The author analyzed the findings and compared LVFR's dispatch and response procedures, staffing methods, and training and other work schedules to those of the departments surveyed. The author discovered that each department used in the study was also failing to meet response time targets. As a result of the research project, the author's recommendations were: (a) increase the number of fire stations and staff, (b) set more realistic response time goals, (c) require EMS turnout time within 30 seconds, and (d) provide training to companies while in district and in service.

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INTRODUCTION

The problem was that Las Vegas Fire & Rescue (LVFR) was not meeting fractal Fire and EMS response time targets necessary to maintain its accredited status through the Center for Public Safety Excellence (CPSE) Commission on Fire Accreditation International (CFAI).

The purpose of this research project was for the author to analyze all factors affecting or contributing to the Department's fire and EMS response time performance, gain more insight to the existing problem, identify potential solutions, and provide the Fire Chief recommendations to help the Department meet response time performance goals and maintain status as an accredited fire department. The Evaluative Research Method was used to answer the following questions: How do Las Vegas Fire & Rescue's call-taking and dispatch procedures compare to those of other accredited fire departments? How do Las Vegas Fire & Rescue's response procedures compare to those of other accredited fire departments? How does Las Vegas Fire & Rescue's staffing model compare with those of other accredited fire departments? What impact does the scheduling and completion of non-emergency work by firefighters have on fire and EMS response times? What additional resources would be required for Las Vegas Fire & Rescue to achieve its fractile fire and EMS response times?

BACKGROUND AND SIGNIFICANCE

Background

As an eager and grateful participant in the Executive Development Course for Executive Fire Officer (EFO), the author asked Las Vegas Fire & Rescue's Fire Chief if there was any particular problem the department was facing that could serve as the subject of this author's Applied Research project (ARP). At that time, the Chief was considering an expansion of the ambulance transport program and it was not clear what the impact of doing so would be on fire

and EMS response times. As a result, the author's intent was to use this lack of knowledge as the research problem. While working with the assigned evaluator it became evident that the subject, albeit compelling and interesting, was quite broad and probably lacked the scope and focus necessary for the completion of the project within the required six-month period allowed by the National Fire Academy (NFA). After working together through a number of email messages, the author and evaluator agreed on a more narrowly focused problem statement still related to response times. Consequently, the problem statement is, Las Vegas Fire & Rescue was not meeting fractal Fire and EMS response time targets necessary to maintain its accredited status through the Center for Public Safety Excellence Commission on Fire Accreditation International.

The author provided a brief description of LVFR, a short description of key city of Las Vegas and Clark County characteristics and detailed historical account of population growth in the city, it related to the growth and development of Las Vegas Fire & Rescue. The author then summarized the progression of LVFR's response time goals and measurement, and provided a brief explanation of the department's experience with the accreditation process.

Department Description

Las Vegas Fire & Rescue provided emergency Fire, EMS, Hazardous Materials, and Technical Rescue services to residents and visitors of the city of Las Vegas, Nevada. There were more than 599,000 residents (City of Las Vegas Fact Sheet, 2008), 20,000 businesses, and over 37 million tourists visited the metropolitan area in 2008 (Las Vegas Convention and Visitors Authority, n.d.). LVFR has a workforce of 623 authorized positions, 519 of which are uniformed (City of Las Vegas Fact Sheet, 2008). The city has a total area of 133 square miles, of which 92 were developed (R.J. Wassmuth, personal communication, July 7, 2009). LVFR provided all-

hazards emergency response service from 17 fixed fire stations (City of Las Vegas Fact Sheet, 2008), one temporary/portable station, and an auxiliary facility that housed the Fire Investigations and Bomb Squad units. The department staffed 19 Advanced Life Support (ALS) engines, 20 ALS rescues, and 6 Basic Life Support (BLS) trucks, of which two are Tillers, as primary emergency response units. LVFR's minimum staffing policy required four-persons per company (five on Tillers) and all units to be in service around the clock. Other emergency response units staffed daily include 3 Battalion Chiefs, 1 EMS Coordinator, 1 Air Resource, 1 Heavy Rescue and 1 CBRNE (Chemical, Biological, Radiological, Nuclear, and Explosive) unit. Fire Station 3 was designated the HazMat station and was staffed with firefighters certified as Hazardous Materials Technicians. The Hazardous Materials Response unit had no staffing. Instead, when a HazMat call came in, engine company personnel moved to the HazMat unit and responded.

Through an Inter-local agreement between the cities of Las Vegas, North Las Vegas, and Unincorporated Clark County, LVFR managed and operated of the Combined Communications Center that performed call-taking and dispatching services for all three agencies. Also known as the Fire Alarm Office (FAO), funding was provided proportionate to population, the annual breakdown averaged about 50% for Clark County, 40% for Las Vegas, and 10% for North Las Vegas. The Las Vegas Metropolitan Police Department (LVMPD) served as the region's Public Safety Access Point (PSAP). Emergency calls for Clark County, Las Vegas, and North Las Vegas went from the PSAP to the FAO. The FAO received 328,960 9-1-1 calls in 2008 and processed 226,734 emergency dispatches. Call-takers and dispatchers used a modified form of the priority dispatch Medical Priority Dispatch System (MPDS).

Fire prevention services included fire code adoption, amendment, and enforcement; fire safety plan reviews, and Fire and Life Safety Public Education. The Fire Prevention division had twenty-seven full-time employees, of which twenty were fire inspectors. Fire inspections were broken down into four numbered categories based on risk with one being the greatest and four being the lowest. There were approximately 20,000 businesses operating within the city of Las Vegas and the fire prevention division's goal was to inspect each business location at least once per year.

Characteristics of the city of Las Vegas and Clark County

The city of Las Vegas was located in Clark County, the southern-most county in the state of Nevada. The cities of Las Vegas, North Las Vegas, Henderson, and Unincorporated Clark County combined to make up the Las Vegas Metropolitan area, also referred to as the Las Vegas Valley. The Las Vegas Valley had a population of over 1.8 million people as of July 1, 2008 (City of Las Vegas Fact Sheet, 2008). The city's total estimated property value was over $63 billion in 2007 (City of Las Vegas Community Profile 2008). Clark County had been the fastest growing county in Nevada since 1920. In fact, since 1990, the Las Vegas Valley increased in size by 151.7% (U.S. Census Bureau, 2009). According to Wassmuth, during that same period, the Las Vegas population increased 117% from 275,636 to 599,087.

Historical relationship between population and fire department growth

While the city's population grew steadily over the past half decade, fire station growth was been sporadic and occurred at a much slower pace. In 1962, the department provided emergency response services out of five fire stations and served an area of about 28 square miles and a population of 79,000. By 2008, the city had grown to an area of 133 square miles, a population over 599,000, and the fire department had 17 fire stations. Between 1962 and 2008,

the overall population and size of the city grew exponentially compared to the growth of the fire department.

Between 1962 and 1978, the city built and staffed fire stations at pace with growth. In 1962, five fire stations served an area of 29 square miles and a population of almost 80,000. By comparison, in 1978 the city covered 54 square miles, had 161,000 residents and the department had nine fire stations. The number of fire stations increased by 80 percent while at the same time population doubled.

The next 16-year period began with the recession of the early 1980's but once recovery began in 1983, growth in Las Vegas increased at an unprecedented rate. By 1994, the population increased by 188 percent to 352,305. Comparatively, while LVFR expanded services and staff, the department still had only nine fire stations.

The department's fire station growth phase began in 1995. With funding obtained through two earlier bond issues, three new stations were built and two others replaced by the year 2000, bringing the total number of fire stations to 11. The next phase of fire department growth included four new fire stations, a new fleet, and operating staff. The funding came from a property tax increase approved by voters in the 2000 general election. The new stations were completed and in service by spring 2003. At that time, the department had 15 fire stations covering 118 square miles and serving 535,000 people. In 2007 and 2008, two more stations opened, bringing the total to 17.

Looking forward, the department's five-year plan that included the replacement and strategic relocation of station 6 and the addition of three new fire stations expected to increase coverage and improve response time performance. While these three stations are projected to response times in their immediate area, the city may not have the resources necessary to hire

firefighters for the new stations due to the economic downturn expected to last through 2012. As a result, the department will likely relocate engines and rescues from multi-company stations to the new facilities. Doing so is likely to have the consequential impact of a reduction of response time performance based on poor resource reliability in the densely populated areas of the city.

LVFR was due to for re-accreditation in March 2011. The department would spend 2010 updating the Self-Assessment Manual, the Community Risk Assessment, the Strategic Plan, and the Standards of Cover in preparation for a return visit and evaluation by Peer Assessors. The results of this research project would provide insight on how the department may be successful in its attempt to maintain accredited status.

Department's Historical Response Time Standards

The earliest reference that the author found related to LVFR's historical response time standards came from the Las Vegas Fire Department 1980/1981 Annual report. In the "Goals of 1981/82" section under the heading "Suppression Division", the department stated the goal was to "Provide an initial engine company response to all fire calls within three minutes and to provide fire attack with charged lines, 2 ½" in diameter or larger, within four minutes." In addition, it was the department's goal to have a ladder company at the scene of fire calls within five minutes, and for "sufficient manpower …that will provide for the safety of fireman …and provide the ability to perform basic firefighting and rescue operations" within one minute of the first apparatus arriving on scene. The EMS Division's goal was to "provide firefighting, rescue or extrication response within a five minute response time", and to provide medical aid within three minutes (Cite 1980/82 Annual Report and add it to reference list). Evidently, as early as 1980, the department had begun to recognize and break out fractal elements of response time, including travel and set up time.

