ICMA

Leaders at the Core of Better Communities

I C M A C O N S U L T I N G S E R V I C E S

PUBLIC SAFETY SERVICES

Helping Local Governments Achieve Measurable Results

ICMA Leaders at the Core of Better Communities

Public Safety Services

ICMA Consulting Services

International City/County Management Association

Beaufort, South Carolina

ICMA Background

The International City/County Management Association (ICMA) is the premier local government leadership and management organization. Since 1914, ICMA's mission has been to create excellence in local governance by developing and advocating professional local government management worldwide. ICMA provides an information clearinghouse, technical assistance, training, and professional development to more than 9,000 city, town, and county experts and other individuals throughout the world.

ICMA Consulting Services

The ICMA Consulting Services team helps communities solve critical problems by providing management consulting support to local governments. One of ICMA Consulting Services' areas of expertise is public safety services, which encompasses the following areas and beyond: organizational development, leadership and ethics, training, assessment of calls for service workload, staffing requirements analysis, designing standards and hiring guidelines for police and fire chief recruitment, police/fire consolidation, community-oriented policing, and city/county/regional mergers.

Performance Measures

The reports generated by the academic data analysis team are based upon key performance indicators that have been identified in standards and safety regulations, by special interest groups such as the International Association of Fire Chiefs (IAFC), International Association of Fire Fighters (IAFF), Association of Public Safety Communication Officials – International (APCO), and through the Center for Performance Measurement of ICMA. These performance measures have developed following decades of research and are applicable in all communities. For that reason, comparison of reports will yield similar reporting pictures; the individual data is analyzed community by community by the ICMA specialists.

I. Executive Summary

The City of Beaufort, South Carolina is faced with a number of challenges as it deploys emergency resources for the future.

The irregular boundaries of the City, coupled with islands of annexed property which are not contiguous result in resources traveling across unincorporated areas. The annexation of these areas lowers density and requires a further dispersal of resources to meet the larger geographic area potential for service.

It is evident that past administrations (city and fire) attempted to position stations and resources for joint response by the city and fire district. The topography and natural barriers caused by development occurring on island areas makes uniform deployment of resources difficult if not impossible.

Demographic data is important when looking at operational recommendations. The fire department serves the City of Beaufort as well as Port Royal with automatic aid from other agencies. These agencies include: Lady's Island, Burton Fire District and the military installations. These military installations offer a significant opportunity to avoid duplication for handling hazardous materials and other specialty services.

The City of Beaufort is a county seat for Beaufort County, South Carolina. It was chartered in 1711 and is the second-oldest city in South Carolina, behind Charleston. The city's population was 12,950 in the 2000 census and is not expected to be significantly different in the 2010 census. While a number of tracts of land have been annexed to the city, one large one north of the city will never be developed but is used as a buffer to protect encroachment on the adjacent military installation. Other tracts have been planned but no development has taken place and is likely years from occurring.

The Beaufort Fire Department contracts to operate the Port Royal Fire Department. The City of Port Royal owns the building and equipment but the staffing and operation is by BFD. Military establishments that have fire departments include Parris Island, the U.S. Naval Hospital and the U.S. Marine Corps Air Station in Beaufort.

As of the 2000 census, there were 12,950 people, 4,598 households, and 3,034 families residing in the city. The population density was 695.7 people per square mile. There were 5,080 housing units at an average density of 272.9 per square mile. The racial makeup of the city was: 69.41% white, 25.14% African American, 0.32% Native American, 1.07% Asian, and 1.10% other races.

Of the households, 31.8% had children under the age of 18. The average household size was 2.37 and average family size was 2.90. The population age ranges were: 21.6% under the age of 18, 19.5% from 18 to 24, 28.9% from 25 to 44, 17.8% from 45 to 64, and 12.2% who were 65 years of age or older. The median age was 30 years.

The median income for a household in the city was $36,532, and the median income for a family was $42,894. The per capita income was $20,501 and 11.5% of families and 13.0% of the population were below the poverty line, including 20.3% of those under age 18 and 11.1% of those 65 or over.

The housing stock appears to be a mix of old and new; the old is from the 19th century. Stately mansions line the waterfront and create risk in the event a fire occurs. Several have been destroyed when a fire did occur because of open wall spaces and balloon construction. This is a risk that should be addressed through code.

There are several key components that Beaufort is utilizing in creating a department to serve not just the needs and demands of today but also well into the future. Those components include:

- Conducting a review of the hazards that are likely to occur in the community. Hazards are not limited to fire but also things such as combined space, technical rescue and a variety of human-made and natural incidents.
- Evaluate the risks that are present in the community. The presence of a significant senior population is a risk that must be considered when deploying and designing resources because of the unique challenges it places upon emergency response.
- Prevention and mitigation processes. The city should look at alternatives to paid service delivery. A volunteer force exists and should be expanded to meet the needs of the city; it will be difficult to expand the career resources when the population is not growing and is not likely to grow for some time. Past deployment and planning envisioned a much larger community than is present. These prevention concepts will be discussed further in a later section of this report.
- Deployment of resources based upon risk, hazard, with prevention. The deployment process that is proposed for Beaufort will also involve monitoring performance using benchmarks and baselines established by various standards and processes. By definition, benchmarks are the performance levels achieved by agencies of like demographics and deployment. Baseline performance is the level of service achieved by the City of Beaufort. By comparing these two points, Beaufort will be able to continually adjust and improve (if possible) its service delivery and eliminate problems that are found in new-focused agencies.

II. Creating the Department for the Future, Today

The city has undertaken considerable research for creating the department it believes will best meet the needs of its citizens. Cost has not been a limiting factor but is a consideration; whatever form the department takes it must be sustainable now and in the future to be successful. The department must be accountable to the Mayor, Council and citizens of Beaufort as well as Port Royal for which it contracts to service. It must be innovative and look at new ways to handle the old problem of extinguishing fire while being tasked with additional duties such as EMS, confined space, and homeland security.

