DRAFT Report

Fire Operations and Data Analysis

Frisco, Texas
August 2012

ICMA CENTER FOR PUBLIC SAFETY MANAGEMENT

Submitted by:
ICMA *Center for Public Safety Management*
International City/County Management Association
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ICMA
Leaders at the Core of Better Communities

Background

About ICMA

The International City/County Management Association (ICMA) is a 100-year-old, nonprofit professional association of local government administrators and managers, with approximately 9,000 members located in 28 countries.

Since its inception in 1914, ICMA has been dedicated to helping local governments provide services to its citizens in an efficient and effective manner. ICMA's work spans all of the activities of local government: parks, libraries, recreation, public works, economic development, code enforcement, brownfields, public safety, and a host of other topic areas.

ICMA advances the knowledge of local government best practices across a wide range of platforms, including publications, research, training, and technical assistance. Our work includes both domestic and international activities in partnership with local, state and federal governments as well as private foundations. We are involved in a major library research project funded by the Bill and Linda Gates Foundation, for example, and are providing community policing training in El Salvador, Mexico and Panama with funding from the United States Agency for International Development (USAID). ICMA personnel in Afghanistan are helping to build wastewater treatment plants and teams in Central America are working with SOUTHCOM to conduct assessments and develop training programs for disaster preparedness.

ICMA *Center for Public Safety Management*

The ICMA *Center for Public Safety Management (*ICMA/CPSM*)* is one of four Centers within the ICMA's U.S. Programs Division, providing support to local governments in the areas of police, fire, emergency medical services (EMS), emergency management, and homeland security. In addition to providing technical assistance in these areas, we also represent local governments at the federal level and are involved in numerous projects with the U.S. Department of Justice and the U.S. Department of Homeland Security.

ICMA/CPSM also has provided assistance with police and fire chief selection, helping local governments to identify the right leaders through original research, the identification of core competencies of police and fire managers, and assessment center resources.

Our local government technical assistance includes workload and deployment analysis, using operations research techniques and credentialed experts to identify workload and staffing needs as well as best practices. We have conducted approximately 140 such studies in almost 100 communities ranging in size from Boone, Iowa, which has a population of roughly 8,000, to Indianapolis, which has more than 800,000 citizens.

Thomas Wieczorek is the Director of the Center for Public Safety Management. Leonard Matarese is the Director of Research & Project Development.

Methodology

The ICMA Center for Public Safety Management team follows a standardized approach to conducting analyses of fire, EMS, police and other departments involved in providing services to the public. We have developed this approach by combining the experience sets of dozens of subject matter experts in the areas of police, fire, and EMS. Our collective team has more than one hundred years of conducting research in these areas for cities in and beyond the United States.

The reports generated by the operations and data analysis team are based upon key performance indicators that have been identified in standards and safety regulations and by special interest groups such as the International Association of Fire Chiefs, International Association of Fire Fighters, Association of Public Safety Communication Officials International, and through the Center for Performance Measurement of ICMA. These performance measures have developed following decades of research and are applicable in all communities. For that reason, comparison of reports will yield similar reporting formats, but each community's data are analyzed on an individual basis by the ICMA specialists and represent the unique information for that community.

The ICMA team begins most projects by extracting calls for service and raw data from a public safety agency's computer aided dispatch system. The data are sorted and analyzed for comparison to nationally developed performance indicators. These performance indicators (e.g., response times, workload by time, multiple-unit dispatching) are valuable measures of agency performance regardless of departmental size. The findings are shown in tables and graphs organized in a logical format. Due to the size and complexity of the documents, a consistent approach to structuring the findings allows for simple, clean reporting. While the categories for the performance indicators and the overall structure of the data and documents follow a standard format, the data and recommendations are unique to the organization under scrutiny.

In conjunction with the data collection and analysis, the ICMA team conducts an operational review of relevant departments and areas under study. The review process follows a standardized approach comparable to that of national accreditation agencies and industry best practices, with the performance indicators serving as the basis. Prior to the first site visit by the ICMA team, agencies are asked to provide the team with key operational documents (e.g., policies and procedures, asset lists, etc.). The team then visits the city to interview fire agency management and supervisory personnel, rank-and-file officers, and local government staff.

The information gathered through the data collection and site visits results in a set of observations and recommendations that highlight strengths, weaknesses, opportunities, and threats of the organizations and operations under review. To generate recommendations, the team reviews operational documents, interviews key stakeholders and observes physical facilities, reviews relevant literature, statutes and regulations, industry standards, and other information and/or materials specifically included in a project's scope of work.

The standardized approach ensures that the ICMA Center for Public Safety measures and observes all of the critical components of an agency, which in turn provides substance to benchmark against localities with similar profiles. Although agencies may vary in size, priorities, and challenges, there

are basic commonalities that enable comparison. The approach also enables the team to identify best practices and innovative approaches.

In general, the standardized approach adopts the principles of the scientific method: We ask questions and request documentation upon project start up; confirm accuracy of information received; deploy operations and data analysis teams to research each unique environment; perform data modeling; share preliminary findings with the jurisdiction; assess inconsistencies reported by client jurisdictions; follow up on areas of concern; and communicate our results in a formal, written report.

ICMA Project Contributors

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Executive Summary

In March 2012, ICMA executed a contract with the city of Frisco to complete a comprehensive analysis of the city's fire and EMS services. This analysis is designed to provide the city with a thorough and unbiased review of all emergency services provided by the Frisco Fire Department (hereinafter, the FFD). This report identifies best practices already in place by the department and as important is accompanied by recommendations for ways to improve current services. This report also provides a benchmark of the city's existing service delivery performance. Benchmark performance information can be found in the Data Analysis section of this report.

An initial site visit was conducted by ICMA's Director of Research & Project Development on April 4, 2012. The project management team conducted site visits on April 16 and 17, 2012, with a follow-up visit on June 8 for the purpose of observing fire department and agency-related support operations, interviewing key fire department staff, and reviewing preliminary data and operations. The ICMA team also made follow-up telephone calls to affirm the project information and elicit further discussion regarding the operational and data analysis.

The ICMA team analyzed performance data and administrative documents provided by the FFD and examined firsthand the department's operations, which the ICMA team found to very good. The ICMA team reviewed all of the FFD divisions and interviewed senior, mid-level, and operational staff. The ICMA team found all of the staff to be competent in their responses, willing to listen to suggestions, and eager to participate, which resulted in a comprehensive review and report. The fire chief and senior staff appear open to most of the recommendations that will bring about improvement and result in a more effective and efficient agency.

The information provided by the city of Frisco was used in conjunction with raw performance data that was collected. The raw data helped to measure the existing performance of the fire department and compare that performance to national benchmarks that have been developed by the National Fire Protection Association (NFPA), Center for Public Safety Excellence, Inc., the ICMA Center for Performance Measurement, and other national organizations. City staff was provided an electronic shared information folder to upload information for analysis and use by the ICMA project management staff.

The FFD is well equipped with state-of-the-art fire and EMS equipment and apparatus, is staffed and deployed appropriately to handle current emergencies, has appropriately identified gaps in response coverage, and is planning future fire station locations correctly, basing these future stations on projected growth and community development. As an all-hazards agency, the FFD is also charged with the responsibility to oversee and manage the city's emergency operations center (EOC) and has implemented several FEMA best practices. Further, the FFD provides a full fire marshal's office that provides fire prevention, arson investigation, and plan review functions. The ICMA team identified industry best practices that have been implemented by the fire marshal's office.

A hallmark component of the FFD is its public education effort. The deliverables from this program area are focused on not only fire safety and prevention, but also on injury prevention, life safety,

Internet safety, bicycle safety, and other community safety-related initiatives. Safety Town is a nationally recognized program that receives visitors and participants from around the world.

In reviewing information and discussing operations with department members, the ICMA team always seeks first to understand how the fire department operates and then to identify ways the department can improve efficiency, effectiveness, and safety for both its members and the community it serves. While the FFD has implemented many best practices, deploys effectively for current demand, and has a highly regarded public education program, there is always room for improvement.

To this end, the ICMA team has identified several gaps and critical areas in need of improvement, including: the lack of formal strategic and risk management planning documents with accompanying performance measures and goals; communication gaps and officer time allocation management that create a perception of micromanagement and affect morale; the lack of a succession plan and preparation of officer candidates through a career development program; the need to aggressively continue with the accreditation program as a means to self-assess the agency to gain additional improvements; a need to review response procedures on both EMS and fire alarm calls for service with a goal of becoming more efficient; organizational structure changes at the station and management levels. Additional recommendations are offered to assist the department in overall efficiency, effectiveness, and improvement.

Recommendations and best practices for fire and EMS services in the city of Frisco, Texas are listed below. The recommendations are based on best practices derived from the National Fire Protection Association, Center for Public Safety Excellence, ICMA, U.S. Fire Administration, International Association of Emergency Managers, and FEMA to name a few, as well as the knowledge of ICMA reviewers. Supporting information for these recommendations is detailed within the report.

Recommendations

The recommendations contained herein may be adopted in whole, in part, or rejected. However, ICMA recommends that specific objectives that are undertaken be assigned to individuals with a reporting/score card process to deliver input to city administration.

1. Continue to implement the current Fire Station Master Plan based on sustained growth; a community risk analysis; the demand for service; established, accepted, and approved response times; and ability to fund construction, equipment, and staffing.

2. Develop a functional table of organizational chart to accompany the formal department organizational chart.

3. Implement the proposed organizational chart *now* and the proposed future organizational chart over the next three to five years as the organization expands.

4. Develop and implement a communication model that establishes and ensures an effective conduit of clear and productive communication throughout the entire organization.

5. Adopt a time allocation model; implement and monitor time allocation to ensure effective use of officer and staff time as it relates to achieving the organizational mission.

6. Develop and implement a succession planning process that identifies and develops future leaders.

7. Complete a comprehensive needs assessment to identify department weaknesses and community needs; incorporate an all-hazards risk assessment; develop and implement those planning documents the department lacks to ensure the core mission is achievable.

8. Continue in the Commission on Fire Accreditation International (CFAI) accreditation program and conduct a self-assessment under the guidelines CFAI as a means toward overall organizational improvement.

9. Appoint an accreditation manager whose primary function is to manage the accreditation process until the Frisco Fire Department is fully accredited.

10. Develop and implement a comprehensive strategic plan.

11. Incorporate improved goals and objectives into strategic and comprehensive planning documents, as well as the annual budget and long-range fiscal documents.

12. Conduct a community risk assessment and continually analyze/utilize the results in the planning of fire station locations, apparatus needs, and staffing requirements.

13. Develop and implement an internal risk management plan following the standards of NFPA 1500, Standard for a Fire Department Occupational Safety and Health Program.

14. Develop and implement a performance measure reporting system that includes measures of quality and customer satisfaction.

15. Develop performance measures for each fire department activity, and implement a performance measurement system to be included in strategic and comprehensive planning documents, and fiscal/budget documents.

16. Consider ICMA recommendations germane to this operational analysis report that require additional funding, and implement as funding allows.

17. As funding allows, consider and implement for the construction of new and the renovation of current facilities, the components of NFPA 1402, NFPA 1581, NFPA 1500, and Texas OSHA facility requirements.

18. Structure a facility preventive maintenance program designed to maintain efficiencies of systems and longevity of equipment in order to reduce overall building maintenance costs. The facility preventive maintenance program should include all facility components.

19. Develop and implement a ten-year capital replacement program with target replacement years and projected cost for all capital equipment.

20. Identify occupancy and false alarm type calls for trends and frequency and implement appropriate measures to mitigate alarm issues with a focus on reduction of responses. Ensure compliance with Chapter 6 of the Code of Ordinances, Frisco, Texas.

21. Implement a documentation program that captures time spent on nonemergency tasks; report on nonemergency productivity monthly and annually.

22. Continue to plan and locate fire stations based on community risk and acceptable average response times of first-arriving fire suppression companies with a focus on 240- to 360-second travel times.

23. Continue to maximize the deployment of compressed air foam system (CAFS) to increase efficiencies in fire suppression.

24. Evaluate current and future department funding and strive to meet Fire Suppression Rating Schedule Texas Addendum minimum requirements for fire inspection staffing to meet service demands of this office.

25. Evaluate current and future department funding and strive to add a plans review position (non-uniform) to the fire marshal's office to effectively meet the demands of this function and release fire inspection personnel to perform fire prevention inspections.

26. Enhance programs with community and civic groups, and other private organizations for the placement of automated external defibrillators (AEDs), and seek out private contributions/partnerships to assist in funding this vital community program.

27. Reorganize the public education function to the fire marshal's office as a direct report to the fire marshal.

28. Evaluate current and future department funding to strive to add one additional arson investigator to assist with arson investigations as well as initiate and sustain a Juvenile Fire Setter Program. In the interim, train a current staff member to fulfill this function.

29. Evaluate current and available technology and funding, and strive to implement a paperless inspection records–management system that focuses on customer service and improves efficiencies.

30. Reorganize to create a new fire prevention/investigation/public education division that encompasses all of these programs and establishes a direct report status to the fire chief.

31. Cap the number of FFD operational paramedics to efficiently staff advanced life support (ALS) response units (with a minimum of one each on fire suppression units/two on medic units) to avoid diluting the EMS system; and to ensure that skills are maintained to a high degree.

32. Deploy a medic unit in District 3 during peak hours of the day (0900–2100), utilizing current staffing from C-Com/HazMat units in lieu of adding staff. Cross-staff C-Com/HazMat units with current staff from Heavy Rescue 601.

33. Review response procedures to EMS calls; utilize current emergency medical dispatch component and dispatch the appropriate resource(s) to EMS calls for service with a goal of reducing fire suppression unit response to nonemergency call types.

34. Provide requisite training as emergency management specialists for operations staff responsible for an emergency operations center (EOC) assignment so they can serve as redundant staff to emergency management staff.

35. Assign the emergency management coordinator function to the city manager and the assistant emergency management coordinator function to the fire chief for the purpose of establishing and ensuring effective and efficient emergency management operations.

36. Improve the damage assessment annex in the FFD comprehensive all-hazard emergency plan to ensure the plan is sufficient and the essential components are in place to receive state and federal assistance if needed.

37. Develop a training plan that includes quarterly tabletop exercises so that city management becomes more familiar with the all-hazards plan, management responsibilities, and the workings of the EOC.

38. Implement Medical Priority Dispatch ProQA software to increase emergency medical dispatch (EMD) efficiencies by responding with the most correct resources to EMS incidents, and to establish a communications center quality assurance program for EMS incidents.

39. Ensure that all frontline fire and EMS apparatus have mobile data computers; ensure the automatic vehicle location (AVL) feature is turned on and integrated with computer-aided dispatch (CAD); and implement CAD-recommended closest unit response to all fire and EMS incidents.

40. Research the feasibility of establishing a driver-operator position; consider the actual versus the perceived need, fiscal impact, effectiveness, and potential cost savings on equipment and apparatus.

41. Review and implement stated recommendations in this report that improve organizational development, organizational effectiveness, and interpersonal relationships. Develop training programs focused on current and future officers that link to these recommendations.

42. Research the feasibility of placing captains on each shift/each station where there are multiple fire units or a single quint (combination engine/ladder) unit.

43. Ensure that hands-on, practical fire and EMS training is included in all monthly company training schedules. This should include technical rescue training for truck and heavy rescue companies.

44. Seek partners to construct a regional training center that includes classroom, burn, and specialized training props to serve both fire and EMS training.

45. Encourage and provide support for FFD officers and technical staff to attend Emergency Management Institute and/or National Fire Academy courses to enhance department competencies and for agency and self-development purposes.

46. Develop and implement a career path training and development program for lieutenant, captain, battalion chief, and division chief that focuses on personal and professional development for promotion.

47. Encourage the use of the city's tuition reimbursement program and include progressive formal education requirements in each level of officer promotional qualifications that has an end goal of requiring minimum college credit hours for lieutenant and captain and a baccalaureate degree for battalion, division, and assistant chief positions.

48. Implement computer-based training courses on a variety of technical, management, and supervisory topic areas.

Best Practices

As noted, the FFD has implemented several industry best practices. Listed below are examples of these best practices that cross several FFD divisions, and are focused on improving the organization and providing an effective service to the community. It is important to reinforce these best practices when carrying out the above recommendations and/or making other changes to improve the organization.

1. As a best practice, the FFD has implemented non-emergency programs that include hydrant inspections; pre-fire planning; equipment and station maintenance; didactic and practical training.

2. The FFD utilizes best practices such as response times, current and future community growth and development, current and future road networking, available land and staff experience to site fire stations.

3. The FFD currently deploys resources based on factors such as internal response time data, community development and growth patterns, the NFPA 1710 standard, building type in a response district, and neighborhood density—all of which are best practices.

4. As a best practice, the FFD does an excellent job targeting and analyzing hazards and making this information available for planning purposes, as well as for responding operational personnel, through its SAFER program.

5. The fire marshal's office coordinates fire department operations personnel in conducting SAFER inspections on a regular basis. In addition to providing critical first-line data on possible code violations, this best practices program has an added benefit in that it assists operational firefighters with pre-fire planning by familiarizing them with the building interiors, and ensuring that information is updated in the SAFER data base system.

6. The FFD Public Education program to include Safety Town, safety tours, citizen fire academy, safe and sound tours, and birthday parties are all excellent fire prevention programs and best practices in public education.

7. In Frisco, the planned disaster organization and response are as similar as possible to the day-to-day emergency organizational structure and response to routine emergency events. Frisco's EOC is staffed by the EOC specialist and two firefighters on a 24/7 basis and is used daily to monitor traffic, news, and routine citywide and regional emergencies. This is a FEMA-recommended best practice.

8. The EOC is backed up by a fully functional mobile command truck that can be used as the emergency operations center should the building housing the emergency function be damaged or destroyed in a major event. Having a fully functional back-up EOC is also a FEMA best practice.

9. Frisco's mayor is familiar with his emergency-related responsibilities and regularly participates in the EOC when storms threaten or when a major emergency or disaster occurs in a nearby community. It is considered critical and a known best practice for the chief elected official to be familiar with EOC functions and to actively participate in the EOC on a regular basis.

10. As a best practice, the FFD currently utilizes CAFS and is deploying modern compressed air foam systems on all new and future fire suppression apparatus.

Operational Analysis

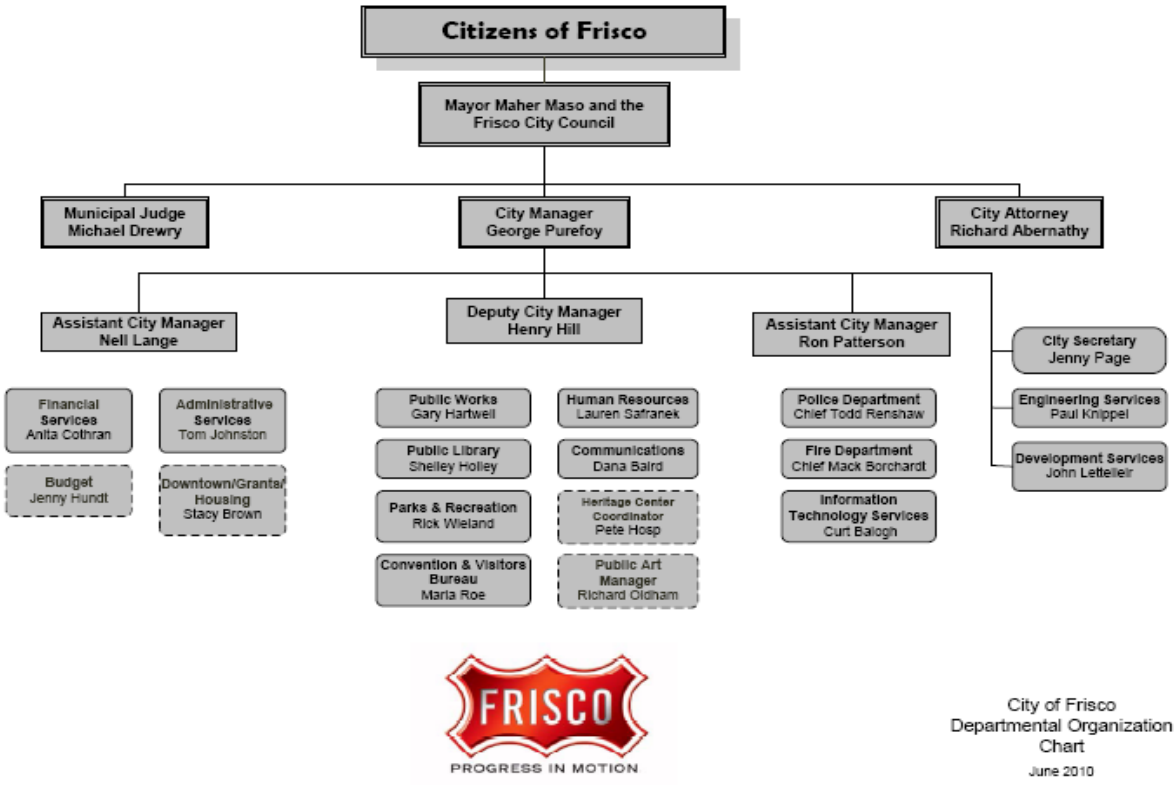
Governance and Administration

Through the adoption of a home rule charter, the city of Frisco, Texas, is a home rule municipal government in accordance with the statutes of the state of Texas. Article 1, Section 1.01 of the charter establishes the municipal government to operate as a council-manager form of government.[1]

The city council consists of a mayor and six council persons elected at-large under the place system. A city manager is appointed by a majority vote of the city council to administer the affairs of the city, other than exceptions identified in the charter. The city's organization is illustrated in Figure 1.

Section 38-21 of the Code of Ordinances for the City of Frisco, Texas, establishes a fire department; Section 38-22 delineates the duties of the fire department to include, but not be limited to, firefighting, emergency rescue services, emergency medical services, fire prevention services and enforcement, and other duties as may be prescribed by the city council. Section 38-23 of the code establishes a chief of the fire department.

FIGURE 1: City of Frisco Organizational Chart



[1] Code of Ordinances, City of Frisco, Texas.

To improve the effectiveness and efficiency in how it operates and governs, the city council has adopted the "policy governance" model. The intent of this model is to provide operational definition to the leadership of the council as this applies to those items and policy germane to a governing council. This model provides the council, collectively, with an opportunity to have organizations (internal and external) achieve council-stated goals and focus on desired end outcomes.[2]

During discussions with FFD staff, the ICMA team learned that some FFD staff members have engaged in direct conversation with city council members regarding FFD business, specifically discussing matters about the FFD senior staff. Some FFD members stated that they are aware of regular conversations between FFD staff and city council members. It was further iterated to the ICMA team that some FFD members felt as though they would see certain actions from city council regarding the fire chief and other matters within the FFD based on these conversations.

In a council-manager form of government the powers of the elected and appointed officials are segregated to provide a fair balance between the political and managerial leadership. The appointed city manager is intended as an apolitical position, educated in public management. In Frisco, city council members are expressly prohibited from interfering with the manager's administration by providing direction or giving orders to employees under the manager's supervision, pursuant to Section 3.08 (c) of the Charter. Pursuant to Section 3.08 (b), the council is not to interfere with the appointment or removal of any subordinates of the manager.[3]

Thus, the communication between FFD members and elected officials potentially violates the city charter. Moreover, it is contradictory to the intent of the council-manager form of government and may undermine the effectiveness of city administration. Thus, ICMA recommends that FFD members stop communicating directly with city council members so that they do not put themselves or city council members in a position of a charter violation.

The FFD is an Insurance Services Office (ISO) 1 Fire Department. ISO classifies a community's public protection classification (PPC) from 1 (superior) to 10 (does not meet minimum criteria). ISO collects information on municipal fire-protection efforts in communities throughout the United States. In each of these communities, ISO analyzes the relevant data using a Fire Suppression Rating Schedule (FSRS). ISO reviews three major areas when evaluating a fire department: the fire department; the water system; and emergency communications. The ISO also considers the fire department's equipment, manpower, and fire alarm facilities in its recommended rating.[4]

Frisco's PPC rating of 1 is significant in that Class 1 generally represents superior property fire protection and is representative of the city's investment in fire mitigation. It is important to note

[2] Carver Governance Policy. http://www.ci.frisco.tx.us/government/Pages/CarverGovernancePolicy.aspx.
[3] Code of Ordinances, City of Frisco, Texas.
[4] ISO Public Protection Classification System, http://www.isomitigation.com/ppc/0000/ppc0001.html.

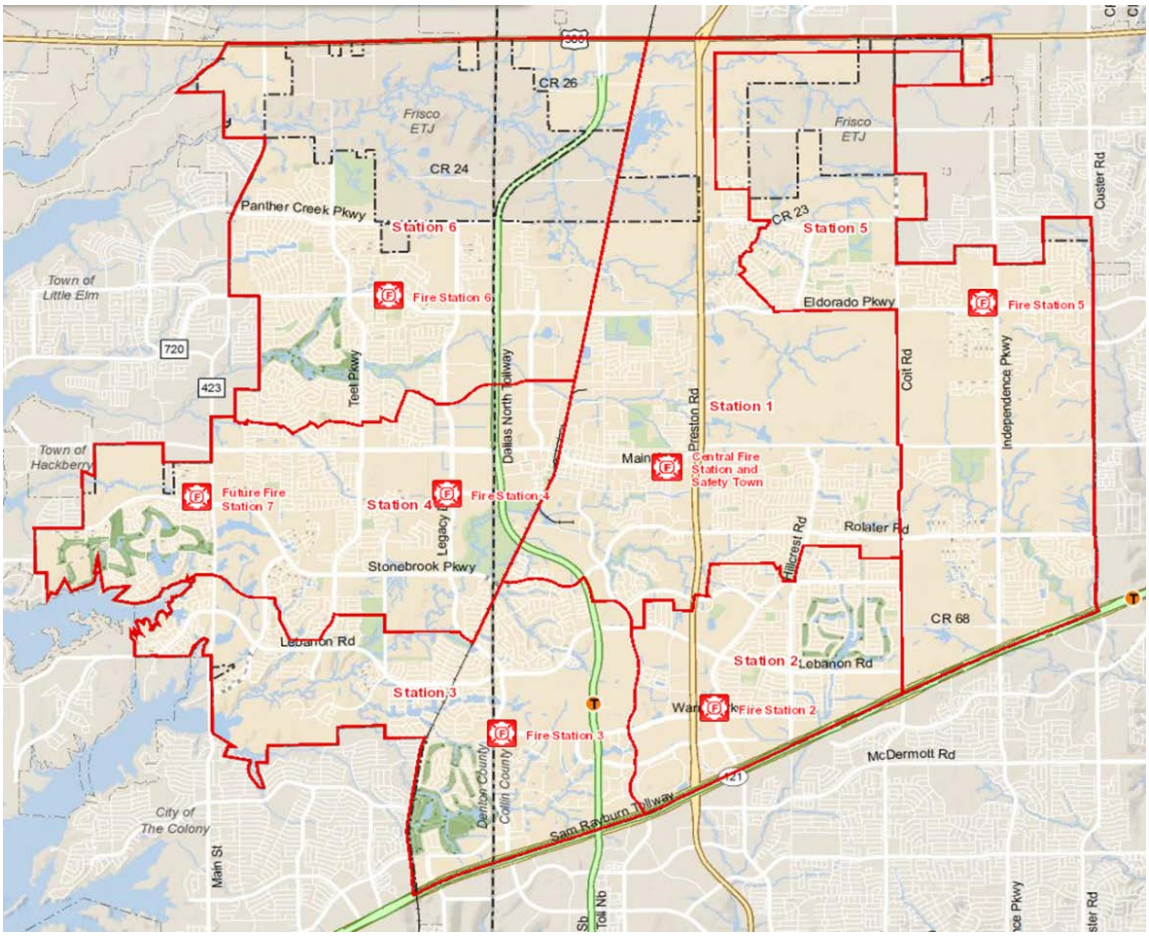
that a fire department's PPC rating has a direct bearing on the cost of property insurance for every real property (home/commercial buildings) in a community, as insurance companies generally offer lower premiums in communities with better fire protection. The ISO rating does not however represent a comprehensive review of a fire department that includes fire prevention and investigation, logistical and administrative support, policies and procedures, and comprehensive planning.

The FFD is primarily a career fire and EMS department; it operates seven fire stations to deliver fire and EMS services to more than 126,000 citizens within a total of seventy square miles of incorporated city and unincorporated area of the Frisco extraterritorial jurisdiction (ETJ).[5] A staff of 154 operational personnel works a three-platoon system to deliver fire suppression and EMS services. Each platoon works twenty-four hours on and has forty-eight hours off. Field Operations is commanded by an assistant chief who reports directly to the fire chief and is supported indirectly by an administrative staff. The career service is augmented by a volunteer contingent that supports fire suppression staffing and ancillary department projects and programs.

Figure 2 illustrates the current FFD station locations. The seven stations deploy seven engine companies (three are 75-foot quints[6]); two ladder companies; five medics (ambulance transport); one heavy rescue squad; one hazardous materials unit; one communications/command unit.

[5] City of Frisco, Development Services Department.
[6] A quint is a combination pumper/ladder apparatus that carries hose and has a pump and water tank, a hydraulic ladder, and ground ladders.

FIGURE 2: Current FFD Fire Stations

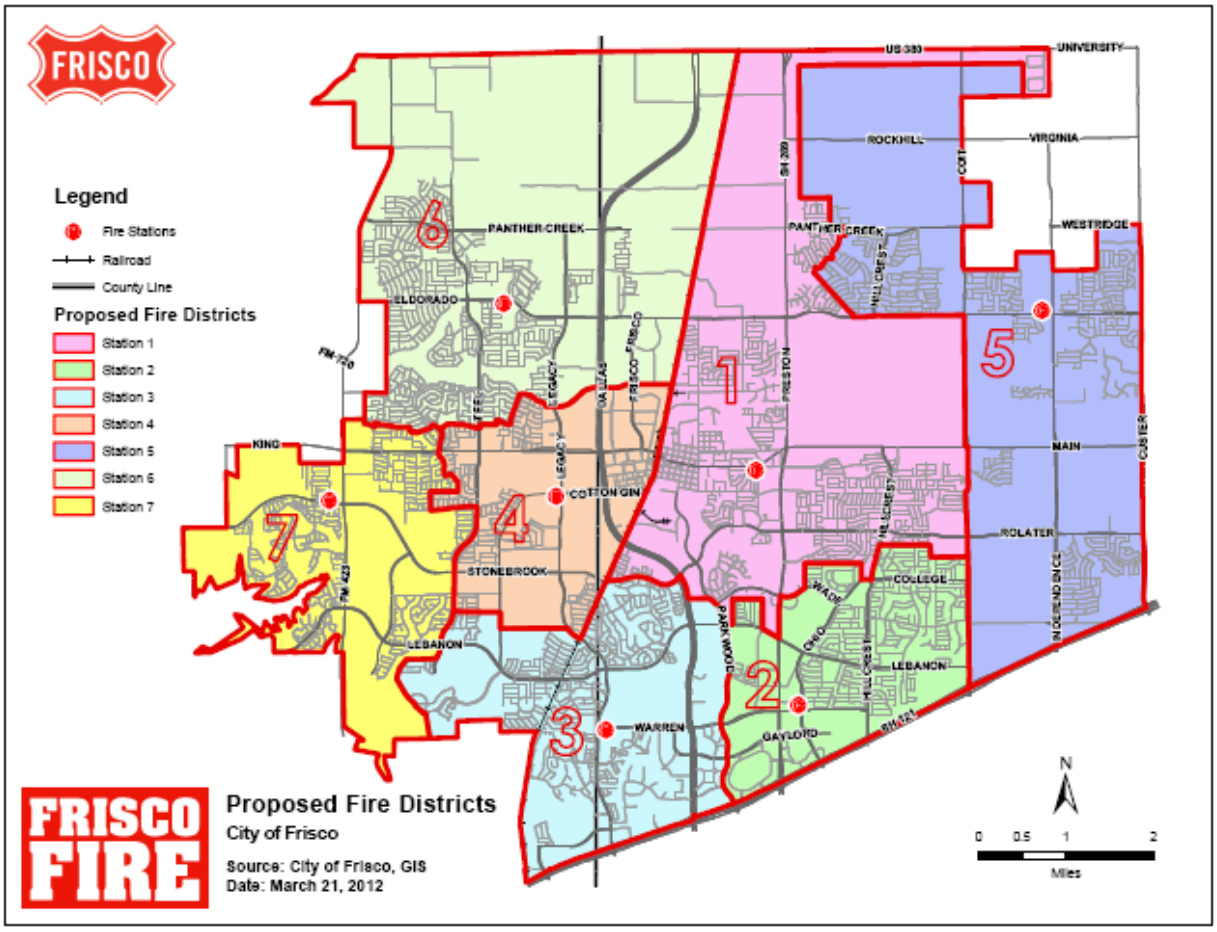


There is one battalion chief (middle manager) on duty each 24-hour shift. This position manages the day-to-day operational component of the department, supervising the operational personnel and providing command and control of multi-unit emergency incidents. This highlights the importance of the incumbent being not only an excellent resource manager but also an effective manager of human resources.

The FFD opened a new station in June 2012 (Figure 3). This station is located in the southwest portion of the city and deploys one engine company (75-foot quint) and one medic (ambulance transport). When this station was opened the number of medic units was not increased; rather, the medic unit from Station 6 was relocated to Station 7. The response districts for the seven stations are illustrated in Figure 4 on page 12.

FIGURE 3: Fire Station #7, *Under Construction*

FIGURE 4: FFD Response Districts, as of June 2012



Using current growth data projections and build-out projection models, the FFD has developed and implemented a plan for future fire stations. The city has projected the long-term build-out costs, as shown in Figure 5.

The location of future fire stations, which is illustrated in Figure 6, is designed to meet future fire and EMS service demands, while maintaining response times that are established through department-implemented performance measures and the city's executive staff, and that are acceptable to the city's elected leaders.

Figure 5: Build Out Plan

BUILD-OUT YEAR BY ANNUAL GROWTH RATE			
Year	3%	5%	7%
2015	134,600	145,350	156,750
2020	156,000	185,500	219,800
2025	180,900	236,700	280,000 (in 2023)
2030	209,650	280,000 (in 2029)	
2035	243,000		
2040	280,000		

FIGURE 6: Future Fire Station Locations

O indicates future stations

indicates stations in out years

Recommendation:

- Continue to implement the current Fire Station Master Plan based on sustained growth; a community risk analysis; the demand for service; established, accepted, and approved response times; and ability to fund construction, equipment, and staffing.

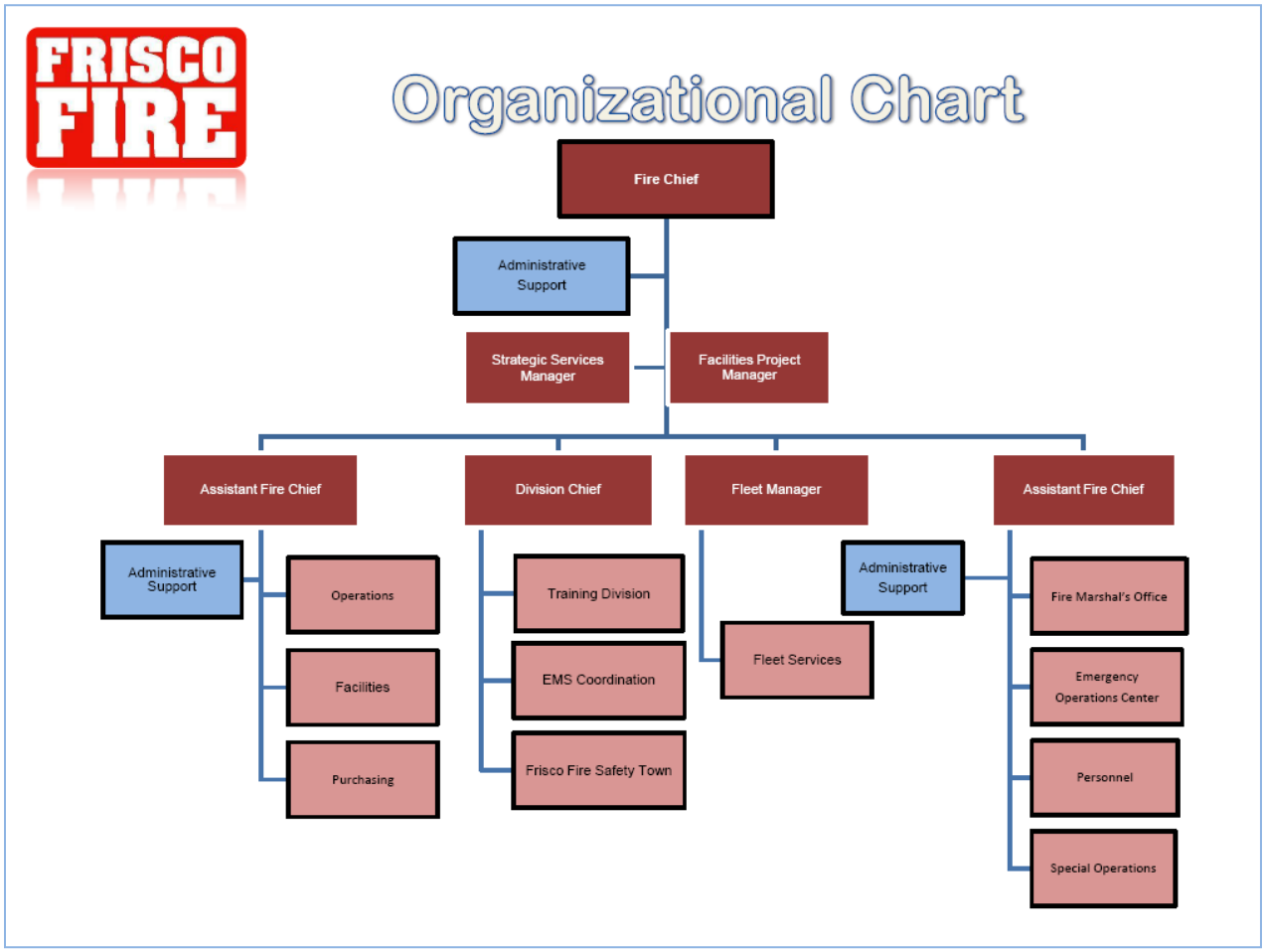
Organizational Structure

The department utilizes a traditional organizational structure, with the fire chief designated as the leader of the organization. This structure provides a clearly defined division of responsibility for critical day-to-day functions and identifies each functional division/program the department is responsible for delivering. It also distributes authority so that service is delivered in a timely, orderly, and effective manner, with leadership and accountability identified from the company-

level officers up to the top of the organization.[7] The organization of the Frisco Fire Department is illustrated in Figure 7.

Frisco is America's fastest growing city; it has grown 204 percent during the last decade.[8] As a result, the FFD has had to increase both its operational and its administrative staff, and has expanded its organizational structure accordingly. Senior leadership has been challenged to manage the organization through a vertical structure that identifies rank and authority, but may not define clearly the function of each office and program. The vision and mission of each program and office of the organization are not fully recognized by the organization, the community, or the governing body. Further, communication gaps are created throughout the organization, which ultimately leads to morale and organizational culture issues.