The three-minute response time standard, although without great detail, was reinforced in a city of Las Vegas News Release dated December 16, 1989. The release announced the dedication of fire stations 2, 4, and 42, during which the Mayor said, "With the addition of these new fire stations, residents will be protected by a fire department dedicated to responding to an emergency anywhere in the city in three minutes or less" (City Of Las Vegas, 1989).

In August 1992, the department published its 1991 Annual report as the "50th Anniversary Report", in which the author found the first record of reported response time performance. According to the report, the average response times for EMS and Fire Calls in 1991 was 2.89 and 3.10 minutes, respectively. This indicated that at least through the early 1990's the fire department kept pace adequately with city growth as evidenced by its ability to provide timely emergency response services to the community.

At some point during the mid-nineties, the department's Fire Alarm Office converted from the McDonnell Douglas Dispatch and Records system to a new Computer Aided Dispatch and Records Management System. The former McDonnell-Douglas system was disposed of after the City Clerk archived critical data. While it may have been possible to mine data files and find response time goals and performance data, the author did not have time before completing the project. As a result, the author's next reference to the department's response time goals was his own knowledge and personal experience.

The author participated as a campaign team member in preparation for the November 2000 General Election during which Las Vegas residents voted on a city-sponsored ballot question requesting a tax increase for new firefighters, fire stations, and a new fleet of fire engines and ladder trucks. The campaign team participated as speakers at various luncheons, community meetings, and any other event that provided an opportunity to promote the ballot

question and lobby public support. During presentations, we explained the department's goal was to have a first arriving engine or rescue on the scene of a fire or other emergency within six minutes on average. Our justification for the six-minute goal was the time-temperature curve for flashover during fires, and the irreversible brain damage after six minutes of hypoxia. For whatever reason, department officials were not measuring fractal elements of response time. Also, it was implied that response time was defined as the time elapsed between the public's request for emergency services and the arrival of the first unit on scene. The author distinctly recalled that the campaign team reported that the department was arrived on emergency scenes in about seven minutes and forty-three seconds on average.

Because of the self-assessment process, LVFR made distinct changes to the identification, measurement and reporting of response time goals and performance. Averages and means were no longer the predominant or featured measure for response times. Instead, the department strived to achieve the performance goal for a predetermined percentage of calls, in most cases 90 percent. In addition, these performance goals were stated and measured as part of the LVFR's Strategic Business Plan. For example, in the FAO, the department strived to process all life-threatening medical and structure fire calls in 90 seconds or less 95% of the time. Firefighters were expected to go en-route to emergency calls within 60 seconds of being notified during the day, and within 90 seconds after 10 P.M. Firefighters and Paramedics were expected to arrive on the emergency scene within 5 minutes and 12 seconds of going en-route.

LVFR Obtains Accredited Status

In December 2004, Las Vegas Fire & Rescue (LVFR) embarked on the arduous task of becoming an accredited fire department. After completing the self-assessment manual, developing a Standards of Response Coverage (SORC) document, and having an onsite peer assessment, the department received accredited agency status in March 2006. As an accredited fire department, LVFR was required to prepare and submit Annual Accredited Agency Compliance Reports (ACR) for each of the ensuing four years and then go through the re-accreditation process in the fifth year. LVFR's response time performance goals were determined and stated clearly in the SORC and represented the required level of performance that the department believed was necessary to provide an effective response to fire and EMS emergencies. Because of the self-assessment process, the department realized the need to meet response time targets more frequently than on average.

In January 2007, the city of Las Vegas hired an outside consultant that helped all city departments develop Strategic Business Plans based on performance measures and performance-based budgeting. This City Manager-driven initiative was named Performance Plus, and LVFR was one of six city departments selected to pilot for the program. One of the most encouraging characteristics of the program was that each department would utilize a common format and terminology that provided uniformity throughout the city. Once completed, LVFR began to report the results of its performance measures on a quarterly basis to the city's Performance Plus Executive Team (PPET). For the first time, the department was part of a regularly scheduled process for reporting response time performance to the city manager and other city leaders for analysis and inquiry. LVFR was not able to meet its fractal response time goals and, in order to

maintain accredited status; the department would need to close the gap between the service level goals stated in the Standards of Cover and the actual performance reported to the PPET.

Significance

This research project related to the Executive Fire Officer Executive Development course in that it addressed a real problem the author's department experienced. Furthermore, it was the author's intent to conduct research regarding the experience of similar fire departments that were or had previously dealt with the issue of poor response time performance. As a result, the author compared the experiences and lessons learned from other departments to those of Las Vegas Fire & Rescue, and provided recommendations to the fire chief that would help the department solve this particular problem.

Another requirement of the project was that the research to relate to one of the United States Fire Administration operational directives. Because the research problem was about achieving response time targets required to maintain accredited status, this project related to all five USFA operational directives. Responding to fires in the shortest possible amount of time helps to reduce loss of life from (a) the age group 14 years and below, (b) the age group 65 years and older, and (c) firefighters. In addition, accredited departments were required to go through the self-assessment process, which included a thorough community risk assessment. As a result, a Standards of Cover document was developed that included the assessment and performance-based plans for dealing with and reducing community risk and responding to emerging issues in a timely manner.

LITERATURE REVIEW

This literature review provided a summary of the author's findings from various sources related to the research project. This section presented each referenced literary source,

information that contributed to this research project, and how that information contributed to the project. The author developed five research questions on which to base this study. The first four where designed to gather information related to the research problem from other sources and comparable fire departments. The answer to the final question was expected to be comprised of the author's summation of the findings provided by the first four questions and expressed in the form of recommended solutions to the research problem.

The author selected *Fire & Emergency Service Self-Assessment Manual (FESSAM), 7th edition*, published by the Commission for Fire Accreditation International, as part of the literature review. This publication provided a general overview of the four basic steps in the accreditation process: self-assessment, community risk assessment, strategic planning and standards of response coverage. In addition, the FESSAM provided good information regarding the elements of response time, including the difference between "*soft*" and "*hard*" data. Response time elements were grouped as pre-response elements, response time, and post-response elements. Pre-response elements included the initiation of the event, the emergency event itself, alarm, and notification. Response time elements included alarm processing, turnout time, travel time, and on-scene time. Post-response elements included initiation of actions and termination of incident (Fire & Emergency Service Self-Assessment Manual [FESSAM], 2006). Recommended industry response time standards were also found in this publication. Rather than overall averages, or *central measures of tendency*, response times were measured in fractal segments, and targets varied based on community risk. In addition, it was recommended that fire departments evaluate different types of risks and communities and design resource deployment based on the configuration of resources required to manage each risk effectively. Four population categories, based on density, were provided with the recommended baseline and

benchmark response time standards for first-in, second-in, and the balance of the first alarm for each population category. The information obtained from this source helped the author to learn how to better express performance information for response times. Averages can give a false impression of good performance. Fractal response time, that is reporting the length of time in which a department responds on a specified percentage of its calls, gives a true measure of the level of service provided.

Creating and Evaluating Standards of Response Coverage for Fire Departments, Fourth edition provided abundant information related to response time measurement, the cascade of events, the use of time information, unit deployment as it related to distribution and concentration, and confirmed that fire department personnel regularly engaged in non-emergency tasks that were credible and supportive of the departments mission. Historically, LVFR used response time averages as a measure of response performance. However, when the subject of response time measure was being researched by the International Association of Fire Chiefs Accreditation Task Force several years ago, the group realized that because of the potential for any number of isolated abnormal response time values to be included in data, the average could be skewed, resulting in misleading results (Creating and Evaluating Standards of Response Coverage for Fire Departments [CESRCFD], 2003). Averaging did not truly represent performance. Instead, more departments were beginning to use a fractile measure such as 70, 80, or even 90 percent as a goal for how often the department could respond to an emergency within a set time (CESRCFD, 2003). Similarly to FESSAM, this publication presented the time elements of response as the "Cascade of Events" but in quite a bit more detail. More importantly, it detailed the use of time information.

LVFR reported the total number of calls responded to each year as well as the accompanying average response time. By itself, this method of reporting was not very informative. For instance, there was no distinction given between the type of emergencies responded to, whether fire, medical, or a specialized rescue; or what percentage of calls there were for each category. While the majority of fire calls were true emergencies, requiring the shortest possible response times, such was not necessarily the case for EMS calls. The majority of medical calls for service were not, by definition, true emergencies.

This point was made quite succinctly in CESRCFD (2003):

> For medical emergencies, a prompt response is needed to relieve suffering and save lives, but few calls for service are true life or death emergencies. Again, a reasonable service goal is to be on scene soon enough to: 1) assess patients and prioritize care to minimize death and disability, 2) intervene successfully in life-threatening emergencies, 3) stabilize patients to prevent additional suffering. Typically this means providing basic defibrillation or advanced life support and minor rescue as necessary for one to three patients.

This was not to say that these patients did not need emergency response or field medicine, but in the interest of community and firefighter safety, it was wise to exercise extra care when responding in these instances, when known.

As a result, most fire departments utilized some form of a priority dispatch system for the purpose of aligning advanced life support units with true medical emergencies and allowing emergency responders to use more discretion regarding their haste on certain calls. Consequently, fire department response time averages were greater, giving the wrong impression on performance.

The definition of response time has been a common fire service misconception. From the caller's or victim's perspective, it was likely defined as the time elapsed between their call for help and the arrival of first responders. To firefighters, it was likely considered the time between their notification to their arrival at the scene or at the patient's side. Furthermore, there were often discrepancies between different fire departments when it comes to reporting response times (CESRCFD, 2003). Some departments measured and reported travel time while others included alarm processing time and turnout time. The self-assessment process provided an opportunity for fire departments to use standard terminology, definitions, and measures in reporting performance.