The department and city have been progressive thinking, looking at how resources can be shared rather than duplicated. With shared services comes the establishment of performance objectives as well as cost. One of the past shared services included automatic aid from the Burton Fire District.

The fire district and city cooperated in establishing services as well as deploying services. However, in at least two instances the fire district has proposed terminating agreements or limiting the response that will be provided should a call come from the cities of Beaufort and Port Royal. Because of past history as well as a current litigation case, it is recommended that the cities position themselves to be responsible for service delivery and look to the fire district only for mutual aid when absolutely needed.

By planning and organizing fire/EMS resources independent of the fire district, the city council and city administration will retain control and, ultimately, financial support necessary to deliver sustainable services. From interviews and financial review, it past planning envisioned a much larger service delivery area both in terms of value as well as population. Full time, career departments are the most expensive option when considering service delivery and require substantial financial

commitment. The combination department which uses paid on call or "volunteers" to staff peak incidents is one of the more economical and is being used by the Beaufort Fire Department. It is recommended this be expanded.

A. Administrative

An administrative structure exists but is very flat. The acting chief has officers in key support positions. It is recommended that a fire chief be selected using core competencies similar to those identified by the National Institute of Justice for police chiefs. The chief would oversee a combination fire department that would retain its character and identity. By having an overall person in command, duplicative resources could be identified and shared with other city departments on an economical basis. Areas that could be shared: office support, communications, records management, information technology, GIS, and human resource management.

The fire command in Beaufort is to be commended. From the fire chief to the officer in charge of public education, it was evident that the mission of providing service to the citizens was foremost in the minds of command. The fire chief is forward thinking and was found to be extremely progressive in how he envisioned delivery of services. He had identified one of the recommendations that will be made – to construct and staff one additional station. He has also embraced a department that is not reactive to calls for service but that seeks to prevent and mitigate calls before they occur. This has rarely been found by the ICMA team and is worthy of specific mention.

The other command staff is also to be commended for being equally progressive. It was refreshing to find such an embrace for progress rather than tradition which usually is used to govern deployment and utilization of resources. Specific areas will be addressed later in this report.

By creating a chief and command structure, some of the administrative burdens will be lifted from the already overworked fire administration, freeing them to develop even more fully the progressive service delivery they envision. Beaufort will serve as an example of service delivery well into the future if these concepts and processes can be developed.

The proposed administration structure will involve the creation of a "Chief" position that will oversee fire and EMS services. The Chief will be given the following powers:

Powers, Duties, and Responsibilities. The chief shall have the following powers, duties, and responsibilities:

1. Plan, coordinate, supervise, and evaluate fire and EMS operations and activities in and related to the city
2. Research, write, establish, and evaluate policies
3. Develop organizational structures, including lines of authority, responsibility, and communication to carry out the policies and goals, and revise organizational structure as required
4. Coordinate media relations, oversee the release of all public information in cooperation with the city administrator, and oversee all public announcements and communications to ensure compliance with applicable policy, decisions, and protocol
5. Monitor general activities to ensure compliance with standard operating procedures
6. Direct and conduct strategic planning
7. Research fire and emergency medical programs and practices, and implement strategies to better carry out policies and goals
8. Conduct program evaluations and formulate action to upgrade efficiency and capability as needed

9. Perform any other related duties as deemed necessary or required by the city administrator, mayor, and city council.

The Chief shall have division chiefs/deputies assigned for managing the performance of the fire/EMS division.

Reporting shall be to the Mayor and City Council through the City Manager as outlined by the City Charter.

B. Performance Measurement and Benchmarking

Most United States fire departments have been organized using a series of traditional tactics that were predicated on research done in the United Kingdom beginning in 1936. The concept utilized in deploying resources was known as the "Standard of Response Coverage." (SOC)

The concept began in the UK because of the realization that ultimately the war in Europe would spread to that island nation. Professionals had reviewed the consequences of aerial bombardment that had taken place in Europe and made plans to extinguish the resulting fire and control disorder that was likely to result.

The work on this process did not stop with World War II but continues to this day and has been slowly brought into the U.S. However, beginning in 2001, the tactical deployment showed that outcomes did not significantly change when the SOC process was used. Instead, the process evolved into a continuing succession of outputs that built upon each other and reflected deploying for the worst case scenarios.

The weaknesses in this approach were further exposed when the Center for Public Safety Excellence reviewed existing software tools that had been developed for the

U.S. Fire Service based on the SOC method. The software that had been developed – known as "RHAVE" which stood for Risk, Hazard, and Value Evaluation – was released in 2001. It was subsequently updated by the CPSE and re-released as "VISION" Software. A grant from the Assistance to Firefighters through the Department of Homeland Security reviewed the formulas and found that they utilized a linear approach and were not able to incorporate regression analysis. In other words, a community could add fire stations, add equipment, add staffing and the outcome remained the same; the risk did not decrease nor were prevention strategies recognized as having any impact on the outcome of deployment.

This led to the abandonment of the software by the accreditation agency and further research has been stalled by lack of available funding. At the same time two other developments were taking place. The first was the release of research in the U.K. that found the existing Standard of Coverage model did not lead to increasing safety for responders or the public. Instead, it found that the focus of that model was on property at the expense of people. Without comprehensive prevention and mitigation efforts, the outcome of events was predictable and unchanging.

The U.K. moved towards the creation of Integrated Risk Management Planning which utilized the SOC concept but integrated comprehensive prevention and mitigation. The result in four years has been significant improvements in safety for people (responders and citizens) as well as significant reductions in fire loss to property. Several progressive departments in the United States have utilized these concepts and achieved similar results. One such example is Fargo, North Dakota which continues to see decreases in fire loss as well as being able to manage calls for EMS service in a growing population. The department has also been able to save by evaluating the need for specialized equipment recommended by entities like the Insurance Standards Organization (ISO) and reaching the decision that the purchases were not necessary based on historical performance.

