CENTER FOR PUBLIC SAFETY MANAGEMENT, LLC

OPERATIONAL AND ADMINISTRATIVE ANALYSIS

CORINTH, TEXAS for Lake Cities Fire Department

Final Report-Dec. 2019

CPSM®

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The International City/County Management Association is a 103-year-old, nonprofit professional association of local government administrators and managers, with approximately 13,000 members located in 32 countries.

Since its inception in 1914, ICMA has been dedicated to assisting local governments and their managers in providing services to its citizens in an efficient and effective manner. ICMA advances the knowledge of local government best practices with its website (www.icma.org), publications, research, professional development, and membership. The ICMA Center for Public Safety Management (ICMA/CPSM) was launched by ICMA to provide support to local governments in the areas of police, fire, and emergency medical services.

ICMA also represents local governments at the federal level and has been involved in numerous projects with the Department of Justice and the Department of Homeland Security.

In 2014, as part of a restructuring at ICMA, the Center for Public Safety Management (CPSM) was spun out as a separate company. It is now the exclusive provider of public safety technical assistance for ICMA. CPSM provides training and research for the Association's members and represents ICMA in its dealings with the federal government and other public safety professional associations such as CALEA, PERF, IACP, IFCA, IPMA-HR, DOJ, BJA, COPS, NFPA, and others.

The Center for Public Safety Management, LLC, maintains the same team of individuals performing the same level of service as when it was a component of ICMA. CPSM's local government technical assistance experience includes workload and deployment analysis using our unique methodology and subject matter experts to examine department organizational structure and culture, identify workload and staffing needs, and align department operations with industry best practices. We have conducted more 315 such studies in 42 states and provinces and 224 communities ranging in population from 8,000 (Boone, Iowa) to 800,000 (Indianapolis, Ind.).

Thomas Wieczorek is the Director of the Center for Public Safety Management. Leonard Matarese serves as the Director of Research & Program Development. Dr. Dov Chelst is the Director of Quantitative Analysis.

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SECTION 1. EXECUTIVE SUMMARY

The Center for Public Safety Management LLC (CPSM) was retained by the City of Corinth to evaluate the Lake Cities Fire Department (LCFD) and conduct an Operational and Administrative Analysis of the fire department, including a detailed review of department operations, its interaction with hospital services, workload, staffing, fire stations, fire apparatus, and deployment practices. This analysis includes a thorough review of the organization's structure, training, performance measures, prevention activities, and interactions with mutual aid and regional partners. Specifically, CPSM was tasked with providing recommendations and alternatives regarding fire department operations, staffing levels, alternate modes of operation in relation to the current service demand, and options that can position the department to best manage the community's anticipated rapid growth.

During the study, CPSM analyzed performance data provided by the Lake Cities Fire Department and examined firsthand the department's operations. Fire departments tend to deploy resources utilizing traditional approaches, which are rarely reviewed. To begin the review, project staff asked for certain documents, data, and information. The project staff used this information/data to familiarize themselves with the department's structure, assets, and operations. The provided information was supplemented with information collected during an on-site visit to observe the performance of the department and to compare that performance to national benchmarks. CPSM will typically utilize benchmarks that have been developed by organizations such as the National Fire Protection Association (NFPA), Center for Public Safety Excellence Inc. (CPSE), the ICMA Center for Performance Measurement, as well as others.

Project staff conducted a site visit on August 18-21, 2019, for the purpose of observing fire department and agency-connected support operations, interviewing key department staff, city managers (from all cities that are served by LCFD), elected officials, and reviewing preliminary data and information. Telephone conference calls as well as email exchanges were conducted between CPSM project management staff, the city, and the fire department so that CPSM staff could affirm the project scope and elicit further discussion regarding this analysis.

The Lake Cities Fire Department is a highly skilled and progressive organization that is making exceptional progress in dealing with a very significant and growing workload. The personnel with whom CPSM interacted are truly interested in serving the Cities of Corinth, Hickory Creek, Lake Dallas, and Shady Shores to the best of their abilities and demonstrated a unified goal of achieving excellence in service delivery. As service demands increase and the fire department is required to provide expanded services, it is essential that the organization continue its strategic planning efforts, organizational team building, performance measurement, and goal setting. The challenges for the Lake Cities Fire Department are not unique nor are they insurmountable. CPSM will provide a series of observations and recommendations that we believe will enable the LCFD to become ***more efficient*** and ***smarter*** in the management of its emergency and non-emergency responsibilities.

The current multicity contractual relationship is providing for the most efficient, most effective, and most affordable service delivery system to all residents. CPSM will discuss in detail what a small, one-station volunteer/paid-on-call department would cost in Corinth for delivery of only fire services. The volunteer/paid-on-call model does not work well with EMS service delivery because it is not timely in delivering the right services in the right place at the right time. The existing model being used by LCFD has been shown to be effective by several evaluations; splitting or attempting "cheaper" service delivery increases the risk and cost to communities.

RECOMMENDATIONS

The LCFD provides an excellent range of services to its citizens, local businesses, the university, and visitors to the area. The department is well-respected in the community and by city leadership. For organizations of the caliber of the LCFD, the recommendations provided in our analysis are minor in comparison to the department's performance and do not denote flaws in its day-to-day operations or overall efficiencies. In an organization such as the Lake Cities Fire Department, which is achieving a high level of performance, the real challenge becomes the drive to maintain—in its line personnel and managerial staff—the continued pursuit of excellence and ongoing improvement. One criticism that was made to CPSM concerning equipment replacement was that it appeared ostentatious to have such a new and regularly replaced fleet; the statement was "Cadillac when a Ford" would suffice. The LCFD provides a Cadillac service for the price one would find in a lower cost Ford.

The LCFD is an exemplary department. CPSM looked for areas that could be viewed as needing improvement and found few that would require attention. Extraordinary efforts have been made to reconfigure the operations of the department, and these efforts have resulted in reduced overtime, improved service, and management by data-driven decisions.

Eleven recommendations are listed below and in the applicable sections within this report. The recommendations are based on best practices derived from the NFPA, CPSM, ICMA, the U.S. Fire Administration, the International Association of Emergency Managers (IAEM), and the Federal Emergency Management Agency (FEMA).

These recommendations are listed in the order in which they appear in the report.

1. The LCFD should consider staffing three command positions, that is, a Battalion Chief for each shift, to alleviate some demand on the administration, for incident command, and for operations management when the Chief is absent for training, vacation, or illness. (See p. 8.)
2. The LCFD should institute an internet-based video conferencing system to facilitate regular meeting forums (daily/weekly/monthly), to discuss departmental initiatives and new directives, and enable remote training delivery sessions by chief officers and support personnel. City Managers should be included in these briefings (unless restricted due to medical issues), which may continue to improve the feeling of ownership in the organization. (See p. 10.)
3. The LCFD should expand its excellent training program so as to establish a professional development program for all personnel interested in seeking administrative positions. This could be done in conjunction with a local college. It could also be expanded to a succession planning program for the department. (See p. 11.)
4. The LCFD should fill its vacant command position. (See p. 11.)
5. Prior to any anticipated, large public event, the fire and police departments should identify a common radio communications channel to be utilized for interoperability during the event. (See p. 18.)
6. The Lake Cities Fire Department should conduct a formal fire risk analysis for each of the four member communities, taking into account the varying demographic make-ups. (See p. 26.)
7. It is recommended the LCFD develop a written internal risk management program, including implementing a wellness program with a background physical screening (stress test, lung and cancer screens, etc.). (See p. 28.)

8. Action has been taken to alleviate shortcomings in hazardous material incidents and the department should continue its efforts to handle smaller incidents with contracts in place between the cities and a professional firm for larger responses. The fire department should be tasked with maintaining control on incidents, with larger ones that require more involvement and expertise handled through a contractual arrangement. (See p. 30.)
9. Recommendation: Lake Cities should consider CPSE fire accreditation in the future. (See p. 31.)
10. LCFD and its member cities should adopt the Community Risk Reduction philosophy. (See p. 37.)
11. LCFD should work with the medical director and dispatch to reduce the overall need to run with lights and siren to both EMS and fire calls. (See p. 37.)

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SECTION 2. SCOPE OF PROJECT

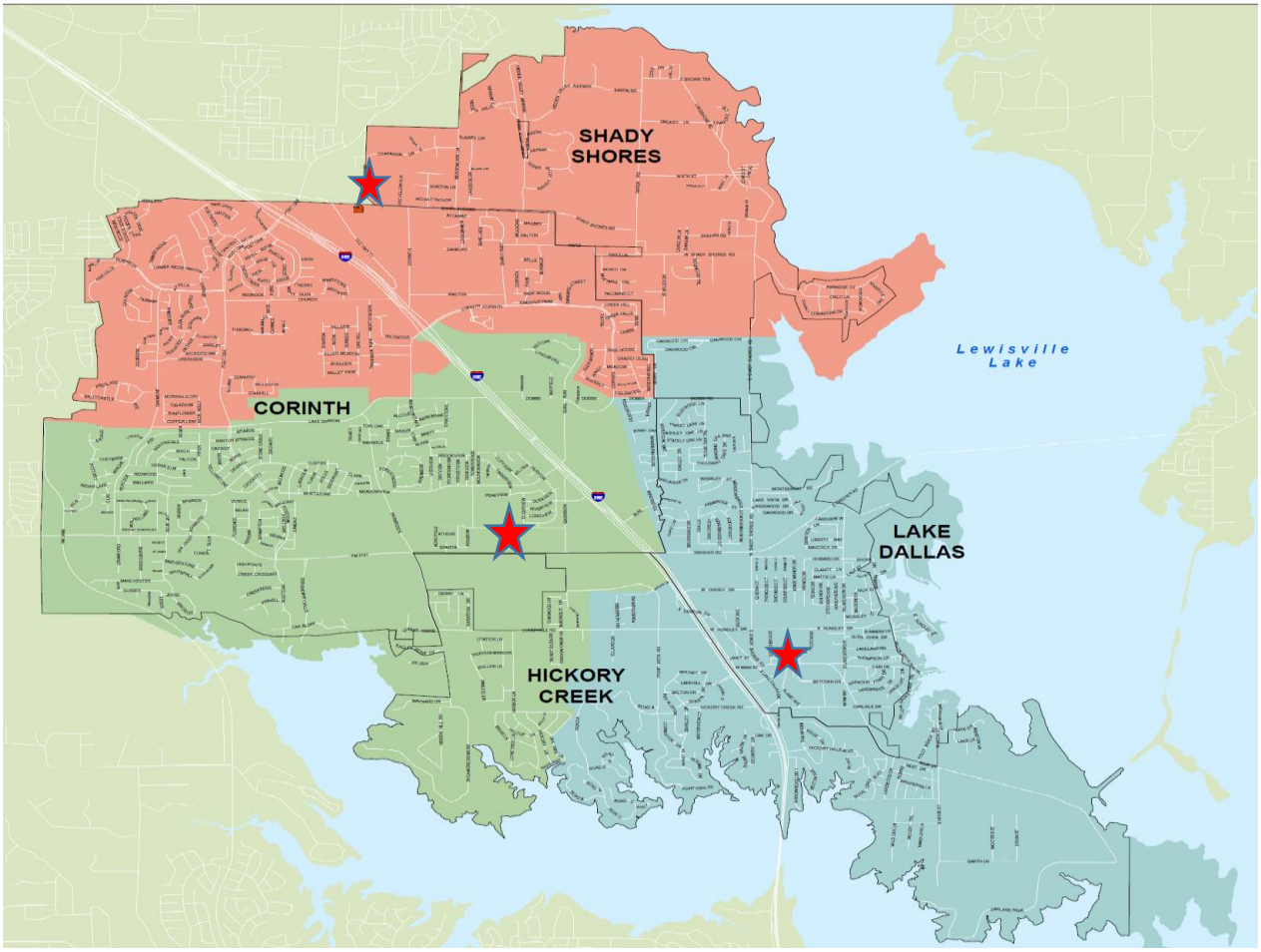
The scope of this project was to provide an independent review of the services provided by the Lake Cities Fire Department (LCFD) so that officials from Corinth, Lake Dallas, Hickory Creek, and Shady Shores could obtain an external perspective regarding the fire and EMS delivery system. This study provides a comprehensive analysis of the LCFD, including its organizational structure, workload, staffing, overtime, deployment, training, fire prevention, emergency communications (911), planning, and public education efforts. In addition, CPSM will offer its insights to help the department determine the appropriateness of the level of response and alternative delivery systems that could be utilized in meeting both current and projected service demand. Local government officials often commission these types of studies to measure their department against industry best practices. In this analysis, CPSM provides recommendations where appropriate, and offers input on a strategic direction for the future.

Key areas evaluated during this study include:

- Fire department response times (using data from the city's computer-aided dispatch system and the LCFD records management systems).
- Deployment, staffing, and overtime.
- Agency interaction with neighboring mutual aid and joint response partners.
- Organizational structure and managerial oversight.
- Fire and EMS workloads, including unit response activities.
- LCFD support functions (training, fire prevention/code enforcement, and 911 dispatch).
- Essential facilities, equipment, and resources.
- An evaluation of the capacity of the organization to best position itself in meeting anticipated demand.

SECTION 3. ORGANIZATION AND MANAGEMENT

GOVERNANCE AND ADMINISTRATION



The Lake Cities Fire Department services Corinth, Hickory Creek, Lake Dallas, and Shady Shores. It is located in Denton County, Texas, which is near the Dallas-Fort Worth Metroplex. The population of Corinth is estimated at 22,000, that of Lake Dallas at 7,000, Hickory Creek at 4,000, and Shady Shores at 2,000. Corinth is on the cusp of a major downtown development and commercial project, while Hickory Creek and Shady Shores are more residential. The manager of Shady Shores indicated the city has no commercial development and the council has adopted a development plan that maintains the residential focus.

As of the 2010 U.S. Census, there were 19,935 people residing in the City of Corinth. The population density was 2,523.4 people per square mile (977.2/km²). There were 7,138 housing units, at an average density of 903.5 per square mile (349.9/km²). The racial makeup of the city was 84.7 percent White, 5.7 percent African American, 0.8 percent Native American, 2.7 percent Asian, 0.05 percent Pacific Islander, 3.2 percent some other race, 1.0 percent Boedeker,

and 2.9 percent from two or more races. Hispanic or Latino of any race were 11.8 percent of the population.

There were 6,897 households, out of which 43 percent had children under the age of 18 present, 68.2 percent of households were headed by married couples living together, 8.4 percent had a female head of house, and 20.0 percent were nonfamilies; 14.7 percent of all households were made up of individuals, and 4.2 percent had someone living alone who was 65 years of age or older. The average household size was 2.89, and the average family size was 3.23.

In the city, the population spread was as follows: 29.6 percent under the age of 18, 6.7 percent from ages 18 to 24, 31.1 percent from ages 25 to 44, 25.5 percent from ages 45 to 64, and 7.1 percent who were 65 years of age or older. The median age was 35.7 years. For every 100 females, there were 95.9 males. For every 100 females age 18 and over, there were 93.0 males.

According to a 2007 estimate, the median income for a household in the city was $95,967, and the median income for a family was $96,375. Males had a median income of $52,362 versus $35,089 for females. The per capita income for the city was $30,492. About 1.0 percent of families and 1.6 percent of the population were below the poverty line, including 1.6 percent of those under age 18 and 2.0 percent of those age 65 or over.

The Lake Cities Fire Department had its origins in volunteer fire departments in Lake Dallas and Corinth. As the population grew and commercial activity increased, the department found it difficult to deploy using a volunteer system.

In the United States, the most economical fire departments are usually those staffed by volunteers, largely because they do not require salaries, wages, or benefits. The next most economical are usually departments that rely on "paid-on-call" or POC staff. All career departments are usually the costliest, largely driven by full-time staff costs.

CPSM has observed that volunteer departments are becoming increasingly difficult to operate. Pre-entry training, ongoing training, response to an increasing number of calls for service (largely medical), and family demands make it more difficult to attract and retain volunteers. CPSM was involved in a national study through the National Fire Administration that looked at volunteer and POC departments. As an example, the State of Pennsylvania (which relies heavily on volunteers) has seen the ranks of volunteer firefighters dwindle from more than 300,000 to fewer than 50,000 today. Even cities that have deployed using paid-on-call firefighters are finding it increasingly difficult to attract and retain members because of the training and education demands. Pre-hire fire training runs from 270 to 400 hours; paramedic training requires an additional 1,000 hours as well as ongoing CEU requirements; and specialization can require many additional hours prior to deployment. All of these demands on top of a full-time career and family time make it unlikely either a volunteer or POC department can be started up successfully today.

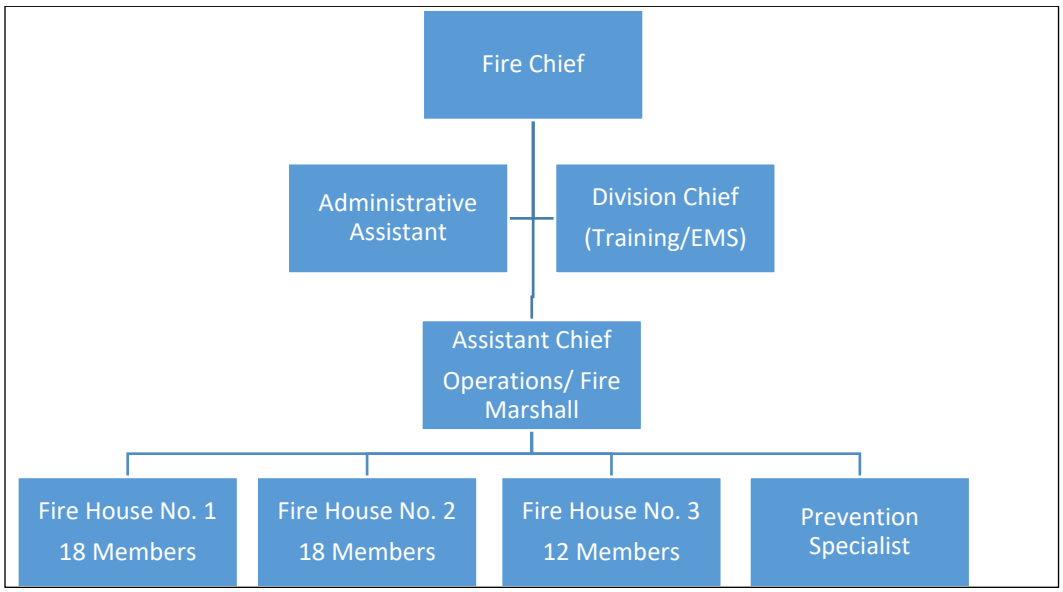
In the case of the Lake Cities Fire Department, should any of the partners desire to start their own department, they are likely to compete for staff from the Dallas-Fort Worth area or the career Lake Cities Fire Department. The fire department enjoys an ISO rating of Class 2 and at its last evaluation was within points of achieving a Class 1 or "best in class" status. A small, stand-alone station is unlikely to receive a similar positive evaluation. Also, for larger incidents, a stand-alone department would likely require mutual or automatic aid from larger departments that are nearby. Due to the current district's location alongside Lewisville Lake, those areas are likely to be Corinth and areas north and west.

Creating a department today is an expensive and difficult proposition. Start-up costs include purchase of personal protective equipment, physicals, psychological testing, field training, hand

tools, vehicles, and medical. Starting a new EMS delivery system may require approvals at both the county and state level; as well, protocols need to be developed and adopted to ensure patient care quality standards are met. EMS is not well-suited to volunteer or paid-on-call delivery models because of the critical time element involved in ensuring successful patient outcomes.

The existing configuration of stations is well-suited to the topography and demographics of the area the department serves. The central station is ideally suited to handle additional staff who can respond to other areas of the fire district, particularly during times of peak call volume.

FIGURE 3-1: Lake Cities Fire Department Table of Organization



LAKE CITIES FIRE DEPARTMENT OVERVIEW

The Lake Cities Fire Department (LCFD) is a career fire department comprised of 53 personnel. The department is led by a fire chief who has overall responsibility for managing the department's day-to-day operations and providing administrative oversight. The chief is assisted by a division chief who assists with training and EMS (position currently vacant), an assistant chief who oversees operations, and a fire marshal. Fire stations 1 and 2 each have 18 staff assigned, while station 3 has 12 members assigned. Station 1 is the smallest station and is owned by the City of Lake Dallas. Station 1 and 2 have a captain, driver, and four firefighters assigned to each of three shifts to staff an engine and medic unit. Station 3 has a captain, driver, and two firefighters assigned on each of three shifts.

The department has a minimum staffing standard of 13 personnel on duty and currently has no shift battalion chiefs. The assistant chief and chief are on call to handle roles in major incidents.

The lack of battalion chiefs means the chief or assistant chief would need to assume command of any incident of significant size, no matter the time of day. For purposes of on-scene command and management, as well as day-to-day oversight of personnel on duty, it would behoove the department to have a battalion chief for each of the three shifts.

Recommendation: The LCFD should consider staffing three command positions, that is, a battalion chief for each squad, to alleviate some demand on the administration, for incident command, and for operations management when the chief is absent for training, vacation, or illness. (Recommendation No. 1.)

The Operations Division is responsible for providing the department's emergency response functions for a wide array of fire, rescue, and emergency medical services. These units are operational 24 hours per day, 7 days a week.

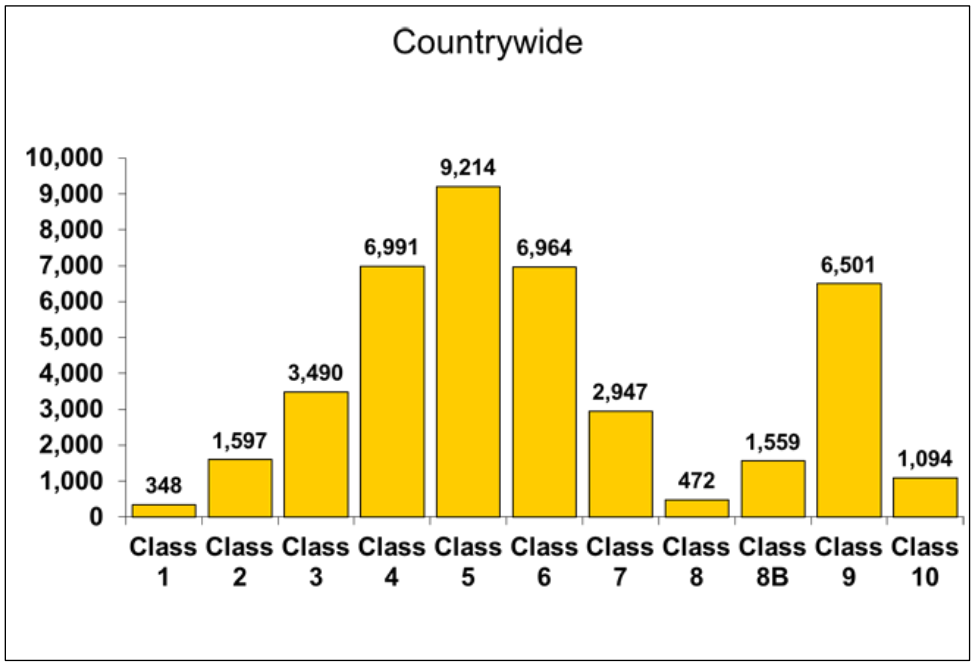
LCFD operates with three-person staffing on each of its engines. The medic vehicles have two-person staffing.

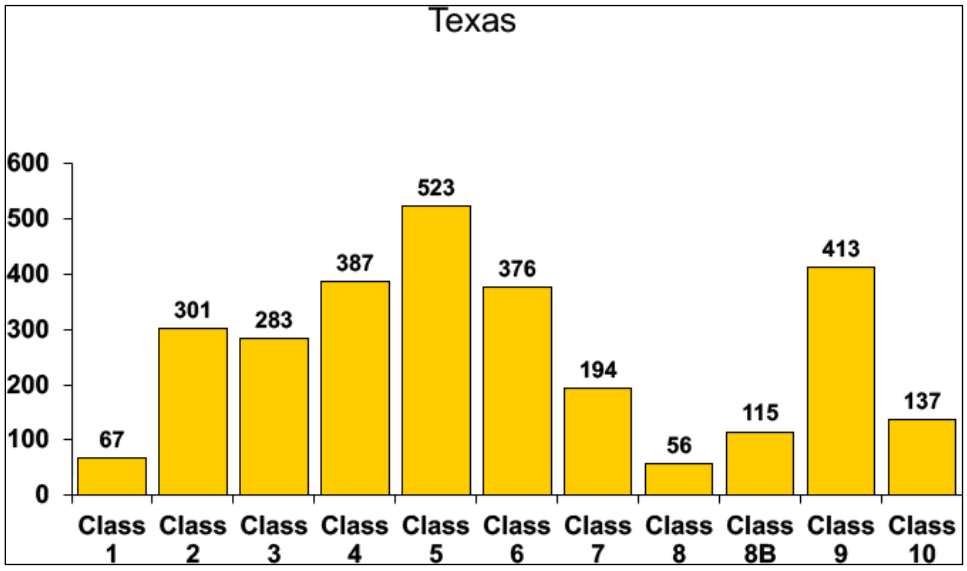
The department provides engine-based advanced life support services on its primary first response apparatus to supplement the two medic units. A third medic unit is planned for station 3 in the future.

The population is aging in parts of the fire district, which will drive calls for service for EMS in the future. Consideration is being given to telemedicine or community paramedicine service delivery through the hospital. CPSM is familiar with other EMS operations in the Dallas area (Medstar, for instance) which generate more than $2 million per year in delivering community paramedicine services while diverting patients from emergency rooms.

The Lake Cities Fire Department was rated a Class 2 rating from the ISO. This is a significant achievement, as only 1,597 departments out of more than 33,000 country-wide have achieved that rating. In Texas, 301 departments have achieved an ISO Class 2 status and only 67 have achieved Class 1 recognition. It is our belief that, with minor changes to training and dispatch, Lake Cities is likely to be able to achieve the Class 1 status in the future.

FIGURE 3-2: Country-wide and Texas State-wide ISO Rankings by Class





Note: LCFD has achieved a Class 2 rank.

STAFFING AND DEPLOYMENT

Individual unit staffing and minimum daily staffing levels are perhaps the most contentious aspects of managing fire operations in the U.S. There are several factors that have fueled the staffing debate. Aside from FAA requirements for minimum staffing levels at commercial airports, ***there are no state or federal requirements for the staffing of structural fire apparatus.*** The U.S. Occupational Safety and Health Administration (OSHA) has issued a standard that has been termed the ***"Two-in-Two-Out"*** provision. This standard affects most public fire departments across the U.S., including the LCFD. Under this standard, firefighters are required to operate in teams (of no fewer than two personnel) when engaged in ***interior structural firefighting.*** The environment in which interior structural firefighting occurs is further described as areas that are immediately dangerous to life or health (an IDLH atmosphere) and subsequently require the use of self-contained breathing apparatus (SCBA). When operating in these conditions, firefighters are required to operate in pairs and they must remain in visual or voice contact with each other and must have at least two other employees located outside the IDLH atmosphere.

This assures that the "***two in***" can monitor each other and assist with equipment failure or entrapment or other hazards, and the "***two out***" can monitor those in the building, initiate a rescue, or call for backup if a problem arises.[1] This standard does not specify staffing on individual apparatus, but rather specifies a required number of personnel be assembled on-scene when individuals are in a hazardous environment. There is, however, a provision within the OSHA standard that allows two personnel to make entry into an IDLH atmosphere without the required two backup personnel outside. This is allowed when they are attempting to rescue a person or persons in the structure before the entire team is assembled.[2]

A second factor that contributes to the staffing debate is the National Fire Protection Agency (NFPA) 1710 publication, *Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire*

1. OSHA-Respiratory Protection Standard, 29CFR-1910.134(g)(4).
2. Ibid, Note 2 to paragraph (g).

Departments (2016 Edition Sec., 5.2.1.). This standard specifies that the staffing level on responding engine and ladder companies be established at **a minimum of four on-duty personnel**. Unlike the OSHA guideline, which is a mandatory provision, the ***NFPA 1710 guideline is advisory***, meaning that communities (including Lake Cities) are not required to adhere to this NFPA guideline. NFPA 1710 also provides guidance regarding staffing levels for units responding to EMS incidents; however, the provision is less specific and does not specify a minimum staffing level for EMS response units. Instead, the standard states; "*EMS staffing requirements shall be based on the minimum levels needed to provide patient care and member safety.*"[3] The difficulty that many agencies have is the co-utilization of fire companies and EMS companies in responding to both fire and EMS calls. Working fires involving hazardous environments are labor intensive and more personnel are needed to effectively manage these incidents. EMS calls are typically managed with fewer personnel, and the majority of EMS calls can be handled with a single rescue company of two fire personnel. In the call-screening process, those calls that require additional personnel are typically identified at the dispatch level and additional personnel can be assigned when needed.

LCFD operates three primary fire suppression companies that are staffed daily. In addition, there are two, two-person medic vehicles, and a third is anticipated at the new central station.

The ability to communicate work assignments, conduct training sessions, discuss new program initiatives, or merely to update employees on departmental programs or the strategic direction of the organization requires ongoing outreach, specifically from the fire chief, chief officers, and training instructors in the organization.

Lake Cities is linking all of its stations and headquarters with the latest technology to improve communication and improve the opportunity to train together. There are a number of communication tools currently available that can be used to conduct video conference calls, training sessions, and information exchanges among multiple work settings (for example, see GoTo Meeting™, WebEX™, Skype for Business™, and AnyMeeting™, etc.). These tools are inexpensive and, in some cases, once the initial software is purchased, there are no recurring charges. CPSM believes that the LCFD would benefit greatly from an expanded information exchange, which may continue to eliminate conflicts with paying cities by including city managers in training and briefing opportunities.

> ***Recommendation: The LCFD should institute an internet-based video conferencing system to facilitate regular meeting forums (daily/weekly/monthly), to discuss departmental initiatives and new directives, and enable remote training delivery sessions by chief officers and support personnel. City managers should be included in these briefings (unless restricted due to medical issues). This may continue improving the feeling of ownership in the organization. (Recommendation No. 2.)***

The ability to discuss key department issues along with training sessions is critical to organizational effectiveness and operational readiness. An online delivery forum would enable real-time discussions, question and answer sessions, and the capability to record these meetings and training sessions for review at a later time.

Essential to the sustainability of any organization is the concept of career development and professional growth of the workforce. Fire service organizations are extremely regimented in the oversight of personnel issues. As is the case in Lake Cities, these processes are guided by public

3. (NFPA) 1710, *Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments* (2016 Edition Sec., 5.3.32.).

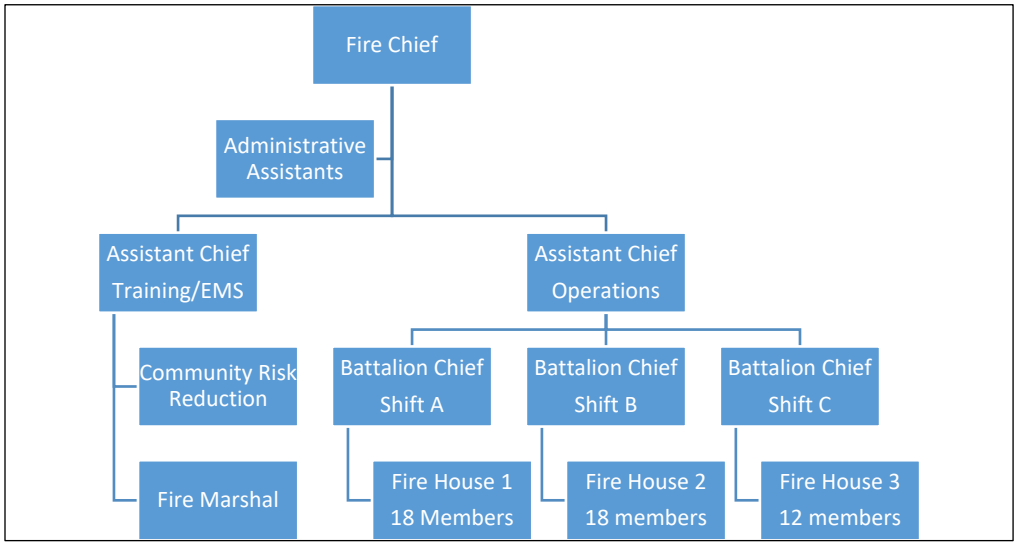
personnel guidelines. The fire service promotional process is very competitive, yet it provides an opportunity to develop individual skills and to institute organizational philosophies. The ability to direct the learning effort in developing the needed skill sets is a key function that can be orchestrated through the promotional testing process. This factor is essential in the development of the future workforce and in creating or perhaps changing the culture of an organization. In the promotional and testing process, management has the ability to identify and utilize the source materials for testing and to establish the prerequisite training criteria for promotional eligibility. It is very important the department have the ability to establish prerequisites that include components such as college coursework, associate's and bachelor's degrees, specific training certifications, project management experience, and fitness and performance appraisal achievements.

The LCFD promotional process is an example of best practice. The training program, largely the work of the Fire Chief, is one of the best that CPSM has seen from a department the size of LCFD. A "coffee table training" guide ensures that training is done throughout the department in a uniform basis. Topics that have been delivered are easily searchable for refresher training or regular updating. The Chief is to be commended and the cities should take great pride in his efforts. CPSM is, however, concerned that so many demands are being placed on existing administration that burnout could occur. The administration for the department is flat and in the long-term that is not sustainable. For that reason, CPSM concurs with filling the vacant command position.

Recommendation: The LCFD should expand its excellent training program so as to establish a professional development program for all personnel interested in seeking administrative positions. This could be done in conjunction with a local college. It could also be expanded to a succession planning program for the department. (Recommendation No. 3.)

Recommendation: CPSM concurs in filling the vacant EMS position. (Recommendation No. 4.)

FIGURE 3-3: Lake Cities Proposed Table of Organization



FIRE STATION FACILITIES

Fire department capital facilities are exposed to some of the most intense and demanding uses of any public local government facility, as they are occupied and in use 24 hours a day and 7 days a week.[4] The Lake Cities Fire Department operates out of three fire stations. Two stations are relatively new and the third is owned by the City of Lake Dallas.

The LCFD serves an estimated population of approximately 35,000 people. Corinth's population of 22,000 is expected to increase to approximately 35,000; a new downtown center is being proposed that would be serviced from the most recently opened station.