When it came to determining the emergency resource needs of the community, adequate response coverage was comprised of five key elements: (a) Distribution, (b) concentration, (c) resource efficiency, (d), response reliability, and (e) response effectiveness (CESRCFD, 2003). *Distribution* referred to the location of fire stations for the purpose of allowing the initial responding unit to arrive at the most potential locations in that station's immediate area within the community expected time standard. Relatively, *concentration* was concerned with the positioning of individual resources so that an effective response could be provided to the emergency scene within the community adopted time standard. *Resource efficiency* was a performance concept that referred to the even distribution of the workload among units and stations. While achieving and maintaining an equal distribution of the workload was not likely, a basic indicator of efficiency was that the overall percentage of calls handled by a resource should be close to the overall percentage of the departments overall coverage area. *Resource reliability* referred to the probability that a resource would be available to answer an emergency call that occurred in its area. Departments that measured resource reliability used methods that forecasted

resource response failure in order to determine when to add more units to any given area. Finally, *response effectiveness* referred to the number of firefighters required to respond to a fire within a time frame sufficient for them to mitigate the fire or emergency.

The author found a great deal of information related to response times in the *Fire Protection Handbook: Nineteenth Edition*. Time was the most important factor related to the response and outcome an emergency event. Obviously, the sooner properly trained emergency responders arrived on the scene, the greater their chances of having a positive impact on the event. Because it has been proven that fire grows at a rate of many times its volume for each minute it burns, the time element in fire emergencies is critical. Although response times were one of the most commonly evaluated measures of emergency response performance, fire departments tended to focus most on the time it took for firefighters to be alerted, mount their apparatus and travel to the emergency scene. However, the total time span of the emergency event was much greater than that. In addition, there were some segments the fire department could manage and others the department could only influence, or *indirectly manage*. For example, there was a period of time between when the fire or medical emergency started and when it was discovered and reported. According to Barr & Caputo (2003), in the case of fires, "automatic detection and/or suppression systems and automatic reporting to the PSAP" was one way fire agencies could indirectly manage this time period. For EMS, the best example of time criticality was in the event of sudden cardiac arrest. Patients receiving cardiopulmonary resuscitation (CPR) in less than four minutes after a heart attack were four times more likely to leave the hospital alive than those who receive CPR more than four minutes after the heart attack (Barr & Caputo, 2003).

Most segments of response time could be directly managed by the fire department. These time periods included dispatch time, turnout time, response time, access time, and set-up time. The author noted and acknowledged that, in his experience; set-up time was seldom used in response time measurement and reporting and, as a result of this common practice, realized the potential for unintentionally over-rating the response performance of a fire department. Definitions of the previously mentioned response time periods, as described by Barr & Caputo (2003), can be found in the *Definitions* heading of the *Procedures* section of this paper.

According to Barr & Caputo (2003), the time interval that began when the dispatcher sends notification to the station and ended with station alerting is considered to be part of turnout time. The author took special notice of this because LVFR had isolated this particular time segment and was measuring it separately, in order to monitor and evaluate the performance of the computer software, hardware, and other data transmission components that facilitate data transmissions.

This publication also verified national standards for fire department response times that were considered to be industry best-practices. The National Fire Protection Association (NFPA) had three standards that provided time requirements related to fire and EMS delivery services, two of which provided a useful application to LVFR. The first, NFPA1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical operations, and Special Operations to the Public by Career Fire Departments* set standards for turnout time, fire response time, first responder or higher emergency medical response time, and advanced life support response time. Secondly, NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems* set time standards for answering alarms, dispatching, and for fire department unit response.

Finally, this text contributed to the author's understanding and knowledge of factors to be considered when setting response and travel time standards. Like the CFAI, Barr & Caputo (2003) explained that the community must ultimately decide what length of time was acceptable for response and travel. Once those standards had been determined, that information should be the basis for deciding fire station locations.

Exploring the Feasibility of Meeting NFPA 1710 for Response Time Standards at Northwest Fire Rescue District written by Gary R. West was an Applied Research Project (APR) the author chose to review because of the similarity of West's research problem statement to the author's. West (2008) revealed that his department defined two demand zones, differentiated from one another by density of development and population, and the department set different response time standards for each. Also, Northwest Fire Rescue District (NFRD) decided to differentiate turnout time standards based on day or night, and whether the call was for EMS or fire. This information made a significant contribution to the author's recommendations for LVFR as it relates to the upcoming re-accreditation process and the required revision of the Standards of Cover. After reading FESSAM and conducting personal and telephone interviews with representatives of comparable accredited departments, the author learned that multiple service standards were an option. West (2008) further solidified this idea.

U.S. Census Bureau Population Estimates was a web page referenced from the U.S. Census Bureau website. This resource provided statistical analysis of historical Las Vegas population trends which contributed information for the Background and Significance section.

Structure Fire Response Times was a report from the Topical Fire Research Series produced by the U.S. Fire Administration National Data Center in August 2007. This report provided information that contributed to the selection of the comparable fire departments used in

this study. After narrowing the list of accredited fire departments to 14, the author eliminated all but those departments in the Western Region of the U.S. based on a chart that illustrated regional response time trends in the U.S.

The *2008 Las Vegas Year-to-Date Executive Summary* found on the Las Vegas Convention and Visitors Authority Website, and the *City of Las Vegas Fact Sheet* found on the City of Las Vegas home page, were sources for updated city population, area, workforce, and visitor and tourist data used in the Background and Significance section.

Finally, the *Las Vegas Fire Department 50 Year Annual Review* was the source for most of the fire department-related historical information related to response time performance targets and averages. This resource also provided general information regarding funding initiatives such as bond issues.

PROCEDURES

The first procedural step after deciding on the project's problem statement and research questions was to conduct a search for literary sources. In order to accomplish this, the author identified keywords and key phrases that were related to each of the project's research questions. These key words and phrases included: response times, accreditation, emergency dispatch procedures, emergency response procedures, fire service staffing, and fire service training. The search for literary sources began while the author was attending Executive Development at the NFA. During free time after class, the author spent several hours at the Learning Resources Center on the NFA campus. During this time, the author focused on APR's with titles that were related to the aforementioned keywords and phrases. In the interest of time management, the author reviewed those papers that were only available on site while at the LRC, and made a list

of those papers available online for reference later when he could access them through the internet while at home.

After returning home, the author visited the local library and conducted many searches for material through the internet. The author found it difficult to find relevant information related to a fire departments struggle to meet performance standards for the purpose of maintaining accredited status. In addition, the keyword and key phrase searches revealed only a few select publications related to the fires service in general. Where possible, the author obtained those publications. More importantly and relevant, the author realized that there would be no better source for accurate and relevant information and data than other departments that may have the same problem. As a result, the author decided to include a survey element to his research.

Before proceeding, the author needed to answer a number of questions. What criteria should be considered when identifying fire departments against which to compare LVFR? How many fire departments should be selected? How long would it take to create a valid survey? How many questions would be required to get specific answers to fairly broad research questions? How much time would be required for respondents to reply? The answers to these questions provided the method for completing this research project.

The first step was to select fire departments that were comparable to LVFR. The author obtained a list of all accredited fire departments in the United States, which numbered 128. This list was in the form of a spreadsheet with the following fields: organization name, city, state, country, agency type, and population served. The author started by evaluating population. LVFR served a population of 599,000. There were six distinct population ranges from which any organization on the list could fall within ranging from 0-9,999 to over 1 million. The author

excluded all departments except for those that served populations of 200,000-499,000, and 500,000-999,000, narrowing the list of potential comparable fire departments to 24.

The author then accessed the website for each of the remaining departments' cities to further compare them to LVFR. Specifically, the author evaluated the population served, the area in square miles, number of fire stations, and the number of sworn or uniformed personnel. As a result, there were 14 fire departments remaining for the author to select from. Because of information obtained through the literature review, the author decided to add one more step in the filtering process. A report published by U.S. Fire Administration (2006), showed a regional trend in the length of fire department response times that varied by region. Using data from 2001 and 2002, the report pointed out the following:

> As the regions move from the Northeast to the West, the percent of structure fires with a response time of less than 5 minutes decreases. The regional differences may be due to population densities. Usually as population densities increase, fire stations are situated so they cover less and less geographic area, which may contribute to reduced response times.

Because the number of fire stations and area covered were two of the criteria used for distinguishing comparable departments, the author determined that this study would likely be more relevant if the departments selected were in the same region as LVFR. Of the 14 remaining fire departments, the author selected the 5 remaining organizations in the Western region.

Once the criteria and number of fire departments had been determined, the next step was to develop a survey instrument. The author recognized that with a survey population of 5, this would not be a typical survey. In addition, of the author's research questions, only the first four required information from other departments. The fifth research question would be answered by

making recommendations as a result of conducting the research. Furthermore, there would need to be more detailed questions asked, many of which would need to be open-ended, which was contrary to the recommendations of the research self-study guide. The author decided that the best way to get relevant information from the small number of comparable departments being referenced in this research was to develop more detailed questions for each of the research questions and conduct personal interviews either in person, by telephone, or through email. Because of local proximity, the interviews with the Henderson Fire Department were conducted in person. Interviews with Mesa and Portland were conducted by telephone. Due to scheduling and time constraints, Santa Clara County participated in the study by answering the research questions through email. As a result, some of the Santa Clara County responses were brief and contained minimal detail. Following is a list of general questions about each department, followed by those that were asked for each research question:

1. What is the size of your department's service area?
2. What is the population your fire department serves?
3. What is your department's annual budget?
4. What is the size of your workforce?
5. How many fire stations does your department operate out of?

How does Las Vegas Fire and Rescue's dispatch procedures compare to those of other accredited fire departments?

