Operations and Data Analysis Report
Fire and Emergency Medical Services
Johnson City, Tennessee
January 2014

Final Report

FIRE/EMS OPERATIONS

CENTER FOR PUBLIC SAFETY MANAGEMENT

Submitted by and reply to:
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ICMA
Leaders at the Core of Better Communities

General Information

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 assisting local governments in providing services to their citizens in an efficient and effective manner. Our 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 critical 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. For example, we are involved in a major library research project funded by the Bill & Melinda Gates Foundation and are providing community policing training in El Salvador, Mexico, and Panama with funding from the United States Agency for International Development. We have personnel in Afghanistan helping to build wastewater treatment plants and have teams working with the United States Southern Command (SOUTHCOM) in Central America on conducting assessments and developing training programs for disaster preparedness.

ICMA Center for Public Safety Management

The ICMA *Center for Public Safety Management* (ICMA/CPSM), one of four centers within ICMA's U.S. Programs Division, provides 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 is also involved in police and fire chief selection, assisting local governments in identifying these critical managers 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 and best practices. We have conducted approximately 140 such studies in 90 communities ranging in size from 8,000 population (Boone, Iowa) to 800,000 population (Indianapolis, Indiana).

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, 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 several hundred years of experience leading and managing public safety agencies, and 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 (IAFC), the International Association of Fire Fighters (IAFF), and the Association of Public-Safety Communication Officials International, and through ICMA's Center for Performance Measurement. These performance measures have been developed following decades of research and are applicable in all communities. For this reason, the data 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 with 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. Despite the size and complexity of the documents, a consistent approach to structuring the findings allows for simple, clean reporting. The categories for the performance indicators and the overall structure of the data and documents follow a standard format, but the data and recommendations are unique to the organization under scrutiny.

The team conducts an operational review in conjunction with the data analysis. The performance indicators serve as the basis for the operational review. The review process follows a standardized approach comparable to that of national accreditation agencies. Before the arrival of an on-site team, agencies are asked to provide the team with key operational documents (policies and procedures, asset lists, etc.). The team visits each city to interview fire agency management and supervisory personnel, rank-and-file officers, and local government staff.

The information collected during the site visits and through data analysis results in a set of observations and recommendations that highlight the strengths, weaknesses, and opportunities of – and threats to – the organizations and operations under review. To generate recommendations, the team reviews operational documents; interviews key stakeholders; observes physical facilities; and 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 Management 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/CPSM Project Contributors

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Executive Summary

ICMA was retained by the city of Johnson City, Tenn., to perform an operational analysis of the city's fire department. The analysis is intended to provide the city with an unbiased review of fire services provided by the Johnson City Fire Department (hereinafter, JCFD). This report is the result of the ICMA analysis and is accompanied by recommendations for ways to improve efficiencies and effectiveness in the delivery of services.

This report provides strategic planning points from which the city and the JCFD can further develop and implement our recommendations for continuous department improvement. The report also provides some benchmarking of the city's existing service delivery performance, which was derived from data provided to ICMA by the JCFD. Benchmark performance information can be found in the data tables and the data analysis contained in this report.

To begin the review, the project staff asked the city and the fire department for certain documents, data, and information. The project staff used this information/data to familiarize themselves with the fire department's structure, assets, and operations. The information provided was also used in conjunction with the performance data collected to determine the existing performance of the fire department.

The ICMA project management staff conducted one site visit for the purpose of observing fire department and agency-connected supportive operations; interviewing key city, fire department, and external service provider staff; and reviewing preliminary data and operations.

The ICMA team, while reviewing information and discussing operations with department members, always seeks first to understand the operations, then to identify ways the department can improve efficiency, effectiveness, and safety for both its members as well as the community it serves. ICMA found that the city of Johnson City is not unique, in that it seeks to create a more efficient fire department within existing financial resources and properly and strategically plan for the future.

ICMA found the city has a capable department for the delivery of first response emergency medical services (EMS) and fire services, but there is always room for improvement. Critical areas the ICMA team has identified that need improvement and that resulted in our recommendations are:

- There is a lack of a current, formal strategic and community risk analysis planning, with accompanying performance measures and goals that will assist the JCFD with current operations and critical tasking, and more importantly assist in planning for the future.
- The department needs to evaluate and consider changes to the current deployment plan of apparatus, personnel, and equipment, as well as review certain human resource matters.
- The department needs to review current facility and apparatus infrastructure for improved safety and efficiencies.
- The department should review and consider modifications to its training, pre-fire planning and fire prevention programs.

Further recommendations are discussed in the order in which they appear in this report.

Recommendations

- The JCFD should undertake a capital improvement plan to install automatic auxiliary power systems with uninterrupted power supply (UPS) at all fire stations.
- The JCFD should install decontamination sinks at all fire stations for the purpose of cleaning EMS equipment that may become contaminated during field operations.
- The JCFD should consider the use of smaller, light-chassis rescue trucks that work in tandem with ladder trucks for response to nonemergency or public assist-type responses.
- Johnson City should adopt an apparatus replacement program for future acquisition of fire apparatus and an associated funding method.
- The JCFD should undertake a concerted effort to develop performance measures throughout the organization and which should be utilized to monitor system performance and system outcomes. The process of developing these measures should utilize input from JCFD members, the community, the city commission, and city administration.
- The JCFD should consider pursuing accreditation through the Center for Public Safety Excellence (CPSE) accreditation process.
- The JCFD should consider joint EMS training classes with the Washington County EMS system, with a focus on enhancing EMS training and the co-utilization of joint resources.
- Johnson City should evaluate the option of instituting an internet-based video conferencing system to facilitate real-time interaction between all JCFD fire stations.
- ICMA concurs with the recent upgrade of the Training Lieutenant to Training Captain. We also believe that as a collateral duty the Training Captain should serve to back up and assist the shift Captain in both emergency and administrative duties.
- The City should move expeditiously in the appointment of a permanent Assistant Fire Chief in charge of Operations.
- The JCFD should evaluate options that deploy fewer vehicles on the initial response to both fire and EMS incidents. The city should work with the Washington County Emergency Communications District to adjust run cards for fire calls and to adjust the combined assignment of JCFD and Washington County EMS units to EMS incidents.
- The JCFD should limit the use of overtime to maintain the daily minimum staffing at thirty-one personnel, and should utilize overtime only during peak periods of operation (8:00 a.m. to 8:00 p.m.). During nonpeak periods (8:00 p.m. to 8:00 a.m.), overtime expenditure should be utilized to bring minimum staffing to twenty-nine personnel.
- The JCFD should establish a second Captain position on each shift and should split its service area into two distinct battalions, each with on-duty supervision.
- The JCFD should fully acknowledge the supervisory role of the Sergeant/Engineer, should include this function as a part of the position's job description, and should provide supervisory and tactical safety training for these personnel.

- The JCFD should develop a staffing enhancement program that increases staffing on those two-person engine companies (E-1, E-8, and E-9) that operate in stations as the sole responding unit from that facility.
- The JCFD should consider an alternative staffing model for one of its ladder trucks, utilizing a "jump-squad" that can be deployed to either the ladder truck or a smaller EMS response vehicle, depending on the nature of the call.
- Maintain existing emergency communications with the WCECD and participate in WCECD User-Group once it is established.
- Johnson City should include in the fire department's job descriptions, within the ranks of Firefighter through Captain, the requirement that as a condition of employment these employees possess and maintain a valid EMT certification.
- Johnson City should include in the fire department's job descriptions, within the ranks of Firefighter through Captain, the requirement that these employees annually qualify under the JCFD's adopted physical requirements.
- The JCFD should develop a departmental policy that specifies the scheduling, test components and their weighting, and the eligibility criteria for the Fire Engineer, Lieutenant, and Captain promotional testing. ICMA recommends that promotional testing for Engineer and Lieutenant be held every two years.
- The JCFD should alter its testing process for fire promotional examinations so that the minimum passing score that is utilized in determining eligibility is for the entire testing process and not the written portion of the test alone.
- The Johnson City Human Resources Department along with the JCFD should work cooperatively in the development and administration of all fire promotional exams. The design and makeup of each exam should be done with the assistance of both internal and external subject matter experts for each position being tested.
- The JCFD should implement a supervisory training effort designed to instruct Engineers, Lieutenants, and Captains in the proper techniques for conducting effective performance appraisals.
- JCFD Engineers should be trained and responsible for completing performance appraisals for personnel under their supervision.
- Supervisors in the JCFD should be required as part of the performance appraisal process to meet and document their discussions with each subordinate at least on a quarterly basis.
- The JCFD should eliminate its residency requirements for fire personnel subject to emergency recall.
- The JCFD take-home vehicle policy is viable; the number of vehicles currently authorized and the assignment of personnel to whom they are issued are acceptable and justified.

- The JCFD should ensure that its annual inspection/familiarization process, which places fire companies into these structures for the purpose of updating pre-plans and providing response personnel ongoing familiarization with targeted structures, is carried out in accordance with existing policy.
- The JCFD should evaluate its options to expand the automation of its pre-planning process so that critical occupancy information, including hazardous components and updates regarding inoperable or out-of-service systems, are identified by the system and automatically flagged in order to give responding personnel critical information regarding an occupancy's status or specific hazard.
- The JCFD should develop and institute an ongoing fitness assessment process for its operational personnel in accordance with NFPA 1583. Further, JCFD should consider a partnering effort with neighboring jurisdictions in providing fitness assessments to its personnel.
- ICMA recommends the JCFD fill the vacant Fire Marshal position.
- Johnson City should adopt a Life Safety Code to strengthen enforcement authority and provide guidance for code enforcement efforts in existing buildings throughout their life cycle.
- Johnson City should initiate a comprehensive effort to reduce the number of fire deaths in Johnson City with a three-pronged effort aimed at fire safety in rental properties, expansion of the smoke detector give-away program, and comprehensive public education.
- Johnson City should reevaluate its treatment of Assistant Fire Marshals (and if applicable its personnel assigned to Training) with regard to overtime payment on the basis of the 212-hour work cycle and the firefighters' 7–K Exemption.
- The JCFD should initiate an effort to conduct maintenance inspections by both in-service engine companies and fire inspectors in those occupancies that have fire protection or suppression features that require ongoing maintenance

Organizational Analysis

Governance and Administration

Johnson City, Tennessee

Johnson City is located in the northeastern corner of Tennessee and according to 2010 United State Census data, has a year-round population of 63,152. Johnson City is located in three separate counties—Carter, Sullivan and Washington—with the majority of the city within Washington County. The city is situated in the heart of the Southern Appalachian Mountains, which feature rolling hills, idyllic farm settings, beautiful lakes, rivers, and tumbling mountain streams. Johnson City is part of the "Tri Cities" region of East Tennessee, which includes Kingsport and Bristol. It is a bustling urban center that features East Tennessee State University, the James H. Quillen VA Medical Center, Mountain States Heath Alliance, and a number of major U.S. corporations, including American Water Heater Company, RR Donnelley, Cantech Industries, General Shale and Brick, AT&T Mobility, and Citi Commerce Solutions. Johnson City is bisected by Interstate 26, which connects the city to Kingsport to the north and Ashville, North Carolina and Spartanburg, South Carolina to the south. Interstate 81 is a second main transportation network that intersects I-26 just north of the city, and provides access to Knoxville to the south and a number of major urban centers along the Mid-Atlantic coast and into the northeastern corridor of the U.S.

Johnson City operates under a council/manager form of government, which was adopted in 1939. This form of government combines the political leadership of elected officials in the form of a five-person city commission with the managerial experience of an appointed city administrator. Pursuant to Amendment No. 7 of the Limited Constitutional Convention of Tennessee and a city election in 1955, Johnson City became a Home Rule Municipality, enabling a number of self-executing authorities of governance. Article IX of the charter provides that the city manager is the chief administrative officer of the city, and is appointed by the city commission to administer the affairs of the city other than those exceptions identified in the code.

Johnson City is typical of many cities and towns across the United States in that it has its own police and fire departments, public works, community development, leisure services, finance, and human resources functions. Unique to Johnson City is its strong working relationship with Washington County; in a number of key service areas the city and county have entered into cooperative agreements. Through this partnership they provide EMS services, including both emergency and inter-facility (convalescent) transport services. They operate a joint emergency management service, including a joint emergency operations center (EOC), during large scale emergencies. They also created an Emergency Communications District that serves as the 911 Public Safety Answering Point (PSAP) for Washington County and all its law enforcement, fire, and EMS services.

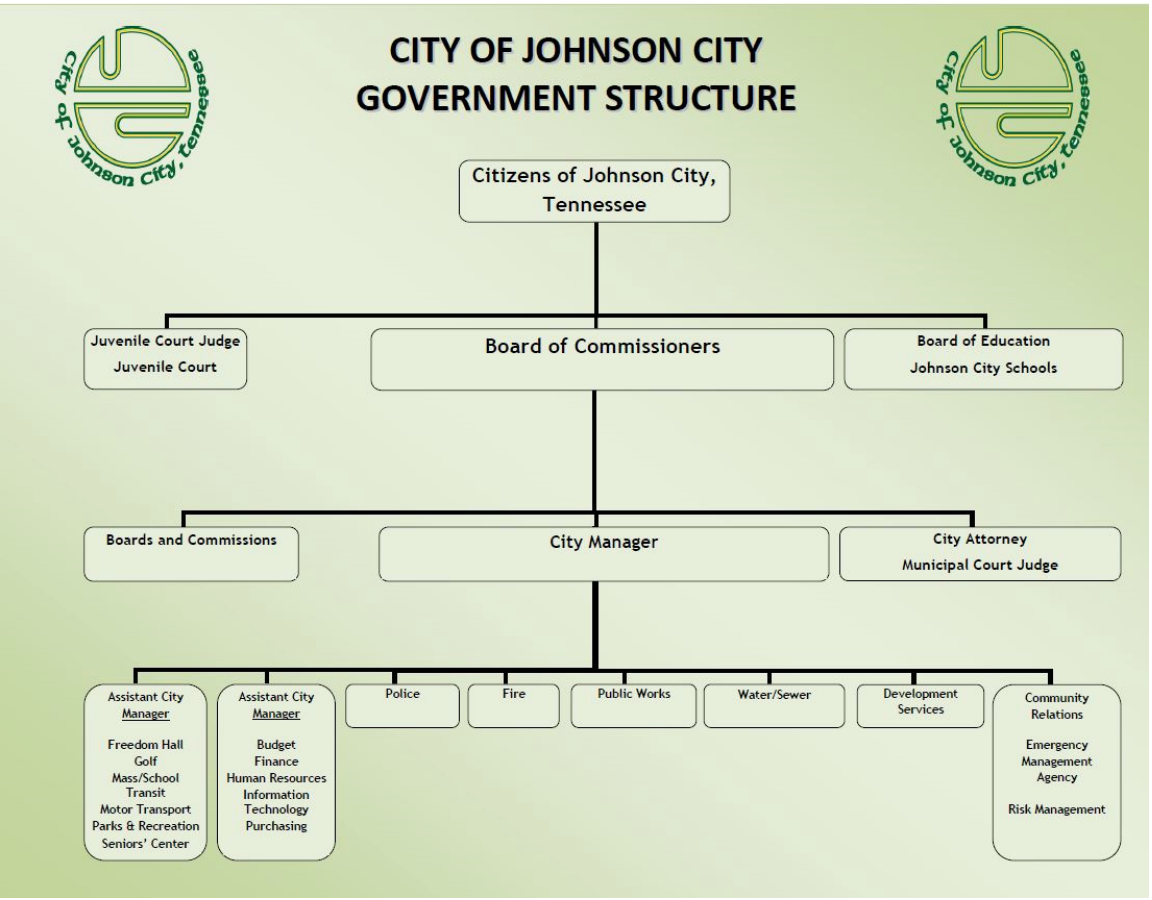
Johnson City operates under Tennessee's "right to work" provisions established in Title 50, Chapter 1 of the Tennessee Code. Under this state statute employees cannot be required to be part of a labor union or be required to pay union dues. In addition, the employer is not required to bargain collectively or recognize unions. Employees of the Johnson City Fire Department have, however,

established the Johnson City Fire Fighters Association, Local 1791 of International Association of Fire Fighters (IAFF). The union's formal activities are very limited. It does not represent employees in contract negotiations or personnel issues (discipline, grievance procedures, testing and promotion, etc.). The IAFF local in Johnson City instead focuses on safety issues and charitable fundraising. The Union also attempts to be active in local politics and to communicate its concerns to city leaders through informal channels.

Article XXVI of the charter also establishes a Civil Service Commission for Public Safety. The Civil Service Commission generally serves as an appellate body for employees of the police and fire departments. Its focus is the review of disciplinary actions, specifically suspension, dismissal, and demotions. The Commission also has limited involvement in the oversight of entrance examinations and the testing procedures for promotions. Once again, its role is to hear employee complaints or discrepancies arising from alleged violations in the administration of these exams. This body works in close cooperation with the city's Human Resources Director, who generally oversees the personnel functions of the city under the direction of the City Manager.

Figure 1 illustrates the organizational chart for Johnson City, Tennessee.

Figure 1: Johnson City Organizational Chart



Johnson City Fire Department

The Johnson City Fire Department is a career fire and first response emergency medical services (EMS) department. The JCFD responds to calls for service from nine fire stations, which are strategically located throughout the city's service area of 43 square miles. The department has developed a unique organizational structure and ICMA feels that many aspects of its current deployment strategy have been impacted by the following historical events:

Sevier Hotel Fire-1989: A Christmas Eve fire in a high-rise residence for the elderly resulted in sixteen fire deaths (fourteen residents and two visitors). In addition, 50 people were injured, including fifteen firefighters. This was the second fire with a fatality at the Sevier Hotel in two months. The first occurred on October 25, 1989 and resulted in a single resident fatality. The first fire elevated concern over a number of structural hazards that contributed to the second, more deadly fire. These hazards included an open stairway design that allowed rapid smoke dispersal throughout the structure, the absence of automatic fire sprinklers, and insufficient fire separation between units. After the first fire there was an effort underway to bring the 65-year-old structure up to code when the second, more deadly fire occurred.

Washington County/Johnson City Emergency Medical Service: In 1999 Johnson City and Washington County entered into an inter-local agreement that established a new quasi-government agency charged with the delivery of emergency medical services. Prior to this EMS was provided by a voluntary rescue/ambulance squad that was funded through donations, fundraising efforts, and user fees. The new entity is funded through agreements with the local governments it serves and continues to collect fees for transport services. This new entity, in effect, became the primary provider of emergency medical services throughout Washington County, including Johnson City.

Public Safety Organization: Johnson City operated as a quasi-Public Safety Organization until 2004. Police and fire maintained separate administrative offices; police were cross-trained public safety officers while fire maintained their traditional duties and were not cross-trained. The city decided to separate these functions and operate separate police and fire departments after 2004.

Fire Response to EMS Incidents: In 2009 the Johnson City Fire Department began responding to all EMS incidents within city limits. Prior to this time the fire department responded on limited occasions to EMS incidents with isolated units. As a result of this change fire department response activities nearly tripled from 3,289 incidents in 2008 to 9,040 incidents in 2010. In addition, this added service responsibility changed the organization's focus of activity. Employee training was modified and resource allocations shifted in response to the predominant EMS workload.

Recent Fire Deaths: Since 2007 there have been a total of fourteen fire deaths within city limits. The majority of these deaths were single-fatality fires and only one fire, in 2012, was a multi-fatality fire that resulted in two deaths. Nationally, cities with populations ranging from 50,000 to 99,999

have on average 0.44 fire deaths per year.[1] The Johnson City fire death rate for the past three years has averaged 3.46 per year, more than seven times higher than the national trend.

Personnel/Organizational Structure

The Johnson City Fire Department employs a total of 122 personnel. This includes five management and administrative staff: one Fire Chief, two Assistant Fire Chiefs (one A/C position is currently vacant), one Administrative Coordinator, and one Clerical Specialist II. There are 110 suppression personnel who work 24-hour shift assignments. Suppression personnel work an average 56-hour work week and utilize a stacked 24-on and 24-off schedule (for three cycles) followed by 96 consecutive hours off. The system is based on a nine-day cycle in which all employees are scheduled to work 72 hours (three 24-hour shifts) every nine days. Most fire departments including JCFD, utilize a "static" staffing model. In this regard staffing levels remain the same throughout the day. Typically there is not an adjustment which decreases staffing levels during the slowest timeframes (late night and early morning) when call activity is considerably less than in the peak demand periods (typically mid to late afternoon). In the ***Operational Analysis*** section of the report (page-31), we provide an alternative to the current staffing model. This option provides an alternative which is intended to improve the efficiency and moves to a "dynamic" staffing model, or one that is adjusted to correspond to the workload.

The 24-hour shift assignment is almost universally utilized by fire departments across the nation. Questions are often raised regarding the effectiveness of employees working extended periods of time and the potential for reduced proficiency due to fatigue. Individuals regardless of their level of fitness will fatigue and become less proficient if subjected to extended periods of heavy fiscal exertion. Very few fire departments however have moved away from the 24-hour work schedule, primarily because the workloads that cause fatigue are not typically experienced on a daily basis. In addition the 24-hour work schedule is greatly preferred by fire department employees and there would be marked resistance to any change in this arrangement. As indicated in our ***Operational Response and Workload*** section of this report, the busiest unit in the JCFD system (Engine-4) works on average 2.2 hours in each 24-hour cycle. Though working incidents can tax the capacity of field personnel, these occurrences do not occur with great frequency. Several of the major cities, particularly in the north-eastern United States have moved to a 10/14 or 9/15 work schedule. In this schedule, individuals work a 10 or 9 hour day and then are relieved by a different shift to work the remaining 14 or 15 hour night shift. These schedules typically work a 42-hour work week and operate as a four-platoon system. The 10/14 or 9/15 schedules continue to utilize a static staffing model and both the day and night shift have the same staffing. ICMA suggests that Johnson City workloads be monitored and unless there is a substantial increase in call volume and the frequency of large working structural fires, modifying the 24-hour schedule will not result in improved efficiency or safety.

Title 7, Section 7.34. of the City Charter establishes a fire-rescue department for the city.[2] Title 7, Chapter 1, Section 7-101-103 of the Code of Ordinances delineates the composition of the fire

[1] "Fire Loss in the United States During 2012", Michael J Karter Jr., National Fire Protection Agency, September 2013.
[2] Official Code of Ordinances, City of Johnson City, Tennessee.

department, the creation of the Bureau of Fire Prevention, and powers of the chief.[3] The department performs fire protection and suppression as well as emergency medical services.

The Johnson City Fire Department operates a Fire Prevention Division which is staffed by three Assistant Fire Marshals. The Fire Prevention Division is currently supervised by the Fire Chief. Previously the department utilized a Fire Marshal to supervise the Fire Prevention Division and this person also served as a member of the fire department's executive managerial staff. In addition, the Fire Marshal would represent the fire department in the development process and worked closely with the city's community services staff and its chief building official. The Fire Marshal position was eliminated through attrition as a cost saving measure in 2010 and no determination has been made with regard to its replacement. The Fire Prevention Division is also charged with determining fire cause and origin and conducting all fire investigations. It was noted that the Assistant Fire Marshals are non-exempt employees and are subject to overtime payment when called out for fire investigations or after-hours inspections. This issue will be discussed further in the Fire Prevention section of the report.

The JCFD Training Division is staffed with one training instructor. Recently, the department assigned a shift Fire Lieutenant to supervise the Training Division and concurrently assigned this same person as Acting Assistant Chief over Operations. In September 2013 this position was upgraded to the rank of Captain. Typically, the Training Division is supervised by a Fire Lieutenant, who along with a Training Instructor, coordinates training activities involving fire, EMS, and specialty training throughout the department. The Training Division also utilizes temporarily-assigned JCFD personnel to develop and deliver specialty training in areas in which they have an expertise (for example, Hazardous Material Response, Officer Development, Collapse, and Search and Rescue).

The department utilizes a traditional organizational structure in managing its field and administrative duties. Unfortunately the department has been unsuccessful in filling its key supervisory and managerial positions and this has resulted in a number of workload, productivity, and consistency issues. The absence of key leadership and supervisory roles in Fire Prevention, Operations, and Training will continue to be a major challenge and will compound the organizational effectiveness of the JCFD. Figures 2, 3, and 4 illustrate the JCFD organizational structure.

[3] Official Code of Ordinances, City of Johnson City, Tennessee

Figure 2: Johnson City Fire Department Administrative Organizational Chart

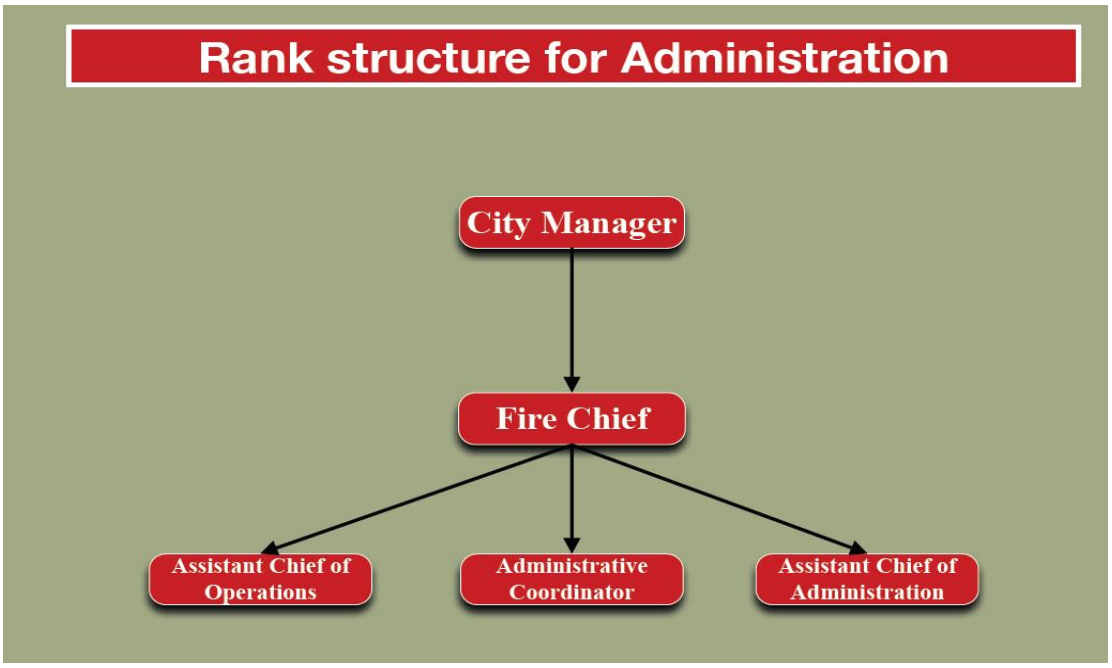


Figure 3: Johnson City Fire Department Operations Organizational Chart

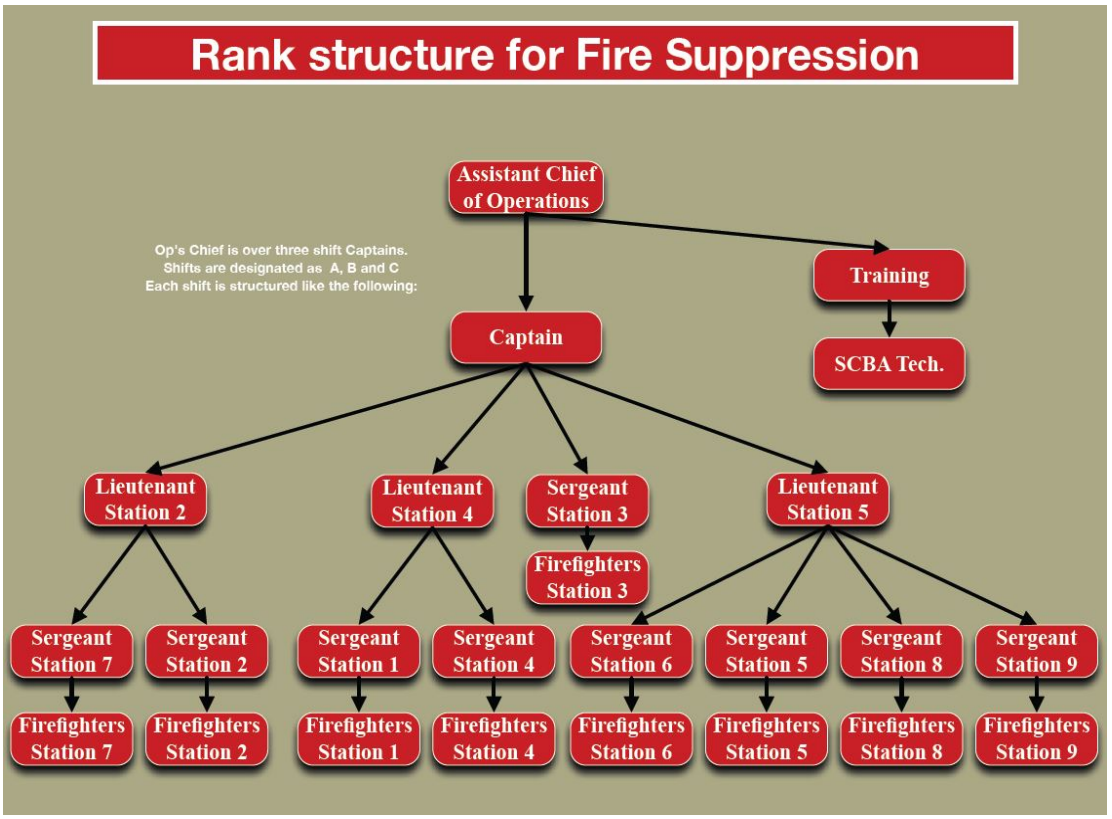
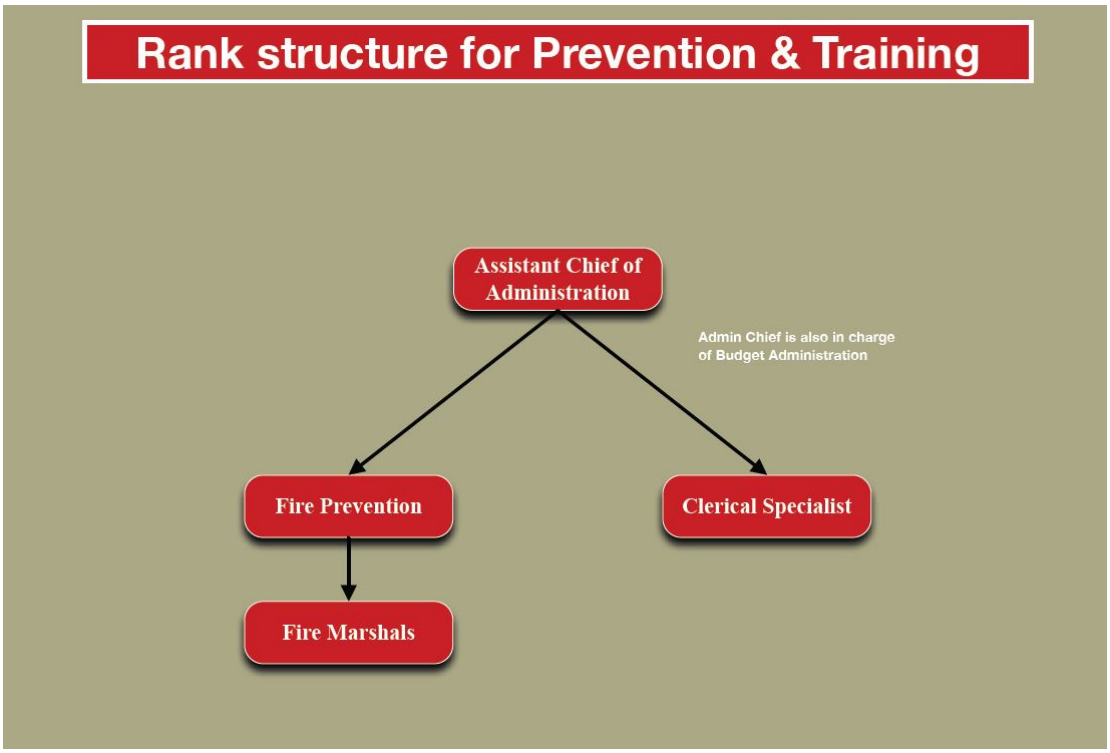


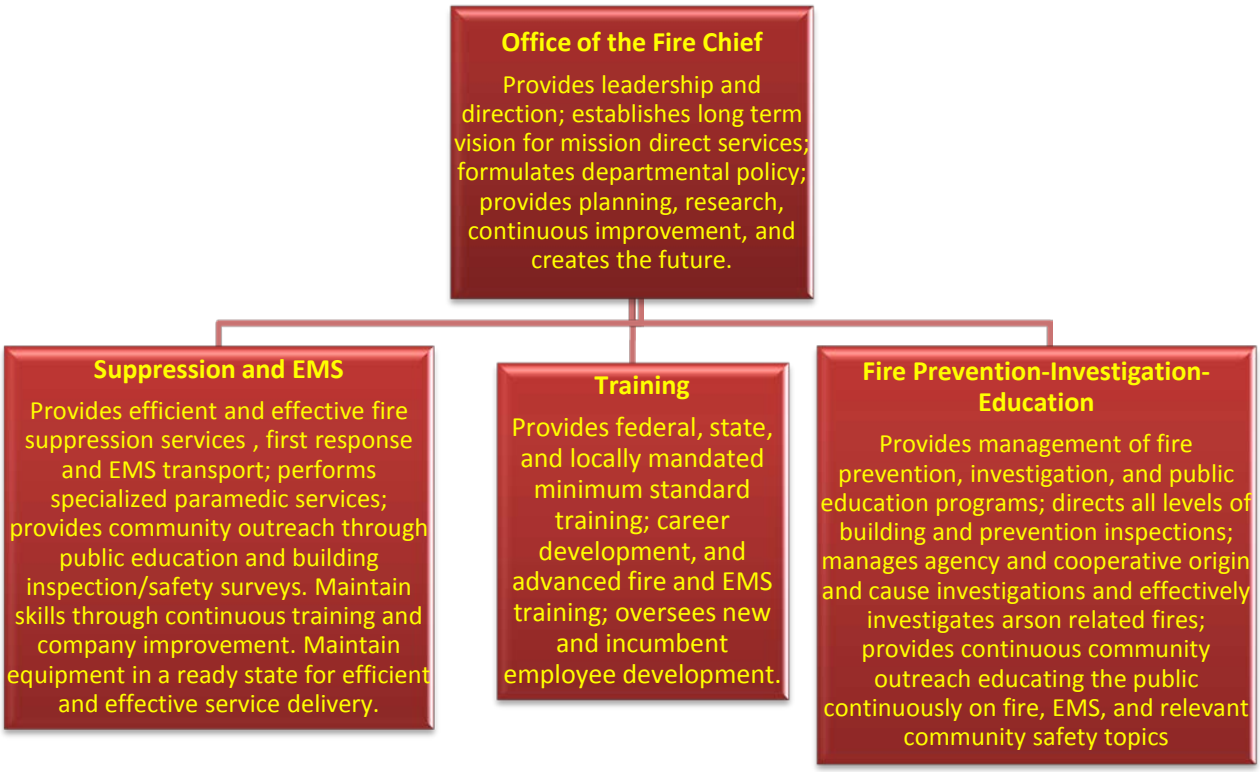
Figure 4: Johnson City Fire Department Fire Prevention Organizational Chart



A functional table of the organization illustrates to the community a clear picture of what and where key services of the organization are located within an organization. In this organizational matrix, each task or functional area becomes a focal point. Specialization is centralized and employees who are doing these specialized jobs or tasks are identified. This functional matrix enables the JCFD to better visualize its division of responsibilities, better links the three organizational structures illustrated above together, and offers a high level of transparency to both internal and external stakeholders. The functional matrix is supported by in-depth definitions of each collateral duty, clearly laying out the responsibility of each, as well as the accountability level.