FIGURE 7: Current FFD Organizational Chart

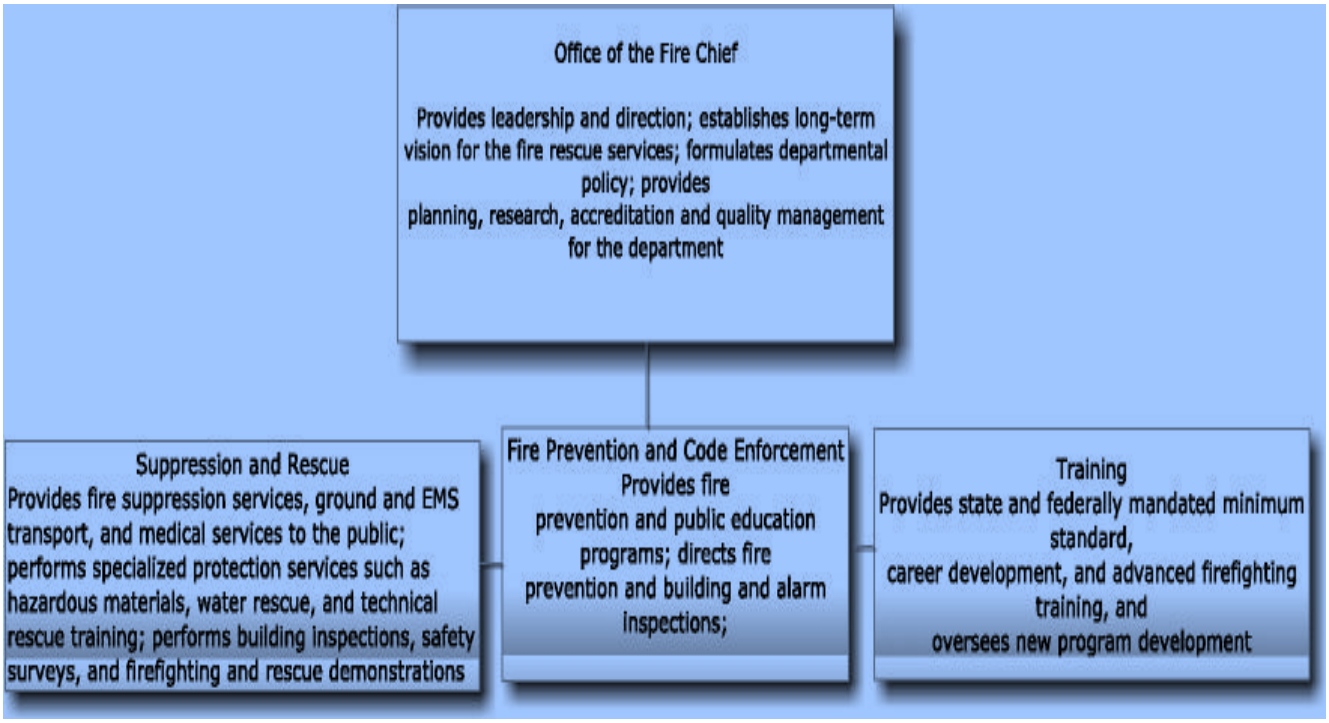


[7] Dennis Compton and John Granito, editors, *Managing Fire and Rescue Services* (Washington, DC: International City/County Management Association, 2002), 115

[8] MSN Real Estate, "America's Fastest Growing Cities," http://realestate.msn.com/slideshow.aspx?cp-documentid=25918118#2.

A functional organizational structure provides the organization, community, and the governing body with a clear picture of what the key services are and where they are located within the department. In this type of organization, each task or functional area becomes the focal point. Similar function-based tasks performed by the employees are put together in groups. Specialization is centralized, and employees doing the specialized jobs or tasks are clustered into a unique division. Figure 8 provides an example of a functional table of organization chart.

FIGURE 8: Example of a Functional Organizational Chart

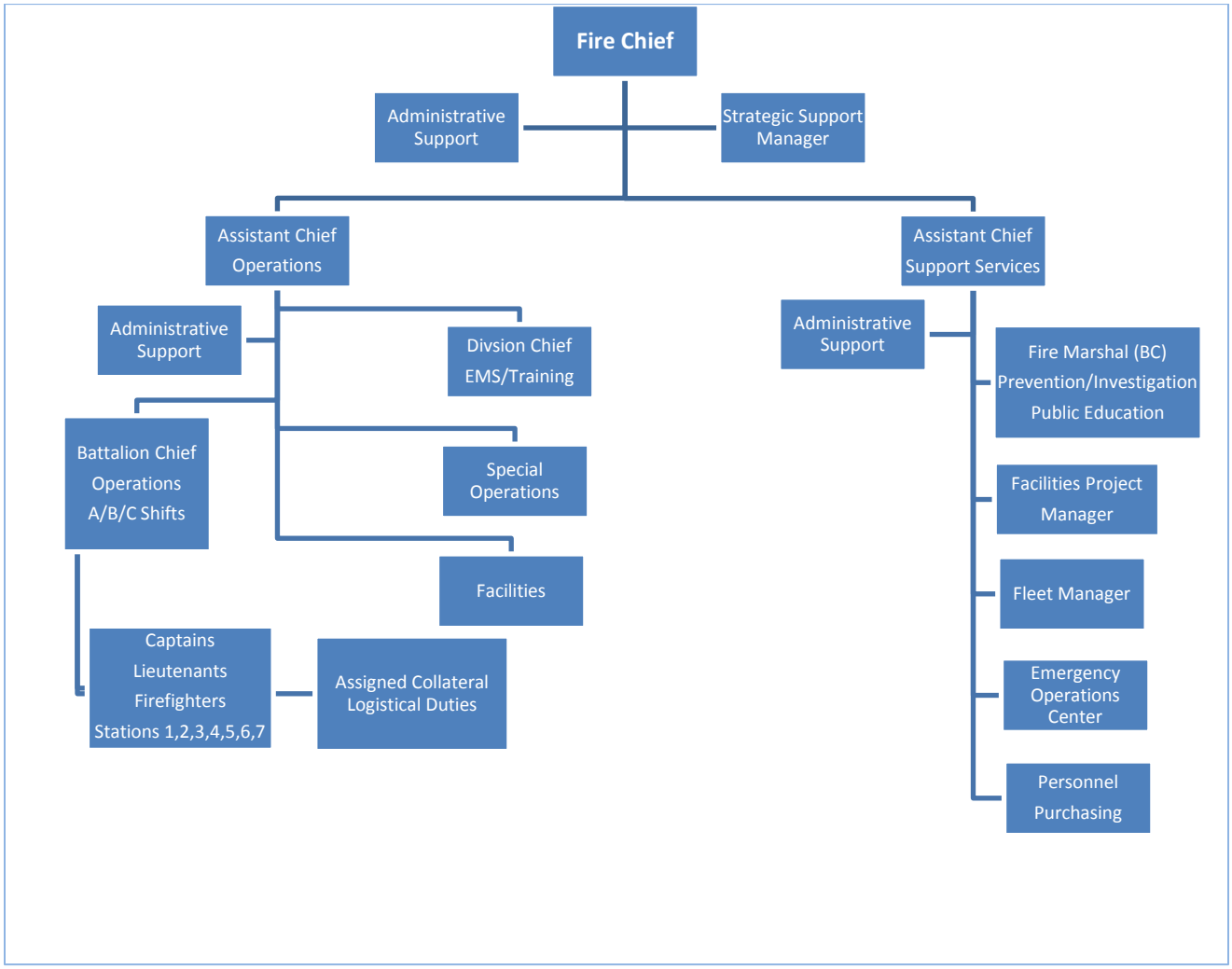


As service demands have increased for the FFD due to development and population growth, so have the demands on the organization and the organizational structure. During this rapid growth the department has not effectively adjusted the organizational structure to meet these increased and sometimes new demands. The current organizational structure remains centralized to the fire chief's office.

Given this, it is recommended that the FFD organize the department so as to optimize the use of subordinate officers (to include Battalion Chiefs, Captains and Lieutenants) to the fire chief within the leadership and management of all department operations. Additionally, this report will recommend additions and deletions to the organization.

Figure 9 illustrates a proposed organizational chart to facilitate current organizational challenges, while Figure 10 illustrates a proposed model to meet future organizational and service demand challenges.

FIGURE 9: Proposed Organizational Chart

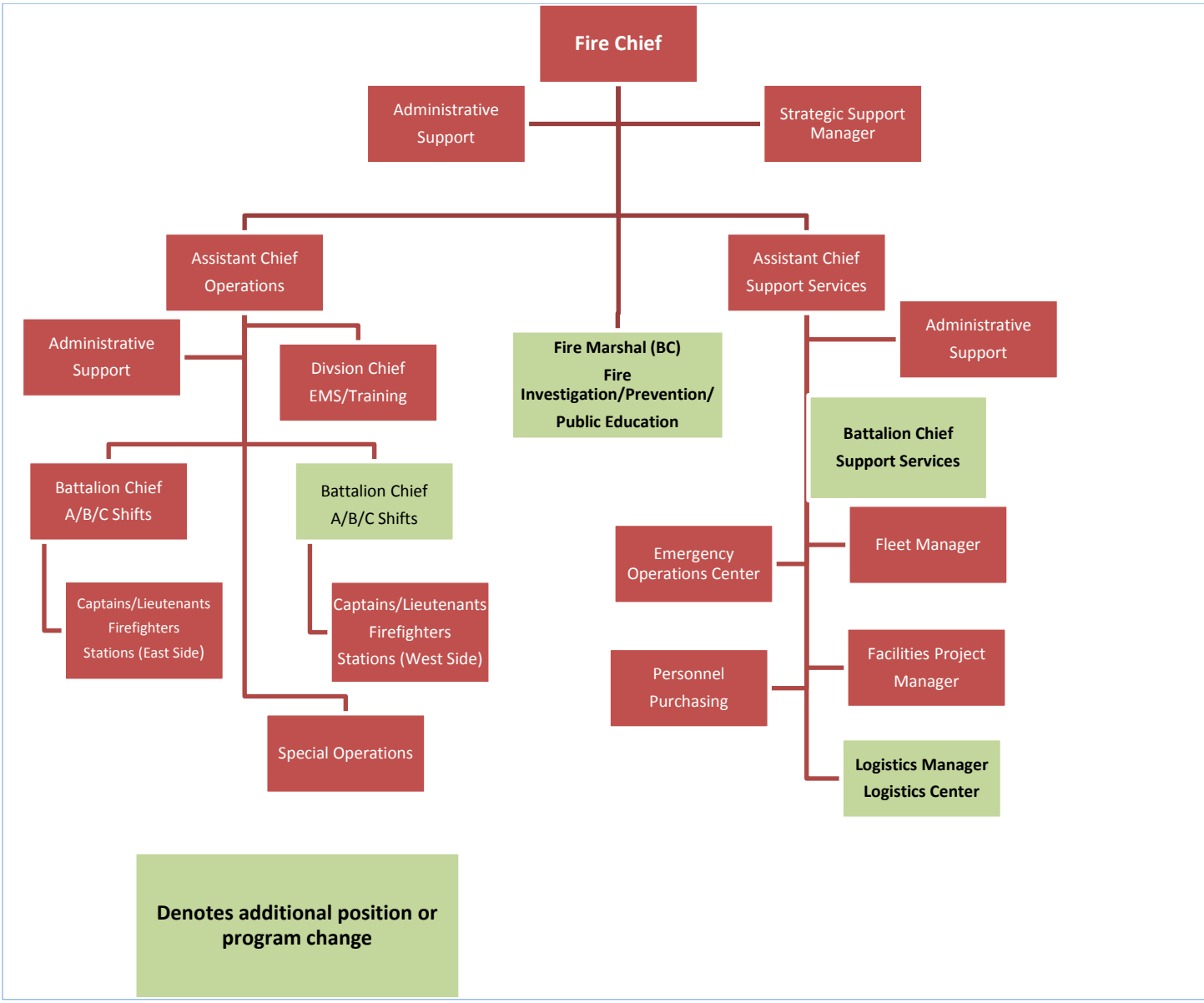


In Figure 9, a reorganization of current positions/programs occurs. In this organizational chart, functional programs that are alike are more directly linked together. Each assistant chief assumes a more direct functional management of programs and components of the organization, decentralizing organizational workload from the fire chief's office.

Additionally, each battalion chief (operations and fire marshal) and the division chief should now, when linked to a functional table of organization, expand their roles and manage more directly station and company specific programs, collateral duties as well as the operational component of their assignment, decentralizing day-to-day operational management from the Assistant Chief level. Collectively, this will allow the fire chief and the executive staff to allocate the greatest percentage of their time to improve and create the future of the organization.

Figure 10 illustrates the proposed organization of the future. As the fire department continues to expand with the future growth of the city by adding stations, programs, and staffing, the ability to manage components of the organization effectively diminishes as the span of control increases for senior and middle management.

FIGURE 10: Proposed Future Organizational Chart



It is recommended that as the Frisco Fire Department grows with additional stations and staff, middle management should be added to ensure effective leadership, management of programs, and communication within the larger, more complex organization. The future organization depicted in Figure 10 adds a second operational battalion chief to reduce the span of control as stations and operational staff is added. A battalion chief is also added in Support Services to manage day-to-day operations of critical logistical and support programs. Further, the fire marshal and associated programs are reorganized. **The ICMA team recommends that the fire marshal's office report directly to the fire chief.**

Logistical support is another area that will have an impact on staff as the organization grows. Supply chain management must be managed from a central supply facility by a logistics manager to

effectively receive and maintain resources and distribute them to various parts of the organization, as needed. This will require that sufficient physical space is set aside for equipment and supplies to be received, inventoried, and stored. Figure 10 identifies this as a subordinate position and function under the assistant chief of Support Services.

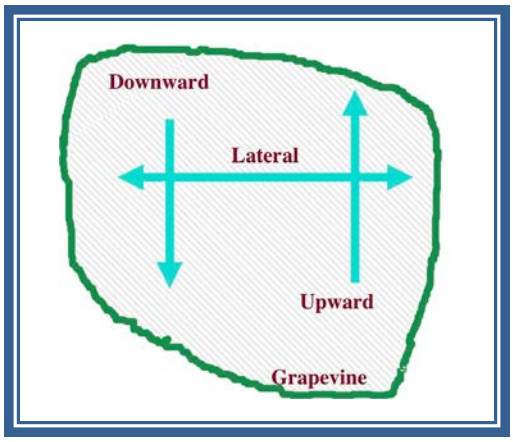
Recommendations:

- Develop a functional table of organizational chart to accompany the formal department organizational chart.

- Implement the proposed organizational chart (in Figure 9) *now* and the proposed future organizational chart (in Figure 10) over the next three to five years as the organization expands.

Organizational Communication

Communications in any organization is critical to its success, particularly an organization, such as a fire department, in which one or more work facilities are decentralized from corporate headquarters. The shift work schedule of rotating 24-hour shifts complicates communication. The inherent communication challenges and breakdowns throughout an organization that is decentralized, both vertically and laterally, often result in miscommunication. (See figure at left.) The lack of formal communication channels can feed communication through the "grapevine," in which most employees get their information from informal sources. These types of organizations become fodder for the rumor mill.

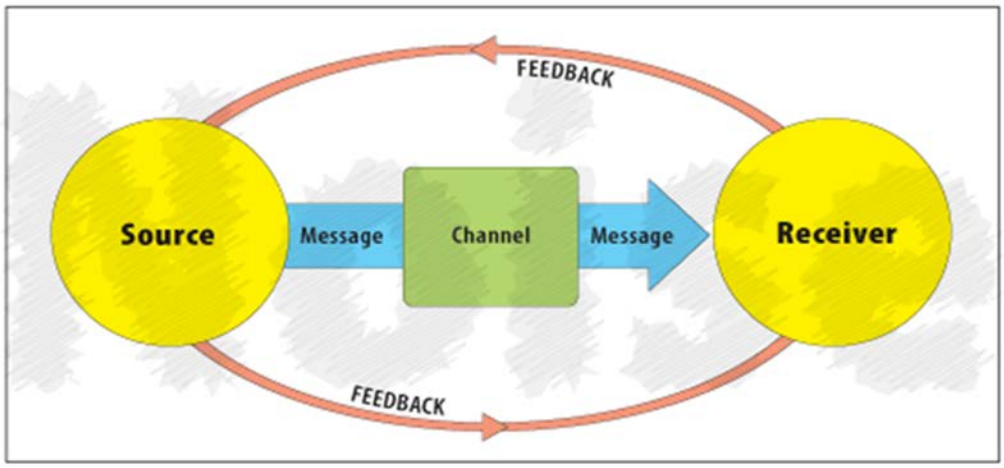


Despite the tremendous advances in communication and information technology, communication among people in organizations leaves much to be desired.[9] The importance of effective communication, established communication processes, and ongoing follow-up cannot be overstated. Developing a communication model that provides a consistent means for communication within and among various levels of the organization, and encourages feedback that can be integrated into continuous improvement supports a healthy organizational culture.

Figure 11 represents a basic communication model that, if followed, enhances communication across any organization. Having a "channel" by which information flows is key to ensuring effective ongoing communication, written and oral. The vertical flow of information between the fire chief, top management, mid-level managers, and frontline staff impacts the lateral communication that takes place. A lack of communication and direction, or disconnect at the channeling stage creates morale issues, promotes inconsistencies, and fuels grapevine communication and informal leadership.

[9] See James L. Gibson, John M. Ivancevich, James H. Donnelly, and Robert Konopaske, *Organizations: Behavior, Structure, Processes (8th ed.)* (New York: Irwin/McGraw-Hill, 2002).

FIGURE 11: Basic Communication Model

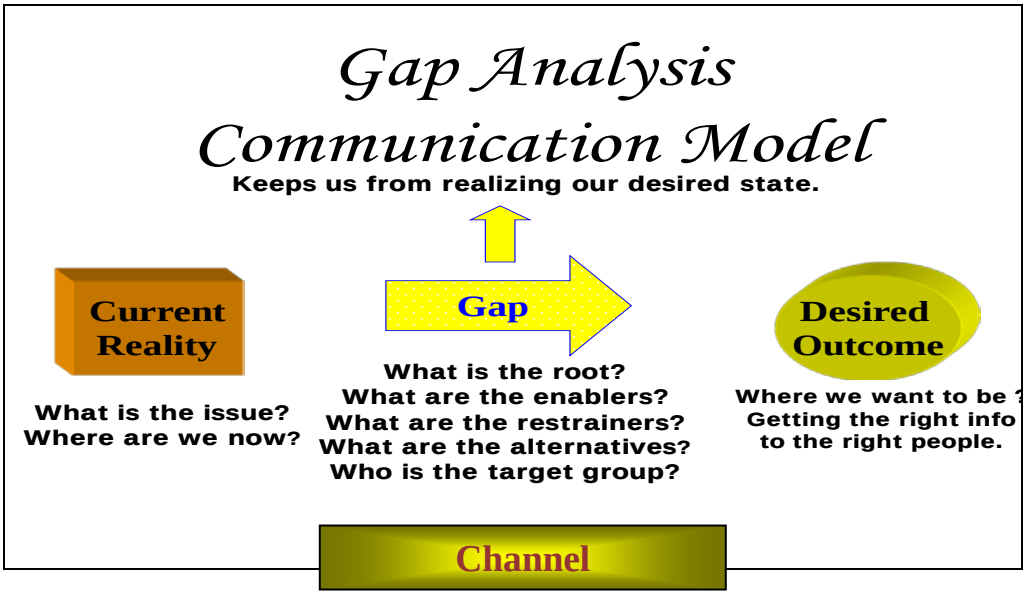


From Sanctioning Agent Communication Consultancy, "Communication Model," http://www.sanctioningagent.com/about/what.htm

Information gathered during ICMA's interviews with staff and field personnel suggests that the aforementioned communication issues currently exist or are perceived to exist in the FFD organization. Recommendations related to this issue are included in this report.

Figure 12 depicts a communication model that identifies communication gap issues, and forces the sender or receiver to bridge this gap through processing the communication disconnect at the "channel" by performing a simple gap analysis.

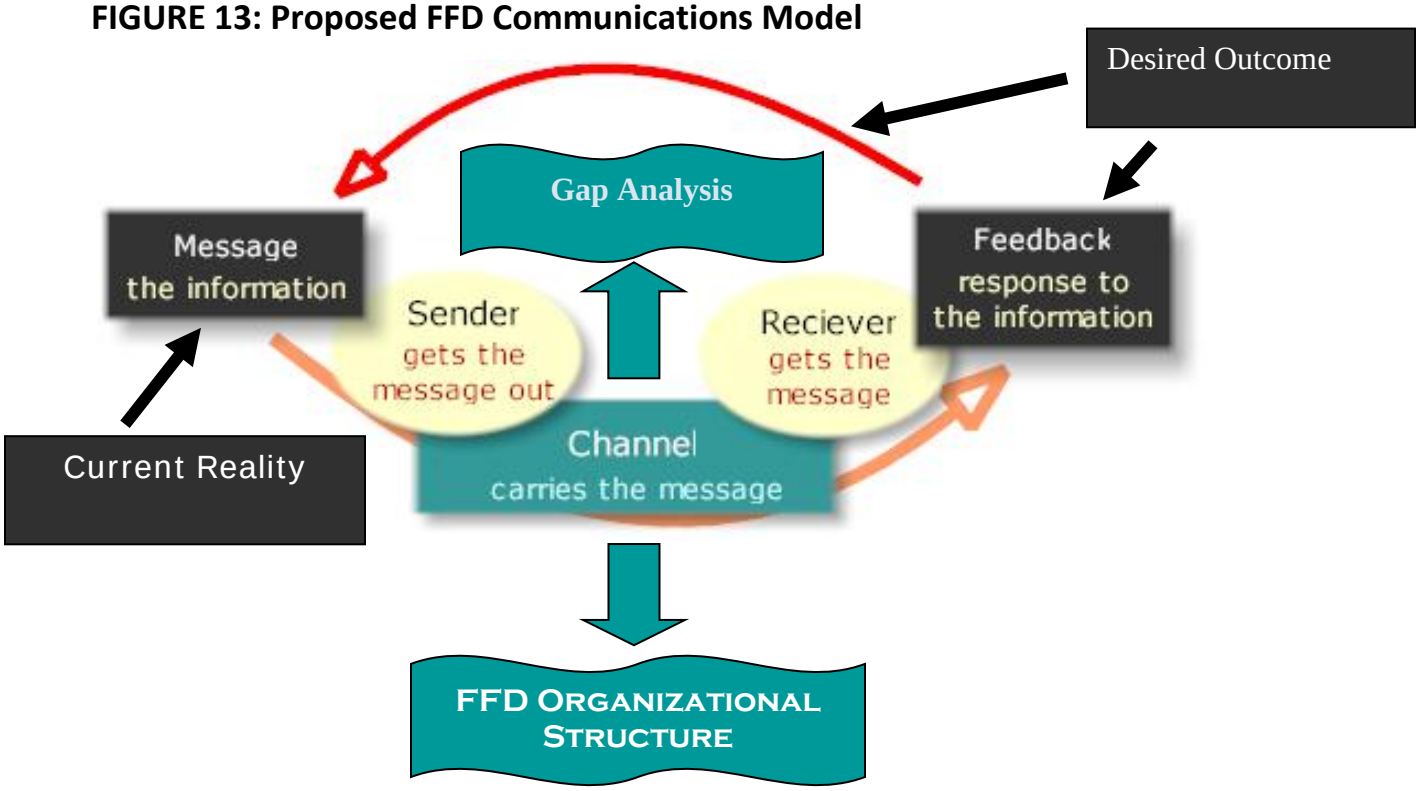
FIGURE 12: Gap Analysis Communication Model



From Joseph Pozzo, Loudoun County Fire, Rescue and Emergency Management Strategic Plan, 2005.

Figure 13 ties both the Basic Communications model together with the Gap Analysis Communications model, and creates a model the FFD should strive to adopt and implement. During the on-site visit by ICMA staff, both formal and informal discussions with staff and operational organizational members led us to the conclusion that there are real and perceived organizational issues that stem largely from communication disconnects. The FFD managers and leaders must strive to become better communicators, they must first improve their messages, and then they must seek to understand the messages coming from those they manage and lead, thus encouraging feedback and following-up on that feedback.

FIGURE 13: Proposed FFD Communications Model



From Joseph Pozzo, Loudoun County Fire, Rescue and Emergency Management Strategic Plan (Loudon County, VA: 2005).

Recommendation:

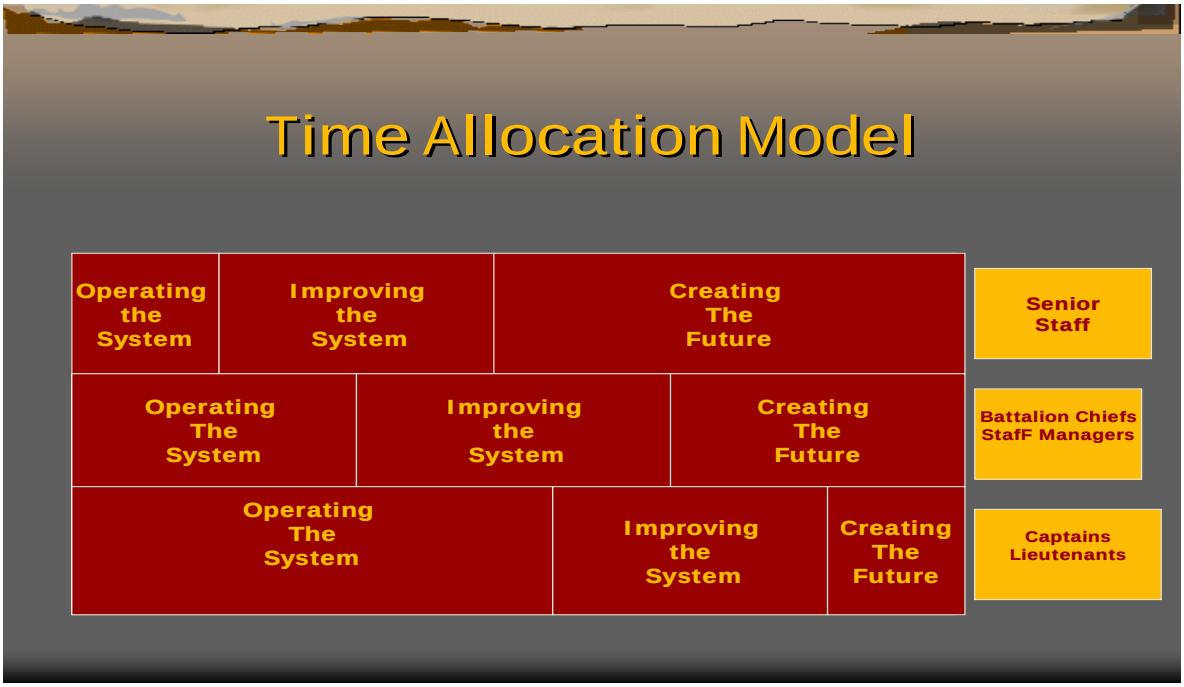
- Develop and implement a communication model that establishes and ensures an effective conduit of clear and productive communication throughout the entire organization.

Time Allocation

To effectively operate in an organization, an organizational member must understand his or her role and where he or she should allocate time to be most effective. There are three segments of organizational time allocation that allows individuals to achieve goals and objectives and, more important, enable the organization to fulfill its mission and realize its vision. These three areas focus on (1) operating the system; (2) improving the system; and (3) creating the future.

Figure 14 illustrates by officer rank how the FFD staff should allocate officers' time each day based on these three segments.

FIGURE 14: Time Allocation Model



From Virginia Beach, VA, "Guide to the Virginia Beach Quality Service System," 1997.

Employees at all levels of the organization—from the fire chief to frontline staff—need to maintain a balance between each time allocation component according to their level of responsibility. Managers and firefighters have a responsibility to understand their organizational roles and responsibilities, and to perform the tasks related to these roles and responsibilities. One would not expect senior-level officers to spend as much time operating the system as a frontline service provider does. Conversely, one would not expect a mid-level officer—a captain or lieutenant—to spend as much time as a senior-level officer planning for the future of the organization. In this way, each level of the organization has a different set of priorities and employees at each level should allocate their time accordingly.

In interviews with the ICMA team, FFD staff indicated that senior and middle management–level staff micromanages operations at the station level and on emergency scenes. This has contributed to some morale issues at the company officer level. For example, the ICMA team observed the entire senior staff engaged in a technical rescue incident, some were in positions that may be better served by lower-ranking officers or firefighters. This contributes to the perception among some company-level staff that management does not trust them to do their jobs. Moreover, this may direct the focus of mid-managers away from other important managerial and leadership responsibilities. This elevates the need for *all* officers to understand and engage a Time Allocation Model like the one in Figure 14.

Recommendation

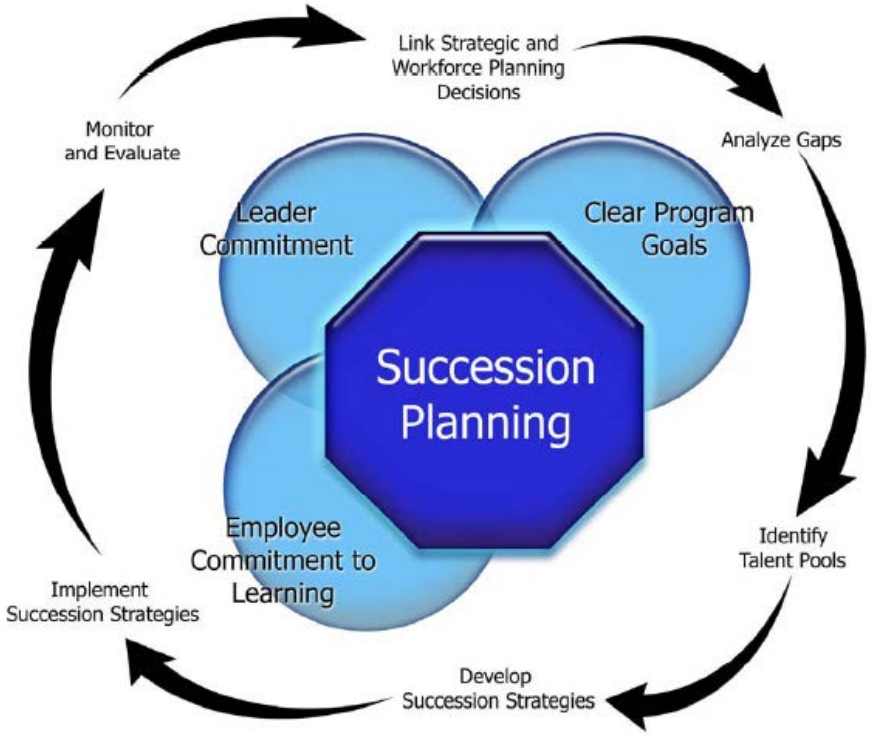
- Adopt a time allocation model; implement and monitor time allocation to ensure effective use of officer and staff time as it relates to achieving the organizational mission.

Succession Planning

The analysis of the FFD did not identify a clear organizational succession plan, career path training model, or expectations that help to prepare middle and senior managers for advancement in the organization. Succession planning is a systematic approach to developing potential successors to ensure organizational leadership stability. Successful succession planning identifies, develops, and nurtures potential future leaders. It is critical for the long-term success of any organization that such a process occurs.

Critical to the success of succession planning is the engagement and commitment of the senior leaders to the program, as well as a commitment of other members of the organization to their own personal and professional development. To be a part of the succession plan, one must commit to one's own professional development process to be able to compete for and fill critical organizational leadership roles. Recommendations are discussed later in this report regarding formal and technical education regimens and opportunities for this self/organizational development process. Figure 15 illustrates an example of a six-step succession planning model presented by the U.S. Office of Personnel Management.

FIGURE 15: Six-Step Succession Planning Model



From United States Office of Personnel Management, HCAAF Systems, 2005.

Recommendation:

- Develop and implement a succession planning process that identifies and develops future leaders.

Assessment and Planning

Deciding how many emergency response resources to deploy and where to deploy them is not an exact science. The final decision on a deployment model is based on a combination of risk analysis, professional judgment, and the city of Frisco's willingness to accept more or less public safety risk based on available revenues. Accepting more risk generally means that fewer resources are deployed, but deploying more resources cannot guarantee that loss will be less, especially in the short term. In any case, matching available revenues to expenditures generally is the greatest driver for deploying fire and EMS resources.

To justify funding for various deployment strategies it is essential that fire department management conduct a needs assessment and community risk analysis within the community. This process will help determine the necessary resources and assets needed to accomplish the department's core mission functions. Additionally, an all-hazards agency such as the FFD must plan for and deploy resources that are available to mitigate emergencies beyond the capacity of a traditional fire and EMS department.

Figure 16 illustrates the components of a comprehensive needs assessment; Figure 17 illustrates a risk assessment model that focuses on the identification of hazards and the potential impact reduction through mitigation.

FIGURE 16: Comprehensive Needs Assessment

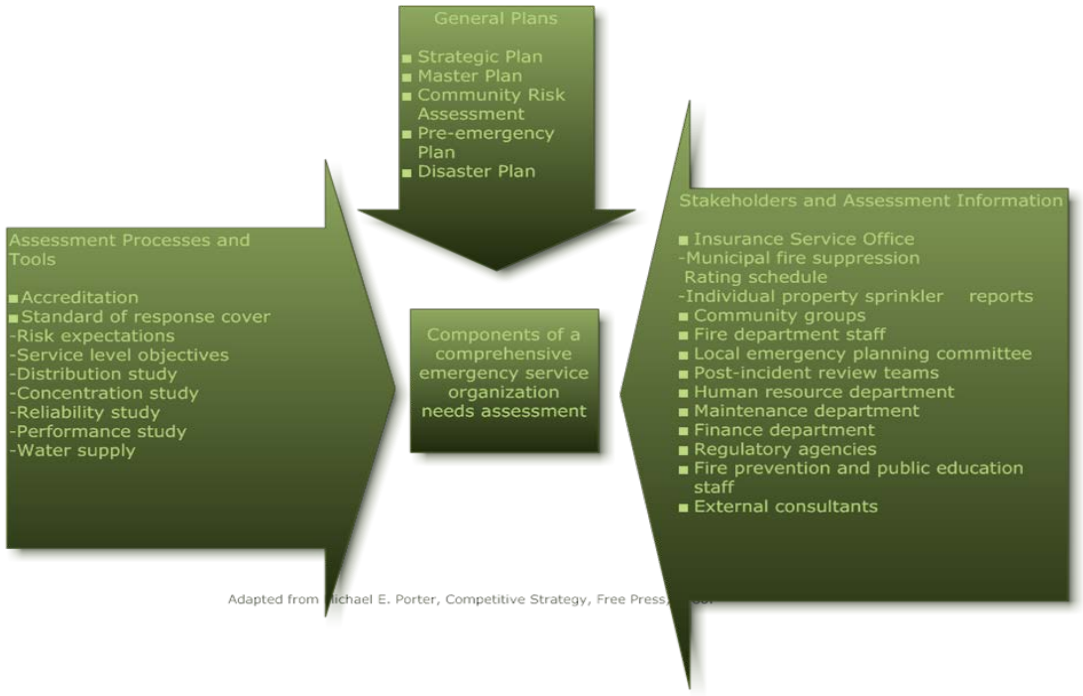
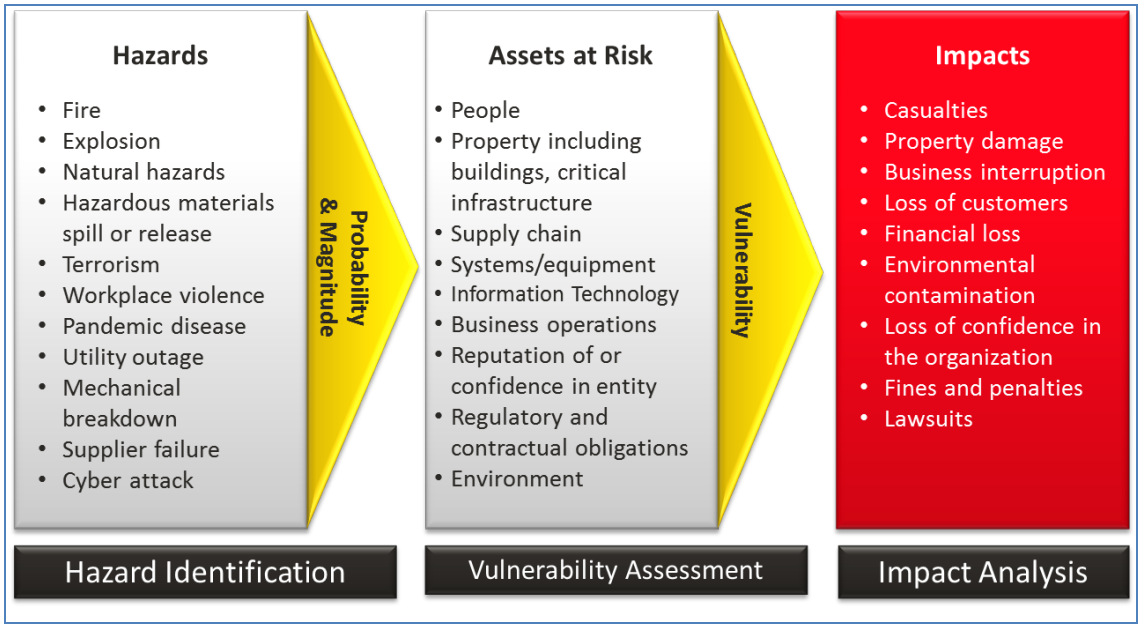


FIGURE 17: Risk Assessment Model



The FFD currently deploys resources based on factors such as internal response time data, community development and growth patterns, the NFPA 1710 standard, building type in a response district, and neighborhood density—all of which are best practices. Additionally, apparatus is deployed based on potential citywide and district needs to ensure that the equipment coverage (engines, ladders, and ambulances) is best suited to the current model and available funding. The current practices implemented to deploy staffing and equipment is sound and well thought out by senior staff, but the model can be enhanced by completing both a comprehensive needs assessment and all-hazards risk assessment.

An available tool that involves a comprehensive assessment of a fire department is the accreditation program managed by the Commission on Fire Accreditation International (CFAI) Center for Public Safety Excellence (CPSE). This program provides an analytical self-assessment process to evaluate ten categories of the agency's performance. During this process, the department examines more than 240 separate performance indicators, 98 of which are considered core or required competencies.

Included within the ten accreditation categories is an expectation for the fire department to analyze itself by planning zones, to identify the hazards posed within each planning zone, to rank hazards by potential severity, and to ensure that the appropriate resources are available to manage the hazards.[10]

Currently the FFD is participating in the initial step of this program and is considered a registered agency with the CFAI. Any agency seeking accreditation may become a registered agency. This status allows a department to be involved with the accreditation process at a low cost for three

[10] CPSE, "CFAI Accreditation Process," http://www.publicsafetyexcellence.org/agency-accreditation/the-process.aspx.

years and allows the agency the benefit of CFAI information, guidance, and training.[11] If the FFD continues through the remaining three steps of the accreditation process, the self-assessment materials and processes will allow the department the benefit of a comprehensive self-assessment that potentially will improve overall organizational performance.

Recommendations:

- Complete a comprehensive needs assessment to identify department weaknesses and community needs; incorporate an all-hazards risk assessment; develop and implement those planning documents the department lacks to ensure the core mission is achievable.

- Continue in the CFAI accreditation program and conduct a self-assessment under the CFAI guidelines as a means toward overall organizational improvement.

- Appoint an accreditation manager whose primary function is to manage the accreditation process until the Frisco Fire Department is fully accredited.