In an FY 2011 Data Report, the International City/County Management Association (ICMA) tabulated survey information from 34 municipalities with populations greater than 100,000 people. In this grouping the average fire station service area was 13.1 square miles.[5] The median service area for this grouping was 7.17 square miles per fire station.[6]

TABLE 3-1: Lake Cities 90th Percentile Response Performance, by Jurisdiction

Location	Call Type	Dispatch	Turnout	Travel	Total	Number of Calls
Corinth	EMS	1.3	2.9	6.8	9.6	943
	Fire	1.8	2.8	8.0	11.3	258
	Total	**1.4**	**2.9**	**7.1**	**10.0**	**1,201**
Lake Dallas	EMS	1.4	2.9	6.9	9.7	488
	Fire	1.4	2.7	8.5	11.8	96
	Total	**1.4**	**2.8**	**7.2**	**9.8**	**584**
Hickory Creek	EMS	1.3	2.7	8.0	10.8	228
	Fire	1.7	2.8	9.8	12.7	89
	Total	**1.4**	**2.8**	**8.4**	**11.5**	**317**
Shady Shores	EMS	1.0	2.5	7.4	10.6	80
	Fire	1.4	2.6	9.4	12.4	35
	Total	**1.1**	**2.6**	**8.7**	**11.5**	**115**
Denton County	EMS	1.1	2.6	8.3	11.3	30
	Fire	0.9	2.9	7.8	10.9	15
	Total	**1.1**	**2.9**	**8.3**	**11.3**	**45**
Total		**1.4**	**2.8**	**7.5**	**10.3**	**2,262**

Table 3-1 shows the existing stations and the 90th percentile performance measures. Due to a narrow road network and irregular lakefront areas, the travel times shown are higher than the benchmarks developed by NFPA and ISO. However, in interview, the city managers of the involved jurisdictions indicated that the risk of somewhat longer travel times was acceptable to the communities.

The NFPA and ISO have established different indices in determining fire station distribution. The ISO Fire Suppression Rating Schedule, Section 560, indicates that first-due engine companies

4. Compton and Granito, eds., *Managing Fire and Rescue Services*, 219.
5. *Comparative Performance Measurement*, FY 2011 Data Report - Fire and EMS, ICMA Center for Performance Measurement, August 2012.
6. Ibid.

should serve areas that are within a 1.5-mile travel distance.[7] The placement of fire stations that achieves this type of separation creates service areas that are approximately 4.5 square miles in size, depending on the road network and other geographical barriers (rivers, lakes, railroads, limited access highways, etc.). The National Fire Protection Association (NFPA) references the placement of fire stations in an indirect way. It recommends that fire stations be placed in a distribution that achieves the desired minimum response times. NFPA Standard 1710, Section 5.2.4.1.1, suggests an engine placement that achieves a 240-second (four-minute) travel time.[8] Using an empirical model called the "piece-wise linear travel time function" the Rand Institute has estimated that the average emergency response speed for fire apparatus is 35 mph. At this speed the distance a fire engine can travel in four minutes is approximately 1.97 miles.[9] A polygon based on a 1.97-mile travel distance results in a service area that on average is 7.3 square miles.[10]

The current LCFD fire stations are well-placed for the populations and risks served. Staffing the new station 3 will reduce demand on the other two stations and improve response times. Each of the three stations covers approximately 6.03 square miles, which is a smaller area than the NGPA recommendation and the median service area as measured by ICMA. One challenge for Lake Cities is the narrow road networks and irregular shapes of the shoreline areas. There are no wide grid pattern routes from which all parts of the fire district can be accessed. In addition, one of the risks that the department must respond to are waterfront incidents; apparently, a fuel leak call on waterfront resulted in some dissatisfaction on how it was handled.

Fire and EMS services are extremely labor intensive. Typically, the overwhelming share of annual operating expenses are primarily attributable to personnel costs. In many systems it is not uncommon to see personnel costs account for as much as 85 to 90 percent of the annual budget expenditures. For this reason, fire departments will not deploy additional resources (new fire stations, new apparatus, and the consequent needed staffing) until the actual service demand exists. Unlike public water utilities, sewer systems, and transportation networks, where it is cost effective to develop this infrastructure prior to development, fire and EMS service enhancements are best established after growth has occurred and the service demand actually exists.

Fire service demand is very predictable. In many systems, this demand is a by-product of population growth, the transportation network, and service demand generators related to commerce, institutions, and tourist attractions. Another important point when considering the expansion of the service network is that the increase in additional call volume is typically very gradual and can be tracked or monitored sufficiently to allow for a more orderly expansion of the service network. As subdivisions are built and commercial markets are developed, the activities involved in responding to calls gradually trail the growth of these alarm generators. Monitoring response activities provides ample lead time to develop funding, construct new facilities, and deploy the needed resources. The only real difficulty in meeting future service expansion is when there is a rapid and block-type service increase associated with the assumption of service responsibilities from an existing development, as which typically occurs when there is an annexation or an addition of a contract service arrangement with a

7. Insurance Services Office. (2003.) Fire Protection Rating Schedule (edition 02-02). Jersey City, NJ: Insurance Services Office (ISO).
8. National Fire Protection Association. (2010). NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*. Boston, MA: National Fire Protection Association.
9. University of Tennessee Municipal Technical Advisory Service, "Clinton Fire Location Station Study," Knoxville, TN, November 2012. p. 8.
10. Ibid. p. 9.

developed community or service district. Even in these scenarios, there is ample lead time to arrange temporary quartering or deployment strategies until the permanent infrastructure and staffing can be established.

FIGURE 3-4: Lake Cities Stations

Stations are designed to adequately house apparatus and necessary equipment. Typically, new fire stations have an anticipated service life of 50 years. However, we note that in many jurisdictions older facilities are being replaced in a 30- to 35-year time frame. In most cases, facilities require replacement because of their size constraints, a need to relocate the facility to better serve changing population centers, the absence of needed safety features or service accommodations, and the general age and deterioration of the facility.

Stations 2 and 3 are well-designed and can handle additional resource deployment. Station 1 is limited in size. According to personnel interviewed, many deferred housekeeping needs have now been completed in Station 1.

APPARATUS AND FLEET MANAGEMENT

Fire departments utilize a wide range of fire apparatus, along with tools and equipment, in carrying out their core mission. Apparatus generally includes emergency response vehicles such as engines, tenders/tankers (water supply vehicles), aerial apparatus (ladders), quints, rescue vehicles/squads, and ambulances. There are also specialized apparatus including wildland engines and off-road vehicles, along with watercraft that are typically part of the emergency fleet. Trailers are utilized to carry specialized equipment when needed. These include hazardous materials response/equipment, decontamination devices and diking materials, structural collapse equipment, portable air filling stations, scene lighting, foam units, and mass casualty incident supplies. In addition, a wide range of utility vehicles including command vehicles and emergency communications units, staff vehicles, and maintenance trucks can be part of the fleet.

The mission, duties, demographics, geography, and construction features within the community all play a major role in the makeup of the apparatus and equipment inventory utilized. These factors, as well as the funding available, must be taken into consideration when specifying and purchasing apparatus and equipment. Every effort should be made to make new apparatus as versatile, safe, and multifunctional/capable as is possible as well as practical.

Apparatus maintenance is also an integral part of any fire department, and is invariably a key component in keeping such large ticket items as apparatus running and extending their usefulness. It takes a big chunk of a city's budget to purchase and subsequently maintain a fire department fleet. As fleets age, it is logical and sound planning to conclude that repairs and costs will increase exponentially. There are two proven ways to mitigate the long-term and short-term costs associated with repairs and replacements. The primary way is to have a sound, dedicated preventive maintenance (PM) program that is on a regular cycle for each vehicle in a department's fleet. PM should be a sacrosanct practice and unwavering. This strategy not only saves money but saves lives as well by keeping the number of viable fleet apparatus ready to respond to emergencies and accident free. The other method is to have a realistic capital improvement plan (CIP) to acquire new apparatus when an existing vehicle has outlived its usefulness. NFPA 1911, which sets standards for *Guidelines for First-Line and Reserve Fire Apparatus*, has changed and adapted over the years to reflect the changes in industry standards, but on one thing it has been wholly consistent:

> *"…it is imperative that all fire apparatus be checked and maintained regularly to ensure that they are reliable and safe to use. The manufacturer's instructions should always be followed when maintaining the fire apparatus."*

The standard further states:

> *"In the fire service there are fire apparatus with 8 to 10 years of service that are simply worn out. There is also fire apparatus that were manufactured with quality components, that have had excellent maintenance, and that have responded to a minimum number of incidents that are still in serviceable condition after 20 years. …the quality and timelessness of maintenance are perhaps the most significant factors in determining how well a fire apparatus ages.*

NFPA Standard 1915 addresses the minimum expectations for a comprehensive PM program. The benefits of implementing a PM program in compliance with NFPA 1915 are many. First, maintaining a vehicle is less expensive than repairing it. Second, vehicles that undergo PM on a dedicated schedule are more likely to have a longer life span. Third, PM reduces the time that a vehicle is unavailable for use in the community by reducing the chances that it will need repairs that take it out of service for a lengthy period of time. Finally, demonstrating adherence to an NFPA 1915-compliant PM program reduces the chance of a maintenance-related untoward event and possible resulting lawsuits.

The LCFD fleet is outstanding. The standard rolling stock—pickups, SUVs, and standard truck chassis—are leased through Enterprise. Many communities use the leasing option to keep current on these types of vehicles. The cost of leasing is normally less compared to purchasing and helps to lessen shocks to the budget when multiple vehicles must be replaced. Leasing provides current vehicles that meet all of today's standards and also helps to avoid costly repairs that are usually encountered as vehicles age. For vehicles that experience repeated maintenance issues, leased vehicles can be returned and replaced by new without penalty.

It is for these reasons that the public sector is also now leasing heavy rolling stock—ladder trucks, engines, and quints. Leasing companies (some affiliated with banks and some with

manufacturers) provide the heavy stock and charge a lower yearly lease payment than could be financed. The heavy equipment must have routine maintenance performed and certified by the department/jurisdiction, but after a contracted-for period (usually five or seven years), the equipment is exchanged for new. This, again, avoids the large expenditures that can quickly consume a maintenance budget when the heavy stock ages. Communities then have the most recent equipment with improved safety features, the cost is less than financing a purchase, large shocks to the budget are avoided, and the older equipment can be resold to departments that could not otherwise afford new. Purchase costs for heavy stock are significant and rising. An engine can cost from $500,000 to $800,000 (depending on make, manufacturer, and other specialization). Ladder trucks can cost approximately $1.3 million. Avoiding these one-time shocks to the budget is desirable. Having all rolling stock needing replacement in a short period of time or finding that the rolling stock cannot be used due to maintenance issues are not desirable situations, and would impact the outcomes that could be expected from fire departments.

It should be noted that the most recent LCFD engine purchase was under budget after the specifications were shopped to various manufacturers. The cost savings demonstrated the value of having specific requirements and a management team focused on delivering the best equipment at the best value for the department and its participating cities.

The LCFD fleet is services regularly; the rolling stock of the department is in excellent condition as a result. Most of the work is performed in a well-designed, small shop on department grounds. Two firefighters work on the equipment regularly and the captain performs all preventive maintenance. Equipment used to be taken out to dealers or other locations; having the work done in-house places the equipment first in line and ensures that quality issues are being addressed. A third party is contracted for ladder and pump tests.

The city purchased a computer diagnostic system, which has aided in ensuring issues are addressed in maintenance in a cost-effective manner. CPSM reviewed documentation that showed the investment in this system will easily pay for itself; also, it has reduced the need to take equipment out for service. Performing the work in house eliminates the cost of transporting equipment to a dealer (usually requiring a second employee to return the first to the department), the loss of equipment while out to service, and then retrieving the equipment.

The fleet manager spends approximately one full day, once per week, off shift and on overtime to address all of the service demands. However, this is at far less than a full-time, dedicated employee or transferring the work out of the department. Note that it may be necessary to factor these duties into succession planning to continue this service into the future.

NFPA 1901, *Standard for Automotive Fire Apparatus*, 2016 edition, serves as a guide to the manufacturers that build fire apparatus and the fire departments that purchase them. The document is updated every five years, using input from the public/stakeholders through a formal review process. The committee membership is made up of representatives from the fire service, manufacturers, consultants, and special interest groups. The committee monitors various issues and problems that occur with fire apparatus and attempts to develop standards that address those issues. Of primary interest to the committee over the past years has been improving firefighter safety and reducing fire apparatus accidents.

The Annex Material in NFPA 1901 contains recommendations and work sheets to assist in decision making in vehicle purchasing. With respect to recommended vehicle service life, the following excerpt is noteworthy:

"It is recommended that apparatus greater than 15 years old that have been properly maintained and that are still in serviceable condition be placed in reserve status and upgraded in accordance with NFPA 1912, Standard for Fire Apparatus Refurbishing, to incorporate as many features as possible of the current fire apparatus standard. This will ensure that, while the apparatus might not totally comply with the current edition of the automotive fire apparatus standards, many improvements and upgrades required by the recent versions of the standards are available to the firefighters who use the apparatus."[11]

"Apparatus that were not manufactured to the applicable apparatus standards or that are over 25 years old should be replaced."[12]

In a 2004 survey of 360 fire departments in urban, suburban, and rural settings across the nation, Pierce Manufacturing reported on the average life expectancy for fire pumpers.[13] The results are shown in Table 3-2.

TABLE 3-2: Fire Pumper Life Expectancy by Type of Jurisdiction

Demographic	First-Line Service	Annual Miles Driven	Reserve Status	Total Years of Service
Urban	15 Years	7,629	10 Years	25
Suburban	16 Years	4,992	11 Years	27
Rural	18 years	3,034	14 Years	32

Note: Survey information was developed by Added Value Inc. for Pierce Manufacturing in, "Fire Apparatus Duty Cycle White Paper," Fire Apparatus Manufacturer's Association (FAMA), August 2004.

Through its leasing program and regular vehicle replacement, LCFD easily meets the recommended standards and is well-positioned for the future. Because of the leasing program, major purchases do not shock the budget. The program used in LCFD is exemplary and could be recognized as a best practice.

Capital Equipment

Fire apparatus are equipped with various types of tools and equipment that are utilized in providing fire and EMS services. Many of the tools and much of the equipment carried on fire apparatus are specified in NFPA and ISO guidelines. Fire and EMS equipment includes such items as hose, couplings, nozzles, various types of ladders, foam, scene lighting, oxygen tanks, AEDs, defibrillators, stretchers, small hand tools, fire extinguishers, mobile and portable radios, salvage covers, and medical equipment and supplies. Many of the small tools and equipment are considered disposable items and are replaced with ongoing operating funds. However, some pieces of equipment are very expensive, and thus require planning for their useful life and replacement. The more expensive capital items include:

- Self-contained breathing apparatus (SCBA) and fill stations.
- Firefighting PPE (personal protective equipment).
- Hydraulic/pneumatic extrication equipment.
- ECG Monitors/Defibrillators/AEDs.

[11] NFPA 1901, *Standard for Automotive Fire Apparatus*, 2016 Edition. Quincy, MA.
[12] NFPA 1901, *Standard for Automotive Fire Apparatus*, 2016 Edition. Quincy, MA.
[13] "Fire Apparatus Duty Cycle White Paper," Fire Apparatus Manufacturer's Association. August 2004.

- Ambulance stretchers.
- Thermal imaging cameras.
- Mobile/portable and base radios.
- Mobile data computers.
- Gas monitoring and detection devices.
- Watercraft/boats/outboard motors.

Much of the more expensive capital equipment is generally on a ten-year replacement cycle. Each new apparatus is equipped with a complement of capital equipment that has an estimated cost of nearly $200,000.

All personnel are issued two sets of gear, which is a recognized best practice, as it can help to minimize the chance of exposure to carcinogens and other pathogens that may affect the long-term health of staff. A third-party provider collects, inspects, and cleans the gear twice a year and there are extractors at each station to further help minimize exposures.

RADIO INTEROPERABILITY AND COVERAGE

In general, interoperability refers to seamless radio communications between emergency responders using different communication systems or products. Wireless communication interoperability is the specific ability of emergency responders to use voice and data communication in real time, without delay. For example, police, fire, and EMS responding to an incident are interoperable when all can communicate with one another over individual and perhaps shared communication channels. Interoperability enables first responders from any jurisdiction to communicate with one another at larger incidents and also enables emergency planners and personnel to coordinate their radio operations in advance of major events.[14]

One issue that was raised during interviews with the various cities was interoperability between police and fire. An incident was discussed with the CPSM team that involved possible communication difficulties at a festival event. The after-action review conducted by the LCFD and verified by CPSM was that the police operated on one frequency and the fire on another assigned frequency. However, the existing system has more than 25 frequencies available for use on special events or other incidents. In order to access other frequencies, they should be identified in pre-incident planning. That has taken place and the situation is unlikely to repeat.

The existing system not only has more than 25 channels available for incidents, there exists the capability of using additional state channels. However, this has to be planned and an all-hazard, all-incident communications annex should be developed for all agencies. All festivals or special events should identify common channels that will be used and those should be established prior to any event.

> ***Recommendation: Prior to any anticipated, large public event, the fire and police departments should identify a common radio communications channel to be utilized for interoperability during the event. (Recommendation No. 5.)***

14. SAFECOM, U.S. Department of Homeland Security, "Interoperability," http://www.safecomprogram.gov/SAFECOM/interoperability/default.htm.

SECTION 4. FINANCE

BUDGET AND COSTS

The cost of providing fire and EMS protection in many communities has increased steadily in recent years. This has been fueled in part by rising wages, additional special pay, and escalating overtime costs. In addition, funding requirements have been compounded by increasing health insurance premiums and spiraling pension contributions. In Texas, tax capture limitations affect the funding available for fire department operations.

The City of Corinth collects less sales tax for its size than surrounding comparable cities, although this may change when the proposed downtown district is completed, but that will be in the future. As a result, many jurisdictions are asking the fundamental question of whether the level of risk in their jurisdiction is commensurate with the type of protective force that is being deployed. To this end, a fire risk and hazard analysis can be helpful in providing a more objective assessment of a community's level of risk.

In 2015, the City of Corinth began a budget process called "Service Level Based" budgeting. Like other terms such as "Zero-Based Budgeting" or "Priority-Based Budgeting," the new budget process requires departments to evaluate what services are mandated and at what minimum levels. Evaluating all facets of city operations forces departments to remove silos that had been created over years and enables them to add programs only when funds are available, and with specified program outcomes.

From that "zero" basis, the fire department has expanded but at a sustainable rate. Core services have been identified and can be protected during downturns while additional optional services can be eliminated should the need arise. Funding and expenses are looked at on a five-year basis. The fire department has operated within its budget, and overtime has been reduced.

By removing silos, the LCFD has been able to more fully utilize the services of the HR and finance departments for the city rather than create additional and duplicative operations. Key to the success of such an endeavor is communication between and among all stakeholders, and CPSM found all departments are communicating regularly and thus achieving specified, successful outcomes.

An issue was raised by the participating contract cities that the use of leases for equipment results in the department having "Cadillacs" while "Pintos" may be acceptable. As discussed in earlier sections, the process of leasing vehicles used by Corinth for the Lake Cities Fire Department is a best practice. Engines and ladders are on a seven-year capital financing cycle, ambulances on a five-year lease-purchase arrangement, and standard trucks on a five-year leases through Enterprise. In its entirety, the practices in place help to avoid major shocks to the budget when specialized equipment has to be replaced; the practices also ensure that all stock is deployed and available. Coupled with the cost-effective fleet management largely done by in-house personnel, the process is one that is sustainable and could be identified as a best practice.

The leasing of vehicles has been shown to be less costly than purchasing. Many communities are now leasing their rolling stock to avoid the cost of major repairs that occur five to seven years after purchase and to keep their emergency vehicle fleet in peak readiness condition. Firms like Enterprise are able to purchase in bulk and pass the savings onto their customers. The leasing

flattens out the budgetary demands. CPSM has reviewed communities that attempt to keep stock longer only to find that repairs increase with age, dependability decreases, and there is little value in the equipment when disposed of.

Discussions have been and are taking place on financing the department into the future. The opening of station 3 and the possibility of a third medic unit will add approximately $1 million to the overall budget costs. A SAFER grant will fund positions in the short-term but in the long-term the department's operating costs will increase. Corinth currently pays 57 percent of the cost of the Lake Cities Fire Department; Lake Dallas pays 22 percent; Hickory Creek, 15 percent; and Shady Shores, 6 percent. As discussed earlier, several of the communities are largely residential and will likely remain that way.

During interviews with contract cities in the current department, concern was expressed about the cost of service. CPSM recently worked with several other cities that were looking at breaking away from decades-old service districts and starting their own departments. CPSM reviewed the existing distribution formulas and total amounts contributed by the various communities that make up the Lake Cities Fire Department. The existing formula results in participating communities paying less than comparable cities pay for just fire operations while still having a department that is capable of producing a full deployment force from on-duty staffing. An independent department in any one of the current participating jurisdictions would most likely have to depend on mutual and automatic aid from other departments to field a full deployment force.

The lowest-cost provision of fire service is usually delivered by volunteer departments. Costs are minimized because there is no payroll. However, today a volunteer department is in a constant battle to retain staffing and volunteers are becoming more difficult to depend upon because of time commitments. The cost of on-boarding volunteers can be considerable because of the need to have many more sets of personal protective equipment, some which is rarely, if ever, used. Volunteer departments are not successful in communities that have populations which migrate out to work. Volunteer departments are particularly ill-suited for handling the growing role of EMS calls for service because time is critical to successful outcomes and volunteers cannot respond quickly enough.

Paid-on-call staffing is usually the next step up in dependability, particularly to ensure scheduled staff are available during daytime hours. The paid-on-call staff model usually avoids the legacy costs associated with career departments, although a number of POC departments have formed unions or associations that bargain for other benefits. Some states have also stepped in to ensure the continued availability of POC by setting minimums for health, retirement, and other benefits.

Career fire departments are usually the costliest, driven by salary, wages, and benefits. This is true in Lake Cities, where wages and benefits accounted for $4,735,640 of the $5,937,279 budget in 2017-18. That total budget number is expected to rise to $5,573,230 in 2018-19 with the opening of station 3 (although with SAFER funding, the projection is $5,064,231).

If the Lake Cities Fire Department were to dissolve, administrative costs would likely not be reduced and could in fact double, triple, or quadruple collectively for the jurisdictions—depending on how divided responsibilities became. CPSM has usually recognized the opportunities that mergers provide for departments and which are lost when departments divide. When departments divide into smaller units, administrative costs are duplicated, promotional opportunities and specialization are reduced or eliminated, support services may not be in place to support increases in demand by adding staff, and the labor market may not be conducive to bringing on new hires.

CPSM has been working with a national research group on how to attract and retain volunteer firefighters in the United States. The situation is grim in many parts of the country because the demands of training and deployment often exceed the availability of time by many volunteers. In Pennsylvania, as was noted earlier, 300,000 volunteers used to staff fire departments; today that number is under 50,000. Paid-on-call staff usually are full-time firefighters in a nearby career department and pull available POC shifts to supplement their income. However, some jurisdictions with career departments are now capping the numbers of hours that their staff may work in a POC department, which reduces the availability for filling shifts. In many parts of the country, bidding wars have taken place to fill POC shifts, which has increased the costs of operation. It is not uncommon to see "help wanted – POC" banners in the front yards of many fire stations across the country.

Against that backdrop, CPSM looked at the existing funding split for the Lake Cities Fire Department. The current formula used to determine costs is based on call volume and assessed valuation of the communities, as illustrated in the following table.

TABLE 4-1: LCFD Cost Allocation Calculations

Lake Cities Services Agreement
2016 Allocation Percentages

	2011	2012	2013	2014	2015	2015 % Only	5 Year Average
Calls							
Corinth	1,226	1,234	1,446	1,554	1,705	56.9%	55.1%
Hickory Creek	296	303	400	345	390	13.0%	13.3%
Lake Dallas	582	672	672	758	747	24.9%	26.4%
Shady Shores	132	109	130	142	157	5.2%	5.2%
	2,236	2,318	2,648	2,799	2,999	100%	100%
Population							
Corinth					19,926	59.5%	59.5%
Hickory Creek					3,750	11.2%	11.2%
Lake Dallas					7,300	21.8%	21.8%
Shady Shores					2,500	7.5%	7.5%
					33,476	100%	100%
Assessed Valuation							
Corinth	1,390,506,929	1,393,698,516	1,428,952,690	1,538,127,064	1,638,520,892	61.8%	62.1%
Hickory Creek	302,866,187	302,445,569	314,860,613	347,620,645	392,362,715	14.8%	14.0%
Lake Dallas	334,005,790	329,085,692	338,010,097	356,162,311	376,064,041	14.2%	14.6%
Shady Shores	208,576,513	209,890,906	217,419,641	229,470,127	245,823,065	9.3%	9.3%
	2,235,955,419	2,235,120,683	2,299,243,041	2,471,380,147	2,652,770,713	100%	100%

	Current	2015 % Only	5 YR Average
Corinth	59.50%	59.38%	58.92%
Hickory Creek	12.70%	13.00%	12.83%
Lake Dallas	21.30%	20.30%	20.92%
Shady Shores	6.50%	7.32%	7.32%
	100.00%	100.00%	100.00%

CPSM looked at the existing split and compared it to known costs of other models that could be considered for service delivery in the Lake Cities. One question that was made of CPSM during interviews with elected and appointed officials was on the question of "cheaper."

A volunteer department may be cheaper to operate than the career-staffed model currently used. However, the start-up costs are likely far more than that of continued participation in the LCFD. As well, the volunteer staffing model is likely to reflect poorly when evaluated by the ISO,

which has awarded a Class 2 grade to the LCFD. Unless equivalent staffing could be demonstrated (one volunteer equates to one-half of a career paramedic/firefighter), the ISO rating is likely to be downgraded, which can affect the insurance costs paid by business and residential property owners. Thus, the current 53 staff would require nearly 100 volunteers for an equivalency; that level of volunteer participation is unlikely in even generational fire departments that have long relied on the volunteer model.

As discussed, the volunteer model is the model least suited to EMS delivery. It is unlikely the medical control director will advocate for a reduction in service level. Time is critical to successful outcome on emergency medical calls; for example, for a sudden cardiac arrest (SCA) patient, the recognized level of intervention required is set at 10 minutes. In other words, if some type of intervention does not take place within 10 minutes (bystander CPR, AED, etc.), the likelihood of a successful outcome is near zero.

CPSM recently worked with a small, one-station, paid-on-call department on creating its own system. The department does not provide any EMS services and is limited to fire-only response. The budget follows. In order to move from paid-on-call ($12 per hour and 30 firefighters) to two full-time staff 24/7/365, the cost would increase by more than $1 million per year. Thus, having fire depend on paid-on-call and EMS using a career model increases the budget that follows by nearly $1 million. It also anticipated that HR, finance, and other support services would be provided by existing city departments at no additional costs.

It is our conclusion that, based on the actual budget models versus what is charged under the formulas developed for LCFD, the current service delivery costs are efficient, highly effective, and provide one of the safest service levels for the cost involved.

Modern fire deployment today also takes into account a third factor—risk. While the populations and valuations can be similar between two communities, if one contains a high-risk facility (such as manufacturing plant or storage facility with hazardous materials, a nuclear power plant, senior citizen critical care facility), the deployment necessary to contain a situation will be far more costly.

An incident was cited during community interviews of a fuel leak on the waterfront. While the Lake Cities Fire Department did not at the time have the capability to handle the incident, mutual aid was called and mitigated the incident.

Such unusual risks must be planned with an All-Hazard Community Risk Assessment. Such an assessment is required for accreditation and involves evaluating all properties and risks in each community. The new software being implemented for the fire department that is created by Emergency Reporting can include a module for creating an all-hazard risk assessment.

For risks that exceed the capabilities of the department, such as hazmat, contracts can be pre-negotiated for response when needed. This avoids training, equipping, and staffing for incidents that occur very infrequently.

TABLE 4-2: Costs of a One-Station, Paid-on-call (POC), Fire-Only Department

	Start-up	Lake Cities	Stand-alone 2021	Stand-alone 2022	Stand-alone 2023
Turnout gear	100000				4000
Vehicle rental	80000		80000	80000	80000
Other equipment	140000		130000	130000	130000
Salary & benefits FT (chief)	60000		60000	62000	64000
Salary & benefits POC	233600		233600	233600	233600
Salary & benefits calls for service	32000		32000	32000	32000
Salary and benefits OT	39000		29000	29000	29000
Cleaning					
Station improvements	40000				
Social security			14000	15000	16000
Dental plan			2105	2210	1400
Hospitalization			17270	18130	19030
Life insurance			1070	1150	1230
Full-time pension			9000	9200	9500
Part-time pension			4500	4500	4500
Office/cleaning supplies			4000	4000	4000
Uniforms and cleaning	12000		4000	4000	4000
Gas and oil			6000	6000	6000
Operating supplies			3000	3000	3000
Medical supplies and training	12000		3500	3500	3500
Radio equipment	15000		5000	5000	5000
Fire contractual services					
Legal fees			40000	20000	10000
Professional reports					
Telephones			6000	6000	6000
Conferences			6000	6000	6000
Fire prevention			2000	54000	56000
Contract janitorial			3000	3000	3000
Insurance			5000	5000	5000
Utilities			15000	15000	15000
Building maintenance			5000	5000	5000
Equipment maintenance			7000	8000	8500
Memberships			2500	2500	2500
Training			25600	14000	14000
Cost totals					
(Lake Dallas)		978000			1
(Hickory Creek)	$691,600	613633	$683,145	$708,790	$708,760
(Shady Shores)		313952			

Notes:
-Vehicles would be leased on five-year turn-back. Vehicle rental anticipates one reserve engine and one engine/rescue.
-Five sets of turnout gear would be purchased each year beginning in 2025 to regularly replace without major purchases.
-Assumes adding two new POC each year and adding turnout gear for them.
-Other equipment would include breathing apparatus, hose, assorted tools, fans.
-A chief in charge of fire would be FT.
-Consideration might be given to a detective/fire marshal position, which would lead fire prevention, inspection, etc. Cost $100,000 @ year.
-At start-up, two POC would identified to respond to station 24/7/365.
-POC would be paid $16.00 per hour. Rates across the country are $12.00 to $22.00.
-OT salary and wages at start-up would be for training police/DPW at overtime rates as well as regular hourly rates.
-Turn-out gear would be 25 sets of turnout gear for FT and POC.

If the cost of the paid-on-call or POC department were comparable with the service delivery now provided by Lake Cities, the salary and wages for POC would reduce by $233,600, but the salary and wages for full-time would increase by $1.34 million. A full-time department would also require quadrupling the cost of administration (line 4), since the POC would be irregularly staffing the station by command.

If the scenario was to staff an all-volunteer department, the cost of line 5 could be eliminated in part, but deployment of an ambulance using volunteers is difficult, if not impossible. The quality of care, patient outcomes, and performance would likely not meet medical standards.

DEPLOYING USING RISK

Regardless of whether the Lake Cities Fire Department retains all current jurisdiction members or separates, an all-hazard risk assessment utilizing a "fire risk score" should be created. This is a rating of an individual property on the basis of several factors, including:

- Needed fire flow if a fire were to occur.
- Probability of an occurrence based on historical events.
- The consequence of an incident in that occupancy (to both occupants and responders).
- The cumulative effect of these occupancies and their concentration in the community.

A community risk and vulnerability assessment is used to evaluate community properties and assign an associated risk as either a high-, medium-, or low-hazard. The NFPA *Fire Protection Handbook* defines these hazards as:

> **High-hazard occupancies:** Schools, hospitals, nursing homes, explosive plants, refineries, high-rise buildings, and other high life-hazard or large fire-potential occupancies.
>
> **Medium-hazard occupancies:** Apartments, offices, and mercantile and industrial occupancies not normally requiring extensive rescue by firefighting forces.
>
> **Low-hazard occupancies:** One-, two-, or three-family dwellings and scattered small business and industrial occupancies. [15]

15. Cote, Grant, Hall & Solomon, eds., *Fire Protection Handbook* (Quincy, MA: NFPA 2008), 12.

Plotting the rated properties on a map provides a better understanding of how the response matrix and staffing patterns can be used to ensure a higher concentration of resources for worst-case scenarios or, conversely, fewer resources for lower levels of risk.[16]

Hazard Analysis and Community Risk Assessment

Hazard analysis and community risk assessment are essential elements in a fire department's planning process. The Lake Cities Fire Department has recognized the need for a comprehensive community risk and vulnerability assessment and is working diligently in pursuing this outcome to help define the optimum arrangement for deploying resources. Such a process is required for accreditation and is the basis for meeting NFPA 1710 standards. Without the risk assessment, deploying resources may not ensure the right equipment is deployed in the right location at the right time. Because several of the communities in the Lake Cities Fire Department response area are very residential, with little or no commercial development, the demands are far different than that of a community with vibrant commercial, industrial, and office sectors. The latter tend to "fill" during daytime hours and empty at later times, with the opposite holding true for the former.

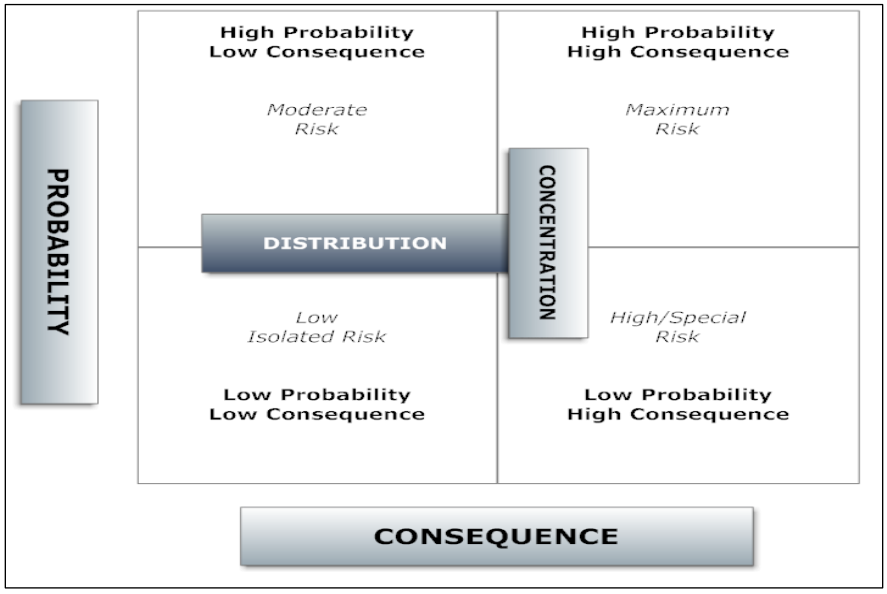
Each jurisdiction has to decide what degree of risk is acceptable to the citizens it serves. This determination is based on criteria that have been developed to define the levels of risk (e.g., of fire) within all sections of the community.17 To this end, a comprehensive planning approach that includes a fire risk assessment and hazard analysis is essential in determining local needs.