A functional table of the organization also provides to the agency a clear picture of the leadership functions at each organizational level, and as well illustrates the work of leadership, which must be performed at these organizational levels. Integrating the functional table of the organization with the traditional organizational model directs leadership from a specific focus of an individual to one of leadership viewed from an organizational perspective that breaks down organizational silos and creates leadership teams within each organizational component; this promotes lateral team building between organizational divisions. Johnson City has been severely hampered in it structure by the absence of key positions and identifiable voids in the leadership of these key department functions. It is imperative that the JCFD closely evaluate its structure and make the necessary promotions and assignment of these personnel.

Figure 5: Functional Table of Organization



Facilities

The department operates nine fire stations and deploys thirteen first-line apparatus (including one command vehicle) as shown in Table 1.

Table 1: Station Locations and Apparatus

Station	Location	Apparatus at this Location		
Fire Station 1	2238 Watauga Rd.	Engine 1	HazMat 1	
Fire Station 2	702 Cherokee Rd.	Engine 2	Truck 2	
Fire Station 3	505 E. Main St.	Engine 3	Brush 1	Captain 820
Fire Station 4	800 W. Main St.	Engine 4	Truck 3	
Fire Station 5	205 Broyles Dr.	Engine 5	Truck 1	
Fire Station 6	4501 Browns Mill Blvd.	Engine 6	Air Truck 6	Rehab
Fire Station 7	2830 W Walnut St.	Engine 7	Air Truck 7	
Fire Station 8	105 Gray Commons Cr.	Engine 8		
Fire Station 9	105 Carroll Creek Rd.	Engine 9		

Also, Washington County EMS operates nine EMS units and a supervisory response unit from six locations throughout the city. In addition, county EMS operates its “Power Truck” during the 12-

hour period from 7:00 p.m. to 7:00 a.m. This unit operates from EMS headquarters and is the primary response vehicle to EMS units during this timeframe.

Table 2: Washington County EMS Locations and Apparatus

Station	Location	Apparatus at this Location		
EMS Station 1	507 E. Main St.	Medic 1	Rescue 1	
EMS Station 2	400 N. State of Franklin Rd.	Medic 2	Rescue 2	
EMS HQ	296 Wesley St.	Supervisor	Rescue 3	Power Truck**
EMS Station 3	1021 W. Oakland Ave.	Medic 3		
EMS Station 4	148 Bob Fitz Rd.	Medic 4	Rescue 4	
Fire Station 6	4501 Browns Mill Blvd.	Medic 6		

*Note: At Fire Station 6, Johnson City Fire Dept. and Washington County EMS units are co-located.
**The Power Truck operates from 7:00 p.m.to 7:00 a.m. daily

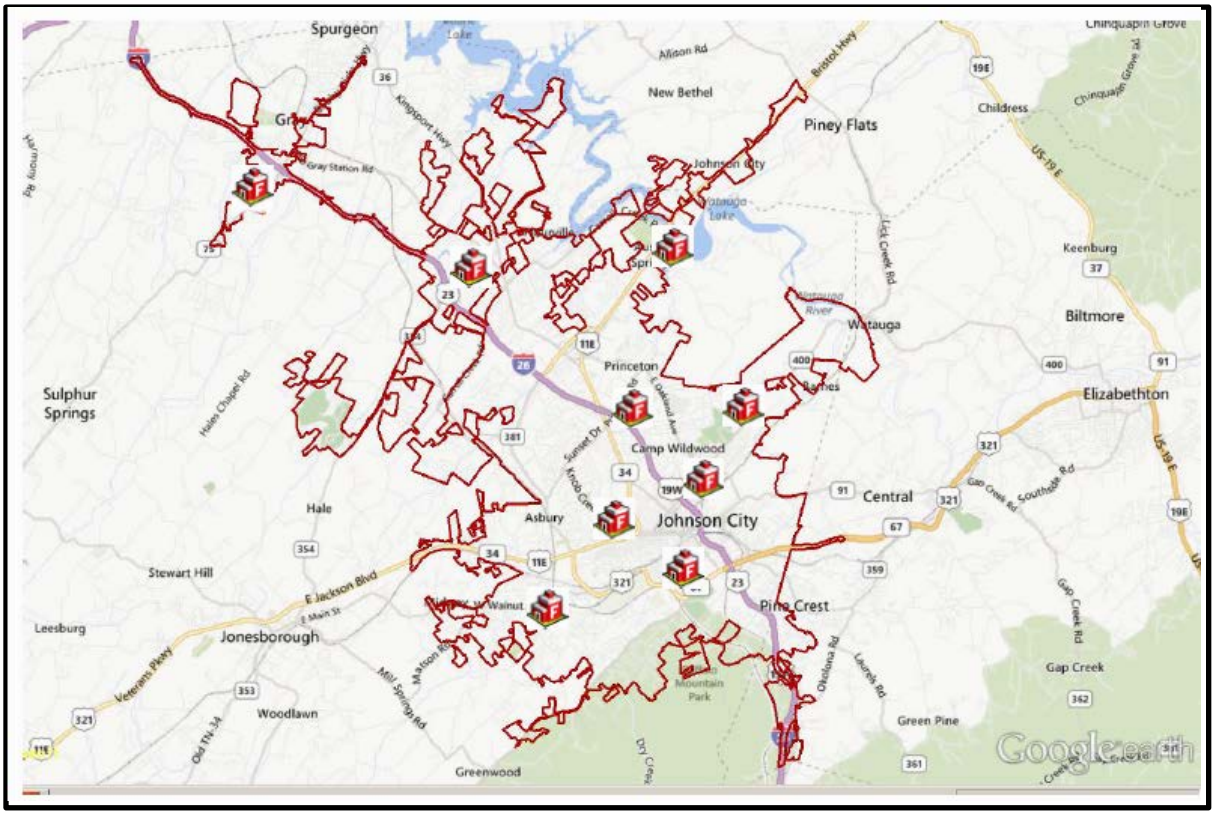
The distribution of fire and EMS units in Johnson City provides a significant amount of resources to handle a relatively low service demand for fire and EMS activities. In the JCFD system only two units (E-3 and E-4) are approaching annual response activities of 2,500. ICMA typically looks at call volumes in excess of 3,000 annual responses as moderate workloads depending on call duration. When workloads exceed 3,000, we often observe higher frequencies of simultaneous alarms occurring in these busier response areas. The busiest units in the JCFD system are responding to 6-7 alarms each day. With the typical call duration of 20 minutes, this equates to a total deployed time of roughly 2-hours on average in the 24-hour work period. This point will be evaluated in greater detail in subsequent sections of this report.

The JCFD has made a concerted effort to install automatic fire sprinklers and electronic fire alarms at each of the fire stations. This has been a very lengthy and committed effort on the part of Fire Administration, the City Manager, and the City Commission. These upgrades are commendable and indicative of an effort to provide a safe working environment for fire department personnel.

The JCFD fire station facilities were well maintained and generally in good repair. We did note that none of the fire stations have ***auxiliary power systems*** that allow the facility to remain operable during power outages. Fire stations are, however, equipped with battery power packs which allow the receipt of radio transmissions for a limited timeframe. During power outages all electrical appliances, the HVAC systems, and apparatus bay doors are inoperable. Bay doors must be manually operated when the power is out. In addition, the stations did not have separate ***decontamination sinks*** for the cleaning of equipment and protective clothing that may come in contact with biohazards and other contaminants. ***Turn-out gear storage*** areas were fully exposed to diesel exhaust fumes in the apparatus bay areas as gear is not stored in separate rooms or enclosed lockers.

The geographic distribution and placement of fire stations appears to have been more a product of historical sprawl rather than a strategic design that reflects the road network and area alarm generators. Additionally, it appears that at least two fire stations (Stations 8 and 9) were built in response to annexations and the corresponding demand created along the acquired transportation corridors associated with this expansion. We observed significant inequalities in the workloads among the individual fire stations. There was more activity in the downtown, central business areas and significantly lower call activity in the periphery areas where population densities are lowest. Though this is not an unusual occurrence when looking at call distributions in other jurisdictions, the disparity appears pronounced in Johnson City and we suspect this is a product of the city's historical growth patterns and the impacts of annexation. Annexation can be very beneficial to a community when managed correctly. Annexations can result in greater efficiencies and a broader tax base. Many agencies often fall into a trap in the wake of an annexation and feel pressured in providing certain municipal services, particularly public safety, prematurely or at a level that is unrealistic. Rural or dispersed areas of the community, cannot receive the same level of protection enjoyed in the more densely populated city centers. Many communities feel inclined to provide a similar level of protection in the outlining areas as they do in the core centers of the city. This is unrealistic and extremely inefficient. A good ***Annexation Agreement*** which stipulates when and how additional services will be provided to the annexed areas is key in managing service demands created by annexation. A good rule of thumb in determining when a new fire station is needed is based on emergency call generation (both Fire and EMS). We suggest that a new fire station be constructed when an area is generating a minimum of 3 calls per day, and this area is beyond a 2-mile travel distance from an existing fire station. Three calls per day is a light workload but is characteristic of a service population that is approaching 10,000 people in which there should be a developed transportation network combined with a mix of non-residential uses (i.e., commercial, institutional, open space, etc.). Developing language in the annexation agreement that ties the provision of city resources only when a specific service demand is realized will assist to minimize the occurrence of costly facilities and personnel that would otherwise be under-utilized. Figure 6 illustrates the current location of JCFD fire stations. Johnson City boundaries are outlined in red.

Figure 6: Johnson City Fire Department Station Locations



Apparatus and Fleet Maintenance

The fleet of first response apparatus is fairly new and indicative of an apparatus replacement program that has fared well during the recent economic downturn. It has been our experience in recent years to observe more and more municipalities deferring the purchase of expensive fire apparatus. Since 2011 Johnson City has purchased two new aerial apparatus, a USAR Trailer, and a HazMat Trailer. We estimate that the first-line engines currently average 8.6 years of age; three units (Engines 6, 8, and 9) each have 15 or more years of service. Table 3 provides an overview of the apparatus inventory for the Johnson City Fire Department.

Table 3: Engine and Ladder Inventory

Unit	Type	Make	Year	Age
Engine 1	Type 1/Pumper	Sutphen Shield	2009	4 Years
Engine 2	Type 1/Pumper	Pierce Contender	2002	9 Years
Engine 3	Type 1/Pumper	Sutphen Shield	2007	6 Years
Engine 4	Type 1/Pumper	Sutphen Shield	2008	5 Years
Engine 5	Type 1/Pumper	Sutphen Shield	2007	6 Years
Engine 6	Type 1/Pumper	Pierce Quantum	1996	17 Years
Engine 7	Type1/Pumper	Pierce Contender	2002	11 Years
Engine 8	Type 1/Pumper	Pierce/FL-80	1998	15 Years
Engine 9	Type 1/Pumper	Pierce/FL-80	1998	15 Years
Truck 1	105' Aerial Tower	Smeal/Spartan Gladiator	2013	0 Years
Truck 2	105' Aerial Tower	Pierce Quantum	1999	14 Years
Truck 3	100' Platform	Smeal/Spartan Gladiator	2012	1 Year
Brush Engine 1	Type 6/Wildland	Ford F-350 4X4	1997	14 Years
Ops 1	Road Tractor	Freightliner	2007	6 Years
Air/Light 7	Specialty	Ford F-450 4X4	2001	10 Years
Reserve 1	50' Telesquirt	Pierce Lance	1993	20 Years
Reserve 2	Type 1/Pumper	Pierce/FL-80	1998	13 Years
Reserve 3	Type 1/Pumper	Pierce Arrow	1990	23 Years
Reserve 2	75' Telesquirt	Pierce Lance	1992	21 Years

The JCFD has been using an apparatus replacement schedule that anticipates the useful working life to be 15 years for engines in frontline service and five years in a reserve status. Ladder trucks have a slightly higher life expectancy; 20 years as frontline units and five years in reserve. This is a rough guide and can vary on the basis of alarm activity, accidents, and proper maintenance. This guideline is consistent with many organizations we have observed and generally is a reasonable standard for Johnson City. Due to funding constraints and the city's funding prioritization, the JCFD vehicle replacement program has not been funded to the extent recommended by fire administration. Stations 8 and 9 are the least busy stations in the system, so the wear and tear on these stations' apparatus is far less than the busier stations in the system. Placement of the department's oldest apparatus at these locations appears prudent.

An on-going problem faced throughout the American fire service is the age, appropriateness, and operability of its apparatus. The dramatic increase in response activity resulting from the JCFD's response to all EMS incidents will certainly accelerate apparatus replacement and may even necessitate a reevaluation of the types of response units that are best suited for the predominant

EMS workload. Currently, JCFD responds only fire engines and ladder truck to EMS alarms. Future consideration should be given to the use of smaller, light-chassis rescue trucks that work in tandem with engines and ladder trucks when an EMS or public assist response is needed.

The current fleet of first-line engines and aerial apparatus has a replacement value of more than $6.3 million in 2013 dollars ($450,000 per engine and $900,000 per aerial). A straight-line calculation utilizing a 15-year replacement schedule indicates a need to earmark $420,000 annually for apparatus replacement. This figure excludes reserve apparatus and any specialty units. Johnson City does not have a formalized apparatus replacement program for fire apparatus, and more importantly it does not have any ongoing funding or depreciation program for future expenditures. In the absence of this type of sinking fund, many communities are faced with major capital expenditures and often opt for a municipal bond election to fund these costs.

Fleet management services are provided by the city's Motor Transport Department. It provides fuel, preventive maintenance, and all repairs to fire apparatus and staff vehicles, including repairs to radios and fire department equipment. Motor Transport operates seven facilities, including a heavy truck garage, transit garage, a light vehicle garage, a tire shop, paint and body shop, a parts department, and a communications shop. Motor Transport has thirty-seven full-time employees, including eleven heavy truck mechanics and two mechanic supervisors. The fire department is charged $64 per hour for labor costs. In FY 2012-13 the fire department expended nearly $265,000 for parts and repairs (including labor) for all its repair and maintenance services. In addition, the fire department estimates an additional $20,000 per year in expenditures for outside service and parts not supplied by Motor Transport. The JCFD has budgeted more than $110,000 in fuel costs.

Motor Transport provides emergency mechanical field response on a 24/7 basis and coordinates towing services if needed. It is noted that the JCFD staff is very pleased with the quality of service and reliability of Motor Transport. JCFD and Motor Transport work jointly in new fire apparatus acquisitions, specification writing, and the oversight of vehicle assembly. ICMA believes that the services provided by Motor Transport are of very high quality, timely, and reasonably priced. Many communities we have observed would envy the JCFD and its relationship with Motor Transport

Organizational Processes

Performance Measurement

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

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

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

> **Administrative feasibility:** How difficult will it be to set up and operate the program?
>
> **Effectiveness:** Does the program produce the intended effect in the specified time? Does it reach the intended target group?
>
> **Efficiency:** How do the benefits compare with the costs?
>
> **Equity:** Are the benefits distributed equitably with respect to region, income, gender, ethnicity, age, and so forth?
>
> **Political feasibility:** Will the program attract and maintain key actors with a stake in the program area?[4]

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

Within the fire service, performance measures tend to focus on inputs (the amount of money and resources spent on a given program or activity) and short-term outputs (the number of fires in the community, for instance). One of the goals of any performance measurement system should be also

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

to include efficiency and cost-effectiveness indicators, as well as explanatory information on how these measures should be interpreted. The types of performance measures are shown in Table 4.

Table 4: The Five GASB Performance Indicators[5]

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

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

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

> Too often, fire service performance measures are created by internal customers and laden with jargon that external customers do not understand. For example, the traditional fire service has a difficult time getting the public to understand the implications of the "time temperature curve" or the value of particular levels of staffing in the suppression of fires. Fire and emergency service providers need to be able to describe performance in a way that is clear to customers, both internal and external. In the end, simpler descriptions are usually better.[6]

The JCFD is measuring a number of key aspects of its performance, and has recognized the importance of regularly posting these findings for city officials, fire department members, and the public. For instance, the department collects data on response times and nonemergency service activities, fire loss, and training hours. This data, although reflecting typical workload measures and department activity, does not provide a direct link to department goals of specific target measures.

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

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

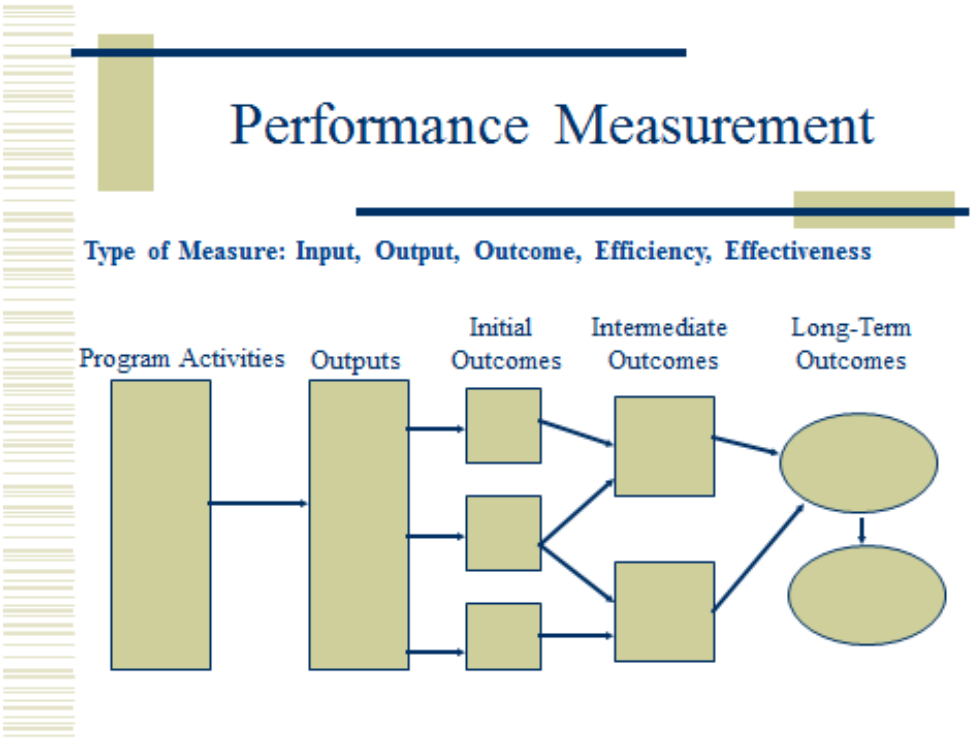
This type of ongoing analysis and the monitoring of trends are most useful to justify program budgets and to measure service delivery levels.

To accomplish this linkage, other forms of performance measures, particularly service-quality and customer-satisfaction measures, should be incorporated into the system. Staff throughout the organization should participate in developing performance measures. In addition to helping facilitate department wide buy-in, this could provide an opportunity for upper management to better understand what the line staff believes to be critical goals—and vice versa. For the same reason, the process of developing performance measures should include citizen input, which the city has with regard to service level preferences. Translating this advice from the citizens into performance measures will link the citizens and business community to the department, and will articulate clearly if the public's expectations are being met. A great example of this is with regard to the JCFD smoke detector give-away program. Clear goals reflecting targeted populations, neighborhoods, occupancy types, numbers distributed, and follow-up once installed are the types of measurements that provide a clear understanding to the public as to the status of the program.

Establishing a performance management system within the framework of an overall strategic plan would help city management and elected officials gain a better understanding of what the JCFD is trying to achieve. Building any successful performance management system that measures more than outputs requires a consistent model. Figure 7 illustrates a successful program logic model[7] designed to build consistent performance measures and should be linked to the performance measure indicators shown in Table 4 to build a successful performance measurement system.

[7] Shows the logic by which program activities are expected to lead to targeted outcomes. Poister, 35.

Figure 7: Performance Measure Program Logic



- Type of Measure: identify the type of indicator to be measured.
- Program Activities: the provision of services provided by this program area.
- Outputs: the results of or how much is produced from the program activities.
- Initial/Intermediate Outcomes: substantive changes/improvements/benefits of the program as measured against the program goal.
- Long-term Outcomes: satisfy the stated *goal*—links to the budget/strategic plan.

Johnson City has identified Bristol and Kingsport as benchmark cities, yet no data were available that monitored activities and performance among these entities. In addition, the fire department leadership discussed openly the need for this evaluation process and to drill down on its performance in both emergency and support activities. However, little is currently planned in this regard.

ICMA has identified this shortfall and recommends that Johnson City undertake a concerted effort to develop performance measure throughout the organization. The following are a number of performance measures that may be considered:

Operations:

- Response Times (Fire & Fractile/Average/Frequency of Excessive Times)
  - Alarm handling

    - Turnout times
    - Travel times
    - On-scene time
    - Call duration
    - Cancelled en route

- Workload Measures
    - Emergency vs. nonemergency responses
    - Response to automatic fire alarms/frequency and outcomes
    - Company inspections/area occupancy familiarization
    - Smoke detector distribution(installations and follow-up)
    - Pre-fire planning
    - Public education-contact hours/numbers by age group

- Outcome Measures
    - EMS/save rates/action taken
    - Fire loss/limit of fire spread-point of origin, room of origin, etc.
    - On-duty injuries/workers' comp claims
    - Lost time-sick/injury
    - Vehicle accidents
    - Equipment lost or broken
    - Fitness performance

Training:

- Fire and EMS hours
- Officer development
- Specialty training
- Professional development/formal education/certifications

Prevention:

- Plans review (numbers/valuation $/completion time)
- Inspections (new and existing)
    - Numbers
    - Completion time
    - Violations (found/corrected)
    - Quantification by type of violation and occupancy type
- Fire investigations
    - Numbers and determinations
    - Arson arrests/convictions
    - Fire deaths(demographics/occupancy type/cause and origin)

Miscellaneous:

- Customer service surveys (by engine/by shift)
  - Following emergency response
  - Public assist
  - Inspections (prevention and company)
  - Public education
  - In-service training (student assessments)

Accreditation

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

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

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

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

CPSE accreditation has national recognition and is widely used throughout the fire service. The key to its success is that it allows communities to set their own standards that are reflective of their needs and a service delivery model that is specific to the community. In addition, it is a program that is based on ongoing improvement and continuous monitoring. ICMA feels that the CPSE accreditation model is very well suited for the Johnson City Fire Department and should be considered in the near future.

Standard Operating Procedures

The JCFD has an extensive number of standard operating procedures (SOPs) and places a great deal of emphasis in their design and use. The range of topics covered by departmental SOPs appears very comprehensive and their structure is typically very detailed. There is an ongoing debate in the American fire service regarding the level of detail that departmental SOPs should provide. This

debate is whether SOPs should be very prescriptive in their writing with a narrative that is specific and directed. The counter approach is that SOPs should be general in nature and provide greater latitude in directing outcomes. The logic behind a more general approach is that every situation, and the possible actions taken in response to that situation, cannot be reduced to writing. Instead the general approach emphasizes good judgment and outcomes rather than process.

In reality, either approach as to how policies are structured can work. The key is that there is consistency in the application of policy and a unified understanding as to their purpose. Successful policy direction is built upon good training prior to implementation and effective supervision that ensures that policy directives are followed correctly. ICMA's observation regarding the level of supervision in the JCFD workplace has elevated some concern. We believe that the role of Sergeants as supervisors requires further clarification. The JCFD has been inconsistent in its designation of the Sergeant as a supervisor. We believe that this situation warrants modification and we will discuss some options in subsequent chapters of this study.

ICMA observed a number of formal internal communication tools in use at the JCFD. These include;

- General orders
- SOPs
- Interoffice memorandum
- Information bulletins.

When questioned regarding the differences in these formats, we were told that it was generally personnel preference as to which format was used. Though this did not appear overly confusing within JCFD's membership, ICMA suggests that the JCFD leadership create more organization in their use of formal communication documents.

In addition to formal written communications it is critical in achieving effective leadership that there are a number of face-to-face communications techniques. The JCFD leadership was cognizant of the importance of providing this type of communication. The Fire Chief indicated that he conducts frequent station visits for the purpose of informal communication. In addition, he utilizes the Captains/Shift Commanders as the primary medium in providing explanations and holding forums for line personnel. However, a good organizational structure must utilize a whole array of techniques in keeping personnel informed and in providing active forums for feedback and questioning. The following communication tools/methods are suggested for use within the JCFD.

- Newsletter/Chief's Communication: We observed a very viable and comprehensive newsletter that was distributed by the Fire Chief. It contained very relevant and timely communications regarding key departmental activities. The document was well received by the fire department; however, its distribution is very sporadic, perhaps twice yearly. The Fire Chief should attempt to publish and distribute this newsletter with greater frequency and regularity; we suggest at least on a quarterly basis.

- Staff Meetings: ICMA did not observe the occurrence of executive staff meetings with any frequency of regularity. There were a number of ad hoc meetings and there are weekly meetings between the on-duty Captain and the Assistant Chief. We recommend that the Fire Chief should conduct a monthly staff meeting that includes the two Assistant Chiefs, the on-duty Captain, and representation from Training and Fire Prevention. Minutes should be taken for the meeting and these minutes distributed throughout the organization and available for periodic review in an electronic format.
- Open Forum/Officer Forums: On a periodic basis (one to two times a year), the Fire Chief should conduct an open forum in order to facilitate a direct exchange between the Chief and line personnel. The Fire Chief has conducted these forums in the past and has indicated his intent to restart this method of communication in the near future. The focus of these meetings is to discuss new policy directives and provide for a question and answer period to facilitate open dialog. These forums should also be attended by the Executive Command Staff, Prevention, and Training. In addition, special presentations may be given by city officials or other agencies for educational or informational purposes. Again meeting minutes or a video of the meeting should be made available for review by off-duty personnel.
- On-line Video-Conferencing: JCFD should investigate and acquire the capability to conduct real time-video conferencing between the administrative offices, training, and the fire stations. This technology is readily available for nominal startup costs and virtually no ongoing costs. Video conferencing provides real-time audio and visual communications and is ideal for planning and scheduling between the shift Captain and all on-duty personnel. These internet-based systems can accommodate links to video presentations, PowerPoint training, maps, schematics, and photographic formats. Again, these presentations and discussions can be stored and retrieved for future reference.
- Telephone Conference Calling: In the absence of video conferencing, JCFD should utilize a daily telephone conference call between the shift Captain and the nine fire stations. This communication can facilitate personnel assignments, training, work details, and general direction and communication among on-duty personnel. The Fire Chief, along with the Assistant Chiefs, Training, and Prevention, may also from time-to-time join the call to provide guidance or insight on a related topic to be discussed.
- Text Messaging: JCFD should expand the use of text messaging so that all critical communications, notifications, announcements, paging, emergency re-calls, reminders, etc., are distributed to all personnel with immediacy and accuracy. Many JCFD personnel have voluntarily linked to text messaging for departmental communications and alarm notifications. This technology is readily embraced by line personnel and provides an excellent method to provide rapid communications with limited start-up difficulties and little or no additional costs.

Education and Training Programs

Education and training programs create the character of a fire service organization. Agencies that place a real emphasis on their training have a tendency to be more proficient in carrying out day-to-day duties. The prioritization of training also fosters an image of professionalism and instills pride in the organization. The JCFD has an excellent training program and there is a dedicated effort focused on its wide array of training activities.

The Tennessee Commission on Fire Fighting is responsible for the certification of volunteer and career firefighters in the state. The Commission also administers the Educational Incentive Pay Program for career firefighters in Tennessee. The Commission is responsible for approving training programs to meet the requirements of T.C.A. 4-24-112 (the Minimum Training Statute), and proof of compliance with this statute must be submitted to the Commission. The Commission endeavors to raise the standards of firefighting personnel who participate in its certification and training programs. It enables Tennessee firefighters to be better prepared through training courses facilitating the skills and knowledge necessary in promoting firefighting safety, efficiency, decorum, and ethical considerations throughout the certification process.[8] In 2013 the JCFD was recognized as one of thirty-two agencies statewide which achieved excellence in their training efforts. JCFD received the Tennessee Fire and Codes Academy's "Gold Level" recognition for documenting nearly 3,000 training hours.

The JCFD is responsible for administering the training program for its members and maintaining compliance with state training requirements. Training is conducted primarily while on duty, with topics identified in the monthly training calendar. The International Fire Service Training Association (IFSTA) manual for firefighting is used by the department as the basis for training and complies with the National Fire Protection Association standards for firefighters, NFPA Standard #1001. All uniformed employees receive each year a minimum of forty hours of training required by the state. In addition each member receives twenty hours of training required by the Insurance Services Office (ISO). Firefighters spend a minimum of two hours each day on training. Multi-company or all-hands drills generally last two to three hours and are conducted on a regular basis (at least four per year). Technical rescue training (USAR), hazardous materials training, and firefighter safety training are coordinated by in-house subject matter experts (SMEs).

A Training Captain who works a five-day week, assisted by a Training Sergeant, coordinates and monitors the training program. As with other key positions in the JCFD, the Training Captain has been vacant for nearly two years. Just prior to our review, a line Lieutenant was assigned to training and simultaneously was assigned as the Assistant Chief of Operations. At the same time this Training Captain position was upgraded from the rank of Lieutenant to a Captain status. Training needs a full-time officer to oversee these duties. In addition, the Assistant Chef of Operations is a critical position in the organization and it also requires a full-time assignment. ICMA believes that the duel assignment, though interim in nature, needs to be addressed and a permanent Assistant Chief in charge of Operations be appointed. As will be discussed, the span of control issue for the Captain on each shift is a concern. If the city chooses not to create a second shift Captain, ICMA feels

[8] Tennessee Commission on Fire Fighting website, 2012.

that the Training Captain may be utilized on an interim basis to assume some of the supervisory and administrative functions of the line Captains and respond to major incidents to facilitate the command process. As a collateral duty to training responsibilities, this individual can serve as the primary back-up to the Fire Captain on major incidents or to cover the city when the on-duty captain is tied up on an incident. Consideration may be given to periodically rotating the shift Captain into the training assignment in an effort to introduce new concepts or provide a fresh perspective in the training effort. The Training Captain's duties are critical to the organization and any efforts to broaden these duties to fill those unmet needs of the field Captains must be monitored to insure that critical training oversight is not compromised.

The JCFD has a number of functional training facilities that are distributed throughout the system. These include a four-story training tower, a confined space maze, three classrooms, and four propane props. The JCFD does not have access to any closed-circuit TV for simultaneous viewings at all stations nor does it use any online video conferencing for instruction or informational purposes.

In addition to fire training the Training Division coordinates EMS recertification, safety, blood-borne pathogens, driver safety, and emergency vehicle operations training. Most emergency medical training is done with the use of the 24/7 video and an online training curriculum. This is a subscription service that is authorized under state guidelines in meeting the annual continuing education requirements for EMS. 24/7 is also used for some fire service and safety training delivery. Washington County EMS is the primary provider of EMS services in Johnson City. The JCFD and Washington County work closely with one another in the delivery of EMS care in the community; however, there are few joint-training efforts between these two agencies.

New firefighter recruit training is done through the Northeast Tennessee Regional Fire Training Association. This is a coalition of ten agencies, including one private chemical company, which have joined together in providing basic firefighter recruit training. The association is composed of the following agencies;

- Kingsport
- Jonesborough
- Morristown
- Bristol
- Elizabethton
- Newport
- Johnson City
- Tennessee Eastman
- Greenville
- Cocke County

This academy builds its firefighter curriculum around the IFSTA Firefighter 1 & 2 curriculum; instructors from member agencies are utilized in delivering the required training. The academy's 13-week curriculum has been certified by the state of Tennessee.

Recommendations

- The JCFD should undertake a capital improvement plan to install automatic auxiliary power systems with uninterrupted power supply (UPS) at all fire stations.
- The JCFD should install decontamination sinks at all fire stations for the purpose of cleaning EMS equipment that may become contaminated during field operations.
- The JCFD should consider the use of smaller, light-chassis rescue trucks that work in tandem with ladder trucks for response to nonemergency or public assist type responses.
- Johnson City should adopt an apparatus replacement program for future acquisition of fire apparatus and an associated funding method.
- The JCFD should undertake a concerted effort to develop performance measures throughout the organization and which should be utilized to monitor system performance and system outcomes. The process of developing these measures should utilize input from JCFD members, the community, the City Commission, and the City Administration.
- The JCFD should consider pursuing fire accreditation through the Center for Public Safety Excellence (CPSE) accreditation process.
- The JCFD should consider joint EMS training classes with Washington County EMS, with a focus on enhancing EMS training and the co-utilization of joint resources.
- Johnson City should evaluate the option of instituting an Internet-based video conferencing system to facilitate real-time interaction between all JCFD fire stations.
- ICMA concurs with the recent upgrade of the Training Lieutenant to Training Captain. We also believe that as a collateral duty the Training Captain should serve to back-up and assist the shift Captain in both emergency and administrative duties.
- The City should move expeditiously in the appointment of a permanent Assistant Fire Chief in charge of Operations.

Operational Analysis

Unit Deployment, Workload, Response, and Operational Personnel Assignments

During the period covered by this study, the JCFD operated thirteen frontline response apparatus, including nine engines, three ladder trucks, and one command vehicle (Captain Unit-820). The daily minimum staffing set by the JCFD is thirty-one personnel. Whenever a staffing shortage brings on-duty staffing below thirty-one, off-duty personnel are brought in, on an overtime basis, to maintain the minimum. There are a total of thirty-six personnel assigned to each shift, with five personnel available on a daily basis to cover for absences resulting from vacation usage, training, sick, disability, and other leaves. The number of coverage personnel is consistent with other agencies we have observed, but is driven by the city's effort to maintain minimum staffing at thirty-one. The JCFD frequently calls back off-duty personnel on an overtime basis in order to maintain the minimum staffing levels.

ICMA estimates that in 2012 the JCFD expended a total of just over $343,000 for overtime. In addition to the overtime associated with minimum staffing, this figure includes overtime for emergency call-back of off-duty personnel, FLSA overtime payment(half-time), and overtime for any training done in an off-duty status. This total equates to approximately $3,500 per employee, with the vast majority of this cost resulting from maintaining the minimum staffing levels.