Beaufort's efforts have shown that prevention efforts eliminate the calls for service. It is one of only a few that have made this change from tradition and the recommendation is to expand it as much as possible. Prevention is always cheaper than reaction; studies by road agencies as well as emergency managers indicate that for every $1 spent on prevention, $4 to $7 is saved in reaction to calls for service and subsequent loss.

The Assistance to Firefighters grants funded a process known as "Vision 20/20" that led to the consensus of a large group of fire experts that without prevention, outcomes for calls for fire did not change. The group reviewed historical efforts and found that building codes, production of non-flammable bedding and sleepwear, fire alarms, and similar measures had reduced the severity and calls for fire response. The work of the group led to the International Code Council (ICC) adopting a sprinkler recommendation in all new construction single family homes beginning with the 2009 code amendments. The success of sprinklers has been evident in places like Bellevue, Washington and Addison, Texas where alarms are rare and those calls received are often to shut off activated sprinkler heads and perform clean-up versus fighting growing fires.

The administration in Beaufort has already begun the process of incorporating this design.

In order to determine if improvements are being made for service delivery, it is important to identify methods for measurement. The historic methodology that was used for locating and deploying resources appears to have used the NFPA 1710 Standard as the basis for its deployment. The 1710 standard is designed for all-career departments and is one tactic for responding to fire and EMS calls for service. The 1710 standard does not preclude developing additional tactics and contains an "Equivalency Clause" to allow for this type of individualism.

Beaufort seeks to develop deployment strategies after carefully considering the published tactics. The department has developed using a combination of paid-on-call and career members which allows it to utilize a different standard for analysis of effectiveness: the NFPA 1720 standard. The city will utilize careers for not just suppression and EMS response; it will also use these career members for prevention and mitigation efforts between calls for service as well as evaluating the outcome of the department's efforts. If outcomes do not meet the desires of elected officials and the community, the tactics will be changed.

The career members will be supplemented with paid-on-call and trained personnel from other city departments. Because the city already employs these persons, many are working shifts and are able to respond to calls for service from those other duties. In creating a department of public safety, police, public works, and other city agencies should be evaluated for membership on the paid-on-call ranks. For EMS response, training police officers as medical first responders can result in them being able to get to a caller and begin medical intervention, thereby delivering a viable patient to the responders on the fire division with transport occurring to the proper medical center.

Fixed stations will be located across the city with one additional station proposed to serve Port Royal and Beaufort in the area near Robert Smalls Parkway which would serve and could quickly deploy to either incorporated area. The Central Headquarters Station will be staffed with additional resources that can be deployed to support the north or south or west stations; all stations will be available for the unlikely and infrequent call for service that requires such a response.

Prevention efforts should not be limited just to fire; identifying frequent users of the EMS service and intervening or eliminating these calls by use of volunteers or paid staff frees up resources to develop even more preventive efforts. Such intervention can include daily blood pressure or blood-sugar analysis by paid staff; phone calls

from other senior volunteers to ensure they are doing well and taking medication; arranging rides to medical treatment centers on a non-emergency basis by volunteers or other city services; and inspection of homes to eliminate hazards.

The data analysis showed a very high level of calls for cardiac symptoms and strokes – almost 1 per day. This was in addition to almost 1 call for respiratory distress per day. For a city the size of Beaufort along with Port Royal, this is a very substantial number and should be a target for intervention. Almost 16% of the EMS calls for service are for stroke and cardiac systems.

By employing a preventive approach, the effort will be to eliminate many of these as emergencies and instead free up resources from making repeated calls to these areas.

C. Communications Data Analysis

The new-focused department, as proposed, will incorporate regular review of performance. In reviewing the existing performance it was found that the dispatch center is taking 3 minutes, on average, to process an EMS call. For fires, it is taking 2.9 minutes on average. This should be compared to national statistics for performance as well as communication standards that indicate it should take no longer than 1.5 minutes to answer the phone, receive the information, and alert responders. By doubling this time, the outcome for medical and fire calls will be affected.

Another problem was identified when reviewing turnout times for BFD. When first looking at the time from when the dispatch alerts responders to when the equipment leaves the station – also known as "turnout time," the turnout time averages 2 minutes for EMS; 4.5 minutes for fire. National benchmarks indicate this time should be 1 minute to 1.5 minutes (1 minute and 30 seconds). As a point

to note, travel time to move emergency equipment 1.5 miles usually is in the range of 4 minutes. From that review, the recommendation would be to shorten turnout and dispatch times which would result in the same outcome as building multiple additional fire stations.

However, when further analyzing the data and looking at reasons for this time difference, data entered into the CAD by Beaufort County Dispatch is plagued by incorrect times. One particular structure fire showed a discrepancy of 1 hour and 6 minutes in turnout time. A second fire call revealed a discrepancy of 1 hour and 17 minutes. With such wide variables, it is possible that other times recorded by the dispatch center may be in error as well.

It is recommended that the new-focused department utilize the COMPSTAT process for communicating both within the department as well as with other city departments. COMPSTAT or "Comparative Statistics" looks at calls for service and performance on a regular basis. From that review, problems are identified both in terms of the agency responding as well as how other departments in the city might be of use in achieving improved levels of service.

When problems develop, the cumulative department staffs can be focused on the problem with the goal of eliminating it in the future, if possible. Examples might be in the area of enforcement of building and property codes. Instead of having to hire additional employees, can existing personnel be trained on these codes and conduct the inspections as part of their regular duties? By eliminating blight and hazards, calls for emergency response are eliminated or reduced and responders that are called face a situation with better education and familiarity of the premises. Sharing what is being seen in the field can lead to agencies changing their processes and ultimately result in a safer community.

In order to present an accurate picture of the time demands facing the department; all activity must be accurately recorded on the Computer Aided Dispatch/Records Management System (CAD/RMS) and accessed to prepare weekly progress reports to City Administration. If service does not meet adopted levels, an explanation should be given for the non-compliance. The dispatch times and turnout times, for instance, should be the first target for reduction.