The term *integrated risk management* refers to a planning methodology that recognizes that citizen safety, the protection of property, and the protection of the environment from fire and related causes must include provisions for the reasonable safety of emergency responders. This means assessing the risk faced, taking preventive action, and deploying the proper resources in the right place at the right time.[18] There are two main considerations of a risk assessment: the probability of an event occurring and the consequence of that event occurring. The matrix in Figure 4-1 divides the risk assessment into four quadrants. Each quadrant of the chart creates different requirements in the community for commitment of resources.

§ § §

16. *Fire and Emergency Service Self-Assessment Manual*, Eighth Edition (Center for Public Safety Excellence, 2009), 49.
17. Compton and Granito, *Managing Fire and Rescue Services*, 39.
18. Cote, Grant, Hall & Solomon, eds., *Fire Protection Handbook* (Quincy, MA: NFPA 2008), 12-3.

FIGURE 4-1: Community Risk Matrix



Plotting the rated properties on a map will provide a better understanding of how the response matrix and staffing patterns can be used to ensure a higher concentration of resources for worst-case scenarios or, conversely, fewer resources for lower levels of risk.[19]

Community risk and vulnerability assessments are essential elements in a fire department's planning process. Although LCFD has identified a number of potential hazards in the community, a comprehensive community risk and vulnerability assessment has not been done.

> ***Recommendation: The Lake Cities Fire Department should conduct a formal fire risk analysis for each of the four member communities, taking into account the varying demographic make-ups. (Recommendation No 6.)***

As a guide in conducting a vulnerability assessment, CPSM has developed the following template that may be utilized in completing this process.

Community Risk Assessment Template

TASK 1: Establish a Risk Assessment Team

- Five to six members with assorted skills.
- Team leader.
- Data analyst.
- Tactical/command expertise.
- City planning/growth management.
- Financial/economic.
- GIS/mapping.

19. *Fire and Emergency Service Self-Assessment Manual*, Eighth Edition, (Center for Public Safety Excellence, 2009), 49.

TASK 2: Review and Plot Historical Workload (5 years)

- Breakout daily call distribution by type.
  - Location/occupancy type.
  - High-volume/frequent use.
    - Hospital.
    - University.
    - Adult living center.
- Identify high-dollar loss fire events (>$25K).
  - Location/occupancy type.
  - Cause & origin/demographic.
- Identify high-manpower events (>20 people).
- Identify high-time duration events (>2 hours).
- Identify events with significant economic impact (>$1 million).
- Identify events with multiple injuries or fatalities.
- Identify events with significant environmental impacts (which require remediation).

TASK 3: Identify the Community Risks for High-profile Events

- Transportation accidents (rail, air, roadway, port).
- Occupancies with high OVAP scores.
- Special situations
- Large, complex fire (dormitory, assisted living, jail, hospital, etc.).
- Processing or manufacturing accident (chemical, radiologic, petroleum, electrical, etc.).
- Mass casualty incident.
- Weather, flooding, or seismic event.
- Terrorist event.
- Driven by a community profile or demographic.

TASK 4: Identify Capacity Issues or Incidents in which Insufficient Resources Resulted in a Negative Outcome

- Related to daily activities.
- Related to larger/significant events.
- Related to incidents requiring the utilization of mutual aid or external resources.
- Other incident types.

TASK 5: Identify Additional Service Demands Related to Anticipated Growth of the Service Area

- Affecting daily activities
- Related to larger/significant events
- Incidents that required specialized services or a currently unavailable expertise

TASK 6: Identify Risk Reduction or Prevention Efforts that can Reduce or Eliminate Future Workload

- Related to daily activities.
- Related to larger/significant events.
- Related to new demand resulting from growth.
- Develop cost/outcome analysis.

TASK 7: Identify Additional Training Needs to Better Manage Current or Anticipated Service Demand

- Develop cost/outcome analysis.

TASK 8: Identify Organizational or Tactical Capabilities Needed to Meet Current Shortfalls

- Develop cost/outcome analysis.

In addition to examining risks faced by the community at large, the department needs to examine internal risks. The National Fire Protection Association's *Standard for a Fire Department Occupational Safety and Health Program* (NFPA 1500) requires a risk management plan for fire departments to be developed separately from those that are incorporated in the local government plan.[20] The Lake Cities Fire Department does not have a written internal risk management program in place.

A fire department risk management plan is developed and implemented to comply with the requirements of NFPA 1500. The following components must be included in the risk management plan:

Risk Identification: Actual or potential hazards.

Risk Evaluation: The potential of occurrence of a given hazard and the severity of its consequences.

Prioritizing Risk: The degree of a hazard based upon the frequency and severity of occurrence.

Risk Control: Solutions for elimination or reduction of real or potential hazards by implementing an effective control measure.

Risk Monitoring: Evaluation of effectiveness of risk control measures.[21]

> ***Recommendation: It is recommended the LCFD develop a written internal risk management program, including implementing a wellness program with a background physical screening (stress test, lung and cancer screens, etc.). (Recommendation No. 7.)***

20. Robert C. Barr and John M. Eversole, eds., *The Fire Chief's Handbook*, 6th edition (PennWell Books, 2003), 270.
21. NFPA 1500, *Standard for a Fire Department Occupational Safety and Health Program* (2007 ed.), Annex D.

HAZARDOUS MATERIALS RESPONSE

Hazardous materials incidents occur with limited frequency in the Lake Cities.

The types of hazardous materials at fixed facilities, on the waterfront, and passing through on major transportation thoroughfares in the LCFD service area present the potential for a more significant event and the possibility for an event is always present. The presence of the interstate highways and multilane highways with an unknown quantity of hazardous materials traveling through the service area on a daily basis poses a challenge in the development of adequate mitigation measures. Leaks related to boating were mentioned as a possible hazard during interviews with elected and appointed officials; those situations appear to have mitigation plans in place.

Indeed, the traditional primary risks are those generated by hazmat transportation and fixed facilities. However, over the years, the type and nature of incidents to which regional hazmat teams may respond has significantly changed and have become more technically challenging. Examples include the following:

- Clandestine labs, criminal and terrorist use of hazmat as weapons, chemical suicides, etc.
- Interdisciplinary response scenarios in which the regional hazmat teams interface with their response partners in the law enforcement, emergency medical, and fire communities. Scenarios include special events and the use of Joint Hazard Assessment Teams (JHAT), improvised explosive devices, coordinated/complex attack scenarios, active shooter/assailant scenarios, and the emergence of virus threats such as Ebola and Zika.
- Tourism and economic development initiatives have drawn national level and sporting events and festivals to the state. While this is a positive economic development, high-profile and high-density crowd events raise the threat level that requires a more sophisticated hazmat preparedness and response package.
- Changes in the U.S. domestic energy infrastructure have impacted the response community, such as for incidents involving high-hazard, flammable trains with crude oil and ethanol, increased use of liquefied natural gas (LNG) and related facilities, etc.
- The increasing use of social media is viewed as both a situational awareness asset and a potential operations security (OPSEC) vulnerability. The regional hazmat teams can assume a leadership role in determining future pathways and options on how social media can be safely and effectively integrated into response operations.[22]

Lake Cities is compliant with OSHA, Hazardous Waste Operations and Emergency Response, 29 CFR Part 1910.120 and NFPA 472, *Professional Competence of Responders to Hazardous Materials Incidents*. Level I incidents can be effectively managed and mitigated by the first response personnel without a hazardous materials response team or other special unit. These incidents include:

- Spills that can be properly and effectively contained/or abated by equipment and supplies immediately accessible to LCFD.
- Leaks and ruptures that can be controlled using equipment and supplies accessible to LCFD.

22. Flippin, P., et al; Virginia Department of Emergency Management Hazmat Program Strategic Review (VDEM, Richmond, VA, 2016)

- Fires involving toxic materials and which can be extinguished and cleaned up with resources immediately available to LCFD.
- Hazardous materials incidents not requiring civilian evacuation. (Example: A small pool supply spill that can be diluted with water for clean-up.)

The Lake Cities Fire Department contributes members to the Regional Hazardous Materials Response Team and has developed protocols for water incidents. The various teams which will respond to specific incidents have been identified and protocols developed since incidents occurred.

Each LCFD responder maintains hazardous materials operations-level certification, which enables them to identify hazards and defensive operations for those situations requiring Level II and III capability. CPSM recognizes the LCFD's participation as a ***Best Practice***, and we view the current level of response capability as appropriate for the community.

> ***Recommendation: Action has been taken to alleviate shortcomings in hazardous material incidents and the department should continue its efforts to handle smaller incidents with contracts in place between the cities and a professional firm for larger responses. The fire department should be tasked with maintaining control on incidents, with larger ones that require more involvement and expertise handled through a contractual arrangement. (Recommendation No. 8.)***

ACCREDITATION

Accreditation is a comprehensive self-assessment and evaluation model that enables organizations to examine past, current, and future service levels. It is used to evaluate internal performance and compares this performance to industry best practices. The intent of the process is to improve service delivery.

The Center for Public Safety Excellence (CPSE) provides an extensive evaluation process, on a fee basis, to member agencies and which ultimately leads to accreditation. CPSE is governed by the Commission on Fire Accreditation International (CFAI), an 11-member commission representing a cross-section of the fire service, including fire departments, city and county management, code councils, the U.S. Department of Defense, and the International Association of Firefighters.

The CPSE Accreditation Program is built around the following key measurements:

- Determine community risk and safety needs.
- Evaluate the performance of the department.
- Establish a method for achieving continuous organizational improvement.

Local government executives face increasing pressure to "do more with less" and justify expenditures by demonstrating a direct link to improved or measured service outcomes. Particularly for emergency services, local officials need criteria to assess professional performance and efficiency.

CPSE accreditation has national recognition and is widely used throughout the fire service. The key to its success is that it allows communities to set their own standards that are reflective of

their needs and a service delivery model that is specific to these needs. In addition, it is a program that is based on ongoing improvement and continuous monitoring. The CPSE accreditation model may be well-suited for Lake Cities.

Recommendation: Lake Cities should consider CPSE fire accreditation in the future. (Recommendation No. 9.)

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SECTION 5. OPERATIONAL RESPONSE APPROACHES

As mentioned previously, many agencies incorporate the use of prefire plans to provide a response and tactical strategy for those more critical or complex occupancies in the community. Figures 5-1 and 5-2 illustrate the critical tasks and resources required on low-risk incidents and moderate-risk structure fires, respectively. Understanding the community's risk greatly assists fire department planning, and with ongoing training, these activities improve overall effectiveness and responder safety.

Periodically, the contract cities of the LCFD have questioned whether it may be more cost-effective to form their own, individual fire departments. CPSM has found that when larger departments divide, the resulting smaller departments often are unable to muster enough staffing to handle fire incidents. Staffing daily is then usually drawn from each other and during critical incidents the entire fire service area must be activated to respond, much like when the departments were merged. The only difference is usually multiple levels of command.

FIGURE 5-1: Low-Risk Response–Exterior Fire Attack

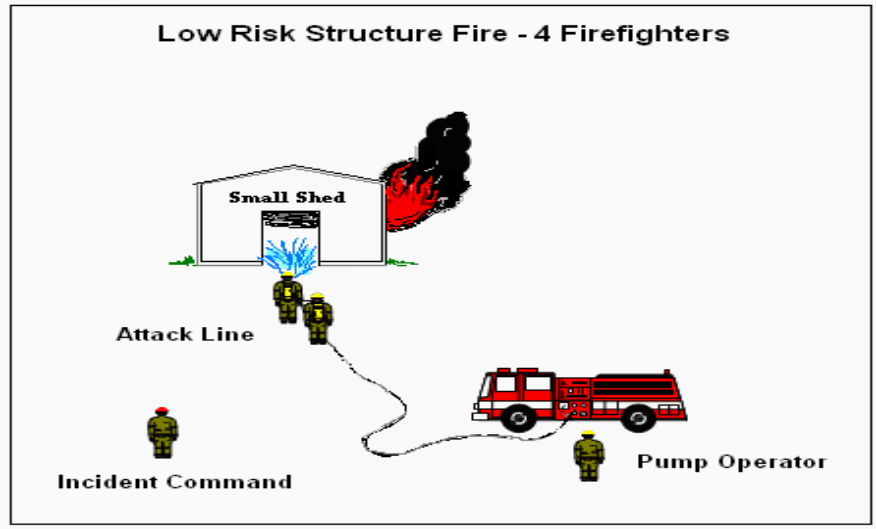
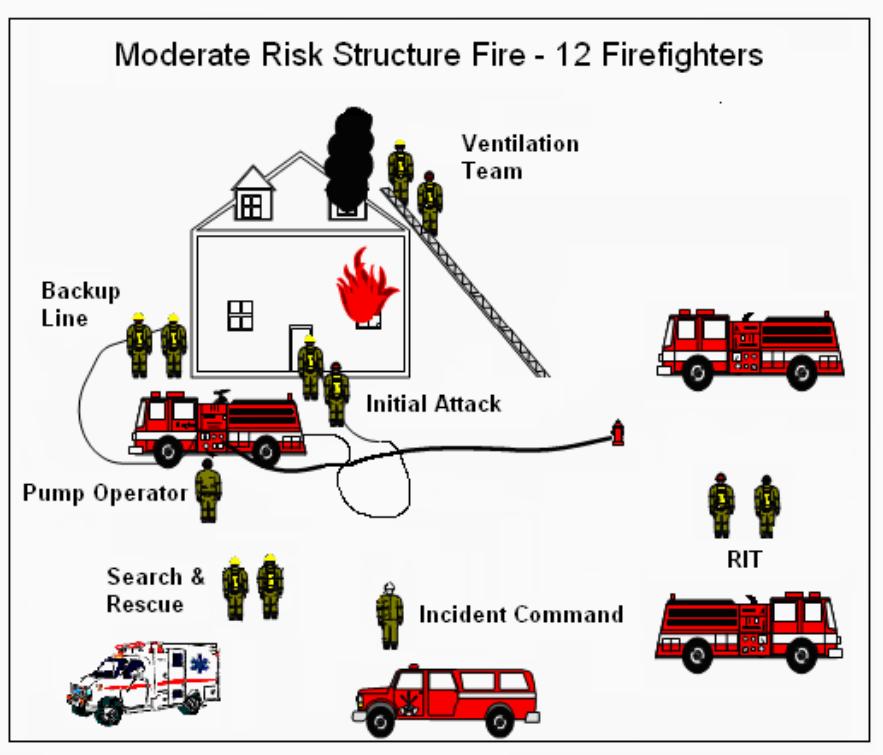


Figure 5-2 represents the critical task elements for a moderate-risk structure fire. Some jurisdictions add additional response resources to meet and, in some cases, exceed the national benchmarking provided by the National Fire Protection Association (NFPA) 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Departments*, 2014 Edition. NFPA 1710 calls for the initial assignment of 14 personnel on a single-family residential structure fire when an aerial ladder is not utilized. Lake Cities is able to assemble a full complement of resources for a single-family residential structure fire from its on-duty resources. In fact, on the initial assignment to a residential structure fire, LCFD will typically assemble upwards of 20 personnel. As well, LCFD often incorporates the resources from neighboring jurisdictions through mutual aid and automatic response agreements. CPSM recognizes these joint and automatic response activities as a ***Best Practice***.

FIGURE 5-2: Moderate Risk Response–Interior Fire Attack



LAKE CITIES RESPONSE PROTOCOLS

Fire Response

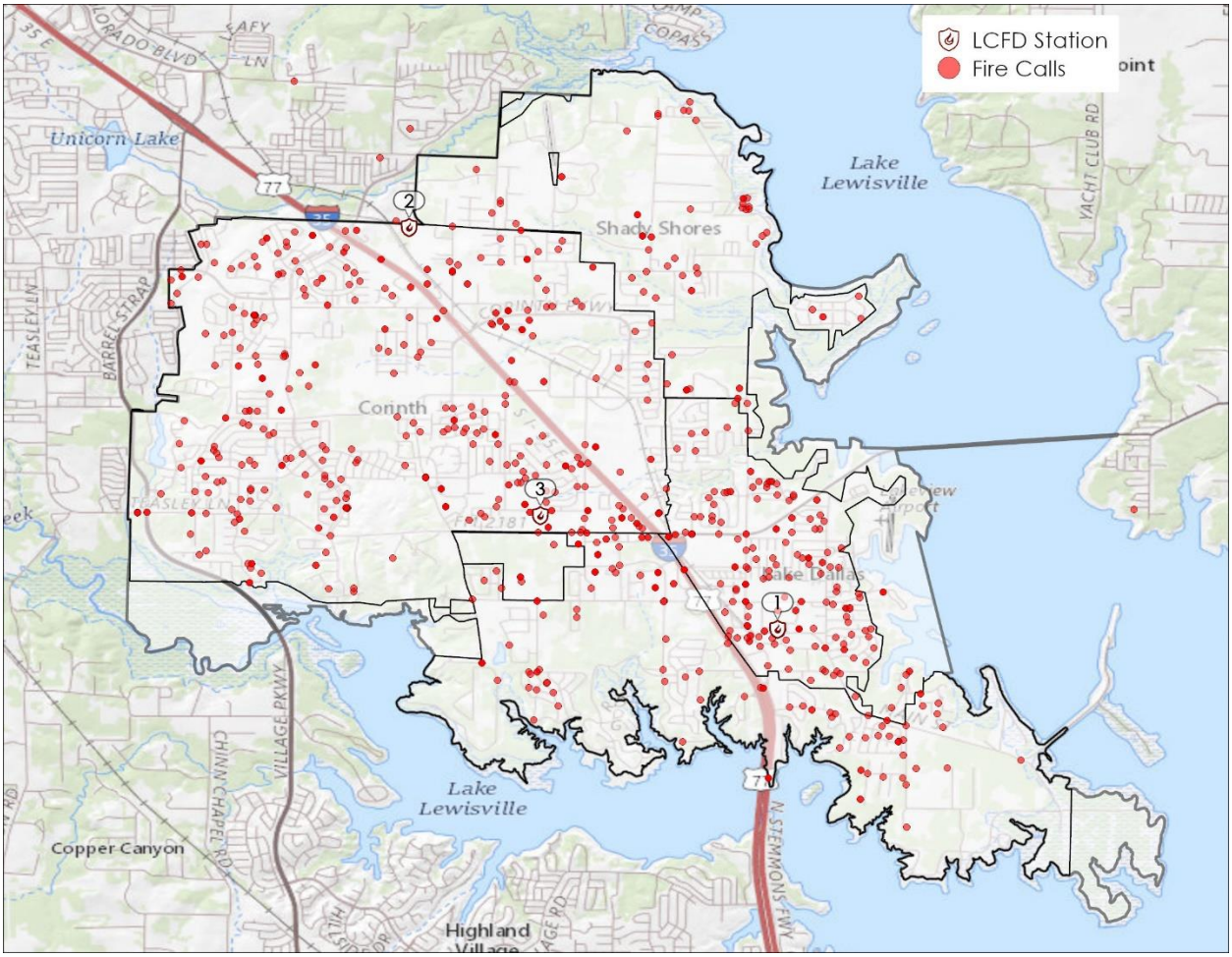
The ability to assemble the necessary resources to effectively manage even a smaller residential or commercial structure fire is significant. As mentioned above, the NFPA standard (NFPA 1710) recommends a minimum of 14 personnel as the initial response to a fire at a single-family residential structure. An actual fire of any significance will require 14 to 17 personnel or more for extended periods of time. As the incident grows in size and complexity, it is not unusual to see staffing needs that can exceed 30 to 40 personnel. This would be the case in a fire at a big-box retail center like a Home Depot or Walmart, a wildfire, or a fire at an apartment complex. Though these larger incidents do not occur frequently, when they do occur, the ability to assemble sufficient resources rapidly can significantly impact the outcome.

The decision as to what is the proper staffing level for a specific community's protection is perhaps the most difficult assessment faced by policy makers and fire department leadership across the nation. As communities adjust this level of response, the costs associated with maintaining this level of readiness will have significant financial implications. CPSM believes that Lake Cities is very well-staffed to manage its current workload. The department has one additional element to consider: heat. Temperatures can easily reach 95 degrees during the year; this factor requires additional staffing for rehab and relief. Failure to preplan for rehab and relief can result in catastrophic failure to responders.

The key to organizational efficiency and the safety of responding personnel is directly related to response activities and departmental deployment practices. Lake Cities should evaluate its

response practices and make every effort to dispatch the fewest number of units needed and whenever possible minimize the frequency in which units respond with lights and sirens.

FIGURE 5-3: Location of Fire Calls



During the study period, there were 14 structure fires in which some degree of fire damage was noted in the incident report. The total fire loss (structure and contents) for all structural fires in the 12-month evaluation period was estimated to be $192,580. Fire damage estimates are made by LCFD investigators and company officers.

For the calls in which damage was reported (structure and contents), we estimate that the average damage for each fire was approximately $13,756. We can compare this experience to average fire loss nationwide for structure fires. NFPA estimates that in 2017 the average fire loss for a structure fire in the U.S. was $21,463.[23] From this perspective, we can see that the average fire loss in Lake Cities is significantly lower than the amount of loss found in many communities across the nation.

Another indication that we use in our analysis of structure fire occurrence is the frequency in which an individual event results in a combined loss that exceeds $20,000. The $20,000

23. Ben Evarts, "Fire Loss in the United States during 2017," NFPA September 2018.

demarcation is relevant from two perspectives. First, this is a dollar amount that is comparable to the national average for fire loss in a structure fires, and second, it indicates a fire loss that from CPSM's perspective is representative of a more significant fire event that requires fire department extinguishment. In the period evaluated, there were ***only 4 structure fires in which the combined fire loss exceeded $20,000.*** The largest combined fire loss (structure and contents) for a single event was $70,000. The average fire loss and the frequency of higher loss fires appears lower in Lake Cities than what would be expected. It is hard to fully determine the reason(s) for the lower number of fires that resulted in significant fire loss. Much of this must be attributed to the quality of the fire suppression efforts exhibited by LCFD and another factor must be the fire prevention efforts of the residents of the cities and their ability to limit those factors that contribute to larger fire loss. It is our assessment, however, that the fire problem is limited in Lake Cities and this a very positive aspect in considering the overall risk in the community.

Tables 5-1 and 5-2 provide an analysis of fire loss in Lake Cities during the year-long evaluation period.

TABLE 5-1: Content and Property Loss – Structure and Outside Fires

Call Type	Property Loss		Content Loss	
	Loss Value	Number of Calls	Loss Value	Number of Calls
Outside fire	$56,965	14	$12,450	9
Structure fire	$146,250	12	$46,335	14
Total	**$203,215**	**26**	**$58,785**	**23**

Note: This includes only calls with a recorded loss greater than 0.

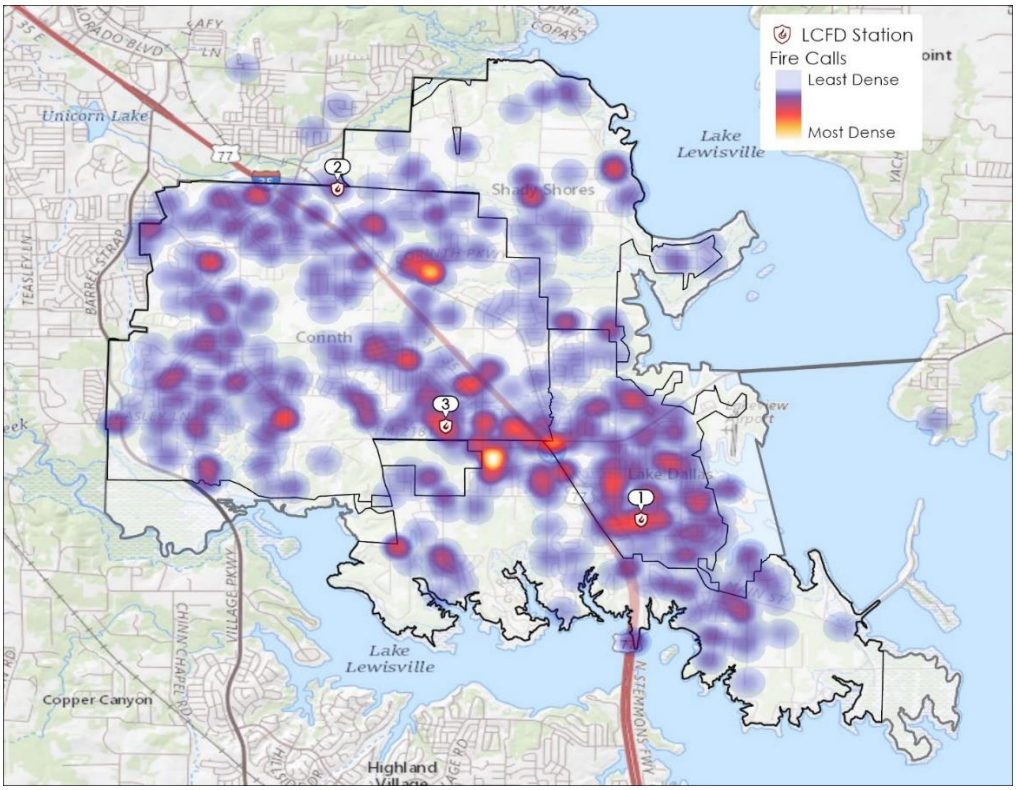
TABLE 5-2: Total Fire Loss Above and Below $20,000

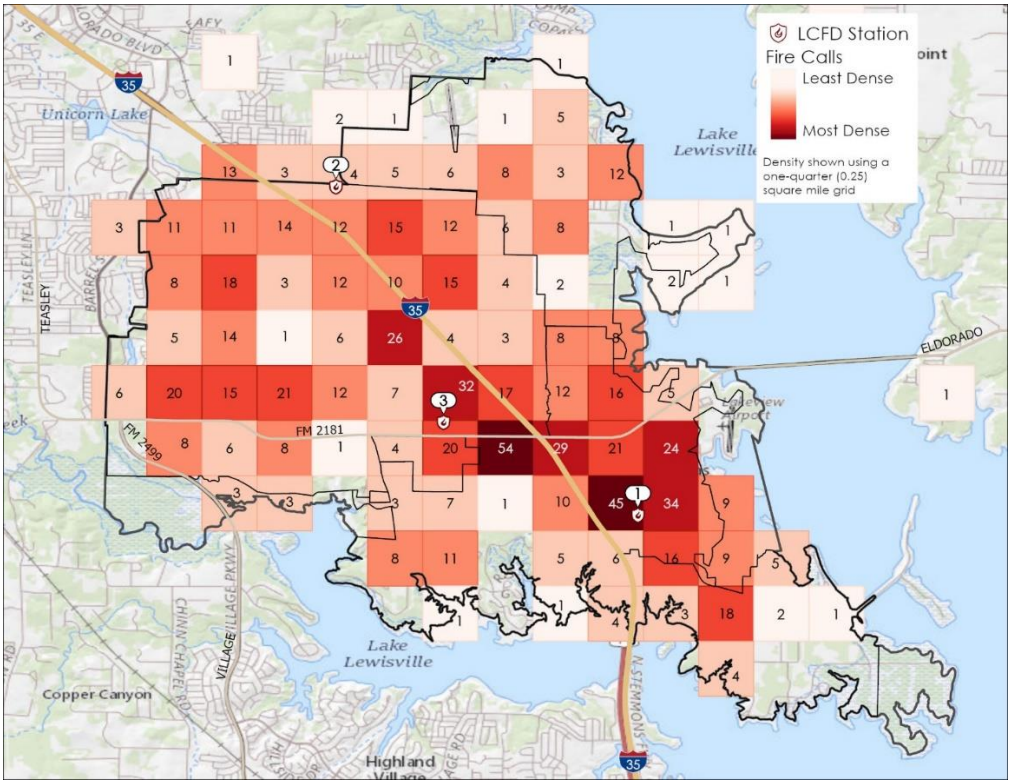
Call Type	No Loss	Under $20,000	$20,000 plus
Outside fire	21	15	1
Structure fire	8	10	4
Total	**29**	**25**	**5**

Observations:

- Out of 37 outside fires, 14 had recorded property loss, with a combined $56,965 in losses.
- 9 outside fires had content loss with a combined $12,450 in losses.
- The highest total loss for an outside fire was $31,000.
- Out of 22 structure fires, 12 had recorded property loss, with a combined $146,250 in losses.
- 14 structure fires had a content loss, with a combined $46,335 in losses.
- The highest total loss for a structure fire was $70,000.
- The average total loss for structure fires with loss was $13,756.

FIGURE 5-4: Areas of Concentration of Lake Cities Fire Calls





The concentration of fire calls with the Lake Cities service area is fairly evenly spread, most likely due to the low numbers of incidents. Adopting a philosophy of "Community Risk Reduction" throughout the department and focused efforts on all communities participating is likely to reduce incidents and loss further while minimizing risks to occupants and visitors.

Community Risk Reduction is a department and community philosophy—much like the Community Oriented Policing (COPS) efforts that have been in place for nearly 30 years. The philosophy is to prevent fires (and EMS calls) from occurring that require emergency response. CRR is not driven by an individual or a few individuals; it is best developed when the entire community and department philosophy focuses on using data to eliminate risks before they escalate into incidents. CPSM believes that enhanced code enforcement efforts, concentrated public outreach, directed prefire planning, smoke detector distribution, and in-service company inspections may have an impact on reducing fire incidents in this area.

Recommendation: LCFD and its member cities should adopt the Community Risk Reduction philosophy. (Recommendation No. 10.)

LCFD has a significant workload, the majority of which is EMS-related. Overall, about 3.2 percent of all incidents in Lake Cities are handled by a single unit response. Figures 5-5 and 5-6 illustrate the breakout of unit responses for EMS and fire call types, respectively.

LCFD should work with Medical Control to minimize the number of times two units are required—particularly for calls that do not require "hot" or "lights and siren" response. Minimizing the number of responding units also minimizes risks to responders and the community. CPSM has found and studies have indicated that approximately 70 to 80 percent of calls received by EMS do not require a lights and siren response and would be classified as "Basic Life Support" needs.

Recommendation: LCFD should work with the medical director and dispatch to reduce the overall need to run with lights and siren to both EMS and fire calls. (Recommendation No. 11.)

CPSM discussed paramedicine or telemedicine options with the medical director and found that this idea is in discussion phases at the local hospitals. LCFD should be involved as these discussions progress, as it is an opportunity to reduce emergency responses while also generating potential revenue for the communities and increasing the level of service to residents. A successful program exists in the Dallas-Ft. Worth area that is operated by MedStar.

UNITS DISPATCHED TO CALLS

Table 5-3, along with Figures 5-5 and 5-6, details the number of LCFD calls with one, two, or three or more units dispatched overall and broken down by call type. Figure 5-6 provides additional detail regarding units dispatched to fire calls.

TABLE 5-3: Calls by Call Type and Number of Units Dispatched

Call Type	Number of Units			Total Calls
	One	Two	Three or More	
Breathing difficulty	4	172	5	181
Cardiac and stroke	8	228	12	248
Fall and injury	11	377	21	409
Illness and other	26	463	17	506
MVA	10	319	56	385
Overdose and psychiatric	0	106	14	120
Seizure and unconsciousness	9	236	15	260
EMS Total	**68**	**1,901**	**140**	**2,109**
False alarm	38	97	74	209
Good intent	41	17	9	67
Hazard	51	34	21	106
Outside fire	19	11	7	37
Public service	229	196	15	440
Structure fire	1	1	20	22
Fire Total	**379**	**356**	**146**	**881**
Canceled	161	121	20	302
Mutual aid	109	38	5	152
Total	**717**	**2,416**	**311**	**3,444**
Total Percentage	**20.8**	**70.2**	**9.0**	**100.0**

FIGURE 5-5: Calls by Number of Units Dispatched – EMS

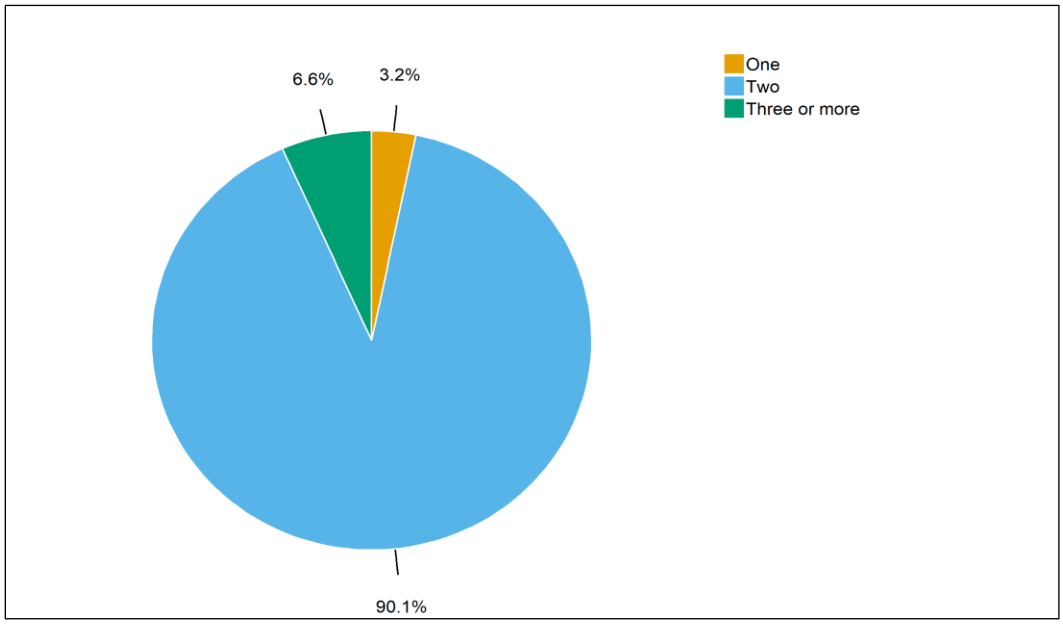
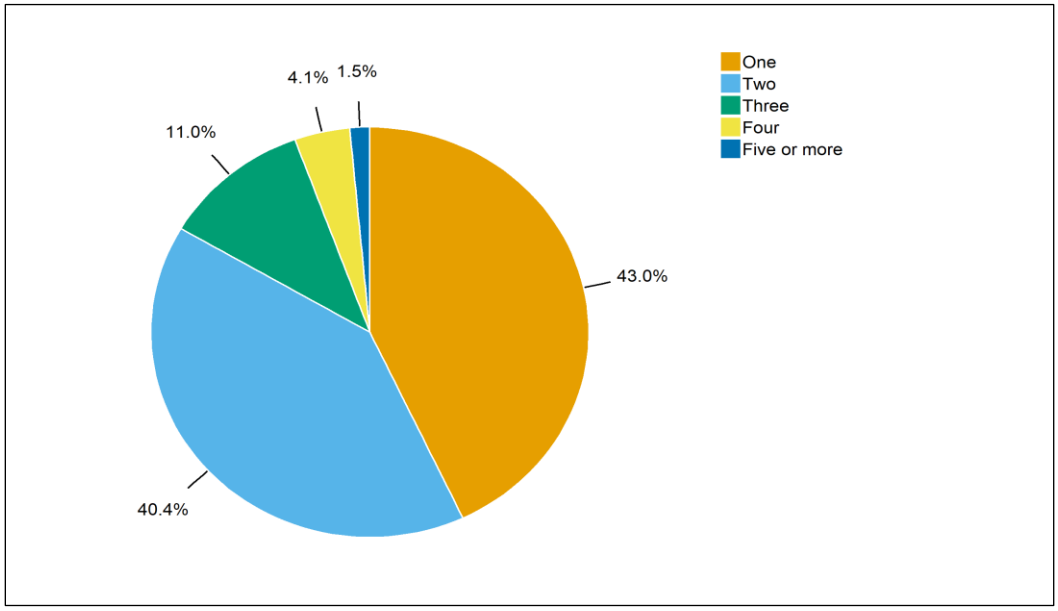


FIGURE 5-6: Calls by Number of Units Dispatched – Fire



Observations:

Overall

- On average, 1.9 units were dispatched to all calls; for 21 percent of calls only one unit was dispatched.
- Overall, three or more units were dispatched to 9 percent of calls.