ICMA believes that the city can save a significant amount of overtime if it limits the hours in which minimum staffing is maintained at thirty-one personnel. The city currently maintains minimum staffing at thirty-one for the entire 24-hour shift. When overtime is needed to maintain minimum staffing we believe that this level of staffing should be maintained only during peak periods of operation, that is, between 8:00 a.m. and 8:00 p.m. During the timeframe between 8:00 p.m. and 8:00 a.m., we recommend minimum staffing be reduced to twenty-nine personnel and one ladder company be temporarily removed from service. ***If overtime is not needed to maintain minimum staffing we are not proposing a reduction to the twenty-nine person minimum staffing.*** This level would only be enacted to reduce the number of hours that suppression personnel are in an overtime status. Our evaluation indicates that in FY-2012-2013 only 12 percent of the time that overtime was needed to maintain minimum staffing were there three or more personnel who were recalled. ICMA feels that the cost savings associated with a change to twenty-nine minimum personnel during the aforementioned hours can be substantial, possibly up to 40 percent of the current overtime costs associated with minimum staffing. In addition, ICMA does not feel that this reduction in staffing will adversely affect service delivery. In a subsequent section of the report we elevate our concern regarding two-person staffing on a number of first response units. These two issues should be considered separately. The JCFD must address the issues of dynamic staffing and simultaneously address its utilization of two-person staffing on fire engines.

Captain/Shift Commander

The Captain/Shift Commander is the daily supervising officer, responsible for administrative oversight and command functions for their individual shift. The Captains work the same 24-hour shift assignment as the crew they supervise and are considered non-exempt employees, thus subject to overtime. Typically, the duties and functions associated with the JCFD Captain are those held by a Battalion Chief position in departments of similar size and structure. Battalion Chiefs, though often considered managerial/exempt employees, are typically assigned to some type of supervisory bargaining unit or afforded certain managerial benefits that result in additional pay afforded to non-exempt personnel. Efforts made in Johnson City to remove the Captain/Shift Commander from the non-exempt status and to place them in a salaried, managerial/confidential position will likely cause difficulties in the areas of pay compaction and the recall of off-duty personnel to fill Captain vacancies. In addition, this change in status would require that certain tests be met in qualifying these personnel as managerial/confidential exempt in accordance with Department of Labor criteria. Also, this decision would be subject to review by the Department of Labor or could be contested by an employee filing a formal complaint.

ICMA feels that the reclassification of the Captain to Battalion Chief or some other Chief Officer designation is not recommended. The current method of utilizing Captains on an overtime basis to cover for vacancies or emergency call back is not especially expensive and we believe cost effective. Our investigation indicates that the total annual overtime payment to all three captains during fiscal year 2012-2013 was approximately $15,000. This included all overtime, including payment for off-duty training, recalls for minimum staffing, emergency recalls for major incidents, and FLSA overtime payments. This is a nominal figure considering the level of service provided by these individuals and the important link they provide between the administration and field personnel. If there is a desire to expand the leadership activities of these positions including strategic planning duties and accountability, we believe these are best addressed through a modification to the Captain Job Description.

An area of greater concern is the ***span of control*** of the Captains with regard to the number of fire stations and emergency response units that they supervise. Span of control is a measurement which limits the number of personnel and equipment that can be safely supervised during an emergency event. Guidelines for span of control typically set the limit at three to seven units, with five being the optimum.[9] This would include any combination of apparatus, working groups, individuals, or service functions. The Captain's range of supervision typically exceeds this limit on most fire events.

Many jurisdictions that provide service in larger geographic areas (typically seven-stations or more) split their service area into two geographic areas or battalions. Each battalion then would be supervised by an individual command officer. As indicated above, Captains currently supervise all nine fire stations and twelve responding units. In addition to exceeding the span of control issue, there are frequent occurrences when the Captain is tied up on an incident and the remaining service units are without command supervision. In these instances, an off-duty chief officer is called

[9] FEMA, "ICS-200, ICS for Single Resources and Initial Action Incidents" 2010.

in to provide this oversight or an on-duty Lieutenant or Sergeant assumes this role until an off-duty officer can respond. Off-duty responses can result in delays and difficulties due to out-of-town travel or unavailability.

Engineer/Sergeants

JCFD utilizes an unorthodox method with regard to the supervision of its fire stations and first response apparatus. At full staffing, only four of the responding engines are supervised by a Lieutenant. On the remaining eight units (Engines 1, 3, 7, 8, and 9, Ladder Trucks 2, 4, and 5) supervision is provided by the Sergeant. It is not uncommon to have the Engineer serve as the engine or station officer during absences. What is unique in Johnson City is that on a daily basis the majority of units in service are supervised by individuals who are not recognized as supervisors.

ICMA feels that the supervisory practice involving the Sergeant/Engineers is problematic and presents the potential for added liability to the city. The city ultimately is responsible for ensuring that the workplace is properly supervised and the job-place is free from discriminatory practices. The Sergeants/Engineers have not been clearly assigned this responsibility and they have not been trained in the execution of these critical duties. In addition, from a field perspective, the practice of the Sergeant/Engineer supervising active firefighting operations from a location that is apart from the firefighting activity (at the engine pump panel and not in the structure burning), is inconsistent with generally accepted safety and command practices. The company officer should be the sole individual to provide oversight of personnel operating under their direction. This is a basic tenet of ***unity of command***. In addition, with regard to ***personnel accountability***, an officer should have visual and/or verbal contact with personnel operating under their supervision. We also have additional questions regarding administering discipline, conducting performance appraisals, and ensuring adherence to adopted safety practices. It is also critical that when the Sergeant is acting as Lieutenant, the Sergeant should be fully engaged in firefighting activities and the leader of the crew operating in a hazardous environment. He or she should not be apart from the crew and positioned at the engine pump panel.

EMS First Response

JCFD provides BLS first response in conjunction with Washington County EMS (WCEMS), which serves as the ALS provider and the agency responsible for emergency and nonemergency ambulance transports. The JCFD provides EMS first response at the Emergency Medical Technician-Intravenous (EMT-I) level of care. This level of care is extremely advanced and operates in accordance with the state of Tennessee EMS licensing guidelines. ICMA believes that the EMT-I level of care is a very progressive and perhaps the most cost effective method for delivering pre-hospital emergency medical care.

JCFD operates in a two-tiered EMS delivery system. In this arrangement, two agencies combine their efforts in the delivery of pre-hospital EMS and ambulance transport. Typically, two-tiered delivery systems utilize an EMS first responder; normally a fire department that provides basic life support (BLS). The first responder is then paired with an ambulance provider (such as WCEMS) that is licensed to deliver advanced life support (ALS) services. The two-tiered system is designed

to deliver basic life support services first, in order to stabilize the patient. The ALS provider typically arrives after BLS has been initiated and the ALS agency is charged with providing a higher level of care and to transport the patient to the hospital if needed. ALS services utilize paramedics who deliver a higher level of care involving the administration of a wide range of intravenous drugs, advanced airway management (including endotracheal intubation), and 12-15 lead cardiac monitoring. Another feature of the two-tiered system is that once the patient is treated and transported, the BLS provider stays in the district and is available for the next call. National guidelines recommend that BLS services be available within four minutes from the notification process and ALS be delivered within eight-minutes.[10]

We observed that the level of care, the proficiency of EMTs and paramedics, and the cooperation between JCFD and Washington County was very professional and provides an excellent level of patient care. ***ICMA feels that the current two-tiered operation is the most appropriate delivery model for Johnson City and Washington County.***

However, we do feel that greater efficiencies can be achieved in this delivery model. Key among our observations are the following:

- **Facility locations**: As shown earlier, JCFD and WCEMS operate fourteen separate facilities in delivering fire and EMS services in the 43 square-mile service area of the city. In only one facility, fire station 6, do the agencies co-locate. In several locations, the fire and EMS facilities are separate but in sight of each other. ICMA feels that there is an excellent opportunity to co-locate fire and EMS facilities. This can result in operational savings and foster stronger working relationships.
- **Deployment of resources to EMS incidents**: On nearly all EMS responses, the combined response of JCFD and WCEMS is a minimum of three units. In most instances, all units respond in a Code-1 response mode (lights and sirens). This level of response is unnecessary and heightens the potential for vehicle accidents. JCFD and WCEMS should work with the Washington County 911 in better screening call types in an effort to reduce the number of units responding and to downgrade the mode of response whenever possible.
- **Vehicle extrication**: EMS rescue vehicles and all JCFD apparatus carry extrication equipment. This equipment is essential during certain vehicle accidents and for forcible entry into buildings, locked enclosures, etc. This equipment is expensive, requires ongoing maintenance, and occupies limited compartment space on vehicles. JCFD and WCEMS should consider a more strategic placement of these resources and work more cooperatively in delivering extrication services.
- **Joint training activities**: JCFD and WCEMS operate separate training divisions responsible for the delivery of a number of identical training programs. These include EMS recertification, scene safety, patient lifting and packaging, contagious disease prevention,

[10] Footnote: NFPA 1710- *Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special operations to the Public by Career Fire Departments- Sect.* 4.1.2.1.1(3)&(4), 2010

disposal of bio waste hazards, emergency vehicle operation, and ICS. Efforts to combine training functions will expand the training capacity of both organizations, result in some economies of scale for specialized training delivery systems (web-based or subscription services), and foster improved working relations.

Operational Response and Workload

The Johnson City Fire Department provides fire and EMS services from its nine fire stations located throughout the city. On a daily basis the JCFD operates nine fire engines, three ladder trucks, and a captain/command vehicle. The city has a very identifiable central business area surrounded by an expanding suburban area that is populated by a number of residential subdivisions, light manufacturing occupancies, and a series of commercial strip centers.

The JCFD responds to emergency calls received through the Washington County Emergency Communication District which serves as the City's 911 Public Safety Answering Point (PSAP). During the twelve-month study period from which information was derived (July 1, 2012 to June 30, 2013), JCFD units responded to 8,820 calls. Of these, 102 were structure fire calls and 159 were classified as other or outside fire calls (grass, trash, sheds, dumpster, vehicle, etc.). There were 259 incidents classified as "hazardous conditions" and 5,880 emergency medical incidents (66.7 percent of responses) that included 576 motor vehicle accidents. The remaining 1,288 calls (14.6 percent) were classified as public assist, good intent, and false alarms. In addition, the data indicates that JCFD responded to 192 incidents that were mutual aid responses. ICMA has been informed that this number is erroneous due to a reporting error. JCFD is attempting to correct this error. On approximately 940 of the calls, JCFD units were cancelled en route to the call, prior to arrival. As a result of the call screening efforts at the dispatch center, JCFD units responded to a total of 5,280 calls (60 percent of all responses) in an emergency mode (lights and sirens). The emergency call volume observed is relatively light and typically does not significantly overload the array of service resources available.

Figures 8 and 9 illustrate demand and the distribution of fire and EMS incidents occurring during the study period. The plotting of these incidents and the distribution they represent do not indicate any anomaly or concentration of alarms that would necessitate additional resources or facility relocations. Call activity is most concentrated in the city core that is serviced by fire stations 2, 3, 4, and 5. Consequently, these stations are the busiest in the system, with units from these stations arriving as the first unit on scene on approximately 70percent of all responses. In addition, stations 2, 4, and 5 are staffed with ladder trucks in addition to the fire pumpers. This provides added capacity in these areas and this level of resource is sufficient so as to not significantly overload any single unit operating within the system.

Figure 8: Fire Call Distribution

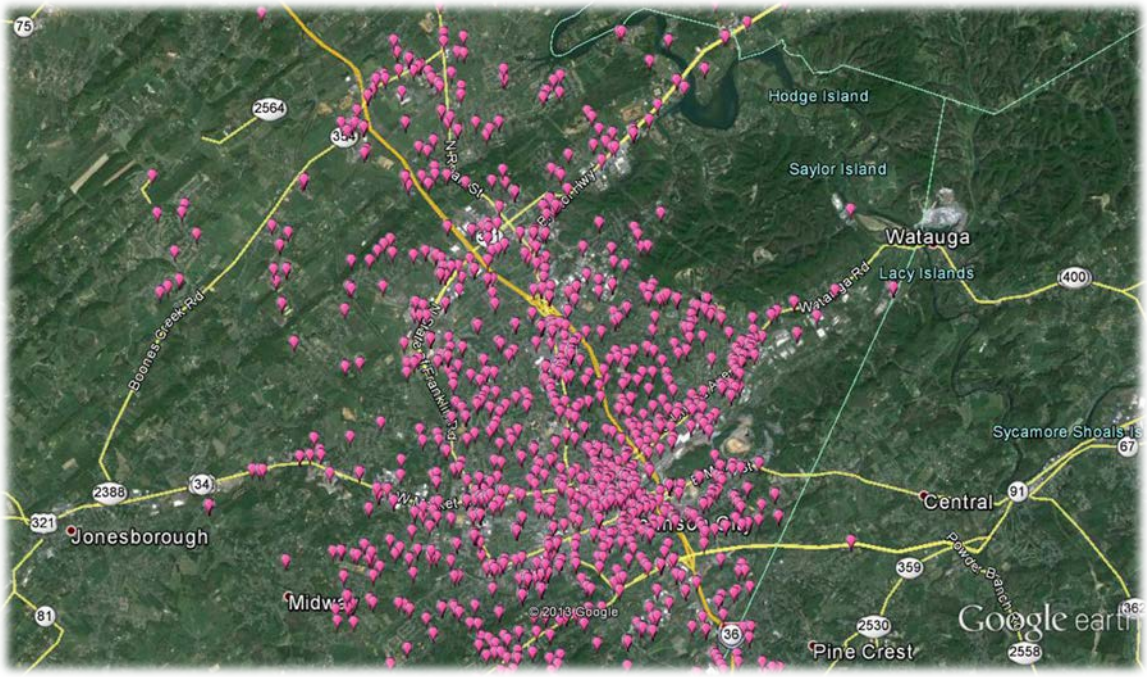
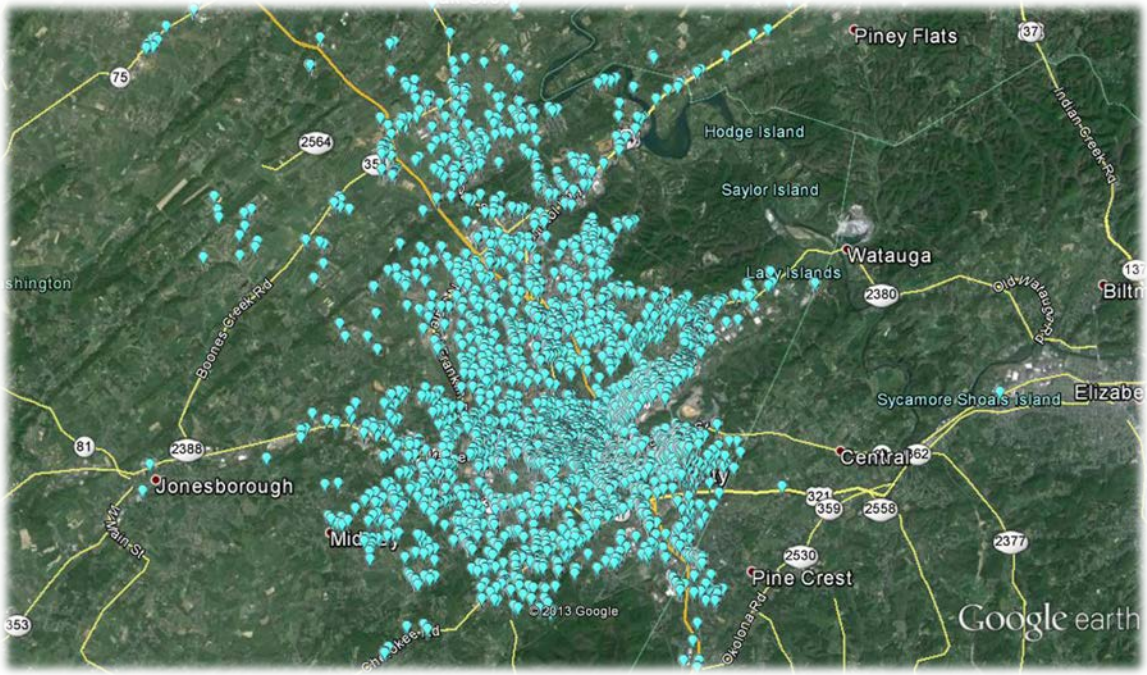


Figure 9: EMS Call Distribution



Operational Category Call Type

Nationwide, fire departments are responding to more EMS calls and fewer fire calls, particularly fire calls that result in active firefighting operations by responders. ICMA data collected from more than sixty fire department data analyses confirms this trend. Improved building construction, code enforcement, automatic sprinkler systems, early detection systems, and aggressive public education programs have contributed to a decrease in serious fires and, more importantly, fire deaths among civilians. Though Johnson City is following national trends regarding the frequency of fires, recent data also indicate that Johnson City is well exceeding the national averages with regard to civilian fire deaths. Since 2007 there have been a total of 14 civilian fire deaths, or an average of over two fire deaths per year. Nationally, the fire death average in comparable sized cites is 0.44 fire deaths per year. In the last three years, Johnson City has averaged three fire deaths per year, again far surpassing the national average. Twelve of the fourteen fire deaths were single-fatality incidents; only one fire led to multiple deaths (two). Fire and fire deaths are greatly influenced by demographics; lower income earners and rental properties have a higher occurrence of fire on a national basis. One of ICMA's strongest recommendations throughout this report is that Johnson City should undertake a comprehensive effort to address its fire death issue.

Another interesting trend ICMA continues to evaluate is the frequency of true emergencies vs. nonemergency or public assist calls. Our findings nationally (internal ICMA fire data reports) indicate that in some jurisdictions more than 50 percent of all responses (fire, EMS, and other) are nonemergency in nature. This factor is critical when calculating response time data, determining staffing levels, and identifying appropriate deployment strategies.

This trend is compounded when looking at the JCFD response patterns. On very few fire occasions does the JCFD reduce the number of units it responds to fire calls, particularly those that are characteristically non-fire events (primarily automatic fire alarm soundings, public assists, smoke investigations, hazardous conditions, etc.). Our analysis finds that on only 38 percent of all fire responses does JCFD respond a single unit. Even more startling is the number of units that respond to false alarms. Our analysis found that on nearly 73 percent of all false alarm responses, JCFD responded three or more units. The JCFD is attempting to address this issue and our data shows that on a significant number of responses (both EMS and Fire) JCFD units were downgraded in their response. We recognize this as a good practice that should be continued and possibly expanded. In addition, ICMA believes that there is the potential to reduce several thousand unit runs annually by reducing alarm assignments on several call categories.

The key to improved efficiency when deploying emergency resources is a robust call screening process at the 911 dispatch center. When we examined the combined response of both JCFD and Washington County EMS on EMS responses we saw, on average, 3.2 units responding to every EMS incident. Both agencies have altered their patterns of response so that not all units are responding in an emergency mode (lights and sirens). The ability of 911 call takers to accurately screen calls and then assign the most appropriate unit (s) to a call can pay substantial dividends in the following ways:

- Increased unit availability
- Reduced wear and tear on the vehicles
- Reduced fuel costs
- Reduced vehicle maintenance
- Reduced potential for vehicle accidents.

In addition to having fewer units respond, there is an added benefit in responding units at slower speeds, without using lights and sirens, and obeying all traffic signals. We believe that the JCFD, in conjunction with the Washington County Emergency Communication District, can adjust its response patterns and downgrade significantly the mode of response of both JCFD and Washington County EMS units. The key to this effort is an expanded use of the medical priority dispatch system (MPDS) and call prioritization process. The following tables and figure depict the specific call types and number of units that responded during the study year.

Table 5: Call Types

Call Type	Number of Calls	Calls per Day	Call Percentage
Cardiac and stroke	1,034	2.8	11.7
Seizure and unconsciousness	735	2.0	8.3
Breathing difficulty	762	2.1	8.6
Overdose and psychiatric	110	0.3	1.2
MVA	576	1.6	6.5
Fall and injury	1,168	3.2	13.2
Illness and other	1,495	4.1	17.0
EMS Total	**5,880**	**16.1**	**66.7**
Structure fire	102	0.3	1.2
Outside fire	159	0.4	1.8
Hazard	259	0.7	2.9
False alarm	982	2.7	11.1
Good intent	88	0.2	1.0
Public service	218	0.6	2.5
Fire Total	**1,808**	**5.0**	**20.5**
Mutual aid	192	0.5	2.2
Canceled	940	2.6	10.7
Total	**8,820**	**24.2**	**100.0**

Observations from Table 5 include:

- On average, the department received 24.2 calls per day, including 2.6 canceled calls and 0.5 mutual aid calls.
- EMS calls for the year totaled 5,880 **(67 percent of all calls)** and averaged 16.1 calls per day.
- Fire calls for the year totaled 1,808 **(20 percent of all calls),** and averaged 5.0 calls per day. Structure and outside fires combined for a total of 261 calls during the year, averaging 0.7 calls per day.

Table 6: Number of JCFD Units Dispatched to Calls

	Number of Units							
Call Type	One	Two	Three	Four	Five	Six	Seven or More	Total
Cardiac and stroke	976	54	3	1	0	0	0	1,034
Seizure and unconsciousness	679	55	1	0	0	0	0	735
Breathing difficulty	732	28	2	0	0	0	0	762
Overdose and psychiatric	104	6	0	0	0	0	0	110
MVA	443	110	20	3	0	0	0	576
Fall and injury	1,092	74	2	0	0	0	0	1,168
Illness and other	1,389	95	11	0	0	0	0	1,495
EMS Total	**5,415**	**422**	**39**	**4**	**0**	**0**	**0**	**5,880**
Structure fire	8	0	1	0	31	44	18	102
Outside fire	114	26	10	2	4	2	1	159
Hazard	145	35	8	1	25	36	9	259
False alarm	195	75	9	3	38	596	66	982
Good intent	47	6	1	0	13	18	3	88
Public service	178	26	1	1	1	9	2	218
Fire Total	**687**	**168**	**30**	**7**	**112**	**705**	**99**	**1,808**
Mutual aid	170	19	1	0	0	2	0	192
Canceled	843	83	5	0	6	2	1	940
Grand Total	**7,115**	**692**	**75**	**11**	**118**	**709**	**100**	**8,820**
Percentage	**80.7**	**7.8**	**0.9**	**0.1**	**1.3**	**8.0**	**1.1**	**100.0**

Table 7: JCFD and JC-WCEMS EMS Co-response within City Limits

Call Type	Number of Units from Two Agencies				
	Two	Three	Four	Five or More	Total
Cardiac and stroke	23	1,008	195	25	1,251
Seizure and unconsciousness	35	598	150	25	808
Breathing difficulty	14	727	157	16	914
Overdose and psychiatric	10	101	25	0	136
MVA	23	12	4	2	41
Fall and injury	120	672	159	23	974
Illness and other	162	1,032	237	38	1,469
EMS Total	**387**	**4,150**	**927**	**129**	**5,593**
Percentage	**6.9**	**74.2**	**16.6**	**2.3**	**100.0**

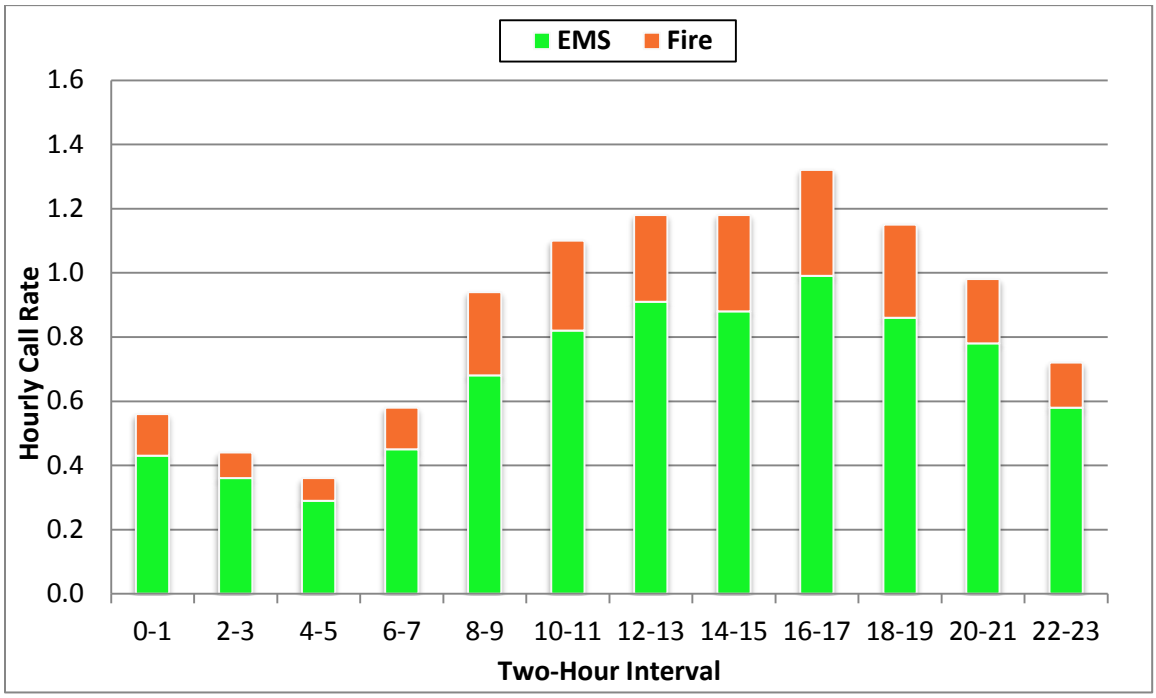
Note: Tables 6 and 7 include responding units from both agencies, except for administrative vehicles.

Observations from Table 7 include:

- The average number of units per EMS call responding in Johnson City was 3.2 units.
- On average, 2.1 Washington County units and 1.1 JCFD units responded to an EMS call in the city of Johnson City.

Calls by hour of day and associated workload are important benchmarks when reviewing call demand and overall call workload of a fire agency, particularly when considering alternative staffing and deployment models. Figure 8 illustrates this for the JCFD. Table 8 depicts workload (time spent on calls for service) for the same hours per day.

Figure 8: Calls by Hour of Day



Observations from Figure 8 include:

- Call rates were highest during the day between 10:00 a.m. and 8:00 p.m., averaging between 1.11 and 1.32 calls per hour.
- The call rate peaked between 4:00 p.m. and 6:00 p.m., when it averaged 1.32 calls per hour.
- Call rates were lowest between midnight and 8:00 a.m., averaging between 0.36 to 0.58 calls per hour.

Table 8: Deployed Minutes by Hour of Day

Two-Hour Interval	EMS	Fire	Total
0-1	10.1	12.1	22.2
2-3	7.8	9.0	16.8
4-5	6.7	8.6	15.3
6-7	10.8	11.8	22.6
8-9	15.7	18.8	34.5
10-11	20.2	20.1	40.2
12-13	20.9	20.9	41.8
14-15	20.5	18.2	38.7
16-17	23.4	21.8	45.1
18-19	18.9	19.1	38.0
20-21	17.4	11.7	29.1
22-23	13.0	13.1	26.1
Daily Total	370.7	370.4	741.1

Note: Daily totals shown equal the sum of each column multiplied by two, since each cell represents two hours.

Table 8 observations are:

- Hourly deployed minutes were highest during the day between 10:00 a.m. and 8:00 p.m., averaging between 38.0 minutes and 45.1 minutes per hour. Average deployed minutes peaked between 4:00 p.m. and 6:00 p.m., averaging 45.1 minutes per hour.
- Hourly deployed minutes were the lowest between midnight and 6:00 a.m., averaging fewer than 23 minutes per hour.

Workload by Individual Unit

Workload represents that time a unit is busy on a call for service. A dispatch of a unit is defined as a run; thus a call might include multiple runs. The data shown in Table 9 are characteristic of workloads generally being experienced by comparable jurisdictions across the nation. A 20 minute call duration is very typical of two-tiered EMS systems and a 20 minute duration for fire calls is representative of the vast distribution of fire-related calls. Fire-related calls include few working fires or significant situations that typically last between one and two hours. What is unique about Johnson City is the volume of resources that are sent to most calls, which are rarely emergency situations. This is strikingly apparent in the total runs associated with false alarms. The data indicate that 4,628 runs (vehicle movements) were made by JCFD units to false alarms, most of which were in an emergency response mode (lights & sirens). This constitutes nearly 70 percent of all runs for fire-related calls (6658 total fire runs-See Table D4 on page 90). This volume of activity appears elevated and warrants further evaluation.

Table 9: Call Workload by Unit

Station	Unit Type	Unit ID	Average Deployed Minutes per Run	Annual Number of Runs	Annual Hours	Runs per Day	Deployed Hours per Day
1	Pumper	E1	22.5	1,070	401.5	2.9	1.1
2	Pumper	E2	21.4	1,554	553.9	4.3	1.5
	Ladder	TR2	18.4	621	190.4	1.7	0.5
3	Pumper	E3	17.5	2,463	716.4	6.7	2.0
4	Pumper	E4	19.4	2,432	787.2	6.7	2.2
	Ladder	TR3	18.5	1,045	321.5	2.9	0.9
5	Pumper	E5	20.7	1,808	623.0	5.0	1.7
	Ladder	TR1	19.9	654	217.0	1.8	0.6
6	Pumper	E6	20.9	833	290.2	2.3	0.8
	Rehab	REHAB	172.8	1	2.9	NA	NA
7	Light and air support	AIR1	42.6	11	7.8	NA	NA
	Pumper	E7	19.1	1,139	363.3	3.1	1.0
8	Pumper	E8	28.0	229	107.0	0.6	0.3
9	Pumper	E9	21.8	492	178.8	1.3	0.5
Total			**19.9**	**14,352**	**4,760.9**	**39.3**	**13.0**

Observations from Table 9 include:

- E4 in station 4 was the unit with the most deployed hours. It averaged 6.7 runs and **2.2 hours of deployed time per day.** E3 in station 3 was the second most utilized unit, and it averaged 6.7 runs and **2.0 hours of deployed time per day.**

- Of the three ladders, TR3 made the most runs. It averaged 2.9 runs and **0.9 hours per day.**

Dispatch and 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 these 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 and ends when the dispatched unit arrives on the scene to initiate action.

According to NFPA 1710, "*Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Departments,*" 2010 Edition, the alarm processing time or dispatch time should be less than or equal to 60 seconds 90 percent of the time. This standard also states that the turnout time should be less than or equal to 80 seconds (1.33 minutes) for fire and special operations 90 percent of the time, and travel time shall be less than or equal to 240 seconds for the first arriving engine company 90 percent of the time. The standard further states the initial first alarm assignment should be assembled on scene in 480 seconds 90 percent of the time. ***NFPA 1710 response time criterion is a benchmark for service delivery and not an ICMA recommendation.***

The 90th percentile measurement, often referred as a "Fractile Response," is a more conservative and stricter measure of total response time. ***Most fire agencies are unable to meet this standard.*** Simply explained, for 90 percent of calls, the first unit arrives within a specified time, and if measured, the second and third unit. This is further analyzed and reported in the data analysis appendix.

Table 10 depicts average dispatch, turnout, travel, and total response times of the JCFD's first arriving fire units for EMS and fire category calls.

Table 10: 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	2.4	1.8	3.2	7.4	851
Seizure and unconsciousness	2.4	1.6	3.0	7.1	559
Breathing difficulty	2.2	1.9	3.2	7.3	624
Overdose and psychiatric	2.8	1.7	3.3	7.9	80
MVA	1.1	1.4	3.1	5.6	386
Fall and injury	2.6	1.8	3.2	7.6	560
Illness and other	2.5	1.7	3.0	7.2	833
EMS Total	**2.3**	**1.7**	**3.1**	**7.2**	**3,893**
Structure fire	1.4	1.3	2.8	5.5	91
Outside fire	1.6	1.3	3.3	6.2	144
Hazard	1.8	1.5	3.5	6.9	211
False alarm	1.6	1.3	3.2	6.1	798
Good intent	1.8	1.4	4.0	7.2	74
Public service	2.1	1.8	3.8	7.7	69
Fire Total	**1.7**	**1.4**	**3.3**	**6.3**	**1,387**
Total	**2.1**	**1.6**	**3.2**	**6.9**	**5,280**

Note: First arriving units with valid dispatch, turnout, and travel times were used in this analysis.

For this data study period ***unless otherwise indicated response times and travel times measure the first arriving unit only***. The following averages were determined from the data provided to ICMA: for all calls, the average dispatch time was 2.1 minutes, the average turnout time was 1.6 minutes, and the average travel time was 3.2 minutes.

For EMS calls the average dispatch time was 2.3 minutes, the average turnout time was 1.7 minutes, and the average travel time was 3.1 minutes. The average total response time for EMS calls was 7.2 minutes.

For fire calls, the average dispatch time was 1.7 minutes, the average turnout time was 1.4 minutes, and the average travel time was 3.3 minutes. The average total response time for fire category calls was 6.3 minutes. The 90th percentile total response time for EMS and fire category calls was 10.0 and 9.8 minutes, respectively.

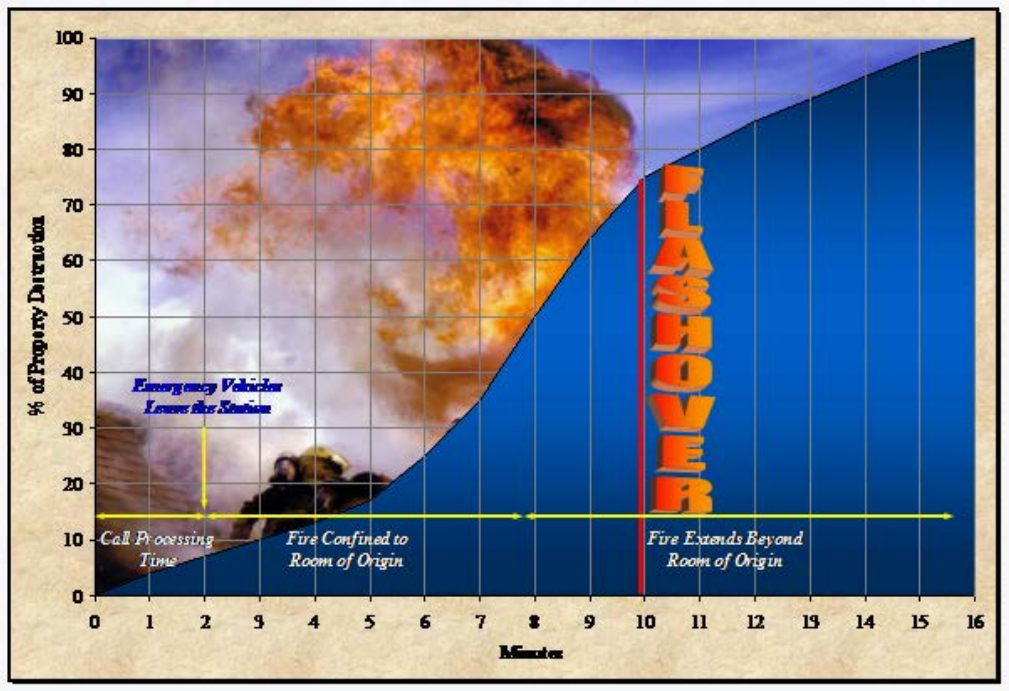
Response times are typically the primary measurement in evaluating fire and EMS services. However, most deployment models have been built around a four-minute initial response time for EMS and an eight-minute full force response for fire. Though these times have validity, the actual impact of a speedy response time is limited to very few incidents. For example, in a full cardiac arrest, analysis shows that successful outcomes are rarely achieved if basic life support (CPR) is not initiated within four minutes of the onset. However, cardiac arrests occur very infrequently, on average in 1 percent to 1.5 percent of all EMS incidents.[11] There are also other EMS incidents that are truly life threatening and the time of response can clearly impact the outcomes. These involve full drownings, electrocutions, and severe trauma (gunshot wounds, stabbings, motor vehicle accidents, etc.). Again, the frequency of these types of calls is very limited.