Strategic Planning

Strategic planning is a disciplined effort with a goal of producing fundamental decisions and actions that shape and guide what an organization is, what it does, and why it does it.[12] This process helps to ensure that an adequate level of resources, including staffing and equipment, are allocated as efficiently as possible to meet the community's needs for the services delivered by the fire department.

Defining clear goals and objectives for any organization through a formal strategic planning document establishes a resource that any member of the organization, or those external to the organization can view and determine in what direction the organization is heading, and as well how the organization is planning to get there. Ultimately the strategic plan defines the systems thinking the organization is conducting to serve its core mission.

In a strategic plan, it is essential that clear and achievable goals and objectives for each program area are developed. Each program area must then (1) define its goals, (2) translate the goals into measurable indicators of goal achievement, (3) collect data on the indicators for those who have utilized the program, and (4) compare the data on program participants and controls in terms of goal criteria.[13] Objectives should be SMART: **s**pecific, **m**easurable, **a**mbitious/**a**ttainable, **r**ealistic, and **t**ime-bound.

The FFD does not have an identifiable, comprehensive strategic plan. The FFD does have a compilation of goals and objectives contained in documents provided to the ICMA analysis team. However, it was noted during this analysis that the current goals and objectives could be improved, particularly in the areas of EMS, training and education, emergency management, capital equipment and infrastructure, human resources, special operations, and administration. Further, it

[11] CPSE, "CFAI Accreditation Process."
[12] John M. Bryson, *Creating and Implementing Your Strategic Plan: A Workbook for Public and Nonprofit Organizations, 2nd edition* (Jossey-Bass, 2004), 3.
[13] Grover Starling, *Managing the Public Sector, 8th edition* (New York: Thomson/Wadsworth, 2008), p. 287.

is critical to the overall achievement of improving service delivery and accountability to the local government and to the citizenry, that all aspects of department operations be examined on a continual basis. One method to accomplish this is the review of established goals and objectives through the development and implementation of a strategic plan.

Recommendations:

- Develop and implement a comprehensive strategic plan.
- Incorporate improved goals and objectives into strategic and comprehensive planning documents, as well as the annual budget and long-range fiscal documents.

Community Risk Assessment

The cost of providing fire protection and EMS to a community continues to escalate; therefore, the need to examine the planning processes involved in providing services is paramount. Each jurisdiction decides what degree of risk is acceptable in that jurisdiction; the determination is based on criteria that has been developed to define the levels of risk (e.g., of fire) within all sections of the community.[14] 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*, first developed in the United Kingdom, refers to a planning methodology that recognizes that citizen safety, plus the protection of property and 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.[15] As a best practice, the FFD does an excellent job targeting and analyzing hazards and making this information available for planning purposes, as well as for responding operational personnel, through its SAFER program. A completion of a comprehensive risk analysis would build on and improve what is currently in place.

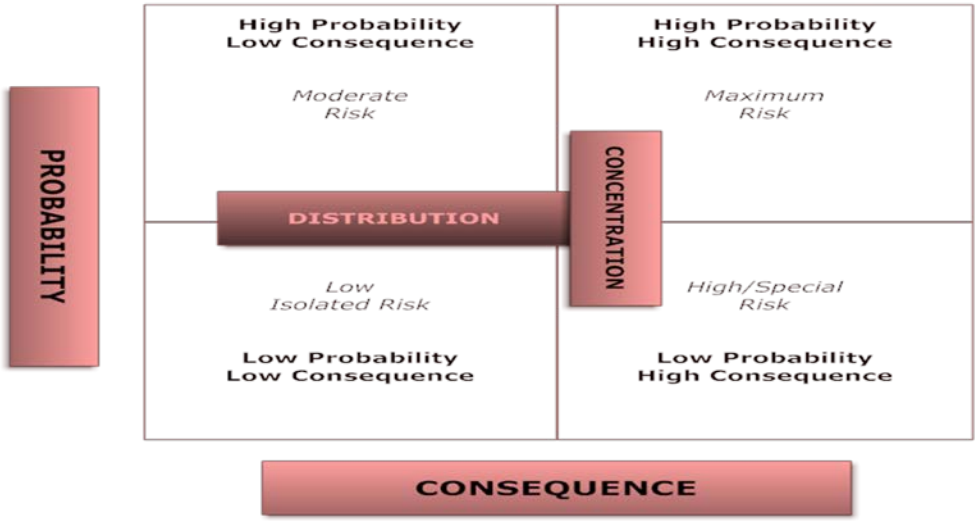
What's involved in a fire risk analysis? A fire department collects and organizes risk evaluation information about individual properties and on the basis of the rated factors can derive a "fire risk score" for each property. The score is then used to categorize the property as one of low, moderate, or high/maximum risk. To assist in this endeavor, there are retail products currently available that rate the property based on information inputs.

As the rated properties are plotted on a map, fire station locations and staffing patterns can be considered to provide a higher concentration of resources for worst-case scenarios or, conversely, a lower concentration of resources based on the risk.[16]

[14] Compton and Granito, *Managing Fire and Rescue Services*, 39.
[15] National Fire Protection Association, *Fire Protection Handbook* (2008 Edition), 12-3.
[16] *Fire and Emergency Service Self-Assessment Manual, 8th edition*, (Center for Public Safety Excellence, 2009), 49.

Figure 18 presents the two main considerations of a risk assessment: the probability of an event occurring and the consequence of that event occurring. The matrix in Figure 18 divides the risk assessment into four quadrants. Each quadrant of the chart creates different requirements in the community for commitment of resources.

FIGURE 18: Probability and Consequence Matrix



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

In addition to examining risks faced by the community at large, the department needs to examine internal risks in an effort to protect all assets, including personnel, resources, and property. This concept is not new to the fire service and can be an excellent tool for strengthening existing health and safety guidelines. The National Fire Protection Association's *Standard for a Fire Department Occupational Safety and Health Program* (NFPA 1500) requires the development of a separate risk management plan for fire departments; that is, separate from those incorporated in a local government plan.[17] **The FFD does not have a written internal risk management program in place at this time.**

A fire department risk management plan is developed and implemented to comply with the requirements of *NFPA 1500*. In order for this process to be effective, the following components must be included in the risk management plan (Figure 19):

- **Risk identification:** Actual or potential hazards;
- **Risk evaluation:** The potential of occurrence of a given hazard and the severity of its consequences;

[17] Robert C. Barr and John M. Eversole, eds., *The Fire Chief's Handbook, 6th edition* (PennWell Books, 2003), 270.

- **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. [18]

FIGURE 19: Risk Management Plan Model

The risk management plan establishes a standard of safety for the daily operations of the department. This standard of safety establishes the parameters in which the department conducts activities during emergency and nonemergency operations. The intent is for all members to operate within this standard or plan of safety and not deviate from this process.

Recommendations:

- Conduct a community risk assessment and continually analyze/utilize the results in the planning of fire station locations, apparatus needs, and staffing requirements.
- Develop and implement an internal risk management plan following the standards of NFPA 1500, Standard for a Fire Department Occupational Safety and Health Program.

[18] NFPA 1500 (2007). Standard for a Fire Department Occupational Safety and Health Program, Annex D.

Performance Measurement

Organizational programs need to be planned and managed so they achieve specific, agreed-upon results. This requires establishing a set of goals regarding the activities of any given program and the intended results. Determining how well an organization or program is doing requires measurable goals that are routinely 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 to help communicate to service providers, customers, and other stakeholders how well the agency is performing in key areas. Performance measurement provides organizations with tools to assess performance and identify areas in need of improvement. Simply put, what gets measured gets done.

The need to continually assess performance requires the addition of 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, sex, ethnicity, age, and so forth?
- **Political feasibility:** Will the program attract and maintain key actors with a stake in the program area?[19]

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. Five areas of performance measures are shown in Table 1.

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 in the community, for instance. One of the goals of any performance measurement system should be to include efficiency and cost-effectiveness indicators, as well as explanatory information that impacts how these measures should be interpreted.

[19] Starling, *Managing the Public Sector,* 396.

TABLE 1: The Five GASB Performance Indicators

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.
From Harry P. Hatry, et al., eds. *Service Efforts and Accomplishments Reporting: Its Time Has Come* (Norwalk, CT: GASB, 1990).	

One of the most important elements of performance measurement within the fire service is to describe service delivery performance so 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.

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.[20]

The Frisco Fire Department measures some aspects of performance. It collects typical fire department data on response times, number of inspections, arson investigations, and response to structure fires and EMS calls by type. These reflect typical workload measures used in fire service organizations, but the measures need to link department goals to specific target rates or percentages if they are to be used to justify program budgets and service delivery levels. To accomplish this, other forms of measures, particularly service quality and customer satisfaction measures, should be incorporated into the performance measurement system.

Of particular importance is engaging staff at various levels of the organization in developing performance measures. In addition to aiding department wide buy-in, this could provide an opportunity for upper management to better understand what the line staff believe to be critical

[20] I. David Daniels, "Leading and Managing," in *Managing Fire and Emergency Services* (Washington, DC: ICMA, 2012), 202.

goals—and vice versa. To facilitate this type of communication communitywide, the process of developing performance measures also should include citizen input.

Establishing a performance measurement system for the fire department could assist Frisco's elected officials by providing a better understanding of what the department is trying to achieve. One example is the goal of responding to an emergency call within a specified time. An effective measure for this goal would be the percentage of time an engine company arrives within this time period, and is benchmarked against locally established response times in a *Standard of Coverage* document or national best practices promulgated by the NFPA. This would help those within and beyond the department know how well it is achieving this goal. Another example of a qualitative goal statement might be to "control fire spread upon arrival."

Recommendations:

- Develop and implement a performance measurement reporting system that includes measures of quality and customer satisfaction.

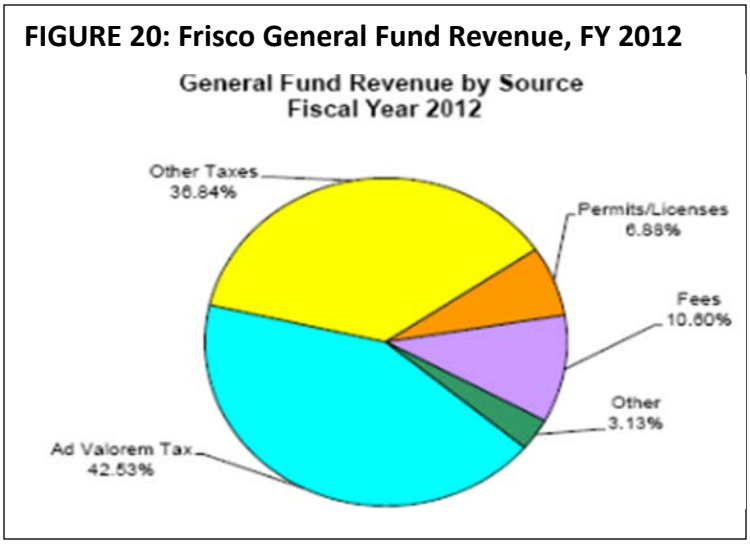
- Develop performance measures for each agency activity, and implement a performance measurement system to be included in strategic and comprehensive planning documents and fiscal/budget documents.

Funding

Funding local government functions and programs requires an appropriate balance of needs, requests, future growth, and community vitality versus available annual or borrowed funding resources.

The FFD is funded through the city's operating or general fund budget. As shown in Figure 20, the greatest percentage of the revenue in this fund comes from ad valorem taxes. (In fiscal year (FY) 2012, these taxes accounted for 42.5 percent of Frisco's total revenues.) The FFD also generates revenue through ambulance transport fees, fire fees, fire permits, and other sources; this revenue is transferred into the general fund.

FIGURE 20: Frisco General Fund Revenue, FY 2012



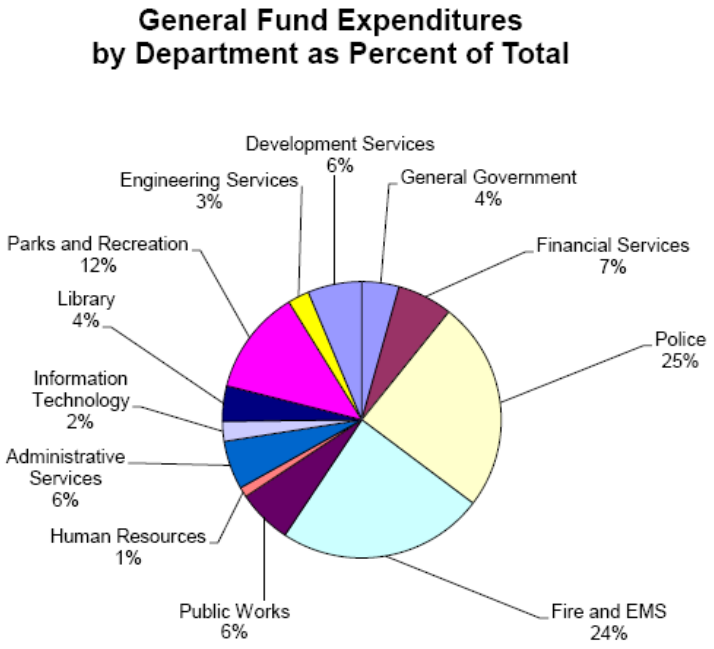
The FFD's FY 2012 budget is $20,032,192, which represents approximately 24 percent of the city's overall $83.42 million general fund budget. The FFD budget for FY 2012 is 10.11 percent greater than FY 2011 budget due primarily to the addition of twenty-one additional personnel to staff Station 7, which opened in June 2012. (Construction costs for the Station 7 project were funded through the sale of general obligation bonds.)

Overall, the FFD budget has increased by 27 percent since FY 2008, as shown in Table 2. Figure 21 illustrates FY 2012 general fund expenditures by city department.

TABLE 2: FFD Budget, Fiscal Years 2008–2012

Actual FY 2008	Actual FY 2009	Actual FY 2010	Revised FY 2011	Proposed FY 2012
$15,811,801	$15,986,516	$16,967,594	$18,193,705	$20,032,192

FIGURE 21: Frisco General Fund Expenditures



The FFD budget is comprised of administration; fire suppression; and emergency medical services. Tables 3, 4, and 5 show the budgeted expenditures for each cost center and compare each with previous fiscal years.

TABLE 3: FFD Administration Expenditure Comparison

	2009–10 Actual	2010–11 Revised	2011–12 Proposed
Personnel	$793,099	$853,784	$909,902
Operations	$58,896	$38,016	$49,327
Capital	—	—	—
Total	$851,995	$891,800	$959,229

TABLE 4: FFD Fire Suppression Expenditure Comparison

	2009–10 Actual	2010–11 Revised	2011–12 Proposed
Personnel	$14,308,701	$14,636,104	$16,331,533
Operations	$1,258,712	$1,603,516	$2,075,181
Capital	$13,185	$98,500	$146,091
Total	$15,580,598	$16,338,120	$18,552,805

TABLE 5: EMS Expenditure Comparison

	2009–10 Actual	2010–11 Revised	2011–12 Proposed
Personnel	$137,814	$100,652	—
Operations	$397,187	$577,953	$520,158
Capital	—	$285,180	—
Total	$535,001	$963,785	$520,158

The community, city council, and city administration understand and support the FFD through appropriate and available funding to provide fire and EMS services that match current risks, demands, and programs, and that sustain the current ISO 1 rating.

Recommendation:

- Consider ICMA recommendations germane to this operational analysis report that require additional funding, and implement as funding allows.

Fixed 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 twenty-four hours a day.[21] The FFD currently operates out of seven permanent fire stations; one of these (Central Fire Headquarters) also serves the administrative offices, the emergency operations center, and is the home of Safety Town. Additionally, the former fire headquarters now serves as the fire apparatus facility in which routine vehicle repairs and maintenance occur. The FFD also operates a fixed training building. This building has no classroom space and is utilized for simulated fire evolutions.

The fire station facilities range in age from four to fourteen years, with the fleet maintenance facility the oldest at twenty-five years. The fire station facilities, including the fleet repair facility, have an estimated life of twenty-two years.[22]

[21] Compton and Granito, *Managing Fire and Rescue Services,* 219.
[22] Frisco Fire Department, 2012 fixed asset list.

The FFD has a three-year capital projections plan that outlines future capital replacement and new facility construction. Included in the facility portion of this plan is renovation of the fire apparatus repair facility, which is currently planned for FY 2013-14 and requires funding approval. The estimated cost is $2 million. There are two additional projects scheduled in the three-year capital projections plan: (1) Phase 1 of the FFD fire training center is scheduled for FY 2013-14 with an estimated cost of $4 million; and (2) a new fire station (Station 8) is scheduled for FY 2012-13 with an estimated cost of $5.6 million.

When constructing or renovating fire facilities, there are a number of best practices a fire department can review to ensure that nuances germane to both fire and EMS service delivery can be appropriately managed. These include:

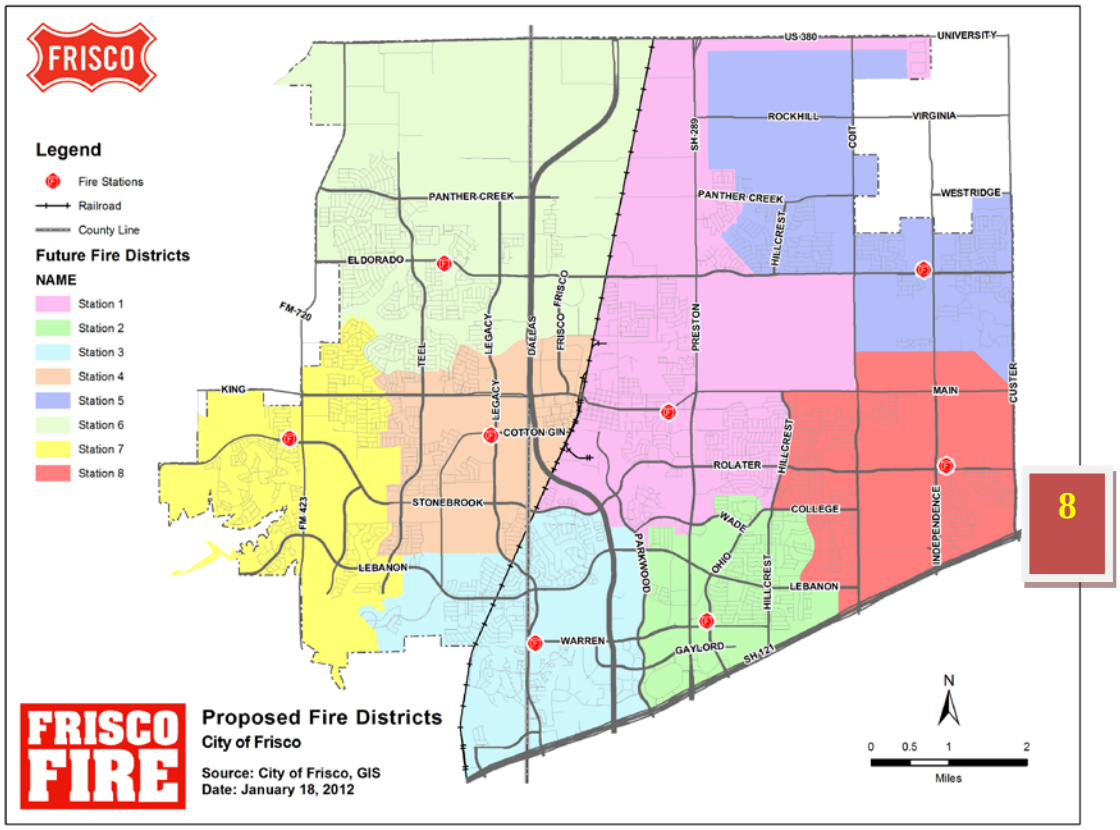
- **NFPA 1402:** Guide to Building Fire Service Training Centers;
- **NFPA 1581:** Standard on Fire Department Infection Control Program;
- **NFPA 1500:** Standard on Fire Department Occupational Health and Safety Program; and
- **Texas OSHA:** Applicable OSHA health and safety facility requirements.

The FFD maintains an up-to-date fixed asset list that includes the fixed facilities and associated outbuildings and appurtenances. This fixed asset list includes both the build/procurement date as well as the expected life of the asset. This information will assist the FFD with future capital facility replacement planning.

As noted, included in the three-year capital projections plan is a new fire station. Station 8 will serve a current population of 14,000 residents and accommodate the future residential and commercial growth in the southeast portion of Frisco. Figure 22 illustrates the proposed response area for Fire Station 8 and adjusted adjacent response areas.

The day-to-day cost of operating a fixed capital facility can be burdensome to an agency operating budget. The total FY 2012 cost for facility maintenance and utilities for the eight current buildings is $358,000 and averages $4.28 per square foot. It is critical to the longevity of a fixed facility that mechanical and structural components be maintained. Deferring routine maintenance creates inefficiencies of mechanical systems and increases costs for replacement and repairs.

FIGURE 22: Fire Station 8 Projected Location/Response District



Recommendations:

- As funding allows, consider and implement for the construction of new and the renovation of current facilities, the components of NFPA 1402, NFPA 1581, NFPA 1500, and Texas OSHA facility requirements.

- Structure a facility preventive maintenance program designed to maintain efficiencies of systems and longevity of equipment in order to reduce overall building maintenance costs. The facility preventive maintenance program should include all facility components.

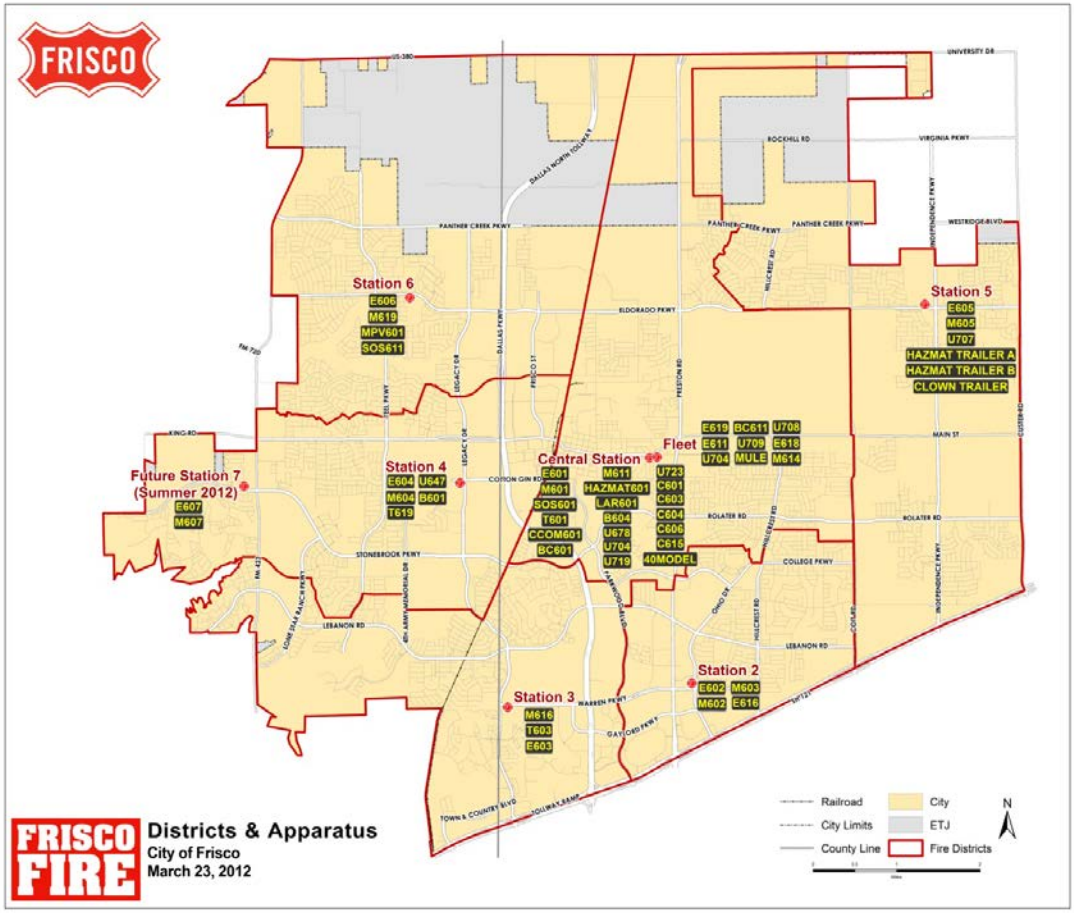
Capital Equipment

The FFD operates an array of capital equipment that includes heavy fire apparatus, light utility and command vehicles, ambulances, trailers, computers, communications equipment, lifesaving equipment, and firefighting and technical rescue equipment. The acquired cost of this equipment totals more than $18 million. The FFD keeps and inventory of each piece of capital equipment with its procurement date, original cost, current book value, and replacement cost. When reviewing the replacement cost of each piece of capital equipment on the current inventory document, it is noted the replacement cost is identical to the original cost, regardless of age. The replacement cost should project a realistic and anticipated increase in cost; this will assist in future fiscal planning.

The FFD operates four frontline engine companies, three frontline quints (combination engine/ladder apparatus), two frontline ladder apparatus, five frontline ambulances, and one each Haz Mat apparatus, heavy squad apparatus, and communications apparatus. In addition to this cache of heavy fire apparatus, the FFD maintains the requisite number of reserve apparatus and ambulances to maintain its ISO 1 rating. Figure 23 illustrates the location of this apparatus.

The FFD projects replacement of fire apparatus at eight years. The three-year (FY 2012–16) capital replacement plan projects the replacement of eight frontline apparatus, with the evaluation of two additional apparatus in the out-years of this plan. The plan additionally calls for heavy fire apparatus, an ambulance, and a command vehicle for the new Station 8. Not included in this plan is the replacement of other capital equipment, such as EMS lifesaving equipment and firefighting, communications, and technical rescue equipment.

FIGURE 23: FFD Apparatus Locations



Recommendation:

- Develop and implement a ten-year capital replacement program with target replacement years and projected cost for all capital equipment.

Programs

Six distinct programs, each of which is integral to the mission and operations of the Frisco Fire Department, are discussed below: (1) fire suppression; (2) prevention and safety; (3) public education; (4) fire investigation/arson; (5) emergency medical services (EMS); and (6) emergency management.

Fire Suppression

As previously noted, the FFD provides fire suppression from seven station locations, with an eighth planned in the next two to three years. From the six stations included in this analysis (station 7 only recently opened), the FFD responded to 2,594 fire incidents, or 33 percent of the 7,871 overall incidents responded to by the FFD. Table 6 breaks down by incident type the fire incident totals. Calls per day and call percentage are measured against the overall total number of calls.

TABLE 6: Fire Incident Totals, by Type

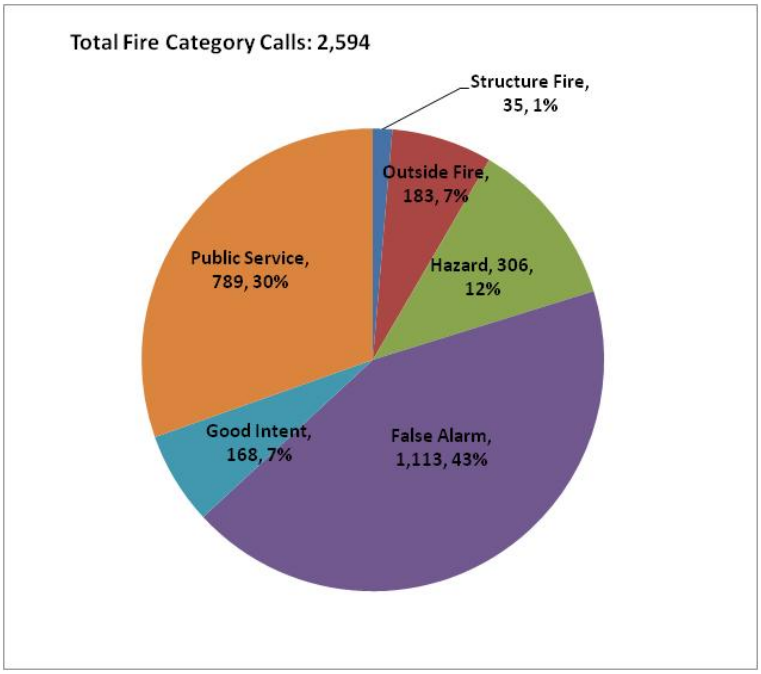
Call Type	Number of Calls	Calls per Day	Call Percentage
Structure fire	35	0.1	0.4
Outside fire	183	0.5	2.3
Hazard	306	0.8	3.9
False alarm	1,113	3.0	14.1
Good intent	168	0.5	2.1
Public service	789	2.2	10.0
Total fire category calls	**2,594**	**7.1**	**33.0**

Based on the table, the following observations can be made:

- Structure and outside fire calls combined were 218 calls for the analysis period, averaging 0.6 calls per day.
- False alarms (fire alarm system, malicious) and public service calls averaged 5.2 calls per day.
- Combined, fire category calls averaged 7.1 calls per day.

Figure 24 illustrates the percentage of various fire call types against the total number of fire incidents.

FIGURE 24: Fire Category Calls



Based on this figure, the following observations can be made:

- A total of 35 structure fire calls accounted for 1 percent of the fire category total.
- A total of 183 outside fire calls accounted for 7 percent of the fire category total.
- Forty-three percent of fire calls were false alarms.
- Twelve percent of the fire calls were hazardous condition calls.
- Seven percent of the fire calls were good intent calls.
- Thirty-two percent of the fire calls were public service calls.

An observation that bears separation from the above is false alarms (fire alarm system, malicious) and public service calls for service. These calls for service accounted for 75 percent of the total fire category calls, and create unnecessary response of one or multiple fire department resources, and require further study by the FFD with a goal of reducing these incidents.

Table 7 depicts by station (district) how the calls for service are dispersed across the city.

TABLE 7: Fire Category Calls by Station (District)

Call Type	District 1	District 2	District 3	District 4	District 5	District 7
Structure fire	13	5	6	4	3	4
Outside fire	44	26	38	32	11	32
Hazard	102	55	31	35	24	59
False alarm	187	222	227	139	162	175
Good intent	35	32	34	21	22	24
Public service	182	136	141	130	65	133
Total fire category calls	**563**	**476**	**477**	**361**	**287**	**427**

The data on this table lead to the following observations:

- District 1 had the highest number of calls for service while District 5 had the lowest number.
- Districts 2 and 3 had the highest number of false alarms.
- District 1 had the highest number of public service calls for service.
- District 1 had the highest number of structure and outside fire calls, but these calls accounted for only 14 percent of that district's overall fire category calls for service.

Recommendation:

- Identify occupancy and false alarm type calls for trends and frequency and implement appropriate measures to mitigate alarm issues with a focus on reduction of responses. Ensure compliance with Chapter 6 of the Frisco Code of Ordinances.

Fire Category Unit Deployment Time

The time a unit is deployed on a single call—in other words, is busy on a call for service—indicates the workload of that particular unit or station. This can be measured as productive emergency response time over a shift period. In the case of the FFD, the shift is twenty-four hours. An analysis of the FFD response data shows that a total of 2,282 of fire category calls (88 percent) lasted less than one hour. Only 287 fire category calls (11 percent) lasted between one and two hours while 25 fire category calls (1 percent) lasted more than two hours. On average, there were only a total of 0.9 fire category calls per day that lasted more than one hour.

Additional analysis and observations regarding fire category calls for service include:

- Of the 35 structure fire calls, 15 (43 percent) lasted less than one hour, 11 (31 percent) lasted between one and two hours, and 9 (26 percent) lasted more than two hours.

- Of the 183 outside fire calls during the year, 127 (69 percent) lasted less than one hour, 51 (28 percent) lasted between one and two hours, and 5 (3 percent) lasted more than two hours.

- A total of 1,004 false alarm calls (90 percent) lasted less than one hour; 109 alarm calls (10 percent) lasted more than one hour.

- A total of 724 public service calls (92 percent) lasted less than one hour; 65 public service calls (8 percent) lasted more than one hour.

Table 8 depicts annual busy time for fire category calls by call type and district/station.

TABLE 8: Annual Deployed Hours, by Call Type and District

Call Type	District 1	District 2	District 3	District 4	District 5	District 6
Structure fire	81	16	15	29	3	17
Outside fire	81	26	38	32	24	32
Hazard	58	44	24	30	11	24
False alarm	62	87	81	49	54	52
Good intent	12	11	14	7	9	6
Public service	54	41	48	41	21	44
Total fire category calls	**348**	**225**	**220**	**187**	**121**	**175**

Based on the data in Table 8, the following observations can be made:

- Annual on duty hours for each district is 8760 (24/7 operation).

- Total deployed hours for the study period are 1276 (14.5% of the total annual hours).

- District 1 is deployed 348 hours, or 4% of the total annual time. This is the most time of any district.

- District 2 is deployed 225 hours, or 2.5% of the total annual time.

- District 3 is deployed 220 hours, or 2.5% of the total annual time.

- District 4 is deployed 187 hours, or 2.1% of the total annual time.

- District 5 is deployed 121 hours, or 1% of the total annual time. This is the least time of any district.

The FFD provides a monthly incident response report that includes Safety Town/Public Education activities, but there is no productivity report that accounts for all of the nonemergency productive time. This time should be better accounted for.

The FFD utilizes Firehouse reporting software and captures some nonemergency activities and programs. However, to accurately account for nonemergency time, and to provide an accounting of how resources are utilized in this nonemergency downtime, a monthly reporting system is essential. The system should provide an annual summary and should illustrate aggregately both emergency and nonemergency productivity.

Station-level nonemergency productive time that should be captured and reported include activities related to station and equipment maintenance, didactic and practical training, fire prevention inspections, hydrant inspections, pre-fire planning, physical fitness training, and target hazard inspections. The FFD utilizes best practices in a number of these areas, and should better document these activities and track the time devoted to them in order to maximize nonemergency time and focus it on mission-critical support tasks and programs.

Recommendation:

- Implement a documentation program that captures time spent on nonemergency tasks; report on nonemergency productivity monthly and annually.

Fire Category Calls Response Time

Dispatch time is the time interval that begins when the alarm is received at the communication center and ends when the response information begins to be transmitted via voice or electronic means to the emergency response facility or emergency response units in the field. *Turnout time* is the time interval that begins when the notification process to emergency response facilities and emergency response units begins by 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 the turn out and travel time segments of the total response time.** *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* (or total response time) is the time interval that begins when the call is received by the primary dispatch center (the Frisco Police Department communications center) and ends when the dispatched unit arrives on the scene to initiate action.

ICMA's definition of response time differs from that used by the Frisco Fire Department. Currently the FFD reports response time as turnout time plus travel time, and reports an average response time of 5.6 minutes for fire category calls during the data analysis period. Broken down in this section, ICMA reports an overall response time for fire category calls as 6.2 minutes. When using FFD's approach, however, fire category yields a very similar average fire category response time of 5.5 minutes.

According to NFPA 1710 (2010), Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Departments, where the primary public safety answering point is the communications center the alarm processing time or dispatch time should be less than or equal to 60 seconds 90 percent of the time.[23] This standard also states that the turnout time should be less than or equal to 80 seconds for fire and special operations 90 percent of the time, and travel time less than or equal

[23] NFPA 1710 (2010), Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Departments, 7.

to 240 seconds for the First-Arriving engine company 90 percent of the time. The standard further states the initial first alarm assignment should be assembled on scene in 480 seconds 90 percent of the time.

Table 9 and Figure 25 depict the FFD's average dispatch, turnout, travel, and total response times of First-Arriving fire units for fire category calls.

TABLE 9: Fire Category Calls: Average Dispatch, Turnout, Travel, and Response Times of First-Arriving Unit

Call Type	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size
Structure fire	0.9	1.0	4.6	6.5	35
Outside fire	0.8	0.8	4.7	6.3	181
Hazard	0.9	0.7	4.6	6.1	305
False alarm	0.6	0.7	4.7	6.1	1,047
Good intent	0.8	0.7	4.9	6.5	162
Public service	0.8	0.6	5.0	6.4	756
Total fire category calls	**0.7**	**0.7**	**4.8**	**6.2**	**2,486**

FIGURE 25: Fire Category Calls: Average Dispatch, Turnout, and Travel Times of First-Arriving Unit

A more conservative and stricter measure of total response time is the 90th percentile measurement. Simply explained, for 90 percent of calls, the first unit arrived within a specified time, and if measured, the second and third unit. Comparatively, "median," which means 50 percent of the time, has data that is perfectly normally distributed, will be the same as average.

Table 10 breaks down the 90th percentile for dispatch, turnout, travel, and response times for First-Arriving unit for fire category calls.

TABLE 10: 90th Percentile: Average Dispatch, Turnout, Travel, and Response Times of First-Arriving Unit: Fire Category Calls

Call Type	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size
Structure fire	1.6	1.9	7.0	9.1	35
Outside fire	1.2	1.1	7.1	8.8	181
Hazard	1.3	1.0	6.5	8.4	305
False alarm	1.0	1.1	7.2	8.7	1,047
Good intent	1.3	1.1	7.3	9.1	162
Public service	1.1	1.0	8.3	9.9	756
Total fire category calls	**1.1**	**1.1**	**7.4**	**9.0**	**2,486**

Observations for fire category calls include:

- The average dispatch time was 0.7 minutes.
- The average turnout time was 0.7 minutes.
- The average travel time was 4.8 minutes.
- The average response time for structure fire calls was 6.5 minutes.
- The average response time for outside fire calls was 6.3 minutes.
- The average total response time for fire category calls was 6.2 minutes.
- The 90th percentile dispatch time was 1.1 minutes.
- The 90th percentile turnout time was 1.1 minutes.
- The 90th percentile travel time for fire category calls was 7.4 minutes.
- The 90th percentile response time for structure fire calls was 9.1 minutes.
- The 90th percentile response time for outside fire calls was 8.8 minutes.
- The 90th percentile total response time for fire category calls was 9.0 minutes.

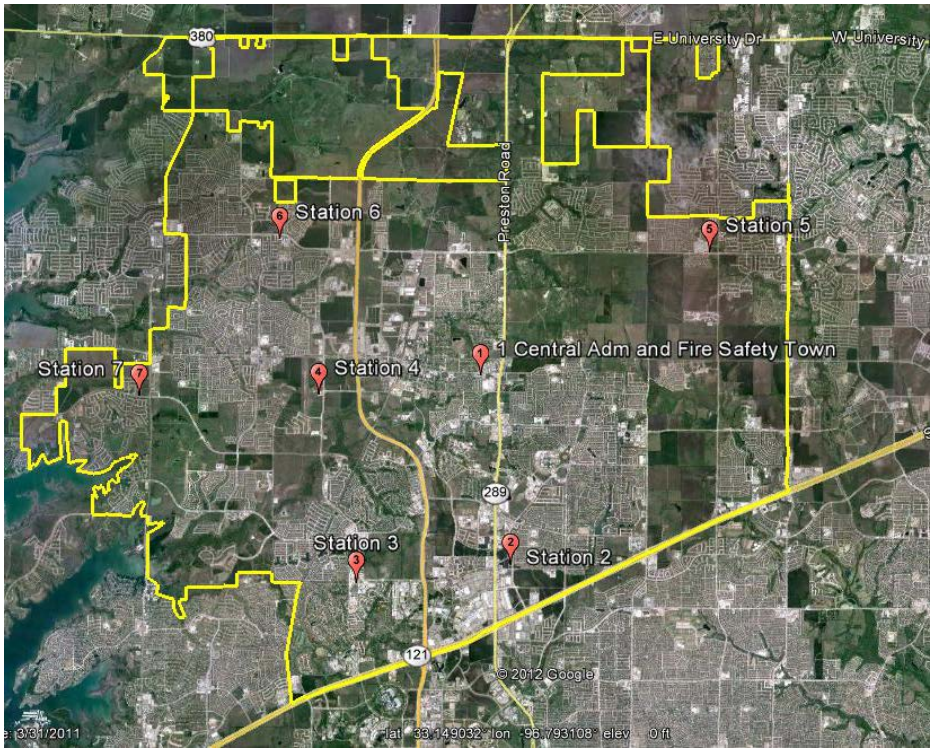
In the areas (turnout time, travel time) the FFD has the most control over, they are meeting or are just exceeding the NFPA 1710 benchmark.