EMS

- For EMS calls, one unit was dispatched 3 percent of the time, two units were dispatched 90 percent of the time, and three or more units were dispatched 7 percent of the time.
- On average, 2.0 units were dispatched per EMS call.

Fire

- For fire calls, one unit was dispatched 43 percent of the time, two units were dispatched 40 percent of the time, three units were dispatched 11 percent of the time, four units were dispatched 4 percent of the time, and five or more units were dispatched 1 percent of the time.
- For outside fire calls, three or more units were dispatched 19 percent of the time.
- For structure fire calls, three or more units were dispatched 91 percent of the time.

SECTION 6. RESPONSE TIME ANALYSIS

Response times are typically the primary measurement used in evaluating fire and EMS services. Most deployment models attempt to achieve a four-minute initial travel time for EMS calls and a full-force travel time of eight minutes for fire calls. A full-force travel time indicates the time it takes for the initial response of all resources assigned for the call to arrive on the scene.

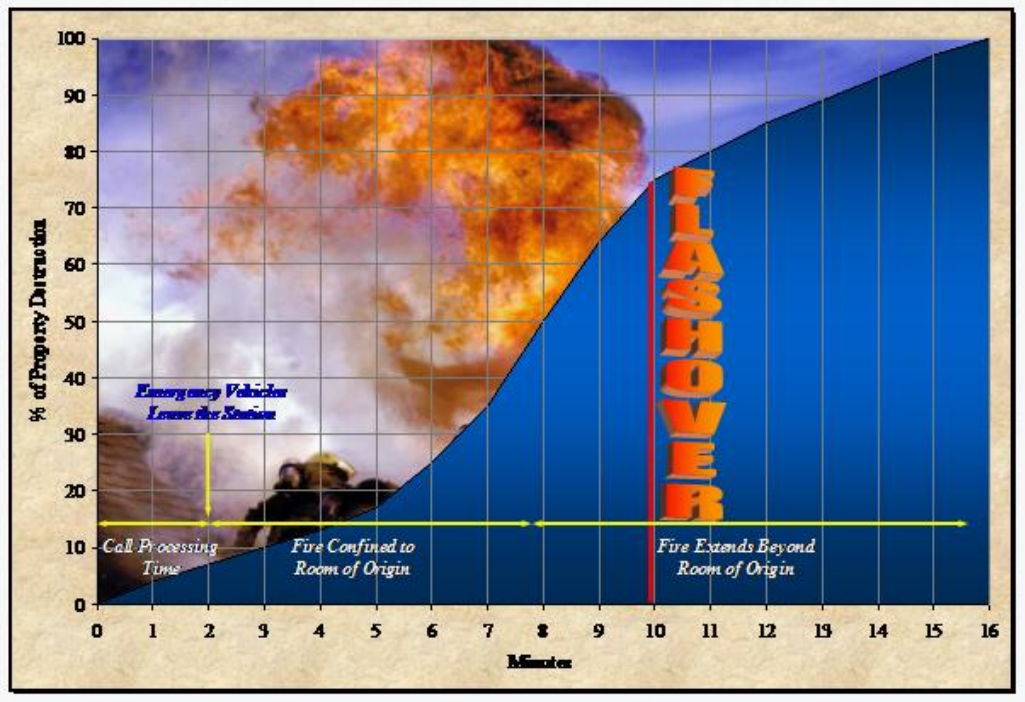
While these times have validity, the actual impact of a speedy response time is limited to very few incidents. For example, in a full cardiac arrest, analysis shows that successful outcomes are rarely achieved if basic life support (CPR) is not initiated within four minutes of the onset of the arrest. However, cardiac arrests occur very infrequently; on average these are 1 percent to 1.5 percent of all EMS incidents.24 There are also other EMS incidents that are truly life-threatening and the time of response can clearly impact the outcome. These involve drownings, electrocutions, and severe trauma (often caused by gunshot wounds, stabbings, and severe motor vehicle accidents, etc.). Again, the frequency of these types of calls are limited.

Regarding response times for fire incidents, the frequency of actual fires in Lake Cities (structure and outside fires) is very low. The criterion for fire response is based on the concept of "flashover." This is the state at which super-heated gasses from a fire in an enclosed area results in a near-simultaneous ignition of the combustible material in the area. In this situation, usually after an extended period of time (eight to twelve minutes), the fire expands rapidly and is much more difficult to contain. When the fire reaches this hazardous state, a larger and more destructive fire occurs. Figure 6-1 illustrates the flashover phenomenon and its potential for increased damage.

Another important factor in the whole response time question is what we term "detection time." This is the time it takes to detect a fire or a medical situation and notify 911 to initiate the response. In many instances, particularly at night or when automatic detection systems (fire sprinklers and smoke detectors) are unavailable or inoperable, the detection process can be extended. Fires that go undetected and thus able to expand in size become more destructive and are more difficult to extinguish.

24. Myers, Slovis, Eckstein, Goodloe et al. (2007). "Evidence-based Performance Measures for Emergency Medical Services System: A Model for Expanded EMS Benchmarking." *Pre-hospital Emergency Care*.

FIGURE 6-1: Fire Propagation Curve



MEASURING RESPONSE TIMES

There have been no documented studies that have made a direct correlation between response times and outcomes in fire and EMS events. No one has been able to show that a four-minute response time is measurably more effective than a six-minute response time. The logic has been "faster is better," but this has not been substantiated by any detailed analysis. Furthermore, the ability to measure the difference in outcomes (patient saves, reduced fire damage, or some other quantifiable measure) between a six-minute, eight-minute, or ten-minute response is not a performance measure often utilized in the fire service. So, in looking at response times it is prudent to design a deployment strategy around the actual circumstances that exist in the community and the fire problem that is perceived to exist. This requires a "fire risk assessment" and a political determination as to the desired level of protection for the community. It would be imprudent, and very costly, to build a deployment strategy that is based solely upon response times.

For the purpose of this analysis, ***response time*** is a product of three components: ***dispatch time***, ***turnout time***, and ***travel time***.

- *Dispatch time* is the time interval that begins when the alarm is received at the communication center and ends when the response information is transmitted via voice or electronic means to the emergency response facility or emergency response units in the field. Dispatch time is the responsibility of the 911 center and outside the control of LCFD officials.
- *Turnout time* is the time interval that begins when the notification process to emergency response facilities and emergency response begins through an audible alarm or visual announcement or both and ends at the beginning point of travel time. The fire department has the greatest control over this segment of the total response time measurement.

- *Travel time* is the time interval that initiates when the unit is en route to the call and ends when the unit arrives at the scene.
- *Response time*, also known as total response time, is the time interval that begins when the call is received by the primary dispatch center and ends when the dispatched unit arrives on the scene to initiate action.

LAKE CITIES RESPONSE TIMES

For this study, and unless otherwise indicated, our response time calculation measures the first arriving unit only. Typically, we track only those responses in which the unit is responding with lights and sirens (hot).

According to NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Departments,* 2014 Edition, the alarm processing time or dispatch time should be less than or equal to 90 seconds 90 percent of the time. This standard also states that the turnout time should be less than or equal to 80 seconds (1.33 minutes) for fire and special operations 90 percent of the time, and travel time shall be less than or equal to 240 seconds for the first arriving engine company 90 percent of the time. Table 6-1 shows the average response time in minutes for the first arriving unit, by call type and jurisdiction.

In this analysis, we included all calls in LCFD's response area to which at least one non-administrative LCFD unit responded, while excluding canceled and mutual aid calls. In addition, non-emergency calls and calls with a total response time of more than 30 minutes were excluded. Finally, we focused on units that had complete time stamps, that is, units with all components recorded, so that we could calculate each segment of response time.

Based on the methodology above, we excluded 324 calls that were outside of LCFD's response area, 154 canceled calls, 140 calls where no units recorded a valid on-scene time, 5 calls where the first arriving unit response was greater than 30 minutes, 197 nonemergency calls, and 356 calls where one or more segments of the first arriving unit's response time could not be calculated due to missing or faulty data. As a result, in this section, a total of 2,622 calls are included in the analysis.

Table 6-1 provides the average dispatch, turnout, travel, and total response times for the first arriving unit to each call in LCFD's response area, broken out by the location of the call. Table 6-2 gives the 90th percentile response times broken out in the same manner. A 90th percentile time means that 90 percent of calls had response times at or below that number. For example, Table 6-2 shows a 90th percentile response time of 10.3 minutes, which means that 90 percent of the time a call had a response time of no more than 10.3 minutes.

Table 6-3 provides average dispatch, turnout, travel, and total response time for the first arriving unit to calls in LCFD's response area, broken out by call type. Figures 6-2 and 6-3 illustrate the average response times for EMS and fire calls, respectively.

TABLE 6-1: Average Response Time of First Arriving Unit, by Location (Minutes)

Location	Call Type	Dispatch	Turnout	Travel	Total	Number of Calls
Corinth	EMS	0.7	1.8	4.7	7.2	943
	Fire	0.9	1.9	5.5	8.3	258
	Total	**0.7**	**1.8**	**4.9**	**7.5**	**1,201**
Lake Dallas	EMS	0.7	1.8	4.1	6.6	488
	Fire	1.1	1.8	5.0	7.9	96
	Total	**0.8**	**1.8**	**4.3**	**6.8**	**584**
Hickory Creek	EMS	0.7	1.7	5.1	7.5	228
	Fire	0.8	1.9	5.9	8.5	89
	Total	**0.7**	**1.8**	**5.3**	**7.8**	**317**
Shady Shores	EMS	0.7	1.7	5.5	7.9	80
	Fire	0.7	1.9	7.0	9.7	35
	Total	**0.7**	**1.8**	**6.0**	**8.5**	**115**
Denton County	EMS	0.7	1.7	5.4	7.8	30
	Fire	0.6	1.9	5.5	8.0	15
	Total	**0.6**	**1.8**	**5.4**	**7.8**	**45**
Total		**0.8**	**1.8**	**4.9**	**7.4**	**2,262**

TABLE 6-2: 90th Percentile Response Time of First Arriving Unit, by Location (Minutes)

Location	Call Type	Dispatch	Turnout	Travel	Total	Number of Calls
Corinth	EMS	1.3	2.9	6.8	9.6	943
	Fire	1.8	2.8	8.0	11.3	258
	Total	**1.4**	**2.9**	**7.1**	**10.0**	**1,201**
Lake Dallas	EMS	1.4	2.9	6.9	9.7	488
	Fire	1.4	2.7	8.5	11.8	96
	Total	**1.4**	**2.8**	**7.2**	**9.8**	**584**
Hickory Creek	EMS	1.3	2.7	8.0	10.8	228
	Fire	1.7	2.8	9.8	12.7	89
	Total	**1.4**	**2.8**	**8.4**	**11.5**	**317**
Shady Shores	EMS	1.0	2.5	7.4	10.6	80
	Fire	1.4	2.6	9.4	12.4	35
	Total	**1.1**	**2.6**	**8.7**	**11.5**	**115**
Denton County	EMS	1.1	2.6	8.3	11.3	30
	Fire	0.9	2.9	7.8	10.9	15
	Total	**1.1**	**2.9**	**8.3**	**11.3**	**45**
Total		**1.4**	**2.8**	**7.5**	**10.3**	**2,262**

TABLE 6-3: Average Response Time of First Arriving Unit, by Call Type (Minutes)

Call Type	Dispatch	Turnout	Travel	Total	Number of Calls
Breathing difficulty	0.7	2.0	4.2	6.9	163
Cardiac and stroke	0.7	1.8	4.4	6.9	219
Fall and injury	0.7	1.8	4.5	7.1	344
Illness and other	0.7	1.9	4.5	7.1	420
MVA	0.6	1.6	5.5	7.6	294
Overdose and psychiatric	1.0	1.9	4.8	7.7	108
Seizure and unconsciousness	0.7	1.6	4.4	6.7	221
EMS Total	**0.7**	**1.8**	**4.6**	**7.1**	**1,769**
False alarm	0.8	1.9	5.3	7.9	154
Good intent	0.7	1.9	6.2	8.8	37
Hazard	1.2	1.8	5.8	8.8	78
Outside fire	1.2	2.2	5.4	8.8	23
Public service	0.9	1.8	5.7	8.4	183
Structure fire	0.7	2.0	5.2	8.0	18
Fire Total	**0.9**	**1.9**	**5.6**	**8.4**	**493**
Total	**0.8**	**1.8**	**4.9**	**7.4**	**2,262**

FIGURE 6-2: Average Response Time of First Arriving Unit, by Call Type – EMS

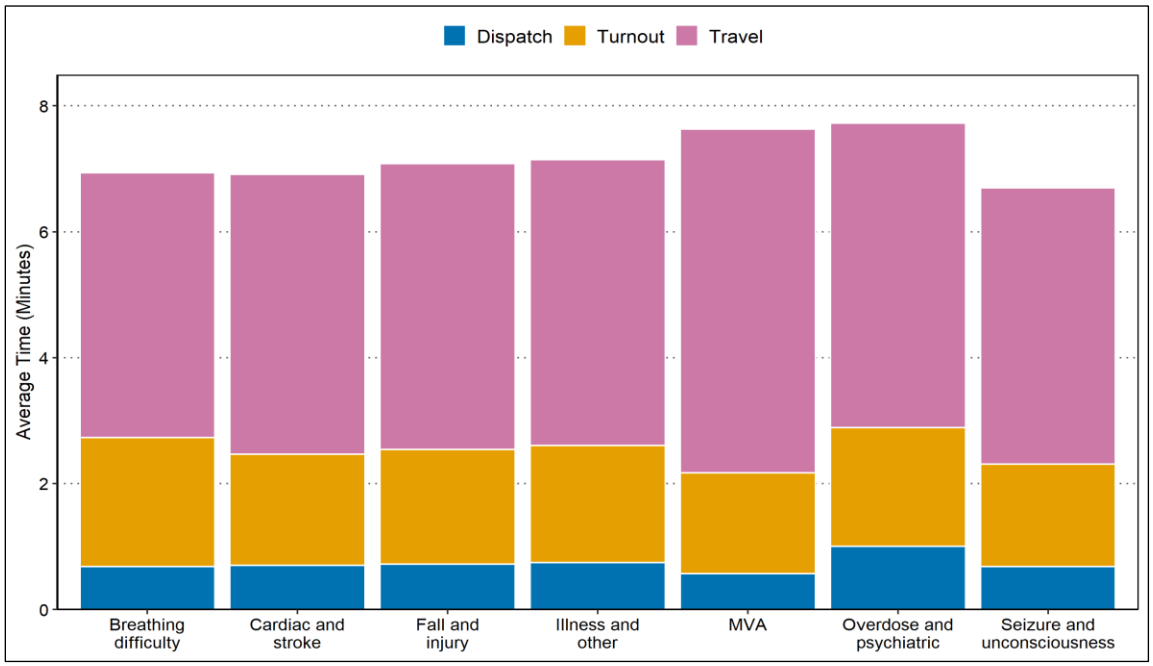


FIGURE 6-3: Average Response Time of First Arriving Unit, by Call Type – Fire

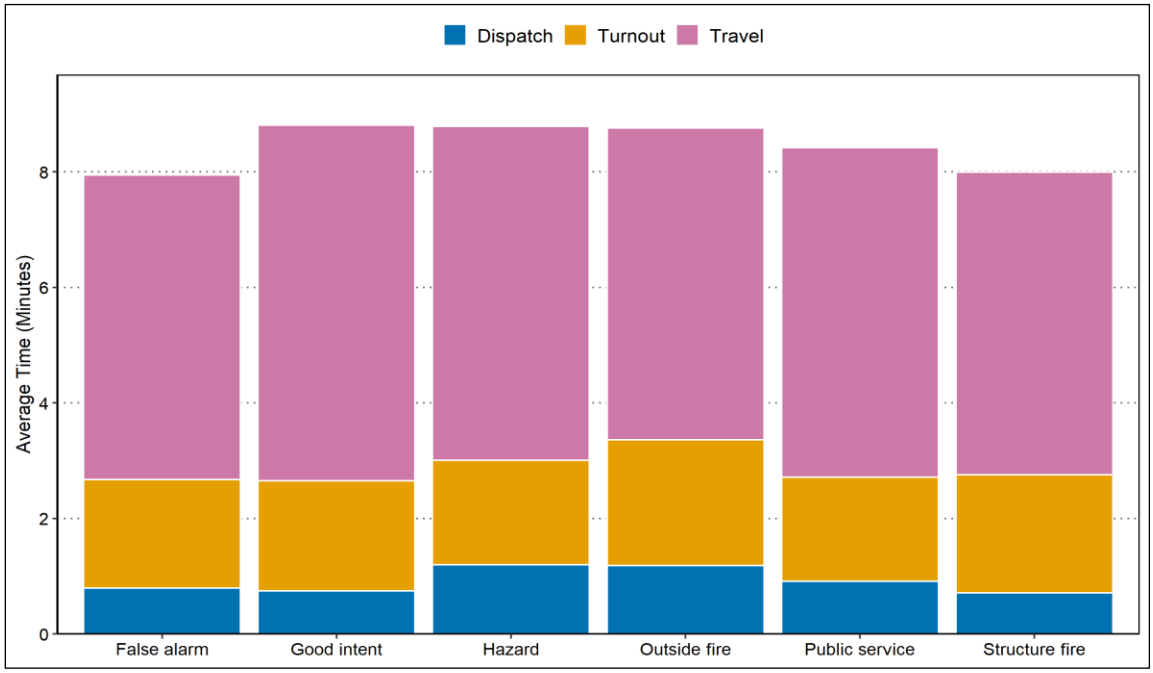


TABLE 6-4: 90th Percentile Response Time of First Arriving Unit, by Call Type (Minutes)

Call Type	Dispatch	Turnout	Travel	Total	Number of Calls
Breathing difficulty	1.3	3.2	6.2	9.5	163
Cardiac and stroke	1.3	2.8	6.6	9.6	219
Fall and injury	1.2	2.9	6.8	9.6	344
Illness and other	1.3	2.9	6.8	9.6	420
MVA	1.0	2.7	8.7	11.3	294
Overdose and psychiatric	1.9	2.8	7.4	10.7	108
Seizure and unconsciousness	1.3	2.6	6.6	9.3	221
EMS Total	**1.3**	**2.9**	**7.1**	**9.8**	**1,769**
False alarm	1.5	2.8	7.8	10.7	154
Good intent	1.4	2.7	9.1	12.1	37
Hazard	1.7	2.7	8.2	11.4	78
Outside fire	1.9	3.0	9.9	16.3	23
Public service	1.7	2.8	9.3	12.4	183
Structure fire	1.3	3.4	7.3	10.2	18
Fire Total	**1.6**	**2.8**	**8.5**	**11.7**	**493**
Total	**1.4**	**2.8**	**7.5**	**10.3**	**2,262**

Observations:

- The average dispatch time was 0.8 minutes.
- The average turnout time was 1.8 minutes.
- The average travel time was 4.9 minutes.
- The average total response time was 7.4 minutes.
- The average response time was 7.1 minutes for EMS calls and 8.4 minutes for fire calls.
- The average response time was 8.8 minutes for outside fires and 8.0 minutes for structure fires.
- The 90th percentile dispatch time was 1.4 minutes.
- The 90th percentile turnout time was 2.8 minutes.
- The 90th percentile travel time was 7.5 minutes.
- The 90th percentile total response time was 10.3 minutes.
- The 90th percentile response time was 9.8 minutes for EMS calls and 11.7 minutes for fire calls.
- The 90th percentile response time was 16.3 minutes for outside fires and 10.2 minutes for structure fires.

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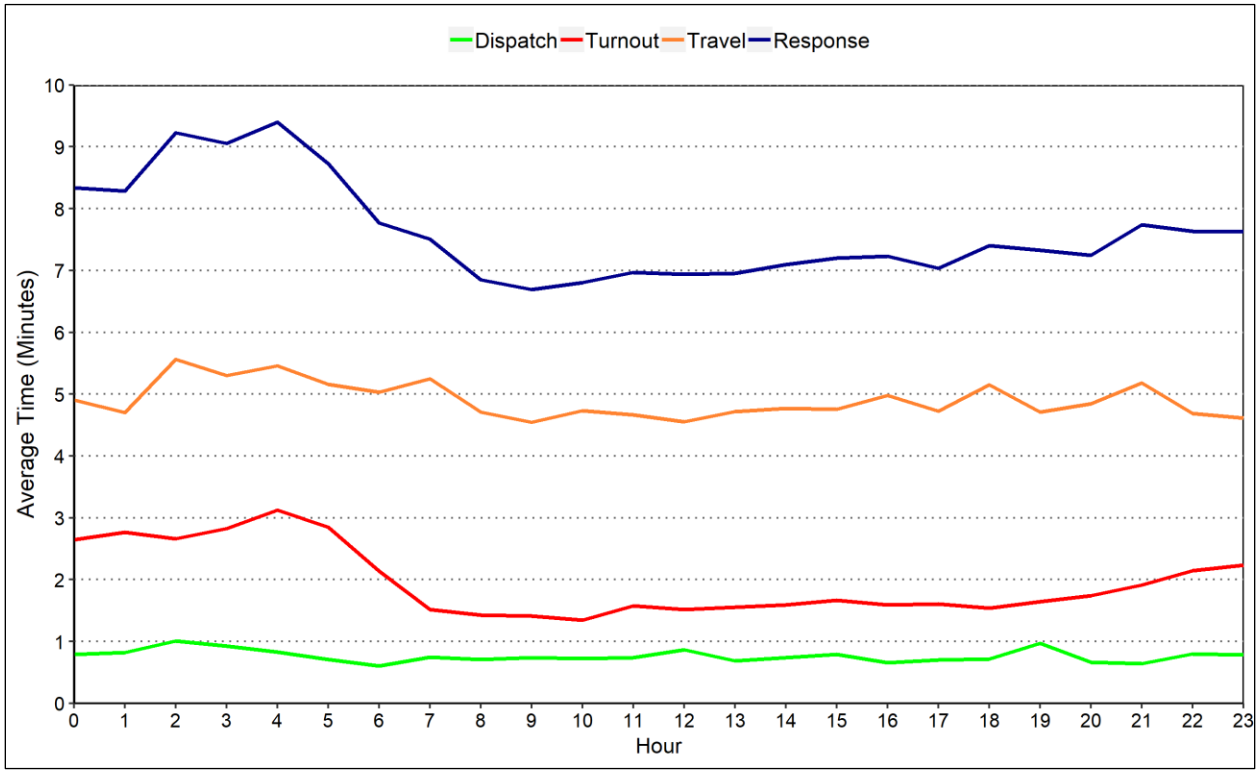
RESPONSE TIME BY HOUR

Average dispatch, turnout, travel, and total response time by hour for calls are shown in Table 6-5 and Figure 6-4. The table also shows 90th percentile response times.

TABLE 6-5: Average and 90th Percentile Response Time of First Arriving Unit, by Hour of Day

Hour	Dispatch	Turnout	Travel	Response Time	90th Percentile Response Time	Number of Calls
0	0.8	2.6	4.9	8.3	10.8	73
1	0.8	2.8	4.7	8.3	10.7	54
2	1.0	2.7	5.6	9.2	12.8	47
3	0.9	2.8	5.3	9.1	11.5	50
4	0.8	3.1	5.5	9.4	13.2	39
5	0.7	2.9	5.2	8.7	10.6	57
6	0.6	2.1	5.0	7.8	10.5	62
7	0.7	1.5	5.2	7.5	10.3	88
8	0.7	1.4	4.7	6.8	9.3	81
9	0.7	1.4	4.5	6.7	9.5	98
10	0.7	1.3	4.7	6.8	9.6	121
11	0.7	1.6	4.7	7.0	9.4	96
12	0.9	1.5	4.6	6.9	10.2	125
13	0.7	1.6	4.7	7.0	10.1	153
14	0.7	1.6	4.8	7.1	10.4	121
15	0.8	1.7	4.8	7.2	9.6	125
16	0.7	1.6	5.0	7.2	9.8	135
17	0.7	1.6	4.7	7.0	9.8	140
18	0.7	1.5	5.2	7.4	9.6	124
19	1.0	1.6	4.7	7.3	10.2	110
20	0.7	1.7	4.8	7.2	10.5	117
21	0.6	1.9	5.2	7.7	10.4	91
22	0.8	2.1	4.7	7.6	9.8	90
23	0.8	2.2	4.6	7.6	9.9	65
Total	**0.8**	**1.8**	**4.9**	**7.4**	**10.3**	**2,262**

FIGURE 6-4: Average Response Time of First Arriving Unit, by Hour of Day



Observations:

- Average dispatch time was between 0.6 minutes (6:00 a.m. to 7:00 a.m.) and 1.0 minutes (2:00 a.m. to 3:00 a.m.).
- Average turnout time was between 1.3 minutes (10:00 a.m. to 11:00 a.m.) and 3.1 minutes (4:00 a.m. to 5:00 a.m.).
- Average travel time was between 4.5 minutes (9:00 a.m. to 10:00 a.m.) and 5.6 minutes (2:00 a.m. to 3:00 a.m.).
- Average response time was between 6.7 minutes (9:00 a.m. to 10:00 a.m.) and 9.4 minutes (4:00 a.m. to 5:00 a.m.).
- The 90th percentile response time was between 9.3 minutes (8:00 a.m. to 9:00 a.m.) and 13.2 minutes (4:00 a.m. to 5:00 a.m.).

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RESPONSE TIME DISTRIBUTION

Here, we present a more detailed look at how response times to calls are distributed. The cumulative distribution of total response time for the first arriving unit to EMS calls is shown in Figure 6-5 and Table 6-6. Figure 6-5 shows response times for the first arriving LCFD unit to EMS calls as a frequency distribution in whole-minute increments, and Figure 6-6 shows the same for the first arriving unit to outside and structure fire calls.

The cumulative percentages here are read in the same way as a percentile. In Figure 6-5, the 90th percentile of 9.8 minutes means that 90 percent of EMS calls had a response time of 9.8 minutes or less. In Table 6-6, the cumulative percentage of 69.6, for example, means that 69.6 percent of EMS calls had a response time under 8 minutes.

FIGURE 6-5: Cumulative Distribution of Response Time – First Arriving Unit – EMS

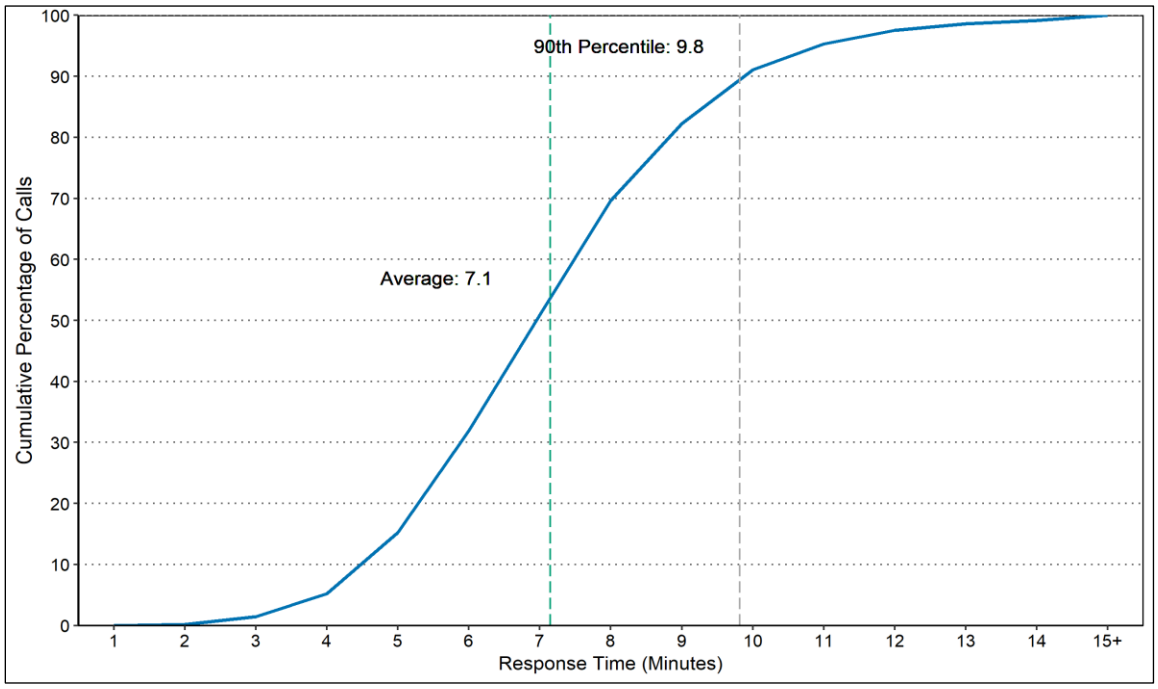

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FIGURE 6-6: Frequency Distribution of Response Time – First Arriving Unit – Fire

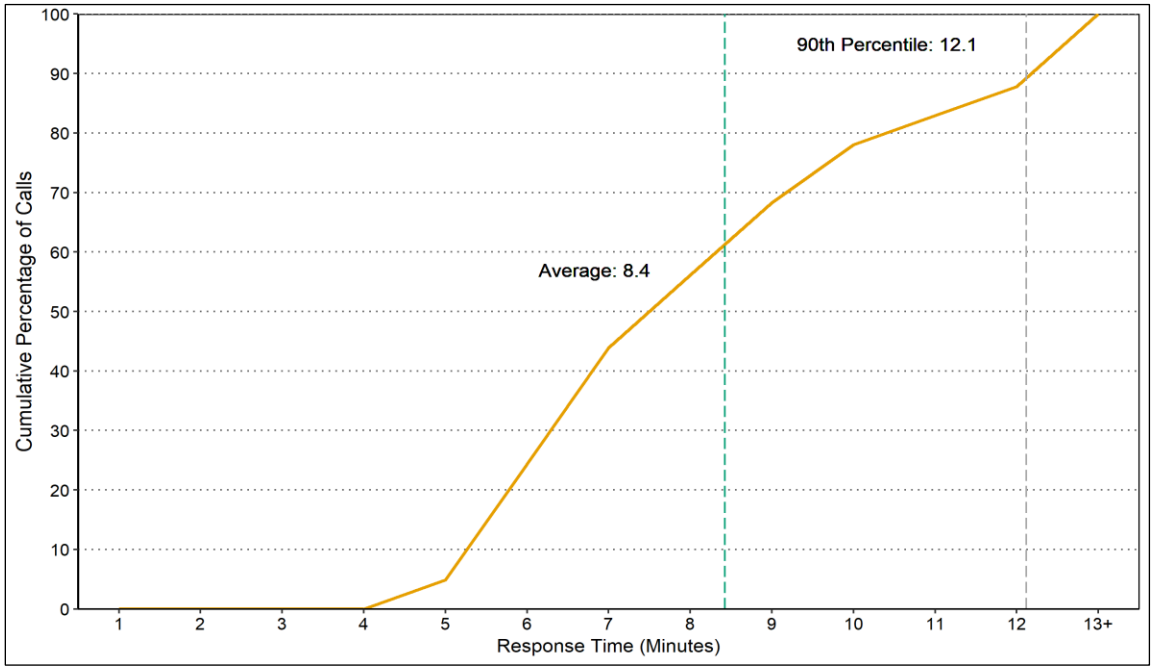

TABLE 6-6: Cumulative Distribution of Response Time – First Arriving Unit – EMS

Response Time (minute)	Frequency	Cumulative Percentage
1	0	0.0
2	3	0.2
3	23	1.5
4	66	5.2
5	178	15.3
6	295	31.9
7	335	50.9
8	332	69.6
9	223	82.2
10	156	91.1
11	75	95.3
12	39	97.5
13	19	98.6
14	10	99.2
15+	15	100.0

TABLE 6-7: Cumulative Distribution of Response Time – First Arriving Unit – Outside and Structure Fires

Response Time (minute)	Frequency	Cumulative Percentage
1	0	0.0
2	0	0.0
3	0	0.0
4	0	0.0
5	2	4.9
6	8	24.4
7	8	43.9
8	5	56.1
9	5	68.3
10	4	78.0
11	2	82.9
12	2	87.8
13+	5	100.0

Observations:

- For 70 percent of EMS calls, the response time of the first arriving unit was less than 8 minutes.
- For 56 percent of outside and structure fire calls, the response time of the first arriving unit was less than 8 minutes.