1. Does your fire department dispatch your emergency responders, or does another agency provide you with these services?
2. Is there a copy of the department's dispatch procedures available?

3. What components or elements of your dispatch procedures if any, are stated as performance elements in your Standards of Cover?
4. Do firefighters respond to Emergency Medical calls for service?
5. Do you use the Medical Priority Dispatch System?
6. Do you prioritize non-EMS emergency calls?
7. Please briefly describe or list the call taking and dispatch process.
8. Do you have time-based performance goals?
9. Are you currently meeting your performance goals?
10. How are time stamps recorded?

How does Las Vegas Fire and Rescue's emergency response procedures compare to those of other accredited fire departments?

1. Do you have specific response plans by type of emergency?
2. Is there a copy of the department’s response procedures available?
3. How was your response zone boundaries determined?
4. What components or elements of your response procedures if any, are stated as performance elements in your Standards of Cover?
5. Do you have different standards of cover for different service call types?
6. What are your response time performance targets for:
7. Turnout time? Day? Night?
8. Travel time?
9. Are you meeting your response time performance goals?
10. Request response time data for the past three years.
11. Do you receive and/or provide automatic and/or mutual aid?

12. Do you have a limit on drawdown?

How does Las Vegas Fire and Rescue's staffing model compare with those of other accredited fire departments?

1. How many persons are assigned to each response unit by type?
2. Are all stations open always? If not, please explain.
3. Does your department provide advanced life support services?
4. If yes, do you have firefighter/paramedics?
5. If yes, do you staff Advanced Life Support engines?
6. Do you have a method for tracking and documenting resource reliability?

What impact does the scheduling and completion of non-emergency work by firefighters have on fire and EMS response times?

1. How do you schedule and deliver training for firefighters and EMS responders? (On duty, off duty, or a combination of both?)
2. If off duty, are they paid? If yes, are they paid overtime?
3. Do you consider peak service demand projections when scheduling training for on-duty firefighters?
4. Do emergency response units respond to non-emergency calls for service?

Assumptions and Limitations

The author wanted to conduct interviews with department representatives as personally as possible. For Henderson, interviews were easily conducted in person, and there were three people present: the accreditation manager and two fire service managers who had specific areas of related technical expertise. For out of state departments, telephone interviews were the preferred method, and this was accomplished in the cases of Portland and Mesa. The interview

with Portland was conducted with the department's accreditation manager who was able to answer almost all of the supplemental questions during the interview. In some cases, follow up with responses through email was necessary. For Mesa, there were two chief officers involved in the interview process, one who was considered the accreditation coordinator, and the other was the chief most responsible for fire department operations. For reasons related to availability and scheduling, the Santa Clara survey had to be done through email, with the questions dispersed between two different people. As a result, the author experienced different levels of detail in the responses, which should be taken into consideration when evaluating the research.

Also, as previously mentioned and contrary to the recommendation in the self-study guide, the author decided to utilize a number of open-ended questions among those supplemental questions designed to extract answers to the main research questions. Because there would be an opportunity in the discussion section to narrate the results, the author justified this deviation in the anticipation of the potential variation in performance measurement, resource allocation, staffing patterns, training methods, and services provided. It was believed that allowing this degree of flexibility during the interview/survey phase would result in getting the most helpful information.

The author's selection of research question #4 was based on his assumption that training schedules, public relations and education demands, and non-emergency calls for service where affecting emergency response units' capabilities to provide timely, effective, and reliable emergency responses, in the end having a negative impact of response times. Although anecdotally understood and known throughout the fire service, it was the author's opinion that research question #4 and the supporting supplemental questions failed to make a strong case in point.

RESULTS

General information

Although there were originally 5 fire departments the author selected to interview, 4 responded to the interview requests. The interviews and surveys began with questions related to general information, specifically, the size of each department's service area, the population served, the annual operating budget, the size of the workforce, and the number of fire stations being operated. The size of the area was reported in square miles. The size of the workforce was reported in terms of uniformed or sworn, and civilian. The departments used in the comparison were: Henderson, Nevada; Mesa, Arizona; Portland, Oregon; and Santa Clara County, California. Table 1 shows the comparative information obtained through the general information survey questions.

Department	Area	Population	Budget	Uniformed	Civilian	Stations
Henderson	104	269,000	$40M	208	10	9
Las Vegas	133	599,087	$111.9M	519	104	17
Mesa	120/168*	465,000	$62M	395	77	17***
Portland	151	563,916	$80.4M	702	53	30
Santa Clara	106	256,000	$64.7M	281**	30	17

Table 1 – General Information

* includes Eastern Maricopa County

** They have an additional 48 volunteers

*** 3 more stations will be added by 2011

As explained in the procedures section, supplemental sets of more detailed questions were developed for each research question. This was necessary because although each research question focused on an area of fire department operations that affect response times, there were

many different operating models throughout the fire service, and it was likely that the agencies interviewed might need a range of flexibility for their respective responses. Because of this, some of the supplemental questions were direct and closed-ended, while others were written as open-ended, to allow for a variety of responses.

The research results were prepared in four sections, with the original research questions used as the section heading. A brief description of the type of information intended to be gained from the supplemental questions was followed by a summary of the responses from each department. Finally, each section ended with a clear definition of the author's findings for that particular research question.

Dispatch Procedures

How does Las Vegas Fire and Rescue's dispatch procedures compare to those of other accredited fire departments? To answer this research question the author inquired about how dispatch was accomplished, the availability of dispatch procedures, the inclusion of firefighters on EMS calls, the use of performance elements in the SOC, the prioritization of EMS calls, the overall dispatch process, and the use of time stamps. A summary of the varied responses follow each supplemental question.

Does your fire department dispatch your emergency responders, or does another agency provide you with these services? LVFR had oversight and operational responsibility for the Combined Communications Center (CCC), which provided emergency dispatch services for fire departments in Las Vegas, North Las Vegas, and Clark County. Portland and Santa Clara County had their dispatch services provided by another department within their municipalities. Henderson and Mesa received emergency dispatch services from their respective police departments.

Is there a copy of the department's dispatch procedures available? Because LVFR operated the CCC for itself and two other fire departments, all related policies and procedures were available and maintained by staff. Input regarding policy and procedure changes, additions, or deletions were required to be reviewed and approved by the board of directors, which was comprised of the three department fire chiefs. Henderson had some related procedures available, but they pertained to the response aspect after notification of dispatch. Policy and procedures were maintained by the police department, with input from Henderson Fire. Mesa, Portland, and Santa Clara County did not have dispatch procedures readily available, and their level of involvement or input was not reported

What components or elements of your dispatch procedures if any, are stated as performance elements in your Standards of Cover? LVFR did not include any dispatch related performance elements in its Standards of Cover (SOC). It did, however mention that the level of performance at that time should be evaluated to determine whether training would be required to improve performance. Henderson set the performance goal of 60 seconds for call processing for fire, EMS, hazardous materials, and technical rescue calls. Portland set performance standards to be achieved 90% of the time based on categories named Urgent, Priority, and Non-Priority. The performance goals were 60, 90, and 120 seconds, respectively. Like Las Vegas, Mesa and Santa Clara County had no dispatch related performance goals in their SOC's.

Do firefighters respond to Emergency Medical calls for service? Firefighters from each of the departments studied responded to emergency medical calls for service, although in different configurations and to different degrees. In Las Vegas, 90% of all calls for service were related to EMS. As a result, the department staffed one firefighter and one paramedic on each of its 19 engines and 20 rescues, and all LVFR units were subject to responding to EMS calls. Las

Vegas rescues provided about 25% of all required transports. Henderson's staffing was similar to Las Vegas', but they provided 100% of all required transports. Mesa staffed 2 paramedics and 2 Emergency Medical Technicians (EMT) on each engine and ladder truck. Medical transports were provided by a private ambulance company. Portland and Santa Clara County acknowledged that their firefighters are dispatched on medical emergencies but gave no further details.

Do you use the Medical Priority Dispatch System? Las Vegas and Henderson both were using a modified version of the Clawson System and ProQA. Santa Clara County acknowledged the use of Medical Priority Dispatch, but gave no details. Mesa was not using any form of priority dispatch and for Portland it was unknown.

Do you prioritize non-EMS emergency calls? This question was designed as a leading question that would capture information related to the prioritization of non-EMS emergency calls for service based on different degrees of severity. In other words, were there some fires that required a faster response than others, or were they all considered the same degree of emergency? Henderson and Portland responded affirmatively with no detail provided. Las Vegas and Mesa determined that it either was or was not an emergency. Santa Clara County did not prioritize non-EMS emergency calls.

Please briefly describe or list the call taking and dispatch process. Henderson, Mesa, and Portland had similar processes due to the fact that they received dispatch services from another department or entity. Las Vegas and Santa Clara County were similar in that they both received emergency calls and provided dispatch services. Santa Cara received a portion of 9-1-1 calls directly, with the rest being passed on to them from one of several other PSAP's in their vicinity. Las Vegas received all 9-1-1 calls from the police department dispatch center. Both Las Vegas

and Santa Clara County used some form of medical priority dispatch which included ProQA and pre-arrival instructions.

Do you have time-based performance goals? Each department had set time-based performance goals and many were similar to each other. 60 seconds was a common time frame for Henderson, Las Vegas, and Portland. For Henderson it appeared to be a constant goal while Las Vegas required 90% compliance. Portland's 60 second target was related to urgent calls, with normal emergencies requiring a 90 second call processing time. Mesa matched its goal to NFPA 1221, which required the processing of all alarms within 90 seconds 95% of the time. There was no specific detail provided for Santa Clara County.