The proper location of fire stations is critical to reducing emergency response time, which in turn is one of the key performance measures in determining the efficiency of fire department operations. The network of fire stations as a whole seeks to optimize coverage with short travel distances while giving special attention to natural and manmade barriers and routes that might interfere with rapid response.[24] Additionally, a community's fire risk analysis and the department's pre-incident planning process will contribute in determining the number and type of engine companies, ladder companies, specialty companies, EMS units, and command officers needed to adequately respond to a reported fire.[25]

The FFD has done an excellent job in identifying current and future fire station locations. As stated earlier, the FFD utilizes best practices such as response times, current and future community growth and development, current and future road networking, available land and staff experience to site fire stations. This is illustrated in the following five figures (27–31).

Figure 26 illustrates the current location of FFD stations.

FIGURE 26: FFD Fire Station Locations



[24] Ibid., 122.
[25] Compton and Granito, editors, *Managing Fire and Rescue Services*, 52.

As noted previously, Station 7 opened in early June 2012. The city of Frisco has planned additional stations based on growth and population projections. The FFD also takes into account response time and associated factors when planning future fire station locations. Station 8 for example, is planned for the southwest section of the city based on growth projections and response times. Other stations are forecasted for southeast, central, northeast, and northwest locations. Figures 27, 28, and 29 show 240-second, 360-second, and 480-second travel time bleeds by road network from each of the seven current stations.

FIGURE 27: 240-Second Travel Time from Current Stations

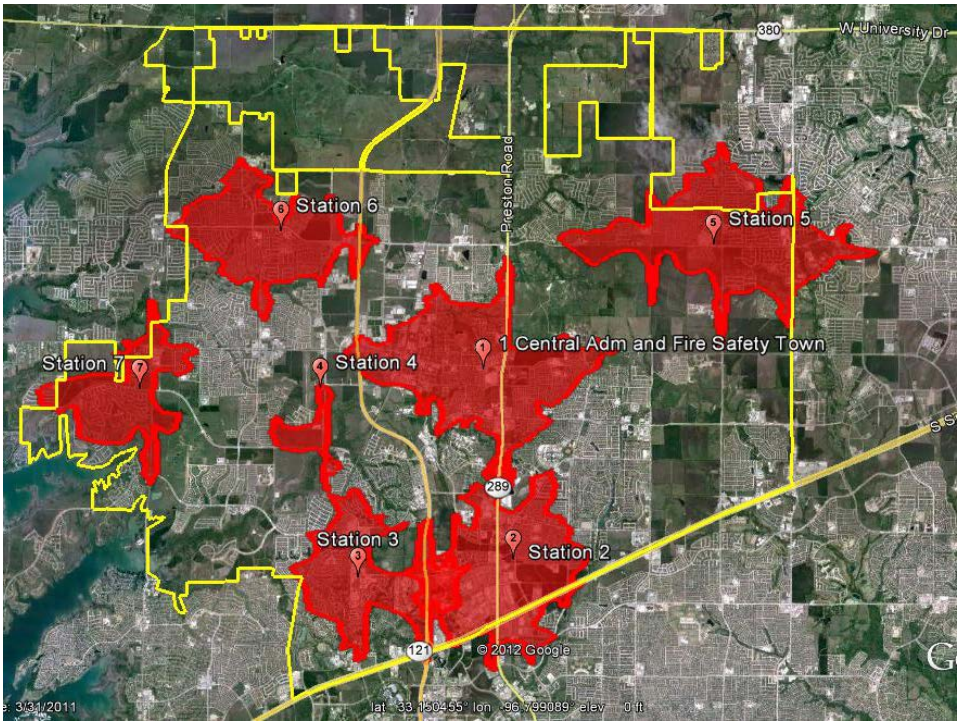


FIGURE 28: 360-Second Travel Time from Current Stations

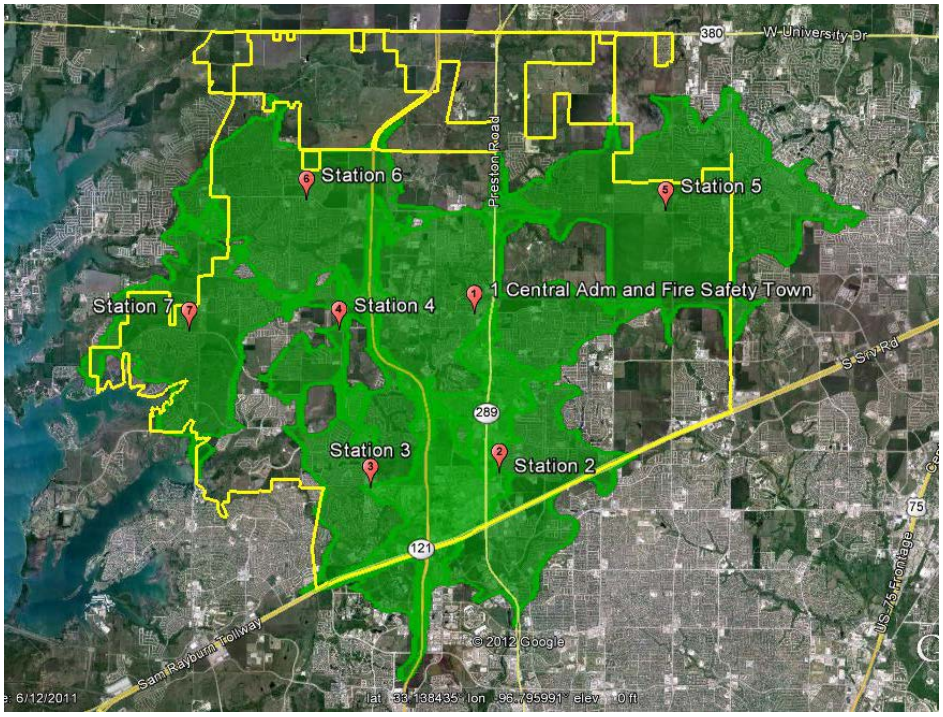
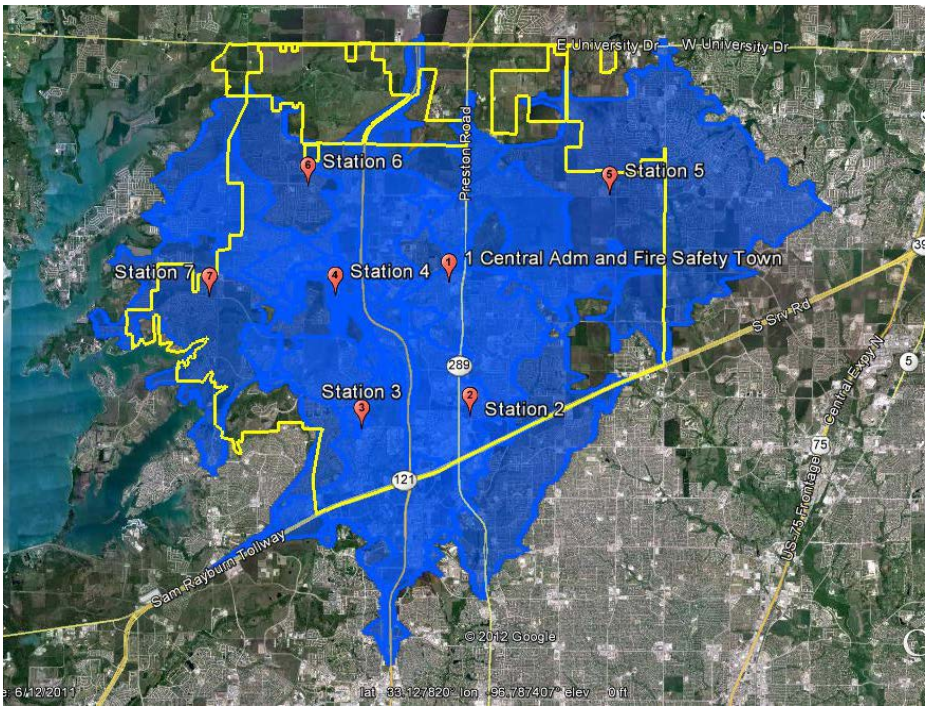


FIGURE 29: 480-Second Travel Time from Current Stations



From these data and figures, the following observations can be made:

- The 240-second travel time bleed map illustrates significant gaps as compared to the NFPA 1710 standard for First-Arriving engine company.
- The 360-second travel time substantially closes travel time gaps for First-Arriving fire suppression units.
- The 480-second travel time bleed map aligns more closely with the 90th percentile average travel time of 7.4 minutes for First-Arriving fire unit.
- The 480-second travel time bleed map meets NFPA 1710 standard for assembling the initial alarm units.
- The 240- and 360-second bleed maps illustrate the gap in a responsive coverage that will be closed with the planned location of station 8.
- The 240- and 360-second bleed maps illustrate the gaps in responsive coverage that will be closed by other forecasted stations.

Figures 30 and 31 show an aggregate picture of the response time bleeds (240, 360, and 480 seconds) with and without Station 7.

FIGURE 30: Travel Time Bleeds with Station 7

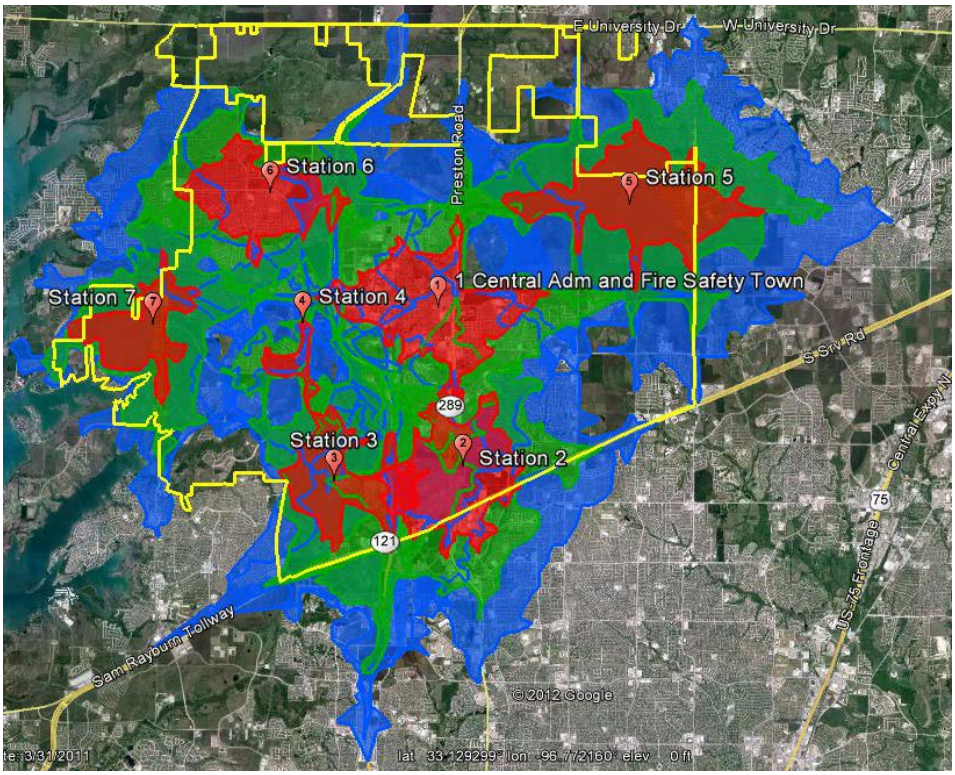
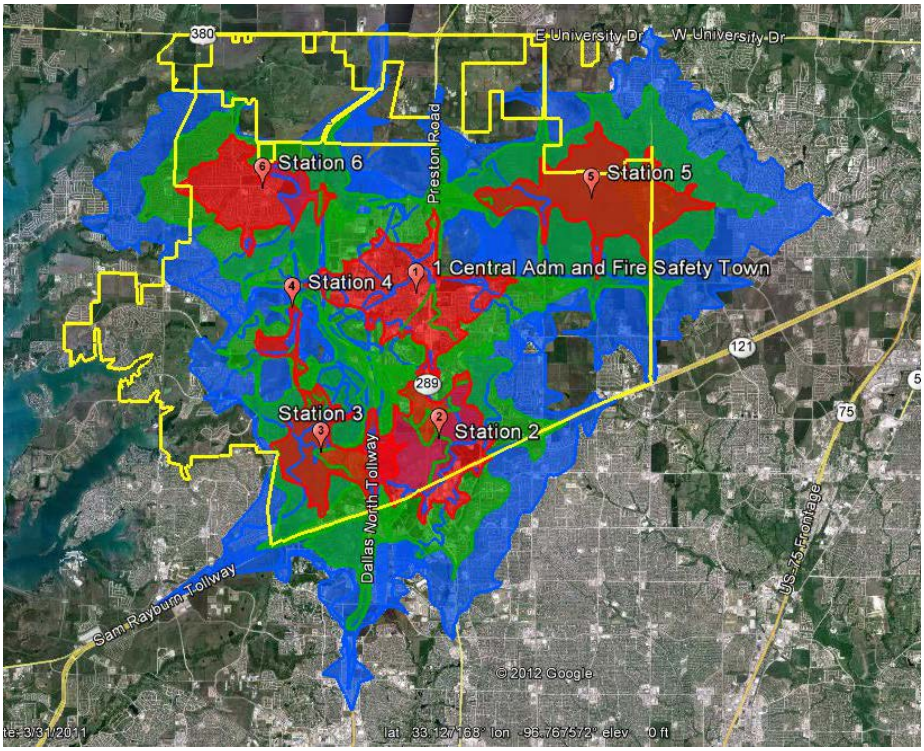


FIGURE 31: Travel Time Bleeds without Station 7



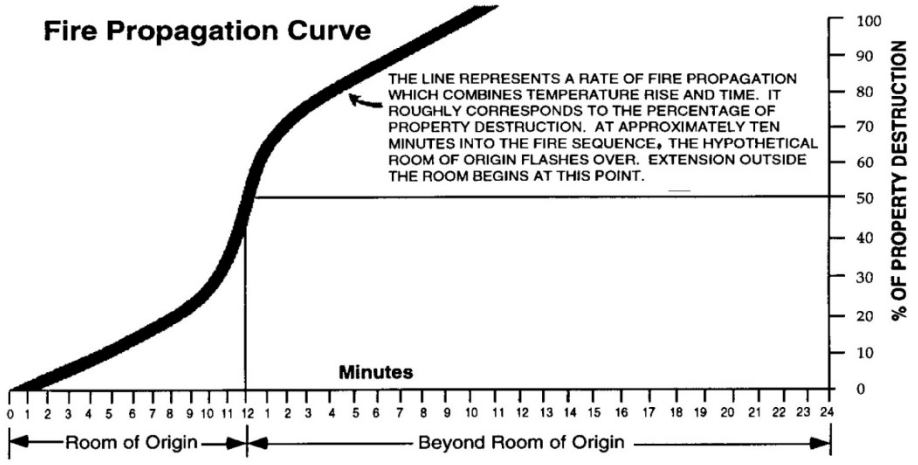
Although trying to reach the NFPA standard for travel time may be laudable, the question is: At what cost and what is the evidence that supports such recommendations? NFPA 1710 travel times are established for two primary reasons: (1) the fire propagation curve, which is shown in Figure 32; and (2) sudden cardiac arrest, where brain damage and permanent brain death occurs in 4 to 6 minutes. The FFD has done an excellent job at filling any gaps in coverage that will occur as a city grows. The FFD should continue to implement its station location plan and utilizing the recommendations contained in this report.

According to fire service educator Clinton Smoke, the fire propagation curve establishes that temperature rise and time within in a room on fire corresponds with property destruction and potential loss of life if present.[26] At approximately the ten-minute mark of fire progression, the fire flashes over (due to superheating of room contents and other combustibles) and extends beyond the room of origin, thus increasing proportionately the destruction to property and potential endangerment of life. The ability to quickly deploy adequate fire staff prior to flashover thus limits the fire's extension beyond the room or area of origin. Figure 32 shows the fire propagation curve.

[26] Carlton Smoke, *Company Officer.* (Delmar Learning: Clinton Park, NY, 2004).

FIGURE 32: Fire Propagation Curve

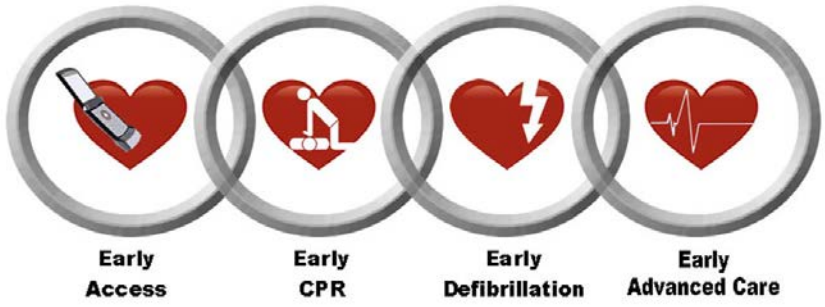
Clearly, an early aggressive and offensive initial interior attack on a working structural fire results in greatly reduced loss of life and property damage. Consequently, given that the progression of a structural fire to the point of "flashover" (the very rapid spreading of the fire due to super heating of room contents and other combustibles) generally occurs in less than 10 minutes , two of the most important elements in limiting fire spread are the quick arrival of sufficient numbers of personnel and equipment to attack and extinguish the fire as close to the point of its origin as possible.



SOURCE: John C. Gerard & A. Terry Jacobsen

Figure 33 illustrates the chain of survival, which is a series of actions that, when put in motion, reduce the mortality of sudden cardiac arrest. Adequate fire department response times coupled with community and public access defibrillator programs potentially can impact the survival rate of sudden cardiac arrest victims by deploying early CPR, early defibrillation, and early advanced care.

FIGURE 33: Sudden Cardiac Arrest Chain of Survival



From "Chain of Survival," http://en.wikipedia.org/wiki/Chain_of_survival.

Recommendation:

- Continue to plan and locate fire stations based on community risk and acceptable average response times of first-arriving fire suppression companies with a focus on 240- to 360-second travel times.

Staffing and Deployment

The question of how many firefighters are needed to appropriately staff a fire apparatus and assemble on the scene of a structure fire has long been debated. Various experts in the field of fire suppression operations have attempted to provide an answer, and standards have been created that identify various staffing parameters for mitigating structure fires. Further, there have been a host of studies that measure the effectiveness and efficiency of two-, three-, and four-person fire companies, as well as the total number of fire staff on the scene to accomplish the various tasks associated with extinguishing a fire in a structure, conserving property, and performing life-safety tasks. The issue is important in that it can have a profound effect on a number of components, including community and fire personnel safety, economic loss from fire, and the overall cost of providing fire protection.

Those who propose a national standard for minimum staffing do not take into account the many variations in local fire problems, in addition to other causal relationships. According to an article written by Cortez Lawrence, several other elements affect fire loss and injury rates, including environmental factors, training and fitness levels of response personnel, leadership skills and capacity, firefighter accountability and operational management systems, fuel density and types, and exposures and effectiveness of fire programs and operations.[27]

The problem with any jurisdiction adopting a national standard is that any such standard by definition does not take into account the various factors that affect a particular community. Community demand for fire service, the local fire risks, and citizens' expectations must be identified before appropriate company size can be determined. A recent report released by the National Institute of Standards and Technology concluded that while resource deployment was addressed in the context of a single structure type and risk level, public policy decisions are a function of many other factors. These include geography, local risks and hazards, and available resources, as well as community expectations (which the report did not specifically address).[28]

Adding to controversy of company size is the fact that although time is a factor in measuring fire company effectiveness by different sizes of fire companies performing specific fireground evolutions, it does not take into account the gap between laboratory and actual field conditions. Because of delays in notification, plus normal dispatch, turnout, and response times, few professionals feel that they arrive at most unattended fires in less than ten to twelve minutes. Yet, the flashover rate is relatively low.[29]

[27] Lawrence Cortez, "Fire Company Staffing Requirements: An Analytic Approach," *Fire Technology* (37:3, 2001), 199.
[28] Report on Residential Fireground Field Experiments, (U.S. Dept. of Commerce, NIST, 2010), 11.
[29] Lawrence, op. cit., 200.

The current body of knowledge does not support the hypothesis that three-person engine crews are any less safe than four- or five-person engine crews. The standards produced and recommended by the NFPA for use, while important to the profession in providing safe, effective, and efficient operating environments for fire service organizations, are not enforceable by law. Further, this standard speaks to assembling personnel on the fireground during the initial alarm for specific functions and tasks, not to a specific number of staffing for individual companies. It is not the intent of this report to diminish the importance of the work done by professional organizations, but it is important to emphasize how and where these standards fit in the bigger picture. Again, it is the role of the individual community to adopt those NFPA recommendations it sees as being in the best interest of citizens based on its financial assets.

The FFD staffs each suppression unit with a minimum of three personnel (one officer and two firefighters). Minimum staffing is maintained when daily vacancies occur as the result of scheduled and unscheduled leave by utilizing additional staffing assigned to each of the three shifts for this purpose. Additionally, if a qualified volunteer member is available, he/she may fill one vacancy per shift. If this cadre is utilized and additional vacancies need filling, overtime is then used to complete minimum staffing requirements. The ICMA team does not recommend augmenting this staffing regimen (minimum of three per fire unit).

Technological advances have been made in fire extinguishment to supplement the overall effectiveness and efficiency where there may be a reduced workforce. These advances have helped introduce viable alternatives to meeting NFPA minimum staffing recommendations. One innovation to be considered in limited staffing situations or situations that have prolonged response is compressed air foam system (CAFS). CAFS is available commercially and has amassed vast anecdotal references substantiating its effectiveness within the firefighting community.

Compressed air foam systems were introduced and advocated for structural firefighting in the 1990s as a way to provide greater fire knock-down power, and to decrease water usage, hose line weight, and water damage. CAFS is now slowly becoming viewed as a possible way to offset reduced staffing policies among career fire service organizations and decreased volunteerism among volunteer and combination departments.

The growing acceptance of CAFS is being driven by fire leaders who see an opportunity for a simple system of primary fire attack that will replace the high-pressure water-fog system. CAFS appears to offer increased performance in fire suppression of post flashover fire and possibly pre flashover situations. It reduces the amount of water needed to suppress a vast majority of fires, so primary water tanks and fire engines can become smaller, as CAFS offers a 7:1 ratio when utilized. Thus, fewer firefighters may be needed, and attacks on a fire can be made from a safer distance. Further still, the costs associated with training firefighters in primary fire attack may well be reduced substantially.[30]

The effects of CAFS on required manpower for suppression activities is well documented in the literature and has been consistently observed, both in actual fire-ground situations and in

[30] Firetactics.com, "Promesius Research Project 2008," http://www.firetactics.com/CAFS.htm.

simulated exercises.[31] For example, controlled room and contents fire tests utilizing CAFS were performed at Wallops Island, Virginia, and Salem, Connecticut, by Hale Fire Pump, the Atlantic Virginia Fire Department, Ansul Fire Protection, the International Society of Fire Service

Instructors, Elkhart Brass, the National Aeronautics and Space Administration - Goddard Flight Center Fire Department, the Charlotte, North Carolina, Fire Department, the Fairfax County, Virginia, Fire Department, F.l.E.R.O. (Fire Industry Equipment Research Organization), and the Salem, Connecticut, Fire Department. Table 11 shows the results of these tests.[32] The table shows that there is significant difference in the rate of the temperature drop using CAFS compared to the plain water and a simple foam solution.

TABLE 7: Temperature Drop: From 1000° F to 212 ° F

Medium	Time (seconds)	Drop Rate (degrees per second)
Water	222.9	3.5
Foam Solution	102.9	7.6
Compressed Air Foam	38.5	20.5

As a best practice, the FFD currently utilizes CAFS and is deploying modern compressed air foam systems on all new and future fire suppression apparatus.

Recommendation:

- Continue to maximize the deployment of compressed air foam (CAFS) as a method to increase efficiencies in fire suppression.

Prevention and Safety

The FFD fire marshal assumes primary responsibility for fire prevention for the city of Frisco. The fire marshal's office prevention responsibilities include reviewing fire code adoption and compliance; issuing permits for fire protection systems; overseeing and maintaining fire alarm systems, standpipes, fire pumps, underground storage tanks, hazardous materials installations, and other systems; conducting plan reviews for new construction and building renovations; and conducting inspections for fire occupancy and special events.

The fire marshal's office is a part of the FFD's fire administrative division and supervised by an assistant fire chief. This office currently has four certified inspectors. Current standards by the *Fire Suppression Rating Schedule Texas Addendum* stipulate that there should be a minimum of one fire inspector per 20,000 residents.[33] **The Frisco Fire Department does not meet this minimum recommendation with regard to fire inspectors.**

Fire code adoption and enforcement are essential to fire prevention. The city of Frisco has adopted a variety of building, environmental, and fire codes for the protection of its citizens. These include 2006 editions of the International Building Code, the International Residential Code, the International Fuel Gas Code, the International Mechanical Code, the International Plumbing Code,

[31] Robert G. Taylor, "Compressed Air Foam Systems in Limited Staffing Conditions," http://www.cafsinfo.com/cafs_limited_staffing.html.
[32] Firetactics.com, "Promesius Project 2008."
[33] Texas Addendum to the Fire Suppression Rating Schedule. Texas Department of Insurance (January 2004), 5–8.

the International Energy Conservation Code, the International Fire Code, and the 2005 edition of the National Electrical Code, all of which were adopted by the city council in 2008. In 2007, the city council adopted the 2006 edition of the International Property Maintenance Code.

Automatic sprinkler systems have been shown to be essential elements in preventing life loss due to fire. An essential element of public safety within the city of Frisco's code prescribes that all residential (Group R) occupancies, except for one- and two-family dwellings, must have fire sprinkler systems installed in accordance with the International Fire Code. Additionally as described below, the aforementioned code speaks further to large one- and two-family dwellings, and requires a fire sprinkler system to be installed in accord with the International Residential Code, Section R325.1 as follows:

> Automatic fire sprinkler systems in accordance with NFPA 13D or NFPA 13R are be provided in all one- and two-family dwellings with a gross floor area 6,000 square feet or greater. For the purposes of this section, gross floor area means conditioned space and attached garage areas. Unenclosed covered areas, such as porches and balconies, are not included. Automatic fire protection systems shall be provided in all buildings containing three or more dwelling units. In the event that an addition or alteration increases the gross floor area from less than 6,000 square feet to equal or greater than 6,000 square feet the entire dwelling unit shall be retrofitted with an automatic fire protection system in accordance with NFPA 13D or NFPA 13R.

The fire marshal's office is involved in the review, adoption, and enforcement of all fire and residential codes. In the past three years the city has experienced a 60 percent increase in fire code permits and plan review documents (from 436 in 2008 to 708 in 2011). In addition, the office has experienced a 64 percent increase in the volume of site plans and plat documents (from 186 to 288) over this same period. The workload requires all fire prevention personnel to review plans, in addition to other inspection, incident and loss data reporting, and arson investigation responsibilities. This workload increase impacts the resources of the fire marshal's office.

Adding a position dedicated to plan review would improve the productivity and overall efficiency of the fire prevention function. Having a dedicated plans examiner would enable more time to be allocated for fire inspectors to address needs associated with new construction, and would allow fire marshal personnel to conduct routine inspections of high and moderate risks within the city limits. This is essential to reaching departmental goals, as fire and building codes are of little use if they are not enforced regularly.

Another critical function of the fire marshal's office is to coordinate fire department operations personnel in conducting SAFER inspections on a regular basis. In addition to providing critical first-line data on possible code violations, this best practices program has an added benefit in that it assists operational firefighters with pre-fire planning by familiarizing them with the building interiors and ensuring that information is updated in the SAFER data base system.

Recommendations:

- Evaluate current and future department funding to strive to meet Fire Suppression Rating Schedule Texas Addendum minimum requirements for fire inspection staffing to meet service demands of this office.

- Evaluate current and future department funding to strive to add a plans review position (non-uniform) to the fire marshal's office to effectively meet the demands of this function and release fire inspection personnel to perform fire prevention inspections.

Public Education

Fire suppression and response, although necessary to protect property, have little impact on preventing fire deaths. Rather, public fire education, fire prevention, and built-in fire protection systems are essential elements in protecting citizens from death and injury due to fire, smoke inhalation, and carbon dioxide poisoning.

The Frisco Fire Department has received national recognition for its innovative public education program. The fire department educates children and adults in fire and life safety and trains volunteers in emergency response. In the last five years, more than 200,000 people from all over the world have visited and participated in Frisco's public education program.

The Frisco Fire Department offers a variety of education programs year-round. The fire and life safety education program includes Safety Town, interactive classrooms with a mock-up of a kitchen, living room, and bedroom, along with hands-on instruction. Safety Town focuses particularly on reaching elementary school students from kindergarten to fifth grade and their families. One fire educator and a firefighter hold daily fire and life education classes for kindergartners on severe weather, fire safety, bike and pedestrian safety, Internet safety, motor vehicle safety, and 911 emergencies.

The education program also utilizes citizen volunteers as classroom facilitators to help with the safety programs and with the outdoor Safety Town (shown at left). During October every elementary school in the city is visited by four firefighters and an assistant chief who act in a skit on fire prevention dressed up as clowns. In Safety Town through interactive classrooms, children practice escaping from a smoke filled room, seeking shelter from a storm, and wearing a seat belt while driving through Safety Town. It is noteworthy that Safety Town was constructed and completely funded by private sector donations.

The department's Safe and Sound educational tours, special events, and birthday parties keep the citizens of Frisco actively involved in fire and life safety issues. Special events include summer Family Nights held on Fridays, Holiday Lights in December, and a fall Trick or Treat Festival, which attracted more than 5,000 residents. The business community has participated by sponsoring these events in return for the fire department's recognition of their support.

The Citizen Fire Academy is an exemplary education program for Frisco citizens age eighteen or older. Over a twelve-week period, citizens learn about fire department operations. Activities include extrication, burn-house training, riding on engines wearing pagers, full turnout gear, and responding with paramedics. Since its founding in 2000, the Citizen Fire Academy has graduated an average of 20 students twice a year, many of whom who have gone on to become volunteer firefighters and later paid firefighters serving in the Frisco Fire Department. In a separate program under emergency preparedness, adult volunteers are trained to assist in major emergencies via Citizen Emergency Response Teams.

As success often builds on success, recognition of successful programs is important. Over the past several years, the Frisco Fire Department has received recognition for its public education programs from several organizations, including the following:

- Institute of Transportation Engineers presented the city of Frisco and Frisco Fire Safety Town a Special Recognition Award for a Fire and Transportation Safety Education Program in 2007.

- Epic Medics, Laerdal, and Zoll presented Frisco Fire Safety Town the 2008 Nicholas Rosecrans Award for Excellence in Injury Prevention.

- Texas Department of Transportation presented Frisco Fire Safety Town the Municipal Traffic Safety Award in March 2010, 2011, and 2012.

- Texas Office of Prevention of Developmental Disabilities, State of Texas, presented Frisco Fire Safety Town the 2012 J. C. Montgomery , Jr., Child Safety Award in April 2012.

Safety Town, safety tours, the Citizen Fire Academy, and birthday parties are all excellent fire prevention programs that make the overall public education program a best practice. From discussions with the firefighters, the ICMA team believes that the comments contained in an earlier climate survey about the undue burden of birthday parties are unfounded. In fact, during two station visits an ICMA team member witnessed birthday events, at which both firefighters and the community participants agreed that the birthday program was a wonderful program. Such programs that invite community members into fire stations where they can interact closely with staff and learn about the many services provided by the department are invaluable.

As with any program, there are some actions that could be taken to enhance it further. For example, studies suggest that the best way to increase the survival rate of heart attack victims is by training citizens in the use of cardiopulmonary resuscitation (CPR) and automated external defibrillators (AEDs). The public education program should expand its curriculum to include teaching these critical skills. Having AEDs readily available is another crucial element to survival. The city and fire

department should engage local businesses, nonprofit organizations, religious organizations, and other local entities to increase the availability of AEDs in the community, perhaps through a citywide discount program.

Because public education is an integral part of a fire department's prevention responsibility, it is usually housed in a fire prevention division. In Frisco, however, public education is in the EMS/training division, which is managed by the fire chief through a division chief. The Frisco fire chief initiated and has championed the public education program and continues to be actively involved in its management and promotion. While the chief's involvement has contributed greatly to the success of the program, relocating it to the fire marshal's office under the responsibility of the fire marshal will help ensure that the program becomes an integral part of the department's other prevention responsibilities. This will also raise community awareness of and respect for code inspection, plan review, and other fire prevention activities.

Recommendations:

- Enhance the program with community and civic groups and other private organizations for the placement of AEDs, and seek out private contributions to assist in funding this vital community program.

- Reorganize the public education function to the fire marshal's office as a direct report to the fire marshal.

Fire Investigation/Arson

The fire marshal's office has three certified origin and cause investigators (dual rolled as fire prevention staff) and one certified arson investigator (the fire marshal). Current standards by the Fire Suppression Rating Schedule Texas Addendum require one fire investigator for every 40,000people.[34] The Frisco Fire Department has the recommended number of origin and cause fire investigators, but falls short of the requisite number of arson investigators. Arson investigation requires specialized and thorough training, particularly as expert forensic skills are needed to provide credible evidence in court. It is important for Frisco to have an additional certified arson investigator to provide arson investigation services. Although the workload for this area may not demand an additional certified arson investigator, the FFD should be prepared should the current fire marshal be unavailable. In the short-term, this additional trained/certified specialist can come from current staff.

Juvenile fire setters are a problem in many communities across the country. The Frisco Fire Department should consider incorporating juvenile fire setter prevention into its public education program. A screening survey developed by the U.S. Fire Administration can help identify emotionally disturbed children and teens that may be at risk of acting out with fire, as well as children and teens with deeply rooted psychological problems that manifest themselves in deliberate fire setting.

[34] Texas Addendum to the Fire Suppression Rating Schedule. Texas Department of Insurance (January 2004), 5–8.

Recording and reporting vital incident data, sharing site plans, conducting plat and plan reviews, and investigating complaints are among the responsibilities of fire prevention, arson investigation, and code enforcement. Efficiently managing the array of documents needed for these responsibilities is complicated. Digital records are providing an answer to fire departments throughout the country. Paperless inspections and computerized plan reviews are examples of how technology can be more effectively utilized by the Frisco Fire Department.

The fire marshal's office is located in the fire administration division, while public education is the EMS/training division. These are interrelated and interconnected parts of an overall goal of fire prevention. Best practices suggest that they should be coordinated through one entity; in Frisco, it makes the most sense for them to be housed in the fire marshal's office. Specifically, it is recommended that the programs be reorganized and combined into a separate fire prevention, fire investigation, and fire education division supervised by the fire marshal. Given the broad scope of responsibilities and link between these responsibilities and life safety, the fire marshal should report directly to the fire chief.

Recommendations:

- Evaluate current and future department funding to strive to add one additional arson investigator to assist with arson investigations and to initiate and sustain a juvenile fire setter program. In the interim, train a current staff member to fulfill this function.

- Evaluate current and available technology and funding to strive to implement a paperless inspection records–management system that focuses on customer service and improves efficiencies.

- Reorganize to create a new fire prevention/investigation/public education division that encompasses all of these programs and establishes a direct report status to the fire chief.

Emergency Medical Services

The operational profile of the department calls for the FFD to utilize paramedics on both fire suppression and medic ambulances (medic units). This allows for a tiered response of an advanced life support (ALS) fire suppression unit if a fire suppression unit is closer, or an ALS transport unit is not readily available. ALS medic units are deployed currently in five of the seven fire stations and staffed with one emergency medical technician (EMT) and one paramedic as a general guideline. For the data analysis of this report, medic units were deployed in four of six stations. The FFD currently has 129 paramedics out of a total of 154 operational uniform personnel.

The concept of "more is better" has always been a common fallacy within the fire service. More paramedics, more firefighters, more suppression and rescue units, more medications—all are believed to produce better outcomes. Recent studies have challenged this concept and will have a profound effect on fire departments in the future. Like fire suppression staffing, staffing paramedic vehicles will undergo a change in paradigms. A paper released in July 2011, "Emergency Medical

Services Evidenced-based System Design White Paper for EMSA," (EMSA report) shows that experience matters and not the number of paramedics on the scene of a pre hospital emergency.[35]

Just as with doctors in hospitals, paramedics need to perform a certain number of medical procedures to maintain proficiency and maximize optimal results. When more paramedics are added to the system, the number of critical procedures conducted and critical patients served per paramedic declines, unless population and patient demand increase in a proportional manner. Thus, after exceeding a certain critical mass of paramedics, the addition of more paramedics may not increase survival rates, but may instead actually drive them down.

Even more compelling is the fact that the majority of EMS calls only require basic life support (BLS) assessment and care, not ALS treatment or interventions. Dispatching multiple resources, including EMTs and two or more paramedics for a patient who requires only a basic evaluation and transport to an emergency department is not only extremely inefficient and costly; it also contributes to burn-out among providers. This is especially true for paramedics in systems where staff may rotate between engine company and medic company assignments during the shift, or by another rotational method.[36]

The following sections break down EMS call and response data similar to what was described in the fire suppression section. Here, the report provides information on EMS incident types and how these are distributed to each station (district). The information further breaks down each station's EMS call load by type and the total EMS deployed time by each station. Because the FFD deploys a single medic resource form each station (district), it is possible to analyze the unit utilization hour for each station's medic unit. As with fire suppression units, response time information is also presented and discussed along with the number of units dispatched to EMS calls.

Recommendation:

- Cap the number of FFD operational paramedics to efficiently staff ALS response units (with a minimum of one each on fire suppression units, two on medic units); to avoid diluting the EMS system; and to ensure that skills are maintained to a high degree.

EMS Category Call Type

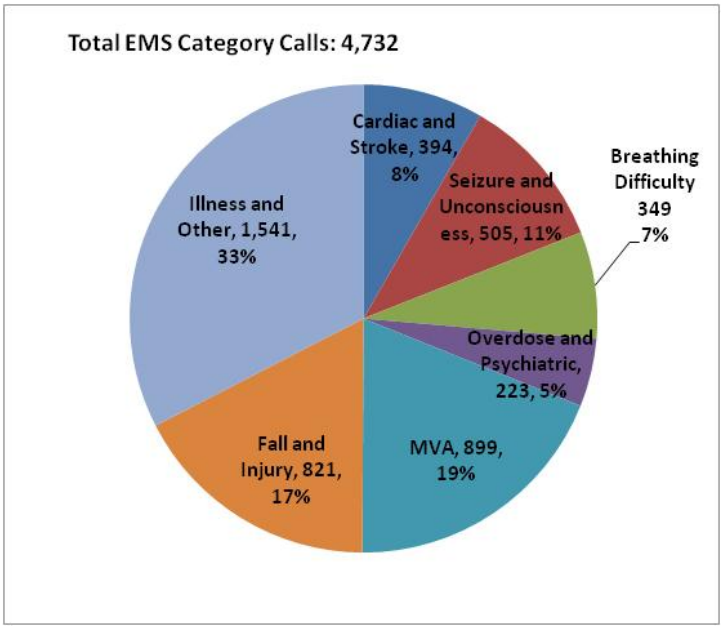
The ICMA analysis looked at EMS response from four stations. In the 12-month period studied, the FFD responded to 4,732 EMS calls for service, or 60 percent of the 7,871 overall incidents to which the department responded. Table 12 breaks down by incident type EMS incident totals, and Figure 34 breaks down the call type totals against the total number of EMS incidents. Calls per day and call percentage in Table 12 are measured against the overall total number of calls.