D. Deployment and Staffing

The department operates on a traditional 24 hour deployment cycle. The ICMA is furnishing a study prepared for the International Association of Fire Chiefs (IAFC) through a grant to from the Department of Homeland Security which showed that the traditional deployment of resources for a 24-hour period could be hazardous to the long-term health of responders as well as a detriment to safe and effective customer service.

The study looked at the 24 hour shifts and found that health concerns included obesity, heart problems, and severe fatigue brought on by sleep deprivation. As departments become busier and attempt to make better use of time, the ability to achieve quality rest is much more difficult. The study recommended changes to the 24 hour shift schedule.

The ICMA does note that moving away from a 24 hour deployment requires additional resources or an adjustment to deployment. Instead, the city might look at using the 24 hour shift for a base and targeting peak demand times for flex staffing. The calls for service are heaviest between 6 a.m. and 9 p.m. The total response time peaks at more than 18 minutes for fire and 10 minutes for EMS at

about 6 a.m. Resources could be added during the peak times for calls and should target reducing these times to acceptable benchmarks.

In positioning the four stations, the location was determined based on the availability of existing property as well as from where calls are received.

The City will place additional resources in the Central Station to support the north west and south deployments.

For larger incidents, the on-duty staff will be supported by paid-on-call coming from both existing city staff as well as the community.

E. Prevention Strategy

As was noted earlier, the prevention and education command are to be commended; they are some of the most forward thinking that have been encountered by ICMA in the entire United States. They recognize that fire prevention and education is not to be limited to one "show" during a fire prevention week once per year. It is only by repetition and repeated exposure that people learn and then respond automatically when an emergency occurs. Hours could have been spent with the prevention staff. Beaufort should hold them as the example for other departments.

However, they are also few in number. The command relies on career members of the department to deliver the fire prevention and education method – an outstanding use of the resources already paid for by the city. It is recommended that others in the community be potentially invited for delivery of the message. Examples would be senior groups, retired teacher organizations, "snow birds" wintering in the area, and other professionals in the city. By using existing

resources and supplementing their efforts with unpaid volunteers, this program can be continually improved and expanded.

As was noted, prevention has been found to be far cheaper than response. The City should review the opportunity to install sprinklers on all new structures and retrofit existing properties when they undergo renovation. Similar efforts in cities like Addison, TX greatly reduced the severity and calls for fire which reduced the need for larger staffs as well as loss from fires that did occur. Beaufort and Port Royal have many treasures on the National Register of Historical places and every effort to protect these structures should be made.

For new home construction, the cost of installing a sprinkler system is the same or less than installing most underground sprinkler systems. In the case of the interior, it protects not just property but the occupants who may have a better chance to escape a fire that does occur. In the case of exterior, underground sprinklers, many parts of the country have severely limited to use of such systems because of the demand on water systems that cannot be met.

Because of the high number of seniors in the community, a Citizen Emergency Response Team (CERT) or Fire Corps program should be incorporated into the department. These individuals can also assist the department when an incident occurs by providing rehab to department members and reducing the exposure to elements such as high heat and humidity by operating cooling stations activated when an incident call is received.

These same volunteers can target ‘frequent fliers” who make calls for service to the department on a regular basis and attempt to intervene so that the call does not have to be handled as an emergency.

F. Elements of Time

For a positive outcome, particularly in EMS but also for fire, time is a critical element. For that reason, the ICMA team looked at the performance of the department across a spectrum of time elements that have been identified as important to achieving successful outcomes. The department's performance and suggested recommendations for improvement were noted in the earlier section of this report on performance measures. ICMA believes that monitoring performance, particular in this area, can result in outcome improvement.

Various standards have attempted to quantify the critical time elements that occur during emergencies. These times are not limited just to fire and EMS but also have applicability for all-hazard responses. An all-hazard response includes natural as well as human-caused incidents such as storms, disasters, and terrorism incidents.

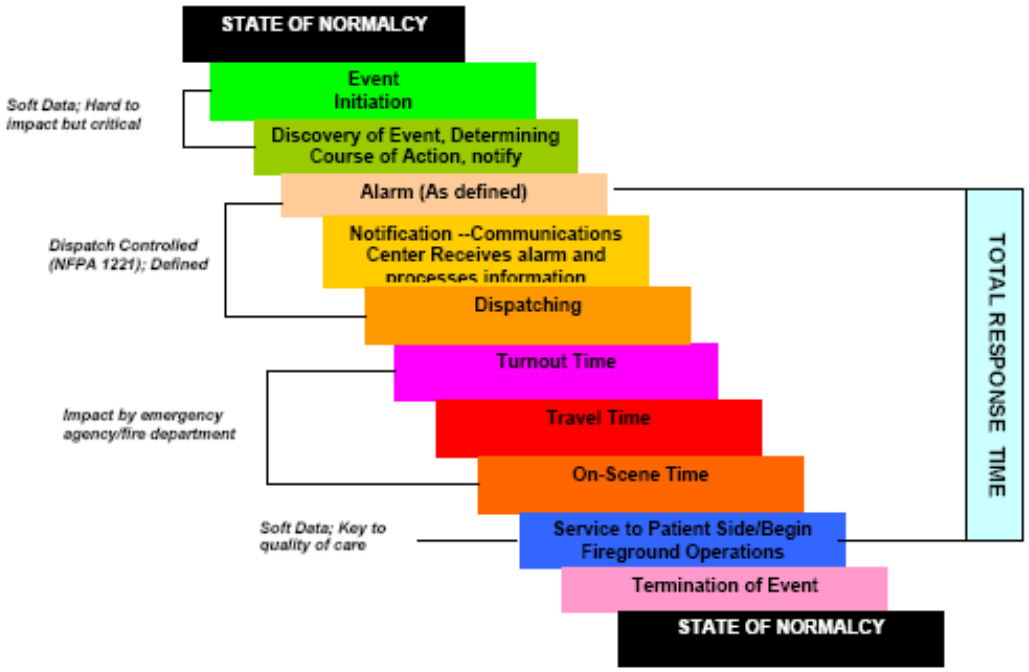


Figure 1 – Time Elements for Response

It is critical that departments continually review the elements that can be controlled; the use of prevention and mitigation can provide some additional time but it is limited in many cases, particularly medical.