Regarding response times for fire incidents, the response criteria is based on a concept called "flashover." This is an occurrence in which super-heated gasses from a fire are released rapidly, causing the fire to burn freely and become so volatile that the fire reaches an explosive state. In this situation, usually after an extended period of time (eight to twelve minutes), the fire expands rapidly and is much more difficult to contain. When the fire does reach this extremely hazardous state, larger and more destructive fire occurs. One major consideration is what has been termed "detection time." This is the time it takes to detect a fire and notify 911 to initiate the response. In many instances, particularly at night and when automatic detections systems (fire sprinklers and smoke detectors) are unavailable or inoperable, the detection time can be extended.

Figure 9 illustrates this phenomenon, known as the fire propagation curve, and its potential impact on firefighters and fire extinguishment.

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

Figure 9: Fire Propagation Curve



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

In evaluating response times it is also critical to fully understand the components of this measure and more importantly those aspects that are more manageable than others. These time segments are:[12]

1. Dispatch Time. Dispatch time is the amount of time that it takes to receive and process an emergency call. This includes (1) receiving the call, (2) determining what the emergency is, (3) verifying where the emergency is located, (4) determining what resources are required

[12] Non-Emergency Fire Department Functions. In Cote, A.E. (Ed.) et al, *Fire Protection Handbook, Volume II, Twentieth Edition* (Quincy, MA: National Fire Protection Association), 12-218.

to handle the call, and (5) notifying the units that are to respond. **Dispatch time is controlled.**

2. Turnout Time. Turnout time is the period beginning from when units acknowledge notification of the emergency to the beginning point of response time. ***Turnout time can be managed by monitoring data recorded in computer-aided dispatch; it is one of the most manageable segments in the reflex sequence.***
3. Travel Time. The time that begins when units are en route to the emergency incident and ends when units arrive on the scene.
4. Access Time. Access time is the amount of time required for the crew to move from where the apparatus stops to the emergency. This can include moving to the interior of upper floors of a large building and dealing with any barriers along the way. ***Access time is managed through a good pre-fire planning process that familiarizes the firefighters with access points, automatic system controls, enunciator panel locations, and travel routes through buildings.***
5. Setup Time. Setup time is the time required for fire department units to set up, connect hose lines, position ladders, and otherwise prepare to extinguish the fire. It includes disembarking from the apparatus, pulling and placing hose lines, charging hose lines, donning self-contained breathing apparatus, making entry into the building, and beginning to apply water. ***The opportunity for saving time during setup is minimal, even for trained personnel.***

By looking at each segment within the total reflex time sequence and understanding the objectives of the segment (see flow chart below), a fire department can measure its current performance against these objectives. Figure 10 illustrates the total reflex time sequence.

Figure 10: Total Reflex Time Sequence

ICMA noted the JCFD does not use performance measures in assessing its operations. We think the system is more apt to achieve community expectations and improve service delivery if such measures are developed and monitored on a regular basis.

Also, understanding response times from a spatial perspective is an essential planning element. To illustrate the importance of this, the following maps show the type of coverage provided by the JCFD. Figures 11, 12, and 13 utilize Geographic Information System (GIS) mapping to illustrate travel time probabilities, showing 240-second (red), 360-second (green), and 480-second (blue)

travel time comparisons. These comparisons are made by utilizing the existing city road network from the existing JCFD fire stations. Johnson City limits are shown with a light yellow line.

Figure 11: 240-Second Travel Time

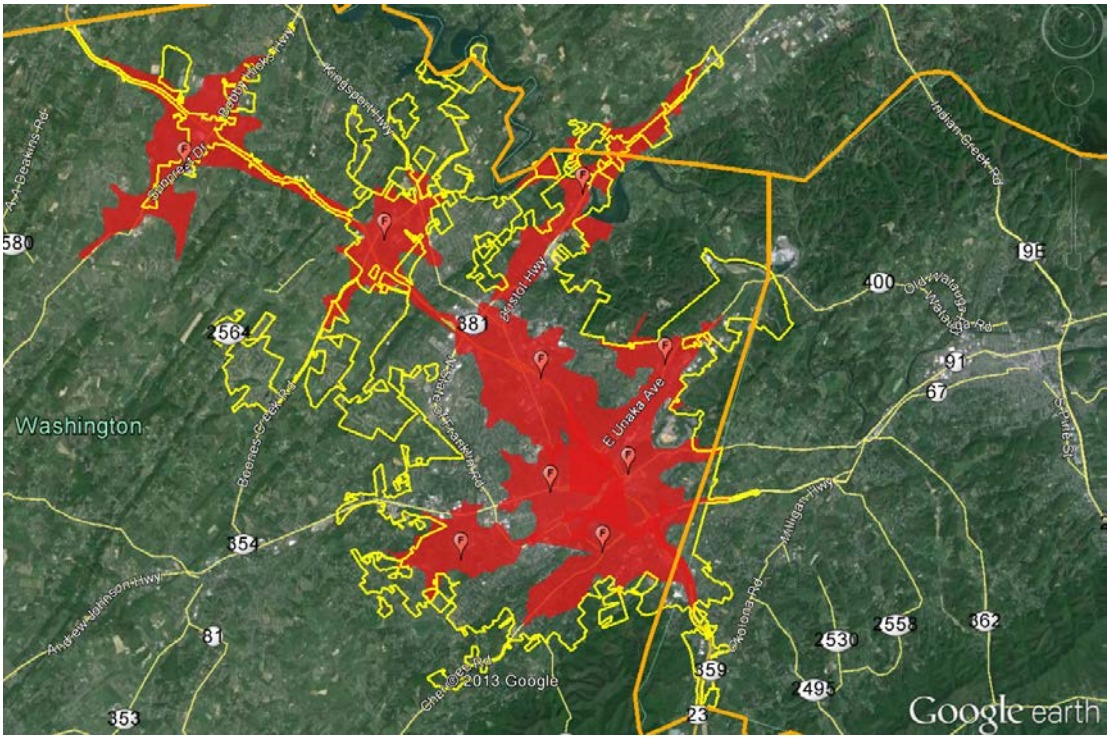


Figure 12: 360-Second Travel Time

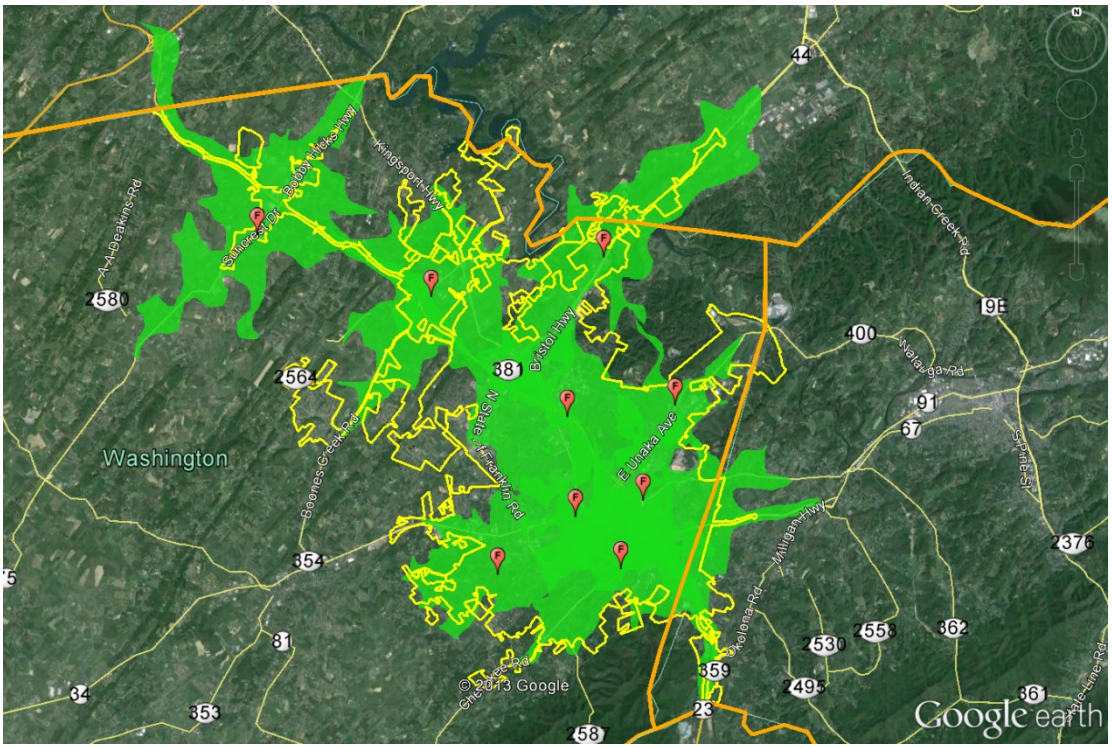


Figure 13: 480-Second Travel Time

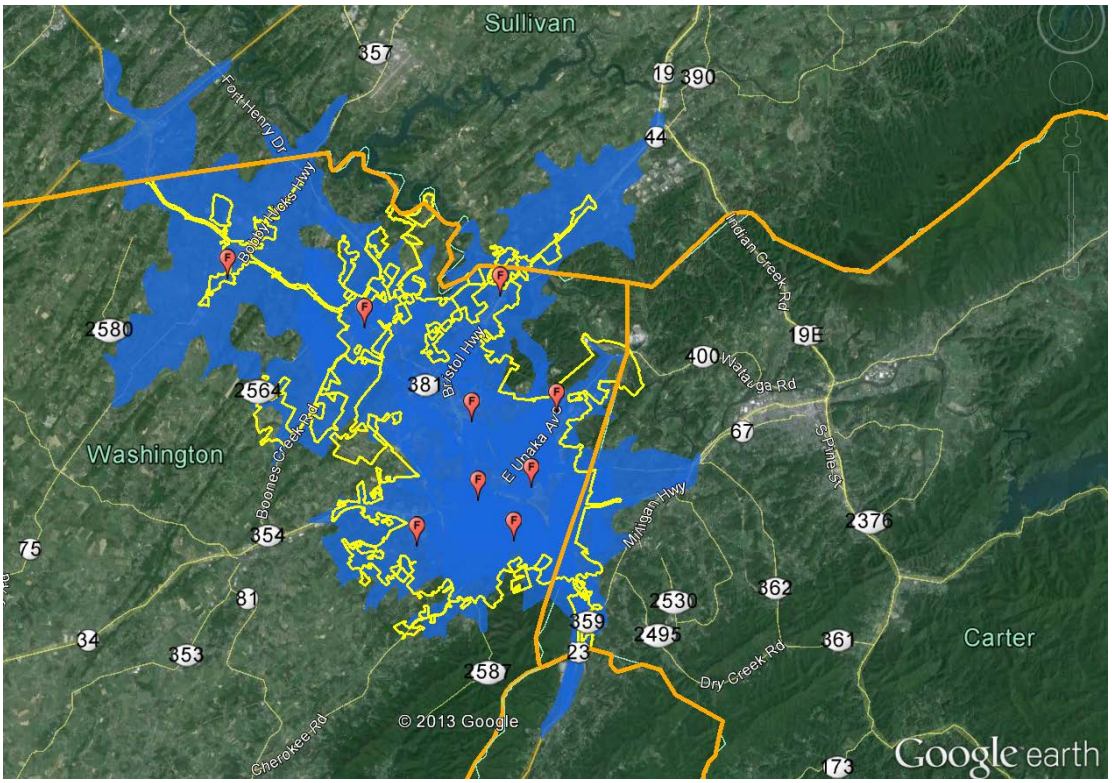
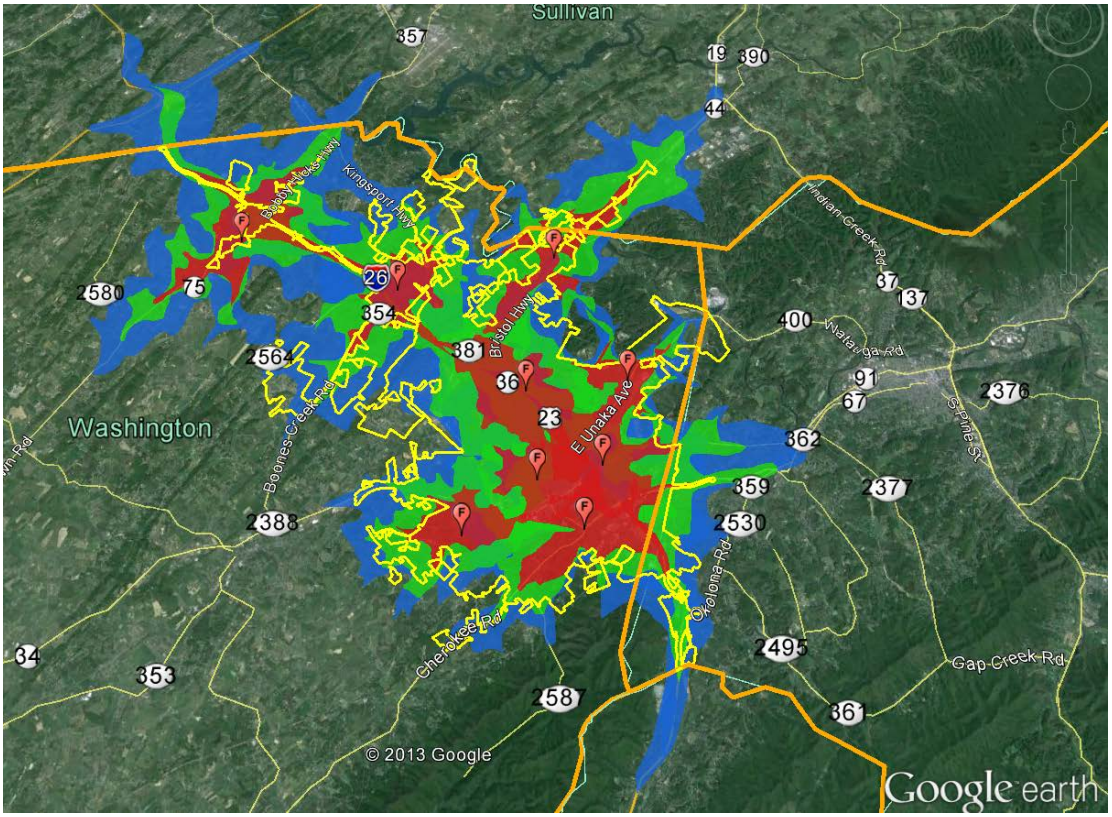


Figure 14: 240/360/480-Second Travel Time from JCFD Facilities

Red = 240 Seconds/Green = 360 Seconds/Blue = 480 Seconds



Observations from the travel time maps show us that a good portion of the city is covered within the 240-second benchmark, the majority of the city is covered within the 360-second benchmark, and the entire city is covered within the 480-second benchmark.

Response to Fire Incidents

Vehicle response to fire incidents is guided by NFPA Standard 1710, *Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments-2010.* The standard recommends a total of fourteen personnel be assembled for an initial response to a fire incident. On responses in which an aerial device is utilized, the recommend staffing is increased to fifteen. The JCFD attempts to meet this standard in its response protocols. The standard is built upon the various functions that are carried out in an active fire scenario (command, water supply, fire attack, search and rescue, ventilation and safety/RIC). JCFD deployment polices assigns three engines, two trucks, and one Captain to a single family structure assignment. On multifamily residential structures, and commercial and industrial buildings, the initial response is increased to four engines, two trucks, and the Captain. When the JCFD is at minimum staffing (thirty-one personnel), six of its first response units (E-1, E-8, E-9, T-1, T-2, T-3) are staffed with two personnel. Depending on the location of the incident and the units assigned to that incident, the number of personnel responding as the initial response can vary from

twelve to fourteen personnel. Similarly, on commercial assignments the number of personnel can range from thirteen to seventeen personnel.

The use of two-person engine and ladder companies is not a common staffing practice in most urban settings. There is ongoing debate regarding staffing levels in the fire service. Two personnel are appropriate when responding to EMS calls and minor service calls; however, in a fire incident a two-person company must team up with other responding units in order to effectively conduct many tactical operations. NFPA recommends that engine and ladder companies be staffed with a minimum of four personnel.[13] Though ICMA does not recommend four-person minimum staffing, this reference is provided to qualify the basis for this citation. Our observations indicate that three-person staffing on engine companies is more prevalent in smaller, suburban jurisdictions and four-person staffing is most common in larger urban areas. The use of two-person engine companies is typically utilized in the more rural settings or when apparatus are assigned in a multi-company station in which the combined staffing of all responding units from that facility would exceed four personnel.

Aerial Apparatus

The deployment of aerial apparatus including ladder trucks, quints, platforms, and telesquirts is a topic of significant controversy in the American fire service. Aerial apparatus in general are the most expensive vehicles to purchase and are very costly to maintain and operate. Recently JCFD paid over $1.65 million for its two aerial apparatus. These apparatus, however, are the most underutilized vehicles in the fire fleet and are rarely used for their intended purpose. The primary uses for aerial equipment is generally four-fold:

- One is to provide an elevated fire stream to reach multistory buildings.
- A second, though similar use, is to produce a protective stream of water (water curtain) to neighboring structures to prevent them from catching fire.
- A third use of aerial apparatus is to provide the rapid placement of fire personnel on upper stories and roof structures for the purpose of providing ventilation. Ventilation is the process in which superheated smoke and gasses are released from a structure in order to improve visibility, cool the environment, and foster extinguishment.
- As a final use, aerial apparatus provide a means to remove or rescue civilians and fire personnel who may be trapped on the upper stories of the structure or on the roof.

An aerial apparatus is very effective in firefighting tactics because it can provide a high vantage point to be able to direct and redirect hose streams with the limited use or endangerment of personnel. In most jurisdictions the number of aerial apparatus deployed is determined through an evaluation done by the Insurance Services Office (ISO). ISO uses a formula that determines the distribution of ladders needed on the basis of the number of high-rise structures (over thirty-five feet) in the community and their associated fire flow calculation. The goal is to achieve a

[13] NFPA-1710, *Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments,* 5.2.2.1.1 & 5.2.2.2.1-2010.

distribution of ladder trucks in order to provide a 2.5 mile travel distance to those areas with concentrations of high rise structures. (ISO-"Credit for Distribution, Item 561)" Johnson City, November 2000). Ironically, ISO places little weighting with regard to the presence of automatic fire sprinklers in these high-rise structures.

The most recent ISO review in Johnson City (November 2000) recommends three ladder companies for the city to receive full credit in this category. Given the nature of the community and the number of unprotected high-rise structures, ICMA recommends that the city reevaluate the use of aerial apparatus and the staffing of these units. The ISO weighting for aerial apparatus provides up to 5 points of the total 100 points in the review. In the 2000 evaluation Johnson City received the full 5 points of credit for ladder service. The ISO rating for Johnson City in this 2000 evaluation was a Class 3/9, with Class-1 being the highest level and Class-10 the lowest. The 3/9 rating means those areas within five miles of a fire station and within 1,000 feet from the municipal water system (fire hydrants) will receive the Class 3 rating. If a property is outside these distances (either from a station or a water source) it receives the Class-9 rating. There is a significant difference between a Class 3 and Class 9 rating as it relates to insurance premiums. However, there is little change in insurance rates for residential properties with class ratings that vary between Class 1 and Class 5.

ISO provides partial credit for the number of aerial apparatus available though not staffed on a regular basis. If personnel are utilized to operate both the ladder truck and a secondary piece of equipment, perhaps an EMS rescue vehicle, the point deduction for this deployment method would be minimal (between one and two points). In the 2000 evaluation, Johnson City received a total of 75.8 points out of the total 100 points available. The Class 3 rating requires a minimum of 70 points.

A number of communities are reexamining the deployment of ladders and fire trucks and opting for a more efficient, less costly vehicle type to handle minor EMS or nonemergency call types. (See Tualatin Valley, Ore., Fire Rescue, "CARS" Program; and the Shreveport, La., Fire Department, "SPRINT" Program). An analysis of repair costs for fire apparatus compared to lighter weight SUVs or a comparable alternative response vehicle is startling. The cost estimates shown in Table 11 were utilized by the Shreveport, La., Fire Department in making a cost comparison between a one-half ton SUV (Ford Expedition) and a typical fire department engine.

Table 9: Fire Apparatus-Small Vehicle Maintenance/Response Cost Comparison

Service	Fire Apparatus (Engine)	SUV
Oil and Filter Change	$175	$25.95
Set of Tires	$1,800	$625
Complete Brake Job	$3,600	$270
Battery Replacement	$429	$53.95
Alternator Replacement	$1,195	$125
Windshield Replacement	$2,400	$600
Fuel Efficiency	3-5 MPG	15-20 MPG

A secondary consideration of the removal of one ladder truck from service is the ability to redeploy these personnel to engines that operate with two personnel. This would reduce the number of two-person engine companies from three to one when the department is operating at minimum staffing. Another option is to utilize the additional personnel to staff the second captain's position and use the remaining position to bolster staffing on one of the two-person engines. In either case ICMA feels that the redeployment of the staffing from one ladder company to either of these staffing options will enhance organizational effectiveness and avoid the costs associated with operating three ladder companies in the city. Truck 2 is a 1999 vintage, 105-foot aerial tower that should be considered for replacement in the next three years.

Recommendations:

- The JCFD should evaluate options that deploy fewer vehicles on the initial response to both fire and EMS incidents. The city should work with Washington County Emergency Communications District to adjust run cards for fire calls and to adjust the combined assignment of JCFD and Washington County EMS units to EMS incidents.
- The JCFD should limit the use of overtime to maintain the daily minimum staffing at thirty-one personnel, and should utilize overtime only during peak periods of operation (8:00 a.m. to 8:00 p.m.). During nonpeak periods (8:00 p.m. to 8:00 a.m.), overtime expenditure should be utilized to bring minimum staffing to twenty-nine personnel.
- The JCFD should establish a second Captain position on each shift and should split its service area into two distinct battalions, each with on-duty supervision.
- The JCFD should fully acknowledge the supervisory role of the Sergeant/Engineer, should include this function as a part of the position's job description, and should provide supervisory and tactical safety training for these personnel.
- The JCFD should develop a staffing enhancement program that increases staffing on those two-person engine companies (E-1, E-8, and E-9) that operate in stations as the sole responding unit from that facility.
- The JCFD should consider an alternative staffing model for one of its ladder trucks, utilizing a "jump-squad" that can be deployed to either the ladder truck or a smaller EMS response vehicle, depending on the nature of the call.

Emergency Communications

ICMA also conducted a comprehensive analysis of the Washington County Emergency Communications District (WCECD). The WCECD has communications and dispatch responsibility for fire operations for the JCFD, as well as Washington County volunteer fire departments, the Johnson City-Washington County EMS agency, and the law enforcement components of Johnson City and Washington County. Johnson City owns the backbone, towers, and infrastructure of the radio system to include mobile and portable radios. The ICMA analysis of the WCECD concludes that it was a professional organization capable of providing emergency dispatch services to public safety agencies of Johnson City.

The WCECD analysis also pointed to several key areas where there were opportunities for improvement, most notably in the need to begin planning for a new facility. This leads to an important question: should Johnson City assume the responsibility for public safety communications and dispatch internally utilizing city resources? ICMA does not recommend this approach and believes strongly that the most efficient use of resources is to maintain the current relationship with the WCECD and not undertake emergency communications responsibilities. The economies of scale and inter-agency cooperation currently enjoyed with the WCECD are benefits that far outweigh the any potential gains possible though an internal operation.

The JCFD discussed with ICMA staff several areas in which they seek improvement with the WCECD, including consistent assignment of a telecommunicator to the separate working incident channel; moving more calls off the main dispatch channel to reduce radio traffic; and station back-fills (move ups) completed by the emergency communications center as opposed to the shift captain. JCFD staff also mentioned that they are not receiving data/dispatch reports.

The WCECD communicated to ICMA that a telecommunicator is assigned to monitor tactical channels during working incidents, but that call demand and workload on other channels may result in some inconsistency in this practice. Enlisting additional telecommunicators to meet JCFD's request would come at a cost. Similarly the movement of more incidents off the main JCFD dispatch channel may also increase demand on a channel that is not currently staffed, requiring an additional telecommunicator. Currently single apparatus calls are moved to a tactical channel with multi-unit calls remaining on the primary channel.

Having WCECD initiate station backfills/move ups to cover vacated JCFD stations is a matter of policy direction by the JCFD to the WCECD. Such a guideline can be added to Section L of the WCECD policy and procedure manual, and staff can be trained in the specifics of the policy.

With regard to data/dispatch reports the JCFD uses Firehouse reporting system for incident reporting, but it does not have the Firehouse/CAD interface that can download CAD information into this system for incident reports. The WCECD explained that the CAD system is a database not a reporting system: data reports have to be requested with the type of data needed clearly specified, and then the requested data must be extracted from the CAD and formulated into a report. This is done when requested, but there is not an automatic report on a regular basis.

In the analysis of the WCECD, ICMA recommended that a "user group" be created representing all of the agencies serviced by the WCECD. This user group could be instrumental in establishing more rigorous protocols for CFS dispatching, and more aggressively triaging CFS response. The user group would also be in an excellent position to participate in the planning process for a new emergency communication facility and the dispatch protocols appropriate for Johnson City.

Recommendation:

- Maintain existing emergency communications with the WCECD and participate in WCECD User-Group once it is established.

Employment Practices

ICMA was asked to evaluate a number of employment practices utilized by the JCFD and provide our insights regarding these efforts. Included in this review are the following;

- Job Descriptions
- Promotional Testing
- Performance Appraisals
- Residency Requirements
- Vehicle Take-Home Policy
- Uniform Allowance.

Job Descriptions

The employee job description is the most recognized and useful tool in defining job duties and employment requirements in the workplace. Job descriptions are a cornerstone of the classification system specifying such things as employment entry criteria, pay grades, promotional and education requirements, physical requirements, and supervisory oversight. In addition, the job description is very malleable and can be changed or altered, usually with only the self-imposed requirement that reasonable lead-time is provided with regard to making substantive changes. Job descriptions are completely under the purview of management and should be utilized as the premiere method in which organizational direction and oversight is implemented.

Johnson City has developed job descriptions for all fire department positions from the rank of firefighter up to and including the position of Fire Chief. Most job descriptions, with the exception of Firefighter, were last revised in July 2008. The Firefighter job description was revised in September 2009. ICMA believes that a number of the employment criteria included in the existing job descriptions are in need of revision. Our analysis of job descriptions will focus on the following positions:

- Fire Captain
- Fire Lieutenant
- Fire Sergeant/Engineer
- Firefighter.

There are a number of job requirements that should be included in all the job descriptions identified above. The most important of these is the requirement that employees possess and maintain ***EMT-I Certification***. This is an essential job function for all positions and all employees should be required to have this certification as a condition of employment. Currently the JCFD provides a pay increment when employees obtain EMT-I Certification. If this becomes a pre-requisite for hire, starting salaries may need adjustment to reflect this added provision. A second provision that should be added to all job descriptions is related to personal fitness and medical health. Each job description should expand the component of ***physical requirements*** to include

reference to annually qualifying under the adopted physical requirements. In addition, the job description should add language to require an annual medical examination by the city's physician. A provision indicating that all positions are subject to annual drug screening, including drug screening when reasonable suspicion occurs, is also recommended.

Under the criteria for acceptable experience and training, **State Certified Firefighter II** should be stated as an entry requirement for all positions above the rank of Firefighter. For Firefighter, ICMA recommends that the Firefighter II certification be obtained prior to completing one year of service as a condition of employment. The Tennessee Commission on Firefighting indicates it will be changing its requirement on the time lag from one-year to 30-days. If this change is implemented, the JCFD should consider changing its time lag for Fire Fighter I's to obtain Fire Fighter II certification. This same provision should apply to the EMT-I certification. Currently, the job description allows the Firefighter II certification to be obtained within three-years from the date of hire and twenty-four months for the EMT certification. All ranks above Firefighter should require these certifications at the time of promotion, with the added provision that they must be **maintained** on an ongoing basis as a condition of employment.

All positions should reference the ability to utilize a number of ***computer applications*** with proficiency in the use of word processing and the fire reporting system currently utilized in the JCFD

Formal ***college education*** is another criterion that requires specifics among all positions above the Firefighter classification. ICMA recommends that the following educational requirements be added to the affected positions. It is also important that all college credits or degree requirements specify that they be obtained from an institution that has been accredited by a regional or nationally recognized accrediting agency. Currently the city does not have college education requirements for promotion. Instead the city offers additional points in the testing process for those candidates who have completed degree programs.

Fire Sergeant/Engineer: ICMA believes that appointment to this position requires the completion of approved college course work in Apparatus and Equipment, Fire Pump Practice and Hydraulics, Emergency Vehicle Operators Course, Fire Service Leadership and Supervision, IS 100 and 200 and ICS 300. We recommend that candidates for this position also complete a minimum of twelve academic credits at the time of application. In addition, ICMA recommends that the job title Fire Sergeant/Engineer be shortened to Fire Engineer. The designation "Sergeant" is a holdover from the Public Safety Officer era and should be discontinued. The current civil service qualifications specified in Article 16 is insufficient.

Fire Lieutenant: ICMA believes that this position should require an Associate's Degree in Fire Science, Emergency Medical Service, or a related field. In addition, all Lieutenants should meet the eligibility criteria for the Fire Engineer. ICMA does not recommend that all future Fire Lieutenants must serve as Fire Engineer in order to be promoted to Lieutenant. We do, however, recommend that they meet the most recent eligibility criteria for Fire Engineer and have taken and passed a recent (within five-years) Fire Engineer promotional exam. All Lieutenants should complete the

following coursework prior to achieving eligibility: Emergency Vehicle Operators Course, state of Tennessee Fire Inspector Certification, Fire Service Leadership and Supervision, Fire Officer 1, Instruction Techniques for Company Officer, IS 100, 200, and 700, and ICS 300 and 400. The current civil service qualifications specified in Article 16 is insufficient.

Fire Captain: ICMA recommends that this position require the completion of a Bachelor's Degree in Fire Administration, Emergency Medical Service, Public Administration, or a degree in a related field. As well, Captains should meet the eligibility requirements for Fire Lieutenant. All Captains should also be certified by the state of Tennessee as Fire Officer 2. The current civil service qualifications specified in Article 16 is insufficient.

There are two areas in fire service job descriptions that are more problematic than in other classified positions. These relate to ***time-in-grade*** provisions and latitude in granting waivers for ***new training and educational requirements***. The time-in-grade provision is important in specifying the minimum years of experience needed for the position, but it also addresses the more critical component of whether a new hire in a position must come from within the organization or if outside candidates are eligible. Current civil service language requires a minimum of three years time-in-grade experience with JCFD in the lower position in order to qualify for promotion. ICMA recommends that, for the positions of Fire Engineer, Fire Lieutenant, and Fire Captain, these positions continue to specify the desired "time-in-grade" requirement from within the Johnson City Fire Department. These positions are very organizationally specific and the ability to hire from outside the organization is compounded with the combination of the technical and organizational familiarities that are required. ICMA feels it would be difficult for an outsider to grasp and commit to knowledge these organizationally specific criteria without a lengthy orientation and training process. In addition, there is a morale issue that will elevate when outsiders to the organization are brought in and the opportunity for advancement from within is thus limited. However, outside candidates may be considered for higher-ranked positions in the organization, including; Assistant Fire Chief, Fire Marshal, and Fire Chief.

With regard to a change in training and educational requirements the question becomes the amount of lead time that is realistic in implementing these new provisions. ICMA recommends that this issue be addressed in the following way:

1. The JCFD leadership should conduct a series of meetings to discuss the proposed changes and the rationale for these changes; there should be ample opportunity for questions and feedback from departmental members
2. The organization should then formally announce and post the intended changes upon finalizing the new requirements, and in this announcement specify the dates that the new criteria will become effective.
3. The new changes do not become effective until the existing cycle and next cycle of the promotional process are completed under the existing criteria. For example, if an eligibility list currently exists for the Fire Lieutenant position, that list will stay in effect until a new list is created. The new list will continue to operate under the existing requirements.

However, when that promotional process runs its course, the next promotional process will utilize the new criteria.

4. Once the new criteria are enacted, candidates on a case-by-case basis may be eligible to sit for the exam but will not be promoted until all the new criteria are met. For example, if a candidate for Fire Lieutenant does not possess the new Associate's Degree requirement, but they have been actively taking courses since the announcement of the new requirements, that individual may be allowed to take the promotional exams but will not be promoted until they obtain the degree. However, if that individual has not completed the Instruction Techniques course and there have been ample opportunities since the posting of the new requirements for he or she to do so, the candidate would be ineligible and not permitted to sit for the exam.

Promotional Testing

The promotional testing and selection process has been very disjointed and has created a lack confidence with the city's leadership among a broad cross section of the JCFD. In our discussions with the JCFD leadership and Human Resources about promotional testing and appointment, there was ready acknowledgement that problems have occurred and that solutions were needed. However, when asked as to the cause of these problems, we could not obtain a definitive answer, nor ownership for this problem. In addition, we noted a number of recent promotions and temporary appointments that appear to have been done, or authorized, in anticipation of our review.

The promotional processes for Fire Engineer, Fire Lieutenant, and Captain are the most competitive and coveted career advancement processes in the fire service. Even more importantly, these promotional processes provide an exceptional learning environment in which candidates prepare themselves and spend countless hours studying and learning the source materials. From an organizational perspective, there is no better training instrument than the fire service promotional processes. It is untenable to squander this level of personal initiative and create an environment in which fire personnel distrust the process and choose not to participate.

The fire service promotional process should be very structured and directed by written policy. The process must be relevant to the position and the test materials should be updated at frequent intervals in order to properly reflect the latest technology and management systems germane to the position. Most fire departments conduct promotional testing processes at defined intervals. Typically, a test is given and a list is created and as vacancies occur, personnel are appointed from the established lists. The JCFD should develop a departmental policy that specifies the scheduling, test components, their weighting, and the eligibility criteria for the Fire Engineer, Lieutenant, and Captain. ICMA further recommends that promotional testing for Engineer and Lieutenant be held every two years. We also recommend that one exam be held on even years and the other on odd years. Captain promotions, due to the fewer number of positions, and subsequent vacancies, can be held when an opening is anticipated or a vacancy occurs.