[35] J.M. Goodloe and S.H. Thomas, "Emergency Medical Services Evidence-Based System Design White Paper for EMSA," (University of Oklahoma, School of Community Medicine, 2011), 33.
[36] Goodloe and Thomas, "Emergency Medical Services," 33.

TABLE 12: EMS Incident Totals, by Type

Call Type	Number of Calls	Calls per Day	Call Percentage
Cardiac and stroke	394	1.1	5.0
Seizure and unconsciousness	505	1.4	6.4
Breathing difficulty	349	1.0	4.4
Overdose and psychiatric	223	0.6	2.8
MVA	899	2.5	11.4
Fall and injury	821	2.2	10.4
Illness and other	1,541	4.2	19.6
EMS Total	**4,732**	**12.9**	**60.1**

FIGURE 34: EMS Category Calls



From the above table and figure, the following observations can be made:

- EMS calls for the year totaled 4,732 (60 percent of all calls), averaging 12.9 per day.
- Motor vehicle accidents accounted for 11.4 percent of the total EMS call volume.
- Cardiac or stroke calls were 8 percent of EMS calls.
- Difficulty breathing calls were 8 percent of EMS calls.

- Motor vehicle accident calls were 19 percent of EMS calls.
- Overdose or psychiatric calls were 5 percent of EMS calls.
- Seizures or unconsciousness calls were 11 percent of EMS calls.
- Falls or injuries calls were 17 percent of EMS calls.
- Calls related to illness or other medical issues were 33 percent of EMS calls.

Table 13 depicts by station (district) how EMS category calls for service are dispersed across the city.

TABLE 13: EMS Calls by Station (District)

Call Type	District 1	District 2	District 3	District 4	District 5	District 7
Cardiac and stroke	95	83	68	75	22	51
Seizure and unconsciousness	115	107	87	102	39	55
Breathing difficulty	106	58	46	67	28	44
Overdose and psychiatric	71	49	43	28	13	19
MVA	216	179	163	111	132	98
Fall and injury	213	204	115	131	57	101
Illness and other	473	297	221	240	119	181
EMS Total	**1,289**	**977**	**743**	**754**	**410**	**559**

From this table, the following observations can be made:

- District 1 had the highest number of EMS category calls and responded to 27 percent of the overall EMS category calls.
- District 5 had the fewest number of EMS category calls and responded to fewer than 8 percent of these calls.

EMS Category Unit Deployment Time

The time a unit is deployed on a single call, or is busy on a call for service, indicates the workload of that particular unit or station. This can be measured as productive emergency response time over a shift period. An analysis of the FFD response data shows that a total of 2,972 EMS category calls (63 percent) lasted less than one hour; 1,738 EMS category calls (37 percent) lasted between one and two hours; and 22 EMS category calls lasted more than two hours. On average, there were 4.8 EMS category calls per day that lasted more than an hour.

Additional analysis and observations regarding EMS category calls for service include:

- A total of 964 illness and other calls (63 percent) lasted less than one hour; 577 illness and other calls (37 percent) lasted more than one hour.
- A total of 255 cardiac and stroke calls (65 percent) lasted less than one hour; 139 cardiac and stroke calls (35 percent) lasted between one and two hours.
- A total of 215 difficulty breathing calls (62 percent) lasted less than one hour; 134 difficulty breathing calls (38 percent) lasted between one and two hours.
- A total of 536 motor vehicle accident (MVA) calls (60 percent) lasted less than one hour; 363 MVA calls (40 percent) lasted more than one hour.

Table 14 depicts annual busy time for EMS category calls by call type and district/station.

TABLE 14: Annual Deployed Hours, by EMS Call Type and District

Call Type	District 1	District 2	District 3	District 4	District 5	District 7
Cardiac and stroke	130	101	89	109	32	77
Seizure and unconsciousness	146	125	108	151	54	81
Breathing difficulty	128	63	51	94	38	59
Overdose and psychiatric	92	62	55	42	16	28
MVA	266	201	242	140	193	145
Fall and injury	278	230	140	180	81	137
Illness and other	533	318	255	311	142	235
EMS Total	**473**	**297**	**221**	**240**	**119**	**191**

An important measure in operating efficiency in emergency medical services is unit hour utilization (UHU). An individual UHU is the ratio of time that an EMS unit is engaged on calls compared to the total on-duty time of the unit. The departmental UHU is the figure for all units combined. For example, if a unit is on duty for 24 hours and is engaged in calls for eight of those hours, its UHU is 0.33 for that period. This is an approximation based on an assumption of one hour per call.

Although not all may agree, a consensus among EMS experts is that a desirable range for UHU is between 0.25 and 0.50, with an optimum being around 0.40. Rates higher than 0.50 signal overuse and employee burnout, lack of available units during simultaneous emergencies, and inadequate preparation for the next call. Rates lower than 0.25 signal underutilization, increased availability of units, and a reduced chance of simultaneous calls in a particular district. The UHU for this report is based on average minutes deployed on EMS calls per day. That is, if a unit is deployed 24 hours/day (1,440 minutes/day) and spends 800 minutes/day deployed on EMS calls, the UHU would be 0.55.

The FFD aggregate UHU is at the optimum level. Individually however, each medic unit is low (below .25) and would signal underutilization. UHU does not however take into account response times and total square miles an agency may have to deploy resources to. In the case of the FFD, units are strategically located around the city from a fixed base to serve designated response areas based on parameters already discussed. Units are moved from station to station when necessary to fill response gaps should another unit be tied up on a call for an extended period of time.

UHU observations for FFD medic units and based on minutes-per-day deployment time:

- Medic 604 had the highest UHU at 0.14
- Medic 601 had the second-highest UHU at 0.13
- Medic 602 had the third-highest UHU at 0.12
- Medic 605 had the lowest UHU at 0.04
- **The aggregate UHU for FFD medic units is 0.43**

UHU observations for stations/districts and based on annual deployed hours for EMS category calls:

- District 1 had the highest UHU at 0.18
- District 2 had the second-highest UHU at 0.13
- District 4 had the third-highest UHU at 0.12
- District 3 had the fourth-highest UHU at 0.11 (no Medic Unit)
- District 6 had the fifth-highest UHU at 0.08 (no Medic Unit)
- District 5 had the lowest UHU at 0.06

Recommendation:

- Deploy a medic unit in District 3 during peak hours of the day (0900–2100), utilizing current staffing from C-Com/Haz Mat units in lieu of adding staff. Cross-staff C-Com/Haz Mat units with current staff from Heavy Rescue 601.

EMS Category Calls Response Time

Some EMS systems have advocated standards that support a response time for 90 percent of calls of no more than four minutes for BLS first responders and no more than eight minutes for ALS transport ambulance.

It was concluded in the EMSA report that when comparing actual and expected survival based on arbitrarily assigned response times, there were no statistically significant differences for times

between five and ten minutes. Further, when response times were categorized into less than or equal to eight minutes, there was no survival benefit identified in the eight-minute cutoff.[37] Lastly, the EMSA study reports there was no evidence of increased mortality for priority patients where ALS response time exceeded 10:59 minutes, and there was evidence to suggest that very low response times (less than 5 minutes) are associated with a low risk of mortality. According to Goodloe and Thomas, "this means that in the first 5 minutes, survival could be improved if response times were less than 5 minutes, but after 5 minutes the curve flattened. Thus, decreasing response times from 10:59 minutes to 9:59 minutes, 9:59 minutes to 8:59 minutes and so forth down to 5 minutes would not improve the potential for survival. It was concluded that when comparing actual and expected survival based on arbitrarily assigned response times, there were no statistically significant differences for times between 5 and 10 minutes, and that mortality risk appeared to be sensitive to times less than 5 minutes. While there was little evidence to support reducing the current response time specification of 10:59 and 12:59 minutes, there was evidence to suggest that very low response times (less than 5 minutes) are associated with a low risk of mortality." [38]

As stated in the fire category calls section, ICMA's definition of response time differs from the FFDs. Currently the FFD reports response time as turnout time plus travel time, and reports an average response time of 4.9 minutes for EMS category calls during the data analysis period. Broken down in this section, ICMA reports an overall response time for EMS category calls as 6.4 minutes. EMS category calls measured according to the FFD methodology yields an identical average EMS category response time of 4.9 minutes.

With regard to total response time (EMS and FIRE), the FFD consistently reported for the data analysis period an average emergency response time of 5.2 minutes (fire and EMS). The ICMA overall response time (fire and EMS)when measured as the FFD measures it (turnout time plus travel time) yields an average response time of 5.1 minutes, which aligns with that reported by the FFD. (ICMA does not differentiate emergency and nonemergency calls.) This decision has minimal effect on the overall averages, however it is recognized that non-emergency calls will show a longer travel time.

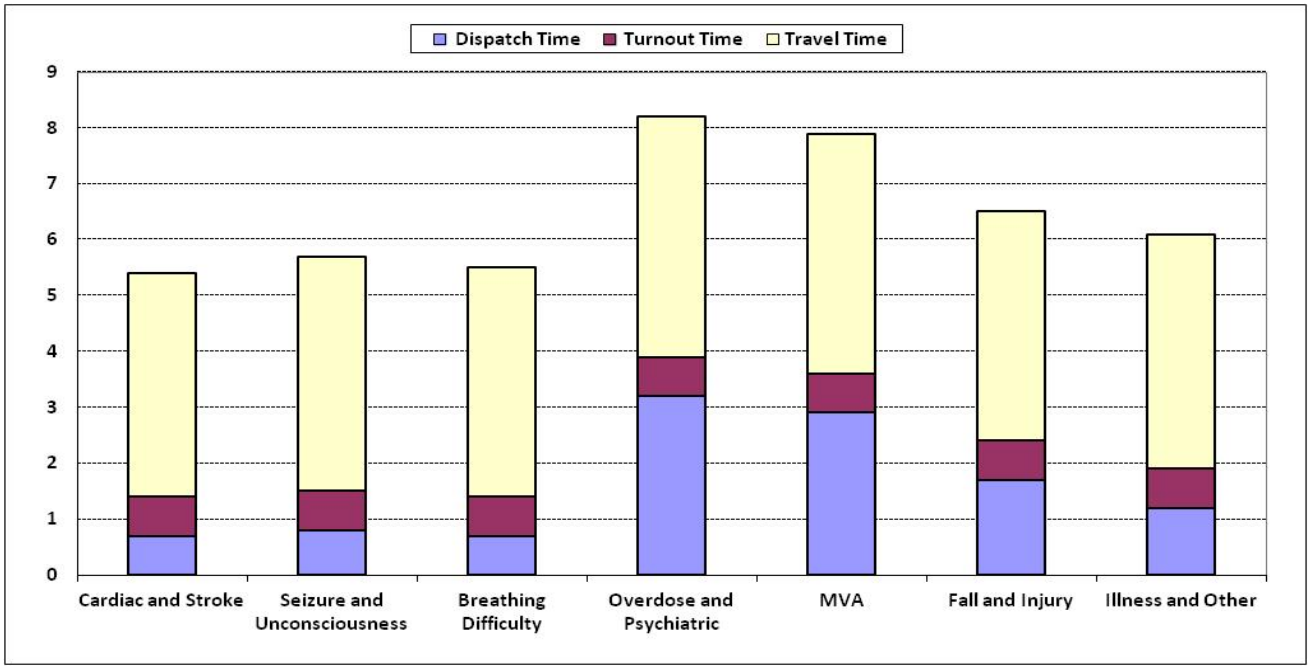
Table 15 and Figure 35 both depict average dispatch, turnout, travel, and total response times of First-Arriving EMS units for EMS category calls.

[37] Goodloe and Thomas, "Emergency Medical Services," 23.
[38] Goodloe and Thomas, "Emergency Medical Services," 23.

TABLE 15: EMS Category Calls: Average Dispatch, Turnout, Travel, and Response Times of First-Arriving Unit

Call Type	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size
Cardiac and stroke	0.7	0.7	4.0	5.3	391
Seizure and unconsciousness	0.8	0.7	4.2	5.7	504
Breathing difficulty	0.7	0.7	4.1	5.4	347
Overdose and psychiatric	3.2	0.7	4.3	8.2	223
MVA	2.9	0.7	4.3	8.0	875
Fall and injury	1.7	0.7	4.1	6.5	812
Illness and other	1.2	0.7	4.2	6.1	1,501
EMS Total	**1.6**	**0.7**	**4.2**	**6.4**	**4,653**

FIGURE 34: Average Dispatch, Turnout, and Travel Times of First-Arriving Unit, by EMS Call Type



As previously reported while discussing fire category response times, a more conservative and stricter measure of total response time is the 90th percentile measurement. Simply explained, for 90 percent of calls, the first unit arrived within a specified time, and if measured the second and third unit. Comparatively, "median," which means 50 percent of the time, having data that are perfectly normally distributed, will be the same as average.

Table 16 breaks down the 90th percentile for dispatch, turnout, travel, and response times for the First-Arriving unit for EMS category calls.

TABLE 16: 90th Percentile: Average Dispatch, Turnout, Travel, and Response Times of First-Arriving Unit for EMS Category Calls

Call Type	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size
Cardiac and stroke	0.9	1.1	6.2	7.5	391
Seizure and unconsciousness	1.1	1.0	6.5	8.1	504
Breathing difficulty	0.9	1.1	6.0	7.3	347
Overdose and psychiatric	15.0	1.1	6.0	18.6	223
MVA	10.9	1.2	7.4	15.5	875
Fall and injury	3.4	1.1	6.2	10.3	812
Illness and other	1.5	1.1	6.4	8.9	1,501
EMS Total	**2.9**	**1.1**	**6.5**	**10.0**	**4,653**

Observations for EMS category calls include:

- The average response time for EMS calls was 6.4 minutes.
- The 90th percentile response time for EMS calls was 10.0 minutes.
- For 58 percent of EMS calls, the response time was less than 6.0 minutes.
- For 90 percent of EMS calls, the response time was less than 10.0 minutes.
- The average response time for overdose and psychiatric calls was excessively high due to prolonged dispatch times as a police officer is routinely sent first to these incidents, which expands the dispatch time for the FFD.

Another area reviewed is the number of units dispatched to EMS calls. Table 17 depicts the number of FFD units dispatched to EMS calls.

TABLE 17: Number of Units Dispatched to EMS Calls

Call Type	Unit				Total
	One	Two	Three	Four or More	
Cardiac and stroke	8	351	33	2	394
Seizure and unconsciousness	5	459	37	4	505
Breathing difficulty	5	323	21	0	349
Overdose and psychiatric	0	200	17	6	223
MVA	19	664	140	74	897
Fall and injury	18	712	78	12	820
Illness and other	48	1,341	127	16	1,532
EMS Total	**103**	**4,050**	**453**	**114**	**4,720**

From this data, the following observations can be made:

- On average, 2.1 units were dispatched per EMS call, typically a fire suppression unit and an ambulance.
- Two units (typically a fire suppression unit and an ambulance) were dispatched to 86 percent of all EMS calls.
- A total of 57 EMS calls (1 percent) had no ambulance or rescue unit dispatched and were responded by fire apparatus acting as MFR (medical first responder). For the rest of the 4,675 EMS calls, one ambulance or rescue unit was dispatched to 90 percent of the calls. Two ambulances or rescue units were dispatched to 8 percent of the calls, three ambulances or rescue units were dispatched to 1 percent of the calls, and four medical units (three ambulances and one heavy rescue) were dispatched to one major MVA call with extrication on June 25, 2011.

Further observations include:

- On average, two or more ambulances were involved simultaneously at calls for one hour every 11.3 hours.
- On average, three or more ambulances were involved simultaneously at calls for one hour every two days.
- On average, two or more ambulances were involved simultaneously at calls for 127 minutes (two hours, seven minutes) per day.

- On average, three or more units were involved simultaneously at calls for 25 minutes per day.

In this section the number of units that respond to EMS calls is analyzed. As observed 86 percent of all EMS calls included the response of two or more FFD units, primarily an engine company and a medic unit. While this is a common practice in fire departments across the country for a variety of reasons (assist with patient loading, assist with patient care), it is not an efficient use of resources for low-priority calls. Fire and EMS units should be dispatched more appropriately according to adopted guidelines supported by emergency communications technology and the operational medical director.

Recommendation:

- Review response procedures to EMS calls; utilize current emergency medical dispatch component and dispatch the appropriate resource(s) to EMS calls for service with a goal of reducing fire suppression unit response to nonemergency call types.

Emergency Management

The mayor of Frisco, as the chief elected official, is responsible for ensuring that there is an emergency plan and an emergency manager to implement this plan. By state law, the mayor has the authority to declare a disaster for the city and, if needed, to request from the governor of Texas a state disaster declaration and disaster assistance. The governor can then declare a state disaster, and in turn request a federal emergency or disaster declaration from the president of the United States.

The fire chief serves as Frisco's emergency management coordinator and is responsible for the management of the emergency management program, which is housed in the fire department. The fire chief submits and manages the emergency management budget. The fire chief has assigned the daily function of managing the program to an assistant fire chief, who is supported in this responsibility by an emergency management specialist.

The range and number of responsibilities held by the emergency management specialist is extensive. An assistant fire chief has overall responsibility for the emergency operations center (EOC), and the emergency management specialist is in charge of updating the emergency management plan, managing grants from the state and the Department of Homeland Security, managing CERT training, monitoring statewide and local special events, and coordinating the resource needs of the Frisco regional task forces. Redundancy should be built in to back up this critical position. The firefighters that regularly staff the EOC should be trained to assist and back up the emergency management specialist.

Disaster response generally requires numerous agencies to work together and share resources. These agencies typically have overlapping lines of authority and responsibility and, during response, work in a dynamic and uncertain situation under extremely stressful time pressures. At the same time, there is often an immediate need for critical and frequently insufficient resources. Too often, these conditions cause miscommunication and conflict.

According to the Frisco emergency management plan, the individual who is appointed to be incident commander is driven by the type of incident. It is unclear whether the incident commander would report to the city manager or the fire chief in a major emergency or disaster situation—an issue that needs to be clarified. For example, the fire chief is the emergency management coordinator and the police chief is responsible for evacuation, but who decides when a major facility or area wide evacuation should be ordered? Would the police chief order the evacuation via the fire chief? A better approach would be to reduce the number of management layers and clarify who would have overall control and responsibility during a citywide or regional disaster response. Based on the experience of cities of comparable size and local government structure and capability, the best way to accomplish this would be by making the city manager the emergency management coordinator and the fire chief the assistant emergency management coordinator, who then carries out the day-to-day functions and management of emergency management.

In Frisco, the planned disaster organization and response are as similar as possible to the day-to-day emergency organizational structure and response to routine emergency events. Frisco's EOC (shown below) is staffed by the EOC specialist and two firefighters on a 24/7 basis and is used daily to monitor traffic, news, and routine citywide and regional emergencies. This is a FEMA-recommended best practice.

The EOC is backed up by a similarly fully functional mobile command truck that can be used as the emergency operations center should the building housing the emergency management function be damaged or destroyed in a major event. Having a fully functional back-up EOC is also a FEMA best practice.

The city of Frisco has a comprehensive all-hazard emergency management plan that includes departmental and generic function annexes. Sections are updated annually on a five-year cycle, so the plan in total is updated every five years. The last full update of the emergency management plan was completed in 2011 as per the state's requirement. The plan details responses to different hazards as well as the requirements of generic functions such as damage assessment, warning, evacuation, sheltering, search and rescue, and so forth. The plan describes all the generic functions and delineates the departmental and/or individual responsibility for each functional annex. Damage assessment is especially crucial because a full assessment is required to request state and possibly federal assistance. The plan's annex that details this need should be very clear about how damage assessment will be accomplished in a timely manner. This may be an area of improvement for the city.

Hazard analysis is another critical aspect of emergency management planning. To accomplish this, the city of Frisco participates in a regional hazard mitigation plan developed by the North Texas Council of Governments.

Frisco's mayor is familiar with his emergency-related responsibilities and regularly participates in the EOC when storms threaten or when a major emergency or disaster occurs in a nearby community. It is considered critical and a known best practice for the chief elected official to be familiar with EOC functions and to actively participate in the EOC on a regular basis to eliminate the learning curve when a disaster occurs.[39] During a disaster, the mayor is sought out by local and national media to serve as a spokesperson and is seen by the public as an expert on the situation. Training in the EOC is also critical for city management and department heads. The fire chief and others with emergency management responsibilities need to make sure that other city department heads and key staff are fully trained in EOC operations and engaged in disaster preparedness and response.

Regular tabletop exercises should be scheduled to familiarize management with the plan, management responsibilities, and the workings of the EOC. In Frisco, such exercises should be conducted at least quarterly, with a particular need prior to tornado season.

The city of Frisco regularly coordinates with surrounding jurisdictions to prepare for events that need a regional response. The Frisco Fire Department has joint channel communication capability with the cities of Plano, Little Elm, Lewisville, The Colony, and the counties of Denton, Rockwall, Hunt, and Collin. Holding regular drills testing interjurisdictional coordination is essential. The Frisco Fire Department also participates in regional wild land fire and hurricane task forces as delineated by a memorandum of understanding with the Texas Interstate Fire Mutual Aid System. Participating in these task force deployments provides excellent operational and hands on training.

Recommendations:

- Provide requisite training as emergency management specialists for operations staff responsible for an EOC assignment so they can serve as redundant staff to emergency management staff.

- Assign the emergency management coordinator function to the city manager and the assistant emergency management coordinator function to the fire chief for the purpose of establishing and ensuring effective and efficient emergency management operations.

- Improve the damage assessment annex in the FFD comprehensive all-hazard emergency plan to ensure the plan is sufficient and the essential components are in place to receive state and federal assistance if needed.

- Develop a training plan that includes quarterly tabletop exercises so that city management becomes more familiar with the all-hazards plan, management responsibilities, and the workings of the EOC.

[39] *Characteristics of Effective Emergency Management Program* (Fairfax, VA: Public Entity Risk Institute, 2001), 27.

Emergency Communications (E-911)

Emergency communication functions for the FFD are handled through the Frisco Police Department (FPD). The FPD communications division is comprised of both supervisory and practitioner-level staff that is trained to handle all levels of calls, from simple inquiries to complex emergencies. Supervisors and staff are trained to prioritize EMS calls for service and deliver pre- and post-arrival lifesaving instructions to callers as needed.

The emergency communications center is located within the FPD central headquarters facility and utilizes state-of-the-art equipment to handle both E-911 emergency and nonemergency phone calls. In 2011 the radio system was upgraded to P-25 digital platform, which provides a much-improved public safety radio system and is in compliance with both current and future interoperability standards.

The FPD communications division is the public safety answering point (PSAP) for both police and fire incidents for the city of Frisco and its animal control division. Incoming calls are received through traditional phone lines as well as cellular phone and voice over Internet protocol (VOIP). Additionally, the center is equipped to handle calls from the hearing impaired utilizing text telephone (TTY) technology.

In CY 2011, the FPD communications center dispatched 126,896 incidents, of which 14,076 or 11 percent were dispatched to the FFD. As a PSAP the communications center handled 130,247 inbound calls for service.[40] For inbound EMS calls for service, the communications center utilizes Medical Priority Dispatch System (MPDS) to prioritize and dispatch calls. According to Geoff Cady, an expert in medical dispatch systems the MPDS:

> *is the most advanced and comprehensive* EMD system available. By virtue of its design, the MPDS is unparalleled in its ability to provide system administrators with complete information on EMD performance as it relates to compliance to the protocol. The MPDS applies a systems approach to quality management of emergency medical dispatch activities that exceeds all national standards and industry position statements.[41]

Cady further states:

> The most visible features of an EMD system is its ability to identify the need for pre-arrival instruction and prioritize an EMS response, the MPDS protocol's ability to assist the EMD in identifying safety issues is often overlooked. The safety and care of the patient, bystanders, and responding rescuers are essential to maintaining the "Do no harm" doctrine in medicine. The first responder and transportation safety issue is related to the use of lights and sirens and the inherent risk associated with their use, as it relates to emergency medical vehicle collisions (EMVCs). It is estimated that nearly 12,000 EMVCs occur annually, resulting in an estimated 120 fatalities of EMS responders and

[40] City of Frisco Police Department Communications Division.
[41] Geoff Cady, "The Medical Priority Dispatch System:-A System and Product Overview," http://www.emergencydispatch.org/articles/ArticleMPDS(Cady).html.

> bystanders. In order to minimize the risk of EMVCs to bystanders and EMS responders, ASTM Standard F 1258-95, Subsection 6.1.1.1(a) states that the EMD process "Adequately establish the correct level of [EMS] response.[42]

Currently the FPD communications center utilizes the Medical Priority Dispatch manual card system. A more sophisticated EMD software system is available that deploys Medical Priority Dispatch as an automated system through a display screen that is integrated with the computer-aided dispatch (CAD) system. It also creates a quality assurance database for each incident on each call-taker and dispatcher. Cady describes these systems:

> The MPDS ProQA software is a decision support system that provides the EMD with an advanced caller-interrogation script; raises and nearly guarantees EMD compliance to protocol; time-stamps protocol activation; provides online pre-arrival and post-dispatch instructions; and provides quicker and more appropriate response and referral recommendations. Data gathered throughout the interrogation process is analyzed and output from ProQA to create EMD comparative histories. This data permits a comparison of interrogation process-times between operators; "Determinant Code" histories permit frequency analysis of caller chief complaints by time of day, day of week, month or against all recorded cases.[43]

Two technology tools that should be incorporated into any communications and dispatch system are automatic vehicle location (AVL) and mobile data computers (MDCs.) An AVL system allows dispatchers to see the precise location of any unit on a computer-generated map of the city. The AVL data can also be integrated into the CAD system to calculate the truly closest unit to any given emergency and make a dispatch recommendation accordingly, rather than making recommendations based on fixed fire station locations.

In addition to improving dispatching, AVL improves personnel safety because a unit that is in trouble can be located quickly. Additionally, an AVL system can be integrated with MDCs installed in each emergency response unit. With the appropriate integration of AVL, navigational, and MDC technologies, the AVL can provide the MDC with a visual map showing the current unit and incident location, together with the most efficient travel route.

MDCs can be used to provide CAD data, city maps, building plans, fire rescue preplans, hospital status, patient information, and navigational directions to responding units directly in the field. MDCs can also be used to log unit status and file field reports. They can be supported by 800 MHz radio system channels, code-division multiple access (CDMA) cellular technology, and other wireless communications technologies. Currently, the FFD utilizes MDCs; however, not all MDCs have the AVL feature turned on.

[42] Cady, “The Medical Priority Dispatch System.”
[43] Cady, “The Medical Priority Dispatch System.”

Recommendations:

- Implement Medical Priority Dispatch ProQA software to increase EMD efficiencies by responding with the most correct resources to EMS incidents, and to establish a communications center quality assurance program for EMS incidents.

- Ensure that all frontline fire and EMS apparatus have MDCs, ensure the AVL feature is turned on and integrated with CAD, and implement CAD-recommended closest unit response to all fire and EMS incidents.

Organizational Resource Analysis

Human Resources

Any recruitment, hiring, promotion, and other human resource functions must be in line with federal labor laws, including the Fair Labor Standards Act (which has applied to public-sector workers since 1985), Title VII of the Civil Rights Act, the Age Discrimination in Employment Act, and the Americans with Disabilities Act. The Frisco Fire Department has not had an issue in any of these areas.

The city of Frisco personnel department is responsible for administering all of the personnel policies and procedures for all city agencies, including the fire department. The personnel department works directly with the fire department to develop job descriptions; recruit candidates; and engage with outside private consulting firms to administer entry-level cognitive testing, physical fitness exams, psychological exams, and polygraph exams. Candidates who pass these tests go on to be interviewed by a personnel board and then by the fire chief.

The Frisco Fire Department is somewhat unique in that its primary pool of new recruits comes from its own fire volunteers, who have already gone through the department's entry-level tests. All of the volunteers are state certified; some have completed fire academy training. This provides a set of candidates for paid positions who are highly skilled and familiar with FFD systems and processes.

The Frisco Fire Department uses private testing firms to administer all of its entry-level exams, which include cognitive, physical fitness, psychological, and polygraph tests. All of these exams have been validated recently. A private human resources consulting firm used a work-step and task-analysis process to establish knowledge, skills, and abilities (KSAs) linked to essential job requirements. A private consulting firm also administers promotional exams using an in-box assessment. The use of private-sector agencies helps ensure fairness, both real and perceived, in the hiring and promotion processes.

The department requires all firefighters to have an annual physical exam; firefighters who are age forty or older also must have an annual stress test. There are no weight requirements for fire department personnel. The city of Frisco has a no-smoking policy inside its public buildings, but there is no policy restricting fire department employees from smoking.

The fire department has not experienced any problems finding an adequate number of qualified recruits to fulfill its needs. When the department recently recruited 22 new firefighters to meet the needs of a new fire station, for instance, it had 180 highly qualified applicants. The department also has not had any real problems with retention, as evident in the department's low turnover rate: just 40 fire employees have left the department in the past ten years. Table 18 presents turnover rates in the city of Frisco since 2008. Comparison of the data reveals that the fire department's turnover rate is lower than that of the city as a whole, as well as of other large departments within the city. Additionally, the FFD's turnover rate is in line with rates of other similar situated departments.

While organizations should always be aware of turnover and take note of its causes, the data suggest that concerns about turnover within the Frisco Fire Department are unfounded.

TABLE 18: City of Frisco Turnover Rates, 2008–2012

	FY 2008–09	FY 2009–10	FY 2010–11	FY 2011–12 (7 months)
Police	7.73%	6.77%	5.45%	2.43%
Public Works	7.84%	7.41%	10.77%	4.62%
Fire & EMS	2.08%	2.03%	2.48%	1.16%
All Departments	7.78%	7.66%	5.79%	3.63%

During the review of the FFD, the ICMA team met with a representative group of firefighters, paramedics, lieutenants, and captains to discuss the issues raised in the *Employee Climate Survey*, which was conducted in the fall of 2011 by Ursey and Associates. This report highlighted several employee relations concerns, including such things as employee turnover, communication within the agency, micromanagement, bureaucracy, and decision making.

During the group discussion with ICMA, these issues were reiterated. Having a sense of belonging and consistency between shifts were also raised as issues, and the group discussed the possibility of establishing a driver-operator position. While the group initially agreed with the idea of creating a driver-operator rank, as they began to discuss the pros and cons, they realized the issue was more complex and needed further study before a recommendation could be made. The group also discussed complaints regarding trust and micromanagement by officers. While there were some specific examples of where micromanagement and mistrust occurred, as the group discussed them in more detail it became clear that these tended to be isolated incidents that occurred over a lengthy period of time. ICMA believes that there is no indication that these are department wide or systemic issues.

What was apparent, however, is that middle- and senior-level officers need to focus more time and attention on strategic issues, or, as described by the time allocation model, on issues associated with "creating the future" and allow company-level officers to take a more prominent role in "operating the system" (see Figure 14). The misallocation of time at the management level is creating the feeling of being micromanaged and undermining trust at the lower levels. This issue suggests that further leadership training and development for all officer-level staff is warranted. This would include follow-up training and/or coaching for senior officers on leadership and communication.

What was clear from our discussion is that the methods, opinions, and conclusions of the *Employee Climate Survey* provided a biased view of the department and its operations. The members present for our discussion espoused a great deal of pride for their current job, their profession, and their department.

Recommendations:

- Research the feasibility of establishing a driver-operator position; consider the actual versus the perceived need, fiscal impact, effectiveness, and potential cost savings on equipment and apparatus.

- Review and implement stated recommendations in this report that improve organizational development, organizational effectiveness, and interpersonal relationships. Develop training programs focused on current and future officers that link to these recommendations.

Station Management

Currently the FFD has at least one captain or one lieutenant assigned to each station/each shift to serve in a leadership position as the company officer. These officers are supervised by a single-shift battalion chief. The current makeup of operational company level officers is eight captains and seventeen lieutenants.

The FFD has established a goal of having one captain assigned to each station/each shift, with multi-unit companies (engine/truck) having an additional lieutenant assigned as a subordinate officer to the additional fire unit. To accomplish this goal will require twenty-one captains and nine lieutenants. There is no FFD goal of assigning an officer to the medic units.

Figures 35, 36, and 37 provide a visual depiction of the outcomes of this goal.

FIGURE 35: Station Management Goal: Single Unit Station

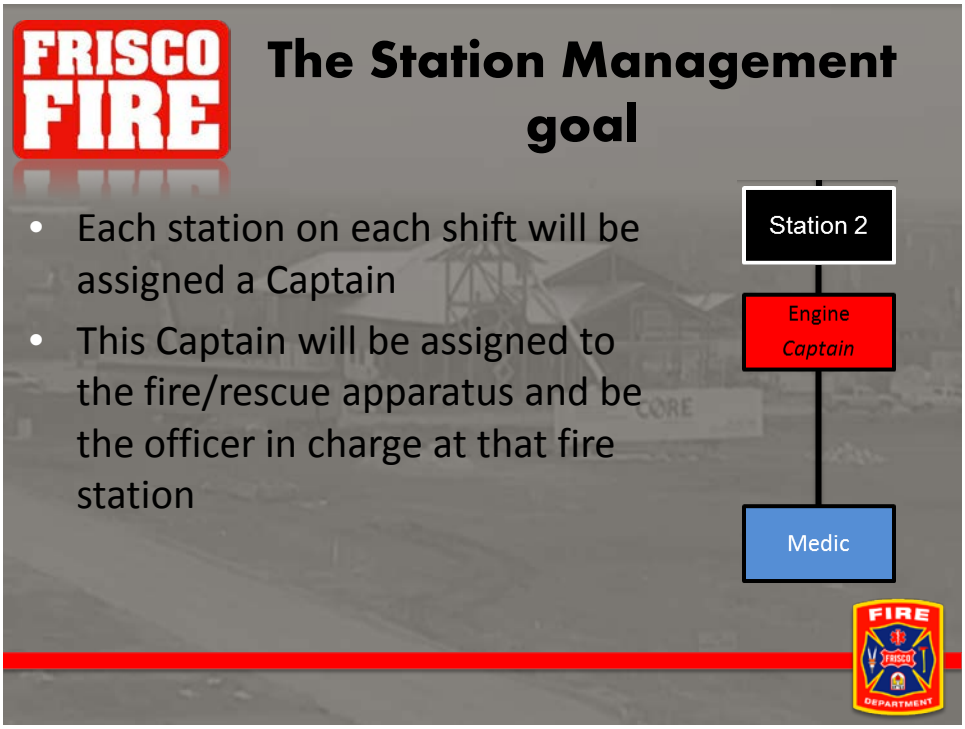


FIGURE 36: Station Management Goal: Multi Unit Station

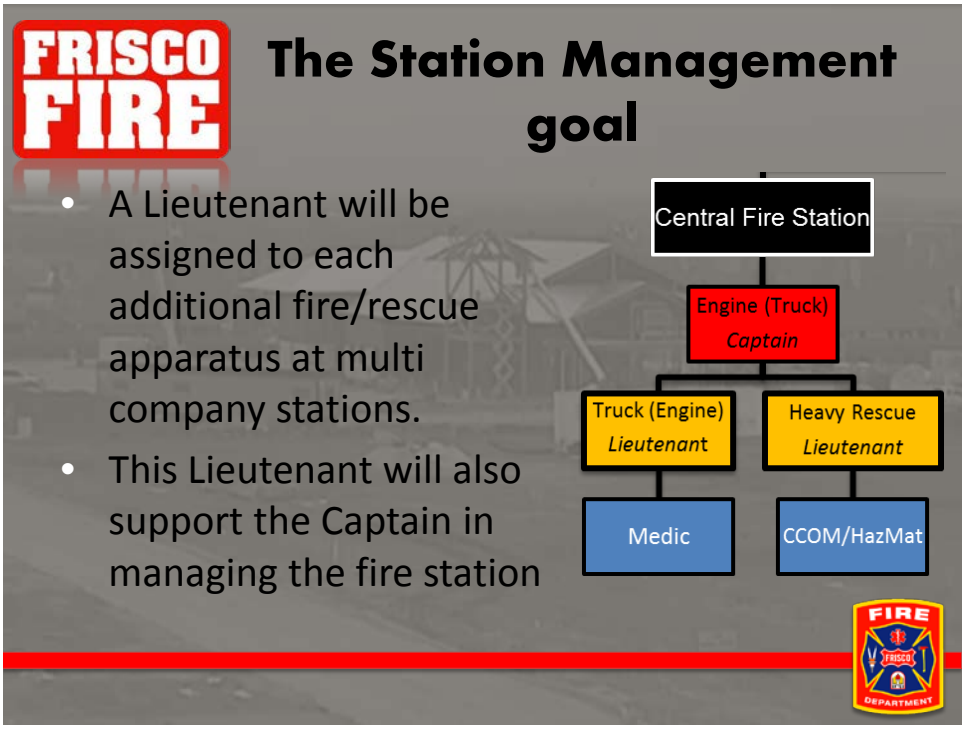
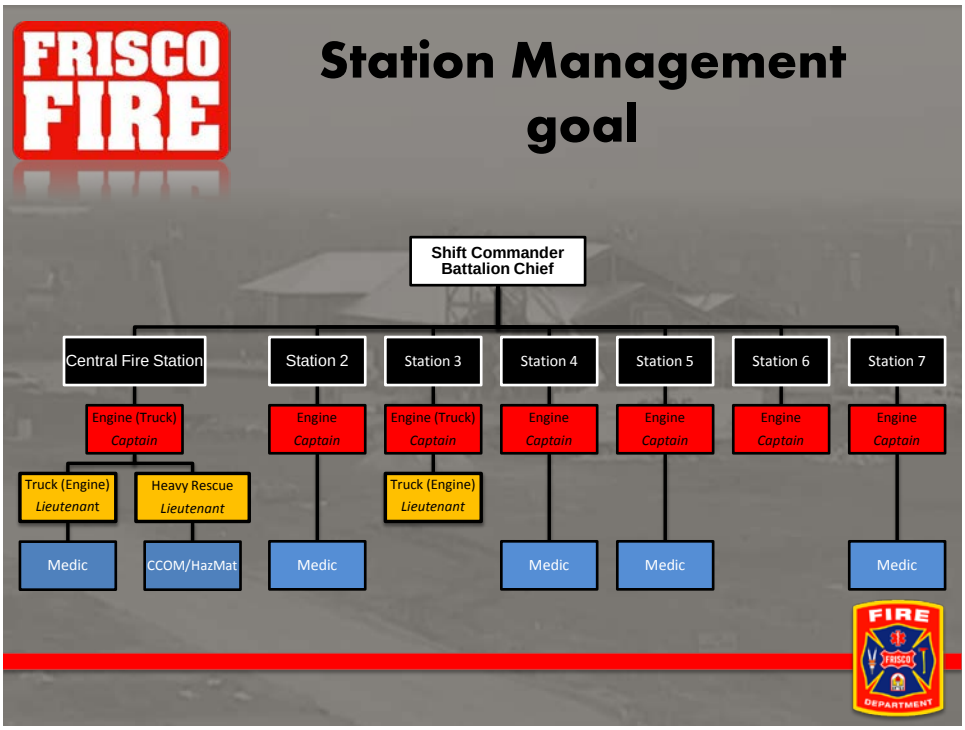


FIGURE 37: Overall Station Management

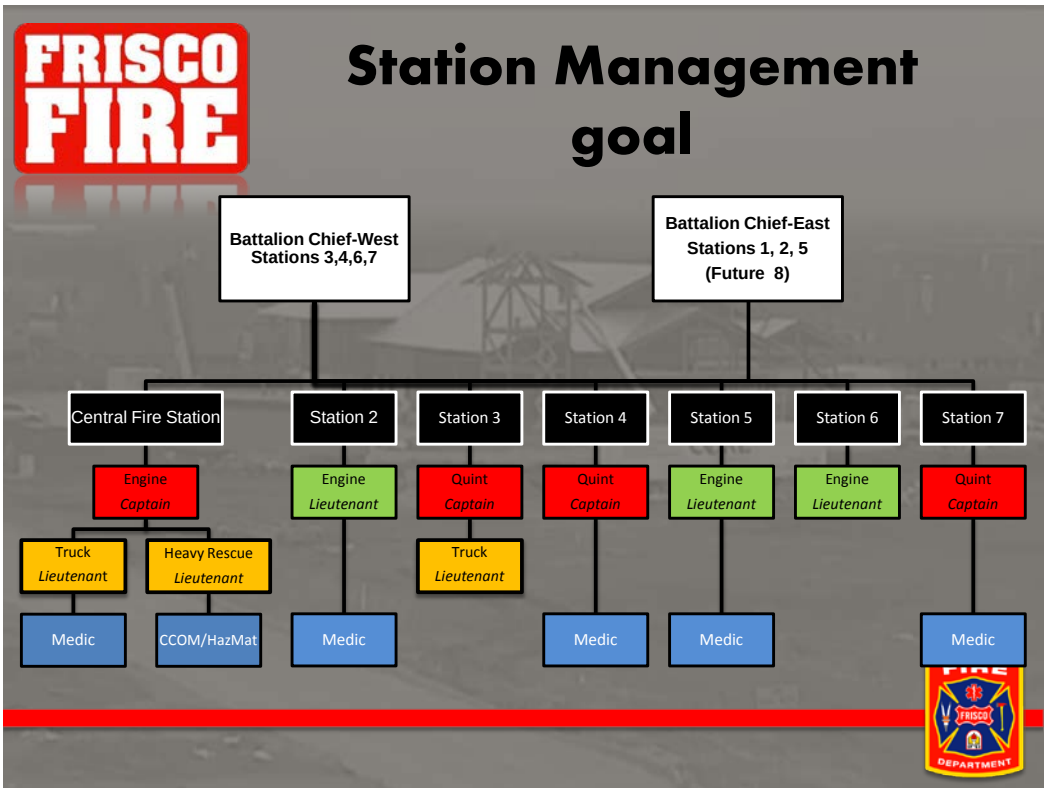


The management of station-level activities is performed by the company officer, regardless of rank. The critical piece to the successful fire organization is that this level is in place, so that appropriate responsibility and accountability of company level operations are identified, and emergency and nonemergency tasks are appropriately supervised.