As Figure 1 illustrates, dispatch time is one of the few times that can be improved and which may make a difference on the outcome of an event.

In the case of cardiovascular incidents requiring defibrillation, there is a 10-minute window from the onset of the incident, according to studies by the

Collapse To CPR	Collapse To Defibrillation	Probability Of Survival
< 5 minutes	< 10 minutes	37%
< 5 minutes	> 10 minutes	7%
> 5 minutes	< 10 minutes	20%
> 5 minutes	> 10 minutes	0%

**Numbers drawn from The Emergency Medical Directors' Association of California 1998 Position Paper.*

Figure 2 – Survivability Matrix

Emergency Medical Director's Association of California that WAs published in 1998. According to the study, the highest survival rates (37 percent) occur when cardiopulmonary resuscitation is begun in less than 5 minutes of collapse and in which defibrillation occurs in less than 10 minutes. Those survivability percentages plunge to a 0 percent probability when CPR is begun after 5 minutes and defibrillation begins after 10 minutes. Therefore, it is critically important that dispatchers receive information, process the information, and alert responders in as short of time interval as possible.

For fire response, the historical reference has been 12 minutes for a fire to reach the stage of "flashover." Flashover is the point at which all objects in a room have been heated to the point of ignition but oxygen levels have been so depleted that combustion does not occur. The influx of oxygen – either by a breaking window or opening door – causes the room and contents to spontaneously ignite in an at-time explosive nature. Fire is rarely confined to the point of origin at this level; severe damage of the building and contents is normally the outcome.
When responders are caught in flashover, even the best protective equipment can fail to prevent injury and such equipment is usually rendered useless for future use after being subjected to such high temperatures and intense conditions.

Research underway through a grant from the Assistance to Firefighters program of DHS to the Center for Public Safety Excellence indicates that the time to flashover may be much less than thought because of the use of lighter and less dense building material. In the past, structural framing consisted of dense growth 2 x 4 with larger diameter wood used for floors and roofs. This has been replaced by lighter weight wooden "I" beams that enable longer floor spans and more creative open space. The danger with these new products is that fire can compromise the structural integrity without warning and lead to collapse; at

least six have been identified in the Metro Washington, DC area over the past year alone.

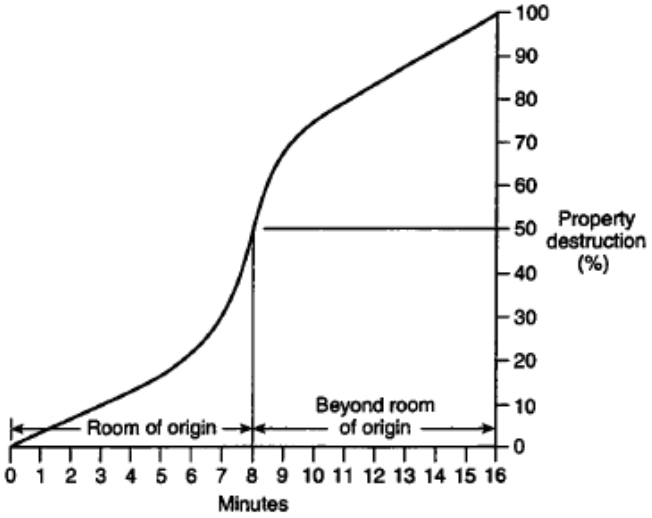


Figure 3 -- Flashover Curve

For successful outcomes, EMS patients must have bleeding, breathing, and beating controlled or restored within 10 minutes. Communities that experience high success rates for surviving these incidents normally do so by first educating the public to respond at the onset of the incident. By providing immediate care, a viable patient is then delivered to medical first responders who are able to deliver a higher level of care. Those responders then move the patient to transport which can increase the techniques and tactics being delivered with the ultimate transfer to a proper trauma center equipped and capable of advanced life saving processes.

A series of outcomes should be established that include:

a. All alarms and phone alarms shall be answered within 15 seconds 95 percent of the time and within 40 seconds 99 percent of the time.
b. All alarm notifications for public safety shall be processed within 60 seconds 90 percent of the time and within 90 seconds 99 percent of the time.
c. Turnout time should occur in less than 1 minute and 30 seconds. The existing NFPA standards use a 1 minute turnout time but discussion has led to a comprehensive study to determine the viability of this time. Fifty-nine departments are being surveyed to determine whether or not the

existing standard of one minute should be revised. The preliminary consensus was that the 1 minute 30 second time provided a safer response and was more likely achievable.

d. First-dispatched units shall leave the station and arrive at the address of the call within 6 minutes 90 percent of the time. The first full-alarm response shall mobilize and travel to the address within 8 minutes 90 percent of the time. Additional alarms, specifying what is needed at the incident, will occur and all responding units shall be tracked by dispatch to determine whether protocols are successful or need revision.

G. Use of AED's

City GIS records should be integrated into the dispatch center's CAD system so that when calls for service are received, responders have all the available data that is compiled. All hazardous material reports should be computerized and linked by geocodes to property files within the city and be immediately accessible to responders through Mobile Data Terminals in fire equipment.

Because the various functions of the city—building department, inspections, records, GIS—are spread across a number of departments, incorporating all of these records into a computer service that could be shared both at the station levels and on Mobile Data Terminals is critical.