NFPA 1710 response time criteria are utilized by CPSM as a benchmark for service delivery and in the overall staffing and deployment of fire departments, and is not a CPSM recommendation. It is also our observation that agencies are seldom able to achieve the response time criteria established in this standard. The data observed in the Lake Cities system are indicative of a system that is extremely proficient in its service delivery, yet it still is unable to meet the response time criteria espoused in NFPA 1710.

The following three figures, 6-7, 6-8, and 6-9, illustrate the 240-seconds, 48-seconds, and composite travel time, respectively, from LCFD stations. ***Note that these maps only depict travel times and not actual response times.***

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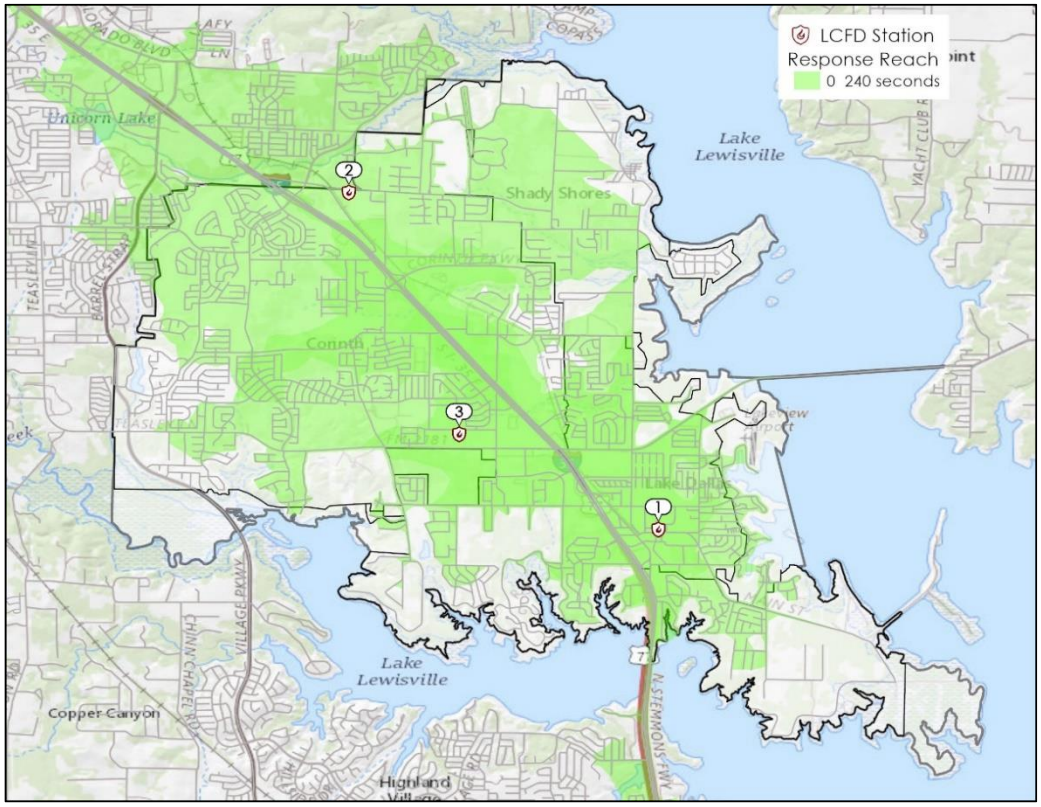
FIGURE 6-7: Lake Cities Station Locations and 240-seconds Travel Projection



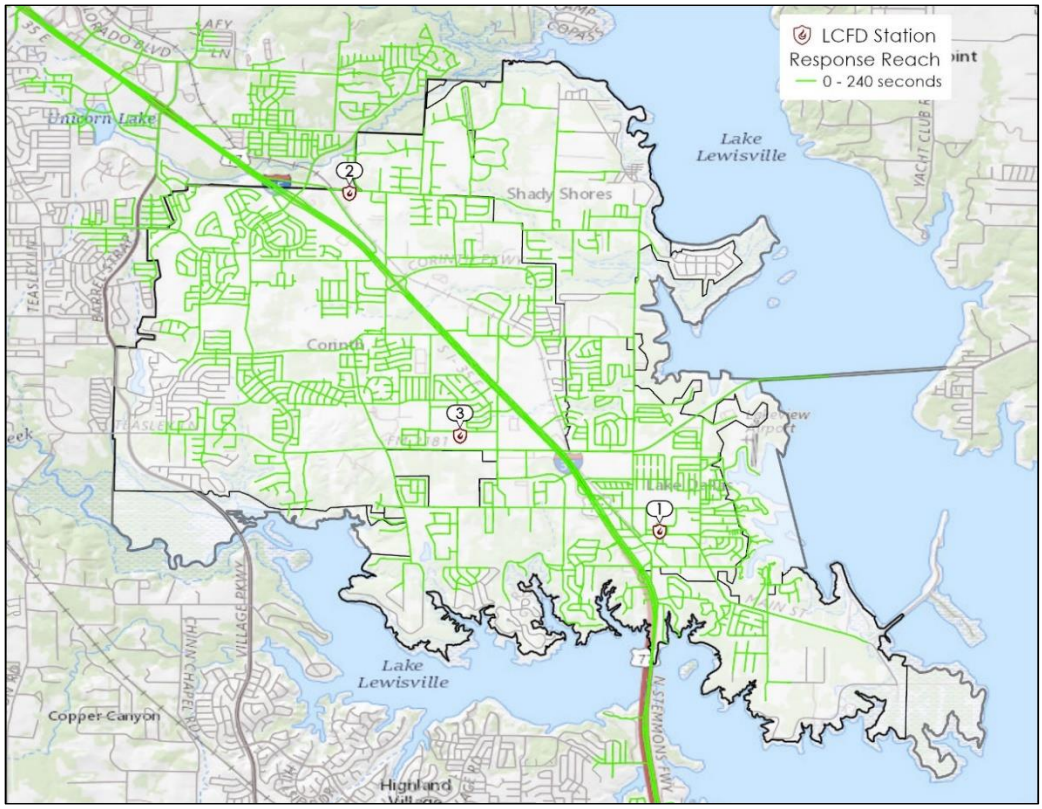


FIGURE 6-8: Lake Cities Station Locations and 480-seconds Travel Projection

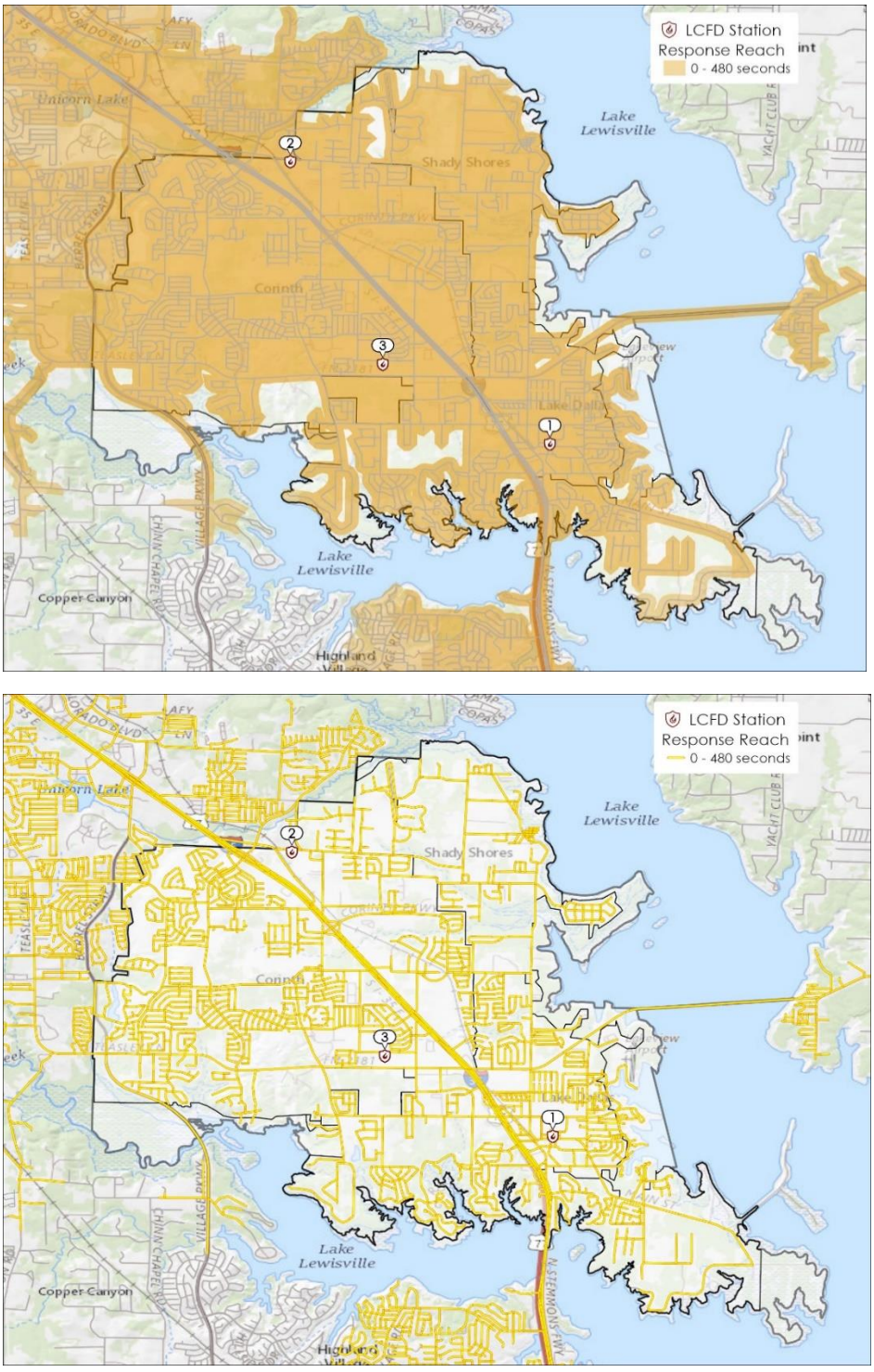
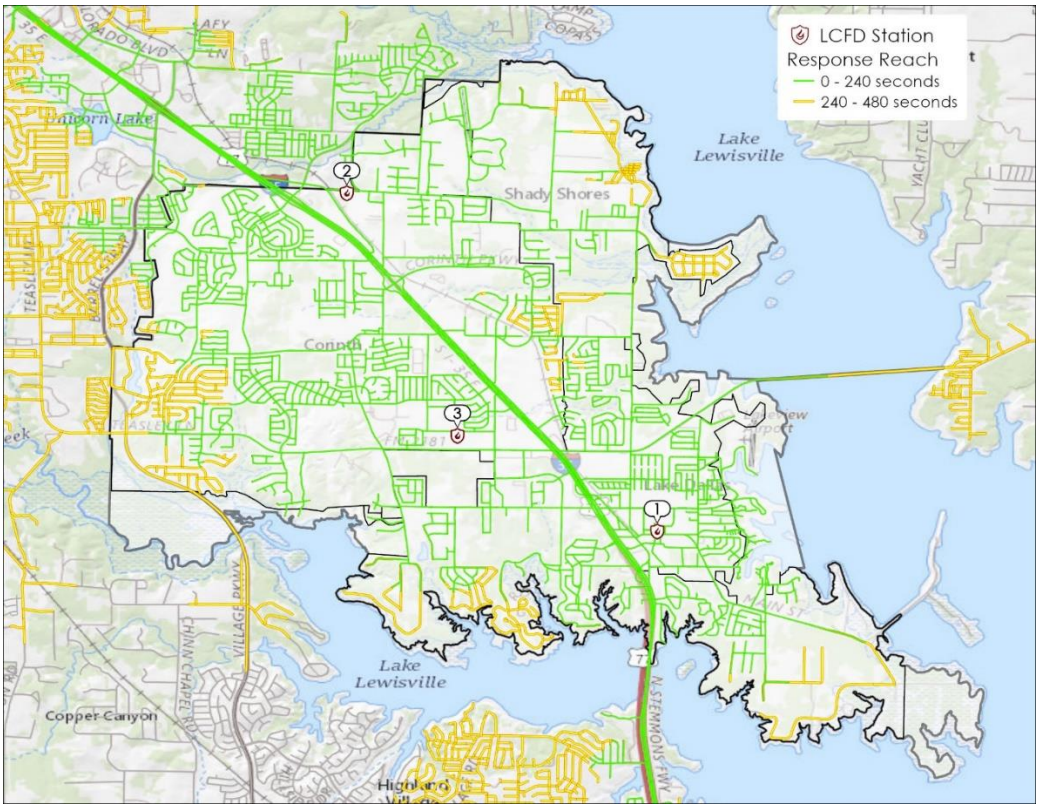
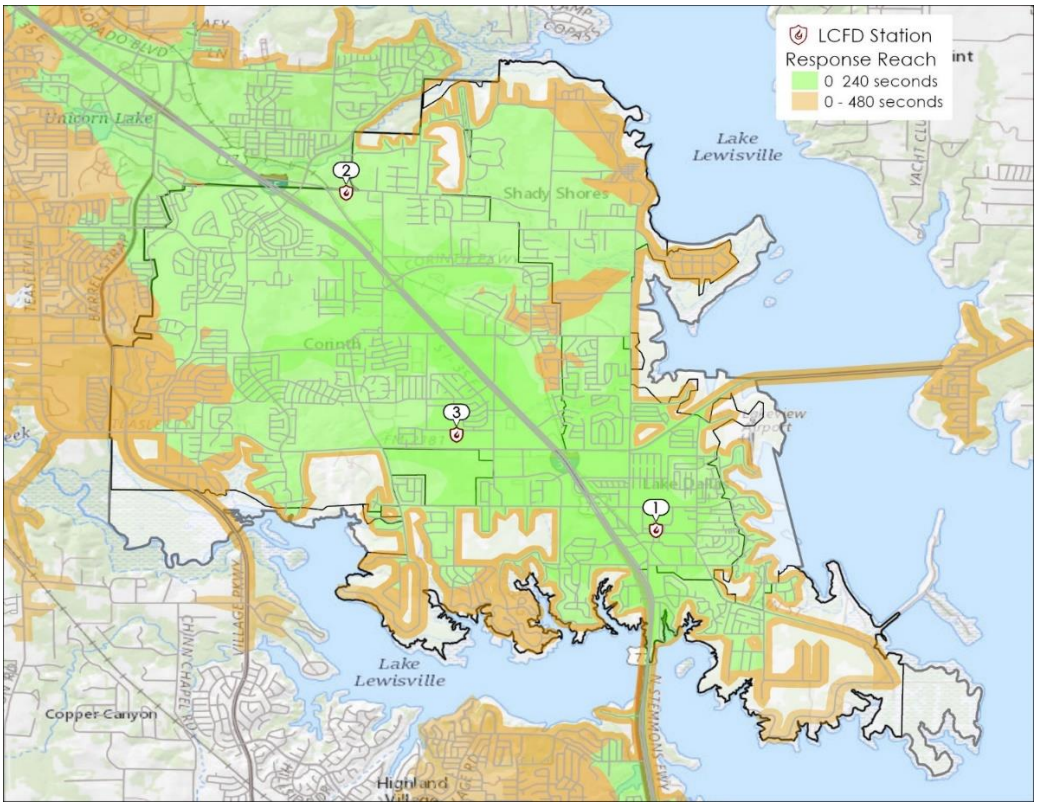


FIGURE 6-9: Lake Cities City Station Locations and Composite Travel Distances





Figures 6-10, 6-11, and 6-12 show the actual locations of fire, EMS, and other emergency responses carried out by the Lake Cities Fire Department. It is apparent from this graphic that most responses in Lake Cities should result in travel times that are within four to six minutes. It also appears that the overall distribution of calls is generally equally dispersed throughout the existing service boundaries and the fire station distribution should provide suitable coverage to ensure an appropriate response outcome.

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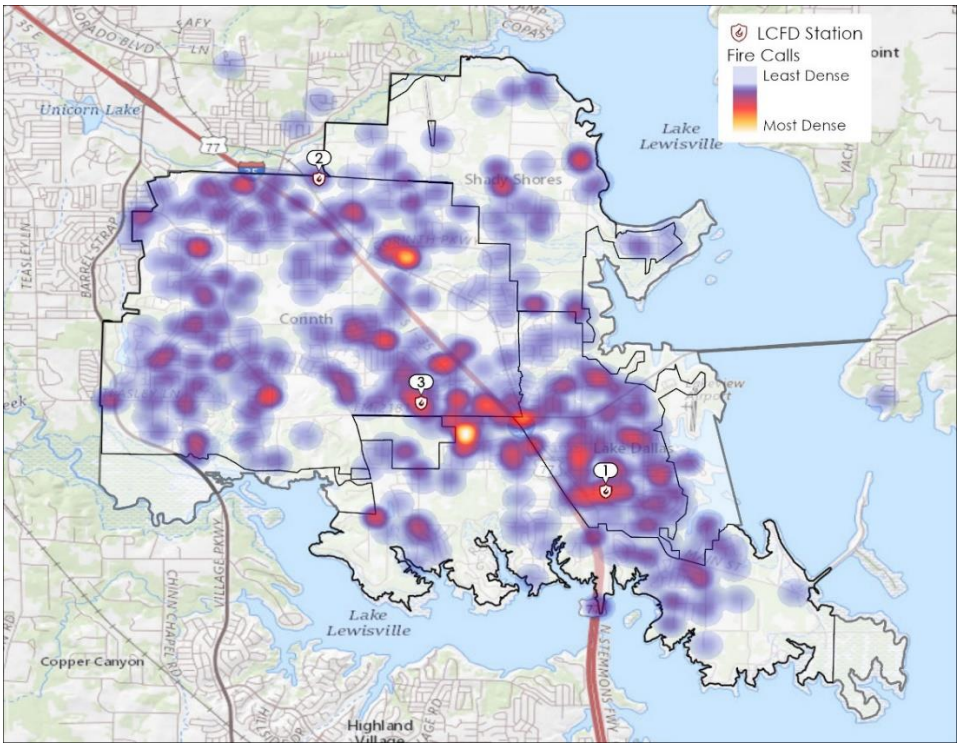
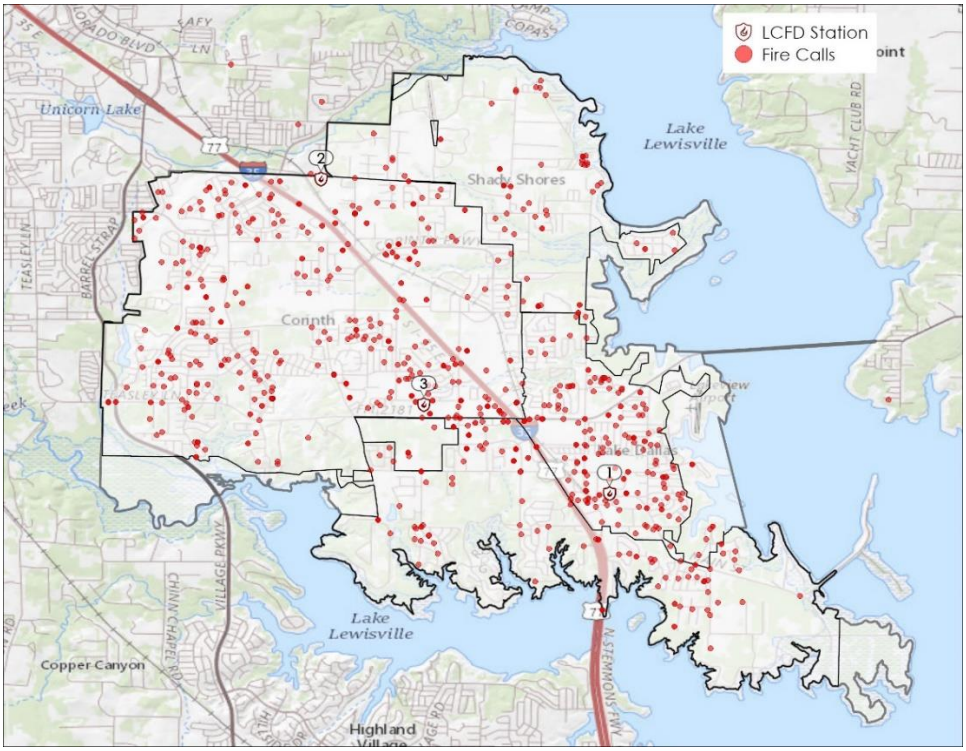
FIGURE 6-10: LCFD Fire Runs





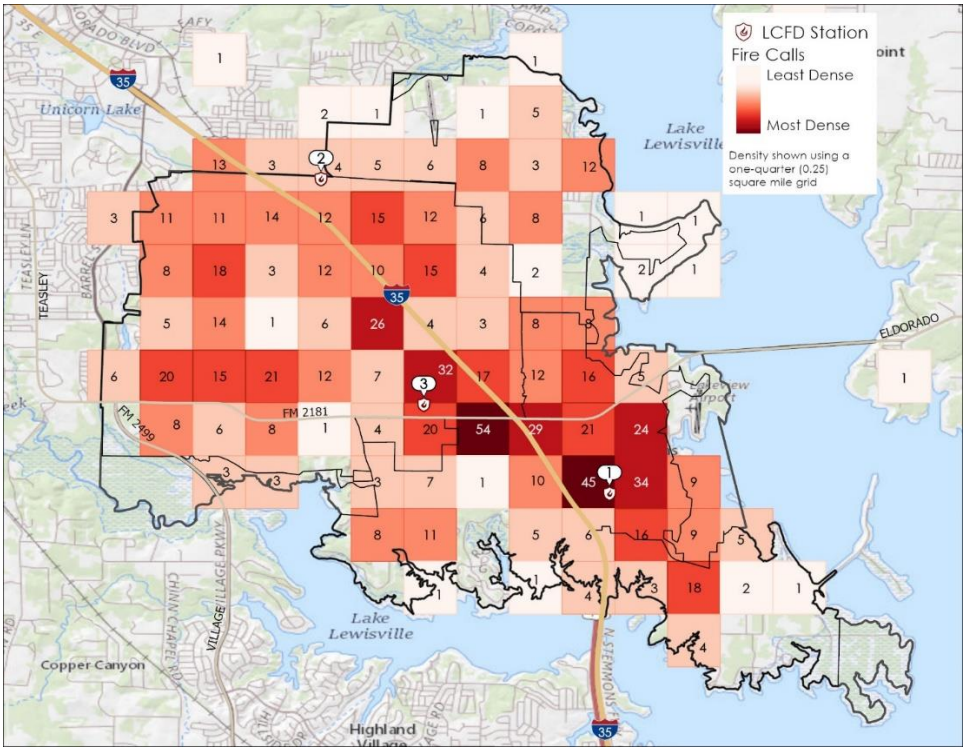
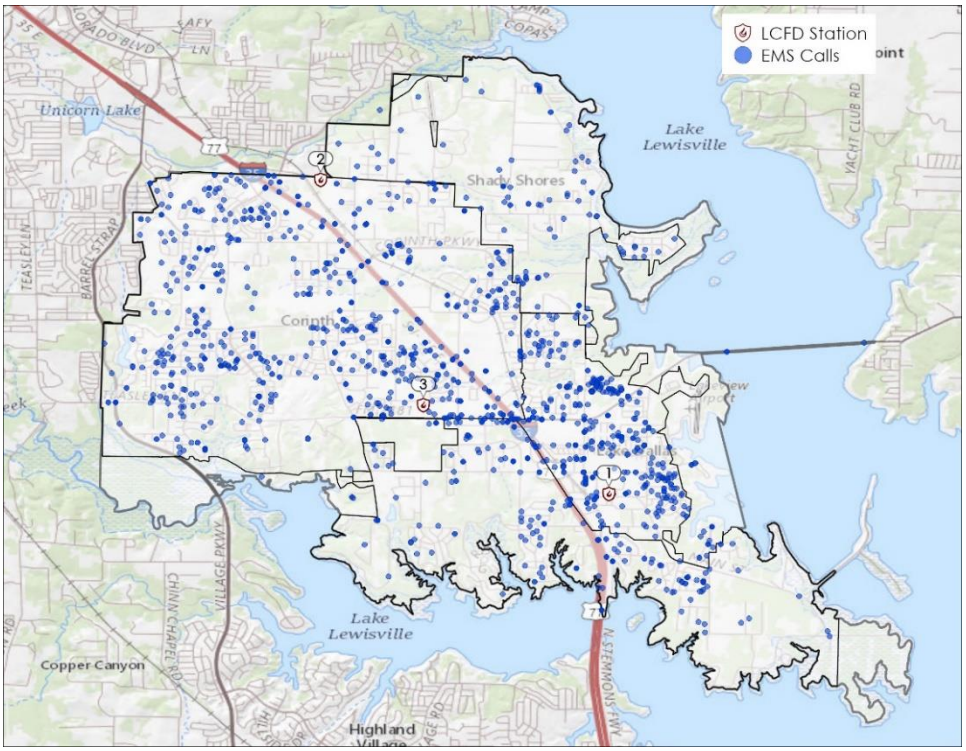
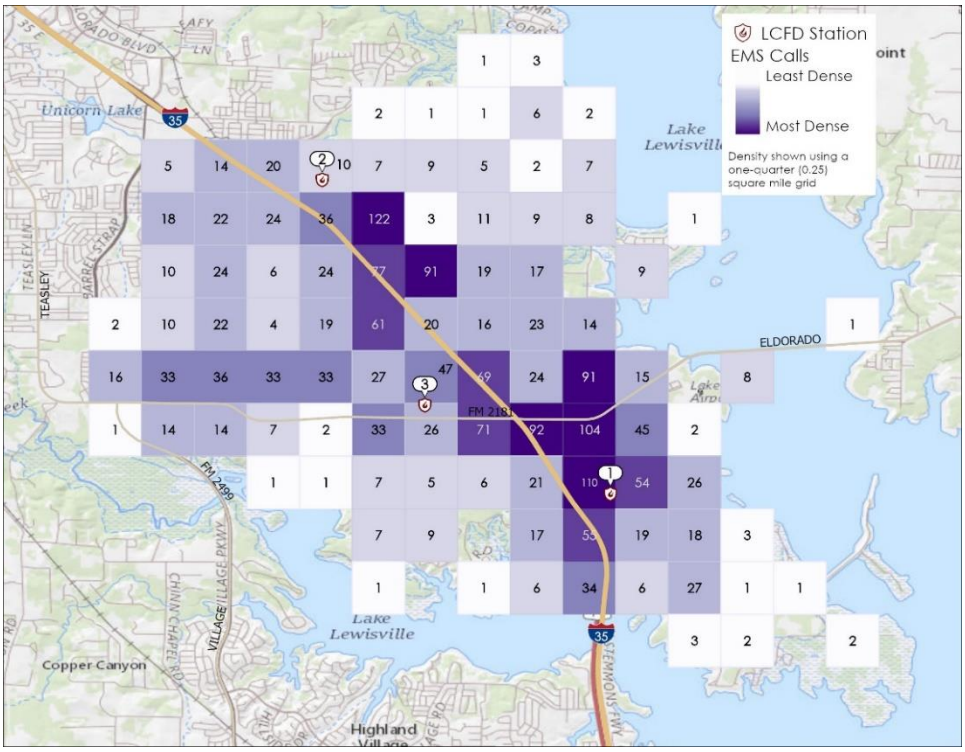


FIGURE 6-11: LCFD EMS Runs




LCFD Station
EMS Calls
Least Dense
Most Dense
Density shown using a one-quarter (0.25) square mile grid
Unicorn Lake
Lake Lewisville
Copper Canyon
Highland Village
ELDORADO
TEASLEY
FM 2499
VILLAGE PKWY
CHINN CHAPEL RD
N STEMMONS FWY

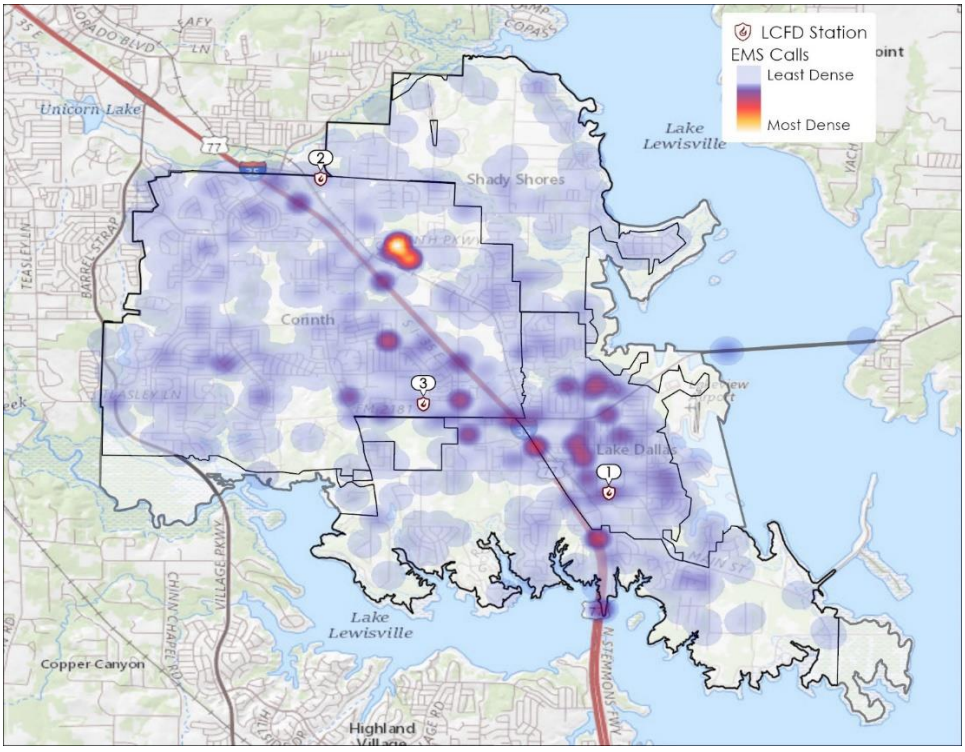
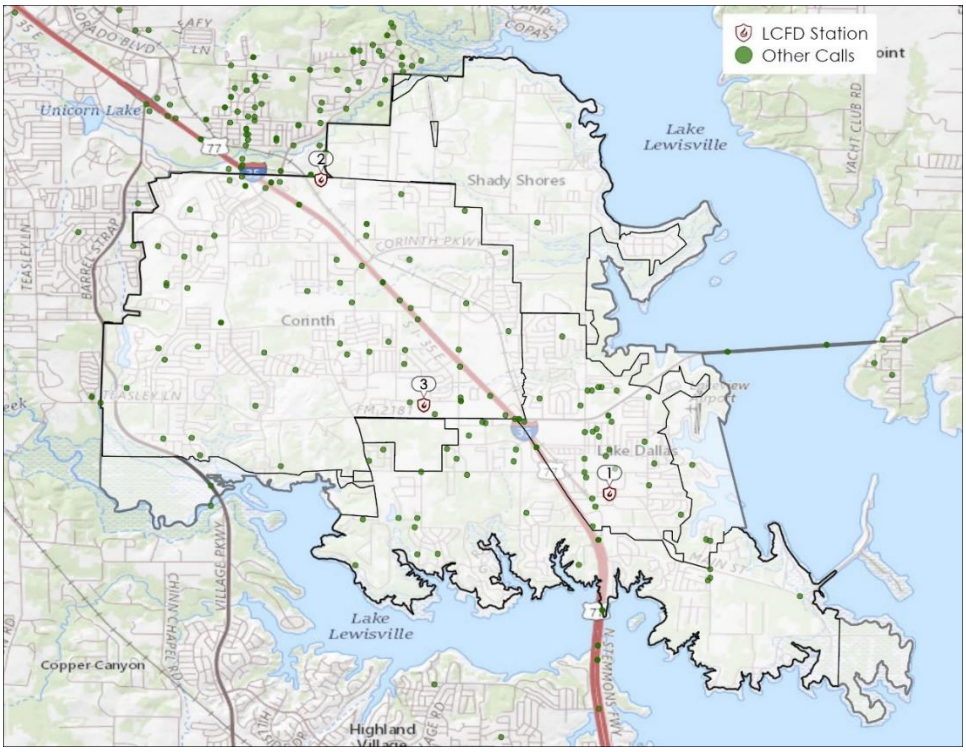
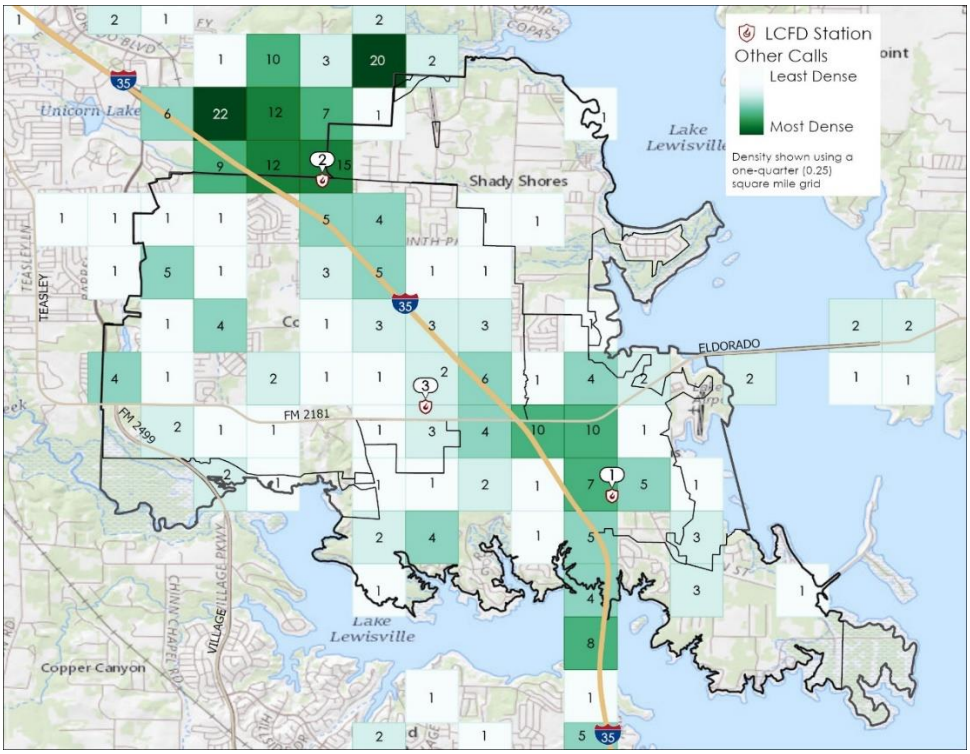
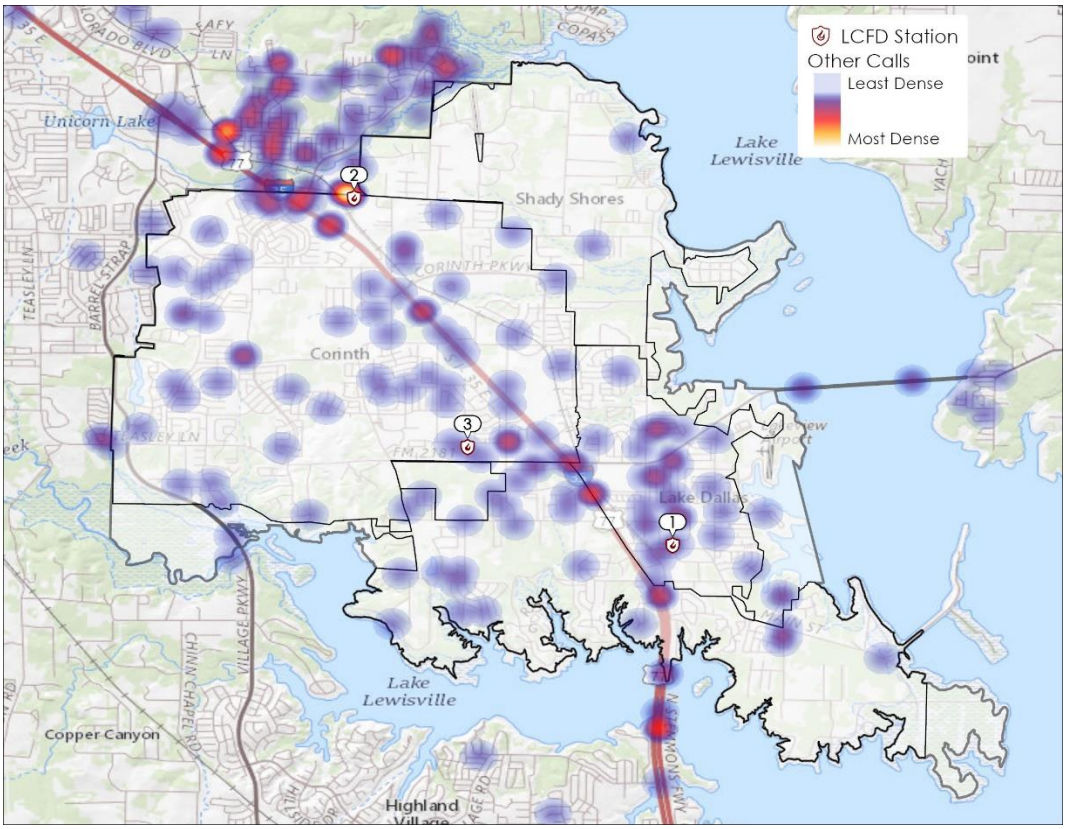

LCFD Station
EMS Calls
Least Dense
Most Dense
Unicorn Lake
Lake Lewisville
Shady Shores
Corinth
Lake Dallas
Copper Canyon
Highland Village
TEASLEY
FM 2499
VILLAGE PKWY
CHINN CHAPEL RD
N STEMMONS FWY

FIGURE 6-12: LCFD Other Runs






LCFD Station
Other Calls
Least Dense
Most Dense
Unicorn Lake
Shady Shores
Lake Lewisville
Corinth
Lake Dallas
Lake Lewisville
Copper Canyon
Highland Village
2
3
1

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SECTION 7. PERFORMANCE MEASUREMENT

Fire suppression, prevention programs, and EMS service delivery need to be planned and managed so that these efforts achieve specific, agreed-upon results. This requires establishing a set of goals for the activities of any given program. Determining how well an organization or program is doing requires that these goals be measurable and that they are measured against desired results. This is the goal of performance measurement.