In the case of the FFD, there is no consistency regarding how station-level operations are supervised (captain or lieutenant) or how each station is managed and supervised. This has the potential to create inconsistencies in the management of shifts and each individual station. Additionally, the current rank structure, with just eight captains, does not establish a sufficiently large pool of candidates for promotion to the next level of battalion chief. Similarly, the proposed model depicted in Figure 37, with nine lieutenants, would not create a sufficiently large pool of candidates for promotion to the level of captain.

To remedy these problems, the ICMA team recommends that the FFD research the feasibility of placing captains on each shift/each station where there are multiple fire units or a single quint unit. This would result in twelve captains and eighteen lieutenants; a more balanced company-level officer pool Lieutenants would fill the remaining company-officer positions. Figure 38 illustrates this company officer level model and adds a shift battalion chief as discussed earlier in this report.

FIGURE 38: Proposed Company Officer Model



Recommendation:

- Research the feasibility of placing captains on each shift/each station where there are multiple fire units or a single quint unit.

Education and Training Programs

Training in the Frisco Fire Department is administered by a division chief who also serves as the department's EMS officer. The training regimen corresponds to the department's standard operating procedures (SOPs), which are detailed in the department's drill manual. The manual's section on the department's SOP for using personnel protective equipment, for instance, includes a set of skills related to the SOP and identifies the training needed to master the skills. The training chief sets a daily training topic (e.g. cutting tools), and each shift station officer has significant flexibility to use that day's training focus to set up training opportunities based on the needs of the personnel on his or her shift (e.g., jaws of life). FireHouse software is used to maintain the training records of all fire department personnel.

In addition to the training tower and training rooms in the central station, the department has excellent training facilities in Stations 4, 5, 6, and 7. Frisco has a live-burn facility, but it needs to be replaced to meet the department's current needs. Given the expense of specialized burn props, the city may choose to look for partners with which to collaborate on a new facility. In many cases, specialized structures have been constructed through regional partnerships or are shared by organizations with different missions.

Leadership training is held annually. All of the officers within the department have completed Fire Officer 1 training, only two are missing their Fire Officer 2 credentials, but only four have completed Fire Officer 3 and 4 training. All of the department's fire and EMS personnel have completed NIMS/ICS training. One assistant chief is a graduate of the National Fire Academy's Executive Fire Officer Program and one has completed his bachelor of science degree.

The National Emergency Training Center (NETC) in Emmitsburg, Maryland, is the host for both the National Fire Academy (NFA) and the Emergency Management Institute (EMI). Courses and integrated programs at the EMI and NFA serve as the national focal point for the development and delivery of emergency management, fire, and EMS training to enhance the capabilities of both the public and private sector, and to minimize the impact of disasters and emergencies on the American public. Training programs and materials are structured to meet the needs of public- and private-sector students and have a focus on such things as command and control of emergencies, organizational development, technical subject matter, and separate organizations working together in all-hazards emergencies to save lives and protect property.

The NETC subsidizes travel and lodging for those attending the courses at both the NFA and EMI. Courses are open year-round; students compete for openings in a particular class through a formal application process. Should an FFD member be accepted into an EMI or NFA course, the FFD or member would be responsible for procuring the on-campus meal program for a nominal fee. The FFD would be expected to provide necessary leave so that the member could attend. Middle and senior managers should be encouraged and at certain levels or in certain circumstances required to attend relevant EMI/NFA courses in support of career/organizational development as well as an adopted succession planning model.

The department does not have a career path training program that identifies technical and organizational development courses (usually ten to twelve certification courses) and formal

education that must be completed to qualify for each level of promotion. Ideally, candidates for any officer level should have the experience and the fundamental technical skills, education, and training to be successful when promoted. The requisite skills should go beyond simply requiring fire officer courses to include fire-related technical and management training, as well as general management and communications training and skills development.

To ensure that the FFD is preparing future officers, a formal program for each rank that identifies those foundational technical and organizational courses germane to each officer level should be selected and implemented. On-the-job experience is also critical. According to experts, "education and training in the fire service are complimented by an equally important third factor: experience. A healthy mix of all three is required for an effective fire officer, but as he or she moves through a career, the mix and the proportion of each tend to vary, with education becoming more and more important over time." [44]

The city of Frisco does offer a tuition reimbursement program for employees to support organizational and personal development. As well the city also provides an educational incentive for various levels of formal education. Along with a career path program that focuses on developing employees for each organizational officer level, formal education is critical to ensure sophisticated leadership and management competencies are introduced and cultivated in the FFD and become a vital part of its culture.

The department works closely with other fire departments and with the community college in the region to provide a wide array of technical skill training, certification programs, and special operations training. The department also regularly hosts training courses that are attended by fire personnel from neighboring departments. As with many endeavors, joint training programs provide access to vast training resources and economies of scale for all departments involved.

Distributed or distance learning modalities—computer-, web-, and video-based training programs can also be of great value for delivering training, particularly in topics not directly related to firefighting. Some communities have used such training to boost supervisory, management, and/or customer service skills, for instance, helping prepare firefighters who are interested in advancing to a higher rank. Offering technology-based or online courses has an added advantage of providing personnel with the flexibility to complete courses at their own pace and in their spare time. Beyond an online drill manual where PowerPoint slides can be accessed, the department does not currently have computer-based training available.

Recommendations:

- Ensure that hands-on, practical fire and EMS training is included in all monthly company training schedules. This should include technical rescue training for truck and heavy rescue companies.

- Seek partners to construct a regional training center that includes classroom, burn, and specialized training props to serve both fire and EMS training.

[44] Joseph R. Bachtler and Thomas F. Brennan, eds. *The Fire Chief's Handbook* 5th edition. (Saddle Brook, NJ: Fire Engineering Books, 1995), 328.

- Encourage and provide support for FFD officers and technical staff to attend EMI and/or NFA courses to enhance department competencies and for agency and self-development purposes.

- Develop and implement a career path training and development program for lieutenant, captain, battalion chief, and division chief that focuses on personal and professional development for promotion.

- Encourage the use of the city's tuition reimbursement program and include progressive formal education requirements in each level of officer promotional qualifications that has an end goal of requiring minimum college credit hours for lieutenant and captain and a baccalaureate degree for battalion, division, and assistant chief positions.

- Implement computer-based training courses on a variety of technical, management, and supervisory topic areas.

External System Relationships

Disasters and other unusually large incidents do not respect jurisdictional boundaries. As a result, the response to such events often requires the cooperation of several local governments and sometimes state, regional, and federal agencies as well. In addition, a disaster or major incident can strain the resources of even the best-prepared and best-equipped fire department. These factors contribute to the necessity of having a mechanism in place to be able to readily access extra or specialized resources and to coordinate response efforts. In many cases, communities also benefit from regional cooperation to contain costs while still providing the community with specialized capabilities such as hazard material response units.

All of these cases reinforce the need for good working relationships among neighboring fire departments and communities. They also suggest an increasing need for interoperable communications, such as the linking of CAD systems and unit status monitors. A clear definition of each organization's responsibilities, cost reimbursement, and/or payment for services rendered is critical to regional cooperation.

Local governments use many different types of intergovernmental agreements to enhance their fire protection and EMS services. Mutual aid is perhaps the most common type of agreement. The FFD has mutual aid agreements with neighboring jurisdictions to include McKinney, Plano, Prosper and The Colony. In addition, the FFD has two other mutual aid agreements: one with the Sweetwater Firefighters Association, which was signed in May 2006, and another with Collin County, which was signed in November 2004. Both agreements clearly spell out the responsibilities of each department and for the reimbursement of costs incurred by the responding department.

The FFD also signed a cooperative agreement with Denton County in January 2011 to provide fire and EMS services to the county on an annual fixed fee and per-call basis (EMS fees are based on per capita, mileage use, and per transport). A similar cooperative agreement has been in place with the city of Hackberry since September 2010.

In total, these agreements help the FFD provide a high level of fire protection and EMS services to the community and help to ensure that it will have the resources needed in a disaster or major event. The department should continue to look for opportunities to work with neighboring jurisdictions to increase its level of service delivery without adding cost.

Data Analysis

The Frisco Fire Department operates out of six fire stations that house twenty-eight pieces of response apparatus (front-line and reserve), including ten engines, three ladders, two brush trucks, nine ambulances, one Haz Mat, two heavy rescue units, and one light/air/rehab truck.

This report is divided into four sections. The first section focuses on the call types and dispatches. The second section explores time spent and workload of individual units. The third section presents analysis of the busiest hours in a year. The fourth section presents response time analysis.

This report covers all calls for service between March 1, 2011, and February 29, 2012 as recorded in the dispatch CAD system. During this period, the Frisco Fire Department received 7,871 calls, including 130 mutual aid calls and 415 canceled calls. The department responded to 35 structure fire calls and 183 outside fire calls. A total of 14,469 Frisco units were dispatched to all calls. The total combined yearly workload (deployed time or busy time) for all units was 7,434 hours. The average estimated response time was 6.4 minutes and the 90th percentile response time was 9.5 minutes.

Aggregate Call Totals and Dispatches

During the year studied, the Frisco Fire Department received 7,871 calls. Of these, 35 were structure fire and 183 were outside fire calls. There were 4,732 emergency medical service (EMS) calls. We joined the CAD data and fire department's National Fire Incident Reporting System (NFIRS) data and categorized the calls based on the NFIRS incident type code. In addition, we joined the CAD data and third-party chief complaint data for EMS calls and used the chief complaint field to categorize EMS calls. The correspondence table between NFIRS incident type codes and call types is included as Appendix II, while the correspondence table between chief complaints and EMS calls is too detailed to be included.

With regard to total response time (EMS and FIRE), the FFD consistently reported for the data analysis period an average emergency response time of 5.2 minutes (fire and EMS). The ICMA overall response time (fire and EMS)when measured as the FFD measures it (turnout time plus travel time) yields an average response time of 5.1 minutes, which aligns with that reported by the FFD. (ICMA does not differentiate emergency and nonemergency calls.) This decision has minimal effect on the overall averages, however it is recognized that non-emergency calls will show a longer travel time.

TABLE 1: Call Types

Call Type	Number of Calls	Calls per Day	Call Percentage
Cardiac and Stroke	394	1.1	5.0
Seizure and Unconsciousness	505	1.4	6.4
Breathing Difficulty	349	1.0	4.4
Overdose and Psychiatric	223	0.6	2.8
MVA	899	2.5	11.4
Fall and Injury	821	2.2	10.4
Illness and Other	1,541	4.2	19.6
EMS Total	**4,732**	**12.9**	**60.1**
Structure Fire	35	0.1	0.4
Outside Fire	183	0.5	2.3
Hazard	306	0.8	3.9
False Alarm	1,113	3.0	14.1
Good Intent	168	0.5	2.1
Public Service	789	2.2	10.0
Fire Total	**2,594**	**7.1**	**33.0**
Mutual Aid	130	0.4	1.7
Canceled	415	1.1	5.3
Total	**7,871**	**21.5**	**100**

Observations:

- The department received an average of 21.5 calls per day, including 1.1 canceled calls and 0.4 mutual aid calls.
- EMS calls for the year totaled 4,732 (60 percent of all calls), averaging 12.9 per day.
- Fire category calls for the year totaled 2,594 (33 percent of all calls), averaging 7.1 per day.
- Structure and outside fires calls combined accounted for 218 calls, an average of 0.6 calls per day.

TABLE 2: Call Types by District

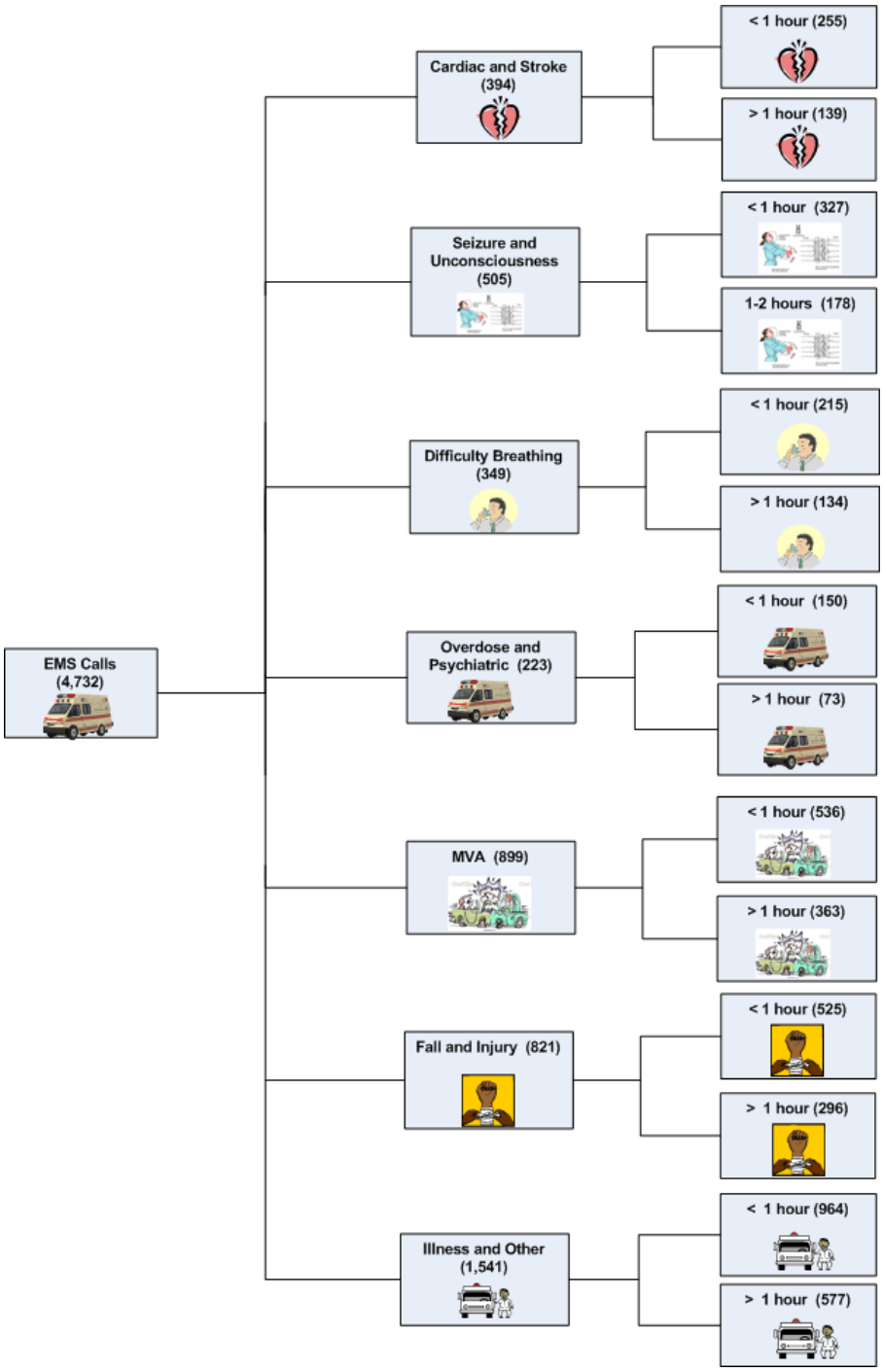
Call Type	District					
	1	2	3	4	5	6
Cardiac and Stroke	95	83	68	75	22	51
Seizure and Unconsciousness	115	107	87	102	39	55
Breathing Difficulty	106	58	46	67	28	44
Overdose and Psychiatric	71	49	43	28	13	19
MVA	216	179	163	111	132	98
Fall and Injury	213	204	115	131	57	101
Illness and Other	473	297	221	240	119	191
EMS Total	**1,289**	**977**	**743**	**754**	**410**	**559**
Structure Fire	13	5	6	4	3	4
Outside Fire	44	26	38	32	11	32
Hazard	102	55	31	35	24	59
False Alarm	187	222	227	139	162	175
Good Intent	35	32	34	21	22	24
Public Service	182	136	141	130	65	133
Fire Total	**563**	**476**	**477**	**361**	**287**	**427**
Total	**1,852**	**1,453**	**1,220**	**1,115**	**697**	**986**
Daily Average	**5.1**	**4.0**	**3.3**	**3.0**	**1.9**	**2.7**
Percentage	**25.3**	**19.8**	**16.7**	**15.2**	**9.5**	**13.5**

Note: A total of three fire and EMS category calls are listed in other districts.

Observations:

- Total number of calls by district ranged from 697 in district 5 to 1,852 in District 1.
- District 1 had the highest number of calls, accounting for 25 percent of total calls and averaging 25.3 calls per day.
- District 5 had the lowest number of calls, accounting for 10 percent of total calls and averaging 9.5 calls per day.

FIGURE 1: EMS Calls, by Type and Duration



Observations:

- A total of 2,972 EMS category calls (63 percent) lasted less than one hour, 1,738 EMS category calls (37 percent) lasted between one and two hours, and 22 EMS category calls lasted more than two hours. On average, there were 4.8 EMS category calls per day that lasted more than an hour.

- A total of 255 cardiac and stroke calls (65 percent) lasted less than one hour; 139 cardiac and stroke calls (35 percent) lasted between one and two hours.

- A total of 327 seizure and unconsciousness calls (65 percent) lasted less than one hour; 178 seizure and unconsciousness calls (35 percent) lasted between one and two hours.

- A total of 215 difficulty breathing calls (62 percent) lasted less than one hour; 134 difficulty breathing calls (38 percent) lasted between one and two hours.

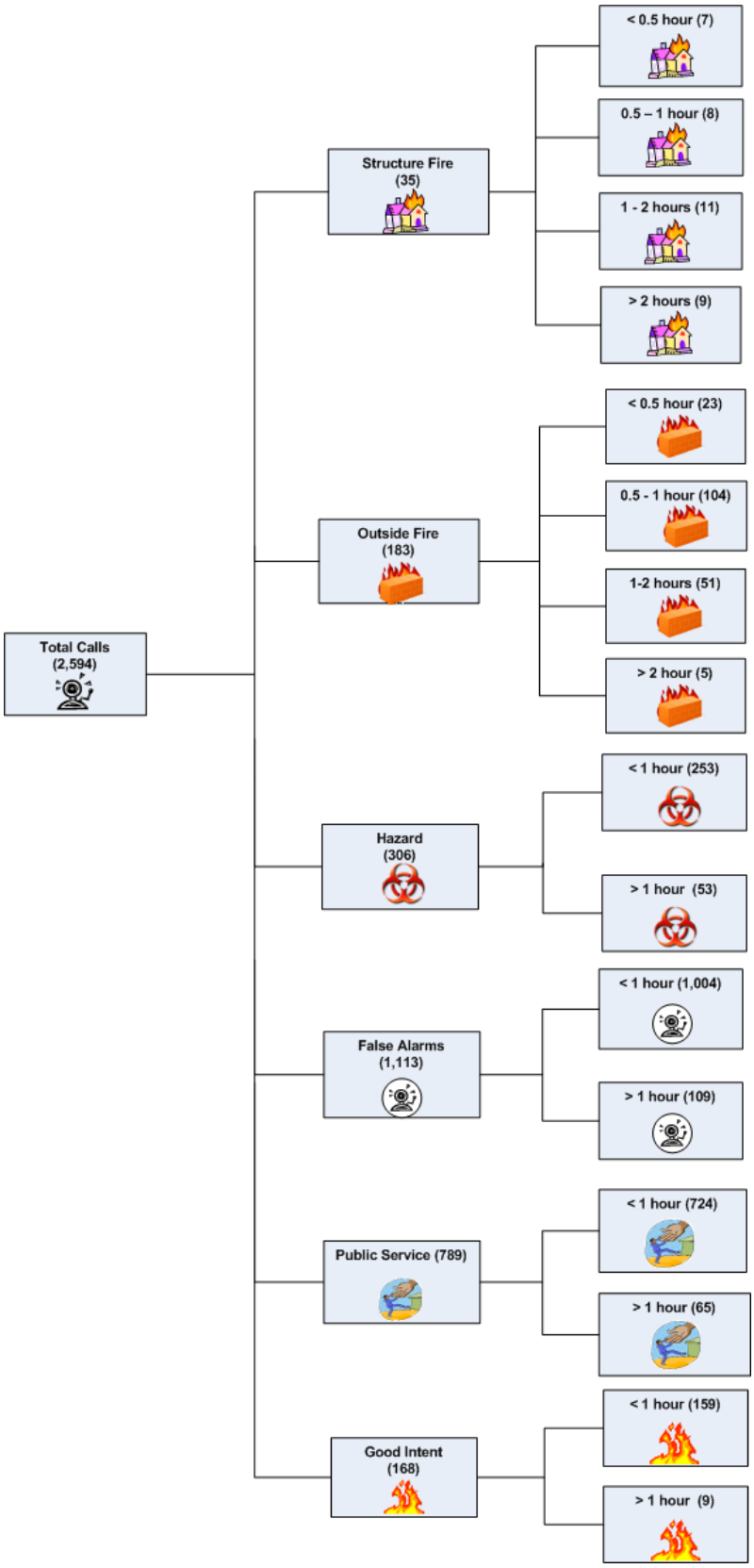
- A total of 150 overdose and psychiatric calls (67 percent) lasted less than one hour; 73 overdose and psychiatric calls (33 percent) lasted between one and two hours.

- A total of 536 motor vehicle accident (MVA) calls (60 percent) lasted less than one hour; 363 MVA calls (40 percent) lasted more than one hour.

- A total of 525 fall and injury calls (64 percent) lasted less than one hour; 296 fall and injury calls (36 percent) lasted between one and two hours.

- A total of 964 illness and other calls (63 percent) lasted less than one hour; 577 illness and other calls (37 percent) lasted more than one hour.

FIGURE 2: Fire Calls, by Type and Duration



Observations:

- A total of 2,282 fire category calls (88 percent) lasted less than one hour; 287 fire category calls (11 percent) lasted between one and two hours; 25 fire category calls (1 percent) lasted more than two hours. On average, there were a total of 0.9 fire category calls per day that lasted more than one hour.

- Of the 35 structure fire calls, 15 calls (43 percent) lasted less than one hour, 11 calls (31 percent) lasted between one and two hours, and 9 calls (26 percent) lasted more than two hours.

- Of the 183 outside fire calls during the year, 127 calls (69 percent) lasted less than one hour, 51 calls (28 percent) lasted between one and two hours, and 5 calls (3 percent) lasted more than two hours.

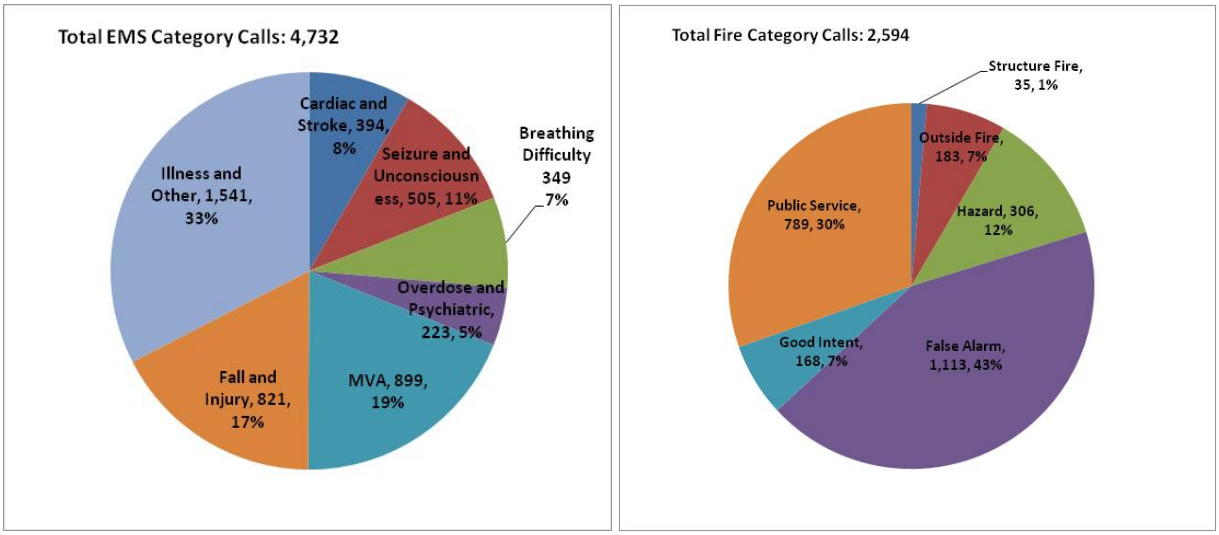
- A total of 253 hazardous condition calls (83 percent) lasted less than one hour; 53 hazardous conditions calls (17 percent) lasted more than one hour.

- A total of 1,004 false alarm calls (90 percent) lasted less than one hour; 109 alarm calls (10 percent) lasted more than one hour.

- A total of 159 good intent calls (95 percent) lasted less than one hour; 9 good intent calls (5 percent) lasted more than one hour.

- A total of 724 public service calls (92 percent) lasted less than one hour; 65 public service calls (8 percent) lasted more than one hour.

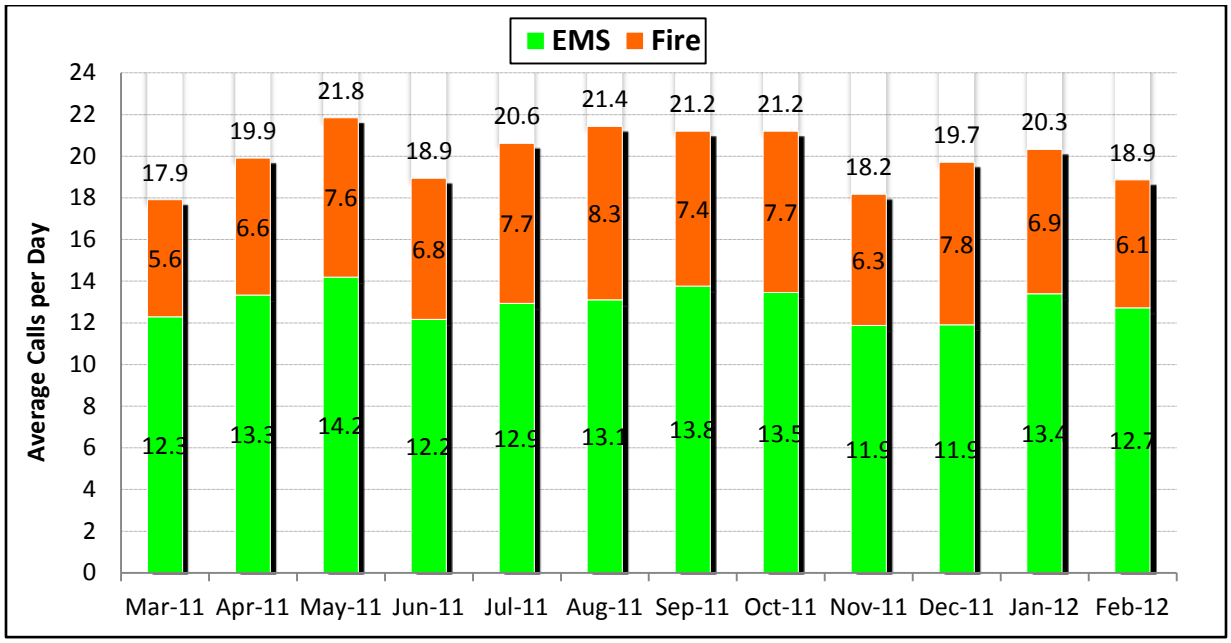
FIGURE 3: EMS and Fire Calls, by Type



Observations:

- A total of thirty-five structure fire calls accounted for 1 percent of the fire category total.
- A total of 183 outside fire calls accounted for 7 percent of the fire category total.
- False alarms were 43 percent of fire calls.
- Hazardous condition calls were 12 percent of fire calls.
- Good intent calls were 7 percent of fire calls.
- Public service calls were 32 percent of fire calls.
- Cardiac or stroke calls were 8 percent of EMS calls.
- Difficulty breathing calls were 8 percent of EMS calls.
- Motor vehicle accident calls were 19 percent of EMS calls.
- Overdose or psychiatric calls were 5 percent of EMS calls.
- Seizures or unconsciousness calls were 11 percent of EMS calls.
- Falls or injuries calls were 17 percent of EMS calls.
- Calls related to illness or other medical issues were 33 percent of EMS calls.

FIGURE 4: Average Calls per Day, by Month



Observations:

- Average calls per day ranged from a low of 17.9 calls per day in March 2011 to a high of 21.8 calls per day in May 2011. The highest monthly average was 22 percent greater than the lowest monthly average.

- Average EMS calls per day varied from a low of 11.9 calls per day in November and December 2011 to a high of 14.2 calls per day in May 2011.

- Average fire calls per day varied from a low of 5.6 to a high of 8.3 calls per day (lowest in March 2011, highest in August 2011).

- The highest number of calls received in a single day was forty-three, which occurred on July 15, 2011. The forty-three calls included twenty-three EMS calls, four hazardous condition calls, five false alarm calls, seven public service calls, and four canceled calls.

FIGURE 5: Calls, by Hour of Day

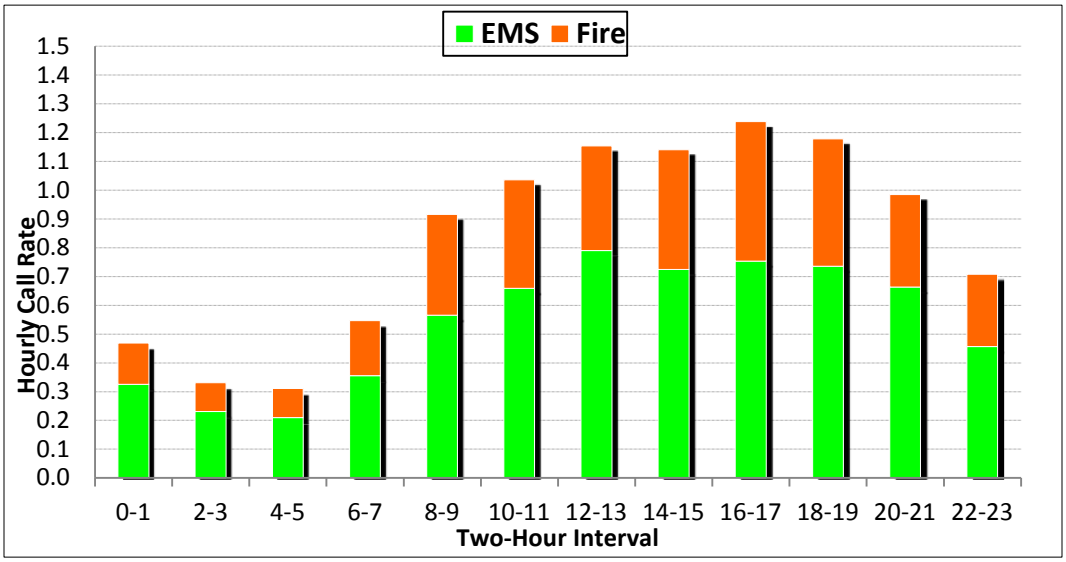


TABLE 3: Calls, by Hour of Day

Two-Hour Interval	Hourly Call Rate		
	EMS	Fire	Total
0-1	0.3	0.1	0.5
2-3	0.2	0.1	0.3
4-5	0.2	0.1	0.3
6-7	0.4	0.2	0.5
8-9	0.6	0.3	0.9
10-11	0.7	0.4	1.0
12-13	0.8	0.4	1.2
14-15	0.7	0.4	1.1
16-17	0.8	0.5	1.2
18-19	0.7	0.4	1.2
20-21	0.7	0.3	1.0
22-23	0.5	0.3	0.7
Calls per Day	**12.9**	**7.1**	**20.0**

Note: Average calls per day shown are the sum of each column multiplied by two, since each cell represents two hours.

Observations:

- Hourly call rates were highest between 10:00 a.m. and 10:00 p.m., averaging between 1.0 and 1.2 calls per hour.
- Call rates were lowest between midnight and 8:00 a.m., averaging fewer than 0.5 calls per hour, or the equivalent of one call every two hours.

FIGURE 6: Number of Units Dispatched to Calls

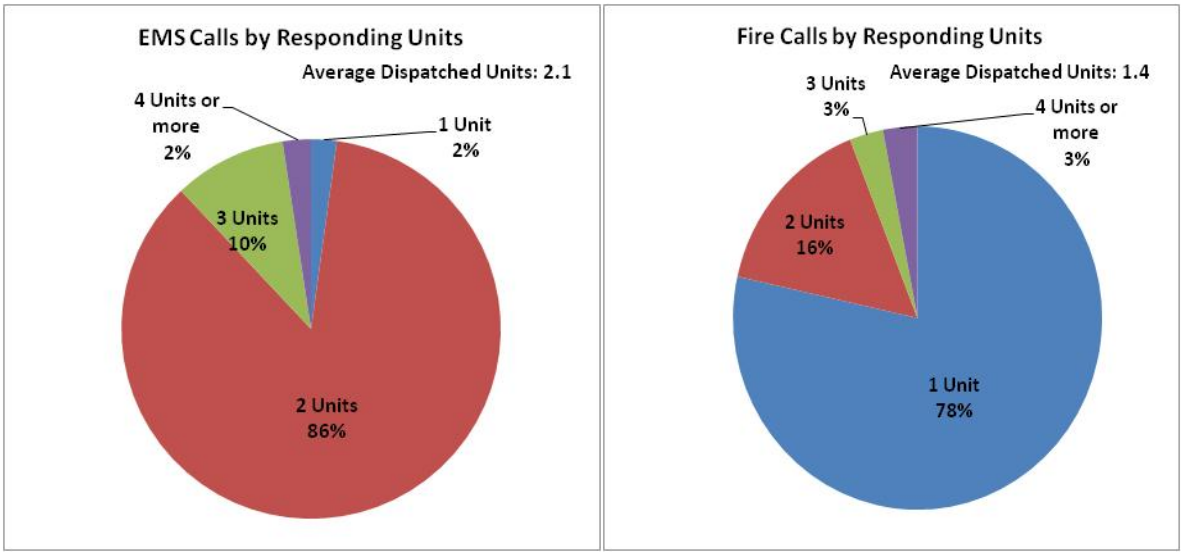


TABLE 4: Number of Units Dispatched to Calls

Call Type	Unit				
	One	Two	Three	Four or more	Total
Cardiac and Stroke	8	351	33	2	394
Seizure and Unconsciousness	5	459	37	4	505
Breathing Difficulty	5	323	21	0	349
Overdose and Psychiatric	0	200	17	6	223
MVA	19	664	140	74	897
Fall and Injury	18	712	78	12	820
Illness and Other	48	1,341	127	16	1,532
EMS Total	**103**	**4,050**	**453**	**114**	**4,720**
Structure Fire	7	3	3	22	35
Outside Fire	46	76	36	25	183
Hazard	275	24	3	4	306
False Alarm	875	208	21	9	1,113
Good Intent	128	24	7	9	168
Public Service	697	67	6	9	779
Fire Total	**2,028**	**402**	**76**	**78**	**2,584**
Grand Total	**2,131**	**4,452**	**529**	**192**	**7,304**
Percentage	**29.2**	**61.0**	**7.2**	**2.6**	**100**

Note: A total of twenty-two calls involving only administrative units or other agencies are not included.

Observations:

- Overall, four or more units were dispatched to 3 percent of calls.
- On average, 1.4 units were dispatched per fire category call.
- For fire category calls, one unit was dispatched 78 percent of the time, two units were dispatched 16 percent of the time, three units were dispatched 3 percent of the time, and four or more units were dispatched 3 percent of the time.
- For structure fire calls, four or more units were dispatched 63 percent of the time.
- For outside fire calls, one unit was dispatched 25 percent of the time and two units were dispatched 42 percent of the time.
- On average, 2.1 units were dispatched per EMS call.
- A total of 57 EMS calls (1 percent) had no ambulance or rescue unit dispatched and were responded by fire apparatus acting as MFR (medical first responder). For the rest of the 4,675 EMS calls, one ambulance or rescue unit was dispatched to 90 percent of the calls. Two ambulances or rescue units were dispatched to 8 percent of the calls, three ambulances or rescue units were dispatched to 1 percent of the calls, and four medical units (three ambulances and one heavy rescue) were dispatched to one major MVA call with extrication on June 25, 2011.