Automatic vehicle locators (AVLs) should be installed on all vehicles so that the dispatch and command know where the resources are at any given time. Software systems are available and used in areas like Hilton Head Island, SC, Moorhead, MN and Grand Rapids, MI to routinely deploy resources and shorten transportation times. With use of automated dispatching systems, the closest unit can be dispatched and additional units can be sent with predetermined protocols, thus avoiding dispatcher efforts. Again, because of the dispersion of command, officers would have access to locating vehicles and department calls

and management decisions could be automated with pre-programmed closest call units receiving the call for service.

The new-focused department should adopt national policy standards that are available from APCO, CALEA, NENA, and others for dealing with false alarms and dispatch protocols.

It is important in cases of sudden cardiac arrest that defibrillation take place to restore the electrical impulses in the heart. To achieve maximum success, all police vehicles should be equipped with AED's. All AED's in the community should be located on a layer of the Geographic Information System and should show when a call on dispatch consoles is received as part of an interlink with the CAD system. Today there are more than 300,000 AED's in locations around the United States with a projection that more than 1 million will be located in 425,000 buildings by 2010, according to studies by Atrus, Inc. which is working with the Sudden Cardiac Arrest Association. AED's are used in only 0.5% of the Sudden Cardiac Arrest incidents reported but the study indicated one was typically within 50 feet. By linking to the CAD system for the dispatcher to relay to the caller, the effective useful range of each AED can be increased from less than 50 feet to more than 300 feet, a 3500% increase in effective range.

The Sudden Cardiac Arrest Association research shows that by locating the AED's, a viable patient is more likely delivered to responders.

H. Vehicle Maintenance

The lieutenant in charge of maintenance should also be commended for the work that is being done on department vehicles as well as the records being maintained. It is rare that all work is done in-house as it is in Beaufort.

Beaufort inspects, records, and repairs all of its vehicles in-house. The records are largely paper records and storage/retrieval of these records is possible by the lieutenant but would probably be virtually impossible if something were to

happen to him. The system should be automated using notebooks for inspections with electronic notification of work needed.

Contracts for major work should be developed; the city should look at offering space for repairs as part of the contract but let the work be performed by these contractors, freeing up time of employees. Record management systems are available through FireHouse which will also design and assist in preparing specific upgrades to the existing city system if needed. ICMA has contacts with administrators at the software firm if needed.

The record management issues are problematic throughout the department and fixing these will result in better performance as well as record keeping at all levels of the future department. Oil changes and routine maintenance should be prompted by programs, not required to be tracked by the command. Small repairs can continue to be made by staff such as light bulbs, fluid levels and such with larger repairs contracted for.

The city should also look at nearby colleges for support in designing and integrating the paper with automated systems. Internships either at the high school level or college entry level can assist with getting the volumes of paper documents recorded in a computer system.

I. Training and Education

Because of the ISO rating given Beaufort, considerable effort has been made to maintain the training and integrity of records. Automating this process, too, would save time on the lieutenant who is doing an exemplary job in trying to maintain as well as improve the education levels for department members.

A recommendation is to develop a formal training consortium with the military and as many other fire departments in the area as possible. A formal training and education strategy should be developed for each member of the department and become part of the review process given to the employee. This removes the emphasis from the training officer having to chase members to members being responsible for the outcome on their evaluation by pursuing opportunities themselves. It would be similar to the process already developed for promotional consideration.

Another recommendation is to accompany the yearly performance evaluation (written) with a practical or skills testing. Just like a police officer, a firefighter's gear is critical to the survival of not just the firefighter but also his team members. Demonstrating competency should be a part of the annual performance review and serves to help identify weaknesses that can then be addressed in the following year's training regimen.

Because the department is fighting fewer fires, maintaining skills is difficult, particularly when a fire burn building is not easily reached.

The two yearly entry options for volunteers should also be promoted and it is recommended they become an academy process – incorporating a flag and other inspirational components. This type of process is used in Auburn, AL quite successfully and helps build camaraderie as well as identify in the department. Keeping and motivating volunteers is a very difficult task; an additional recommendation is to look at a stipend to one of the volunteers to serve as support to the lieutenant and thereby free him from the day-to-day tasks.

I. EMS

The existing EMS system uses a multi-tier response to provide emergency medical services. Successful medical services in the United States employ a systematic process, evaluated regularly using performance measures, to meet the demands of citizens.

A successful system starts with having a trained citizenry. In Seattle, WA, Houston, TX, and Minneapolis, MN, response to emergencies begins with citizens who witness the onset of the incident. Educating all citizens of Beaufort and Port Royal in basic first aid, CPR, and other life-saving techniques should be the first component of the developed response system.

By having immediate intervention, a viable patient is delivered to the next stage of patient care: the first responder. As was noted earlier, AED's should be located and recorded in police cars, in public buildings, and in as many other locations as possible. By having a trained population apply resuscitation efforts, the likelihood that a patient will survive and walk out of the hospital is greatly enhanced. Police cars usually are on patrol and can often arrive first; again a patient is then delivered to fire responders who enhance intervention and treatment.

Monitoring and improving times for dispatch and arrival is critical to patient outcome. The time that it takes the ambulance to arrive is also critical and is an unknown in Beaufort County. If first responders are caring for patients for more than 11 minutes before an ambulance arrives, the system may need augmenting or redeployment. National benchmarks indicate that within 8 minutes of the call being received, processed, and ambulance alerted, the ambulance should arrive on-scene. With the hospital in the community, patients can be loaded and transported in quick fashion for higher levels of intervention.

The monitoring should include outcomes for calls for service: how many patients leave the hospital with no substantial health issues after alerting the medical service? This outcome measure is usually avoided by declaring issues with getting information because of the HIPPA provisions. However, HIPPA does not exclude or preclude emergency responders from this information − they are part

of the information and delivery of service and should be receiving it to further enhance efforts.