Are you currently meeting your performance goals? Two of the departments being studied were meeting their response time goals. Of those that were not, Las Vegas was meeting their targeted performance goal 69% of the time and Henderson was meeting their goal somewhere between 20% and 30%. Mesa and Portland responded affirmatively without specific detail.

How are time stamps recorded? All departments except for Santa Clara County responded that time stamps were recorded through a Computer Aided Dispatch System (CAD). Las Vegas also utilized the Sun Pro Records Management System (RMS). Because data from two separate databases were needed for dispatch and response time analysis, a third computer software application, Crystal Reports, was used to extract data and organize it in a customized report. Santa Clara County dispatchers recorded times as they were transmitted over the radio.

Summary of author's findings for Research Question #1

The first fractile response time interval that a fire department could directly control was from the receipt of the call for service and the dispatching of emergency response units. Fire

department's that provided their own call-taking and dispatching services or had those services provided by a companion department within their municipality or jurisdiction had a better chance of meeting dispatch performance goals identified as industry best practices. This point was further evidenced by the fact that Santa Clara County was meeting its dispatch time performance goals. Although Las Vegas had not yet achieved its goal, its average performance was dramatically increasing and it was meeting its performance goal 69% of the time. Both of these agencies either provided dispatch services or received them from a companion department. Like Santa Clara County, Portland received dispatching services from another department within the city and they were achieving their desired performance.

There was variation among the departments when it came to setting performance goals. Portland had performance goals of 60, 90, and 120 seconds for emergency classifications of Urgent, Priority, and Non-Priority, respectively. Mesa set call answering and dispatch performance goals as recommended in NFPA 1221. Las Vegas had the $90^{\%}$ frequency associated with travel time in mind when the goal of taking the call and dispatching within 60 seconds 90% of the time was set. Clearly, fire departments had the flexibility of determining appropriate levels of service based on situational variances, which could result in setting more realistic, appropriate, and achievable goals.

Three supplemental questions pertaining to firefighters responding to EMS calls, medical priority dispatching, and the prioritization of non-medical calls were asked in order to stimulate discussion and possibly reveal findings related to the impact of EMS calls and the function of patient transport on response time performance, particularly for fire calls and first due units. Incidentally, the preceding idea was the author's original thought for research, but the subject was too broad for the scope of this applied research project. Even so, at least in theory, it was

assumed in the fire service that this phenomenon has an absolute impact on the availability of fire engines and ladder trucks for fire responses, and a subsequent effect on their response time performance. Even so, the research did not provide a compelling argument either way, but the author felt strongly that it was a subject the fire service should research in more detail.

Response Procedures

How does Las Vegas Fire and Rescue's response procedures compare to those of other comparable accredited fire departments? To answer this research question the author inquired about response plans, zones, and procedures; standards of cover, performance goals, automatic and mutual aid, and resource management. The responses were summarized following each supplemental question.

Do you have specific response plans by type of emergency? The research showed that each department responded affirmatively to having response plans by type of emergency. Henderson and Las Vegas both stated that response plans were programmed into their CAD, which means the computer program automatically selects the number and type of units and makes a recommendation to the dispatcher depending on the call type. Mesa and Portland referenced their SOC, in which there were comprehensive details in the critical task sections. There was no specific detail given by Santa Clara.

Is there a copy of the department's response procedures available? Mesa included comprehensive procedures in its SOC. Henderson provided a copy of its procedures for dispatch and response. Las Vegas only has procedures for high-rise fire responses, and there were none available for Portland and Santa Clara County.

How was your response zone boundaries determined? Henderson and Santa Clara County relied on existing boundaries, such as battalions and districts. Portland determined that

all areas required the same level of service and infrastructure, but factors such as topography, coverage area, and resource levels created distinction. As a result, they identified three response zone types: Core, Urban, and Outlying. Las Vegas and Mesa both considered road miles and travel speeds to identify odd-shaped areas, or *polygons*. Las Vegas identified five-minute and twelve second response zones.

What components or elements of your response procedures if any, are stated as performance elements in your Standards of Cover? Henderson followed the recommendations of NFPA 1710, which required turnout time of 60 seconds, travel time for first arriving fire and EMS basic within 4 minutes, and full effective response for fire and advanced life support for EMS within 8 minutes. Las Vegas required a total reflex time, which included call processing, turnout, and travel time, of 6 minutes or less 90% of the time.

Do you have different standards of cover for different service call types? Both Henderson and Las Vegas replied affirmatively. Mesa, Portland, and Santa Clara County responded “no”.

What are your response time performance targets for: Turnout time? Day? Night? Travel time? Henderson had 60 second turnout time and 4 minute travel time for all call types, day or night. Las Vegas had turnout time goals of 60 seconds during the day, and 90 seconds at night. Travel time goals where 4 minutes for EMS 90% of the time, and 5 minutes twelve seconds for fire calls 90% of the time. Mesa made no distinction between day or night for turnout time, but expected 30 seconds for EMS calls, and 60 seconds for fire calls. Portland had the same performance targets day or night for all call types. For turnout time the goal was 80 seconds, and travel time was set at 4 minutes. Santa Clara had a travel time of 6 minutes for all

call types. Like Las Vegas, their turnout time standard was 60 seconds during the day and 90 seconds after bedtime.

Are you meeting your response time performance goals? Not one of the departments included in this study were meeting their response time goals as stated in their respective SOC. Henderson and Las Vegas both responded "no" regarding their turnout time and response time goals. Mesa reported that they averaged 3 minutes 45 seconds for travel time, but they only met the 4 minute goal 67% of the time. Portland did not state the percentage of time they met the 4 minute goal but instead reported that in 2008 their travel time for fire calls was 6 minutes 42 seconds or less on 90% of calls, and for EMS the 90th percentile travel time was 6 minutes 57 seconds. Santa Clara County simply responded "no".

The author requested response time data for the past three years from each department. Las Vegas had its own raw data to analyze. Of the other four departments surveyed, Henderson and Mesa provided comprehensive spreadsheets that had many aspects of response time data. Portland provided their three year data in the form of their 90th percentile performance for fire, EMS, and "with patient". Santa Clara County did not provide response performance data.

Do you receive and/or provide automatic and/or mutual aid? All departments responded affirmatively to receiving and providing aid. Las Vegas and Mesa's aid received and given was mostly automatic, as established through inter-local agreements. Henderson had an automatic aid agreement with Clark County, specifically for county islands located within the city limits, but was mostly involved with mutual aid agreements with all other jurisdictions. Portland reported that they had both types of agreements, but did not state to what degree or proportion. Santa Clara County simply replied "yes".

Do you have a limit on drawdown? Henderson simply answered “no”. Each of the other departments reported some form of limit or minimal available resource level. Las Vegas allowed up to 25% of available units to be out of service at any one time for the purposes of training, public relations, or other department business. Mesa had a minimum number of stations that were required to provide coverage, but did not disclose that number. Portland did not have a stated or pre-determined number. Instead, they had a fire liaison in the dispatch center who would manage resource allocation on a case-by-case basis. Santa Clara County required at least 8 of their 17 fire stations to have at least one company in service providing coverage at all times.

Summary of author’s findings for Research Question #2

The first few supplemental questions were designed to draw information related to the method or methods that determined the number and type of emergency resources sent on emergency calls. Each department was asked about response plans, zones, and procedures. LVFR used the term “response plan” when referring to the specific units programmed into the CAD to be recommended for dispatch based on the type of emergency. Portland referred to areas categorized as one of three risk levels. Response boundaries were varied. Answers included references to first-in areas, run districts, battalions, and polygons created by calculating distances by travel speed. Although each department had been through the accreditation process, there was room for improvement when it came to the consistent use of terminology.

The author asked if departments had developed different standards of cover for different types of call types. This question was written with the idea in mind that effective response time performance goals may be different based on the severity of the call, and in an effort to explore the concept. At the time the questions were developed for the interviews, the author did not adequately understand the meaning of the term Standards of Cover, explaining its unfortunate

misuse in the question. As a result, the responses to that question were limited, inconclusive, and not very useful. Despite the poor wording and possible confusion created by the question, there were other questions related to response time performance that provided very helpful information.

The research proved that setting different performance standards based on call type and even circumstance was not only being done, but there was also very good reason for doing so. For example, Mesa expected fire personnel to get out of the station and begin traveling to EMS calls in 30 seconds or less, compared to 60 seconds for fire calls, a practical requirement based on the fact that there was no need for firefighters to don their turnout gear prior to responding to medical calls. Based on a recent change in the recommendation by NFPA, Las Vegas and Santa Clara County had different turnout time goals depending on the time of day. During the day, fire personnel were required to turnout in 60 seconds or less. During nighttime, determined to be between 10 PM and 7 AM, crews were allowed 90 seconds for turnout time. The practical thinking behind this change was the fact that allowing a few extra seconds to wake up could result in safer driving practices after hours.

If the findings resulting from research of these five fire departments were any indication, a lot of progress had been made in the fire service toward the standardization of the definition and associated terminology related to response time. Each department had fractile measurements, certainly a direct result of the self-assessment process required for accreditation. In every case except one, the goal for travel time was four minutes. Only Las Vegas had a different travel time goal, which was 5 minutes and 12 seconds for fire calls. Even this deviation was influenced by the departments experience with the accreditation process, as it represented the 70^{th} performance percentile as determined by CFAI.

The author was surprised to find that the departments being studied were not able to meet their response time performance in one of or the other. For example, Mesa reported that their average travel time was 3 minutes and 45 seconds, but they were only meeting the four minute goal 67% of the time. Portland reported the actual performance for 90% of their fire and EMS calls, which was not much better than LVFR's performance during the same year. Actual response time data was requested from each department and, for those that responded a summary can be found in tabular format in APPENDIXES B through D.