TABLE 5: Annual Deployed Time, by Call Type

Call Type	Average Busy Minutes per Run	Annual Busy Hours	Percent of Busy Hours	Busy Hours per Day	Number of Runs	Runs per Day
Cardiac and Stroke	39.6	539	7.2	1.5	817	2.2
Seizure and Unconsciousness	38.0	664	8.9	1.8	1,050	2.9
Breathing Difficulty	36.4	433	5.8	1.2	714	2.0
Overdose and Psychiatric	37.1	294	4.0	0.8	477	1.3
MVA	34.1	1,188	16.0	3.2	2,089	5.7
Fall and Injury	36.3	1,046	14.1	2.9	1,728	4.7
Illness and Other	33.9	1,794	24.1	4.9	3,182	8.7
EMS Total	**35.6**	**5,958**	**80.1**	**16.3**	**10,057**	**27.5**
Structure Fire	59.8	160	2.2	0.4	161	0.4
Outside Fire	30.2	232	3.1	0.6	461	1.3
Hazard	31.9	191	2.6	0.5	359	1.0
False Alarm	16.5	384	5.2	1.0	1,398	3.8
Good Intent	13.9	58	0.8	0.2	249	0.7
Public Service	16.7	250	3.4	0.7	902	2.5
Fire Total	**21.7**	**1,276**	**17.2**	**3.5**	**3,530**	**9.6**
Mutual Aid	49.0	140	1.9	0.4	173	0.5
Canceled	5.1	60	0.8	0.2	709	1.9
Total	**30.8**	**7,434**	**100.0**	**20.3**	**14,469**	**39.5**

Observations:

- Total deployed time for the year, or busy hours, was 7,434 hours. This is the total deployment time of all the units deployed on all type of calls, including 140 hours spent on mutual aid calls and 60 hours on canceled calls.
- There were 14,469 runs, including 173 runs dispatched for mutual aid calls and 709 runs for canceled calls.
- Fire category calls accounted for 17 percent of the total workload.
- There were 622 runs for structure and outside fire calls, with a total workload of 392 hours. This accounted for 5 percent of the total workload. The average busy time for structure fire calls was 59.8 minutes, and the average busy time for outside fire calls was 30.2 minutes.
- EMS calls accounted for 80 percent of the total workload. The average busy time for EMS calls was 35.6 minutes.

TABLE 6: Annual Deployed Hours, by Call Type and District

Call Type	District					
	1	2	3	4	5	6
Cardiac and Stroke	130	101	89	109	32	77
Seizure and Unconsciousness	146	125	108	151	54	81
Breathing Difficulty	128	63	51	94	38	59
Overdose and Psychiatric	92	62	55	42	16	28
MVA	266	201	242	140	193	145
Fall and Injury	278	230	140	180	81	137
Illness and Other	533	318	255	311	142	235
EMS Total	**1,574**	**1,100**	**941**	**1,026**	**556**	**761**
Structure Fire	81	16	15	29	3	17
Outside Fire	81	26	38	32	24	32
Hazard	58	44	24	30	11	24
False Alarm	62	87	81	49	54	52
Good Intent	12	11	14	7	9	6
Public Service	54	41	48	41	21	44
Fire Total	**348**	**225**	**220**	**187**	**121**	**175**
Total	**1,921**	**1,326**	**1,160**	**1,213**	**677**	**936**
Busy Hours per Day	**5.2**	**3.6**	**3.2**	**3.3**	**1.8**	**2.6**
Percentage of Total Busy Hours of Fire Department	**26.6**	**18.3**	**16.0**	**16.8**	**9.4**	**12.9**

Note: A total of three fire and EMS category calls in other districts are not included.

TABLE 7: Number of Runs, by Call Type and District

Call Type	District					
	1	2	3	4	5	6
Cardiac and Stroke	206	168	141	153	44	105
Seizure and Unconsciousness	245	226	177	212	80	110
Breathing Difficulty	223	118	92	138	55	88
Overdose and Psychiatric	155	106	91	60	26	39
MVA	504	384	430	251	291	229
Fall and Injury	464	422	242	265	124	211
Illness and Other	986	621	469	467	241	398
EMS Total	**2,783**	**2,045**	**1642**	**1,546**	**861**	**1180**
Structure Fire	71	19	17	24	10	20
Outside Fire	101	61	98	84	42	75
Hazard	112	68	41	39	32	67
False Alarm	245	308	287	167	182	207
Good Intent	57	47	54	29	28	34
Public Service	208	164	165	146	67	151
Fire Total	**794**	**667**	**662**	**489**	**361**	**554**
Total	**3,577**	**2,712**	**2,304**	**2,035**	**1,222**	**1,734**
Runs per Day	**9.8**	**7.4**	**6.3**	**5.6**	**3.3**	**4.7**
Percentage of Total Runs of Fire Department	**26.3**	**20.0**	**17.0**	**15.0**	**9.0**	**12.8**

Observations:

- Busy time per day of all units averaged 5.2 hours for calls in District 1, which was the highest of all six districts. Busy time per day of all units averaged 3.6 hours for calls in District 2. Busy time per day of all units averaged 3.2 hours for calls in District 3. Busy time per day of all units averaged 3.3 hours for calls in District 4. Busy time per day of all units averaged 1.8 hours for calls in District 5. Busy time per day of all units averaged 2.6 hours for calls in District 6.

- Calls in District 1 accounted for 27 percent of annual busy hours. Calls in District 2 accounted for 18 percent of annual busy hours. Calls in District 3 accounted for 16 percent of annual busy hours. Calls in District 4 accounted for 17 percent of annual busy hours. Calls in District 5 accounted for 9 percent of annual busy hours, and calls in District 6 accounted for 13 percent of annual busy hours.

- Runs per day averaged 9.8 dispatches for calls in District 1. Runs per day averaged 7.4 dispatches for calls in District 2. Runs per day averaged 6.3 dispatches for calls in District 3. Runs per day averaged 5.6 dispatches for calls in District 4. Runs per day averaged 3.3 dispatches for calls in District 5. Runs per day averaged 4.7 dispatches for calls in District 6.

- Runs for calls in District 1 accounted for 26 percent of the total runs. Runs for calls in District 2 accounted for 20 percent of the total runs. Runs for calls in District 3 accounted for 17 percent of the total runs. Runs for calls in District 4 accounted for 15 percent of the total runs. Runs for calls in District 5 accounted for 9 percent of the total runs, and runs for calls in District 6 accounted for 13 percent of the total runs.

Workload by Individual Unit—Calls and Total Time Spent

In this section, the actual time spent by each unit on calls is reported in two types of statistics: workloads and runs.

TABLE 8: Call Workload, by Unit

Station	Unit Type	Unit ID	Average Busy Minutes per Run	Number of Runs	Runs per Day	Busy Minutes per Day	Annual Busy Hours
Central	Engine	E601	20.8	1,685	4.6	96.0	585.6
	Ladder Truck	T601	32.2	240	0.7	21.2	129.3
	Heavy Rescue	S601	25.2	296	0.8	20.5	125.1
	Ambulance	M601	45.5	1,601	4.4	199.3	1215.7
2	Engine	E602	20.8	1,466	4.0	83.4	508.7
	Ambulance	M602	40.9	1,521	4.2	170.4	1039.4
3	Engine	E603	22.2	1,365	3.7	82.8	505.1
	Ladder Truck	T603	21.5	233	0.6	13.7	83.6
	Ambulance	M603	6.6	7	0.0	0.1	0.6
4	Brush Truck	B604	30.7	126	0.3	10.6	64.7
	Engine	E604	21.7	1,217	3.3	72.3	441.0
	Ambulance	M604	51	1,470	4.0	205.5	1253.6
5	Engine	E605	23.5	763	2.1	49.1	299.5
	Ambulance	M605	44.7	570	1.6	69.6	424.6
6	Engine	E606	22.3	1,107	3.0	67.8	413.6
	Ambulance	M616	27.6	15	0.0	1.1	6.7
Reserve	Engine	E619	20.3	493	1.3	27.4	167.1
	Ladder Truck	T619	19.7	63	0.2	3.4	20.7
	Ambulance	M619	43.9	231	0.6	27.8	169.6

Note: Workload of E611 is included as E601. Workload of B601, HM601, and LAR601 is included as T601. Workload of E618 is included as E603. Workload of E616 is included as E606. Workload of M611 is included as M601. Workload of M614 is included as M604. Workload of S611 is included as S601.

Observations:

- Engine E601 made 1,685 runs, averaging 4.6 runs and ninety-six minutes (one hour, thirty-six minutes) of busy time per day.
- Ladder T601 made 240 runs, averaging 0.7 runs and twenty-one minutes of busy time per day.
- Heavy rescue S601 made 296 runs, averaging 0.8 runs and twenty minutes of busy time per day.
- Ambulance M601 made 1,601 runs, averaging 4.4 runs and 199 minutes (three hours, nineteen minutes) of busy time per day.

- Engine E602 made 1,466 runs, averaging 4.0 runs and eighty-three minutes (one hour, twenty-three minutes) of busy time per day.
- Ambulance M602 made 1,521 runs, averaging 4.2 runs and 170 minutes (two hours, fifty minutes) of busy time per day.
- Engine E603 made 1,365 runs, averaging 3.7 runs and eighty-three minutes (one hour, twenty-three minutes) of busy time per day.
- Ladder T603 made 233 runs, averaging 0.6 runs and fourteen minutes of busy time per day.
- Ambulances M603 and M616 combined made twenty-two runs and were busy 7.3 hours during the year.
- Brush engine B604 made 126 runs, averaging 0.3 runs and eleven minutes of busy time per day.
- Engine E604 made 1,217 runs, averaging 3.3 runs and seventy-two minutes (one hour, twelve minutes) of busy time per day.
- Ambulance M604 made 1,470 runs, averaging 4.0 runs and 206 minutes (three hours, twenty-six minutes) of busy time per day.
- Engine E605 made 763 runs, averaging 2.1 runs and forty-nine minutes of busy time per day.
- Ambulance M605 made 570 runs, averaging 1.6 runs and seventy minutes (one hour, ten minutes) of busy time per day.
- Engine E606 made 1,107 runs, averaging 3.0 runs and sixty-eight minutes (one hour, eight minutes) of busy time per day.
- Engine E619 made 493 runs, averaging 1.3 runs and twenty-seven minutes of busy time per day.
- Ladder T619 made sixty-three runs and was busy twenty-one hours.
- Ambulance M619 made 231 runs, averaging 0.6 runs and twenty-eight minutes of busy time per day.

FIGURE 7: Busy Minutes, by Hour of Day

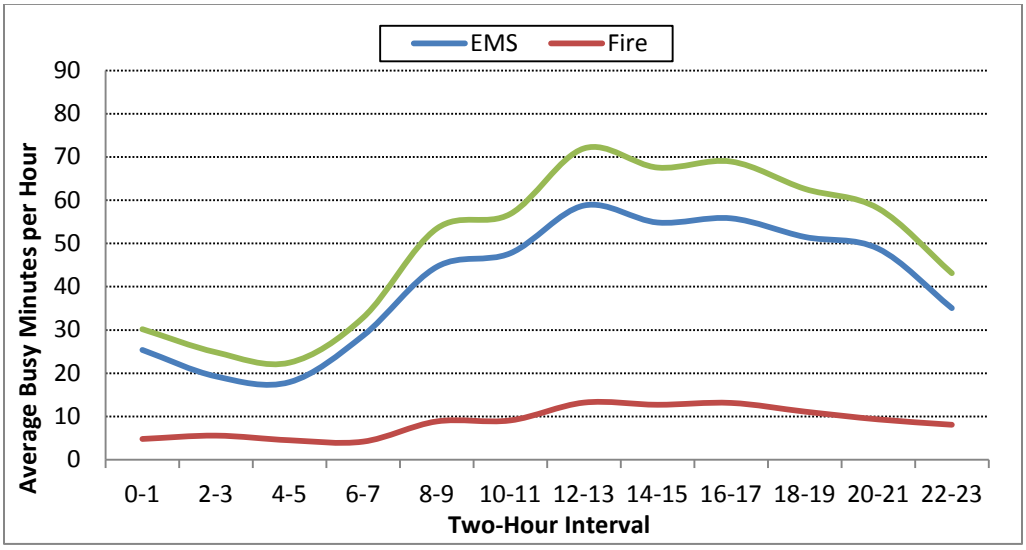


TABLE 9: Busy Minutes, by Hour of Day

Two-Hour Interval	EMS	Fire	Total
0-1	25.4	4.8	30.2
2-3	19.3	5.6	24.8
4-5	18.0	4.5	22.5
6-7	28.7	4.2	32.9
8-9	44.6	8.9	53.4
10-11	47.7	9.1	56.8
12-13	58.8	13.2	72.0
14-15	54.8	12.7	67.6
16-17	55.8	13.1	68.9
18-19	51.5	11.1	62.6
20-21	48.8	9.3	58.1
22-23	35.0	8.1	43.1
Daily Total	976.7	209.1	1185.9

Note: Daily totals shown equal the sum of each column multiplied by two, since each cell represents two hours. Canceled calls are not included.

Observations:

- Hourly busy minutes were the highest between noon and 8:00 p.m., averaging between 62.6 and 72.0 minutes per hour.
- Hourly busy minutes were the lowest between midnight and 8:00 a.m., averaging fewer than 33.0 minutes per hour.

TABLE 10: Fire Equipment: Total Annual and Daily Average Number of Runs, by Call Type

Unit Type	EMS	**Structure Fire**	**Outside Fire**	Hazard	False Alarm	Good Intent	Public Service	Mutual Aid	Canceled	**Total**	**Runs per Day**
E601	1,090	**20**	**59**	88	147	71	172	29	9	**1,685**	**4.6**
T601	40	**24**	**23**	15	35	8	72	9	14	**240**	**0.7**
S601	186	**23**	**22**	13	24	9	6	9	4	**296**	**0.8**
E602	921	**12**	**45**	53	119	79	202	33	2	**1,466**	**4.0**
E603	742	**14**	**45**	31	135	90	229	40	39	**1,365**	**3.7**
T603	83	**6**	**12**	5	24	15	81	7	0	**233**	**0.6**
B604	0	**0**	**76**	3	0	18	8	6	15	**126**	**0.3**
E604	711	**15**	**59**	35	126	87	147	29	8	**1,217**	**3.3**
E605	413	**9**	**20**	22	65	51	153	23	7	**763**	**2.1**
E606	596	**10**	**48**	63	133	40	176	31	10	**1,107**	**3.0**
E619	304	**5**	**21**	20	44	34	48	9	8	**493**	**1.3**
T619	10	**1**	**4**	2	11	4	27	4	0	**63**	**0.2**

Observations:

- Of all fire equipment, engine E601 was dispatched most often. It made 1,685 runs during the year, averaging 4.6 runs per day. However, the vast majority of fire category calls were not actual fires. Actual fire runs occurred on average of once in five days. It also responded to the most of the structure and outside fire calls, seventy-nine calls in a year.

- Engines E602, E603, E604, and E606 were dispatched 1,466, 1,365, 1,217 and 1,107 times during the year respectively, averaging 4.0, 3.7, 3.3 and 3.0 runs per day.

- Heavy rescue unit S601 was dispatched 296 runs during the year, averaging 0.8 runs per day.

- Brush truck B604 was dispatched 126 times during the year, averaging 0.3 times per day.

- Of all three ladders, T601 was dispatched most often; it made 240 runs during the year and averaged 0.7 runs per day. Three ladders (T601, T603, and T619) combined made 536 runs.

TABLE 11: Fire Equipment: Daily Average Deployed Minutes, by Call Type

Unit	EMS	**Structure Fire**	**Outside Fire**	Hazard	False Alarm	Good Intent	Public Service	Mutual Aid	Canceled	**Total**	**Fire Category Calls Percentage**
E601	64.1	**3.3**	**4.7**	7.3	6.5	0.8	7.3	1.2	0.5	**95.7**	**33.0**
T601	2.5	**4.8**	**4.5**	2.0	1.8	0.1	3.0	0.3	2.2	**21.2**	**88.2**
S601	11.7	**3.0**	**1.2**	2.6	0.8	0.2	0.2	0.2	0.6	**20.5**	**42.9**
E602	55.3	**2.8**	**3.6**	4.1	5.3	0.8	9.8	1.3	0.2	**83.2**	**33.5**
E603	50.2	**1.3**	**3.5**	3.1	6.4	1.4	10.9	1.9	3.7	**82.4**	**39.1**
T603	6.0	**0.8**	**0.9**	0.8	1.0	0.1	3.9	0.2	0.0	**13.7**	**56.2**
B604	0.0	**0.0**	**5.9**	0.1	0.0	0.4	0.2	0.1	3.9	**10.6**	**100.0**
E604	45.7	**2.6**	**4.2**	3.7	5.9	1.2	7.4	0.9	0.5	**72.1**	**36.6**
E605	30.8	**1.2**	**1.2**	1.3	3.4	0.7	7.9	1.2	1.2	**48.9**	**100.0**
E606	42.1	**1.9**	**4.3**	3.4	6.0	0.4	7.2	1.0	1.3	**67.6**	**100.0**
E619	17.0	**1.2**	**1.2**	1.6	1.7	0.4	1.9	0.3	1.9	**27.2**	**100.0**
T619	0.6	**0.1**	**0.2**	0.0	0.8	0.0	1.4	0.3	0.0	**3.4**	**100.0**

Note: Fire category calls percentage is the sum of average deployed minutes per day of all fire category calls divided by the total deployed minutes per day.

Observations:

- On average, the busiest fire equipment was engine E601. It was busy an average of ninety-six minutes (one hour, thirty-six minutes) per day. Fire category calls accounted for 33 percent of its daily workload. On average, the unit spent eight minutes per day fighting structure or outside fires.

- Of the three ladders, T601 was the busier unit and averaged twenty-one minutes of busy time per day. On average, the unit spent ten minutes per day fighting structure or outside fires.

- Heavy rescue unit S601 averaged twenty one minutes of busy time per day. Brush truck B604 averaged eleven minutes of busy time per day. On average, it spent 5.9 minutes per day fighting outside fire calls.

TABLE 12: Fire Equipment: Annual Busy Time, by Number of Busy Units

Engine / Ladder / Brush Truck / Heavy Rescue			
Number of Busy Units	**Annual Minutes**	**Annual Hours**	**Percent of Time**
0	380,653	6,344.4	72.2
1	109,556	1,825.9	20.8
2	26,781	446.4	5.1
3	6,619	110.3	1.3
4	1,699	28.3	0.3
5	1,182	19.7	0.2
6	336	5.6	0.1
7	116	1.9	0.0
8	86	1.4	0.0
9	11	0.2	0.0
Total	527,040	8,784	100.0

Observations:

- On average, two or more units (engine, ladder, heavy rescue, and/or brush truck,) were involved simultaneously at calls for one hour once every 14.3 hours.
- On average, two or more units were involved simultaneously at calls for 101 minutes (one hour and forty-one minutes) per day.
- On average, three or more units were involved simultaneously at calls for one hour every 2.2 days.
- On average, three or more units were involved simultaneously at calls for twenty-seven minutes per day.

TABLE 13: Medical Units: Total Annual and Daily Average Number of Runs, by Call Type

Unit	Cardiac and Stroke	Seizure and Unconsciousness	Breathing Difficulty	Overdose and Psychiatric	MVA	Fall and Injury	Illness and Other	Structure and Outside Fire	Fire Other	Mutual Aid	Canceled	**Total**	**Runs per Day**
M601	104	128	123	84	263	244	529	24	53	15	34	**1,601**	**4.4**
M602	105	165	79	74	303	262	408	7	60	10	48	**1,521**	**4.2**
M603	0	0	0	0	1	1	4	0	1	0	0	**7**	**0.0**
M604	133	171	104	55	216	239	425	20	50	15	42	**1,470**	**4.0**
M605	39	40	32	22	160	71	147	5	32	8	14	**570**	**1.6**
M616	0	3	1	0	5	3	2	0	1	0	0	**15**	**0.0**
M619	22	15	16	7	46	39	71	1	6	1	7	**231**	**0.6**

Observations:

- Ambulance M601 was the busiest, making 1,601 runs during the year and averaging 4.4 runs per day.
- Ambulances M602 and M604 were the second and third busiest medical units, averaging 4.2 and 4.0 runs per day, respectively.
- Ambulance M605 made 570 runs in a year, averaging 1.6 runs per day.
- Ambulances M603 and M616 combined made twenty-two runs.

TABLE 14: Medical Units: Daily Average Deployed Minutes, by Call Type

Unit	Cardiac and Stroke	Seizure and Unconsciousness	Breathing Difficulty	Overdose and Psychiatric	MVA	Fall and Injury	Illness and Other	Structure and Outside Fire	Fire Other	Mutual Aid	Canceled	**Total**	**EMS Calls Percentage**
M601	15.9	18.5	17.7	11.5	26.7	33.0	68.1	3.0	0.9	2.7	0.8	**198.8**	**96.7**
M602	15.0	22.2	10.1	8.9	28.5	34.2	47.1	0.8	1.6	0.6	1.0	**170.0**	**98.2**
M603	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	**0.1**	**100.0**
M604	24.1	27.8	16.2	8.8	21.8	35.8	63.4	1.7	1.6	2.9	0.8	**204.9**	**97.0**
M605	6.1	6.1	5.0	2.8	18.1	10.3	18.7	0.6	0.7	0.5	0.6	**69.5**	**97.4**
M616	0.0	0.1	0.0	0.0	0.5	0.3	0.2	0.0	0.0	0.0	0.0	**1.1**	**100.0**
M619	3.5	2.2	2.1	1.2	4.2	5.2	8.8	0.0	0.2	0.2	0.1	**27.7**	**100.0**

Observations:

- Ambulance M604 was the busiest, averaging 205 minutes (three hours, twenty-five minutes) of busy time per day. EMS calls accounted for 97 percent of its daily workload.
- On average, M601, M602, M605, and M619 were busy 199 (three hours, nineteen minutes), 170 minutes (two hours, fifty minutes), 70 minutes (one hour, ten minutes), and 28 minutes per day respectively.
- EMS calls percentage accounted for more than 97 percent of the total workload.

TABLE 15: Medical Units: Annual Busy Time, by Number of Busy Units

Ambulance			
Number of Busy Units	**Annual Minutes**	**Annual Hours**	**Percent of Time**
0	338,232	5,637.2	64.2
1	142,159	2,369.3	27.0
2	37,563	626.1	7.1
3	7,875	131.3	1.5
4	1,008	16.8	0.2
5	195	3.3	0.0
6	7	0.1	0.0
Total	527,040	8,784	100.0

Observations:

- On average, two or more ambulances were involved simultaneously at calls for one hour every 11.3 hours.
- On average, three or more ambulances were involved simultaneously at calls for one hour every two days.
- On average, two or more ambulances were involved simultaneously at calls for 127 minutes (two hours, seven minutes) per day.
- On average, three or more units were involved simultaneously at calls for twenty five minutes per day.

Analysis of Busiest Hours

There is significant variability in the number of calls from hour to hour. One special concern relates to the fire resources available for hours with the heaviest workload. We tabulated the data for each of 8,784 hours in the year. Approximately once every two days the fire department responded to four or more calls in an hour. This is 2 percent of the total number of hours. Here, we report the top ten hours with the most calls received and provide a detailed analysis of two hours with the most calls received.

TABLE 16: Frequency Distribution of the Number of Calls

Number of Calls in an Hour	Frequency	Percentage
0	3,935	44.8
1	2,817	32.1
2	1,334	15.2
3	499	5.7
4	136	1.5
5	45	0.5
6-10	18	0.2

Observations:

- During 698 hours (8 percent of all hours), three or more calls occurred; in other words, the fire department responded to three or more calls in an hour roughly once every thirteen hours.

- During 199 hours (2 percent of all hours), four or more calls occurred; in other words, the fire department responded to four or more calls in an hour roughly once every two days.

TABLE 17: Top 10 Hours with the Most Calls Received

Hour	Number of Calls	Number of Runs	Total Busy Hours
6/21/2011, 11 p.m. to 12 a.m.	9	13	4.9
12/15/2011, 12 p.m. to 1 p.m.	8	16	3.6
7/15/2011, 5 p.m. to 6 p.m.	8	15	6.3
9/7/2011, 3 p.m. to 4 p.m.	7	15	7.6
7/18/2011, 4 p.m. to 5 p.m.	7	13	6.7
4/4/2011, 5 a.m. to 6 a.m.	7	11	6.5
8/22/2011, 9 a.m. to 10 a.m.	7	8	3.6
5/11/2011, 2 p.m. to 3 p.m.	7	7	2.1
9/29/2011, 8 p.m. to 9 p.m.	6	19	11.4
12/14/2011, 12 p.m. to 1 p.m.	6	15	6.9

Note: The combined workload is the total busy minutes spent responding to calls received in the hour, and which may extend into the next hour or hours.

Observations:

- The hour with the most calls received was between 11:00 p.m. and midnight on June 21, 2011. The nine calls involved thirteen individual dispatches. The nine calls included one overdose and psychiatric call, one hazardous condition call, four false alarm calls, one public service call, one mutual aid call, and one canceled call. The combined workload was 292 minutes (four hours, fifty-two minutes). The longest call was the mutual aid structure fire call and took one hour and twenty minutes. The overdose and psychiatric call was responded by three units, and the rest of calls were responded by either one or two units.

- The hour with the most runs and highest combined workload was between 8:00 and 9:00 p.m. on September 29, 2011. The six calls involved nineteen individual dispatches. The six calls included one motor vehicle accident, one structure fire, one false alarm, one public service, and two mutual aid calls. The combined workload was 687 minutes (eleven hours, twenty-seven minutes). The structure fire call involved six units and lasted two hours and eleven minutes and the other five calls each lasted less than an hour.

TABLE 18: Unit Workload Analysis between 11:00 p.m. and 12:00 a.m. on June 21, 2011

Hour	Station	Central				Station 2		Station 3			Station 4			Station 5		Station 6		Number of Busy Units
	Unit	E601	T601	S601	M601	E602	M602	E603	T603	M603	B604	E604	M604	E605	M605	E606	M616	
6/21/2011 11 p.m. to 12 a.m.	0-5												5.0			5.0		2
	5-10					0.3							5.0			5.0		3
	10-15					5.0		2.2					5.0			5.0		4
	15-20					5.0		4.6				2.3	5.0	0.9		5.0		6
	20-25	4.9				5.0						5.0	5.0	5.0		5.0		6
	25-30	5.0				5.0						5.0	5.0	5.0		5.0		6
	30-35	5.0	1.5			4.9						5.0	5.0	5.0		5.0		7
	35-40	5.0	5.0		2.8			2.8				5.0	5.0	5.0		5.0		8
	40-45	5.0	5.0	2.1	5.0			0.3				5.0	2.0			5.0		8
	45-50	5.0	5.0		5.0							5.0				1.1		5
	50-55	5.0	5.0		5.0							1.7						4
	55-60	5.0	5.0		5.0													3
	Total	39.9	26.5	2.1	22.8	25.2		9.9				34.0	42.0	20.9		46.1		

Note: The numbers in the cells are the busy minutes within the five minute block. The cell values greater than 2.5 are coded as red.

Observations:

- A total of nine calls occurred during the hour and included one overdose and psychiatric call, one hazardous condition call, four false alarm calls, one public service call, one mutual aid call, and one canceled call. The longest call was the mutual aid structure fire call, which took one hour and twenty minutes. The overdose and psychiatric call was responded by three units, and the rest of calls were responded by either one or two units.

- During the busiest thirty minutes in the hour (11:15 to 11:45 p.m.), six to eight units were busy simultaneously. Even at the busiest ten minutes, eight units were not involved in any calls. A total of four units were busy for more than thirty minutes.

TABLE 19: Unit Workload Analysis between 8:00 and 9:00 p.m. on September 29, 2011

Hour	Station	Central				Station 2		Station 3			Station 4			Station 5		Station 6		Number of Busy Units
	Unit	E601	T601	S601	M601	E602	M602	E603	T603	M603	B604	E604	M604	E605	M605	E606	M616	
9/29/11 8 p.m. to 9 p.m.	0-5																	0
	5-10																	0
	10-15													4.7	4.7			2
	15-20													3.8	3.4			2
	20-25																	0
	25-30																	0
	30-35																	0
	35-40														1.3	1.3		2
	40-45			0.7		0.7						0.7	0.7	2.3	5.0	5.0		7
	45-50	5.0	2.1	5.0	2.1	5.0	3.4					4.8	5.0	5.0	5.0	5.0		11
	50-55	5.0	5.0	5.0	5.0	5.0	5.0					5.0	5.0	5.0	5.0	5.0		11
	55-60	5.0	5.0	5.0	5.0	3.4	5.0					5.0	3.4	2.4	5.0	5.0		11
	Total	15.0	12.1	15.7	12.1	14.1	13.4					15.5	14.1	23.2	29.4	21.3		

Note: The numbers in the cells are the busy minutes within the five minute block. The cell values greater than 2.5 are coded as red.

Observations:

- A total of six calls occurred during the hour, and included one motor vehicle accident, one structure fire, one false alarm, one public service, and two mutual aid calls. The combined workload was 687 minutes (eleven hours, twenty-seven minutes). The structure fire call involved six units and lasted two hours, eleven minutes; the other five calls lasted less than an hour.

- During the busiest fifteen minutes (8:45 to 9:00 p.m.), eleven units were busy simultaneously. Even at the busiest fifteen minutes, five units were not involved in any calls. No unit was busy for more than thirty minutes.

Dispatch Time and Response Time

This section presents dispatch and response time statistics for different call types and fire units. For most types of calls, the main focus is the dispatch and response time of the first-arriving units. However, for structure and outside fire calls, we also analyze the response time of the second-arriving fire vehicles (no ambulance units).

Different terms are used to describe the components of response time: **Dispatch processing time** is the difference between the unit dispatch time and call received time. **Turnout time** is the difference between the unit time en route and the unit dispatch time. **Travel time** is the difference between the unit on-scene arrival time and the time en route. **Response time** is the difference between the on-scene arrival time and call received time.

Our definition of response time differs from the Frisco Fire Department's current usage. At the moment, the department's reported "response time" does not include dispatch processing time. In this way, it includes only turnout time and travel time.

In this section, a total of 7,139 calls (97 percent of noncanceled calls within Frisco) were used in the analysis. The average dispatch time was 1.3 minutes. The average turnout time was 0.7 minutes, and the average travel time was 4.4 minutes. The average response time for EMS calls was 6.4 minutes, and the average response time for fire category calls was 6.2 minutes. The department's measure of response time, without dispatch processing time, yields an average of 5.1 minutes overall, with 4.9 minutes for EMS calls and 5.6 minutes for fire category calls.

We note that our analysis does not differentiate emergency and non-emergency calls. This decision has a minimal effect on the overall averages. Nevertheless, calls types that are clearly not emergencies, such as public service calls, will show a longer average travel time.

TABLE 20: Average Dispatch, Turnout, Travel, and Response Times of First-Arriving Unit, by Call Type

Call Type	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size
Cardiac and Stroke	0.7	0.7	4.0	5.3	391
Seizure and Unconsciousness	0.8	0.7	4.2	5.7	504
Breathing Difficulty	0.7	0.7	4.1	5.4	347
Overdose and Psychiatric	3.2	0.7	4.3	8.2	223
MVA	2.9	0.7	4.3	8.0	875
Fall and Injury	1.7	0.7	4.1	6.5	812
Illness and Other	1.2	0.7	4.2	6.1	1,501
EMS Total	**1.6**	**0.7**	**4.2**	**6.4**	**4,653**
Structure Fire	0.9	1.0	4.6	6.5	35
Outside Fire	0.8	0.8	4.7	6.3	181
Hazard	0.9	0.7	4.6	6.1	305
False Alarm	0.6	0.7	4.7	6.1	1,047
Good Intent	0.8	0.7	4.9	6.5	162
Public Service	0.8	0.6	5.0	6.4	756
Fire Total	**0.7**	**0.7**	**4.8**	**6.2**	**2,486**
Total	**1.3**	**0.7**	**4.4**	**6.4**	**7,139**

FIGURE 8: Average Dispatch, Turnout, and Travel Times of First-Arriving Unit, by EMS Call Type

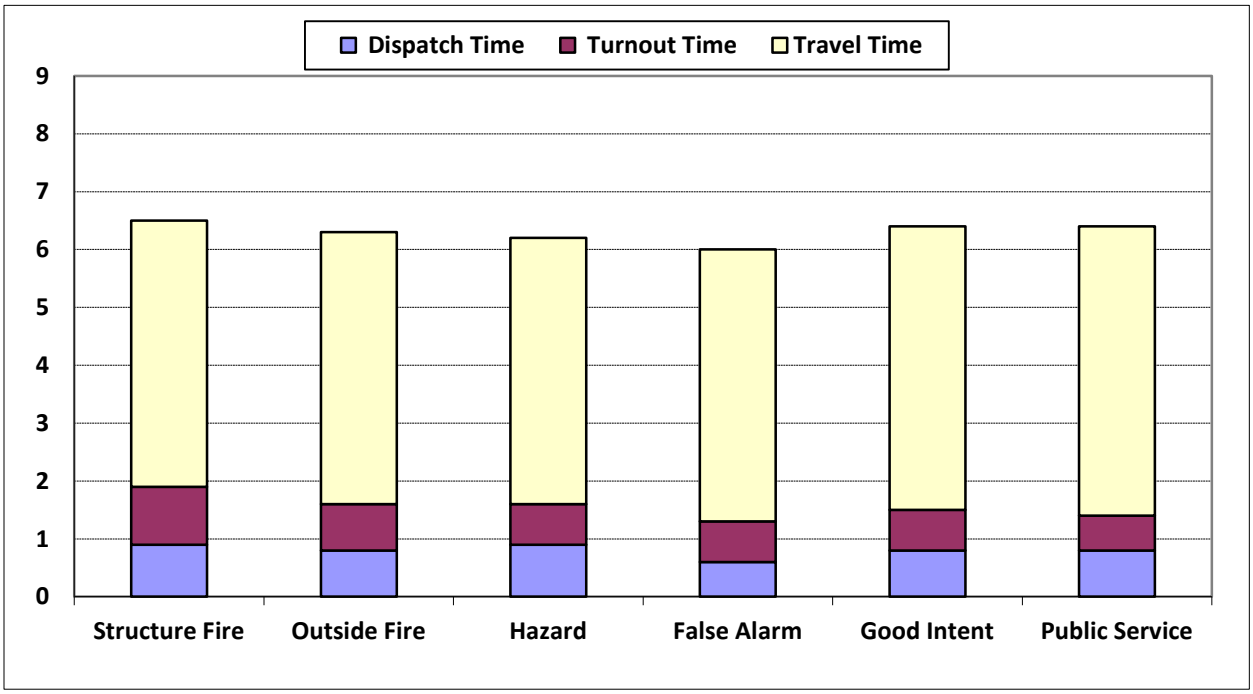
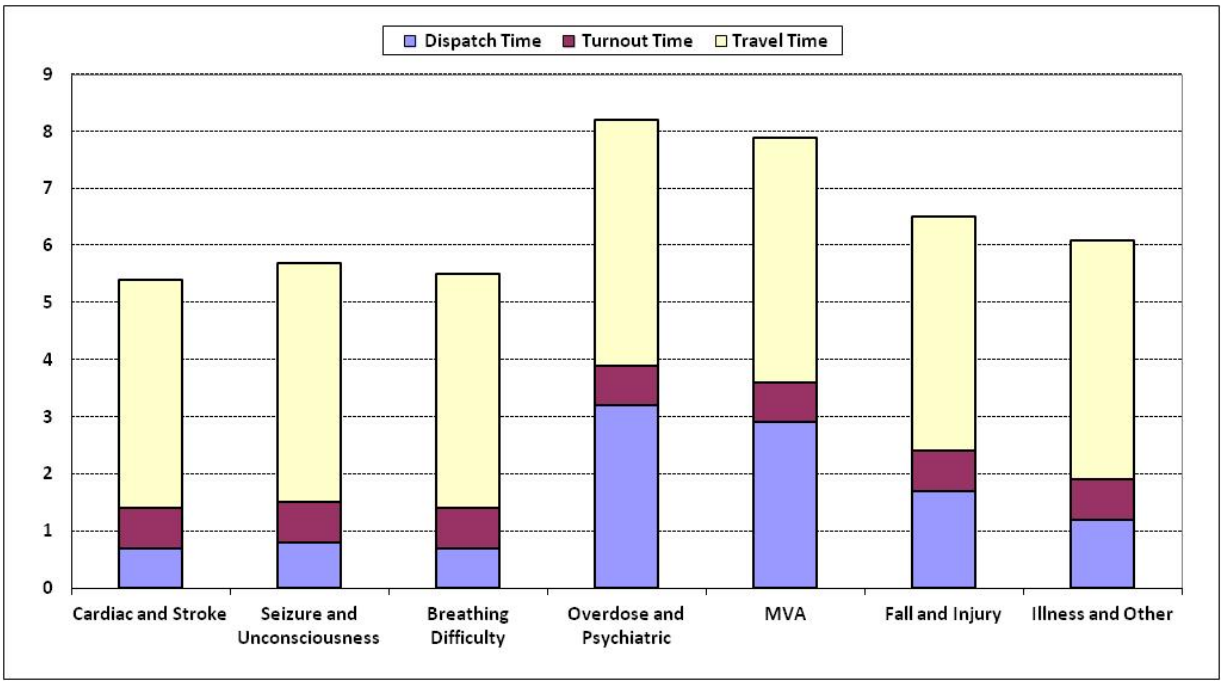


FIGURE 9: Average Dispatch, Turnout, and Travel Times of First-Arriving Unit, by Fire Call Type



Observations:

- The average dispatch time was 1.3 minutes.
- *For certain call types, dispatchers will immediately send police units and only later determine that a fire or EMS unit is required. This leads to a longer dispatch processing time for these calls. In particular, dispatch time for overdose and psychiatric calls and motor vehicle accident calls was significantly longer than other type of calls, averaging 3.2 and 2.9 minutes, respectively.*
- The average turnout time was 0.7 minutes.
- The average travel time was 4.4 minutes.
- The average response time for EMS calls was 6.4 minutes.
- The average response time for fire category calls was 6.2 minutes.
- The average response time for structure fire calls was 6.5 minutes.
- The average response time for outside fire calls was 6.3 minutes.

TABLE 21: 90th Percentile Dispatch, Turnout, Travel, and Response Times of First-Arriving Unit, by Call Type

Note: The 90th percentile response time is not equal to the sum of 90th percentile of dispatch time, turnout time, and travel time.