Without reviews, it is difficult to say what or how many more ambulances are needed and at what times of the day. From calls for service, it would appear the greatest number are required between 6 a.m. and 9 p.m. Because of the numbers of cardiac and stroke calls, the time that units will be deployed increases and creates shortages in availability. Managing these issues is critical to patient outcome.

If ambulances and staff are not properly deployed by the county, the burden of patient care increases for responders from the Beaufort Fire Department.

III. Existing Performance Data

To develop the department that will meet future needs, it is critical that the city understand the existing challenges and demands.

A. Aggregate Call Totals and Dispatches

The data include calls between January 1 and December 31, 2008. Beaufort's fire department has two first-run pumper units, two reserve pumper units, one rescue unit, one tower/ladder and one ladder truck located in two stations. Beaufort fire department also manages a fire station owned by town of Port Royal, which has a pumper unit, a reserve pumper unit and a tower/ladder unit. In 2008, Beaufort's fire department received 2,377 non-cancelled calls. Of these, 422 (1.1%) were structure fire or outside fire calls, and 1,570 (66%) were emergency medical service (EMS) calls. Dispatches of the battalion chief, radio units, and units from neighboring cities are not included in call, workload, and response time analysis; the activity of those units is reported in Appendix I. We

categorized the call type based upon the call description and call description code. For the correspondence between the call description and call type, see Appendix II. The analysis of call types is captured in the following tables and figures:

- Table 1—Call Types
- Figure 1—Fire Calls by Type and Duration
- Figure 2—Fire and EMS Calls by Type
- Figure 3—Calls by Month
- Figure 4 and Table 2—Calls by Hour of Day
- Figure 5 and Table 3—Calls by Hour of Day by Station
- Figure 6 and Table 4—Number of Units Dispatched to Calls

B. Workload by Individual Unit—Calls and Total Time Spent

We report two types of statistics: dispatches and workloads. In Part I we reported that there were 2,377 non-cancelled calls, but because multiple units were often sent, the total number of dispatched units we analyze here is 4,781. In addition, 345 dispatches (6.7%) were cancelled, meaning that the dispatched unit spent less than a minute traveling and staying on scene. We also look at the workload (the actual time spent by each unit on every call). The average time from dispatch until the unit was available for the next dispatch was 16.3 minutes per run. The total unit workload in a year for all units combined was 1,304 hours. After the introductory table, we present run data and workload data for every unit, as well as the daily average for fire and ambulance units, as follows:

- Table 5—Annual Total Deployed Time by Call Type Including Cancelled Units
- Figure 7—Department Total: Average Deployed Minutes per Day by Call Type

- Table 6—Workload by Unit
- Table 7—Total Annual and Daily Average Number of Runs by Call Type
- Table 8—Daily Average Deployed Minutes per Day by Call Type

C. Dispatch Time and Response Time

Dispatch processing time is the difference between the "unit dispatch time" and the "call receipt time." Turnout time is the difference between the "unit enroute time" and the "unit dispatch time", while travel time is the difference between the "unit on-scene arrival time" and the "unit enroute time." Response time includes dispatch processing time, turnout time, and travel time. For most types of calls, we are mainly interested in the dispatch time and response time of the first arriving units. Overall, the average dispatch processing time was 3 minutes for EMS category calls and 2.9 minutes for fire category calls, and the average total response time was 7.2 minutes for EMS category calls and 9.3 minutes for fire category calls. However, for structure fire calls, we analyze the response time of the first, the second, and all arriving fire vehicles. The following figures and tables show the dispatch and response times for Beaufort's fire and rescue units:

- Figure 8 and Table 9—Average Dispatch Time, Turnout Time, Travel Time and Response Time of First Arriving Units by EMS Call Type
- Figure 9 and Table 10—Average Dispatch Time, Turnout Time, Travel Time and Response Time of First Arriving Units by Fire Call Type
- Figure 10 and Table 11—Which Unit Arrived First for EMS Call Type
- Figure 11 and Table 12—Which Unit Arrived First for Fire Call Type
- Figure 12 and Table 13—Average Dispatch Time, Travel Time, and Response Time of First Arriving Units by Hour of the Day for EMS Calls
- Figure 13 and Table 14—Average Dispatch Time, Travel Time, and Response Time of First Arriving Units by Hour of the Day for Fire Calls

- Figure 14 and Table 15—Cumulative Distribution Function (CDF) of Response Time of First Arriving Unit for EMS Calls
- Table 16—Average Response Time of First Arriving Fire Units for Structure and Outside Fire Calls by Unit
- Table 17—Average Response Time of All Arriving Fire Units for Structure and Outside Fire Calls
- Figure 15 and Table 18—CDF of Response Time of First and Second Arriving Fire Units for Structure and Outside Fire Calls