Simply defined, performance measurement is the ongoing monitoring and reporting of progress toward pre-established goals. It captures data about programs, activities, and processes, and displays data in standardized ways that help communicate to service providers, customers, and other stakeholders how well the agency is performing in key areas. Performance measurement provides an organization with tools to assess performance and identify areas in need of improvement. In short, ***what gets measured gets improved***.

The need to continually assess performance requires adding new words and definitions to the fire service lexicon. Fire administrators need to be familiar with the different tools available and the consequences of their use. In *Managing the Public Sector*, business professor Grover Starling applies the principles of performance measurement to the public sector. He writes that the consequences to be considered for any given program include:

Administrative feasibility: How difficult will it be to set up and operate the program?

Effectiveness: Does the program produce the intended effect in the specified time? Does it reach the intended target group?

Efficiency: How do the benefits compare with the costs?

Equity: Are the benefits distributed equitably with respect to region, income, gender, ethnicity, age, and so forth?

Political feasibility: Will the program attract and maintain key actors with a stake in the program area?[25]

Performance measurement systems vary significantly among different types of public agencies and programs. Some systems focus primarily on efficiency and productivity within work units, whereas others are designed to monitor outcomes produced by major public programs. Still others track the quality of services provided by an agency and the extent to which citizens are satisfied with these services.

Within the fire service, performance measures tend to focus on inputs (the amount of money and resources spent on a given program or activity) and short-term outputs (the number of fires, number of EMS calls, response times, etc.). One of the goals of any performance measurement system should be also to include efficiency and cost-effectiveness indicators, as well as explanatory information on how these measures should be interpreted. An explanation of these types of performance measures are shown in Table 7-1.

25. Grover Starling, *Managing the Public Sector*, (Cengage Learning), 396.

TABLE 7-1: The Five GASB Performance Indicators[26]

Category	Definition
Input indicators	These are designed to report the amount of resources, either financial or other (especially personnel), that have been used for a specific service or program.
Output indicators	These report the number of units produced or the services provided by a service or program.
Outcome indicators	These are designed to report the results (including quality) of the service.
Efficiency (and cost-effectiveness) indicators	These are defined as indicators that measure the cost (whether in dollars or employee hours) per unit of output or outcome.
Explanatory information	This includes a variety of information about the environment and other factors that might affect an organization's performance.

One of the most important elements of performance measurement within the fire service is to describe service delivery performance in a way that both citizens and those providing the service have the same understanding. The customer will ask, "Did I get what I expected?" the service provider will ask, "Did I provide what was expected?"

Ensuring that the answer to both questions is "yes" requires alignment of these expectations and the use of understandable terms. The author of the "Leadership" chapter of the 2012 edition of ICMA's *Managing Fire and Emergency Services* "Green Book" explains how jargon can get in the way:

> *Too often, fire service performance measures are created by internal customers and laden with jargon that external customers do not understand. For example, the traditional fire service has a difficult time getting the public to understand the implications of the "time temperature curve" or the value of particular levels of staffing in the suppression of fires. Fire and emergency service providers need to be able to describe performance in a way that is clear to customers, both internal and external. In the end, simpler descriptions are usually better.*[27]

Following are a number of performance measures that may be considered:

Key Performance Indicators for EMS

ESO is an industry leader in patient care reporting software and also as a clinical data analytics provider, ESO utilizes electronic patient care reports (ePCRs) as its platform. In 2018, ESO released its ***ESO EMS Index***, which is an analysis of key performance indicators (KPIs) for EMS quality metrics. The dataset is real-world data, compiled and aggregated from more than 1,000 agencies across the United States that use ESO's products and services. These data are based

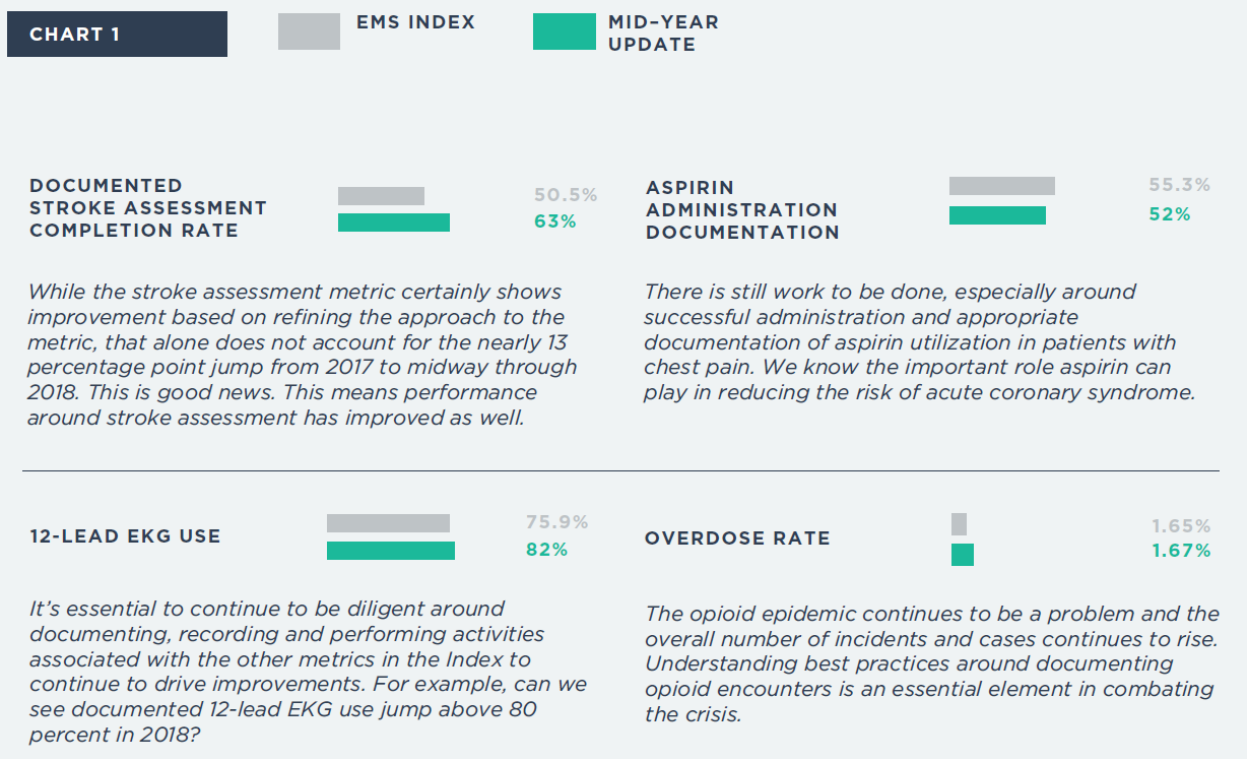
26. From Harry P. Hatry et al., eds. *Service Efforts and Accomplishments Reporting: Its Time Has Come* (Norwalk, CT: GASB, 1990).
27 I. David Daniels, "Leading and Managing," in *Managing Fire and Emergency Services* (ICMA: Washington, DC: 2012), 202.

on 5.02 million patient encounters between January 1, 2017, and December 31, 2017. The Index tracks performance of EMS agencies nationwide across five metrics:

- Stroke assessment and documentation.
- Overdose events.
- End-tidal carbon dioxide ($ETCO_2$) monitoring.
- 12-lead electrocardiogram (EKG) use.
- Aspirin administration for chest pain.

This report is beginning to serve as a benchmark comparator for EMS providers across the country for several important measures of clinical quality. CPSM believes that the ESO EMS Index can provide a valid and comprehensive basis upon which EMS service delivery in Lake Cities can be compared. These comparisons should be reported on a regular basis (no less than quarterly), distributed publicly, and used as a basis for continuous quality improvement.

FIGURE 7-1: ESO EMS Index Example



ISO RATING

The Insurance Services Office (ISO) collects data for more than 48,000 communities and fire districts throughout the country. These data are then analyzed using a proprietary Fire Suppression Rating Schedule (FSRS). This analysis then results in a PPC (Public Protection Classification) score between 1 and 10 for a community, with Class 1 representing "superior property fire protection" and Class 10 indicating that an area doesn't meet the minimum criteria set by the ISO. In 2013, the revised FSRS was released; it adds an emphasis on a community's effort to limit loss before an incident occurs (fire prevention).

Since the 1800s, insurance companies have been involved in one way or another in "rating" fire departments. As cities grew and buildings became larger and communities more industrialized, insurance companies sometimes incurred large losses from fires. Much of the time, these losses were due to inadequate water supplies and ineffective fire suppression capabilities. To help reduce losses, insurance companies developed criteria to evaluate community fire suppression capabilities and to quantify the level of fire services provided. Once quantified, insurance companies used the information (rating) to determine and assign fire insurance rates. The emphasis then, as now, was primarily to reduce dollar loss from fires. Though improving water supplies and fire suppression can and does improve life safety, the purpose of rating fire departments is to adjust insurance rates to lessen insurance company losses.

ISO uses data and information provided by each community to derive a Public Protection Classification (PPC). Community evaluations are performed periodically or when there is reason to believe there may be a change in the PPC. As it is intended, the PPC is only used to assess a community's fire protection—it does not consider other emergencies or important services provided by the fire department such as EMS, technical rescue, or hazmat incident mitigation. The ISO acknowledges the use of the PPC is limited to assessing *fire suppression capabilities* and that fire departments do many more things to improve public safety.[28]

In developing a PPC, the following major categories are evaluated:

- Emergency Communications: Fire alarm and communication systems, including telephone systems, telephone lines, staffing, and dispatching systems.
- Fire Department: The fire department, including equipment, staffing, training, and geographic distribution of fire companies.
- Water Supply: The water supply system, including the condition and maintenance of hydrants and the amount of available water compared to the amount needed to suppress fires.
- Fire Prevention: Programs that contain plan review; certificate of occupancy inspections; compliance follow-up; inspection of fire protection equipment; and fire prevention regulations related to fire lanes on area roads, hazardous material routes, fireworks, barbecue grills, and wildland-urban interface areas.
- Public Fire Safety Education Programs: Fire safety education training and programs for schools, private homes, and buildings with large loss potential or hazardous conditions, and a juvenile fire-setter intervention program.

During it last evaluation, Lake Cities was rated ISO Class 2. The score was within 2 points of achieving an ISO 1. In the evaluation, Lake Cities scored exceptionally well in all areas of the

28. Flippin, P., Gaull E., Laun, J., Flicko, R., District of Columbia Fire and Emergency Medical Services Fleet Management Audit and Assessment (District of Columbia Fire and Emergency Medical Services, Washington, DC 2013).

evaluation. CPSM recognizes the achievement as a Class 2 ISO rating as a ***Best Practice***. Nationwide in 2014, only 750 communities were designated at an ISO 2 rating.

EDUCATION AND TRAINING PROGRAMS

Training is one of the most important functions that a fire department should be performing on a regular basis. One could even make the argument that training is, in some ways, more important than emergency responses, because a department that is not well-trained, prepared, and operationally ready will be unable to effectively and safely fulfill its emergency response obligations. A comprehensive, relative, and ongoing training program is absolutely critical to the fire department's level of success.

An effective fire department training program must cover all of the essential elements of that department's core missions and responsibilities. The program must include an appropriate combination of technical/classroom training, manipulative or hands-on/practical evolutions, and training assessment to gauge the effectiveness of these efforts. Most of the training, but particularly the practical, hands-on training evolutions, should be developed based upon the department's own operating procedures while remaining cognizant of widely accepted practices and standards.

Certain Occupational Safety and Health Administration (OSHA) regulations dictate that minimum training must be completed on an annual basis, covering various topics that include:

- A review of the respiratory protection standard, self-contained breathing apparatus (SCBA) refresher and user competency training, SCBA fit testing (29 CFR 1910.134).
- Blood Borne Pathogens Training (29 CFR 1910.1030).
- Hazardous Materials Training (29 CFR 1910.120).
- Confined Space Training (29 CFR 1910.146).
- Structural Firefighting Training (29 CFR 1910.156).

Education and training programs help to create the character of a fire service organization. Agencies that place a real emphasis on their training have a tendency to be more proficient in carrying out day-to-day duties. The prioritization of training also fosters an image of professionalism and instills pride in the organization.

CPSM was highly impressed by the level of training and ongoing efforts to provide opportunities to the members of LCFD. The coffee table briefing and training books created by the Chief and administration are a Best Practice that the LCFD should be proud to share.

The efforts of the city to link the stations to provide ongoing communication and training is also a Best Practice. This type of communication has been used by many other disciplines but is only just making its way into the fire service. It ensures that all personnel are receiving the same training and information.

SECTION 8. DATA ANALYSIS

This data analysis was prepared as a key component of the study of the Lake Cities Fire Department (LCFD). This analysis examines all the department's calls for service between July 1, 2018, and June 30, 2019, as recorded in the Denco Area 911 District's computer-aided dispatch (CAD) system and in the LCFD's National Fire Incident Reporting System (NFIRS).

This analysis is made up of five parts. The first part focuses on call types and dispatches. The second part explores the time spent and the workload of individual units. The third part presents an analysis of the busiest hours in the year studied. The fourth part provides a response time analysis of LCFD units. The fifth and final part is an analysis of unit transports.

LCFD began the year covered by this study operating out of two stations, utilizing two medics, one backup ambulance, one engine, one backup engine, one quint, one brush engine, one backup brush engine, one heavy rescue unit, one ATV, one squad, one support pick-up, and four administrative vehicles. When a third station opened on February 18, 2019, the backup engine became another primary engine until a new engine arrived in May 2019.

During the study period, the Lake Cities Fire Department responded to 3,444 calls, of which 61 percent were EMS calls. The total combined workload (deployed time) for all LCFD units was 3,316.8 hours. The average dispatch time for the first arriving unit was 0.8 minutes and the average response time of the first arriving LCFD unit was 7.4 minutes. The 90th percentile dispatch time was 1.4 minutes and the 90th percentile response time was 10.3 minutes.

Methodology

In this report, CPSM analyzes calls and runs. A call is an emergency service request or incident. A run is a dispatch of a unit (i.e., a unit responding to a call). Thus, a call may include multiple runs.

We received CAD data and NFIRS data for the Lake Cities Fire Department. We first matched the NFIRS and CAD data based on incident numbers provided. Then, we classified the calls in a series of steps. We first used the NFIRS incident type to identify canceled calls and to assign EMS, motor vehicle accident (MVA), and fire category call types. EMS calls were then assigned detailed categories based on their Emergency Medical Dispatch determinant codes (Clawson codes) and dispatch codes (CBD codes). Mutual aid calls were then identified based on the information recorded in the CAD data's 'district' field and the location of the call.

Finally, units with no corresponding call, and units without an en route or arrival time, were removed. Then, calls with no responding LCFD units were removed, as were calls to which the command or administrative units were the sole responders. For these reasons, 82 incidents are not included in the analysis sections of the report. However, the workload of administrative units is documented in Attachment II.

In this report, canceled and mutual aid calls are included in all analyses other than the response time analyses.

AGGREGATE CALL TOTALS AND RUNS

During the year studied, LCFD responded to 3,444 non-administrative calls. Of these, 22 were structure fire calls and 37 were outside fire calls.

Calls by Type

Table 8-1, Figure 8-1, and Figure 8-2 show the number of calls by call type, average calls per day, and the percentage of calls that fall into each call type category for the 12-month period studied.

TABLE 8-1: Call Types

Call Type	Number of Calls	Calls per Day	Call Percentage
Breathing difficulty	181	0.5	5.3
Cardiac and stroke	248	0.7	7.2
Fall and injury	409	1.1	11.9
Illness and other	506	1.4	14.7
MVA	385	1.1	11.2
Overdose and psychiatric	120	0.3	3.5
Seizure and unconsciousness	260	0.7	7.5
EMS Total	**2,109**	**5.8**	**61.2**
False alarm	209	0.6	6.1
Good intent	67	0.2	1.9
Hazard	106	0.3	3.1
Outside fire	37	0.1	1.1
Public service	440	1.2	12.8
Structure fire	22	0.1	0.6
Fire Total	**881**	**2.4**	**25.6**
Canceled	302	0.8	8.8
Mutual aid	152	0.4	4.4
Total	**3,444**	**9.4**	**100.0**

FIGURE 8-1: EMS Calls by Type

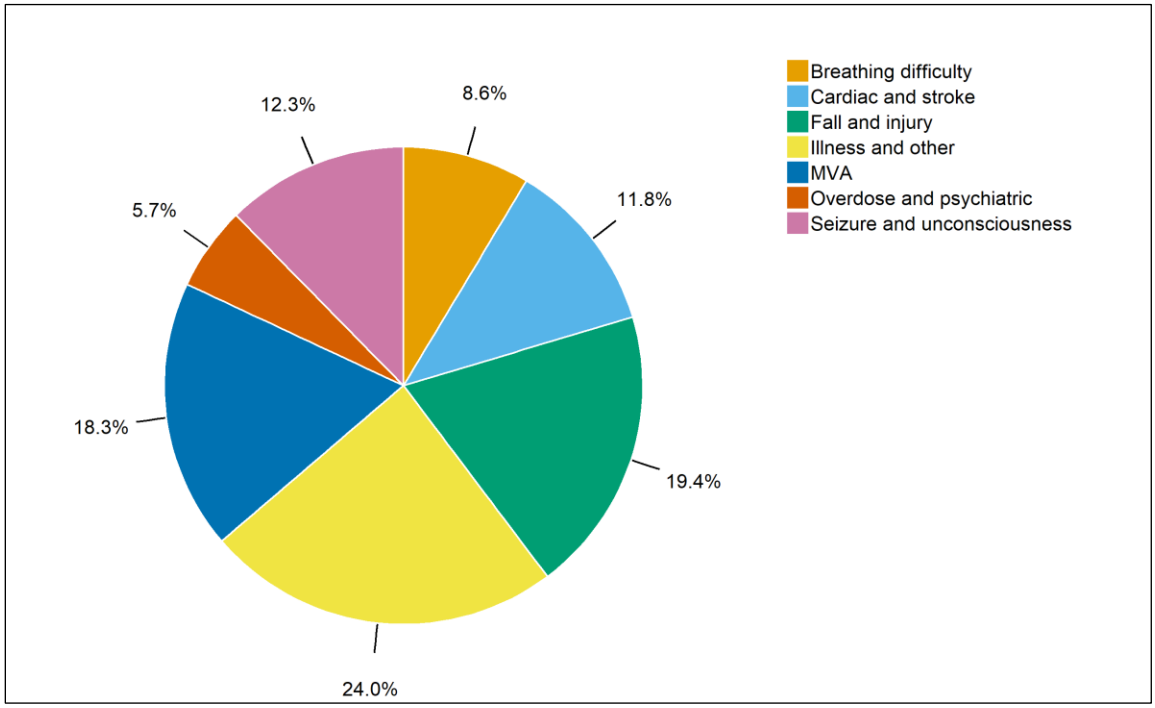
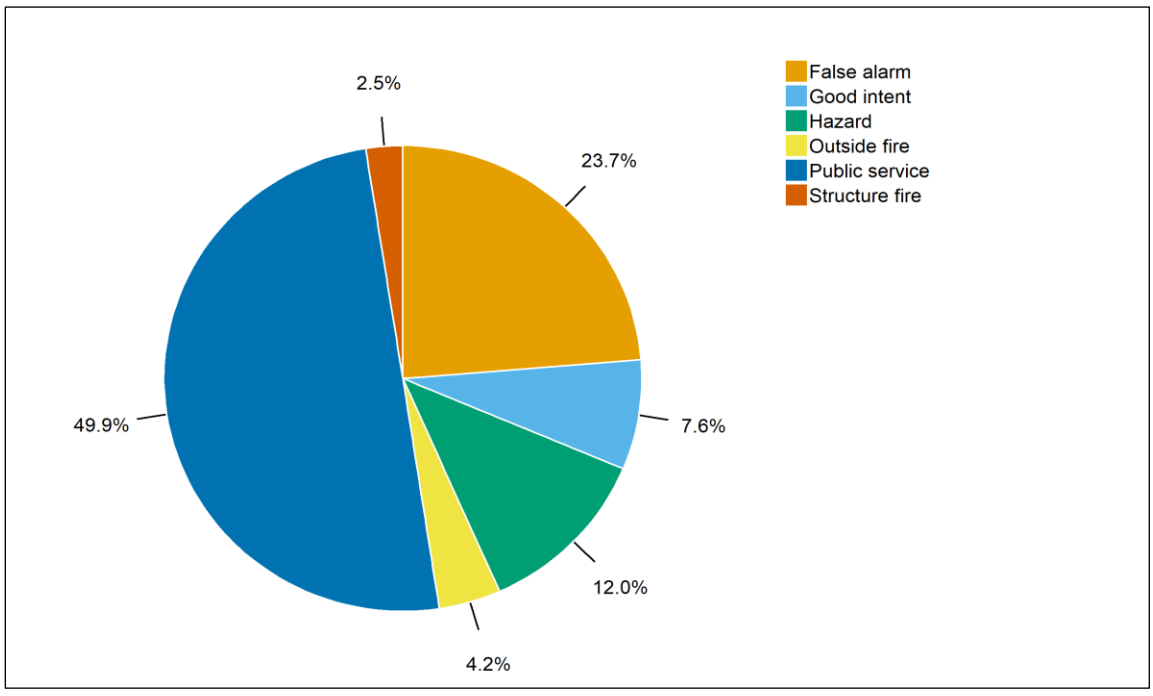


FIGURE 8-2: Fire Calls by Type



Observations:

Overall

- The department received an average of 9.4 calls per day, including 0.8 canceled and 0.4 mutual aid calls.
- EMS calls for the year totaled 2,109 (61 percent of all calls), an average of 5.8 per day.
- Fire calls for the year totaled 881 (26 percent of all calls), an average of 2.4 per day.

EMS

- Illness and other calls were the largest category of EMS calls at 24 percent of EMS calls, an average of 1.4 calls per day.
- Cardiac and stroke calls made up 12 percent of EMS calls, an average of 0.7 calls per day.
- Motor vehicle accidents made up 18 percent of EMS calls, an average of 1.1 calls per day.

Fire

- Public service calls were the largest category of fire calls at 50 percent of fire calls, an average of 1.2 calls per day.
- False alarm calls made up 24 percent of fire calls, an average of 0.6 calls per day.
- Structure and outside fire calls combined made up 7 percent of fire calls, an average of 0.2 calls per day, or one call every 6 days.

Calls by Type and Duration

Table 8-2 shows the duration of calls by type using four duration categories: less than 30 minutes, 30 minutes to one hour, one to two hours, and more than an hour.

TABLE 8-2: Calls by Type and Duration

Call Type	Less than 30 Minutes	30 Minutes to One Hour	One to Two Hours	More Than Two Hours	Total
Breathing difficulty	26	112	38	5	181
Cardiac and stroke	44	149	54	1	248
Fall and injury	114	217	76	2	409
Illness and other	87	302	111	6	506
MVA	183	140	57	5	385
Overdose and psychiatric	36	61	20	3	120
Seizure and unconsciousness	41	164	52	3	260
EMS Total	**531**	**1,145**	**408**	**25**	**2,109**
False alarm	191	15	3	0	209
Good intent	65	2	0	0	67
Hazard	68	24	7	7	106
Outside fire	24	7	4	2	37
Public service	351	46	23	20	440
Structure fire	8	7	6	1	22
Fire Total	**707**	**101**	**43**	**30**	**881**
Canceled	300	2	0	0	302
Mutual aid	81	28	24	19	152
Total	**1,619**	**1,276**	**475**	**74**	**3,444**

Observations:

EMS

- A total of 1,676 EMS calls (79 percent) lasted less than one hour, 408 EMS calls (19 percent) lasted one to two hours, and 25 EMS calls (1 percent) lasted two or more hours.
- On average, there were 1.2 EMS calls per day that lasted more than one hour.
- A total of 193 cardiac and stroke calls (78 percent) lasted less than one hour, 54 cardiac and stroke calls (22 percent) lasted one to two hours, and 1 cardiac and stroke call (less than 1 percent) lasted two or more hours.
- A total of 323 motor vehicle accidents (84 percent) lasted less than one hour, 57 motor vehicle accidents (15 percent) lasted one to two hours, and 5 motor vehicle accidents (1 percent) lasted two or more hours.

Fire

- A total of 808 fire calls (92 percent) lasted less than one hour, 43 fire calls (5 percent) lasted one to two hours, and 30 fire calls (3 percent) lasted two or more hours.
- On average, there were 0.2 fire calls per day that lasted more than one hour.
- A total of 15 structure fire calls (68 percent) lasted less than one hour, 6 structure fire calls (27 percent) lasted one to two hours, and 1 structure fire call (5 percent) lasted two or more hours.
- A total of 31 outside fire calls (84 percent) lasted less than one hour, 4 outside fire calls (11 percent) lasted one to two hours, and 2 outside fire calls (5 percent) lasted two or more hours.
- A total of 808 fire calls (92 percent) lasted less than one hour, 43 fire calls (5 percent) lasted one to two hours, and 30 fire calls (3 percent) lasted two or more hours.

Average Calls per Day and per Hour

Figure 8-3 shows the monthly variation in the average daily number of calls handled by the LCFD during the year studied. Similarly, Figure 8-4 illustrates the average number of calls received each hour of the day over the course of the year.

FIGURE 8-3: Average Calls per Day, by Month

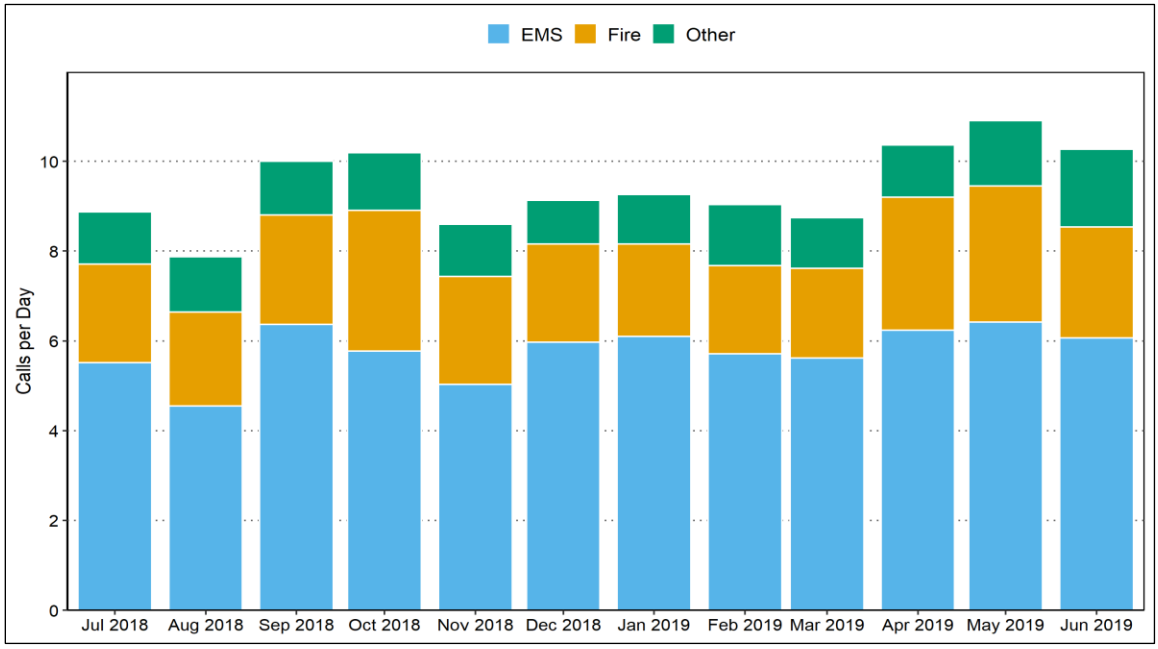
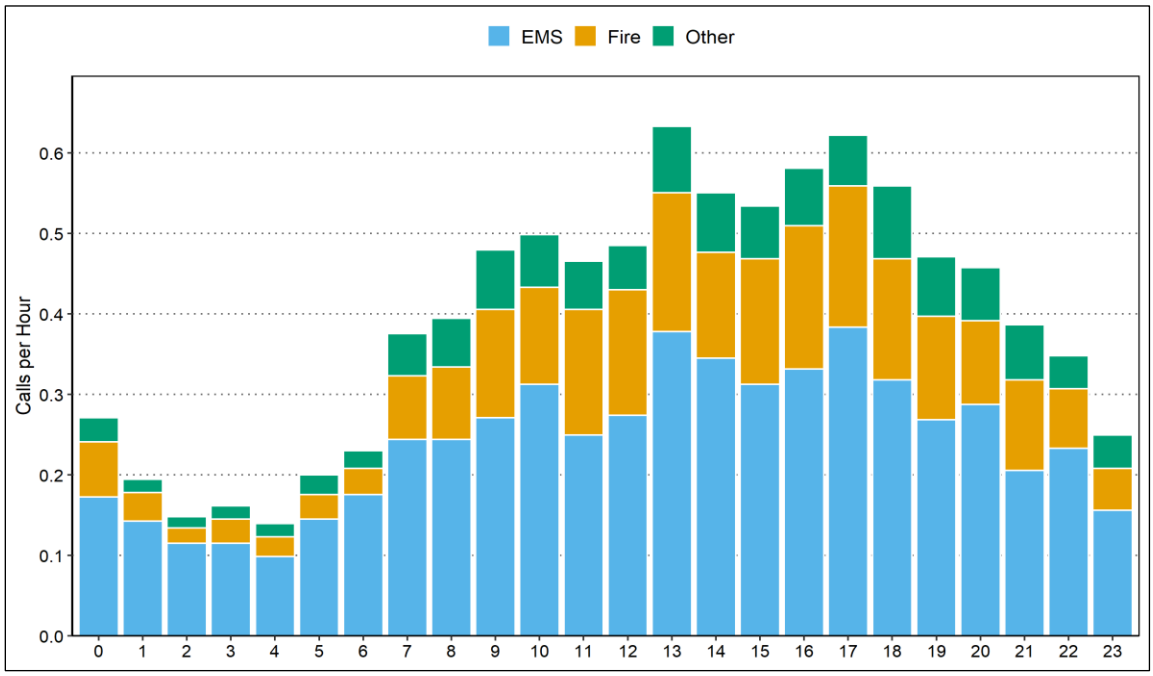


FIGURE 8-4: Calls by Hour of Day



Observations:

Average Calls per Month

- Average EMS calls per day ranged from 4.5 in August 2018 to 6.4 in May 2019.
- Average fire calls per day ranged from 2.0 in February 2019 to 3.1 in October 2018.
- Average other calls per day ranged from 1.0 in December 2018 to 1.7 in June 2019.
- Average calls per day overall ranged from 7.9 in August 2018 to 10.9 in May 2019.