Questions regarding automatic and mutual aid and drawdown or minimum resource limits were expected to illustrate the effect that responses into other jurisdictions was having on response time performance, but failed to do so.

Staffing

How does Las Vegas Fire and Rescue's staffing model compare with those of other accredited fire departments?

This research question was answered by evaluating unit staffing, fire station management, the provision of ALS services, and reliability of first due resources.

How many persons are assigned to each response unit by type? Four of the five departments staffed engines and trucks with 4 people. Henderson had 4 people on each engine and truck and 2 people on each rescue. Like Henderson, Las Vegas staffed 4 people on each engine and truck and two on each rescue. In addition, Las Vegas staffed an extra engineer on each of its two tillers, for a total of 5 people. For Henderson and Las Vegas, the author knew that rescue units were transport-capable medium duty units. Mesa responded that they staffed 4 persons per apparatus. Portland staffed 4 persons on each engine and truck. One of the 4 persons assigned to each engine and truck were also paramedics. Portland staffed its two rescues

with two paramedics. Santa Clara County staffed engines with 3 people, and trucks, rescues and their hazmat unit with 4 persons. As a note, the author was not aware what the distinction "rescue" meant for Portland or Santa Clara County.

Are all stations open always? If not, please explain. At the time of this writing (August 2009), the nation had been in recession for over a year, and most states and local municipalities had been feeling the trickle-down effect. Even so, none of the departments included in this study had yet to shut down stations or units. Each department responded that their stations had all remained open 24 hours per day, seven days per week.

Does your department provide advanced life support (ALS) services? Each department provided some degree of advanced life support. Henderson and Las Vegas staffed transport capable rescues and provided patient transports. Henderson provided all ambulance transports in the city of Henderson, while Las Vegas was transporting about 20-25% within its city limits. Both departments staffed their engine companies with paramedics as well. Mesa reported that they provided ALS services, but did not transport. Portland, and Santa Clara County Provided ALS, but did not elaborate on patient transport.

If yes, do you have firefighter/paramedics? Henderson answered that all engines and rescues were staffed with paramedics, as well as one of their trucks. Las Vega staffed all engines and rescues with one paramedic. Portland also staffed every engine with a paramedic, but they did not provide patient transport. Mesa and Santa Clara County responded that they staffed paramedics, but gave no further detail.

If yes, do you staff Advanced Life Support engines? Although seemingly redundant, certainly for Henderson, Las Vegas, and Portland, of which they had already clarified their staffing of paramedics on engines, there had been no previous indication that either Mesa or

Santa Clara County staffed engine companies with ALS capabilities. Their responses to this question confirmed that they did.

Do you have a method for tracking and documenting resource reliability? Neither Henderson nor Las Vegas had a method for measuring the percentage of time the first due unit was first on scene. Mesa and Portland responded that they did. Mesa had the ability to track and report this statistic through its CAD system. Portland had assigned a Fire Management Area (FMA) to each fire station which was periodically evaluated to determine how many times the first due resource was actually the first to arrive at the scene. There was no response from Santa Clara County.

Summary of author's findings for Research Question #3

The author presented research question #3 in the hopes of finding out about the distribution and capabilities of resources throughout each departments service area for the purpose of providing another perspective to which to compare LVFR's response time performance. One possible strategy for improving response time performance was to staff units with three people rather than four, allowing more units in service but with less concentration of personnel. The author wanted to know if this practice was being used and if so, was better response time a result. Only Santa Clara County was using three-person staffing, and their use was limited to engine companies. Like Las Vegas and Portland, Santa Clara County was operating out of 17 fire stations. The difference was that Santa Clara County had 281 uniformed staff augmented with 48 volunteers, while Las Vegas had 519 uniformed staff and Portland had 702. This fact begged an efficiency comparison by using response time information. Due to the lack of specific response time data from Santa Clara County, this comparison could not be made.

The commitment that each agency had made to EMS was clearly revealed through this research. Each department reported that they staffed engines with paramedics and Portland went one step further, assigning a paramedic to each truck company as well. Las Vegas was providing a portion of patient transports within city limits while Henderson was transporting 100%. Admittedly, the author had a biased belief that agencies providing patient transports without a significant increase of in-service units would experience longer response times and would meet performance targets less frequently. Each department's response time performance information was compared against the others in an attempt to shed some light on the author's assumption.

Surprisingly, comparing the response time data between departments was not as easy as first thought. This was because there was a degree of variety in which response data was provided. Some departments provided averages while others were expressed in fractals. In one case, the author could not immediately determine whether the times provided were an actual performance at the 90th percentile or an average, and if an average, was it total response time or just travel time? The author was able to reason by noting the target, that the value was travel time. Because the three year values provided were closer in comparison to actual performance at the 90th percentile provided by other departments, this was the assumption made.

This first comparison made was between Las Vegas and Henderson. The only compatible measure was fractal travel time for fire and EMS calls at the 70th percentile. From this comparison it appeared that Las Vegas and Henderson were providing the same level of service.

Fire Calls

70th percentile	Las Vegas	Henderson
2006	4:33	4:29

2007	4:42	4:47
2008	4:47	4:51

EMS Calls

70th percentile	Las Vegas	Henderson
2006	4:48	4:40
2007	4:50	4:35
2008	4:49	4:38

Next the comparison was made between Las Vegas and Mesa. The only compatible measure was average travel time. Mesa did not provide patient transport and Las Vegas provided more than 12,000 patient transports per year. This demonstrated a significant difference in the amount of time each departments EMS personnel spent on task during medical calls. Even so, there was not an equal distinction between the response time performances of the two departments. There was no evidence in this comparison of a relationship between patient transport and fire response times.

Average Travel Time			
	2006	2007	2008
Las Vegas Fire	3:52	4:01	4:04
Las Vegas EMS	4:04	4:11	4:05
Mesa Code 3	3:57	3:58	4:05

To make the comparison between Las Vegas and Portland, the travel time measure at the 90th percentile was used. The comparison of EMS travel time performance showed Las Vegas performing slightly better than Portland. This comparison was misleading because Portland

reported turnout time and travel time together, so Portland's travel time was actually less. The opposite was true, however when comparing travel time for fire calls. The performance gap widened significantly during 2007 and 2008, about the same time Las Vegas intentionally increased transport frequency per rescue. The argument could be made that this difference was caused by the patient transport activity performed by Las Vegas. Area served and populations between Las Vegas and Portland were also very comparable. Portland served an area of 151 square miles compared to Las Vegas' 133, and Portland's population is 563,000 compared to Las Vegas' 599,000, fairly unremarkable differences. More significant, however, is the fact that Portland operates out of 30 fire stations compared to Las Vegas' 17. The number of fire stations appeared to be the most influential factor affecting response times.

Fire Calls

90^{th} percentile	Las Vegas	Portland
2006	6:46	6:51
2007	7:02	6:49
2008	7:04	6:42

EMS Calls

90^{th} percentile	Las Vegas	Portland
2006	6:53	6:59
2007	6:43	7:07
2008	6:48	6:57

A comparison could not be made between Henderson and Mesa because there was no compatible response time measure between the two. Portland provided fractal travel time for fire and EMS calls and Henderson provided more complete data for 2008, which included their travel

time in the same measure. The comparison between Henderson and Portland was made by making a comparison of 2008 travel time data at the 90th percentile.

2008 90th Percentile Travel Time

	Fire	EMS/Medical
Henderson	6:42	6:22
Portland	6:42	6:57

This comparison was limited because there was only one year's worth of data available. Keeping in mind that Henderson provided 100 percent of transports within city limits and Portland did not transport patients, there was no significant difference between the two departments' 90th percentile performance. While Portland's service area was 50% larger than Henderson's, Portland had three times as many fire stations and firefighters. There was no compelling evidence that Henderson's patient transport workload was resulting in poor response time performance when compared to Portland's.

Finally, the author wanted to find out how departments were managing resources and measuring their reliability, that is the percentage of time that the intended first-due unit was the first to arrive at the scene. All departments responded that fire stations had remained in operation twenty-four hours a day and seven days per week. No department had to resort to shutting down or browning out fire stations. Mesa and Portland had developed a method to measure the reliability of their resources by identifying specific areas for first response by each unit and measuring performance through the use of CAD data.

Training and Non-Emergency Tasks

What impact does the scheduling and completion of non-emergency work by firefighters have on fire and EMS response times?

This research question was designed to evaluate the impact, if any, that scheduling and delivering of training, and non-emergency calls and tasks had on the availability and reliability of emergency response units, particularly as it related to times of peak service demand.

How do you schedule and deliver training for firefighters and EMS responders? (On-duty, off duty, or a combination of both?) Henderson, Las Vegas, and Mesa mentioned their training centers in their responses. Henderson and Las Vegas had the training calendar prepared by training staff months in advance. Henderson stated their training center was centrally located and that about half their training required units to be out of service. Las Vegas and Mesa had training centers that were not centrally located. Mesa was transitioning to a program that would require Battalion Chiefs to deliver Command and Control training to company officers in district while in service. About half of Mesa's training was conducted at their training center while units were out of service. Portland was providing most of their training presentations through television broadcasts in fire stations, leaving units in their districts, and could be done in or out of service. Broadcast types included scheduled, looped, or on-demand. Las Vegas provided off duty training only when necessary and Mesa provided their EMS training off-duty. Santa Clara County responded that they use a combination of both on-duty and off-duty training.

If off duty, are they paid? If yes, are they paid overtime? Henderson mandated Company Officer Training that was conducted off-duty. Las Vegas scheduled training off-duty out of necessity only. Mesa and Santa Clara acknowledged off-duty training with no specific frequency or degree. Portland did not use off duty training for budgetary reasons. For those departments that utilized off duty training, they all paid overtime.