Another issue that caused difficulties in recent promotional testing relates to a 70 percent passing score on the written portion of the exam. Individuals who did not receive the 70 percent passing score were eliminated from the process and not permitted to complete the other components of the promotional process. Though the written test is a key component of the testing process, ICMA does not feel that this should be the sole determinant in screening people from the other portions of the examination. Use of tests and other selection procedures can also violate the federal antidiscrimination laws if they disproportionately exclude people in a particular group by race, sex, or another covered basis, unless the employer can justify the test or procedure under the law.[14] ICMA believes that the overall test should have a minimum passing score, but this should be based on all aspects of the testing process and not the written portion of test alone.

The Engineer testing process is much more technical and should be weighted on the basis of practical skills relating to vehicle operations, including driving, vehicle maneuvering, pump practices, and hydraulic calculations in producing various types of fire streams and hose lays. In addition, there should be a test component that allows the candidate to demonstrate their operating skills on the various fire apparatus and associated equipment (portable pumps, fans, generators, etc.). The Engineer testing processes should include a written examination, practical testing, and an oral interview; however, the more significant weighting should be in the areas of vehicle operation and pump practices.

The Lieutenant testing process should focus on tactical skills, leadership, emergency field supervision, and problem solving. Additional focus should be given to a broad-based understanding of fire department policy and procedures, fire prevention, and training. The testing process for Lieutenant should again be in three parts, written, practical, and oral interviews. However, the practical and oral interviews should follow an assessment center format utilizing role plays, simulations, and presentation skills, all in an effort to hone in on critical knowledge, skills, and abilities.

The Captain promotional examination should further emphasize the managerial aspects on command and supervision of the workforce. Again, we would suggest a combination of test components including a written test, oral interview, and a more extensive assessment center process. The focus in this position is on leadership, field command, motivation, planning, organizational skills, time management, and a sound understanding of the organizational mission and performance measurement processes. The promotional testing for Captains should incorporate some budgetary issues and questioning that reflects on the political sensitivity of operating in a public setting.

The most critical aspects of all testing and assessment processes is the relevance of the materials utilized in the testing process and that the process is unbiased and fair to all participants. The use of subject matter experts (SMEs) in the development and administration of these examinations is highly recommended. There is always an uncertainty with regard to the use of SMEs and maintaining the confidentiality of the materials utilized in the testing process. This issue is

[14]EEOC- "Fact Sheet on Employment Tests and Selection Procedures", September 23, 2010.

compounded when those SMEs are also from within the organization. Given the past history of the promotional process in the JCFD, we recommend that the city utilize a contingent of both internal and external SMEs in developing and administering all three promotional processes.

It is critical that ample time be given in announcing an upcoming exam and providing the source materials for each examination. ICMA recommends that no less than six months advance notification be given for each examination so that participants have ample time to review the posted source materials and prepare for the examination.

Performance Appraisals

The performance appraisal process is the most improperly utilized supervisory tool available in public sector employment. The fire service has typically had a dismal track record in effectively utilizing performance appraisals in tracking individual performance and goal setting and in utilizing this process in the pursuit of individual excellence. Johnson City has developed a series of well-written and fully functional performance appraisal forms for each position within the fire department. The appraisal forms in use today are designed to provide ample opportunity for the employee and supervisor to develop a measurement process that is relevant and specifically crafted for their individual use. Our observations indicate that the most frequent shortfall in effective performance appraisals stem from the supervisor not utilizing this process effectively. Supervisors simply do not want to place in writing negative observations regarding an employee's performance. Instead, fire department appraisals are typically very complimentary and often lack specifics regarding monitored actions that denote either acceptable or unacceptable performance. The key to an effective performance appraisal process stems from the specific training of the supervisors utilizing these forms and the oversight of the process to ensure that these guidelines are being followed.

As discussed in an earlier section of this report, the Engineer is in fact the first line supervisor for much of the JCFD daily operations. It is therefore imperative that Engineers be involved in the performance appraisal process for the employees under their supervision. Captains should review those performance appraisals completed by their Lieutenants and Engineers to ensure they are being done properly and to understand the employee performance for those individuals under their command. The Captain will play a key role in career development and any disciplinary actions involving one of their crew members so it is imperative that they are formally involved in the review of these subordinates.

In most fire service organizations performance reviews are done on an annual basis. This is the case in the JCFD. The performance review process, in order to be effective, must involve an ongoing exchange between supervisor and subordinate throughout the review cycle. These employees should get together on no less than a quarterly basis to discuss performance goals and the progress that is being made in meeting the pre-established objectives. JCFD does not restrict the times a supervisor can meet with their subordinates, but it does not structure the process so that multiple meetings are held throughout the cycle. In situations that warrant a more closely monitored relationship, monthly meetings should be held. Supervisors should be encouraged to meet with their subordinates as frequently as is needed, but no less than quarterly in order to provide

feedback, have an open exchange regarding observed performance, or to alter or add new goals in the review process. The key to frequent meetings is to provide the necessary guidance to improve performance so that when the annual review is completed it clearly reflects the discussions that have transpired and no one is surprised with the outcome.

Residency Requirements

Fire departments have maintained residency requirements for many years. The primary reason has been to have emergency personnel in close proximity whenever a call-back is needed for additional personnel during a large-scale event. In addition, some jurisdictions have established a residency requirement so that employees live in the community in which they work. The goal is to bolster civic mindedness and ensure that employee wages are spent in the communities in which workers serve. The JCFD maintains a residency requirement for emergency response personnel that calls for them to live within a fifteen-mile distance from the city boundaries. ICMA believes that the maintenance of a residency requirement is not necessary. Employees want to live in their community; housing costs are not prohibitive in the Johnson City area so fire personnel can achieve home ownership. In addition, the frequencies of emergency recalls are very limited and the number of people needed when they do occur can be filled without this type of restriction.

Vehicle Take-Home Policy

A vehicle take-home policy is a subject that often receives public scrutiny when efforts are being made to curtail government spending or to address a perceived abuse. Typically, fire and police personnel are not looked upon as critically as other government employees who are issued take-home vehicles. The perception is that off-duty response by police and fire are true emergencies and take-home vehicles are justified because of the need for marked vehicles that have lights and sirens and the additional specialty equipment that is carried (mobile radios, protective clothing, scene lighting, weapons, etc.). However, fire department operations are prone to criticism when take-home vehicles are provided to employees who do not have emergency response duties or when fire department vehicles are used for personal uses unrelated to after-hours emergency response.

Johnson City does not have a formal vehicle take-home policy. Instead, department heads have discretion in managing this resource. ICMA feels that this level of discretion is viable as long as the Fire Chief understands the sensitivity of this issue and monitors this responsibility regularly. The JCFD has authorized the issuance of take-home vehicles to the following personnel:

1. Fire Chief
2. Assistant Chiefs (2)
3. Assistant Fire Marshals (3)
4. Training Lieutenant
5. Training Sergeant.

A total of seven JCFD take-home vehicles are currently authorized by the Fire Chief. One Assistant Chief who lives more than three miles outside city limits is not issued a take-home vehicle.

Currently, the Training Captain is assigned two functions: Assistant Chief of Operations and Training Captain. Because of this interim arrangement one take-home vehicle is authorized for the combined positions. ICMA feels the number of vehicles currently authorized and the assignment of personnel to whom they are issued is acceptable and justified. The Fire Chief has imposed a three-mile limit beyond city limits for the issuance of a take-home vehicle. Due to the frequent interaction between the city and county and the irregular nature of the city boundaries, ICMA feels that the self-imposed three-mile limit is not necessary, although it is understandable.

Uniform Allowance

The JCFD provides uniforms to all line and administrative staff on a replacement basis. Employees do not receive a cash allowance for uniform purchases nor do they receive any payment for laundering or dry cleaning service. Typically, line personnel receive four pairs of duty pants, two to three short-sleeve shirts and two to three long-sleeve shirts on an annual basis. Uniforms are provided on an as-needed basis, though there is not a turn-in policy of a worn garment in order to receive a replacement. Employees also receive a winter coat and a job shirt as a new hire. These items are also replaced when needed, but on a less frequent basis. Uniform hats and knit caps are also provided upon request. The department also provides uniform shoes on a reimbursement basis. Each employee may be reimbursed up to $100 for their shoes every 18 months. The shoe reimbursement requires that a receipt is provided in order to be reimbursed.

The JCFD expended approximately $65,000 in the last fiscal year for maintaining the inventory of uniforms for operational line personnel. This equates to approximately $600 per year per employee. Our experience indicates that a uniform allowance of $500 per year per line employee is very appropriate given the cost of these ensembles and the wear and tear that is associated with fire service activities. Considering the added shoe allowance (approximately $67/yearly), and the added inventory that is required in maintaining a uniform distribution process, ICMA feels that the current uniform allowance is well within reason, is being managed effectively, and is justifiable.

Recommendations:

- Johnson City should include in the fire department's job descriptions, within the ranks of Firefighter through Captain, the requirement that as a condition of employment these employees possess and maintain a valid EMT certification.
- Johnson City should include in the fire department's job descriptions, within the ranks of Firefighter through Captain, the requirement that these employees annually qualify under the JCFD's adopted physical requirements.
- The JCFD should develop a departmental policy that specifies the scheduling, test components and their weighting, and the eligibility criteria for the Fire Engineer, Lieutenant, and Captain promotional testing. ICMA recommends that promotional testing for Engineer and Lieutenant should be held every two years.
- The JCFD should alter its testing process for fire promotional examinations so that the minimum passing score that is utilized in determining eligibility is for the entire testing process and not the written portion of the test alone.

- The Johnson City Human Resources Department along with the JCFD should work cooperatively in the development and administration of all fire promotional exams. The design and makeup of each exam should be done with the assistance of both internal and external subject matter experts for each position being tested.
- The JCFD should implement a supervisory training effort designed to instruct Engineers, Lieutenants, and Captains in the proper techniques for conducting effective performance appraisals.
- JCFD Engineers should be trained and responsible for completing performance appraisals for personnel under their supervision.
- Supervisors in the JCFD should be required as part of the performance appraisal process to meet and document their discussions with each subordinate at least on a quarterly basis.
- The JCFD should eliminate its residency requirements for fire personnel subject to emergency recall.
- The JCFD take-home vehicle policy is viable; the number of vehicles currently authorized and the assignment of personnel to whom they are issued is acceptable and justified.

Community Risk Assessment and Risk Management Planning

Johnson City and Washington County appear committed in their emergency planning and community risk assessment processes. ICMA has found the caliber of emergency planning and its level of specificity in the Johnson City area to be very comprehensive and consistent with federal guidelines. The city utilizes a recently updated Emergency Operations Plan (2012) and is well versed and utilizes NIMS (National Incident Management System). Both the EOP and NIMS have been formally adopted by the City Commission and these structures are utilized by all sections of city government. The city has joined with Washington County in creating a joint service agency, Emergency Management Agency (EMA). EMA is jointly funded by the city and county to serve Johnson City, Jonesborough, and the unincorporated areas of Washington County. EMA works in conjunction with the Tennessee Emergency Management Association, (TEMA) in serving as part of the state and federal response network in providing the necessary planning, training, mitigation, and recovery efforts for the array of man-made and natural disasters that can impact the area.

In 2010 EMA developed and adopted the Washington County Multijurisdictional Hazard Mitigation Plan. This document, established under FEMA guidelines, includes a hazard risk analysis for Washington County, including Johnson City. The hazard risk analysis identifies those events that would have the highest potential for occurrence and their impacts on critical infrastructure. These include:

- Winter storms and severe weather events
- Flooding
- Fire
- Earthquake
- Hazardous materials incidents.

In our evaluation of the City's planning effort it should be noted that several probable occurrences were not included in these planning efforts. They include:

- Water emergency/disruption/contamination
- Transportation accident – (air, rail, and shipping)
- Terrorism/workplace and school violence
- Energy shortage/disruption
- Continuity of operations planning (COOP)

Community risk and vulnerability assessment are essential elements in a fire department's planning process. According to a National Fire Protection Association (NFPA) paper on assessing community vulnerability, fire department operational performance is a function of three

considerations: resource availability/reliability, department capability, and operational effectiveness.[15] These elements can be further defined as:

Resource availability/reliability: The degree to which the resources are ready and available to respond.

Department capability: The ability of the resources deployed to manage an incident.

Operational effectiveness: The product of availability and capability. It is the outcome achieved by the deployed resources or a measure of the ability to match resources deployed to the risk level to which they are responding.

The community risk and vulnerability assessment evaluates the community as a whole, and with regard to property types. It is used to measure all property and the risk associated with that property and then segregates the property as either a high, medium, or low hazard. According to the NFPA *Fire Protection Handbook*, these hazards are defined as:

High-hazard occupancies: Schools, hospitals, nursing homes, explosives plants, refineries, high-rise buildings, and other high life-hazard or large fire-potential occupancies.

Medium-hazard occupancies: Apartments, offices, and mercantile and industrial occupancies not normally requiring extensive rescue by firefighting forces.

Low-hazard occupancies: One-, two-, or three-family dwellings and scattered small business and industrial occupancies.[16]

Fire Pre-Planning

In addition to examining communitywide risk and vulnerability, the JCFD has examined specific risk and vulnerability on the basis of its critical occupancies. Risk assessment and vulnerability analysis are not new to the fire service, as the NFPA 1620 Standard, *Recommended Practice for Pre-Incident Planning,* identifies the need to utilize both written narrative and diagrams to depict the physical features of a building, its contents, and any built-in fire protection systems. The occupancies that are typically specified for pre-incident plans or "pre-plans" are as follows:

- Large assembly
- Educational
- Health care
- Detention and correction
- High-rise residential
- Residential board and care (assisted living)

[15] Fire Service Deployment, Assessing Community Vulnerability: From http://www.nfpa.org/assets/files/pdf/urbanfirevulnerability.pdf

[16] National Fire Service Data Summit Proceedings, U.S. Department of Commerce, NIST Tech Note 1698, May 2011.

- Mercantile
- Business
- Industrial
- Warehouse and storage

Our evaluation has found JCFD to be very proficient in its pre-planning efforts. JCFD pre-fire plans are guided by written policy with specific reference as to when updates are done and who is responsible. The policy provides a standard format upon which the pre-fire plans are developed and this information has been digitized and is available on each responding unit's on-board computer. We did note, however, that the policy was not being followed and the pre-fire plans that do exist were not being updated.

Risk Management/Firefighter Health and Fitness

In addition to examining community risk and vulnerability, JCFD should examine the internal risk and vulnerability of its personnel. NFPA 1500, *Standard for a Fire Department Occupational Safety and Health Program (2007),* recommends the development of a separate risk management plan for fire department personnel in response to their work environment. In order for this process to be effective, the following components must be included in the risk management plan:

Risk identification: Actual or potential hazards.

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

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

Risk control: Solutions for eliminating or reducing real or potential hazards by implementing an effective control measure.

Risk monitoring: Evaluation of effectiveness of risk control measures.

NFPA 1582, *Standard on Comprehensive Occupational Medical Program for Fire Departments, (2013)*, and NFPA 1583, *Standard on Health-Related Fitness Programs for Fire Department Members, (2008)* provides guidance to fire departments with regard to annual medical screening and annual fitness requirements for its members. ICMA found that JCFD follows the guidelines of NFPA 1582 and provides annual medical physicals by the city's occupational physician, which is commendable. The city, however, does not conduct a thorough fitness assessment that corresponds to fire and EMS workloads. The city utilizes a program through its occupational physician called "Work Steps." This provides limited evaluation of fire and EMS duties and is not tied to a formalized remediation process. This omission is critical to the successful development of a comprehensive risk management plan.

The risk management plan establishes a standard of safety for the daily operations of the JCFD and a guideline for employee medical health and fitness. This standard of safety establishes the parameters within which the JCFD should conduct all 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. Through this effort accidents can be minimized and employee lost time reduced.

Recommendations:

- The JCFD should ensure that its annual inspection/familiarization process, which places fire companies into structures for the purpose of updating pre-plans and providing response personnel ongoing familiarization with targeted structures, is carried out in accordance with existing policy.
- The JCFD should evaluate its options to expand the automation of its pre-planning process so that critical occupancy information, including hazardous components and updates regarding inoperable or out-of-service systems, is identified by the system and automatically flagged in order to give responding personnel critical information regarding an occupancy's status or specific hazard.
- The JCFD should develop and institute an ongoing fitness assessment process for its operational personnel in accordance with NFPA 1583. Further, JCFD should consider a partnering effort with neighboring jurisdictions in providing fitness assessments to it personnel.

Master Planning/Strategic Planning/Goals and Objectives

The Johnson City Fire Department is in critical need of a comprehensive master planning and goal-setting initiative. The department's effort in this regard has been severely lacking and the timing could not be better for this initiative to be undertaken. ICMA has observed in the JCFD organization a lack of identity, the absence of mission, and generally an organization that needs to regenerate itself. We observed a number of talented and dedicated individuals throughout the organization who are eager to rebrand themselves and move the JCFD to a stature of a high performance, premiere organization. A comprehensive master planning effort along with strategic goal setting and mission building will go a long way in rebuilding this organization in fulfilling its true potential.

The development of a long-range fire protection and prevention comprehensive strategic plan involves three key steps. The first step is to generate an assumption of what the community will look like at the end of the planning process. Second, the department needs to assess realistically the strengths and weaknesses of the existing fire protection system to include codes, standards, and ordinances relating to fire prevention efforts, public safety education programs, and emergency response capability. The third and final step is to project the needed capabilities and capacity of the fire protection system and its fire department component as the community changes.[17] This process helps to ensure that an adequate level of resources, including staffing and equipment, are allocated to meet the community's needs for the services delivered by the fire department as efficiently as possible. A strategic plan also assists the department in matching resources with available revenues.

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.

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.[18] Objectives should be SMART, an acronym that stands for **s**pecific, **m**easurable, **a**mbitious/**a**ttainable, **r**ealistic, and **t**ime-bound. Additionally, these goals should link back to fiscal planning goals and be utilized in these documents.

As the JCFD developes its strategic plan, ICMA recommends that the following three concepts serve as cornerstones in completing this critical process:[19]

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[17] *Fire Protection Handbook,* Twentieth Edition, Volume II (National Fire Protection Association, 2008), 12-5.
[18] Starling, *Managing the Public Sector,* 287.
[19] McNamara, C. (1996-2007) Basic Overview of Various Strategic Planning Models. Adapted from the Field Guide to Nonprofit Strategic Planning and Facilitation. Minneapolis, MN: Authenticity Consulting, LLC.

Develop a vision of the community: Work with the community development department and develop a comprehensive vision of what Johnson City will look like in the short term and throughout the strategic planning process.

Look inwardly: Conduct an organizational **s**trengths, **w**eaknesses, **o**pportunities, and **t**hreats (SWOT) analysis with extensive participation from department members and include the results in the strategic planning process.

Monitor and update the plan: Regulalrly reflect on the extent to which the goals are being met and whether action plans are being implemented. Perhaps the most important feedback is positive feedback from customers, both internal and external.

Fire Prevention/Fire Investigation/Public Education

An up-to-date fire code adopted into law and which outlines specific fire prevention requirements and enforcement procedures is essential for an effective fire prevention program. Fire suppression and response, although necessary to protect property, have little impact on preventing fires and reducing 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 monoxide poisoning.

The state of Tennessee has adopted by ordinance the International Fire Code, 2006 edition. The Johnson City Fire Department has been authorized by the Tennessee State Fire Marshal's Office to conduct all plans review and new construction activities for all properties in the city except for those properties exempt under state statutes (primarily, public schools, university properties, state buildings, and adult living facilities). The JCFD has an excellent rapport with the Deputy State Fire Marshal's Office assigned to Washington County. The city currently utilizes the 2006 Edition of the International Fire Code (IFC). We have been advised that the 2012 Edition of the IFC has been presented to the City Commission and full adoption is planned for January 2014. The city, however, has not adopted the NFPA Life Safety Code (NFPA-101). NFPA's *Life Safety Code* is widely used for occupant safety throughout the life cycle of a building. A Life Safety Code provides specific guidance and enforcement authority to maintain the integrity and intent of the code once the building is built and as it changes with different occupancies over time. ICMA recommends that Johnson City adopt a Life Safety Code in order to strengthen its enforcement authority in existing structures and to provide code enforcement guidance throughout a building's life cycle.

The city's fire prevention efforts are carried out in cooperation with the city's Development Services Department and its Chief Building Official. The fire prevention division has been without a Fire Marshal since January 2010. During this period, fire prevention activities have been supervised by the Fire Chief as a collateral duty. In addition, the fire prevention division is staffed by three Assistant Fire Marshals. The fire prevention workload is distributed among these employees; however, two of the Assistant Fire Marshals are relatively new to their assignment and depend heavily on the more tenured inspector, who has been in fire prevention for a number of years. Fire prevention activities include plans review for new construction, along with permitting and inspections. In conjunction with Development Services, JCFD utilizes a number of performance measures in the management of plans review and inspection activities. Plans Review utilizes a ten-day turnaround period in which comments are returned to the applicant. Inspections are conducted within 24 to 48 hours of a request for an inspection. These measures are very appropriate and indicative of a high level of customer service.

In-Service Fire Company Inspections

The fire prevention division does not conduct periodic maintenance inspections unless an inspection is a requirement of a facility's licensing criterion (i.e., heath care facilities, rooming houses, private schools, etc.). The division will conduct an inspection on an existing structure or occupancy on the basis of a request or a complaint. Most occupancies with fire suppression systems (kitchen hoods, automatic fire sprinklers, alarm systems, etc.) are required to have periodic

maintenance checks to ensure operability of the system or to check if a recharge of the extinguishing agent is needed. Fire departments typically have active inspection programs that deal exclusively with existing occupancies. These inspections, often termed "***maintenance inspections,***" are carried out through a combined effort of the fire inspectors and in-service fire companies. Typically the fire companies deal with the less complex aspects of the inspection; exit lighting, charging of extinguishers, exiting, storage issues, and grease buildup in fire hoods. The fire prevention staff usually focuses on the more technical features including alarm systems, auxiliary fire pumps, annunciator panels, sprinkler systems, or to follow-up on violations found by the engine companies.

The JCFD does not conduct in-service fire company inspections and the fire prevention staff conducts a limited number of maintenance inspections. The JCFD should initiate an effort to conduct maintenance inspections by both in-service engine companies and fire inspectors in those occupancies that have fire protection or suppression features that require ongoing maintenance. An added benefit of having engine companies conduct maintenance inspections is that it builds up a rapport between the business owner or manager and the fire staff. This will assist in having questions answered about systems and creates an environment that improves overall safety. In addition, it gives engine companies first-hand familiarization with the structures, their storage areas, and the presence of fire protections systems that would be beneficial when an emergency response occurs.

Fire Marshal

The absence of a Fire Marshal in the JCFD has impacted the overall direction and the effectiveness the fire prevention efforts for the city. This is especially important given the higher than normal fire deaths that have been occurring in Johnson City. Typically, the Fire Marshal and Chief Building Official work in a collegial way, enforcing the building codes and engineering standards related to fire protection. A good relationship between these officials is critical in ensuring public safety and in expediting the construction review and permitting process. Both the building code and fire code include provisions relating to fire protection. However, fire code provisions in single family and smaller residential properties (usually four units or fewer) fall under the purview of the building department. Fire officials are typically involved in the review of fire protection systems in larger residential occupancies, manufacturing, commercial, warehouse, and institutional occupancies. This review concentrates on unit separation and compartmentalization, smoke evacuation systems, automatic fire alarm systems, fire sprinklers, standpipes, and fire flow requirements. In addition, fire and building officials work together to ensure that the life safety features are in compliance with the code and these safety features are properly constructed (exiting and egress features, numbers and distribution of fire extinguishers, fire control stations, etc.). In addition, the Fire Marshal is the city official who typically has the authority to issue citations or in extreme life safety hazards, to close or restrict access to existing occupancies that have become hazardous. The JCFD and the city's Development Services Department have had difficulties in forging an effective relationship as a result of the absence of a Fire Marshal. In addition, the absence of this key official has resulted in a limited effort in shepherding fire code and life safety provisions in addressing the

fire death issue in the city. ICMA feels that it is critical that the city move expeditiously in filling the Fire Marshal position.

Fire Fatalities

As indicated earlier in the report the number of fire deaths in Johnson City is several times higher than the national average. The JCFD has attempted to analyze the locations and causes of these deaths and has instituted a comprehensive smoke detector give-away program. More work is needed and this issue should become a key focus of the combined efforts of the fire department, development services, and the city's public information personnel. In our discussions with fire officials, it was observed that there appears to be a pattern associated with these recent deaths and which involves smoking materials and the abuse both alcohol and drugs. Most of the fatalities have occurred in small residential properties that are typically immune from inspections and regulation. However, our investigation indicates that many of these residential properties are rentals. ICMA feels that an effort should be made in the rental property market to place added requirements on landlords to ensure that hard-wired smoke detectors and inspections of these premises are conducted periodically. In addition, a continued effort by the JCFD to direct its smoke detector give-away program in targeted neighborhoods is recommended. The city should work with both fire and development services to mount a comprehensive public education program that elevates the dangers of smoking and substance abuse as a primary cause in the recent fire deaths.

Fire Investigations

The Assistant Fire Marshals are responsible for fire investigations to determine the cause and origin of each fire and to estimate fire loss. AFMs have rotating weekly on-call duties that will assign them to a fire to conduct investigations. For larger, more complex fires (commercial occupancies, or fires involving fire deaths, etc.) multiple AFMs may be assigned to the investigation. Our data indicate that a fire investigation is performed by an AFM about 30 to 40 times a year. When an AFM is required to respond after hours they are paid overtime for hours worked. The JCFD utilizes a unique overtime eligibility criteria in determining overtime pay for its AFMs. The Fair Labor Standards Act (FLSA) creates a 7-K Exemption for firefighters who work more than forty hours weekly. The exemption was designed to address the extended periods of time firefighters work each week due to the 24-hour scheduling. In effect, the 7-K Exemption allows agencies to pay overtime to firefighters after fifty-three hours of work rather than the typical forty-hour threshold for other municipal (non-exempt) employees. Johnson City has chosen to place AFMs under the 7-K Exemption provision even though these employees work a forty-hour schedule and respond to fire scenes for the purpose of conducting investigations. ICMA feels that this practice is not in concert with the intent of the Fair Labor Standards Act. The city should revise its overtime provision for AFMs (and if applicable, Training Division personnel) so that overtime eligibility occurs after forty hours of time worked.

Public Education

Public education, public relations, and community value-added programs should include coordination of fire suppression company demonstrations, business community CPR and fire extinguisher training, and other public and community programs. The JCFD has made a concerted

effort in the delivery of public education through its engine companies and this program has been very effective. However, given the issue of elevated fire deaths in the community and the large impacts of East Tennessee State University, it is critical that the Fire Prevention Division make a greater commitment to public education. ICMA believes that the JCFD should earmark a significant portion of one AFM's workload in this effort. This AFM's focus should be public education in the following areas:

1. The coordination of fire company public education and injury prevention
2. Fire prevention to targeted populations (fire death reductions)
3. Bar over-crowding/occupancy load outreach
4. Liaison with ETSU in fire safety and injury prevention.

Recommendations:

- ICMA recommends the JCFD fill the vacant Fire Marshal position.
- Johnson City should adopt a Life Safety Code to strengthen enforcement authority and provide guidance for code enforcement efforts in existing buildings throughout their life cycle.
- Johnson City should initiate a comprehensive effort to reduce the number of fire deaths with a three-pronged effort aimed at fire safety in rental properties, expansion of the smoke detector give-away program, and a comprehensive public education program.
- Johnson City should reevaluate its treatment of Assistant Fire Marshals (and if applicable, Training division personnel) with regard to overtime payment on the basis of the 212-hour work cycle and the firefighter 7–K Exemption.
- The JCFD should initiate an effort to conduct maintenance inspections by both in-service engine companies and fire inspectors in those occupancies that have fire protection or suppression features that require ongoing maintenance.

Appendix A: Data Analysis

Introduction

This data analysis was prepared as a key component of the study of the Johnson City Fire Department (JCFD). This analysis examines all calls for service between July 1, 2012, and June 30, 2013, as recorded in the dispatch center.

This analysis is divided into five sections: the first section focuses on 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 provides a response time analysis; and the fifth section analyzes EMS and fire responses from either JCFD or County EMS.

During the period covered by this study, the department operated out of nine stations. The agency deploys 12 frontline apparatus, including 9 pumpers and 3 ladder trucks. In addition, the agency staffs a rehab unit, a light and air support unit, and a command vehicle when needed. During the study period, the agency responded to 8,820 calls, including 940 canceled calls and 192 mutual aid calls. The total combined yearly workload (deployed time) for all units was 4,761 hours. For calls responded with lights and sirens, the average estimated dispatch time was 2.1 minutes and the average response time was 6.9 minutes and the 90th percentile dispatch time was 3.5 minutes and the 90th percentile response time was 9.8 minutes.

Methodology

In this report, we analyze calls and runs. A call is an emergency service request or incident. A run is a dispatch of a unit. Thus, a call might include multiple runs.

We received three sources of CAD data, including calls designated to the JCFD, the Washington County EMS agency, and the Johnson City Police Department (JCPD). We merged the call data from three sources and included all calls to which JCFD units responded. We then processed the data to improve its accuracy. We removed seventeen duplicate calls and one test call. A total of 8,820 calls are used in this report; this total is comprised of 2,409 JCFD calls, 6,395 County EMS calls, and 16 JCPD calls. A total of fifteen incidents to which administrative units were the sole responders are not included in the analysis sections of the report. Nevertheless, the workload associated with these units is documented in Attachment I.

We classified the calls in a series of steps. We first determined canceled and mutual aid calls. We used NFIRS data to accurately identify canceled and mutual aid calls from the JCFD perspective. Then, we used NFIRS incident type to assign fire category call types. Lastly, we used the call description in CAD to assign detailed EMS categories. The classification between NFIRS incident type and call type is documented in Attachment IV.

In this report, mutual aid and canceled calls are included within the introductory summary and all analyses of the fire department's workload. However, they are not included when examining call variability by month and hour and call duration. They also are excluded from the response time analysis.

Aggregate Call Totals and Dispatches

During the year studied, the JCFD responded to 8,820 calls. Of these, 102 were structure fire calls and 159 were outside fire calls. There were 5,880 emergency medical service (EMS) calls.

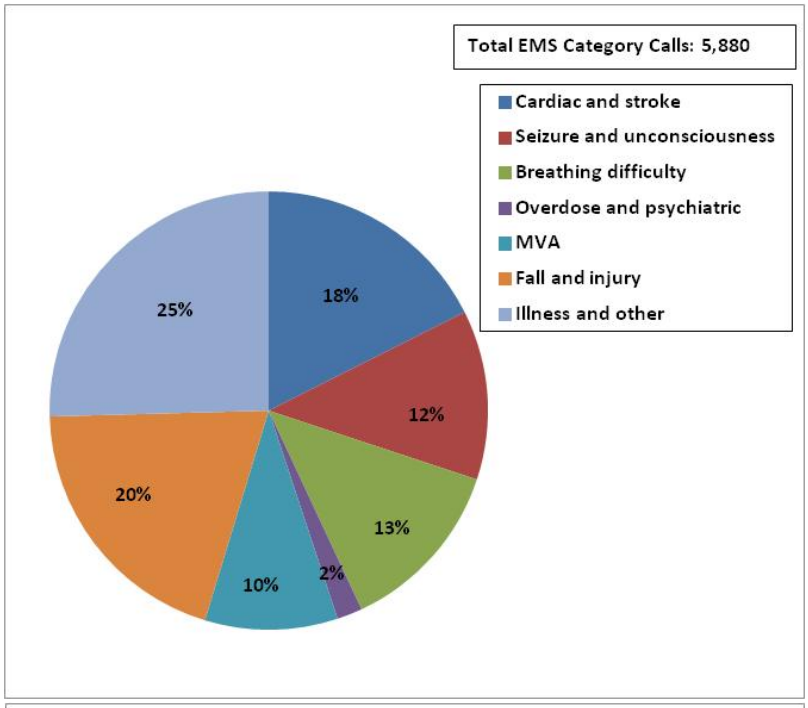
Table D1: Call Types

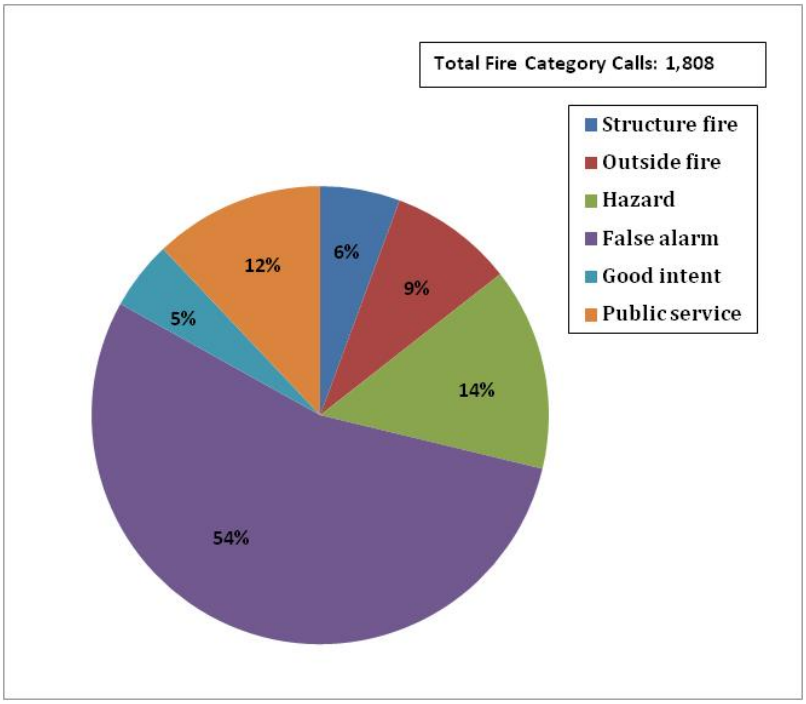
Call Type	Number of Calls	Calls per Day	Call Percentage
Cardiac and stroke	1,034	2.8	11.7
Seizure and unconsciousness	735	2.0	8.3
Breathing difficulty	762	2.1	8.6
Overdose and psychiatric	110	0.3	1.2
MVA	576	1.6	6.5
Fall and injury	1,168	3.2	13.2
Illness and other	1,495	4.1	17.0
EMS Total	**5,880**	**16.1**	**66.7**
Structure fire	102	0.3	1.2
Outside fire	159	0.4	1.8
Hazard	259	0.7	2.9
False alarm	982	2.7	11.1
Good intent	88	0.2	1.0
Public service	218	0.6	2.5
Fire Total	**1,808**	**5.0**	**20.5**
Mutual aid	192	0.5	2.2
Canceled	940	2.6	10.7
Total	**8,820**	**24.2**	**100.0**

Observations:

- On average, the department received 24.2 calls per day, including 2.6 canceled calls and 0.5 mutual aid calls.
- EMS calls for the year totaled 5,880 (67 percent of all calls), an average of 16.1 per day.
- Fire calls for the year totaled 1.808 (20 percent of all calls), an average of 5.0 per day.
- Structure and outside fires combined for a total of 261 calls during the year, an average of 0.7 calls per day.