Average Calls per Hour

- Average EMS calls per hour ranged from 0.1 between 4:00 a.m. and 5:00 a.m. to 0.4 between 5:00 p.m. and 6:00 p.m.
- Average fire calls per hour ranged from less than 0.1 between 2:00 a.m. and 3:00 a.m. to 0.2 between 4:00 p.m. and 5:00 p.m.
- Average other calls per hour ranged from less than 0.1 between 2:00 a.m. and 3:00 a.m. to 0.1 between 6:00 p.m. and 7:00 p.m.
- Average calls per hour overall ranged from 0.1 between 4:00 a.m. and 5:00 a.m. to 0.6 between 1:00 p.m. and 2:00 p.m.

Units Dispatched to Calls

Table 8-3, along with Figures 8-5 and 8-6, details the number of LCFD calls with one, two, or three or more units dispatched overall and broken down by call type. Figure 8-6 provides additional detail regarding units dispatched to fire calls.

TABLE 8-3: Calls by Call Type and Number of Units Dispatched

Call Type	Number of Units			Total Calls
	One	Two	Three or More	
Breathing difficulty	4	172	5	181
Cardiac and stroke	8	228	12	248
Fall and injury	11	377	21	409
Illness and other	26	463	17	506
MVA	10	319	56	385
Overdose and psychiatric	0	106	14	120
Seizure and unconsciousness	9	236	15	260
EMS Total	**68**	**1,901**	**140**	**2,109**
False alarm	38	97	74	209
Good intent	41	17	9	67
Hazard	51	34	21	106
Outside fire	19	11	7	37
Public service	229	196	15	440
Structure fire	1	1	20	22
Fire Total	**379**	**356**	**146**	**881**
Canceled	161	121	20	302
Mutual aid	109	38	5	152
Total	**717**	**2,416**	**311**	**3,444**
Total Percentage	**20.8**	**70.2**	**9.0**	**100.0**

FIGURE 8-5: Calls by Number of Units Dispatched – EMS

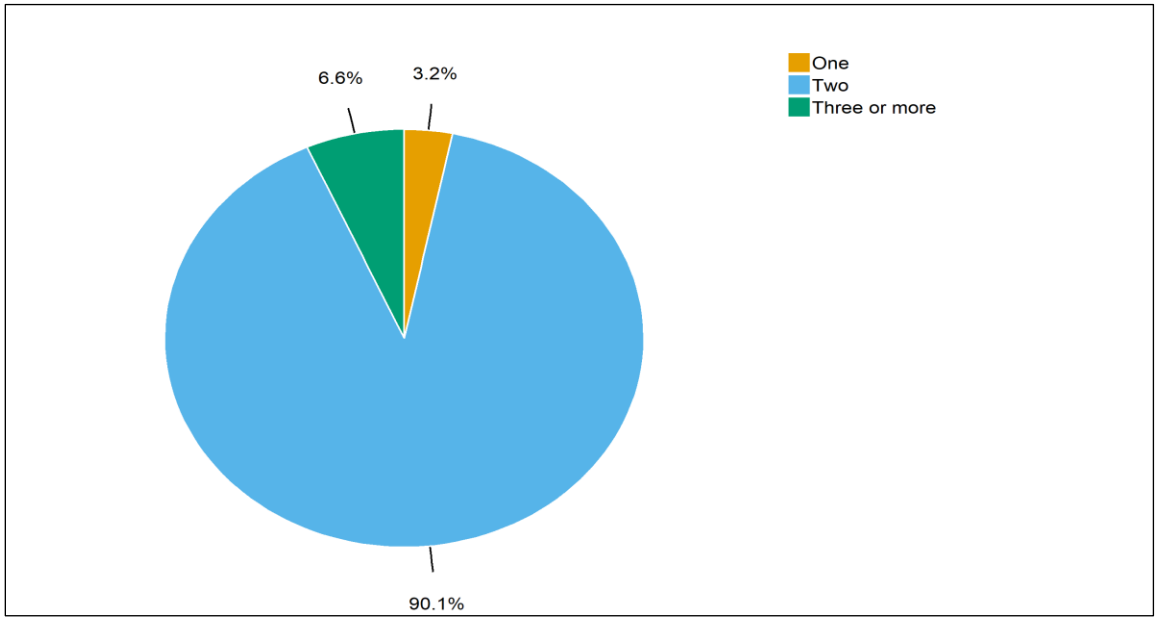
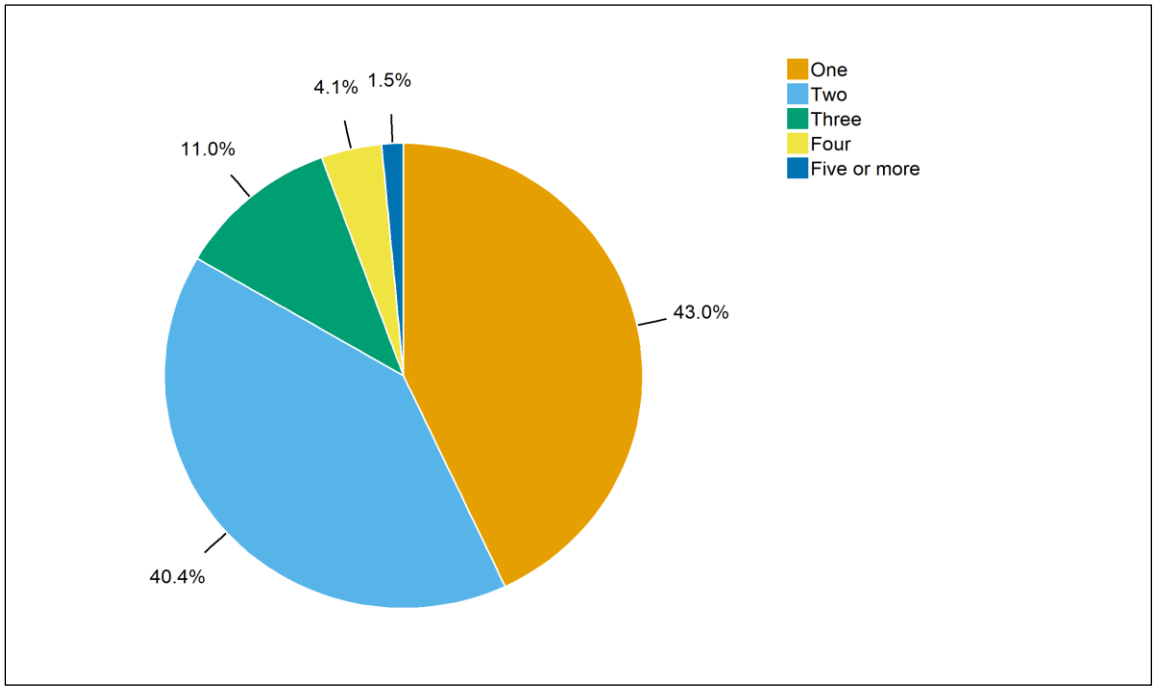


FIGURE 8-6: Calls by Number of Units Dispatched – Fire



Observations:

Overall

- On average, 1.9 units were dispatched to all calls; for 21 percent of calls only one unit was dispatched.
- Overall, three or more units were dispatched to 9 percent of calls.

EMS

- For EMS calls, one unit was dispatched 3 percent of the time, two units were dispatched 90 percent of the time, and three or more units were dispatched 7 percent of the time.
- On average, 2.0 units were dispatched per EMS call.

Fire

- For fire calls, one unit was dispatched 43 percent of the time, two units were dispatched 40 percent of the time, three units were dispatched 11 percent of the time, four units were dispatched 4 percent of the time, and five or more units were dispatched 1 percent of the time.
- For outside fire calls, three or more units were dispatched 19 percent of the time.
- For structure fire calls, three or more units were dispatched 91 percent of the time.

WORKLOAD: RUNS AND TOTAL TIME SPENT

The workload of each unit is measured in two ways: runs and deployed time. The deployed time of a run is measured from the time a unit is dispatched through the time the unit is cleared. Because multiple units respond to some calls, there are more runs than calls and the average deployed time per run varies from the total duration of calls.

Runs and Deployed Time – All Units

Deployed time, also referred to as deployed hours, is the total deployment time of all units deployed on all runs. Table 8-4 shows the total deployed time, both overall and broken down by type of run, for LCFD units during the year studied.

TABLE 8-4: Annual Runs and Deployed Time by Run Type

Call Type	Avg. Deployed Min. per Run	Total Annual Hours	Percent of Total Hours	Avg. Deployed Min. per Day	Total Annual Runs	Avg. Runs per Day
Breathing difficulty	37.2	225.5	6.8	37.1	364	1.0
Cardiac and stroke	35.8	299.4	9.0	49.2	502	1.4
Fall and injury	31.8	444.5	13.4	73.1	838	2.3
Illness and other	35.1	589.9	17.8	97.0	1,009	2.8
MVA	29.8	420.6	12.7	69.1	847	2.3
Overdose and psychiatric	34.3	146.8	4.4	24.1	257	0.7
Seizure and unconsciousness	34.8	308.7	9.3	50.7	532	1.5
EMS Total	**33.6**	**2,435.3**	**73.4**	**400.3**	**4,349**	**11.9**
False alarm	14.5	111.9	3.4	18.4	464	1.3
Good intent	13.7	25.0	0.8	4.1	109	0.3
Hazard	27.6	93.0	2.8	15.3	202	0.6
Outside fire	41.4	46.9	1.4	7.7	68	0.2
Public service	27.6	313.4	9.4	51.5	682	1.9
Structure fire	40.4	58.5	1.8	9.6	87	0.2
Fire Total	**24.1**	**648.7**	**19.6**	**106.6**	**1,612**	**4.4**
Canceled	7.7	60.7	1.8	10.0	474	1.3
Mutual aid	47.8	172.1	5.2	28.3	216	0.6
Other Total	**20.2**	**232.8**	**7.0**	**38.3**	**690**	**1.9**
Total	**29.9**	**3,316.8**	**100.0**	**545.2**	**6,651**	**18.2**

Observations:

Overall

- Total deployed time for the year was 3,316.8 hours. The daily average was 9.1 hours for all units combined.
- There were 6,651 runs, including 474 runs dispatched for canceled calls and 216 runs dispatched for mutual aid calls. The daily average was 18.2 runs.

EMS

- EMS runs accounted for 73 percent of the total workload.
- The average deployed time for EMS runs was 33.6 minutes. The deployed time for all EMS runs averaged 6.7 hours per day.

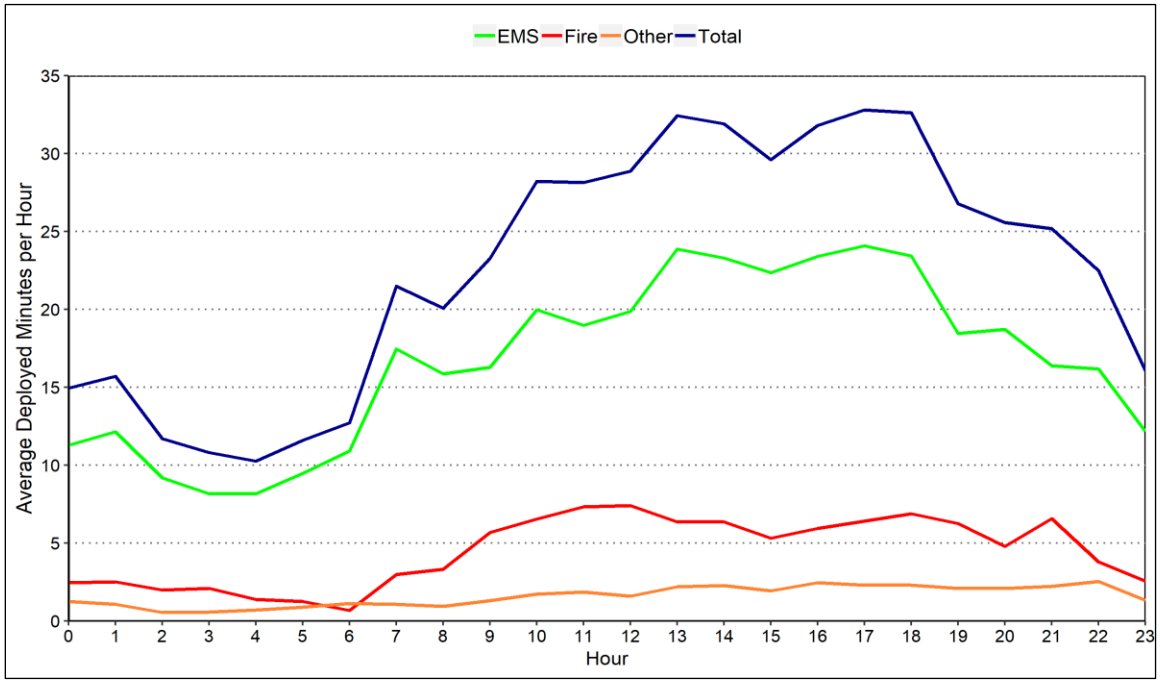
Fire

- Fire runs accounted for 20 percent of the total workload.
- The average deployed time for fire runs was 24.1 minutes. The deployed time for all fire runs averaged 1.8 hours per day.
- There were 155 runs for structure and outside fire calls combined, with a total workload of 105.4 hours. This accounted for 3 percent of the total workload.
- The average deployed time for outside fire runs was 41.4 minutes per run, and the average deployed time for structure fire runs was 40.4 minutes per run.

TABLE 8-5: Average Deployed Minutes by Hour of Day

Hour	EMS	Fire	Other	Total
0	11.3	2.4	1.2	15.0
1	12.1	2.5	1.1	15.7
2	9.2	2.0	0.5	11.7
3	8.2	2.1	0.6	10.8
4	8.2	1.4	0.7	10.3
5	9.5	1.2	0.9	11.6
6	10.9	0.7	1.1	12.7
7	17.5	3.0	1.1	21.5
8	15.8	3.3	0.9	20.1
9	16.3	5.7	1.3	23.3
10	20.0	6.5	1.7	28.2
11	19.0	7.3	1.9	28.1
12	19.9	7.4	1.6	28.9
13	23.9	6.4	2.2	32.4
14	23.3	6.3	2.3	31.9
15	22.3	5.3	1.9	29.6
16	23.4	5.9	2.5	31.8
17	24.1	6.4	2.3	32.8
18	23.4	6.9	2.3	32.6
19	18.4	6.3	2.1	26.8
20	18.7	4.8	2.1	25.6
21	16.4	6.6	2.2	25.2
22	16.2	3.8	2.5	22.5
23	12.2	2.6	1.3	16.1
Total	**400.0**	**106.7**	**38.3**	**545.0**

FIGURE 8-7: Average Deployed Minutes by Hour of Day



Observations:

- Hourly deployed time was highest during the day from 1:00 p.m. to 7:00 p.m., averaging between 30 and 33 minutes.
- Average deployed time peaked between 5:00 p.m. and 6:00 p.m., averaging 33 minutes.
- Average deployed time was lowest between 4:00 a.m. and 5:00 a.m., averaging 10 minutes.

Workload by Location

Table 8-6 breaks down the workload of the LCFD by location of the call. Table 8-7 provides further detail on the workload associated with structure and outside fire calls, also broken down by location.

TABLE 8-6: Annual Workload by Call Location

Location	Calls	Pct. Annual Calls	Runs	Avg. Runs per Day	Avg. Deployed Min. per Run	Total Annual Hours	Pct. Annual Workload	Avg. Deployed Min. per Day
Corinth	1,620	47.0	3,283	9.0	29.5	1,612.1	48.6	265.0
Denton County	86	2.5	173	0.5	43.5	125.5	3.8	20.6
Hickory Creek	475	13.8	926	2.5	29.5	454.7	13.7	74.7
Lake Dallas	802	23.3	1,567	4.3	29.4	767.6	23.1	126.2
Shady Shores	161	4.7	302	0.8	37.8	190.4	5.7	31.3
Other Cities	300	8.7	400	1.1	25.0	166.6	5.0	27.4
Total	**3,444**	**100.0**	**6,651**	**18.2**	**29.9**	**3,316.8**	**100.0**	**545.2**

TABLE 8-7: Structure and Outside Fire Runs by Call Location

Location	Structure Fire Runs	Structure Fires Average Deployed Min. per Run	Outside Fire Runs	Outside Fires Average Deployed Min. per Run	Total Annual Hours for Structure and Outside Fires	Pct. of Structure and Outside Fire Workload
Corinth	36	29.2	29	25.0	29.6	16.0
Denton County	12	163.6	10	122.6	53.2	28.7
Hickory Creek	4	90.8	13	28.5	12.2	6.6
Lake Dallas	35	46.9	16	37.9	37.5	20.2
Shady Shores	12	38.0	4	38.0	10.1	5.5
Other Cities	17	75.2	8	160.4	42.6	23.0
Total	**116**	**58.2**	**80**	**54.5**	**185.2**	**100.0**

Note: Table 8-7 includes 41 runs that are identified as mutual aid in Table 8-4. These include all 29 structure fire runs in Denton County and in other cities as well 12 of the 18 outside fire runs in Denton County and other cities.

Observations:

Corinth

- Total deployed time for the year was 1,612.1 hours, or 49 percent of the total annual workload. The daily average was 4.4 hours for all units combined.
- There were 3,283 runs, including 153 dispatched for canceled calls. The daily average was 9.0 runs.

Denton County

- Total deployed time for the year was 125.5 hours, or 4 percent of the total annual workload. The daily average was 20.6 minutes for all units combined.
- There were 173 runs, including 17 runs dispatched for canceled calls. The daily average was 0.5 runs.

Hickory Creek

- Total deployed time for the year was 454.7 hours, or 14 percent of the total annual workload. The daily average was 74.7 minutes for all units combined.
- There were 926 runs, including 57 runs dispatched for canceled calls. The daily average was 2.6 runs.

Lake Dallas

- Total deployed time for the year was 767.6 hours, or 23 percent of the total annual workload. The daily average was 126.2 minutes for all units combined.
- There were 1,567 runs, including 76 runs dispatched for canceled calls. The daily average was 4.3 runs.

Shady Shores

- Total deployed time for the year was 190.4 hours, or 6 percent of the total annual workload. The daily average was 31.3 minutes for all units combined.
- There were 302 runs, including 4 runs dispatched for canceled calls. The daily average was 0.8 runs.

Other Cities

- Total deployed time for the year was 166.6 hours, or 5 percent of the total annual workload. The daily average was 27.4 minutes for all units combined.
- There were 400 runs, including 167 runs dispatched for canceled calls. The daily average was 1.1 runs.

Workload by Unit

Table 8-8 provides a summary of each unit's workload overall. Tables 8-9 and 8-10 provide a more detailed view of workload, showing each unit's runs broken out by run type (Table 8-9) and the resulting daily average deployed time by run type (Table 8-10).

TABLE 8-8: Call Workload by Unit

Station	Unit ID	Unit Type	Avg. Deployed Min. per Run	Total Annual Hours	Avg. Deployed Min. per Day	Total Annual Runs	Avg. Runs per Day
1	E591	Engine	24.2	700.3	115.1	1,735	4.8
	M591	Medic	37.8	1,014.0	166.7	1,610	4.4
	Total		**30.7**	**1,714.3**	**281.8**	**3,345**	**9.2**
2	B591	Backup Brush Truck	5.4	0.2	0.0	2	0.0
	B592	Brush Truck	137.8	23.0	3.8	10	0.0
	E592	Engine	23.5	269.8	44.3	689	1.9
	M592	Medic	37.3	815.7	134.1	1,312	3.6
	Q592	Quint	22.0	272.9	44.9*	743	2.0*
	R592	Heavy Rescue	212.1	3.5	0.6*	1	0.0
	S592	Squad	29.2	3.4	0.6	7	0.0
	U592	ATV	112.5	15.0	2.5	8	0.0
	Total		**30.4**	**1,403.5**	**230.7**	**2,772**	**7.6**
3	Q593	Quint	20.7	180.5	29.7*	524	1.4*
	R593	Heavy Rescue	6.4	0.1	0.0	1	0.0
	Total		**20.6**	**180.6**	**29.7**	**525**	**1.4**
HQ	S591	Support Pick Up	48.5	4.9	0.8	6	0.0
	Total		**48.5**	**4.9**	**0.8**	**6**	**0.0**
Any	M593	Backup Ambulance	273.2	13.7	2.2	3	0.0
	Total		**273.2**	**13.7**	**2.2**	**3**	**0.0**
Total			**29.9**	**3,316.8**	**545.2**	**6,651**	**18.2**

Note for Tables 8-10: Station 3 opened on February 18, 2019. Q592 and R592 moved from Station 2 to Station 3 when the new station opened, and were renamed to Q593 and R593, respectively. In Table 8-8, we calculated the values with an asterisk assuming that each unit was at each station for the full year covered by this study. This is designed to maintain the accuracy of station subtotals. The observation following Table 8-10 adjusts the average deployed minutes per day and average runs per day for these units to account for the fact that they switched stations mid-way through the year.

TABLE 8-9: Total Annual Runs by Run Type and Unit

Station	Unit ID	Unit Type	EMS	False Alarm	Good Intent	Hazard	Outside Fire	Public Service	Structure Fire	Canceled	Mutual Aid	Total
1	E591	Engine	1,048	104	39	65	28	205	22	137	87	1,735
	M591	Medic	1,194	71	22	26	9	154	17	85	32	1,610
	Total		**2,242**	**175**	**61**	**91**	**37**	**359**	**39**	**222**	**119**	**3,345**
2	B591	Backup Brush Truck	0	0	0	0	0	0	0	0	2	2
	B592	Brush Truck	0	0	1	0	2	2	0	0	5	10
	E592	Engine	394	58	13	29	7	67	13	72	36	689
	M592	Medic	958	97	17	30	6	112	19	64	9	1,312
	Q592	Quint	446	77	10	29	10	64	8	72	27	743
	R592	Heavy Rescue	0	0	0	0	0	0	0	0	1	1
	S592	Squad	4	0	0	0	0	3	0	0	0	7
	U592	ATV	1	0	0	0	0	0	0	1	6	8
	Total		**1,803**	**232**	**41**	**88**	**25**	**248**	**40**	**209**	**86**	**2,772**
3	Q593	Quint	298	57	7	23	6	73	8	42	10	524
	R593	Heavy Rescue	0	0	0	0	0	0	0	1	0	1
	Total		**298**	**57**	**7**	**23**	**6**	**73**	**8**	**43**	**10**	**525**
HQ	S591	Support Pick Up	5	0	0	0	0	0	0	0	1	6
	Total		**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**6**
Any	M593	Backup Ambulance	1	0	0	0	0	2	0	0	0	3
	Total		**1**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**3**
Total			**4,349**	**464**	**109**	**202**	**68**	**682**	**87**	**474**	**216**	**6,651**

TABLE 8-10: Daily Average Deployed Minutes by Run Type and Unit

Station	Unit ID	Unit Type	EMS	False Alarm	Good Intent	Hazard	Outside Fire	Public Service	Structure Fire	Canceled	Mutual Aid	Total
1	E591	Engine	68.0	4.3	1.5	5.0	2.3	16.0	2.6	3.4	12.0	115.1
	M591	Medic	140.5	2.7	0.7	1.5	1.0	12.9	1.9	2.0	3.4	166.7
	Total		**208.5**	**6.9**	**2.2**	**6.5**	**3.3**	**28.9**	**4.5**	**5.5**	**15.5**	**281.8**
2	B591	Backup Brush Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	B592	Brush Truck	0.0	0.0	0.0	0.0	1.3	0.7	0.0	0.0	1.8	3.8
	E592	Engine	27.7	2.4	0.5	3.2	0.4	5.0	1.5	1.1	2.5	44.3
	M592	Medic	116.0	3.6	0.6	1.4	0.6	7.3	2.0	1.4	1.3	134.1
	Q592*	Quint	28.0	3.1	0.4	2.9	1.8	3.9	0.9	1.4	2.6	44.9
	R592	Heavy Rescue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6
	S592	Squad	0.3	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.6
	U592	ATV	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	2.5
	Total		**172.2**	**9.1**	**1.6**	**7.4**	**4.1**	**17.0**	**4.4**	**3.9**	**10.9**	**230.7**
3	Q593*	Quint	19.1	2.3	0.3	1.4	0.3	3.4	0.7	0.6	1.6	29.7
	R593	Heavy Rescue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total		**19.1**	**2.3**	**0.3**	**1.4**	**0.3**	**3.4**	**0.7**	**0.6**	**1.6**	**29.7**
HQ	S591	Support Pick Up	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.8
	Total		**0.5**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.3**	**0.8**
Any	M593	Backup Ambulance	0.1	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	2.2
	Total		**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**2.2**	**0.0**	**0.0**	**0.0**	**2.2**
Total			**400.3**	**18.4**	**4.1**	**15.3**	**7.7**	**51.5**	**9.6**	**10.0**	**28.3**	**545.2**

Note: The values for Q592 and Q593 are calculated assuming that the unit was at each station for the entire year.

Observations:

- On a station level, Station 1 made the most runs (3,345, or an average of 9.2 runs per day) and had the highest total annual deployed time (1,714.3 hours, or an average of 4.7 hours per day).
  - EMS calls accounted for 67 percent of runs and 74 percent of total deployed time.
  - Outside and structure fire calls accounted for 2 percent of runs and 3 percent of total deployed time.
- On a station level, Station 2 made the second-most runs (2,772, or an average of 7.6 runs per day) and had the second-highest total annual deployed time (1,403.5 hours, or an average of 3.8 hours per day).
  - EMS calls accounted for 65 percent of runs and 75 percent of total deployed time.
  - Outside and structure fire calls accounted for 2 percent of runs and 4 percent of total deployed time.
- On a unit level, E591 made the most runs (1,735, or an average of 4.8 runs per day) and had the third-highest total annual deployed time (700.3 hours, or an average of 1.9 hours per day).
  - EMS calls accounted for 60 percent of runs and 59 percent of total deployed time.
  - Outside and structure fire calls accounted for 3 percent of runs and 4 percent of total deployed time.
- On a unit level, M591 made the second-most runs (1,610, or an average of 4.4 runs per day) and had the highest total annual deployed time (1,014.0 hours, or an average of 2.8 hours per day).
  - EMS calls accounted for 74 percent of runs and 84 percent of total deployed time.
  - Outside and structure fire calls accounted for 2 percent of runs and 2 percent of total deployed time.
- On a unit level, M592 made the third-most runs (1,312, or an average of 2.2 hours per day) and had the second-highest total annual deployed time (815.7 hours, or an average of 2.2 hours per day).
  - EMS calls accounted for 73 percent of runs and 86 percent of total deployed time.
  - Outside and structure fire calls accounted for 2 percent of runs and 2 percent of total deployed time.
- When Station 3 opened on February 18, 2019, Q592 and R592 moved from Station 2 to Station 3 and were renamed Q593 and R593, respectively. Q592 and R592 resided at Station 2 for 232 days and Q593 and R593 were at Station 3 for the remaining 133 days of the study period.
  - While at Station 2, Q592 averaged 3.2 runs per day and was deployed for an average of 70.6 minutes per day.
  - While at Station 3, Q593 averaged 3.9 runs per day and was deployed for an average of 81.4 minutes per day.
  - R592/R593 went on 2 runs and was deployed for a total of 3.6 hours (219 minutes) during the study period.

ANALYSIS OF BUSIEST HOURS

There is significant variability in the number of calls from hour to hour. One special concern relates to the resources available for hours with the heaviest workload. We tabulated the data for each of the 8,760 hours in the year. Table 8-11 shows the number of hours in the year in which there were zero to four or more calls during the hour. Table 8-12 examines the number of times a call within a station's first due area overlapped with another call within the same area. Table 8-13 examines the availability of a unit at a station to respond to calls within its first due area. Table 8-14 shows the 10 one-hour intervals which had the most calls during the year.

TABLE 8-11: Frequency Distribution of the Number of Calls

Calls in an Hour	Frequency	Percentage
0	6,038	68.9
1	2,140	24.4
2	470	5.4
3	89	1.0
4+	23	0.3
Total	**8,760**	**100.0**

TABLE 8-12: Frequency of Overlapping Calls

Station	Scenario	Number of Calls	Percent of All Calls	Total Hours
1	No overlapped call	1,335	87.4	894.8
	Overlapped with one call	178	11.7	53.0
	Overlapped with two calls	14	0.9	2.1
2	No overlapped call	1,059	88.0	694.9
	Overlapped with one call	142	11.8	51.4
	Overlapped with two calls	3	0.2	1.1
3	No overlapped call	359	89.5	216.6
	Overlapped with one call	40	10.0	10.6
	Overlapped with two calls	2	0.5	0.8

TABLE 8-13: Station Availability to Respond to Calls

Station	Calls in Area	First Due Responded	First Due Arrived	First Due First	Percent Responded	Percent Arrived	Percent First
1	1,450	1,378	1,357	1,323	95.0	93.6	91.2
2	1,130	1,072	1,058	1,030	94.9	93.6	91.2
3	374	320	308	254	85.6	82.4	67.9
Total	**2,954**	**2,770**	**2,723**	**2,607**	**93.8**	**92.2**	**88.3**

Note: For each station, we count the number of calls occurring within its first due area. Then, we count the number of calls to where at least one LCFD unit arrived. Next, we focus on units from the first due station to see if any units responded, arrived, or arrived first.

TABLE 8-14: Top 10 Hours with the Most Calls Received

Hour	Number of Calls	Number of Runs	Total Deployed Hours
6/9/2019, 1:00 p.m. to 2:00 p.m.	7	12	2.9
10/16/2018, 7:00 a.m. to 8:00 a.m.	5	9	2.7
5/18/2019, 1:00 p.m. to 2:00 p.m.	5	8	1.7
5/29/2019, 1:00 p.m. to 2:00 p.m.	4	10	4.4
2/1/2019, 9:00 a.m. to 10:00 a.m.	4	9	5.4
7/17/2018, 11:00 a.m. to noon	4	9	4.8
9/13/2018, 5:00 p.m. to 6:00 p.m.	4	9	3.6
5/10/2019, 9:00 p.m. to 10:00 p.m.	4	9	3.4
6/9/2019, 6:00 p.m. to 7:00 p.m.	4	8	7.2
10/16/2018, 8:00 a.m. to 9:00 a.m.	4	8	2.5

Note: Total deployed hours is a measure of the total time spent responding to calls received in the hour, and which may extend into the next hour or hours. The number of runs and deployed hours only includes LCFD units.

Observations:

- During 23 hours (0.3 percent of all hours), four or more call occurred; in other words, the department responded to four or more calls in an hour roughly once every 16 days.
  - The highest number of calls to occur in an hour was 7, which happened once.
- The hour with the most calls was 1:00 p.m. to 2:00 p.m. on June 9, 2019. The hour's 7 calls involved 12 individual dispatches resulting in 2.9 hours of deployed time.
  - These 7 calls included four canceled calls, and three hazard calls.
- The hour with the second-most calls was 7:00 a.m. to 8:00 a.m. on October 16, 2018. The hour's 5 calls involved 9 individual dispatches resulting in 2.7 hours of deployed time.
  - These 5 calls included four motor vehicle accident calls, and one public service call.

RESPONSE TIME

In this part of the analysis we present response time statistics for different call types. We separate response time into its identifiable components. *Dispatch time* is the difference between the time a call is received and the time a unit is dispatched. Dispatch time includes call processing time, which is the time required to determine the nature of the emergency and types of resources to dispatch. *Turnout time* is the difference between dispatch time and the time a unit is en route to a call's location. *Travel time* is the difference between the time en route and arrival on scene. *Response time* is the total time elapsed between receiving a call to arriving on scene.

In this analysis, we included all calls in LCFD's response area to which at least one non-administrative LCFD unit responded, while excluding canceled and mutual aid calls. In addition, non-emergency calls and calls with a total response time of more than 30 minutes were excluded. Finally, we focused on units that had complete time stamps, that is, units with all components recorded, so that we could calculate each segment of response time.

Based on the methodology above, we excluded 324 calls that were outside of LCFD's response area, 154 canceled calls, 140 calls where no units recorded a valid on-scene time, 5 calls where the first arriving unit response was greater than 30 minutes, 197 nonemergency calls, and 356 calls where one or more segments of the first arriving unit's response time could not be calculated due to missing or faulty data. As a result, in this section, a total of 2,622 calls are included in the analysis.

Response Time by Type of Call

Table 8-15 provides the average dispatch, turnout, travel, and total response times for the first arriving unit to each call in LCFD's response area, broken out by the location of the call. Table 8-16 gives the 90th percentile response times broken out in the same manner. A 90th percentile time means that 90 percent of calls had response times at or below that number. For example, Table 8-16 shows a 90th percentile response time of 10.3 minutes, which means that 90 percent of the time a call had a response time of no more than 10.3 minutes.

Table 8-17 provides average dispatch, turnout, travel, and total response time for the first arriving unit to each call in LCFD's response area, broken out by call type. Table 8-18 gives the 90th percentile time broken out in the same manner, and Figures 8-8 and 8-9 illustrate the same information.