Do you consider peak service demand projections when scheduling training for on-duty firefighters? Of the five departments, only Santa Clara County took service demand into

consideration when scheduling and delivering training. Like the other four departments, they created and maintained a training calendar in three hour blocks, twice each day, months in advance. Each day they either delivered or rescheduled training depending on call volume and activity that day.

Do emergency response units respond to non-emergency calls for service? Henderson, Las Vegas, and Portland responded affirmatively. Mesa sent emergency units to non-emergency calls, but was in the process of changing policy that would instead send their Transitional Response unit.

Summary of author's findings for Research Question #4

None of the departments provided a direct answer for research question #4. There were, however, indications in supplemental question responses that suggest there is a correlation between scheduled training and response times. Portland was providing a majority of their training through television broadcasts. Mesa was changing to provide more training to units in their response districts by battalion chiefs whether in service or out of service. Although Santa Clara County scheduled training exclusively at its training center, high call volume or service demand would cause training to be cancelled or postponed to some other time. These were all indications that departments recognized the impact that having units out of service for training was having on response times.

Additional Resources

What additional resources would be required for Las Vegas Fire and Rescue to achieve its fractile fire and EMS response times?

When research question #5 was developed the author fully expected the answer to be more fire stations, response units, and personnel. While additional capital and human resources

would certainly help the department improve response time performance, surprisingly there were other in-house changes that could be implemented with very little, if any cost. Those changes included identifying more precise geographic response zones for each unit to illustrate the areas in which four minute and five minute-twelve second travel times could be performed, developing a method for which the department could track and evaluate the percentage of time the first-due unit arrived at the scene first, and focusing on the improvement of turnout times, particularly for EMS calls.

Unexpected Findings

The author was surprised to find that LVFR was not alone in its struggle to meet response time goals that had been stated in the SOC. In some ways, LVFR's response times compared favorably with those of the comparison departments. Another unexpected finding was the lack of correlating evidence that response times were being negatively impacted by other work such as non-emergency calls for service, remedial and updated training of emergency response personnel while on duty, and public relations and education activities.

Finally, this research was conducted during a time that the nation was experiencing one of its most severe recessions in modern history. It might have been assumed that findings would reveal the impact of budget cuts and station closures, but, although the author was intuitively aware that these events were occurring in other cities and departments at the time, there was no indication of such an impact on the departments that this study focused on.

DISCUSSION

How does Las Vegas Fire and Rescue's dispatch procedures compare to those of other accredited fire departments?

Each department included in the study had time-related performance targets for dispatch time. NFPA (2007) provided recommended performance standards for call taking and dispatching in Chapter 7, sections 7.4.1 and 7.4.3 as follows:

> Ninety-five percent of alarms received on emergency lines shall be answered within 15 seconds, and 99 percent of alarms shall be answered within 40 seconds.
>
> Ninety-five percent of emergency call processing and dispatching shall be completed within 60 seconds, and 99 percent of call processing and dispatching shell be completed within 90 seconds.

The research showed that the 60-second time requirement was consistent for each department, with some degree of flexibility. Mesa's dispatch target matched the NFPA standard verbatim. Henderson required 60 second dispatching always, Las Vegas required it 90 percent of the time. Portland required dispatch to be done within 60 seconds for urgent calls, and allowed more times for emergency and non-emergency.

Agencies providing their own dispatching services had more control over time performance than those receiving services from an outside agency. Henderson received dispatch services form it's Police Department, as evidenced by longer dispatch times. Las Vegas was the only studied department that provided its own dispatch services, and even though it received emergency calls forwarded from another PSAP, dispatching times showed an improving trend.

Because each department had limited resources from which to provide effective responses, they used some sort of priority dispatch system. Collectively, the goal was to align resource service capability with the emergency need, for instance, ALS response to heart attacks and respiratory distress. The fact that not all emergency calls for service were true medical emergencies was reinforced in the literature review (CESRCFD, 2003).

How does Las Vegas Fire and Rescue's response procedures compare to those of other comparable accredited fire departments?

The definition of response time had to be defined clearly. The Commission on Fire Accreditation International provided a breakdown of the fractile elements of response time, including those elements fire departments had little, if any, control or influence over. Barr & Caputo (2003) stressed this point as well as standardized criteria regarding dispatch time, turnout time, and travel time. Each department had time-related performance requirements for turnout time and travel time. Again, the 60-second requirement was common among each department with some degree of variation. The most progressive case of turnout time standards was found in Mesa, where the department required crews to turnout in 30 seconds or less for EMS calls. On the other end of the spectrum, but no less progressive from a firefighter safety standpoint, Las Vegas and Santa Clara County allowed 90 seconds turnout time between the hours of 2000 and 0700. Henderson, Portland, and Santa Clara County required 60 seconds for turnout time.

The accreditation documents published by the CFAI made direct references to NFPA standards for industry best performance practices and standards. Even so, the study provided the author a new understanding of the flexibility allowed by CFAI with regards to service level targets. The term *baseline* referred to the level of service or performance a department provided at any given time. *Benchmarks* referred to performance levels considered industry best practices. The benchmarks in the CFAI documents were taken directly from NFPA 1710. Baselines or benchmarks were used to compare response time performance against each department studied. Las Vegas had a 5 minute and 12 second travel time goal based on the 70th percentile according to CFAI. Henderson used the term baseline to describe this 70th percentile, and tracked and reported the percentage of time responders met the goal.

The problem statement for this research was developed based on the assumption that LVFR was not meeting the standard expected by CFAI and the response time performance required to maintain accredited status. LVFR's response time data proved the department needed to improve response times. Even so, the department compared favorably with the other departments used in the study. In fact, taking all the data into account, LVFR fared well. However, turnout times were particularly poor for Las Vegas. If procedural changes were implemented, Las Vegas could see a significant improvement in overall response time performance.

How does Las Vegas Fire and Rescue's staffing model compare with those of other accredited fire departments?

In addition to response times, NFPA 1710 recommended staffing standards. For fire companies, the standard called for a minimum of four people. The research showed that only Santa Clara County, by staffing engine companies with three persons, was not meeting this part of the standard. The study also found that each department was dealing with a high demand for EMS, and the various staffing configurations showed a shared commitment to EMS. The author's pre-conceived assumption that providing EMS transport services resulted in longer fire response times was not evident through this research, although the subject was not examined thoroughly. Still, the results were encouraging for advocates of fire departments providing transport services.

From the perspective of Las Vegas Fire & Rescue, making a direct comparison of response time performance was helpful. The author had the benefit of access to all available LVFR response time data. The opposite was true regarding the other departments and the variety of response time measures was interesting. In most cases, averages were provided, and although

not very effective as a stand-alone measure, they were helpful for the purpose of comparison. But there were variations found even within the confines of fractal measurement. Portland provided time values identified as its 90th percentile for performance and combined turnout and travel time. For example, in 2008 Portland had a combined turnout and travel time of 6 minutes and 42 seconds or less for fire calls 90 percent of the time. In addition, unique to Portland, they provided a total time from dispatch to contact with the patient.

Because Las Vegas had fractal and average response time information, it was possible to match the variety of measures provided by the other departments to make relevant comparisons. One comparison study showed Las Vegas and Henderson provided similar levels of service, despite Henderson providing 100 percent of EMS transports in its jurisdiction. The comparison between Las Vegas and Mesa was interesting because while Las Vegas transported about 25 percent of EMS patients in the city, Mesa did not transport; and both departments operated out of the same number of fire stations. The comparative measure was travel time, and while Las Vegas transported over 12,000 patients in 2008, there was no difference in travel time performance.

Portland included turnout time and travel time as a 90th percentile value. Although the research showed Portland to have a turnout time requirement of 80 seconds, there was no way to calculate accurately the travel time alone. For this reason, the comparison between Portland and Las Vegas was made with Portland's combined turnout and travel time to Las Vegas' 90th percentile travel time. Surprisingly, the response times were close but Portland outperformed Las Vegas, even with the inclusion of turnout time. The most likely explanation is that Portland had almost twice as many fire stations that provided a significant advantage in resource distribution.

The final response time comparison, limited to 2008 data, was made between Henderson and Portland. The performance information used was the actual 90th percentile service level provided for travel time. The author anticipated findings related to the effect of patient transports on fire response times, but the results were inconclusive. While Henderson transported all patients, Portland had three times as many fire stations. The comparison of travel time between these two departments was virtually equal, but because of the difference in services provided and the number of fire stations, no conclusion could be drawn from this comparison. *What impact does the scheduling and completion of non-emergency work by firefighters have on fire and EMS response times?*

The research did not produce findings helpful in answering this question. For convenience and to keep the responses minimal, the related supplemental questions were open-ended. The consequence of this approach was the lack of helpful information or detail regarding the impact regularly scheduled and mandated training had on resource reliability and response times. There was a common conception in the fire service that this dynamic occurred, but responses failed to produce scientific findings. Although the responses provided ideas for the recommendation section, those ideas were not new.

LVFR response time needs improvement, but compared to other accredited fire departments, its performance was more favorable than expected. The results revealed practices that could improve response time performance if implemented by LVFR. LVFR was due to revisit the self-assessment process as required to be re-accredited. This study provided the department with a better understanding of how to match resource capabilities with community risk and revealed the importance of identifying realistic service level capabilities and setting achievable targets and performance improvement goals. Also, the department had acquired sites

for several future fire stations and four were either under construction or in the design phase. The completion and staffing of four new fire stations would help improve the department's ability to increase service levels.