Figure D1: EMS and Fire Calls by Type

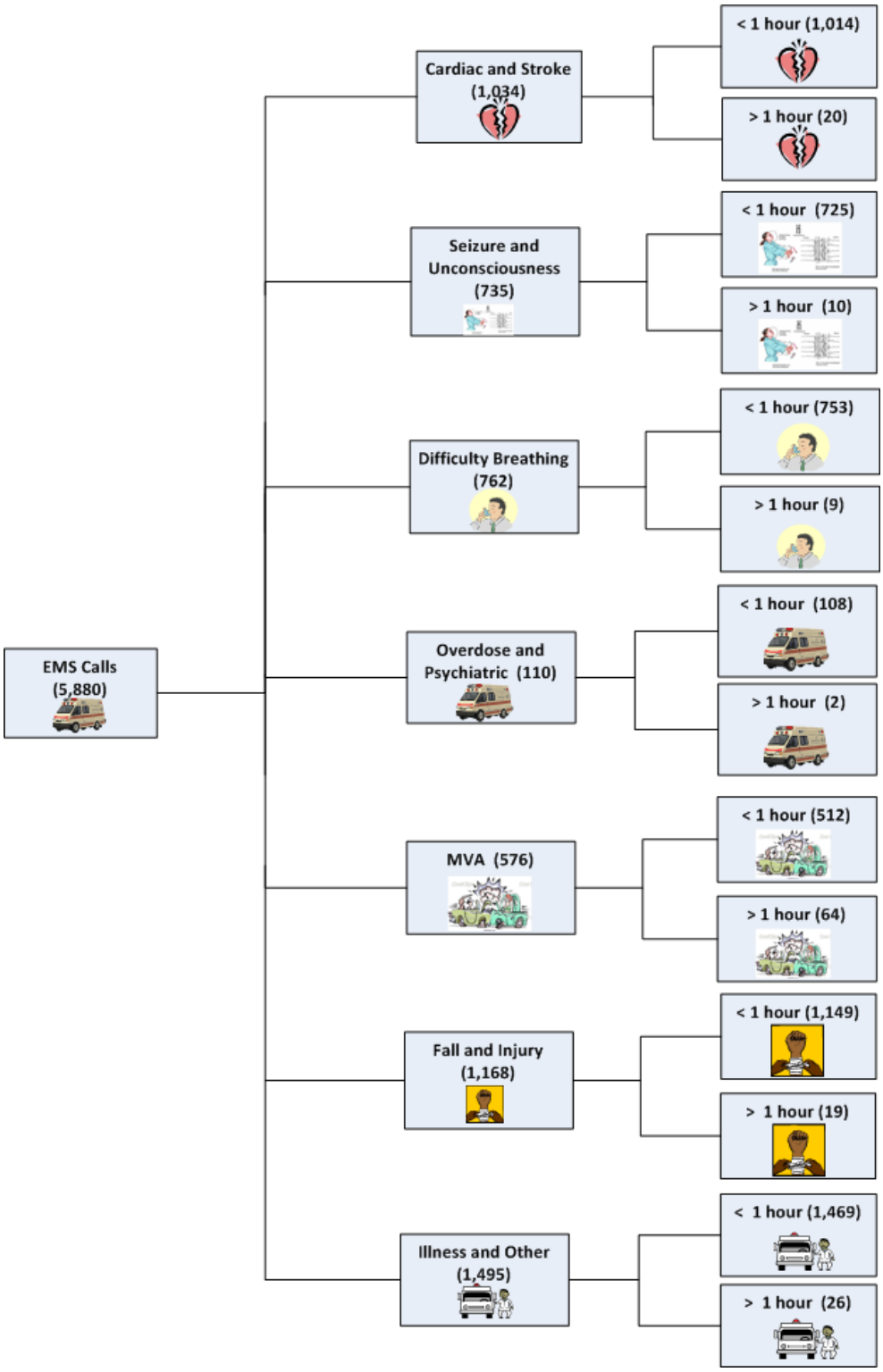




Observations:

- A total of 102 structure fire calls accounted for 6 percent of the fire category total.
- A total of 159 outside fire calls accounted for 9 percent of the fire category total.
- False alarm calls were the largest fire call category, making up 54 percent of the fire category total.
- Cardiac or stroke calls were 18 percent of the EMS category total.
- Motor vehicle accidents were 10 percent of the EMS category total.
- Illness and other calls were the largest EMS call category, making up 25 percent of the EMS category total.

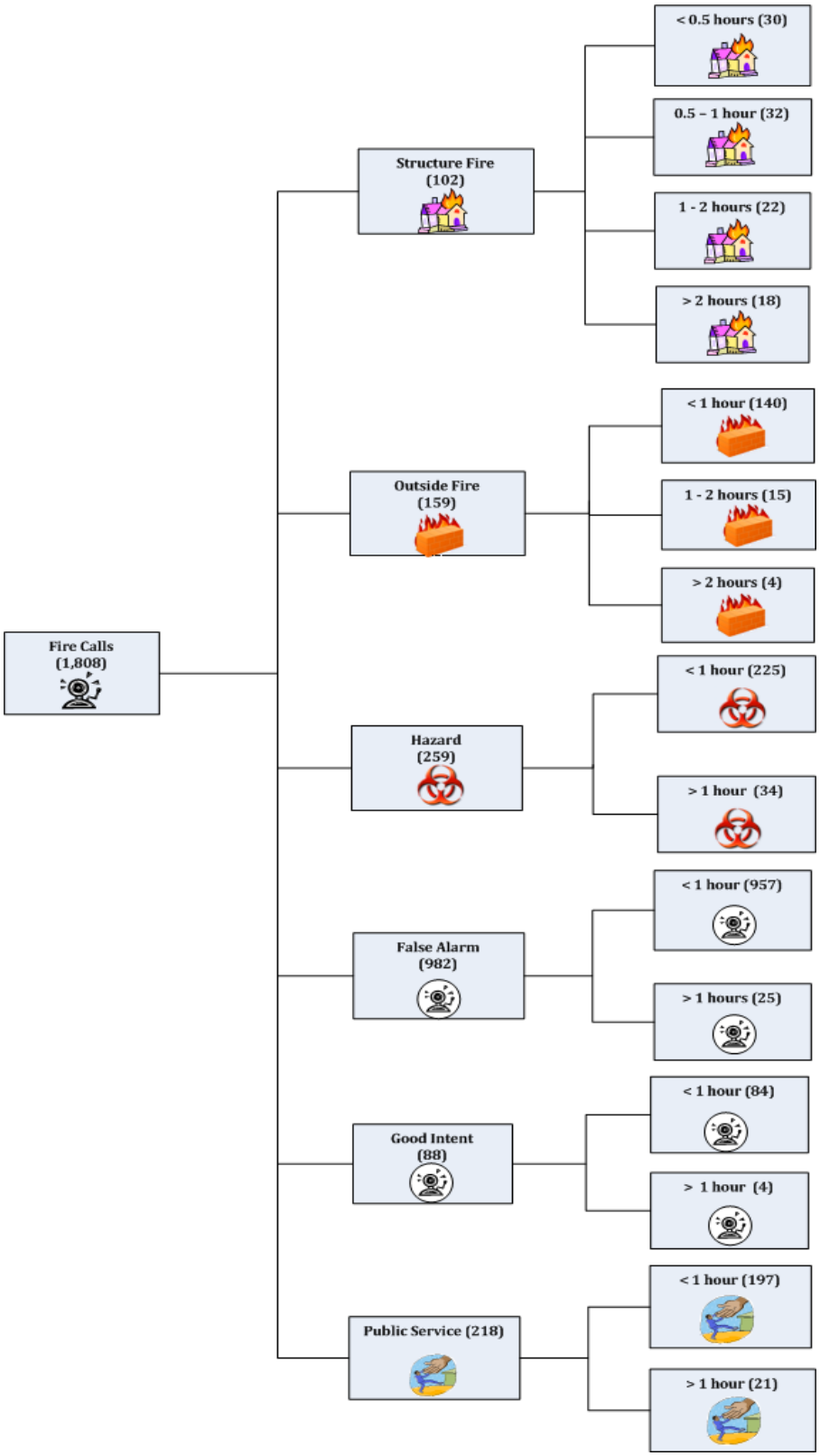
Figure D2: EMS Calls by Type and Duration



Observations:

- A total of 5,730 EMS category calls (97 percent) lasted less than one hour, 127 EMS category calls (2 percent) lasted between one and two hours, and 23 EMS category calls (less than 1 percent) lasted more than two hours. On average, there were 0.4 EMS category calls per day that lasted more than one hour.
- A total of 1,014 cardiac and stroke calls (98 percent) lasted less than one hour, and 20 cardiac and stroke calls (2 percent) lasted more than an hour.
- A total of 512 motor vehicle accident calls (89 percent) lasted less than one hour, and 64 motor vehicle accident calls (11 percent) lasted more than an hour.

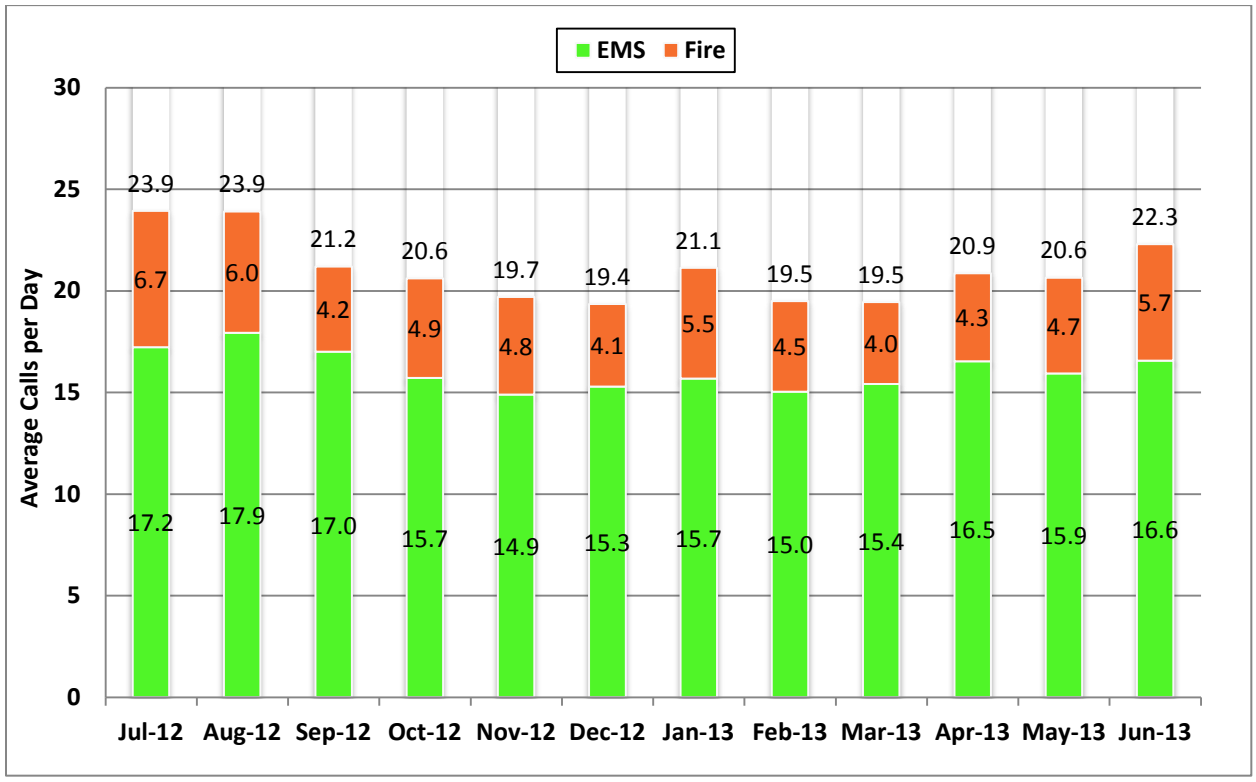
Figure D3: Fire Calls by Type and Duration



Observations:

- A total of 1,665 fire category calls (92 percent) lasted less than one hour, 99 fire category calls (5 percent) lasted between one and two hours, and 44 fire category calls (2 percent) lasted more than two hours. On average, there were 0.4 fire category calls per day that lasted more than one hour.
- A total of 62 structure fire calls (61 percent) lasted less than one hour, 22 structure fire calls (22 percent) lasted between one and two hours, and 18 structure fire calls (18 percent) lasted more than two hours.
- A total of 140 outside fire calls (88 percent) lasted less than one hour, 15 outside fire calls (9 percent) lasted between one and two hours, and 4 outside fire calls (3 percent) lasted more than two hours.
- A total of 957 false alarm calls (97 percent) lasted less than one hour, and 25 false alarm calls (3 percent) lasted more than an hour

Figure D4: Average Calls per Day, by Month



Observations:

- Average calls per day ranged from a low of 19.4 calls per day in December 2012 to a high of 23.9 calls per day in July 2012 and August 2012. The highest monthly average was 24 percent greater than the lowest monthly average.
- Average EMS calls per day ranged from a low of 14.9 calls per day in November 2012 to a high of 17.9 calls per day in August 2012.
- Average fire calls per day ranged from a low of 4.0 calls per day in March 2013 to a high of 6.7 calls per day in July 2012.
- The highest number of calls received in a single day was 56, which occurred on June 13, 2013. The 56 calls included 29 EMS calls, 1 outside fire call, 24 fire other category calls, and 2 canceled calls.

Figure D5: Calls by Hour of Day

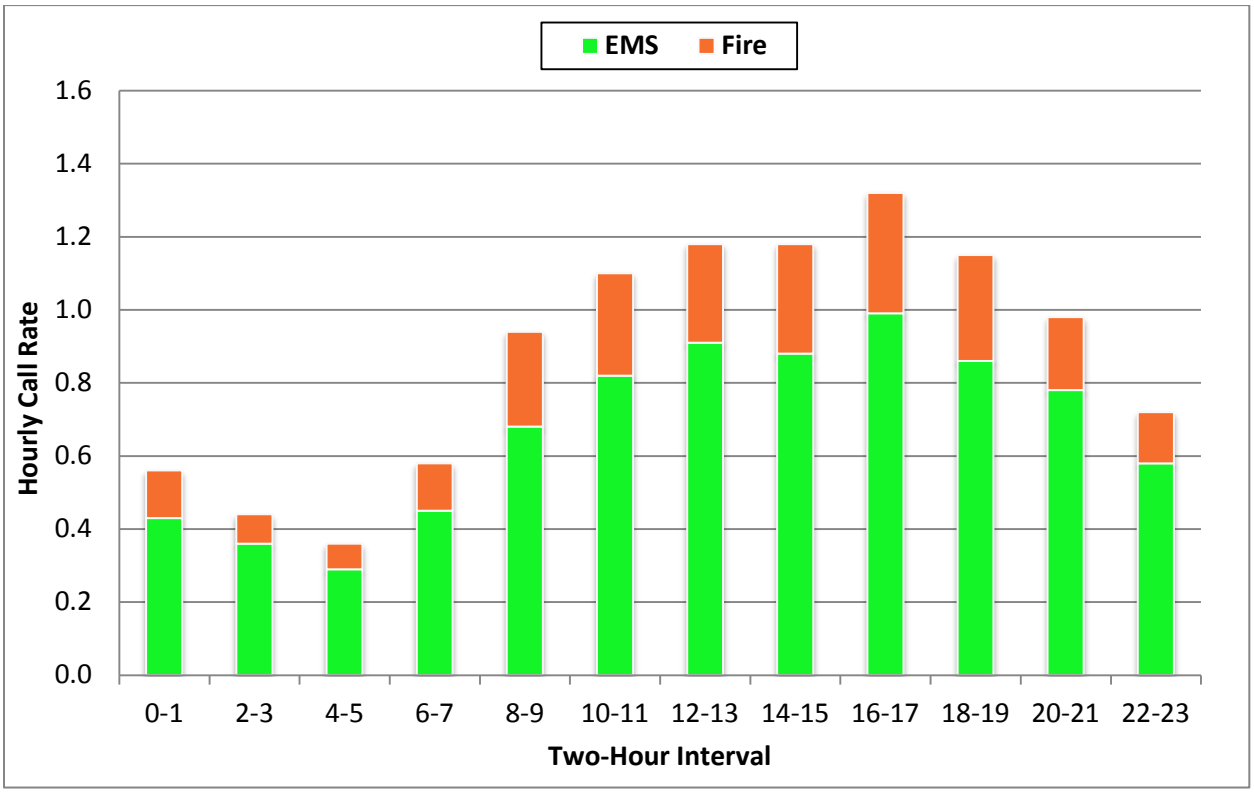


Table D2: Calls by Hour of Day

Two-Hour Interval	Hourly Call Rate		
	EMS	Fire	Total
0-1	0.43	0.13	0.56
2-3	0.36	0.08	0.44
4-5	0.29	0.07	0.36
6-7	0.45	0.13	0.58
8-9	0.68	0.26	0.94
10-11	0.82	0.28	1.11
12-13	0.91	0.27	1.17
14-15	0.88	0.30	1.19
16-17	0.99	0.33	1.32
18-19	0.86	0.29	1.15
20-21	0.78	0.20	0.98
22-23	0.58	0.14	0.72
Calls per Day	**16.11**	**4.95**	**21.06**

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 averaged between 0.36 calls and 1.32 calls per hour.
- Call rates were highest during the day between 10:00 a.m. and 8:00 p.m., averaging between 1.11 and 1.32 calls per hour. The rate peaked between 4:00 p.m. and 6:00 p.m., when it averaged 1.32 calls per hour.
- Call rates were lowest between midnight and 8:00 a.m., averaging between 0.36 to 0.58 calls per hour.

Figure D6: Number of Units Dispatched to Calls

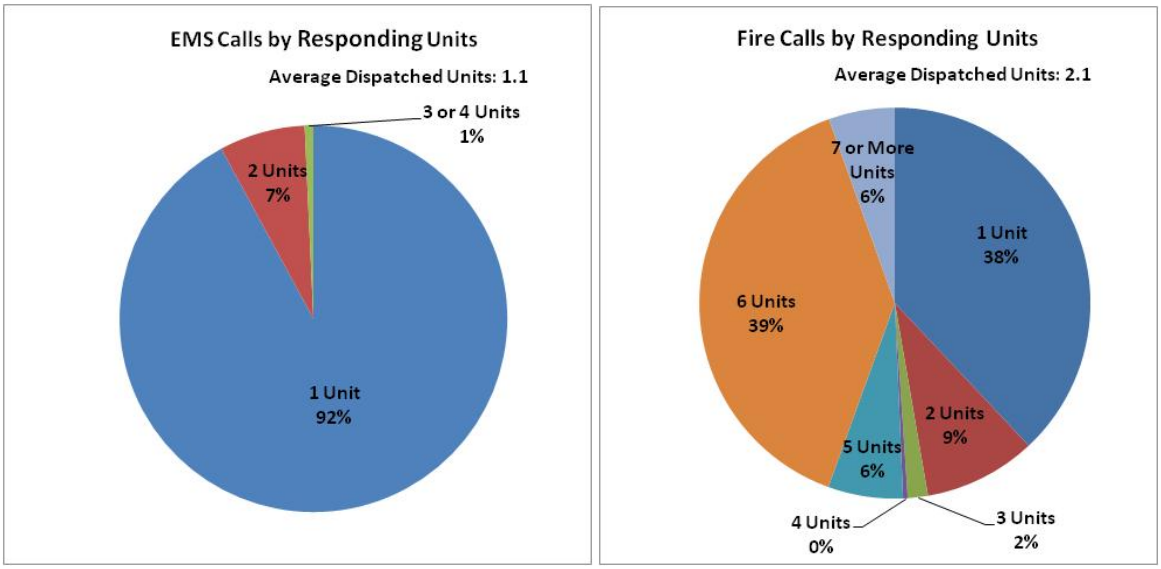


Table D3: Number of Units Dispatched to Calls

Call Type	Number of Units							
	One	Two	Three	Four	Five	Six	Seven or More	Total
Cardiac and stroke	976	54	3	1	0	0	0	1,034
Seizure and unconsciousness	679	55	1	0	0	0	0	735
Breathing difficulty	732	28	2	0	0	0	0	762
Overdose and psychiatric	104	6	0	0	0	0	0	110
MVA	443	110	20	3	0	0	0	576
Fall and injury	1,092	74	2	0	0	0	0	1,168
Illness and other	1,389	95	11	0	0	0	0	1,495
EMS Total	**5,415**	**422**	**39**	**4**	**0**	**0**	**0**	**5,880**
Structure fire	8	0	1	0	31	44	18	102
Outside fire	114	26	10	2	4	2	1	159
Hazard	145	35	8	1	25	36	9	259
False alarm	195	75	9	3	38	596	66	982
Good intent	47	6	1	0	13	18	3	88
Public service	178	26	1	1	1	9	2	218
Fire Total	**687**	**168**	**30**	**7**	**112**	**705**	**99**	**1,808**
Mutual aid	170	19	1	0	0	2	0	192
Canceled	843	83	5	0	6	2	1	940
Grand Total	**7,115**	**692**	**75**	**11**	**118**	**709**	**100**	**8,820**
Percentage	**80.7**	**7.8**	**0.9**	**0.1**	**1.3**	**8.0**	**1.1**	**100.0**

Observations:

- The JCFD has different dispatch patterns for EMS and fire category calls.
- On average, 2.1 units were dispatched per fire category call.
- For fire category calls, one unit was dispatched 38 percent of the time, two units were dispatched 9 percent of the time, three units were dispatched 2 percent of the time, four units were dispatched 0 percent of the time, five units were dispatched 6 percent of the time, six units were dispatched 39 percent of the time, and seven or more units were dispatched 5 percent of the time.
- For structure fire calls, one unit was dispatched 8 percent of the time, three units were dispatched 1 percent of the time, five units were dispatched 30 percent of the time, six units were dispatched 43 percent of the time, and seven or more units were dispatched 18 percent of the time.
- For outside fire calls, one unit was dispatched 72 percent of the time, two units were dispatched 16 percent of the time, three units were dispatched 6 percent of the time, four units were dispatched 1 percent of the time, five units were dispatched 3 percent of the time, six units were dispatched 1 percent of the time, and seven or more units were dispatched 1 percent of the time.
- On average, 1.1 units were dispatched per EMS category call.
- For EMS category calls, one unit was dispatched 92 percent of the time, two units were dispatched 7 percent of the time, three units were dispatched 1 percent of the time, and four units were dispatched 0 percent of the time.

Table D4: Annual Deployed Time by Call Type

Call Type	Average Deployed Minutes per Run	Annual Hours	Percent of Total Hours	Deployed Minutes per Day	Annual Number of Runs	Runs per Day
Cardiac and stroke	19.0	347	7.3	57.0	1,097	3.0
Seizure and unconsciousness	20.0	264	5.5	43.4	792	2.2
Breathing difficulty	19.5	258	5.4	42.4	794	2.2
Overdose and psychiatric	20.2	39	0.8	6.4	116	0.3
MVA	31.7	389	8.2	64.0	737	2.0
Fall and injury	20.4	424	8.9	69.7	1,246	3.4
Illness and other	19.8	533	11.2	87.7	1,615	4.4
EMS Total	**21.1**	**2,255**	**47.4**	**370.7**	**6,397**	**17.5**
Structure fire	47.2	446	9.4	73.4	567	1.6
Outside fire	30.0	122	2.6	20.0	243	0.7
Hazard	26.7	289	6.1	47.5	649	1.8
False alarm	15.2	1,171	24.6	192.5	4,628	12.7
Good intent	21.3	91	1.9	15.0	257	0.7
Public service	25.7	134	2.8	22.1	314	0.9
Fire Total	**20.3**	**2,253**	**47.3**	**370.4**	**6,658**	**18.2**
Mutual aid	25.3	94	2.0	15.4	223	0.6
Canceled	8.9	159	3.3	26.1	1,074	2.9
Total	**19.9**	**4,761**	**100.0**	**782.6**	**14,352**	**39.3**

Note: Each dispatched unit is a separate "run." As multiple units are dispatched to a call, there are more runs than calls. Therefore, the department recorded 24.2 calls per day and 39.3 runs per day.

Observations:

- Total deployed time for the year, or deployed hours, was 4,761 hours. This is the total deployment time of all the units deployed on all type of calls, including 94 hours spent on mutual aid calls and 159 hours spent on canceled calls. The deployed hours for all units combined averaged approximately 13.0 hours per day.
- There were 14,352 runs during the year, including 223 runs dispatched for mutual aid calls. The daily average was 39.3 runs for all units combined.
- Fire category calls accounted for 47.3 percent of the total workload.
- There were 810 runs for structure and outside fire calls, with a total workload of 568 hours. This accounted for 12 percent of the total workload. The average deployed time for structure fire calls was 47.2 minutes, and the average deployed time for outside fire calls was 30.0 minutes.
- EMS calls accounted for 47.4 percent of the total workload. The average deployed time for EMS calls was 21.1 minutes. The deployed hours for all units dispatched to EMS calls averaged 6.2 hours per day. The number of runs dispatched to EMS calls averaged 17.5 runs per day.

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: workload and runs. A dispatch of a unit is defined as a *run*; thus a call might include multiple runs.

Table D5: Call Workload by Unit

Station	Unit Type	Unit ID	Average Deployed Minutes per Run	Annual Number of Runs	Annual Hours	Runs per Day	Deployed Hours per Day
1	Pumper	E1	22.5	1,070	401.5	2.9	1.1
2	Pumper	E2	21.4	1,554	553.9	4.3	1.5
	Ladder	TR2	18.4	621	190.4	1.7	0.5
3	Pumper	E3	17.5	2,463	716.4	6.7	2.0
4	Pumper	E4	19.4	2,432	787.2	6.7	2.2
	Ladder	TR3	18.5	1,045	321.5	2.9	0.9
5	Pumper	E5	20.7	1,808	623.0	5.0	1.7
	Ladder	TR1	19.9	654	217.0	1.8	0.6
6	Pumper	E6	20.9	833	290.2	2.3	0.8
	Rehab	REHAB	172.8	1	2.9	NA	NA
7	Light and air support	AIR1	42.6	11	7.8	NA	NA
	Pumper	E7	19.1	1,139	363.3	3.1	1.0
8	Pumper	E8	28.0	229	107.0	0.6	0.3
9	Pumper	E9	21.8	492	178.8	1.3	0.5
Total			**19.9**	**14,352**	**4,760.9**	**39.3**	**13.0**

Observations:

- Pumper E4 in Station 4 was the unit deployed the most often and had the most deployed hours. It averaged 6.7 runs and 2.2 hours of deployed time per day.
- Pumper E3 in station 3 was the second most utilized unit, and it averaged 6.7 runs and 2.0 hours of deployed time per day.
- Of the three ladders, TR3 made the most runs. It averaged 2.9 runs and 0.9 hours of deployed time per day.

Figure D7: Deployed Minutes by Hour of Day

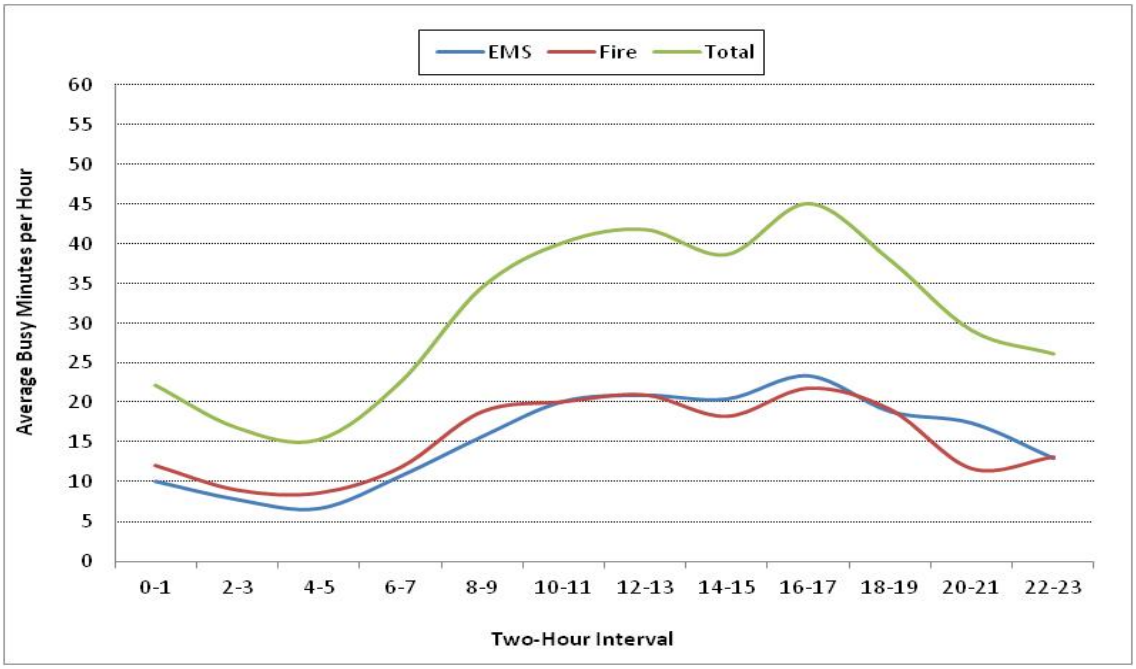


Table D6: Deployed Minutes by Hour of Day

Two-Hour Interval	EMS	Fire	Total
0-1	10.1	12.1	22.2
2-3	7.8	9.0	16.8
4-5	6.7	8.6	15.3
6-7	10.8	11.8	22.6
8-9	15.7	18.8	34.5
10-11	20.2	20.1	40.2
12-13	20.9	20.9	41.8
14-15	20.5	18.2	38.7
16-17	23.4	21.8	45.1
18-19	18.9	19.1	38.0
20-21	17.4	11.7	29.1
22-23	13.0	13.1	26.1
Daily Total	370.7	370.4	741.1

Note: Daily totals shown equal the sum of each column multiplied by two, since each cell represents two hours.

Observations:

- Hourly deployed minutes were highest during the day between 10:00 a.m. and 8:00 p.m., averaging between 38.0 minutes and 45.1 minutes per hour. Average deployed minutes peaked between 4:00 p.m. and 6:00 p.m., averaging 45.1 minutes per hour.
- Hourly deployed minutes were the lowest between midnight and 6:00 a.m., averaging fewer than 23 minutes per hour.

Table D7: Total Annual and Daily Average Number of Runs by Call Type and Unit

Station	Unit	EMS	**Structure Fire**	**Outside Fire**	Hazard	False Alarm	Good Intent	Public Service	Mutual Aid	Canceled	**Total**	**Runs per Day**
1	E1	652	**29**	**16**	40	208	13	29	32	51	**1,070**	**2.9**
2	E2	790	**44**	**25**	52	375	29	32	106	101	**1,554**	**4.3**
	TR2	79	**55**	**9**	39	374	24	22	8	11	**621**	**1.7**
3	E3	1,188	**79**	**43**	107	646	42	43	29	286	**2,463**	**6.7**
4	E4	1,345	**76**	**37**	87	564	41	49	7	226	**2,432**	**6.7**
	TR3	84	**92**	**12**	70	704	34	22	2	25	**1,045**	**2.9**
5	E5	934	**40**	**40**	89	459	21	27	3	195	**1,808**	**5.0**
	TR1	76	**50**	**12**	54	420	12	14	1	15	**654**	**1.8**
6	E6	392	**25**	**18**	38	276	15	18	5	46	**833**	**2.3**
	REHAB	0	**1**	**0**	0	0	0	0	0	0	**1**	**NA**
7	AIR1	0	**9**	**0**	0	0	0	1	1	0	**11**	**NA**
	E7	543	**45**	**17**	41	348	18	23	14	90	**1,139**	**3.1**
8	E8	117	**7**	**5**	7	47	6	19	3	18	**229**	**0.6**
9	E9	197	**15**	**9**	25	207	2	15	12	10	**492**	**1.3**

Note: A dispatch of a unit is defined as a *run*; thus a call might include multiple runs.

Observations:

- Engine E3 made 2,463 runs during the year, an average of 6.7 runs per day. However, structure and outside fire runs accounted for just 122 of the runs.
- Engine E4 was dispatched 2,432 times during the year, also an average of 6.7 runs per day.
- Of the nine pumpers, E8 and E9 were utilized least often. E8 made 229 runs in a year, an average of 0.6 runs per day. E9 made 492 runs in a year, an average of 1.3 runs per day.
- The three ladders (TR1, TR2, and TR3) were dispatched 654, 621, and 833 times during the year, respectively. On average, TR1, TR2, and TR3 were dispatched 1.8, 1.7 and 2.9 times per day, respectively.

Table D8: Daily Average Deployed Minutes by Call Type and Unit

Station	Unit	EMS	**Structure Fire**	**Outside Fire**	Hazard	False Alarm	Good Intent	Public Service	Mutual Aid	Canceled	**Total**	**Fire Category Calls Percentage**
1	E1	38.8	**6.3**	**1.5**	3.1	9.3	0.5	2.6	2.5	1.4	**66.0**	**41.2**
2	E2	48.5	**6.8**	**1.9**	3.9	15.2	1.5	2.1	7.9	3.2	**91.1**	**46.7**
2	TR2	4.8	**6.7**	**0.7**	2.2	13.4	1.0	1.3	0.8	0.5	**31.3**	**84.7**
3	E3	59.5	**10.7**	**2.7**	6.4	25.7	2.1	3.5	1.2	5.9	**117.8**	**49.5**
4	E4	73.3	**10.0**	**2.8**	7.4	23.7	3.5	3.3	0.3	5.1	**129.4**	**43.4**
4	TR3	4.2	**11.2**	**0.7**	4.5	27.7	1.8	1.7	0.1	0.9	**52.8**	**92.0**
5	E5	56.6	**4.3**	**3.5**	7.5	22.2	1.6	1.9	0.2	4.6	**102.4**	**44.7**
5	TR1	4.2	**6.0**	**1.4**	4.3	17.8	0.8	0.7	0.1	0.4	**35.7**	**88.2**
6	E6	24.6	**2.3**	**1.7**	2.5	12.8	0.9	1.6	0.2	1.1	**47.7**	**48.4**
7	E7	30.8	**5.2**	**1.6**	3.1	14.3	0.7	1.0	0.7	2.3	**59.7**	**48.4**
8	E8	10.9	**0.7**	**0.5**	0.6	2.5	0.3	1.2	0.4	0.4	**17.6**	**37.8**
9	E9	14.3	**1.6**	**1.0**	2.0	7.9	0.3	1.2	1.0	0.2	**29.4**	**51.4**

Note: REHAB and AIR1 are not included.