TABLE 8-15: Average Response Time of First Arriving Unit, by Location (Minutes)

Location	Call Type	Dispatch	Turnout	Travel	Total	Number of Calls
Corinth	EMS	0.7	1.8	4.7	7.2	943
	Fire	0.9	1.9	5.5	8.3	258
	Total	**0.7**	**1.8**	**4.9**	**7.5**	**1,201**
Lake Dallas	EMS	0.7	1.8	4.1	6.6	488
	Fire	1.1	1.8	5.0	7.9	96
	Total	**0.8**	**1.8**	**4.3**	**6.8**	**584**
Hickory Creek	EMS	0.7	1.7	5.1	7.5	228
	Fire	0.8	1.9	5.9	8.5	89
	Total	**0.7**	**1.8**	**5.3**	**7.8**	**317**
Shady Shores	EMS	0.7	1.7	5.5	7.9	80
	Fire	0.7	1.9	7.0	9.7	35
	Total	**0.7**	**1.8**	**6.0**	**8.5**	**115**
Denton County	EMS	0.7	1.7	5.4	7.8	30
	Fire	0.6	1.9	5.5	8.0	15
	Total	**0.6**	**1.8**	**5.4**	**7.8**	**45**
Total		**0.8**	**1.8**	**4.9**	**7.4**	**2,262**

TABLE 8-16: 90th Percentile Response Time of First Arriving Unit, by Location (Minutes)

Location	Call Type	Dispatch	Turnout	Travel	Total	Number of Calls
Corinth	EMS	1.3	2.9	6.8	9.6	943
	Fire	1.8	2.8	8.0	11.3	258
	Total	**1.4**	**2.9**	**7.1**	**10.0**	**1,201**
Lake Dallas	EMS	1.4	2.9	6.9	9.7	488
	Fire	1.4	2.7	8.5	11.8	96
	Total	**1.4**	**2.8**	**7.2**	**9.8**	**584**
Hickory Creek	EMS	1.3	2.7	8.0	10.8	228
	Fire	1.7	2.8	9.8	12.7	89
	Total	**1.4**	**2.8**	**8.4**	**11.5**	**317**
Shady Shores	EMS	1.0	2.5	7.4	10.6	80
	Fire	1.4	2.6	9.4	12.4	35
	Total	**1.1**	**2.6**	**8.7**	**11.5**	**115**
Denton County	EMS	1.1	2.6	8.3	11.3	30
	Fire	0.9	2.9	7.8	10.9	15
	Total	**1.1**	**2.9**	**8.3**	**11.3**	**45**
Total		**1.4**	**2.8**	**7.5**	**10.3**	**2,262**

TABLE 8-17: Average Response Time of First Arriving Unit, by Call Type (Minutes)

Call Type	Dispatch	Turnout	Travel	Total	Number of Calls
Breathing difficulty	0.7	2.0	4.2	6.9	163
Cardiac and stroke	0.7	1.8	4.4	6.9	219
Fall and injury	0.7	1.8	4.5	7.1	344
Illness and other	0.7	1.9	4.5	7.1	420
MVA	0.6	1.6	5.5	7.6	294
Overdose and psychiatric	1.0	1.9	4.8	7.7	108
Seizure and unconsciousness	0.7	1.6	4.4	6.7	221
EMS Total	**0.7**	**1.8**	**4.6**	**7.1**	**1,769**
False alarm	0.8	1.9	5.3	7.9	154
Good intent	0.7	1.9	6.2	8.8	37
Hazard	1.2	1.8	5.8	8.8	78
Outside fire	1.2	2.2	5.4	8.8	23
Public service	0.9	1.8	5.7	8.4	183
Structure fire	0.7	2.0	5.2	8.0	18
Fire Total	**0.9**	**1.9**	**5.6**	**8.4**	**493**
Total	**0.8**	**1.8**	**4.9**	**7.4**	**2,262**

FIGURE 8-8: Average Response Time of First Arriving Unit, by Call Type – EMS

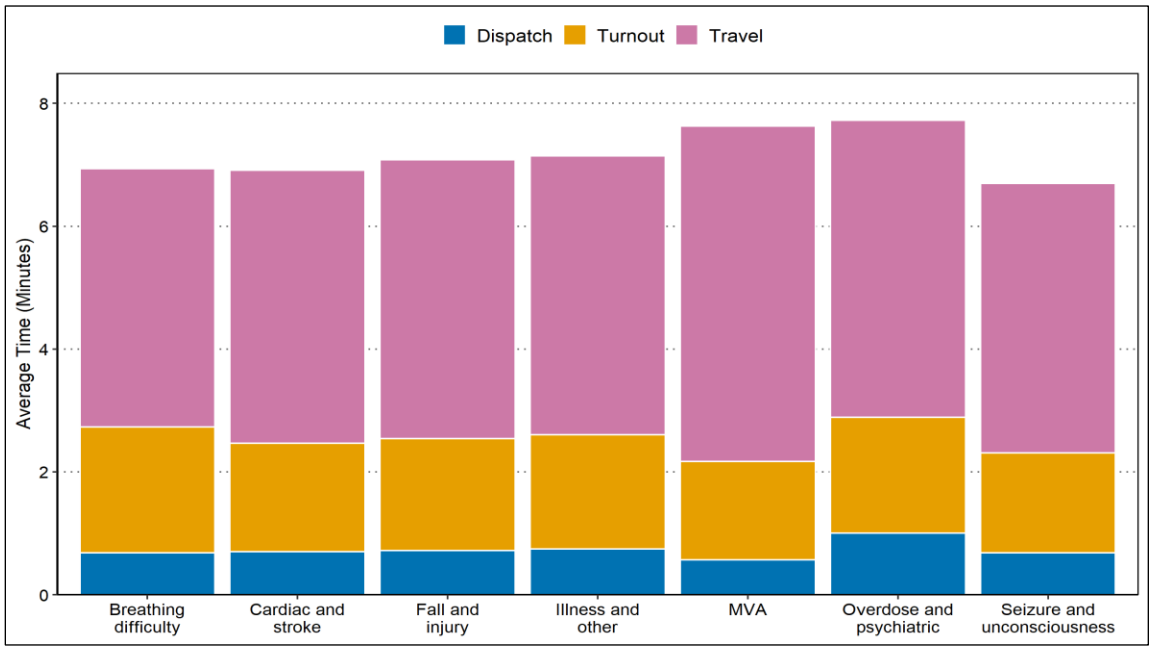


FIGURE 8-9: Average Response Time of First Arriving Unit, by Call Type – Fire

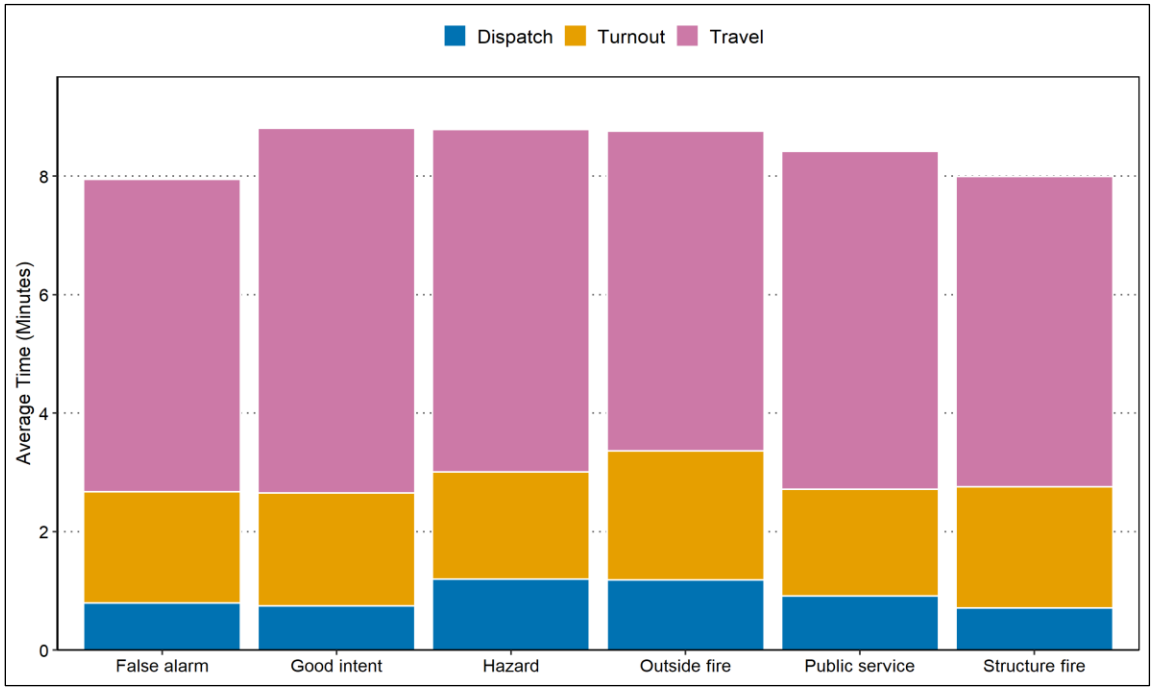


TABLE 8-18: 90th Percentile Response Time of First Arriving Unit, by Call Type (Minutes)

Call Type	Dispatch	Turnout	Travel	Total	Number of Calls
Breathing difficulty	1.3	3.2	6.2	9.5	163
Cardiac and stroke	1.3	2.8	6.6	9.6	219
Fall and injury	1.2	2.9	6.8	9.6	344
Illness and other	1.3	2.9	6.8	9.6	420
MVA	1.0	2.7	8.7	11.3	294
Overdose and psychiatric	1.9	2.8	7.4	10.7	108
Seizure and unconsciousness	1.3	2.6	6.6	9.3	221
EMS Total	**1.3**	**2.9**	**7.1**	**9.8**	**1,769**
False alarm	1.5	2.8	7.8	10.7	154
Good intent	1.4	2.7	9.1	12.1	37
Hazard	1.7	2.7	8.2	11.4	78
Outside fire	1.9	3.0	9.9	16.3	23
Public service	1.7	2.8	9.3	12.4	183
Structure fire	1.3	3.4	7.3	10.2	18
Fire Total	**1.6**	**2.8**	**8.5**	**11.7**	**493**
Total	**1.4**	**2.8**	**7.5**	**10.3**	**2,262**

Observations:

- The average dispatch time was 0.8 minutes.
- The average turnout time was 1.8 minutes.
- The average travel time was 4.9 minutes.
- The average total response time was 7.4 minutes.
- The average response time was 7.1 minutes for EMS calls and 8.4 minutes for fire calls.
- The average response time was 8.8 minutes for outside fires and 8.0 minutes for structure fires.
- The 90th percentile dispatch time was 1.4 minutes.
- The 90th percentile turnout time was 2.8 minutes.
- The 90th percentile travel time was 7.5 minutes.
- The 90th percentile total response time was 10.3 minutes.
- The 90th percentile response time was 9.8 minutes for EMS calls and 11.7 minutes for fire calls.
- The 90th percentile response time was 16.3 minutes for outside fires and 10.2 minutes for structure fires.

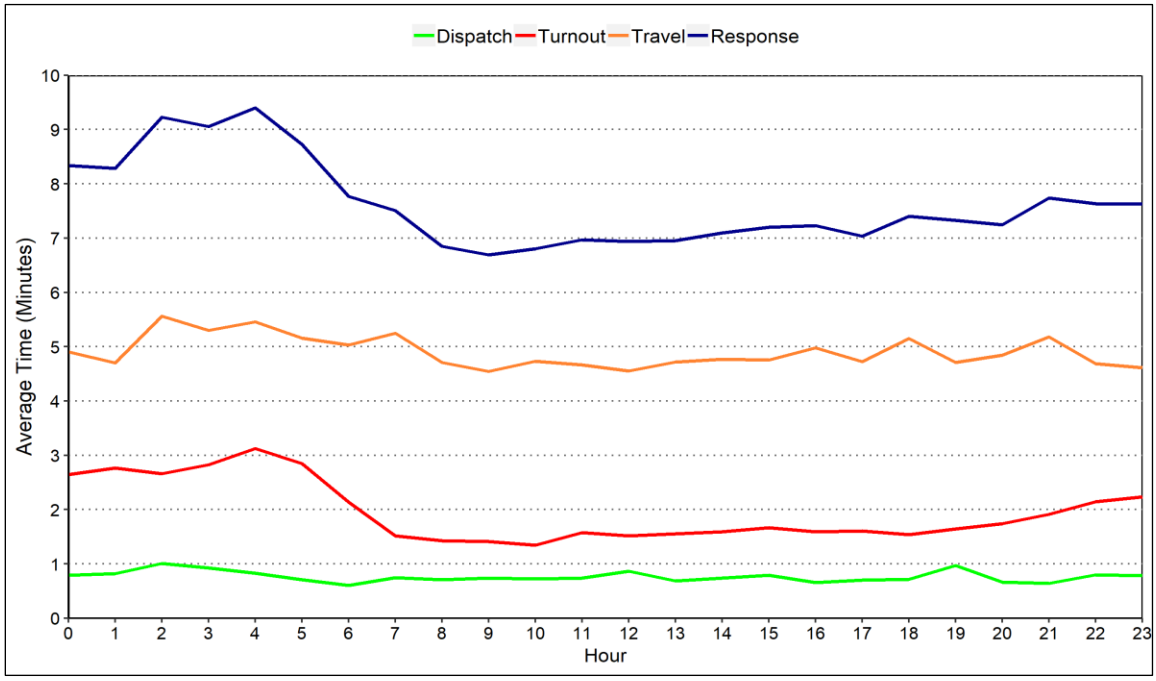
Response Time by Hour

Average dispatch, turnout, travel, and total response time by hour for calls are shown in Table 8-19 and Figure 8-10. The table also shows 90th percentile response times.

TABLE 8-19: Average and 90th Percentile Response Time of First Arriving Unit, by Hour of Day

Hour	Dispatch	Turnout	Travel	Response Time	90th Percentile Response Time	Number of Calls
0	0.8	2.6	4.9	8.3	10.8	73
1	0.8	2.8	4.7	8.3	10.7	54
2	1.0	2.7	5.6	9.2	12.8	47
3	0.9	2.8	5.3	9.1	11.5	50
4	0.8	3.1	5.5	9.4	13.2	39
5	0.7	2.9	5.2	8.7	10.6	57
6	0.6	2.1	5.0	7.8	10.5	62
7	0.7	1.5	5.2	7.5	10.3	88
8	0.7	1.4	4.7	6.8	9.3	81
9	0.7	1.4	4.5	6.7	9.5	98
10	0.7	1.3	4.7	6.8	9.6	121
11	0.7	1.6	4.7	7.0	9.4	96
12	0.9	1.5	4.6	6.9	10.2	125
13	0.7	1.6	4.7	7.0	10.1	153
14	0.7	1.6	4.8	7.1	10.4	121
15	0.8	1.7	4.8	7.2	9.6	125
16	0.7	1.6	5.0	7.2	9.8	135
17	0.7	1.6	4.7	7.0	9.8	140
18	0.7	1.5	5.2	7.4	9.6	124
19	1.0	1.6	4.7	7.3	10.2	110
20	0.7	1.7	4.8	7.2	10.5	117
21	0.6	1.9	5.2	7.7	10.4	91
22	0.8	2.1	4.7	7.6	9.8	90
23	0.8	2.2	4.6	7.6	9.9	65
Total	**0.8**	**1.8**	**4.9**	**7.4**	**10.3**	**2,262**

FIGURE 8-10: Average Response Time of First Arriving Unit, by Hour of Day



Observations:

- Average dispatch time was between 0.6 minutes (6:00 a.m. to 7:00 a.m.) and 1.0 minutes (2:00 a.m. to 3:00 a.m.).
- Average turnout time was between 1.3 minutes (10:00 a.m. to 11:00 a.m.) and 3.1 minutes (4:00 a.m. to 5:00 a.m.).
- Average travel time was between 4.5 minutes (9:00 a.m. to 10:00 a.m.) and 5.6 minutes (2:00 a.m. to 3:00 a.m.).
- Average response time was between 6.7 minutes (9:00 a.m. to 10:00 a.m.) and 9.4 minutes (4:00 a.m. to 5:00 a.m.).
- The 90th percentile response time was between 9.3 minutes (8:00 a.m. to 9:00 a.m.) and 13.2 minutes (4:00 a.m. to 5:00 a.m.).

Response Time Distribution

Here, we present a more detailed look at how response times to calls are distributed. The cumulative distribution of total response time for the first arriving unit to EMS calls is shown in Figure 8-11 and Table 8-20. Figure 8-11 shows response times for the first arriving LCFD unit to EMS calls as a frequency distribution in whole-minute increments, and Figure 8-12 shows the same for the first arriving unit to outside and structure fire calls.

The cumulative percentages here are read in the same way as a percentile. In Figure 8-11, the 90th percentile of 9.8 minutes means that 90 percent of EMS calls had a response time of 9.8 minutes or less. In Table 8-20, the cumulative percentage of 69.6, for example, means that 69.6 percent of EMS calls had a response time under 8 minutes.

FIGURE 8-11: Cumulative Distribution of Response Time – First Arriving Unit – EMS

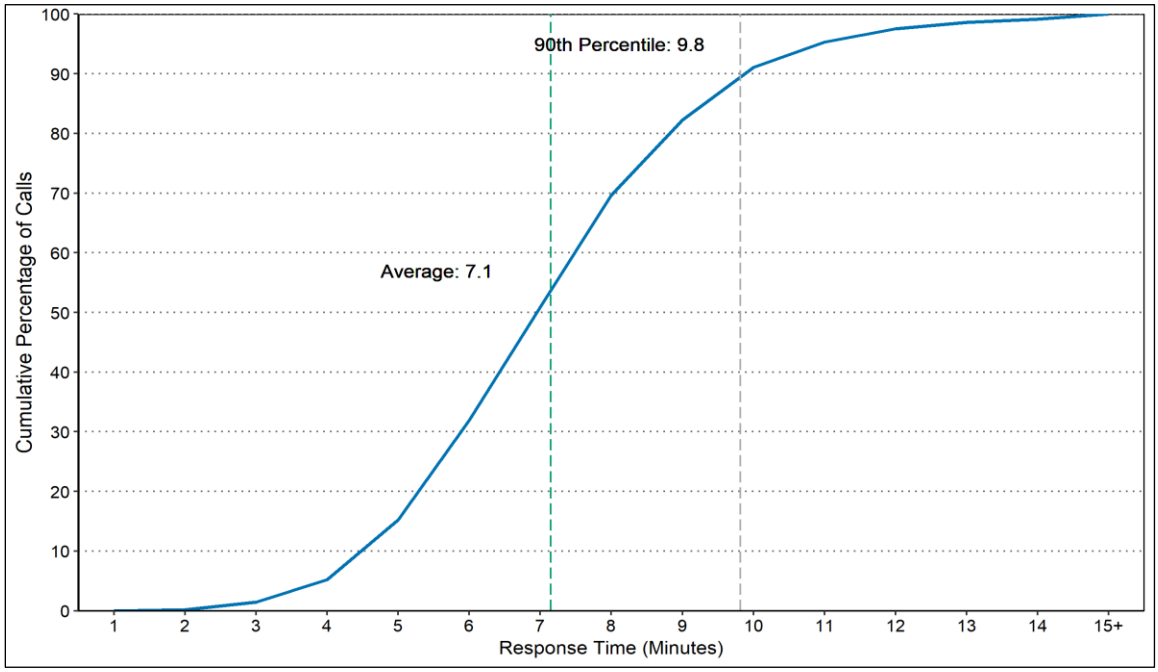


FIGURE 8-12: Frequency Distribution of Response Time – First Arriving Unit – Fire

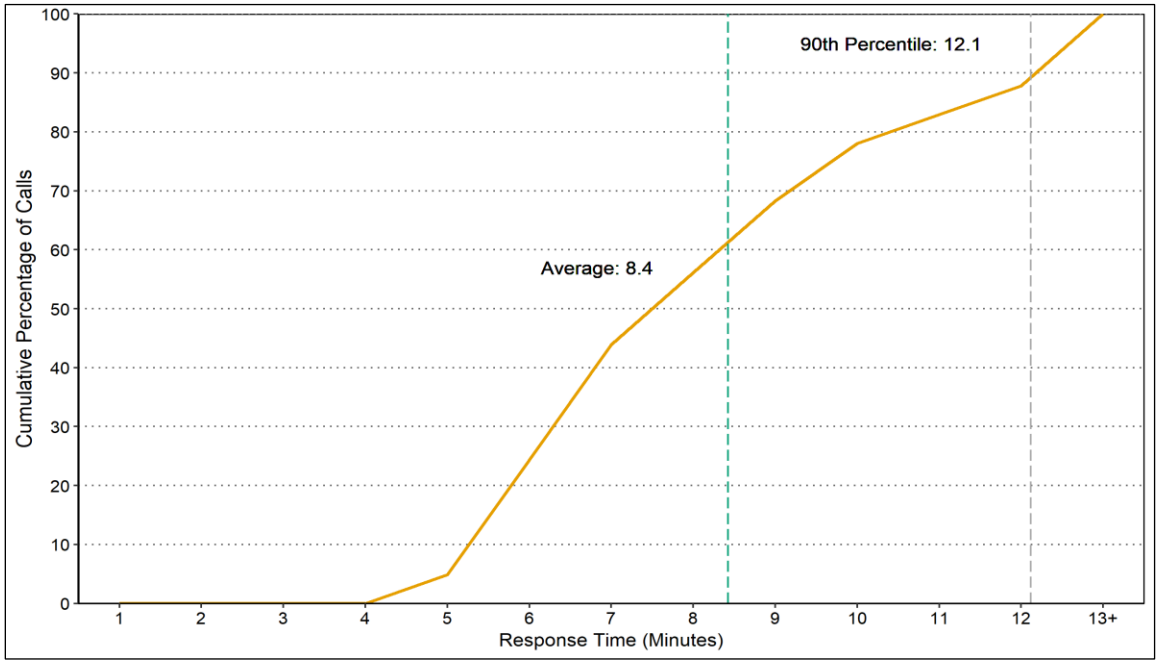


TABLE 8-20: Cumulative Distribution of Response Time – First Arriving Unit – EMS

Response Time (minute)	Frequency	Cumulative Percentage
1	0	0.0
2	3	0.2
3	23	1.5
4	66	5.2
5	178	15.3
6	295	31.9
7	335	50.9
8	332	69.6
9	223	82.2
10	156	91.1
11	75	95.3
12	39	97.5
13	19	98.6
14	10	99.2
15+	15	100.0

TABLE 8-21: Cumulative Distribution of Response Time – First Arriving Unit – Outside and Structure Fires

Response Time (minute)	Frequency	Cumulative Percentage
1	0	0.0
2	0	0.0
3	0	0.0
4	0	0.0
5	2	4.9
6	8	24.4
7	8	43.9
8	5	56.1
9	5	68.3
10	4	78.0
11	2	82.9
12	2	87.8
13+	5	100.0

Observations:

- For 70 percent of EMS calls, the response time of the first arriving unit was less than 8 minutes.
- For 56 percent of outside and structure fire calls, the response time of the first arriving unit was less than 8 minutes.

TRANSPORT CALL ANALYSIS

In this section we present an analysis of LCFD unit activity that involved transporting patients, the variations by hour of day, and the average time for each stage of transport service. We identified transport calls by requiring that at least one responding medic or aid unit had recorded both "beginning to transport" and "arriving at the hospital" times. Based on these criteria, note that 17 non-EMS calls that resulted in transports are included in this analysis.

Transport Calls by Type

Table 8-22 shows the number of calls by call type broken out by transport and non-transport calls.

TABLE 8-22: Transport Calls by Call Type

Call Type	Number of Calls			Conversion Rate
	Non-transport	Transport	Total	
Breathing difficulty	38	143	181	79.0
Cardiac and stroke	59	189	248	76.2
Fall and injury	135	274	409	67.0
Illness and other	131	375	506	74.1
MVA	294	91	385	23.6
Overdose and psychiatric	52	68	120	56.7
Seizure and unconsciousness	67	193	260	74.2
EMS Total	**776**	**1,333**	**2,109**	**63.2**
Fire & Other Total	**1,318**	**17**	**1,335**	**1.3**
Total	**2,094**	**1,350**	**3,444**	**39.2**

Observations:

- Overall, 63 percent of EMS calls that LCFD responded to involved transporting one or more patients.
- Overall, there were around 3.7 calls per day that involved transporting one or more patients.

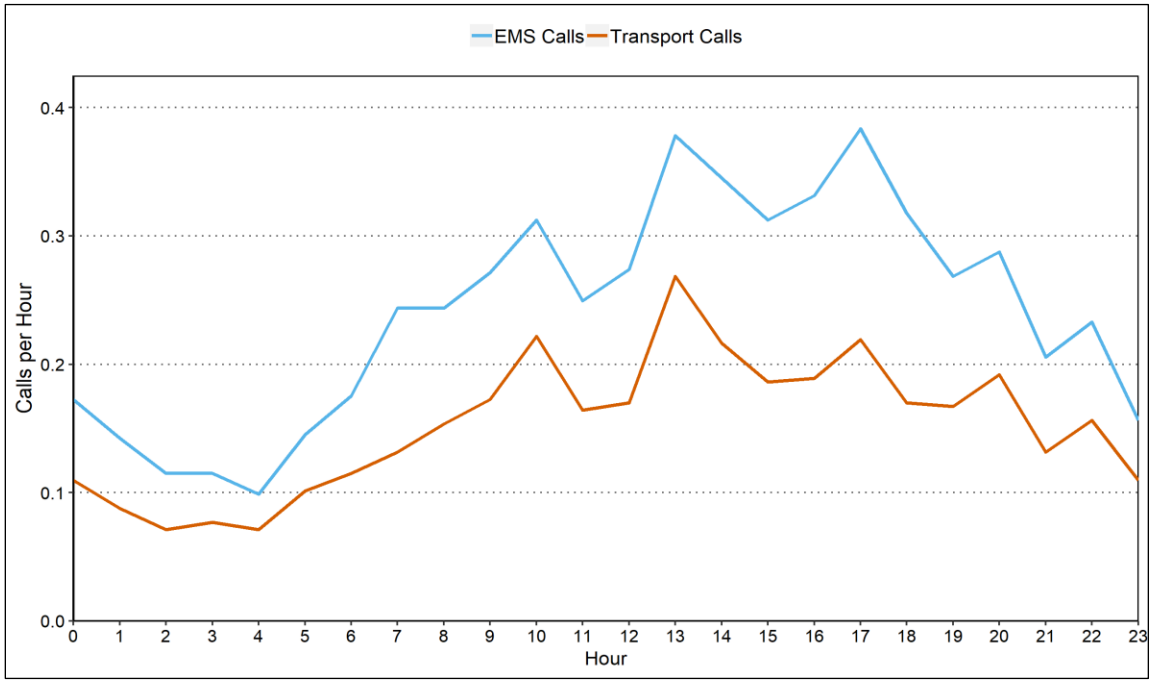
Average Transport Calls per Hour

Table 8-23 and Figure 8-13 show the total and average number of EMS calls received each hour of the day over the course of the year and the total and average number of transport calls. Transport calls categorized as fire, mutual aid, or canceled have been excluded from the table.

TABLE 8-23: Transport Calls per Day, by Hour

Hour	Number of EMS Calls	Number of Transport Calls	Transport Calls per Day	EMS Calls per Day	Conversion Rate
0	63	40	0.2	0.1	63.5
1	52	32	0.1	0.1	61.5
2	42	26	0.1	0.1	61.9
3	42	28	0.1	0.1	66.7
4	36	26	0.1	0.1	72.2
5	53	37	0.1	0.1	69.8
6	64	42	0.2	0.1	65.6
7	89	48	0.2	0.1	53.9
8	89	56	0.2	0.2	62.9
9	99	63	0.3	0.2	63.6
10	114	81	0.3	0.2	71.1
11	91	60	0.2	0.2	65.9
12	100	62	0.3	0.2	62.0
13	138	98	0.4	0.3	71.0
14	126	79	0.3	0.2	62.7
15	114	68	0.3	0.2	59.6
16	121	69	0.3	0.2	57.0
17	140	80	0.4	0.2	57.1
18	116	62	0.3	0.2	53.4
19	98	61	0.3	0.2	62.2
20	105	70	0.3	0.2	66.7
21	75	48	0.2	0.1	64.0
22	85	57	0.2	0.2	67.1
23	57	40	0.2	0.1	70.2

FIGURE 8-13: Average Transport Calls per Day, by Hour



Observations:

- Average hourly transport calls per day peaked between 1:00 p.m. and 2:00 p.m., averaging 0.3 calls per day.
- Average hourly transport calls per day was lowest between 4:00 a.m. and 5:00 a.m., averaging less than 0.1 calls per day.
- Transport conversion rates varied between 53 percent (6:00 p.m. to 7:00 p.m.) and 72 percent (4:00 a.m. to 5:00 a.m.).

Calls by Type and Duration

Table 8-24 shows the average duration of transport and non-transport calls by call type.

TABLE 8-24: Transport Call Duration by Call Type

Call Type	Non-transport		Transport	
	Average Duration	Number of Calls	Average Duration	Number of Calls
Breathing difficulty	31.5	38	59.5	143
Cardiac and stroke	31.4	59	55.4	189
Fall and injury	24.5	135	54.9	274
Illness and other	29.5	131	55.8	375
MVA	33.0	294	60.0	91
Overdose and psychiatric	35.0	52	55.7	68
Seizure and unconsciousness	30.4	67	55.6	193
EMS Total	**30.7**	**776**	**56.2**	**1,333**
Fire & Other Total	**25.8**	**1,318**	**64.1**	**17**
Total	**27.6**	**2,094**	**56.3**	**1,350**

Note: Duration of a call is defined as the longest deployed time of any of the units responding to the same call.

Observations:

- The average duration was 30.7 minutes for a non-transport EMS call.
- The average duration was 56.2 minutes for an EMS call where one or more patients were transported to a hospital.

Transport Time Components

Table 8-25 gives the average deployed time for an ambulance on a transport call, along with three major components of the deployed time: on-scene time, travel to hospital time, and at hospital time.

The on-scene time is the interval from the unit arriving on-scene time through the time the unit departs the scene for the hospital. Travel to hospital time is the interval from the time the unit departs the scene to travel to the hospital through the time the unit arrives at the hospital. At-hospital time is the time it takes for patient turnover at the hospital.

The 1,350 transport calls resulted in 1,356 transports, since more than one transport may occur on a call. 79 runs were excluded from this analysis due to missing arrival times, leaving 1,277 runs for analysis.

TABLE 8-25: Time Component Analysis for Ambulance Transport Runs by Call Type (in Minutes)

Call Type	Average Time Spent per Run				Number of Runs
	On Scene	Traveling to Hospital	At Hospital	Deployed	
Breathing difficulty	14.8	10.0	28.5	59.7	137
Cardiac and stroke	15.2	10.0	23.4	54.9	177
Fall and injury	14.2	11.3	22.5	54.3	261
Illness and other	14.3	11.5	22.6	54.8	356
MVA	13.1	9.9	24.7	55.0	86
Overdose and psychiatric	16.6	11.3	20.4	55.1	66
Seizure and unconsciousness	14.4	10.6	23.7	54.9	181
EMS Total	**14.5**	**10.8**	**23.5**	**55.3**	**1,264**
Fire & Other Total	**15.2**	**11.5**	**25.3**	**60.4**	**13**
Total	**14.5**	**10.8**	**23.5**	**55.3**	**1,277**

Note: Average unit deployed time per run is lower than average call duration for some call types because call duration is based on the longest deployed time of any of the units responding to the same call, which may include an engine or ladder. Total deployed time is greater than the combination of on-scene, transport, and hospital wait times as it includes turnout, initial travel, and hospital return times.

Observations:

- The average time spent on-scene for a transport call was 14.5 minutes.
- The average travel time from the scene of the call to the hospital was 10.8 minutes.
- The average deployed time spent on transport calls was 55.3 minutes.
- The average deployed time at the hospital was 23.5 minutes, which accounts for approximately 43 percent of the average total deployed time for a transport call.

ATTACHMENT I: ACTIONS TAKEN ANALYSIS

TABLE 8-26: Actions Taken Analysis for Structure and Outside Fire Calls

Action Taken	Number of Calls	
	Outside Fire	Structure Fire
Assistance, other	1	0
Control fire (wildland)	2	0
Determine if materials are non-hazardous	0	1
Extinguishment by fire service personnel	18	10
Fire control or extinguishment, other	3	2
Hazardous materials leak control & containment	1	0
Information, investigation & enforcement, other	1	0
Investigate	3	2
Investigate fire out on arrival	8	8
Notify other agencies.	1	0
Provide advanced life support (ALS)	0	1
Provide manpower	1	0
Salvage & overhaul	3	3
Transport person	0	1
Ventilate	1	1

Note: Totals are higher than the total number of structure and outside fire calls because some calls had more than one action taken.

Observations:

- Out of 37 outside fires, 18 were extinguished by fire service personnel, which accounted for 49 percent of outside fires.
- Out of 22 structure fires, 10 were extinguished by fire service personnel, which accounted for 45 percent of structure fires.

ATTACHMENT II: ADMINISTRATIVE WORKLOAD

TABLE 8-27: Workload of Administrative Units

Unit ID	Unit Type	Annual Hours	Annual Runs
C591	Chief's Vehicle	28.7	59
C592	Chief's Vehicle	39.1	81
C593	Chief's Vehicle	42.2	74
C594	Chief's Vehicle	36.8	47
FM594	Prevention Specialist's Vehicle	1.1	11

Note: One chief position was eliminated in October 2018, and the corresponding vehicle, C594, was then put out of service until June 2019, when a prevention specialist was hired. The prevention specialist was assigned the same vehicle, which was renamed FM594.

ATTACHMENT III: FIRE LOSS

TABLE 8-28: Content and Property Loss – Structure and Outside Fires

Call Type	Property Loss		Content Loss	
	Loss Value	Number of Calls	Loss Value	Number of Calls
Outside fire	$56,965	14	$12,450	9
Structure fire	$146,250	12	$46,335	14
Total	**$203,215**	**26**	**$58,785**	**23**

Note: This includes only calls with a recorded loss greater than 0.

TABLE 8-29: Total Fire Loss Above and Below $20,000

Call Type	No Loss	Under $20,000	$20,000 plus
Outside fire	21	15	1
Structure fire	8	10	4
Total	**29**	**25**	**5**

Observations:

- Out of 37 outside fires, 14 had recorded property loss, with a combined $56,965 in losses.
- 9 outside fires had content loss with a combined $12,450 in losses.
- The highest total loss for an outside fire was $31,000.
- Out of 22 structure fires, 12 had recorded property loss, with a combined $146,250 in losses.
- 14 structure fires had a content loss, with a combined $46,335 in losses.
- The highest total loss for a structure fire was $70,000.
- The average total loss for structure fires with loss was $13,756.

- END -