Call Type	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size
Cardiac and Stroke	0.9	1.1	6.2	7.5	391
Seizure and Unconsciousness	1.1	1.0	6.5	8.1	504
Breathing Difficulty	0.9	1.1	6.0	7.3	347
Overdose and Psychiatric	15.0	1.1	6.0	18.6	223
MVA	10.9	1.2	7.4	15.5	875
Fall and Injury	3.4	1.1	6.2	10.3	812
Illness and Other	1.5	1.1	6.4	8.9	1,501
EMS Total	**2.9**	**1.1**	**6.5**	**10.0**	**4,653**
Structure Fire	1.6	1.9	7.0	9.1	35
Outside Fire	1.2	1.1	7.1	8.8	181
Hazard	1.3	1.0	6.5	8.4	305
False Alarm	1.0	1.1	7.2	8.7	1,047
Good Intent	1.3	1.1	7.3	9.1	162
Public Service	1.1	1.0	8.3	9.9	756
Fire Total	**1.1**	**1.1**	**7.4**	**9.0**	**2,486**
Total	**2.0**	**1.1**	**6.9**	**9.5**	**7,139**

Observations:

- The 90th percentile dispatch time was 2.0 minutes.
- The 90th percentile dispatch time for overdose and psychiatric and motor vehicle accident calls was significantly longer than other type of calls, for the reasons described previously.
- The 90th percentile turnout time was 1.1 minutes.
- The 90th percentile travel time was 6.9 minutes.
- The 90th percentile response time for EMS calls was 10.0 minutes.
- The 90th percentile response time for fire category calls was 9.0 minutes.
- The 90th percentile response time for structure fire calls was 9.1 minutes.
- The 90th percentile response time for outside fire calls was 8.8 minutes.

TABLE 22: Response Times of First-Arriving Unit, by Call Type and District

Call Type	District					
	1	2	3	4	5	6
Cardiac and Stroke	5.4	4.8	5.1	5.8	5.6	5.6
Seizure and Unconsciousnes	5.7	4.6	4.8	6.6	7.5	5.9
Breathing Difficulty	5.5	4.6	5.2	6.4	4.9	5.5
Overdose and Psychiatric	8.0	8.9	9.2	8.1	8.6	5.3
MVA	8.0	6.7	8.3	7.7	8.8	8.6
Fall and Injury	6.9	5.7	6.4	7.1	6.9	6.4
Illness and Other	6.2	5.6	5.5	7.2	6.3	5.5
EMS Total	**6.6**	**5.7**	**6.3**	**7.0**	**7.2**	**6.3**
Structure Fire	6.9	5.6	6.4	4.9	9.5	5.9
Outside Fire	6.2	5.7	6.2	6.4	6.5	6.9
Hazard	5.8	5.9	7.3	6.9	6.7	5.7
False Alarm	6.2	5.4	5.9	6.8	6.8	5.8
Good Intent	7.0	5.9	6.3	6.7	6.3	6.6
Public Service	6.0	5.6	6.4	8.1	6.8	5.9
Fire Total	**6.1**	**5.6**	**6.2**	**7.2**	**6.8**	**5.9**
Total	**6.4**	**5.7**	**6.3**	**7.1**	**7.0**	**6.1**
90th Percentile Response Time	**9.2**	**8.0**	**9.3**	**10.6**	**9.9**	**8.8**
Sample Size	**1,810**	**1,412**	**1,192**	**1,085**	**685**	**955**

Observations:

- The average response time for calls in District 1 was 6.4 minutes and 90th percentile response time was 9.2 minutes.
- Calls in District 2 had the fastest average response time of 5.7 minutes and the fastest 90th percentile response time of 8.0 minutes.
- The average response time for calls in District 3 was 6.3 minutes and 90th percentile response time was 9.3 minutes.
- The average response time for calls in District 4 was 7.1 minutes and 90th percentile response time was 10.6 minutes.
- The average response time for calls in District 5 was 7.0 minutes and 90th percentile response time was 9.9 minutes.
- The average response time for calls in District 6 was 6.1 minutes and 90th percentile response time was 8.8 minutes

FIGURE 10: Average Dispatch, Turnout, Travel, and Response Time of First-Arriving Unit, by Hour of Day

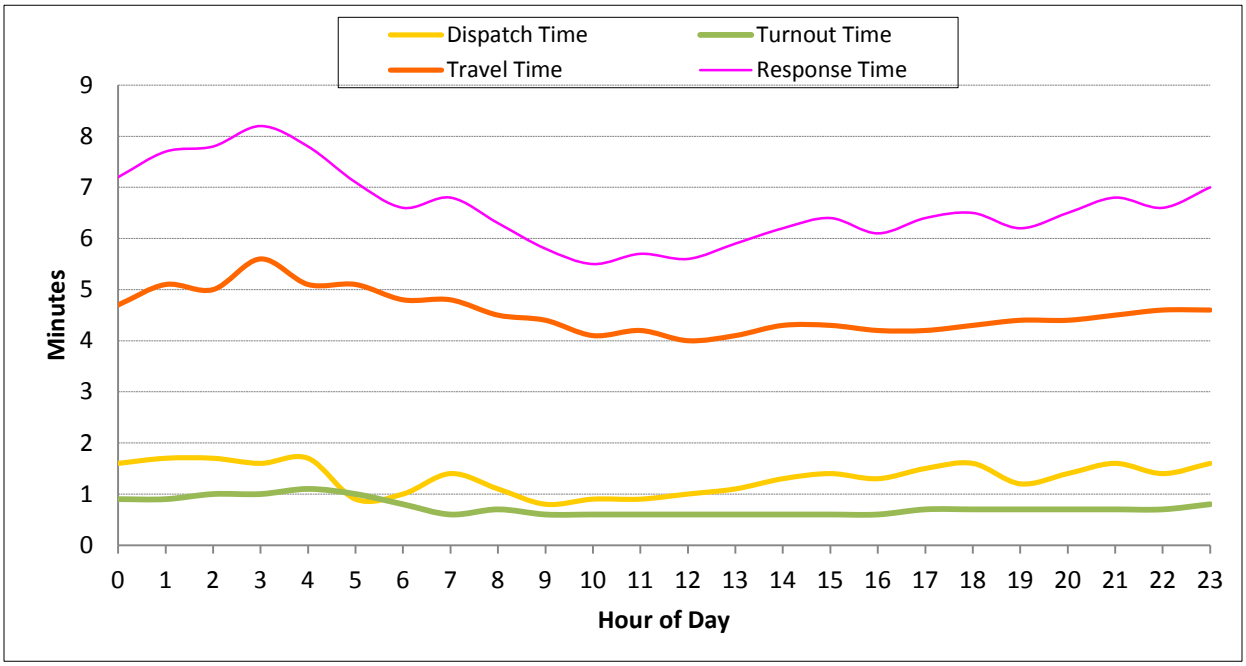


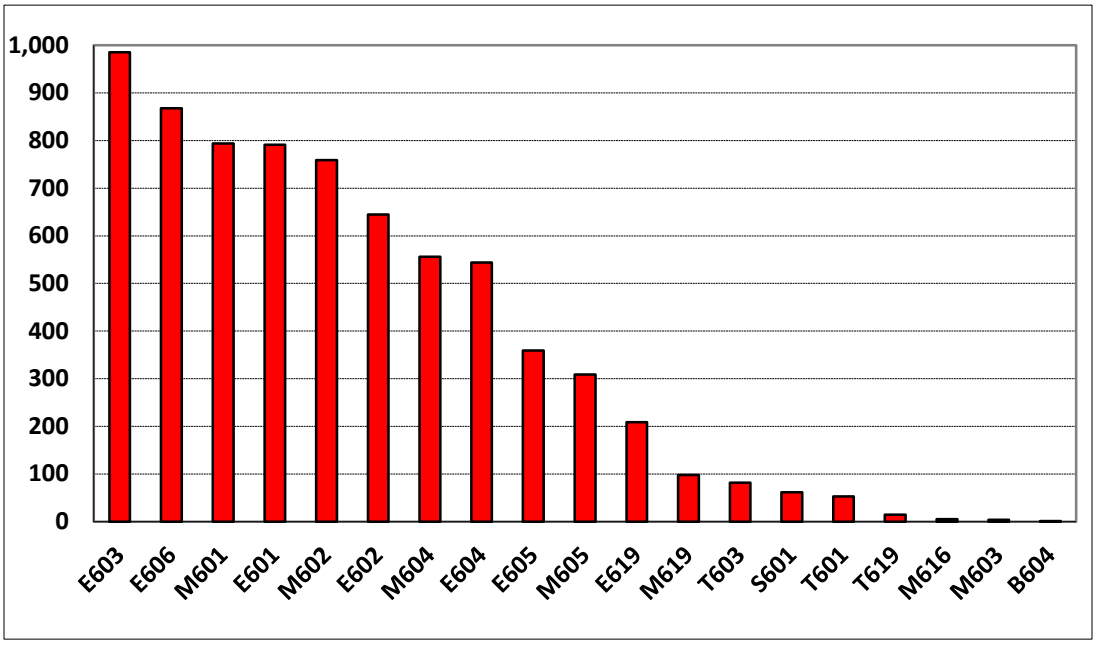
TABLE 23: Average Dispatch, Turnout, Travel, and Response Times of First-Arriving Unit, by Hour of Day

Hour	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size
0	1.6	0.9	4.7	7.2	178
1	1.7	0.9	5.1	7.7	159
2	1.7	1.0	5.0	7.8	134
3	1.6	1.0	5.6	8.2	105
4	1.7	1.1	5.1	7.8	98
5	0.9	1.0	5.1	7.1	127
6	1.0	0.8	4.8	6.6	152
7	1.4	0.6	4.8	6.8	237
8	1.1	0.7	4.5	6.3	300
9	0.8	0.6	4.4	5.8	353
10	0.9	0.6	4.1	5.5	355
11	0.9	0.6	4.2	5.7	378
12	1.0	0.6	4.0	5.6	434
13	1.1	0.6	4.1	5.9	398
14	1.3	0.6	4.3	6.2	401
15	1.4	0.6	4.3	6.4	409
16	1.3	0.6	4.2	6.1	434
17	1.5	0.7	4.2	6.4	446
18	1.6	0.7	4.3	6.5	433
19	1.2	0.7	4.4	6.2	402
20	1.4	0.7	4.4	6.5	349
21	1.6	0.7	4.5	6.8	352
22	1.4	0.7	4.6	6.6	285
23	1.6	0.8	4.6	7.0	220
Total	1.3	0.7	4.4	6.4	7,139

Observations:

- Average dispatch time was between 0.8 and 1.7 minutes.
- Average turnout time was between 0.6 and 1.1 minutes. Between midnight and 6:00 a.m., the average turnout time was consistently more than 0.9 minutes.
- Average travel time was between 4.0 and 5.6 minutes.
- Average response time was between 5.5 and 8.2 minutes. Between midnight and 6 a.m., the average response time was consistently more than 7.1 minutes.

FIGURE 11: Number of Total Calls, by First-Arriving Unit



Note: Figure 11 and Table 24 include calls of the first-arriving unit which had valid unit on-scene time.

TABLE 24: Number of Total Calls, by First-Arriving Unit

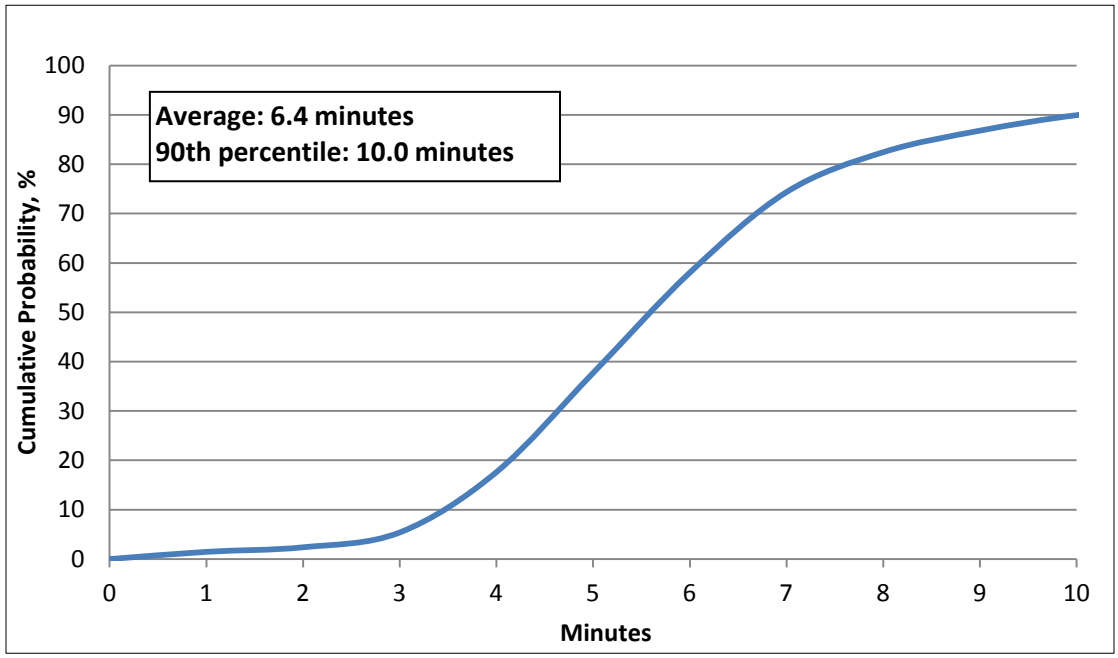
Unit	EMS	Structure and Outside Fire	Fire Other	Total	Percentage	Cumulative Percentage
E603	560	35	390	985	13.8	13.8
E606	472	36	360	868	12.2	26.0
M601	780	1	13	794	11.1	37.1
E601	372	38	381	791	11.1	48.2
M602	739	1	19	759	10.6	58.8
E602	264	29	352	645	9.0	67.8
M604	544	2	10	556	7.8	75.6
E604	217	37	290	544	7.6	83.2
E605	101	15	243	359	5.0	88.3
M605	302	1	6	309	4.3	92.6
E619	100	9	100	209	2.9	95.5
M619	97	0	1	98	1.4	96.9
T603	42	3	37	82	1.1	98.0
S601	39	6	17	62	0.9	98.9
T601	12	2	39	53	0.7	99.6
T619	3	0	12	15	0.2	99.9
M616	5	0	0	5	0.1	99.9
M603	4	0	0	4	0.1	100.0
B604	0	1	0	1	0.0	100.0

Observations:

- Engine E603 arrived first on scene most often, followed by engine E606, ambulance M601, engine E601, and ambulance M602. The top five first-arriving units accounted for 59 percent of the first arrivals at calls.

- For structure and outside fire calls, engine E601, engine E604, engine E606, and engine E603, in that order, were the first units on scene most often.

FIGURE 12: Cumulative Distribution Function (CDF) of Response Time of First-Arriving Unit for EMS Calls



Reading the CDF Chart: The vertical axis is the probability or percentage of calls. The horizontal axis is response time. For example, with regard to EMS calls, the 0.9 probability line intersects the graph at the time mark at about 10.0 minutes. This means that units had a response time of less than 10.0 minutes for 90 percent of these calls.

FIGURE 13: Frequency Distribution Chart of Response Time of First-Arriving Unit for EMS Calls

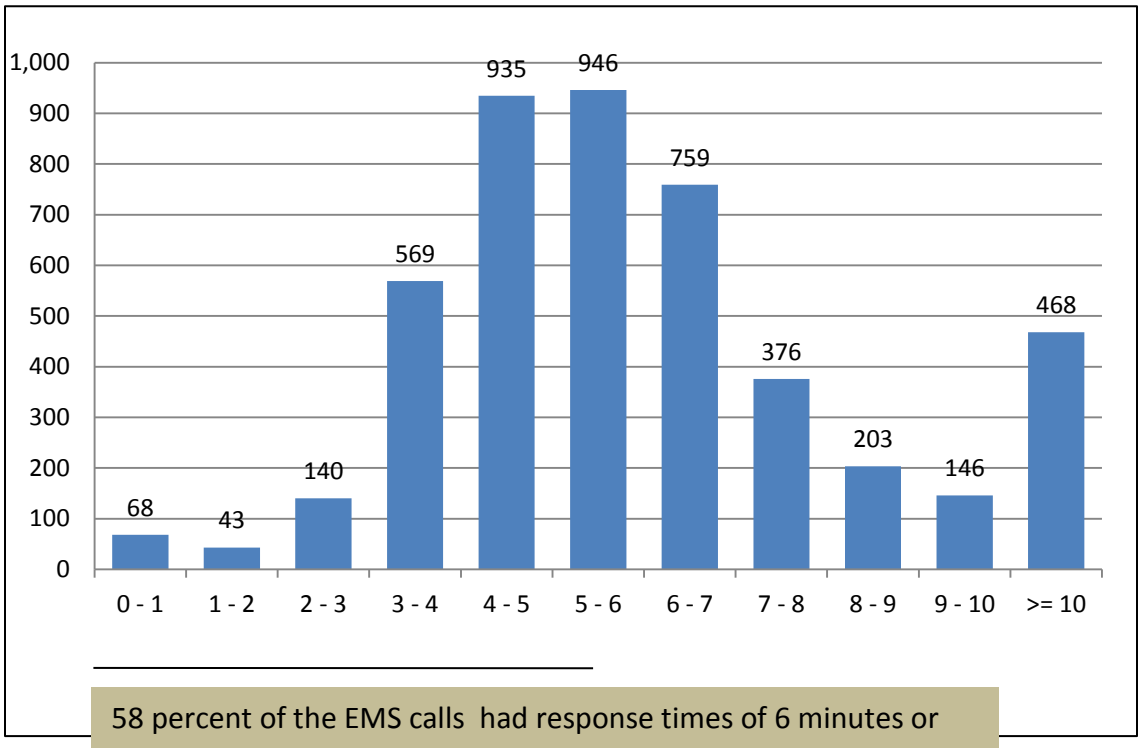


TABLE 25: Cumulative Distribution Function (CDF) of Response Time of First-Arriving Unit for EMS Calls

Response Time (minute)	Frequency	Cumulative Percentage
0–1	68	1.5
1–2	43	2.4
2–3	140	5.4
3–4	569	17.6
4–5	935	37.7
5–6	946	58.0
6–7	759	74.4
7–8	376	82.4
8–9	203	86.8
9–10	146	89.9
10–11	80	91.7
11–12	54	92.8
12–13	39	93.7
13–14	26	94.2
14–15	29	94.8
>15	240	100

Observations:

- The average response time for EMS calls was 6.4 minutes.
- For 58 percent of EMS calls, the response time was less than 6.0 minutes.
- For 90 percent of EMS calls, the response time was less than 10.0 minutes.

Response Time Analysis for Structure and Outside Fire Calls

The following tables and charts report response time analysis of first- and second-arriving units for structure and outside fire calls. The analysis focuses on the arrival of firefighting equipment, including engines, brush truck, and ladders. The response time analysis does **not** include dispatched ambulances for structure and outside fire calls, since they typically arrive with the engine company based in the same station. Heavy rescue is not included because it does not carry water.

TABLE 26: Average Response Time for Structure and Outside Fire Calls, by First-Arriving Fire Unit

Unit Type	First-Arriving Unit	Outside Fire		Structure Fire		Total	
		Response Time	Number of Calls	Response Time	Number of Calls	Response Time	Number of Calls
Brush Truck	B604	10.8	2	NA	0	10.8	2
Engine	E601	6.2	33	7.1	10	6.4	43
	E602	5.6	27	4.8	4	5.5	31
	E603	6.0	30	6.4	6	6.1	36
	E604	6.4	33	6.5	4	6.5	37
	E605	6.2	12	9.5	3	6.8	15
	E606	6.9	32	5.6	4	6.7	36
	E619	7.0	8	5.2	1	6.8	9
Ladder Truck	T601	7.0	1	7.0	3	7.0	4
	T603	8.1	2	NA	0	8.1	2
Total		**6.4**	**180**	**6.6**	**35**	**6.4**	**215**

Observations:

- For outside fire calls, the average response time of the first-arriving firefighting equipment was 6.4 minutes.
- For outside fire calls, engine E601 and engine E604 were the first units on scene most often and had an average response time of 6.4 minutes and 6.2 minutes, respectively.
- For structure fire calls, the average response time of first-arriving firefighting equipment was 6.6 minutes.
- For structure fire calls, engine E601 was the first unit on scene most often and had an average response time of 7.1 minutes.

TABLE 27: Average Response Time for Structure and Outside Fire Calls, by Second-Arriving Fire Unit

Unit Type	Second-Arriving Unit	Outside Fire		Structure Fire		Total	
		Response Time	Number of Calls	Response Time	Number of Calls	Response Time	Number of Calls
Brush Truck	B604	10.7	20	NA	0	10.7	20
Engine	E601	7.9	10	7.5	2	7.9	12
	E602	6.7	6	6.0	1	6.6	7
	E603	8.6	8	NA	0	8.6	8
	E604	7.2	4	NA	0	7.2	4
	E605	9.6	1	NA	0	9.6	1
	E606	8.7	7	8.0	3	8.5	10
	E619	10.2	6	5.1	1	9.5	7
Ladder Truck	T601	7.0	5	9.8	10	8.9	15
	T603	6.0	7	6.6	4	6.3	11
	T619	12.4	1	6.9	1	9.6	2
Total		**8.7**	**75**	**8.2**	**22**	**8.6**	**97**

Observations:

- The average response time of the second-arriving unit for outside fire calls was 8.7 minutes, compared to 6.4 minutes for the first-arriving unit.
- The average response time of the second-arriving unit for structure fire calls was 8.2 minutes, compared to 6.6 minutes for the first-arriving unit.

FIGURE 14: Cumulative Distribution Function (CDF) of Response Time of First- and Second-Arriving Fire Units for Structure Fire Calls

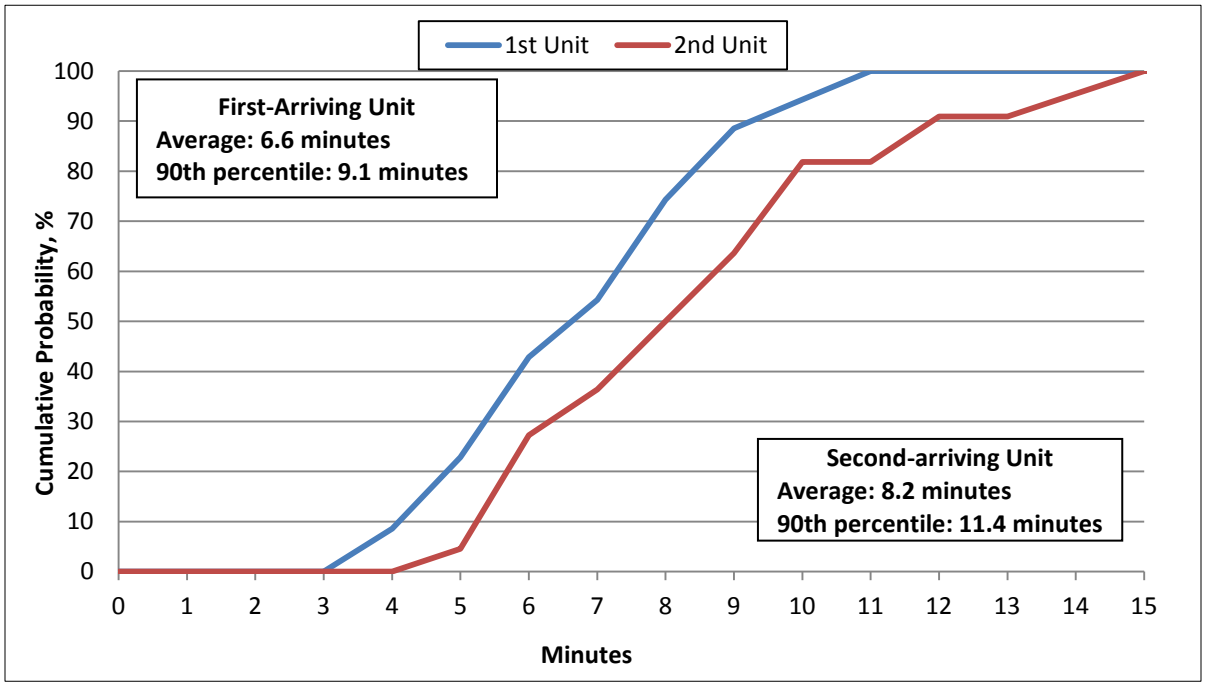


FIGURE 15: Frequency Distribution Chart of Response Time of First-Arriving Unit for Structure Fire Calls

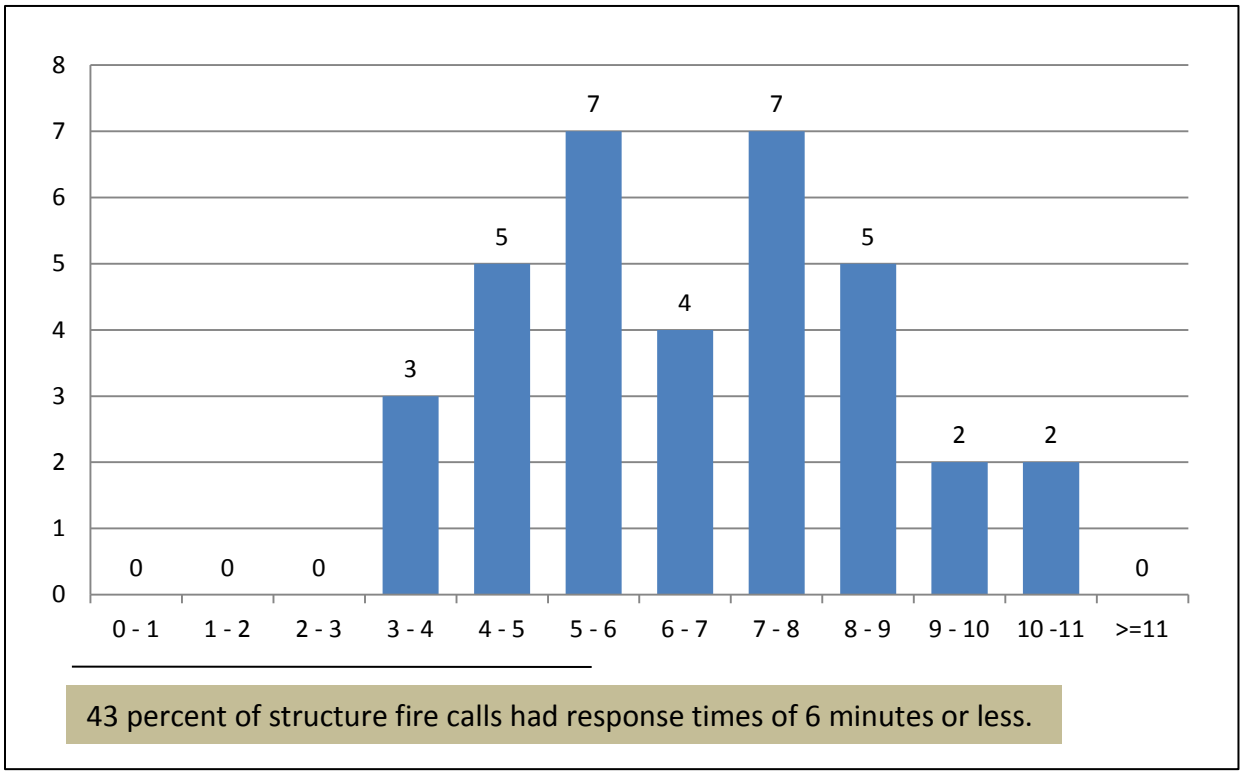


TABLE 28: Cumulative Distribution Function (CDF) of Response Time of First- and Second-Arriving Fire Units for Structure Fire Calls

Response Time (minute)	First Unit		Second Unit	
	Frequency	Cumulative Percent	Frequency	Cumulative Percent
0–1	0	0.0	0	0.0
1–2	0	0.0	0	0.0
2–3	0	0.0	0	0.0
3–4	3	8.6	0	0.0
4–5	5	22.9	1	4.5
5–6	7	42.9	5	27.3
6–7	4	54.3	2	36.4
7–8	7	74.3	3	50.0
8–9	5	88.6	3	63.6
9–10	2	94.3	4	81.8
10–11	2	100.0	0	81.8
>11	0	100.0	4	100.0

Observations:

- The average response time of the first-arriving fire unit for structure fire calls was 6.6 minutes.
- Forty-three percent of the time, the first fire unit's response time was less than 6.0 minutes.
- Ninety percent of the time, the first fire unit's response time was less than 9.1 minutes.
- On average, the response time of the second-arriving unit was 8.2 minutes, which was 1.6 minutes longer than that of the first-arriving unit.

FIGURE 16: Cumulative Distribution Function (CDF) of Response Time of First- and Second-Arriving Fire Units for Outside Fire Calls

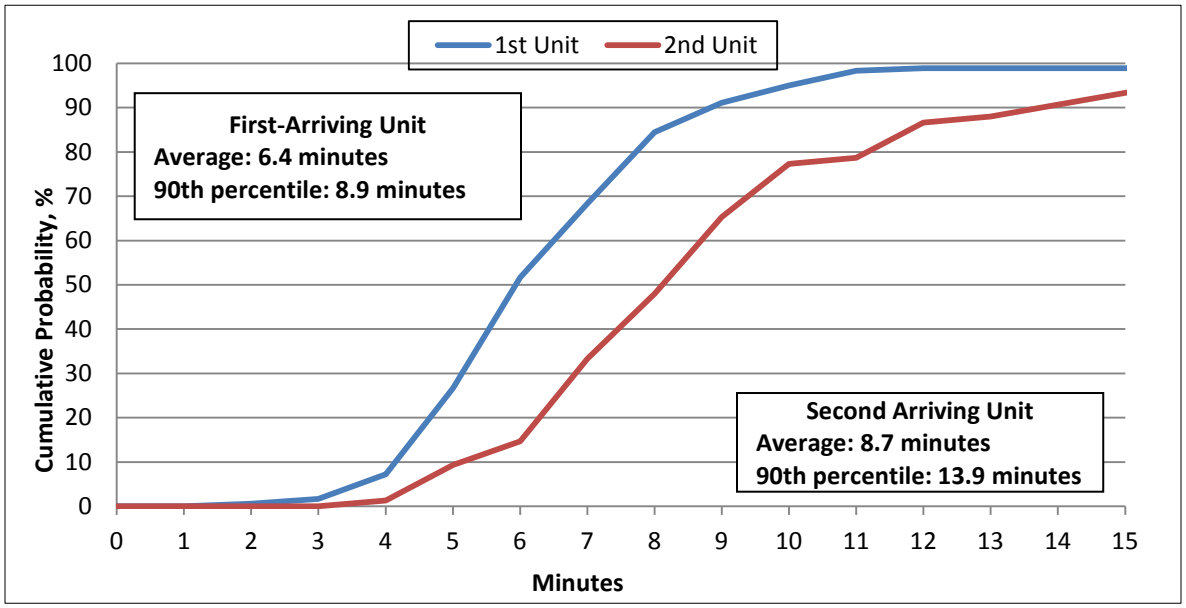
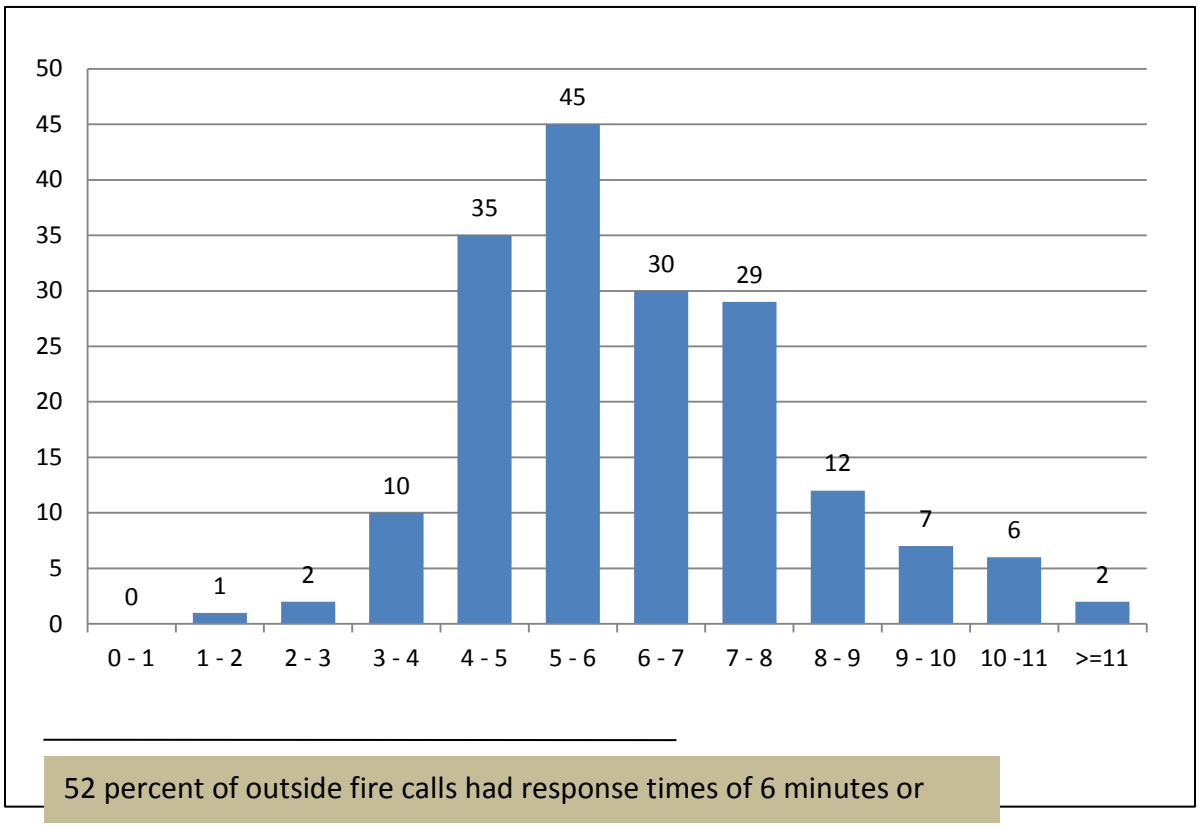


FIGURE 17: Frequency Distribution Chart of Response Time of First-Arriving Unit for Outside Fire Calls



52 percent of outside fire calls had response times of 6 minutes or

TABLE 29: Cumulative Distribution Function (CDF) of Response Time of First- and Second-arriving Fire Units for Outside Fire Calls

Response Time (minute)	First Unit		Second Unit	
	Frequency	Cumulative Percent	Frequency	Cumulative Percent
0–1	0	0.0	0	0.0
1–2	1	0.6	0	0.0
2–3	2	1.7	0	0.0
3–4	10	7.2	1	1.3
4–5	35	26.7	6	9.3
5–6	45	51.7	4	14.7
6–7	30	68.3	14	33.3
7–8	29	84.4	11	48.0
8–9	12	91.1	13	65.3
9–10	7	95.0	9	77.3
10–11	6	98.3	1	78.7
>11	2	100	17	100.0

Observations:

- The average response time of the first-arriving fire unit for outside fire calls was 6.4 minutes.
    - Fifty-two percent of the time, the first fire unit's response time was less than 6.0 minutes.
    - Ninety percent of the time, the first fire unit's response time was less than 8.9 minutes.
    - On average, the response time of the second-arriving unit was 8.7 minutes, which was 2.4 minutes longer than that of the first-arriving unit.

Appendix A: Workload Analysis for Administrative Units

Unit Description	Unit	Number of Runs	Annual Busy Hours
Fire Marshal	678	37	58.6
	719	5	4.5
	723	1	0.7
	C604	23	31.4
	C615	35	60.5
Chief	C601	14	10.3
	C603	49	30.4
	C606	38	19.7
	C607	1	0.1
Battalion Chief	BC601	552	248.9
	BC611	17	4.3
Command and Communications	CCOM601	3	11.7
Utility (Pickup truck)	U707	1	0.9
	U704	1	1.0
Total		777	483

Appendix B: Correspondence between NFIRS Incident Type and Call Type

Call Type	NFIRS Incident Type	Incident Description
EMS	300	Rescue, EMS incident, other
	311	Medical assist, assist EMS crew
	321	EMS call, excluding vehicle accident with injury
	322	Motor vehicle accident with injuries
	323	Motor vehicle/pedestrian accident (MV Ped)
	324	Motor vehicle accident with no injuries.
	331	Lock-in (if lock out , use 511)
	351	Extrication of victim(s) from building/structure
	352	Extrication of victim(s) from vehicle
	353	Removal of victim(s) from stalled elevator
	354	Trench/below-grade rescue
	356	High-angle rescue
Structure Fire	111	Building fire
	113	Cooking fire, confined to container
	118	Trash or rubbish fire, contained
Outside Fire	100	Fire, other
	130	Mobile property (vehicle) fire, other
	131	Passenger vehicle fire
	132	Road freight or transport vehicle fire
	140	Natural vegetation fire, other
	142	Brush or brush-and-grass mixture fire
	143	Grass fire
	150	Outside rubbish fire, other
	151	Outside rubbish, trash or waste fire
	154	Dumpster or other outside trash receptacle fire
	155	Outside stationary compactor/compacted trash fire
	160	Special outside fire, other
	161	Outside storage fire
	162	Outside equipment fire
	163	Outside gas or vapor combustion explosion
	170	Cultivated vegetation, crop fire, other
	173	Cultivated trees or nursery stock fire
Hazard	221	Overpressure rupture of air or gas pipe/pipeline
	251	Excessive heat, scorch burns with no ignition
	400	Hazardous condition, other
	410	Combustible/flammable gas/liquid condition, other
	411	Gasoline or other flammable liquid spill
	412	Gas leak (natural gas or LPG)
	413	Oil or other combustible liquid spill
	420	Toxic condition, other

	421	Chemical hazard (no spill or leak)
	422	Chemical spill or leak
	424	Carbon monoxide incident
	440	Electrical wiring/equipment problem, other
	441	Heat from short circuit (wiring), defective/worn
	442	Overheated motor
	443	Breakdown of light ballast
	444	Power line down
	445	Arcing, shorted electrical equipment
	451	Biological hazard, confirmed or suspected
	481	Attempt to burn
False Alarm	700	False alarm or false call, other
	710	Malicious, mischievous false call, other
	730	System malfunction, other
	731	Sprinkler activation due to malfunction
	733	Smoke detector activation due to malfunction
	734	Heat detector activation due to malfunction
	735	Alarm system sounded due to malfunction
	736	CO detector activation due to malfunction
	740	Unintentional transmission of alarm, other
	741	Sprinkler activation, no fire - unintentional
	742	Extinguishing system activation
	743	Smoke detector activation, no fire - unintentional
	744	Detector activation, no fire - unintentional
	745	Alarm system activation, no fire - unintentional
	746	Carbon monoxide detector activation, no CO
Good Intent	600	Good intent call, other
	631	Authorized controlled burning
	632	Prescribed fire
	641	Vicinity alarm (incident in other location)
	650	Steam, other gas mistaken for smoke, other
	651	Smoke scare, odor of smoke
	652	Steam, vapor, fog or dust thought to be smoke
	653	Smoke from barbecue, tar kettle
	671	HazMat release investigation w/no HazMat
Public Service	500	Service Call, other
	510	Person in distress, other
	511	Lock-out
	512	Ring or jewelry removal
	520	Water problem, other
	521	Water evacuation
	522	Water or steam leak
	531	Smoke or odor removal
	540	Animal problem, other
	542	Animal rescue
	550	Public service assistance, other
	551	Assist police or other governmental agency
	553	Public service

	554	Assist invalid
	555	Defective elevator, no occupants
	561	Unauthorized burning
	814	Lightning strike (no fire)
	900	Special type of incident, other
	911	Citizen complaint
Canceled	611	Dispatched & canceled en route
	621	Wrong location
	622	No incident found on arrival at dispatch address

Note: We first use mutual aid field to identify mutual aid calls. We use chief complaint field to further categorize EMS call types; the chief complaints fields are too detailed to be included in this table. The correspondence can be provided upon request.