Observations:

- Engine E4 had the most deployed time; it averaged 129.4 minutes (two hours and nine minutes) of deployed time per day. The unit spent 57 percent of its deployed time responding to EMS calls.
- Engine E3 was deployed an average of 117.8 minutes (one hour and 58 minutes) per day. The unit spent 51 percent of its deployed time responding to EMS calls.

Analysis of Busiest Hours

There is significant variability in the number of calls from hour to hour. One special concern relates to the fire and EMS resources available for hours with the heaviest workload. We tabulated the data for each of the 8,760 hours in the year. Approximately once every 4.2 days (four days and six hours), the Johnson City Fire Department responded to five or more calls in an hour. This is 1 percent of the total number of hours. We report the top ten hours with the most calls received and discuss the two hours with the most calls received.

Table D9: Frequency Distribution of the Number of Calls

Number of Calls in an Hour	Frequency	Percentage
0	3,468	39.6
1	3,005	34.3
2	1,469	16.8
3	547	6.2
4	186	2.1
5	59	0.7
6	12	0.1
7	7	0.1
8	3	0.0
9	1	0.0
14	2	0.0
15	1	0.0

Observations:

- During 85 hours (1 percent of all hours), five or more calls occurred; in other words, the JCFD responded to five or more calls in an hour roughly once every 4.2 days (four days and six hours).
- Six or more calls occurred only during 26 hours.

Table D10: Top 10 Hours with the Most Calls Received

Hour	Number of Calls	Number of Runs	Total Deployed Hours
7/5/2012, 4 p.m. to 5 p.m.	15	23	4.2
6/13/2013, 2 p.m. to 3 p.m.	14	22	10.1
1/17/2013, 6 p.m. to 7 p.m.	14	18	3.8
8/5/2012, 6 p.m. to 7 p.m.	9	12	3.6
7/18/2012, 2 p.m. to 3 p.m.	8	33	9.7
7/5/2012, 3 p.m. to 4 p.m.	8	13	5.1
1/17/2013, 7 p.m. to 8 p.m.	8	11	2.4
11/16/2012, 5 p.m. to 6 p.m.	7	22	5.8
7/2/2012, 12 a.m. to 1 a.m.	7	18	5.0
6/25/2013, 2 p.m. to 3 p.m.	7	18	5.8

Note: The combined workload is the total deployed 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 4:00 p.m. to 5:00 p.m. on July 5, 2012. The 15 calls involved 23 individual dispatches. These 15 calls included one MVA call, one fall and injury call, one outside fire call, two hazardous condition calls, three false alarms, five public service calls, and two canceled calls. The combined workload was 4.2 hours. The longest call was the outside fire call; it lasted 34 minutes. Eight calls were responded to by two units, and one call was responded to by one unit.
- During the hour from 2:00 p.m. to 3:00 p.m. on June 13, 2013, 14 calls involving 22 individual dispatches occurred. The 14 calls included one fall and injury call, one outside fire call, five hazardous condition calls, four false alarms, two public service calls, and one canceled call. The combined workload was 10.1 hours. The longest call was a hazardous condition call; it lasted two hours and was responded to by two individual units.

Table D11: Unit Workload Analysis between 4:00 p.m. and 5:00 p.m. on July 5, 2012

Hour	Station	1	2		3	4		5		6	7	8	Number of Busy Units
	Unit	E1	E2	TR2	E3	E4	TR3	E5	TR1	E6	E7	E8	
7/5/2012 4:00–5:00 p.m.	0–5	5.0			5.0	3.8		5.0	1.3	5.0		5.0	7
	5–10	2.4	4.1		5.0	5.0		5.0	5.0	5.0		5.0	8
	10–15		5.0		5.0	5.0		5.0	1.6	5.0	1.3	5.0	8
	15–20		2.2		2.4	5.0		5.0	1.5	5.0		5.0	8
	20–25	0.3				5.0		5.0	5.0	5.0		5.0	6
	25–30	5.0	0.6		4.1	5.0	2.2	4.7	5.0	5.0		5.0	9
	30–35	1.2			0.4	5.0	1.8		2.4	5.0	0.3	5.0	8
	35–40					5.0				5.0	5.0	5.0	4
	40–45				4.5	5.0	3.8	1.8		5.0	5.0	5.0	6
	45–50			4.1	5.0	5.0	5.0	5.0		3.6	5.0	5.0	7
	50–55			0.3	3.4	4.0	1.3	5.0			2.6	5.0	6
	55–60					5.0		5.0				5.0	2
	Total	13.9	11.9	4.4	34.8	57.8	14.1	46.5	21.8	48.6	19.2	60.0	

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

Observations:

- During this hour, units in JCFD made 23 runs and responded to 15 calls. These 15 calls included one MVA call, one fall and injury call, one outside fire call, two hazardous condition calls, three false alarms, five public service calls, and two canceled calls. The longest call was the outside fire call; it lasted 34 minutes.
- During the busiest five minutes in the hour (4:25 to 4:30 p.m.), nine units were deployed simultaneously. During 20 minutes in the hour (4:05 to 4:20 p.m., and 4:30 to 4:35 p.m.), eight units were deployed simultaneously.
- A total of five units were deployed for more than 30 minutes.

Table D12: Unit Workload Analysis between 2:00 and 3:00 p.m. on June 13, 2013

Hour	Station	1	2		3	4		5		6	7	8	Number of Busy Units
	Unit	E1	E2	TR2	E3	E4	TR3	E5	TR1	E6	E7	E8	
6/13/2013 2:00–3:00 p.m.	0–5												0
	5–10												0
	10–15												0
	15–20												0
	20–25	0.2			2.3	3.6		4.2			0.0		4
	25–30	5.0	4.1		5.0	5.0	0.8	2.7	4.8		5.0		8
	30–35	5.0	3.9		5.0	5.0	5.0	3.8	5.0		5.0		8
	35–40	5.0	3.3		4.9	1.8	2.3	5.0	5.0		5.0		8
	40–45	5.0			5.0	3.0		0.5	5.0	0.4	5.0		7
	45–50	4.5			5.0	5.0	1.7	4.1	5.0		4.9		7
	50–55	5.0			5.0	5.0	1.2	5.0	5.0			4.6	7
	55–60	5.0			5.0	5.0	5.0	5.0	5.0			5.0	7
	Total	34.7	11.3		37.2	33.4	16.0	30.3	34.8	0.4	24.9	9.6	

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

Observations:

- During this hour, units in the JCFD made 22 runs and responded to 14 calls. These 14 calls included one fall and injury call, one outside fire call, five hazardous condition calls, four false alarms, two public service calls, and one canceled call. The longest call was a hazardous condition call; it lasted two hours and was responded to by two individual units.
- During the busiest 15 minutes of the hour (2:25 to 2:40 p.m.), eight units were simultaneously deployed.
- A total of five units were deployed for more than 30 minutes.

Dispatch Time and Response Time

This section presents dispatch and response time statistics for different call types and fire units. The main focus is the dispatch and response time of the first arriving units for calls responded with lights and sirens, which were identified as priority 2 or 3 in the CAD. However, for structure fire calls, we also analyze the response time of the second arriving pumper or ladder.

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 of the first arriving unit. ***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.

In this section, a total of 5,280 calls (69 percent of EMS and fire category calls) were used in the analysis. The average dispatch time was 2.1 minutes. The average turnout time was 1.6 minutes, and the average travel time was 3.2 minutes. The average response time for EMS calls was 7.2 minutes, and the average response time for fire category calls was 6.3 minutes. The average response time for structure fire calls was 5.5 minutes. The average response time for outside fire calls was 6.2 minutes. The 90th percentile dispatch time was 3.5 minutes, and the 90th percentile response time was 9.8 minutes.

Table D13: 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	2.4	1.8	3.2	7.4	851
Seizure and unconsciousness	2.4	1.6	3.0	7.1	559
Breathing difficulty	2.2	1.9	3.2	7.3	624
Overdose and psychiatric	2.8	1.7	3.3	7.9	80
MVA	1.1	1.4	3.1	5.6	386
Fall and injury	2.6	1.8	3.2	7.6	560
Illness and other	2.5	1.7	3.0	7.2	833
EMS Total	**2.3**	**1.7**	**3.1**	**7.2**	**3,893**
Structure fire	1.4	1.3	2.8	5.5	91
Outside fire	1.6	1.3	3.3	6.2	144
Hazard	1.8	1.5	3.5	6.9	211
False alarm	1.6	1.3	3.2	6.1	798
Good intent	1.8	1.4	4.0	7.2	74
Public service	2.1	1.8	3.8	7.7	69
Fire Total	**1.7**	**1.4**	**3.3**	**6.3**	**1,387**
Total	**2.1**	**1.6**	**3.2**	**6.9**	**5,280**

Note: First arriving units with valid dispatch, turnout, and travel times were used in this analysis.

Figure D8: Average Dispatch, Turnout, and Travel Times of First Arriving Unit, by EMS Call Type

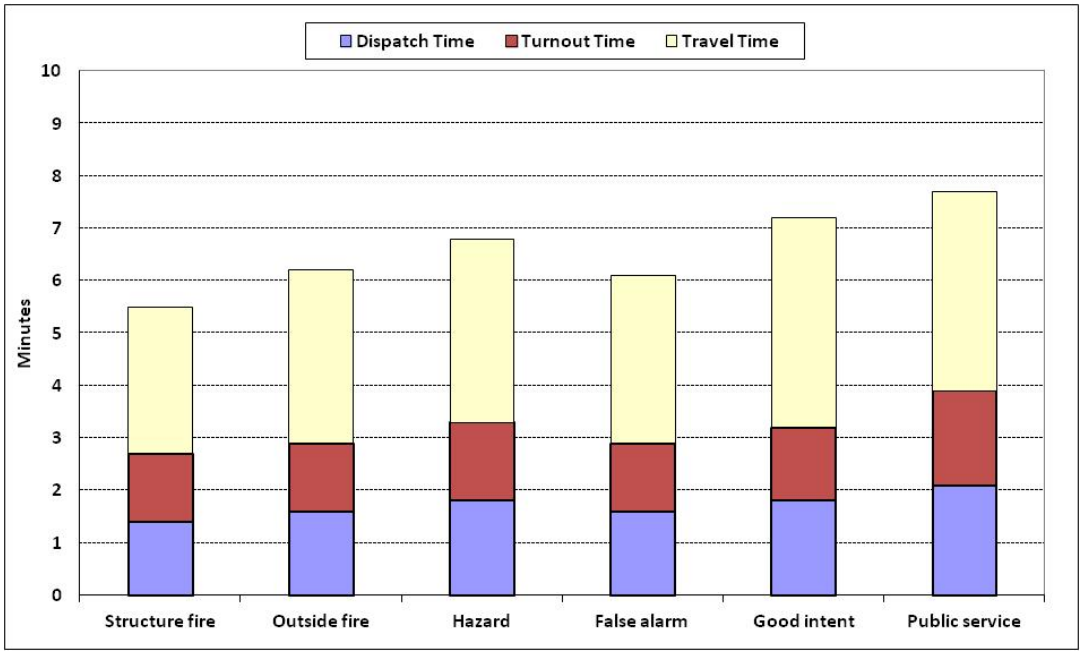
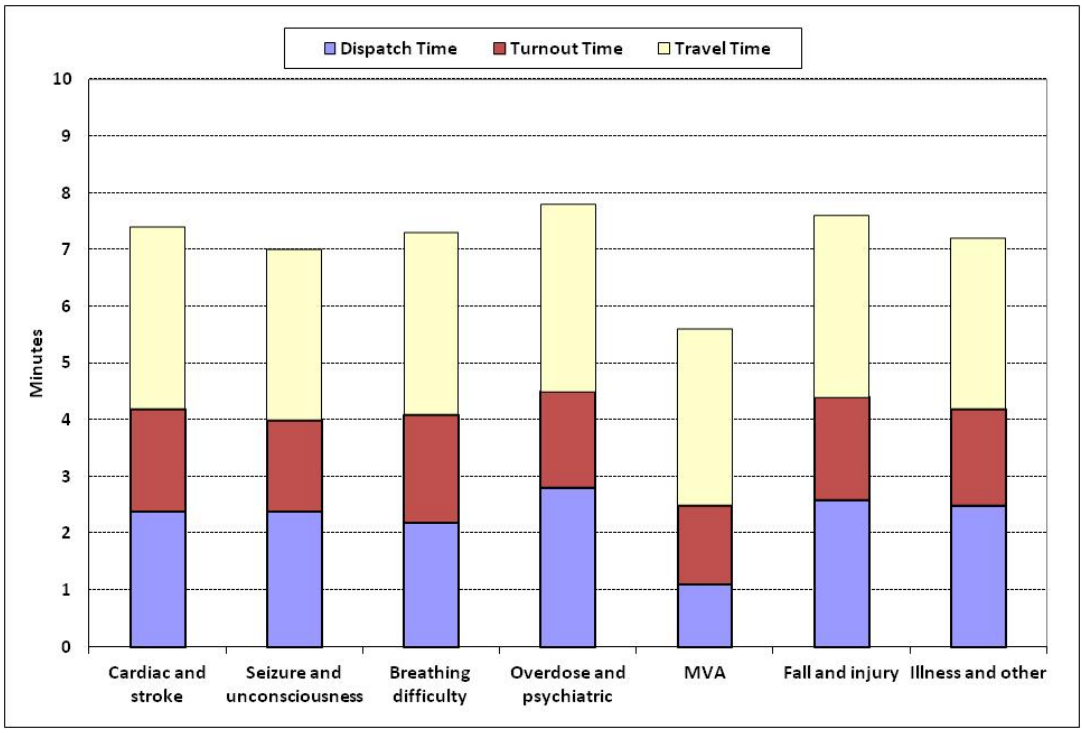


Figure D9: Average Dispatch, Turnout, and Travel Times of First Arriving Unit, by Fire Call Type



Observations:

- The average dispatch time for the first arriving unit was 2.1 minutes.
- The average turnout time was 1.6 minutes.
- The average travel time was 3.2 minutes.
- The average response time for EMS calls was 7.2 minutes.
- The average response time for fire category calls was 6.3 minutes.
- The average response time for structure fire calls was 5.5 minutes. The average response time for outside fire calls was 6.2 minutes.

Table D14: 90th Percentile 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	3.8	2.8	5.1	10.0	851
Seizure and unconsciousness	3.7	2.6	5.0	9.8	559
Breathing difficulty	3.5	3.0	5.1	9.8	624
Overdose and psychiatric	4.5	2.5	5.4	10.5	80
MVA	2.1	2.2	5.3	8.0	386
Fall and injury	4.0	3.0	5.2	10.4	560
Illness and other	4.0	2.7	4.9	9.9	833
EMS Total	**3.8**	**2.7**	**5.1**	**10.0**	**3,893**
Structure fire	2.0	1.8	4.4	7.6	91
Outside fire	2.6	2.0	5.6	8.5	144
Hazard	3.1	2.4	6.1	10.2	211
False alarm	2.5	2.0	5.4	8.7	798
Good intent	3.2	2.1	6.9	11.0	74
Public service	4.5	3.0	7.5	11.7	69
Fire Total	**2.7**	**2.1**	**5.6**	**9.1**	**1,387**
Total	**3.5**	**2.6**	**5.2**	**9.8**	**5,280**

Note: A 90th percentile value of 9.8 indicates that the total response time was less than 9.8 minutes for 90 percent of all calls. Unlike averages, the 90th percentile response time is not equal to the sum of the 90th percentile of dispatch time, turnout time, and travel time.

Observations:

- The 90th percentile dispatch time for the first arriving unit was 3.5 minutes.
- The 90th percentile turnout time was 2.6 minutes.
- The 90th percentile travel time was 5.2 minutes.
- The 90th percentile response time for EMS calls was 10.0 minutes.
- The 90th percentile response time for fire category calls was 9.1 minutes.
- The 90th percentile response time for structure fire calls was 7.6 minutes.
- The 90th percentile response time for outside fire calls was 8.5 minutes.

Figure D10: Average Dispatch, Turnout, Travel, and Response Time of First Arriving Unit, by Hour of Day

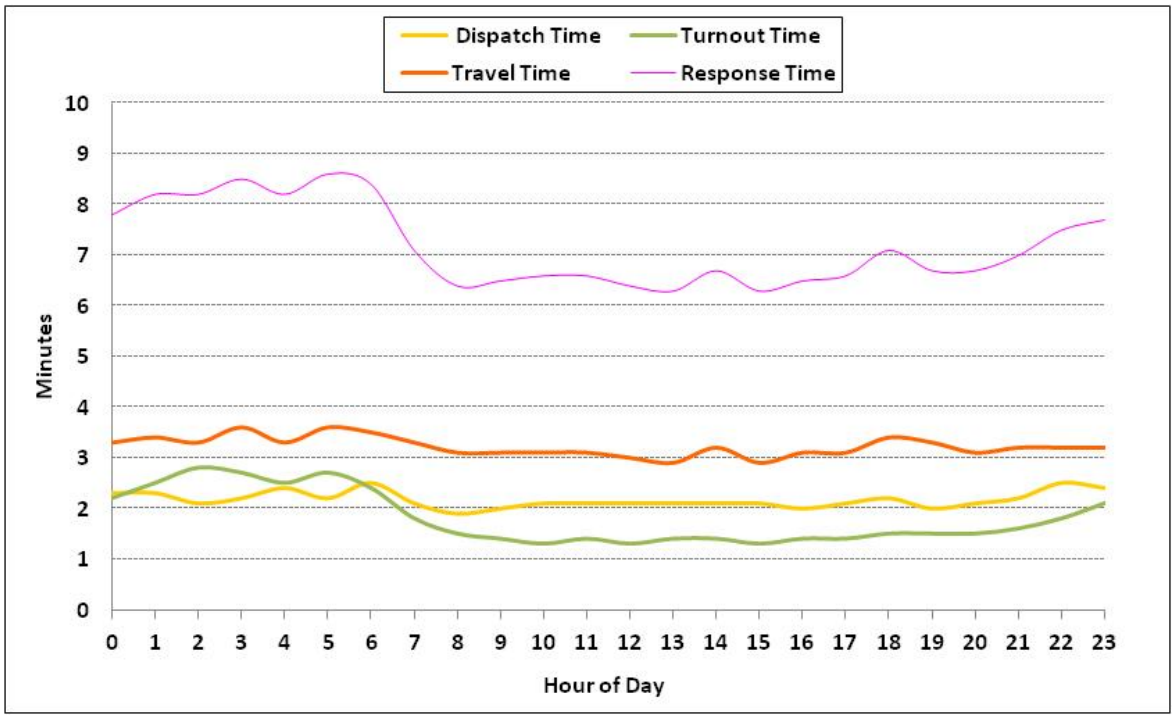


Table D15: Average Dispatch, Turnout, Travel, and Response Times of First Arriving Unit, by Hour of Day

Hour	Dispatch Time	Turnout Time	Travel Time	Response Time	90th Percentile Response Time	Sample Size
0	2.3	2.2	3.3	7.8	10.6	140
1	2.3	2.5	3.4	8.2	11.3	132
2	2.1	2.8	3.3	8.2	10.6	111
3	2.2	2.7	3.6	8.5	11.6	106
4	2.4	2.5	3.3	8.2	11.0	93
5	2.2	2.7	3.6	8.6	12.0	95
6	2.5	2.4	3.5	8.4	11.9	114
7	2.1	1.8	3.3	7.1	9.9	203
8	1.9	1.5	3.1	6.4	8.9	237
9	2.0	1.4	3.1	6.5	9.1	258
10	2.1	1.3	3.1	6.6	9.0	303
11	2.1	1.4	3.1	6.6	9.0	258
12	2.1	1.3	3.0	6.4	8.8	294
13	2.1	1.4	2.9	6.3	9.0	289
14	2.1	1.4	3.2	6.7	9.6	286
15	2.1	1.3	2.9	6.3	8.7	271
16	2.0	1.4	3.1	6.5	9.2	301
17	2.1	1.4	3.1	6.6	9.2	321
18	2.2	1.5	3.4	7.1	9.9	303
19	2.0	1.5	3.3	6.7	9.0	274
20	2.1	1.5	3.1	6.7	9.1	297
21	2.2	1.6	3.2	7.0	9.6	232
22	2.5	1.8	3.2	7.5	10.5	211
23	2.4	2.1	3.2	7.7	11.0	151

Observations:

- Average dispatch time was between 1.9 minutes and 2.5 minutes.
- Average turnout time was between 1.3 minutes and 2.8 minutes. Between 11:00 p.m. and 7:00 a.m., the average turnout time was consistently more than 2.1 minutes.
- Average travel time was between 2.9 minutes and 3.6 minutes.
- Average response time was between 6.3 minutes and 8.6 minutes. Between 1:00 a.m. and 7:00 a.m., the average response time was consistently more than 8.2 minutes.
- The 90th percentile response time was between 8.7 minutes and 12.0 minutes.

Figure D10: Number of Total Calls by First Arriving Units

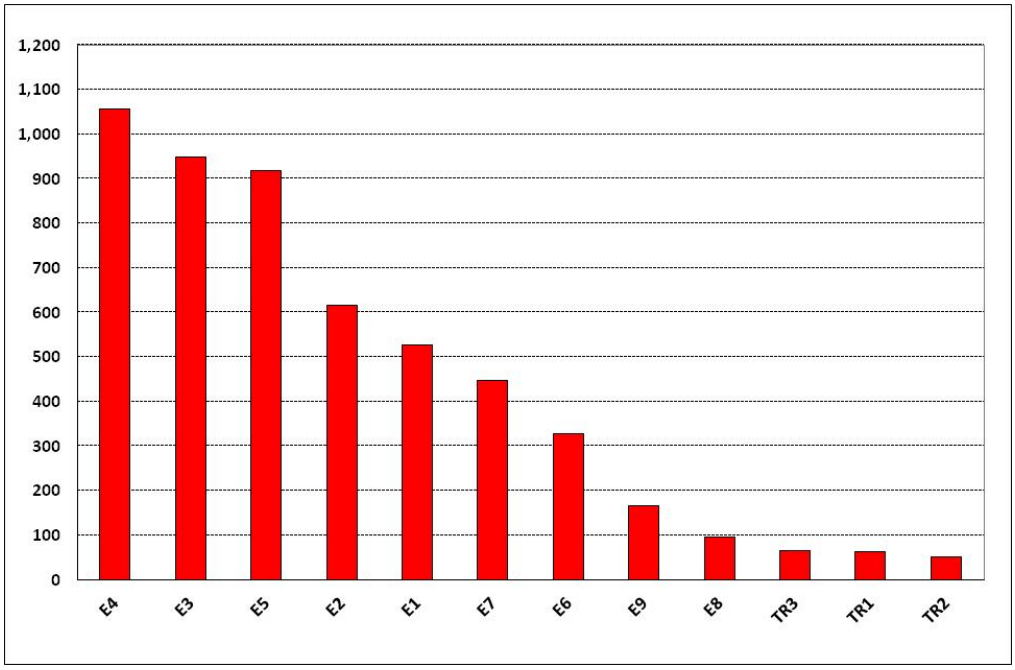


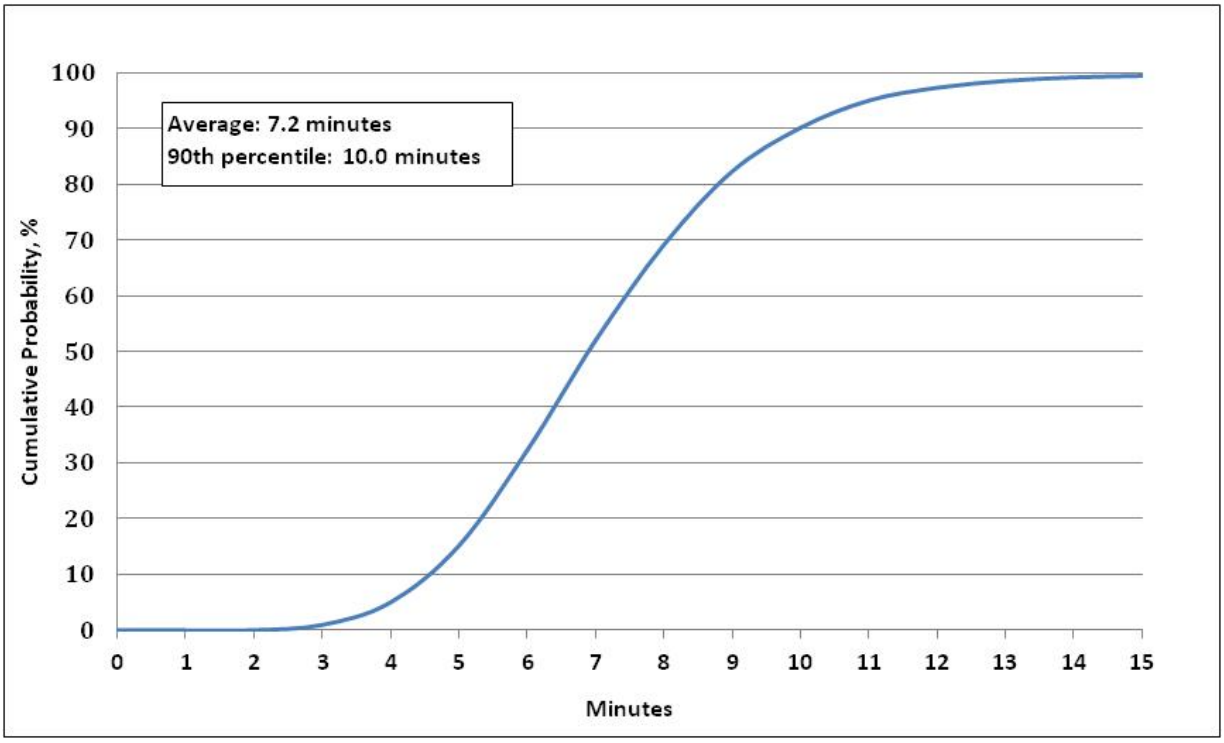
Table D16: Number of Total Calls by First Arriving Units

Unit	EMS	Structure and Outside Fire	Fire Other	Total	Percentage	Cumulative Percentage
E4	832	36	188	1,056	20.0	20.0
E3	767	38	143	948	18.0	38.0
E5	601	42	275	918	17.4	55.3
E2	450	30	136	616	11.7	67.0
E1	422	22	82	526	10.0	77.0
E7	327	27	93	447	8.5	85.4
E6	226	18	84	328	6.2	91.6
E9	121	7	39	167	3.2	94.8
E8	69	6	20	95	1.8	96.6
TR3	27	3	35	65	1.2	97.8
TR1	25	4	34	63	1.2	99.0
TR2	26	2	23	51	1.0	100.0

Observations:

- Engine E4 arrived first on scene most often, followed by E3, E5, E2, and E1. Those five units accounted for 77 percent of the first arrivals at calls.
- For structure and outside fire calls, E5 arrived first on scene most often.

Figure D11: 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 D12: Frequency Distribution Chart of Response Time of First Arriving Unit for EMS calls

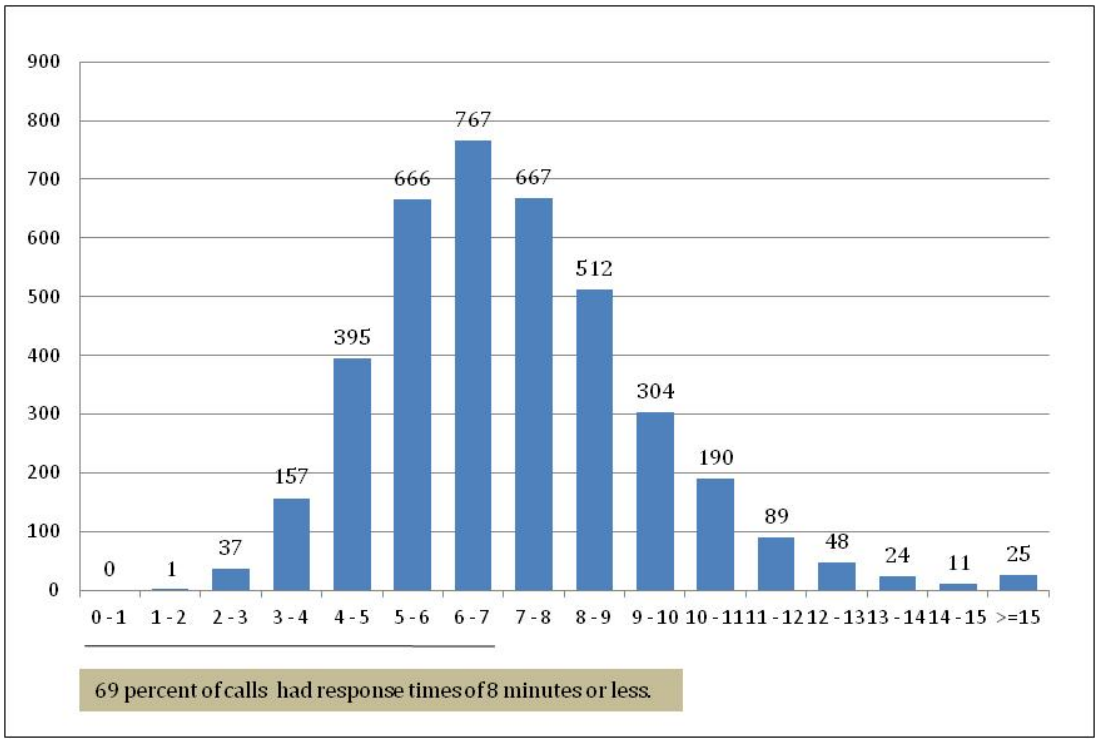


Table D17: Cumulative Distribution Function (CDF) of Response Time of First Arriving Unit for EMS Calls

Response Time (minute)	Frequency	Cumulative Percentage
0 - 1	0	0.0
1 - 2	1	0.0
2 - 3	37	1.0
3 - 4	156	5.0
4 - 5	395	15.1
5 - 6	666	32.2
6 - 7	767	51.9
7 - 8	667	69.1
8 - 9	513	82.3
9 - 10	304	90.1
10 - 11	190	94.9
11 - 12	89	97.2
12 - 13	47	98.4
13 - 14	25	99.1
14 - 15	11	99.4
> = 15	25	100.0

Observations:

- The average response time for EMS calls was 7.2 minutes.
- For 69.1 percent of EMS calls, the response time was less than or equal to 8 minutes.
- For 90 percent of EMS calls, the response time was less than 10 minutes.

Response Time Analysis for Structure and Outside Fire Calls

The following tables and charts report response time analysis of first and second arriving pumper or ladder engaged in emergency response to structure and outside fire calls.

Table D18: Average Response Time for Structure and Outside Fire Calls by First Arriving 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
Ladder	TR1	4.6	4	NA	0	4.6	4
	TR2	8.3	2	NA	0	8.3	2
	TR3	3.6	2	6.4	1	4.5	3
Pumper	E1	6.6	11	5.2	11	5.9	22
	E2	6.7	18	5.5	12	6.2	30
	E3	5.3	24	4.6	14	5.1	38
	E4	6.0	24	4.9	12	5.6	36
	E5	6.4	29	5.4	13	6.1	42
	E6	6.0	12	7.0	6	6.3	18
	E7	6.6	9	5.8	18	6.0	27
	E8	7.8	5	8.5	1	7.9	6
	E9	6.6	4	8.8	3	7.5	7
Total		**6.2**	**144**	**5.5**	**91**	**5.9**	**235**

Observations:

- For outside fire calls, the average response time of the first arriving firefighting equipment was 6.2 minutes.
- For outside fire calls, engine E5 was the first unit on scene most often and had an average response time of 6.4 minutes.
- For structure fire calls, the average response time of first arriving firefighting equipment was 5.5 minutes.
- For structure fire calls, engine E7 was the first unit on scene most often and had an average response time of 5.8 minutes.

Table D19: Average Response Time for Structure and Outside Fire Calls by Second Arriving 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
Ladder	TR1	8.9	5	7.4	16	7.8	21
	TR2	8.6	2	5.6	14	6.0	16
	TR3	6.6	4	6.0	13	6.2	17
Pumper	E1	NA	0	5.8	2	5.8	2
	E2	5.4	2	5.9	4	5.7	6
	E3	8.5	2	7.6	8	7.8	10
	E4	10.3	2	7.6	16	7.9	18
	E5	5.6	1	5.8	3	5.7	4
	E6	5.5	1	0.0	0	5.5	1
	E7	7.8	1	6.7	3	7.0	4
	E8	NA	0	3.2	1	3.2	1
	E9	8.8	1	10.8	2	10.1	3
Total		**7.8**	**21**	**6.8**	**82**	**7.0**	**103**

Observations:

- The average response time of the second arriving unit for outside fire calls was 7.8 minutes, compared to 6.2 minutes for the first arriving unit.
- The average response time of the second arriving unit for structure fire calls was 6.8 minutes, compared to 5.5 minutes for the first arriving unit.