RECOMMENDATIONS

The most obvious and common solution to improving response time performance was building fire stations. Las Vegas had three fire stations under construction and obtained site locations for 12 others. One station under construction was a replacement, and the two others were new. Because of budget limitations, two of the three new stations would likely be staffed by relocating existing resources from multi-company stations. No funding was planned for the staffing of the third. Although increasing the number of fire stations and response units was recommended, doing so would not be achievable until the economy improved.

Set more realistic response time performance levels. When LVFR did its first community risk assessment the response time goal was six minutes total reflex response time on 90% of calls. The recommendation was to set response time goals based on capability, effectively showing polygon shaped areas around each fire station that identify geographic areas in which travel time will be four minutes or less 90% of the time, and a second polygon showing the geographic boundary in which units can travel with 5 minutes and 12 seconds 70% percent of the time. Any areas not within these two boundaries could then be considered for future fire station sites and included in the department's five to ten year plan.

Increase the amount of time units are in service and in their district. Las Vegas sends its units to the east side of the city for most company training, operating with about 75 percent of its resources in service and available for calls. Although Las Vegas did not have a reliable method for evaluating the impact of this practice, it was very likely causing longer response times during

the time training occurred. The author recommends exploring and implementing the use of technology to deliver training to personnel while they are in their fire stations instead of taking them out of service and sending them to the training center. Portland used television broadcasts, and most cities, including Las Vegas, have videoconferencing capabilities.

Las Vegas did not have clearly delineated areas defined as first due for each company, other than one square mile districts used as a reference for responding. As a result, there is no reliable way of recording and tracking the percentage of time a given unit was selected as the first due and was the first on the scene. Both Mesa and Portland knew by geographic area which units or units were designed to be first on the scene. As a result, they were able to track, report, and analyze performance to determine resource reliability. It is recommended that LVFR develop a method for measuring resource reliability because doing so will be critical to the successful placement of future emergency response units and fire stations.

LVFR can improve turnout time for all calls, particularly EMS. In fact, EMS turnout times are worse than fire turnout times. The department should evaluate company turnout time performance to identify reasons performance is poor and identify steps for improvement. It would be helpful to develop a reliable method for tracking and reporting turnout times. Also, LVFR could allow a shorter turnout time for EMS calls, as Mesa did. It makes sense that without the need to put on turnout pants and coats, personnel should easily be able to get out of quarters in less time for EMS calls.

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APPENDIX A – LVFR Fractile Response Times for 2006 through 2008

Las Vegas Call Processing Time (Target 1:00)

	2006	2007	2008
90th percentile	1:44	2:11	1:47
80th percentile	1:19	1:47	1:26
70th percentile	1:04	1:33	1:05
Average	1:34	1:22	1:05

Las Vegas Turnout Time – Fire Calls (Target 1:00)

	2006	2007	2008
90th percentile	2:15	2:16	2:18
80th percentile	1:51	1:53	1:55
70th percentile	1:37	1:41	1:41
Average	1:21	1:25	1:23

Las Vegas Turnout Time – EMS Calls (Target 1:00)

	2006	2007	2008
90th percentile	2:43	2:40	2:39
80th percentile	2:12	2:10	2:10
70th percentile	1:53	1:52	1:52
Average	1:41	1:40	1:37

APPENDIX A (Continued)

Las Vegas Turnout Time – Other Calls (Target 1:00)

	2006	2007	2008
90th percentile	2:37	2:34	2:24
80th percentile	2:05	2:06	1:58
70th percentile	1:52	1:51	1:45
Average	1:41	1:38	1:28

Las Vegas Travel Time – Fire (Target 4:00)

	2006	2007	2008
90^{th} percentile	6:46	7:02	7:04
80^{th} percentile	5:16	5:33	5:35
70^{th} percentile	4:33	4:42	4:47
Average	3:52	4:01	4:04

Las Vegas Travel Time – EMS (Target 4:00)

	2006	2007	2008
90th percentile	6:53	6:43	6:48
80th percentile	5:34	5:35	5:33
70th percentile	4:48	4:50	4:49
Average	4:04	4:11	4:05

APPENDIX A (Continued)

Las Vegas Travel Time – Other (Target 4:00)

	2006	2007	2008
90th percentile	8:40	8:12	8:02
80th percentile	7:12	6:46	6:22
70th percentile	6:06	5:53	5:27
Average	5:06	4:74	4:55

Las Vegas Total Reflex Time – Fire (Target 6:00)

	2006	2007	2008
90th percentile	11:01	10:55	10:26
80th percentile	8:50	8:45	8:28
70th percentile	7:48	7:49	7:30
Average	7:45	7:34	6:98

Las Vegas Total Reflex Time – EMS (Target 6:00)

	2006	2007	2008
90th percentile	11:06	10:45	10:26
80th percentile	9:19	9:05	8:46
70th percentile	8:19	8:07	7:49
Average	7:43	7:21	6:91

APPENDIX A (Continued)

Las Vegas Total Reflex Time – Other (Target 6:00)

	2006	2007	2008
90th percentile	14:02	12:54	12:10
80th percentile	11:16	10:59	10:04
70th percentile	9:51	9:43	8:52
Average	9:02	8:71	7:98

APPENDIX B –Response Times for Henderson Fire Department 2006 through 2008

Henderson Fire Department – Fire Calls

	2006	2007	2008
Call Processing	2:05	2:00	1:42
Turnout Time	1:51	2:03	2:04
Travel Time	4:29	4:47	4:51
Total	8:09	8:14	7:56

Henderson Fire Department – EMS Calls

	2006	2007	2008
Call Processing	2:27	2:35	2:28
Turnout Time	1:44	1:57	1:58
Travel Time	4:40	4:35	4:38
Total	8:33	8:42	8:42

Henderson Fire Department – Technical Rescue Calls

	2006	2007	2008
Call Processing	Not provided	Not provided	Not provided
Turnout Time	3:36	2:07	3:00
Travel Time	13:26	9:49	9:17
Total	17:56	20:49	15:19

APPENDIX B (Continued)

Henderson Fire Department – Hazardous Materials Calls

	2006	2007	2008
Call Processing	2:25	2:28	2:13
Turnout Time	1:59	2:24	1:45
Travel Time	5:14	5:05	4:38
Total	9:39	10:07	7:50

Henderson Fire Department – Quartile Response Times

	2008			Benchmark	Baseline
Fire Calls	90th	80th	70th	90%	70%
Call Procession	2:36	2:08	1:42	1:00	2:00
Turnout Time	2:30	2:21	2:04	1:00	2:30
Travel Time	6:42	5:21	4:51	4:00	5:30
Total Response Time	9:24	8:34	7:56	6:00	9:00
EMS Calls					
Call Procession	3:36	2:52	2:28	1:00	2:45
Turnout Time	2:48	2:16	1:58	1:00	2:15
Travel Time	6:22	5:18	4:38	4:00	5:00
Total Response Time	10:43	9:27	8:42	6:00	9:00

APPENDIX B (Continued)

Henderson Fire Department – Quartile Response Times

		2008		Benchmark	Baseline
Technical Rescue Calls	90th	80th	70th	90%	70%
Call Procession	N/A	N/A	N/A	N/A	N/A
Turnout Time	3:01	3:01	3:00	1:00	5:00
Travel Time	9:13	9:13	8:35	15:00	12:00
Total Response Time	21:02	21:02	15:19	17:00	20:00
Hazardous Materials Calls					
Call Procession	4:07	2:42	2:13	1:00	2:30
Turnout Time	2:14	1:56	1:45	1:00	2:30
Travel Time	6:05	5:07	4:38	4:00	5:00
Total Response Time	10:37	8:21	7:50	6:00	9:00

Henderson Fire Department – Quartile Response Times

		Q1 2009		Benchmark	Baseline
Fire Calls	90th	80th	70th	90%	70%
Call Procession	3:19	2:09	1:47	1:00	2:00
Turnout Time	3:32	2:56	2:38	1:00	2:30
Travel Time	5:41	4:51	4:05	4:00	5:30
Total Response Time	9:04	8:23	7:59	6:00	9:00
EMS Calls					
Call Procession	3:21	2:39	2:20	1:00	2:45
Turnout Time	3:00	2:25	2:04	1:00	2:15
Travel Time	6:28	5:15	4:35	4:00	5:00
Total Response Time	10:37	9:17	8:30	6:00	9:00

APPENDIX B (Continued)

Henderson Fire Department – Quartile Response Times

	Q1 2009			Benchmark	Baseline
Technical Rescue Calls	90th	80th	70th	90%	70%
Call Procession	N/A	N/A	N/A	N/A	N/A
Turnout Time	N/A	N/A	N/A	1:00	5:00
Travel Time	N/A	N/A	N/A	15:00	12:00
Total Response Time	N/A	N/A	N/A	17:00	20:00
Hazardous Materials Calls					
Call Procession	3:23	2:38	1:58	1:00	2:30
Turnout Time	3:02	2:45	2:22	1:00	2:30
Travel Time	5:45	5:33	5:15	4:00	5:00
Total Response Time	10:45	9:22	8:11	6:00	9:00

APPENDIX C –Response Times for Fire Mesa Fire Department 2006 through 2008

2006	
Average Response Time	3:57
% of time 4 minute travel time goal achieved	60.4%

2007	
Average Response Time	3:58
% of time 4 minute travel time goal achieved	63.2%

2008	
Average Response Time	4:05
% of time 4 minute travel time goal achieved	61.5%

YTD 2009 (through May)	
Average Response Time	3:45
% of time 4 minute travel time goal achieved	66.7%

APPENDIX D –Response Times for Fire Portland Fire & Rescue 2006 through 2008

	Fire Calls	Medical Calls	With Patient
2006	6:51	6:59	8:50
2007	6:49	7:07	9:03
2008	6:42	6:57	9:05
Targets	5:20	5:20	8:00