Figure D13: Cumulative Distribution Function (CDF) of Response Time of First and Second Arriving Units for Structure Fire Calls

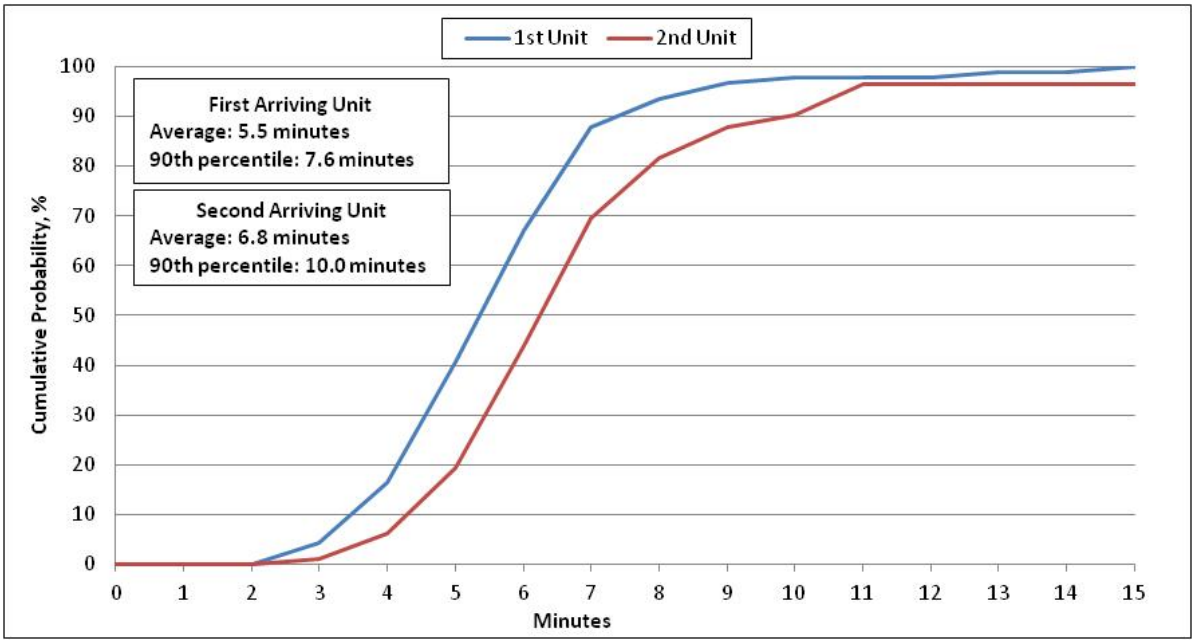


Figure D14: Frequency Distribution Chart of Response Time of First Arriving Unit for Structure Fire Calls

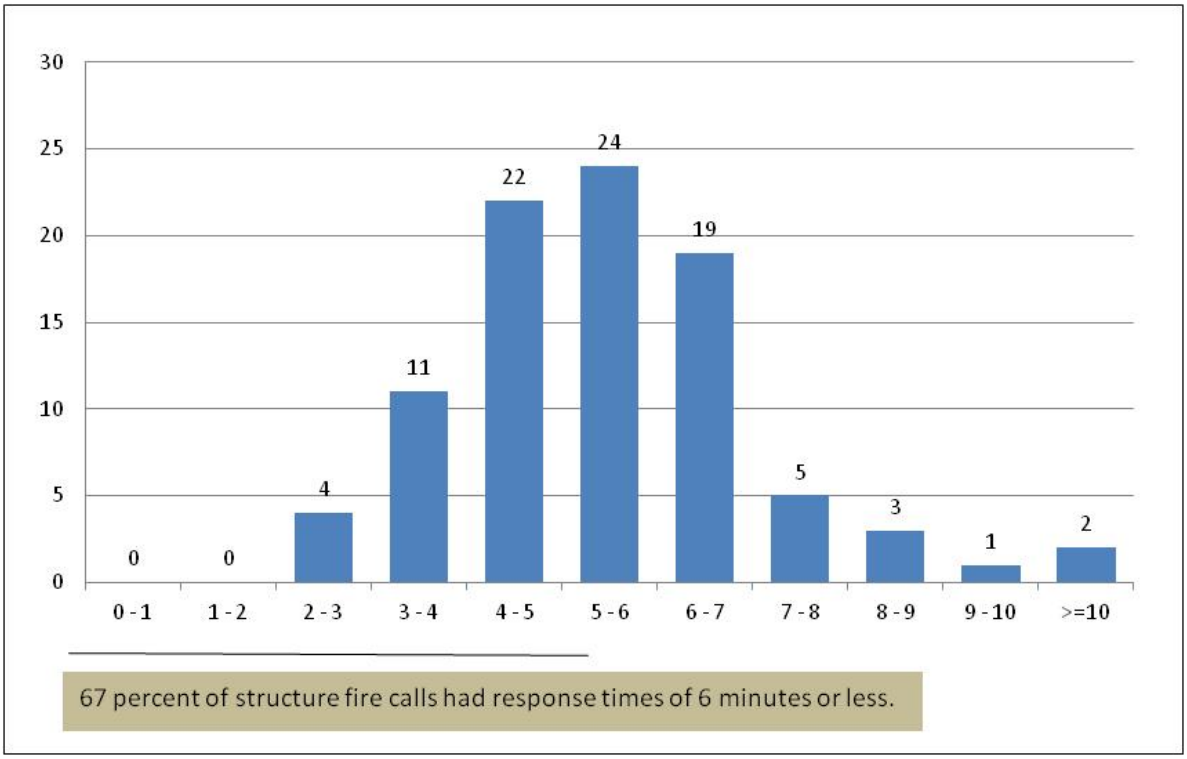


Table D20 Cumulative Distribution Function (CDF) of Response Time of First and Second Arriving Units for Structure Fire Calls

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	4	4.4	1	1.2
3 - 4	11	16.5	4	6.1
4 - 5	22	40.7	11	19.5
5 - 6	24	67.0	20	43.9
6 - 7	19	87.9	21	69.5
7 - 8	5	93.4	10	81.7
8 - 9	3	96.7	5	87.8
9 - 10	1	97.8	2	90.2
10 - 11	0	97.8	5	96.3
11 - 12	0	97.8	0	96.3
12 - 13	1	98.9	0	96.3
13 - 14	0	98.9	0	96.3
14 - 15	1	100.0	0	96.3
>= 15	0	100.0	3	100.0

Observations:

- The average response time of the first arriving fire unit for structure fire calls was 5.5 minutes.
- 67 percent of the time, the first fire unit's response time was less than 6 minutes.
- 90 percent of the time, the first fire unit's response time was less than 7.6 minutes.
- On average, the response time of the second arriving fire unit was 6.8 minutes, which was 1.3 minutes longer than that of the first arriving unit.
- 90 percent of the time, the second fire unit's response time was less than 10.0 minutes.

Figure D15: Cumulative Distribution Function (CDF) of Response Time of First Arriving Units for Outside Fire Calls

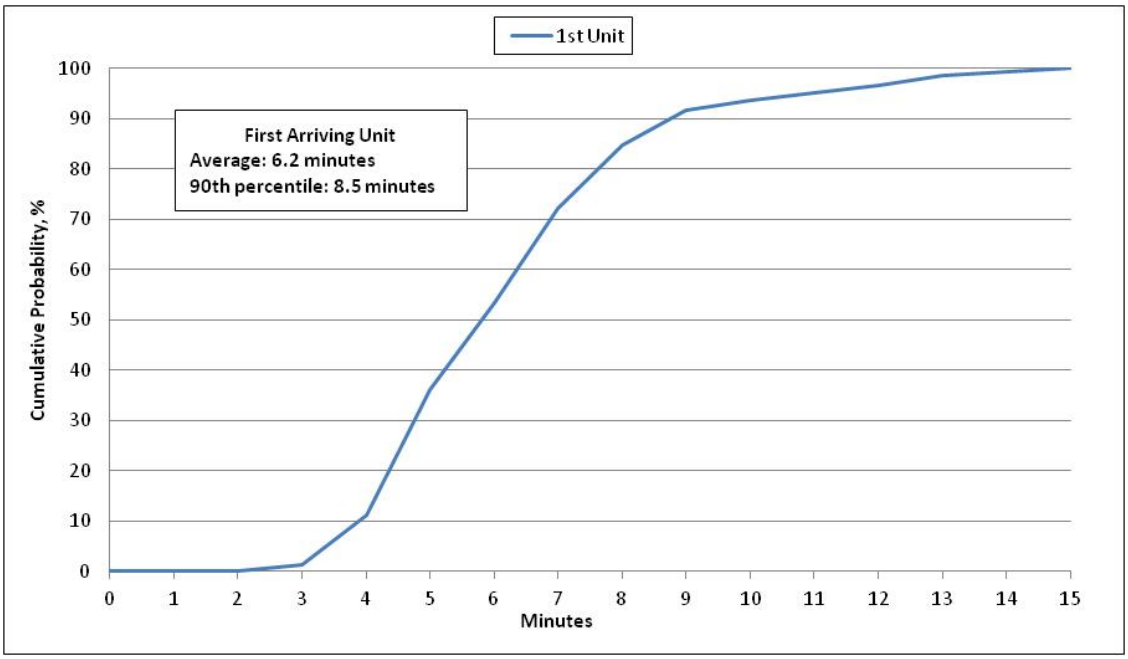


Figure D16: Frequency Distribution Chart of Response Time of First Arriving Unit for Outside Fire Calls

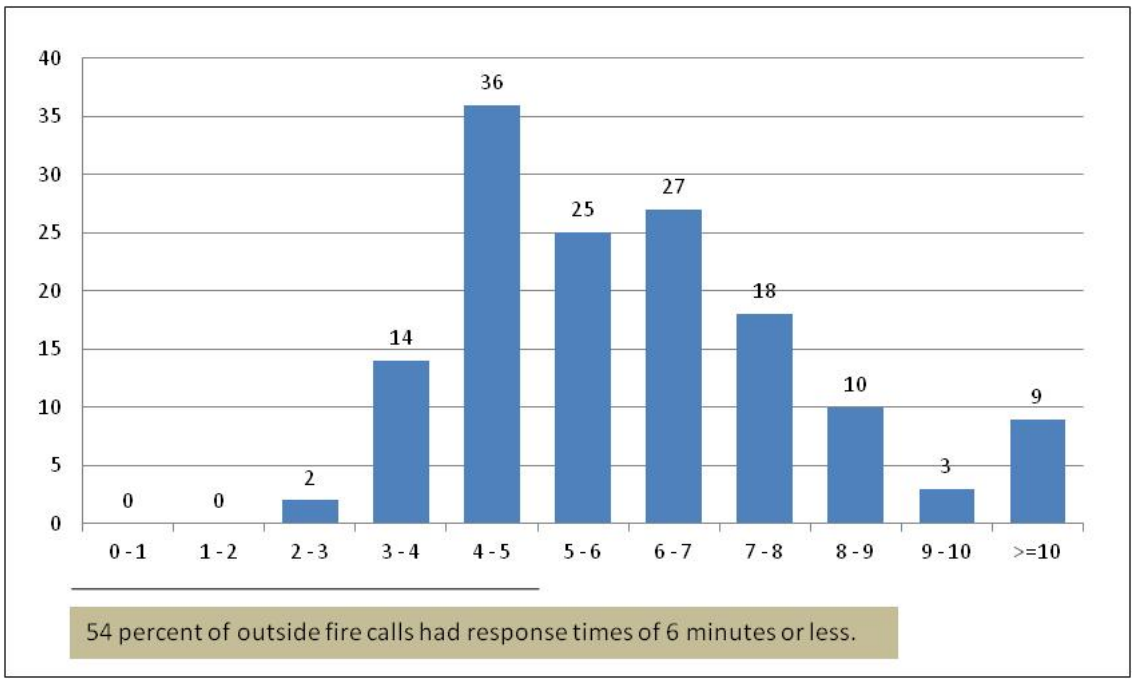


Table D21: Cumulative Distribution Function (CDF) of Response Time of First Arriving Units for Outside Fire Calls

Response Time (minute)	First Unit	
	Frequency	Cumulative Percent
0 - 1	0	0.0
1 - 2	0	0.0
2 - 3	2	1.4
3 - 4	14	11.1
4 - 5	36	36.1
5 - 6	25	53.5
6 - 7	27	72.2
7 - 8	18	84.7
8 - 9	10	91.7
9 - 10	3	93.8
10 - 11	2	95.1
11 - 12	2	96.5
12 - 13	3	98.6
13 - 14	1	99.3
14 - 15	1	100.0
>= 15	0	100.0

Observations:

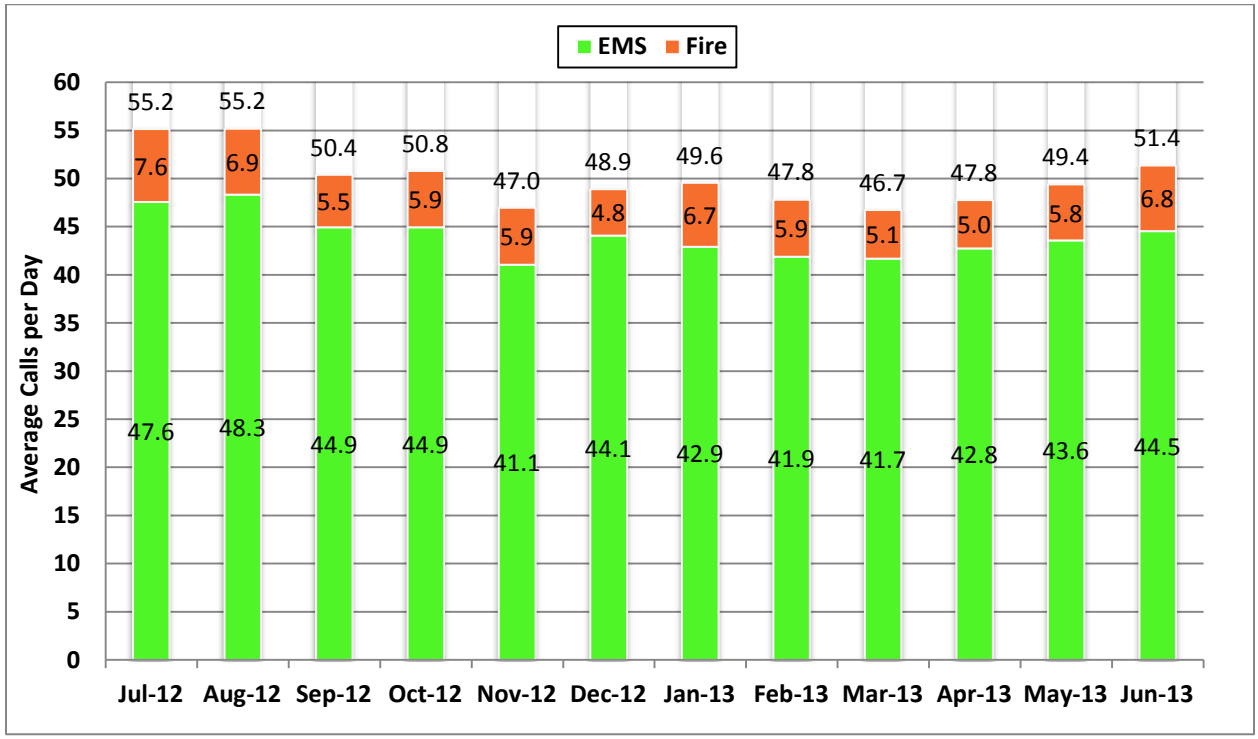
- The average response time of the first arriving fire unit for outside fire calls was 6.2 minutes.
- 54 percent of the time, the first fire unit's response time was less than 6 minutes.
- 90 percent of the time, the first fire unit's response time was less than 8.5 minutes.

Workload and Response Time Analysis for EMS and Fire Calls Responded to by Either JCFD or Washington County EMS

ICMA has analyzed the two agencies and submitted two separate data analysis reports that focused primarily on one agency at a time. The data used in the two individual jurisdictional reports were merged. In this section, the following steps were used to assign call types. For calls with at least one Washington County EMS unit, the call type from the Washington County EMS report is used. For calls with only JCFD units, the call type from the JCFD report is used. JCFD has responded to 60 convalescent and inter-facility evaluation or transfer services, and those calls were categorized as illness and other calls in the JCFD report. A significant portion of JCFD mutual aid and canceled calls were also responded to by the County EMS units, and those calls were reported as the call types used in the Washington County EMS report.

This section first examines call variability by month and hour of day. Since a total of 5,656 calls involved both agencies and 5,593 (99 percent) were EMS category calls, this section particularly focuses on response time analysis for EMS calls which involved both agencies. In the response time analysis, the first arriving units of any of the two agencies were analyzed. In other words, the average response times in Table 29 are less than response times reported in the individual reports that focused primarily on one agency at a time.

Figure D17: All EMS and Fire Category Calls Responded to by Either Agency: Average Calls per Day, by Month



Observations:

- Average calls per day ranged from a low of 46.7 calls per day in March 2013 to a high of 55.2 calls per day in July and August 2012. The highest monthly average was 18 percent greater than the lowest monthly average.
- Average EMS calls per day ranged from a low of 41.1 calls per day in November 2012 to a high of 48.3 calls per day in August 2012.
- Average fire calls per day ranged from a low of 4.8 calls per day in December 2012 to a high of 7.6 calls per day in July 2012.

Figure D18: All EMS and Fire Category Calls Responded to by Either Agency: Calls by Hour of Day

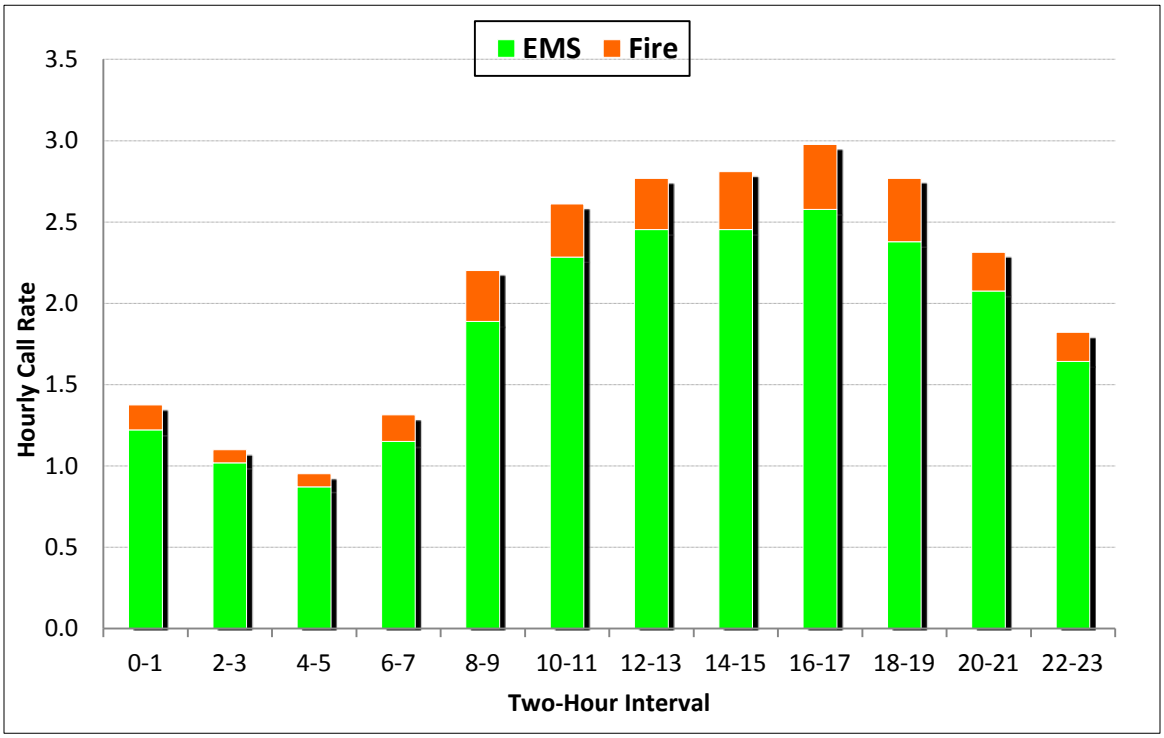


Table D22: All EMS and Fire Category Calls Responded to by Either Agency: Calls by Hour of Day

Two-Hour Interval	Hourly Call Rate		
	EMS	Fire	Total
0-1	1.2	0.2	1.4
2-3	1.0	0.1	1.1
4-5	0.9	0.1	1.0
6-7	1.2	0.2	1.3
8-9	1.9	0.3	2.2
10-11	2.3	0.3	2.6
12-13	2.5	0.3	2.8
14-15	2.5	0.4	2.8
16-17	2.6	0.4	3.0
18-19	2.4	0.4	2.8
20-21	2.1	0.2	2.3
22-23	1.6	0.2	1.8
Calls per Day	**44.0**	**6.0**	**50.0**

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 averaged between 1.0 call and 2.9 calls per hour.
- Call rates were highest during the day between 8:00 a.m. and 10:00 p.m., averaging between 2.2 and 3.0 calls per hour. The rate peaked between 4:00 p.m. and 6:00 p.m., when it averaged 3.0 calls per hour.
- Call rates were lowest between midnight and 8:00 a.m., averaging between 1.0 to 1.4 calls per hour.

Figure D19: Number of Units Dispatched to EMS Calls Involved Two Agencies

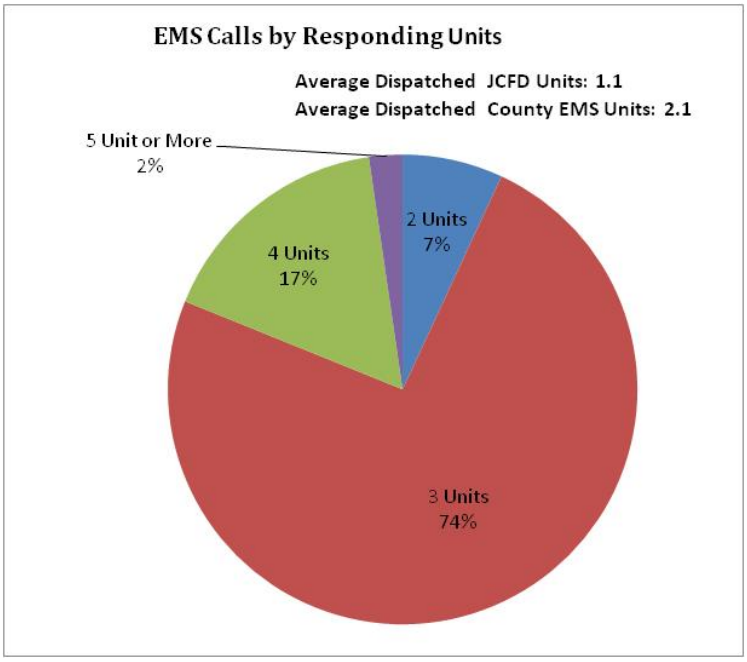


Table D23: Number of Units Dispatched to EMS Calls Involved Two Agencies

Call Type	Number of Units from Two Agencies				
	Two	Three	Four	Five or More	Total
Cardiac and stroke	23	1008	195	25	1,251
Seizure and unconsciousness	35	598	150	25	808
Breathing difficulty	14	727	157	16	914
Overdose and psychiatric	10	101	25	0	136
MVA	23	12	4	2	41
Fall and injury	120	672	159	23	974
Illness and other	162	1,032	237	38	1,469
EMS Total	**387**	**4,150**	**927**	**129**	**5,593**
Percentage	**6.9**	**74.2**	**16.6**	**2.3**	**100.0**

Note: This table includes responding units except administrative vehicles from both agencies.

Observations:

- On average, 2.1 Washington County units and 1.1 JCFD units were dispatched per EMS call, so the average units per EMS call was 3.2 units.
- For EMS category calls involved both agencies, two units were dispatched 7 percent of the time; three units were dispatched 74 percent of the time; and four units were dispatched 17 percent of the time and five or more units were dispatched 2 percent of the time.

Table D24: EMS Calls with Units from Two Agencies: Average Dispatch, Turnout and Response Time of First Arriving Unit, by Call Type

Call Type	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size
Cardiac and stroke	2.4	1.5	3.3	7.3	1,098
Seizure and unconsciousness	2.4	1.5	3.1	7.0	688
Breathing difficulty	2.2	1.7	3.3	7.2	816
Overdose and psychiatric	2.8	1.5	3.2	7.5	106
MVA	2.2	1.5	2.8	6.4	11
Fall and injury	2.5	1.6	3.4	7.5	723
Illness and other	2.4	1.5	3.2	7.1	1,072
EMS Total	**2.4**	**1.6**	**3.3**	**7.2**	**4,514**

Note: First arriving units with valid dispatch, turnout, and travel times were used in this analysis.

Observations:

- The average dispatch time for the first arriving unit was 2.4 minutes.
- The average turnout time was 1.6 minutes.
- The average travel time was 3.3 minutes.
- The average response time for EMS calls was 7.2 minutes.
- 62 percent of the time, a JCFD unit arrived earlier than the County EMS units.

Figure D20: EMS Calls with Units from Two Agencies: Number of Calls by First Arriving Units

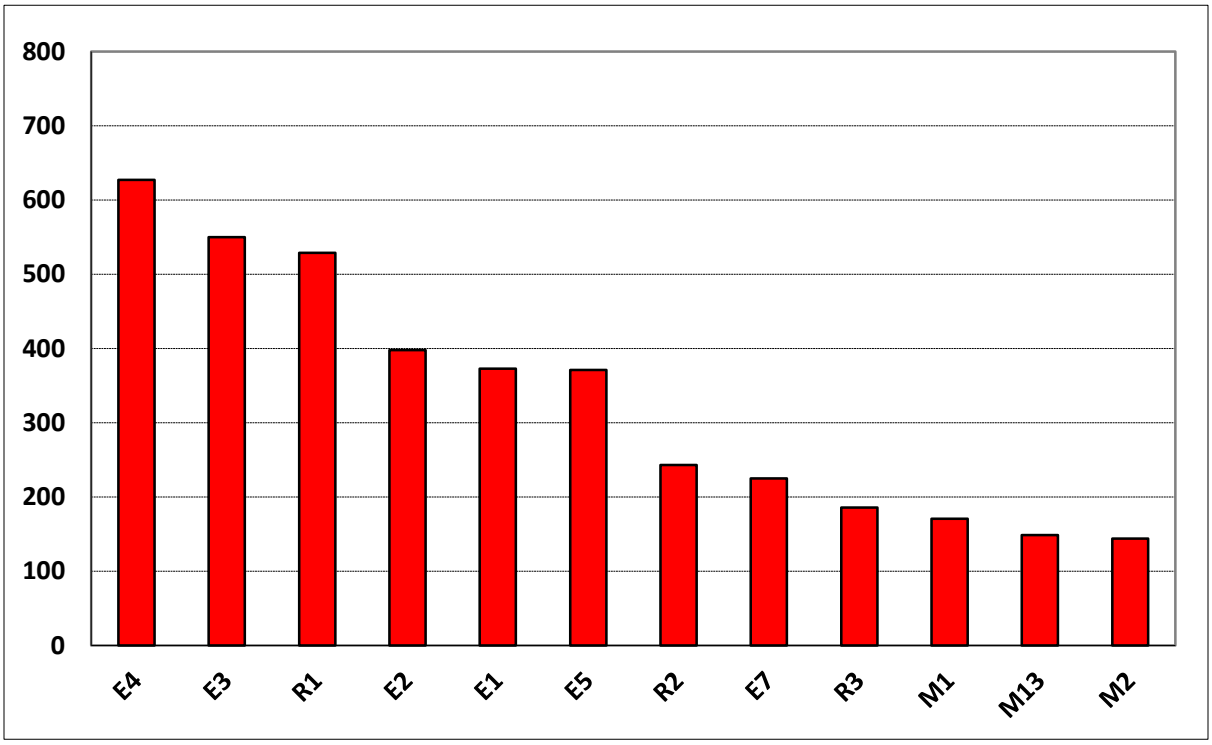


Table D25: EMS Calls with Units from Two Agencies: Number of Total Calls by First Arriving Units

Unit	Agency	Number of EMS Calls	Percentage	Cumulative Percentage
E4	JCFD	627	13.9	13.9
E3	JCFD	550	12.2	26.1
R1	Washington County EMS	529	11.7	37.8
E2	JCFD	398	8.8	46.6
E1	JCFD	373	8.3	54.9
E5	JCFD	371	8.2	63.1
R2	Washington County EMS	243	5.4	68.5
E7	JCFD	225	5.0	73.5
R3	Washington County EMS	186	4.1	77.6
M1	Washington County EMS	171	3.8	81.4
M13	Washington County EMS	149	3.3	84.7
M2	Washington County EMS	144	3.2	87.9
E6	JCFD	124	2.7	90.6
E9	JCFD	91	2.0	92.6
M6	Washington County EMS	91	2.0	94.6
M3	Washington County EMS	79	1.8	96.4
M7	Washington County EMS	65	1.4	97.8
M4	Washington County EMS	19	0.4	98.2
TR2	JCFD	19	0.4	98.7
E8	JCFD	16	0.4	99.0
TR1	JCFD	14	0.3	99.3
TR3	JCFD	13	0.3	99.6
R4	Washington County EMS	9	0.2	99.8
R5	Washington County EMS	7	0.2	100.0
R7	Washington County EMS	1	0.0	100.0

Observations:

- Engine E4 arrived first on scene most often, followed by E3, R1, E2, and E1. Those five units accounted for 55 percent of the first arrivals at calls.
- Of the top five first arriving units, four units were JCFD units.

Table D26: Average and 90th Percentile Response Time by Unit for EMS Calls Involved Two Agencies

Agency	Unit	Average Response Time	90th Percentile Response Time
JCFD	E1	7.1	9.7
	E2	8.1	10.9
	E3	6.9	9.8
	E4	6.9	9.3
	E5	7.3	9.9
	E6	8.4	12.2
	E7	7.6	10.2
	E8	7.6	10.8
	E9	8.3	10.6
	TR1	8.1	10.4
	TR2	8.0	10.4
	TR3	7.9	10.3
	Total	**7.3**	**10.1**
Washington County EMS	M1	8.9	13.5
	M13	9.6	13.2
	M2	9.0	13.2
	M20	13.0	13.4
	M23	11.8	14.1
	M3	10.5	15.8
	M4	9.3	16.3
	M5	11.5	11.5
	M6	9.2	14.3
	M7	10.3	14.5
	M8	16.9	23.7
	R1	7.5	10.5
	R2	8.3	11.4
	R3	8.1	11.0
	R4	6.9	9.8
	R5	10.9	14.3
	R7	15.3	15.3
	Total	**8.6**	**12.5**

Observations:

- For EMS calls involved both agencies, the average response time of the first arriving JCFD unit was 7.3 minutes, and 90th percentile response time was 10.1 minutes. Whereas, the average response time of the first arriving County EMS unit was 8.6 minutes, and the 90th percentile response time was 12.5 minutes.

Attachment I: Workload of Administrative Units

Unit Description	Unit Report	Average Deployed Minutes per Run	Number of Runs	Annual Hours
Administrative vehicle	800	237.0	5	19.7
	801	57.6	6	5.8
	802	39.4	6	3.9
Command vehicle	820	26.2	512	223.5
Fire marshal	FM2	165.5	23	63.4
	FM3	168.5	21	59.0
	FM4	140.2	14	32.7
Total		**41.7**	**587**	**408.0**

Attachment II: Property and Content Loss Analysis for Structure and Outside Fire Calls

Call Type	Property Loss		Content Loss	
	Loss Value	Number of Calls	Loss Value	Number of Calls
Structure fire	$667,900	56	$216,900	44
Outside fire	$131,975	45	$16,600	17
Total	**$799,875**	**101**	**$233,500**	**61**

Note: This analysis only includes calls with property loss or content loss greater than 0.

Observations:

- Out of 102 structure fire calls, 56 calls (55 percent) had recorded property loss, with total recorded loss value of $ 667,900. A total of 44 calls (43 percent) had recorded content loss, with total recorded loss value of $216,900.
- Out of 159 outside fire calls, 45 calls (28 percent) had recorded property loss, with total loss value of $131,975. A total of 17 outside fire calls (11 percent) had recorded content loss and the total loss value was $16,600.

Attachment III: Actions Taken Analysis for Structure and Outside Fire Calls

Action Taken	Number of Calls	
	Structure fire	Outside fire
Fire control or extinguishment, other	8	15
Extinguishment by fire service personnel	48	88
Salvage & overhaul	2	1
Contain fire (wildland)	0	1
Confine fire (wildland)	0	1
Remove hazard	1	0
Ventilate	17	0
Information, investigation & enforcement, other	1	7
Incident command	0	6
Enforce codes	0	1
Investigate	10	21
Investigate fire out on arrival	15	17
Standby	0	1
Total	102	159

Attachment IV: Correspondence between NFIRS Incident Code and Call Type

Incident Type Code	Call Type	NFIRS Incident Description
111	Building fire	Structure fire
112	Fires in structure other than in a building	Structure fire
113	Cooking fire, confined to container	Structure fire
114	Chimney or flue fire, confined to chimney or flue	Structure fire
117	Commercial Compactor fire, confined to rubbish	Structure fire
118	Trash or rubbish fire, contained	Structure fire
130	Mobile property (vehicle) fire, other	Outside fire
131	Passenger vehicle fire	Outside fire
142	Brush or brush-and-grass mixture fire	Outside fire
151	Outside rubbish, trash or waste fire	Outside fire
154	Dumpster or other outside trash receptacle fire	Outside fire
162	Outside equipment fire	Outside fire
164	Outside mailbox fire	Outside fire
311	Medical assist, assist EMS crew	EMS
321	EMS call, excluding vehicle accident with injury	EMS
3210	EMS call, excluding vehicle accident with injury	EMS
322	Motor vehicle accident with injuries	MVA
3220	Motor vehicle accident with injuries	MVA
323	Motor vehicle/pedestrian accident (MV Ped)	MVA
324	Motor vehicle accident with no injuries.	MVA
331	Lock-in (if lock-out , use 511)	EMS
353	Removal of victim(s) from stalled elevator	EMS
357	Extrication of victim(s) from machinery	EMS
364	Surf rescue	EMS
411	Gasoline or other flammable liquid spill	Hazard
412	Gas leak (natural gas or LPG)	Hazard
413	Oil or other combustible liquid spill	Hazard
422	Chemical spill or leak	Hazard
424	Carbon monoxide incident	Hazard
440	Electrical wiring/equipment problem, other	Hazard
441	Heat from short circuit (wiring), defective/worn	Hazard
442	Overheated motor	Hazard
444	Power line down	Hazard
445	Arcing, shorted electrical equipment	Hazard
451	Biological hazard, confirmed or suspected	Hazard

Incident Type Code	Call Type	NFIRS Incident Description
481	Attempt to burn	Hazard
510	Person in distress, other	Public service
511	Lock-out	Public service
520	Water problem, other	Public service
522	Water or steam leak	Public service
5220	Water or steam leak	Public service
531	Smoke or odor removal	Public service
551	Assist police or other governmental agency	Public service
552	Police matter	Public service
553	Public service	Public service
554	Assist invalid	Public service
561	Unauthorized burning	Public service
571	Cover assignment, standby, move-up	Public service
600	Good intent call, other	Good intent
611	Dispatched & canceled en route	Canceled
611F	Dispatched & canceled en route	Canceled
611M	Dispatched & canceled en route	Canceled
611T	Dispatched & canceled en route	Canceled
622	No incident found on arrival at dispatch address	Canceled
631	Authorized controlled burning	Good intent
651	Smoke scare, odor of smoke	Good intent
652	Steam, vapor, fog or dust thought to be smoke	Good intent
653	Smoke from barbecue, tar kettle	Good intent
661	EMS call, party transported by non-fire agency	Good intent
671	HazMat release investigation w/no HazMat	Good intent
672	Biological hazard investigation, none found	Good intent
714	Central station, malicious false alarm	False alarm
715	Local alarm system, malicious false alarm	False alarm
731	Sprinkler activation due to malfunction	False alarm
733	Smoke detector activation due to malfunction	False alarm
734	Heat detector activation due to malfunction	False alarm
735	Alarm system sounded due to malfunction	False alarm
736	CO detector activation due to malfunction	False alarm
740	Unintentional transmission of alarm, other	False alarm
741	Sprinkler activation, no fire - unintentional	False alarm
743	Smoke detector activation, no fire - unintentional	False alarm
744	Detector activation, no fire - unintentional	False alarm
745	Alarm system activation, no fire - unintentional	False alarm

Incident Type Code	Call Type	NFIRS Incident Description
911	Citizen complaint	Public service

Note: First, mutual aid calls were identified using "aid type" information in NFIRS. Then, we used the above correspondence table to categorize the remaining calls. For calls that are designated to the county EMS agency, we used the CAD call description to further assign detailed EMS categories.