D. Appendix

Appendix I: Activity Analysis of Other Units

Appendix II: Correspondence between Call Description and Call Type

Table 1—Call Types

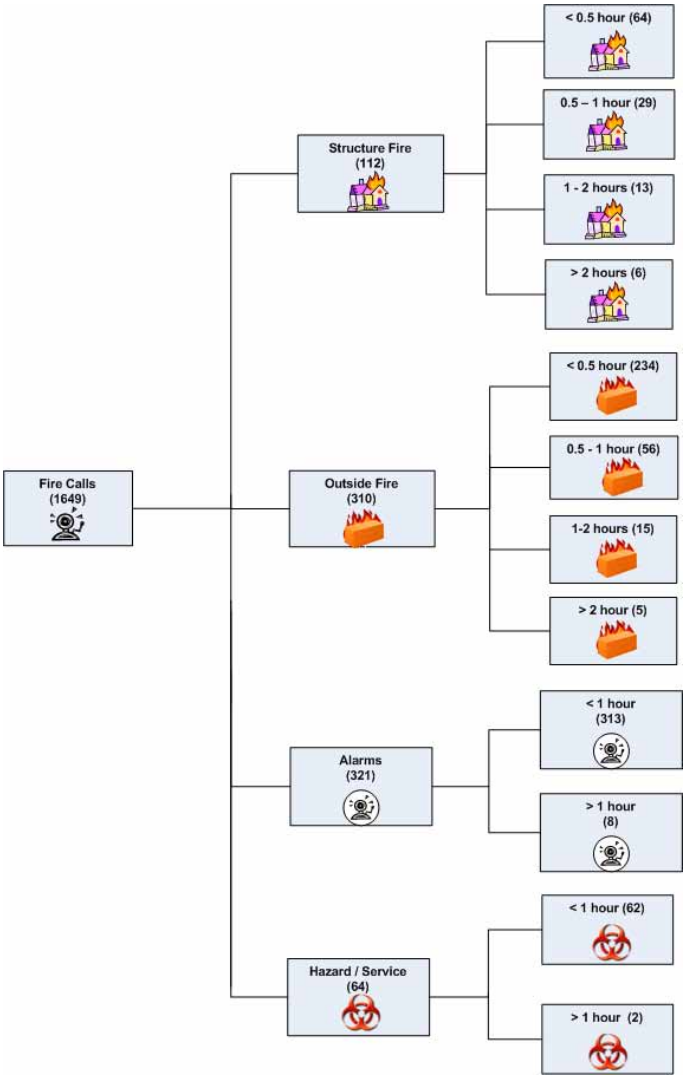
	Call Type	# of Non Cancelled Calls	Calls / Day	Calls %	# of Cancelled Calls	Cancelled %	Total Calls
EMS	Cardiac Symptoms/Stroke	247	0.7	10.4%	4	1.6%	251
	Injury	545	1.5	22.9%	15	2.7%	560
	Respiratory Distress	250	0.7	10.5%	4	1.6%	254
	Medical Other	528	1.4	22.2%	16	2.9%	544
	EMS Total	**1570**	**4.3**	**66.0%**	**39**	**2.4%**	**1609**
Fire	Structure Fire	112	0.3	4.7%	5	4.3%	117
	Outside Fire	310	0.8	13.0%	41	11.7%	351
	Alarm	321	0.9	13.5%	16	4.7%	337
	Hazard/Service	64	0.2	2.7%	12	15.8%	76
	Fire Total	**807**	**2.2**	**34.0%**	**74**	**8.4%**	**881**
Total		**2377**	**6.5**	**100.0%**	**113**	**4.5%**	**2490**

Note: 113 cancelled calls are calls with the total of on-scene time, turnout time and travel time less than a minute for all dispatched Beaufort units.

Observations:

- 4.5% of calls were cancelled.
- On average, the department received 6.5 non-cancelled calls per day.
- EMS calls totaled 1,570 (66%), about 4.3 per day.
- There were 545 injury calls, about 1.5 per day.
- There were 250 respiratory distress calls, about 0.7 per day.
- There were 247 cardiac symptoms or stroke calls, about 0.7 per day.
- Fire category calls totaled 807 (34%), about 2.2 per day.
- Structure and outside fire combined averaged about 1.1 calls per day, 17.7% of total calls.
- There were 321 alarm calls (0.9 per day) and 64 hazardous conditions or service calls (0.2 per day) in 2008.

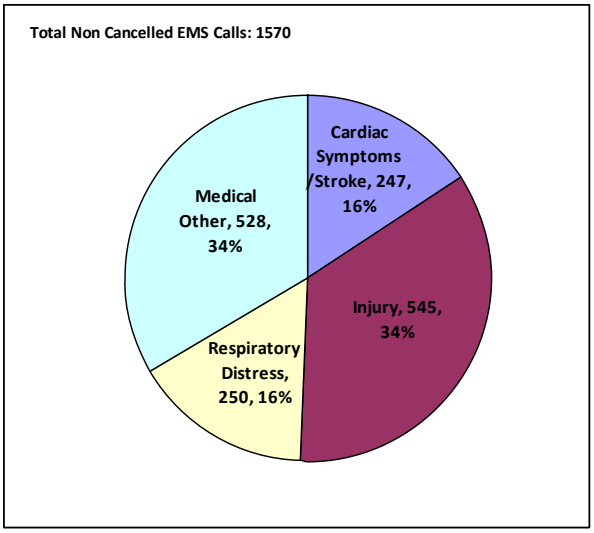
Figure 1—Fire Calls by Type and Duration

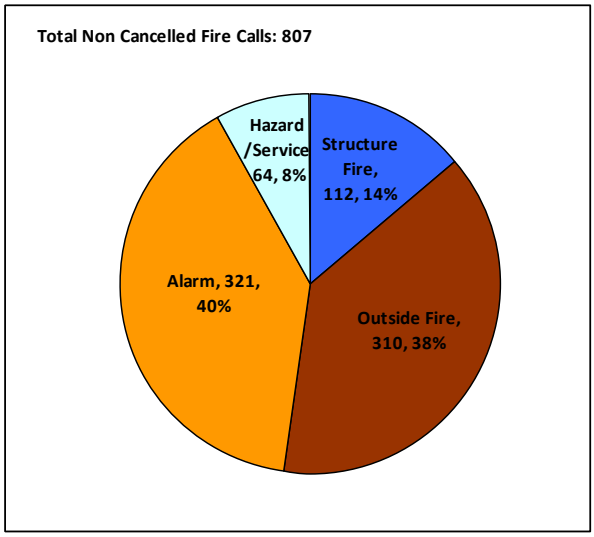


Observations:

- Of the 112 structure fire calls, 6 lasted more than two hours and 13 lasted between one and two hours, and 93 (83%) lasted less than one hour.
- Of the 310 outside fire calls, 5 lasted more than two hours, 15 lasted between one and two hours, and 290 (94%) lasted less than one hour.
- In all, the department handled 49 calls that lasted more than one hour, less than one long fire category call per week. A total of 10 (20%) calls were alarm or hazard conditions/service calls.

Figure 2—Fire and EMS Calls by Type

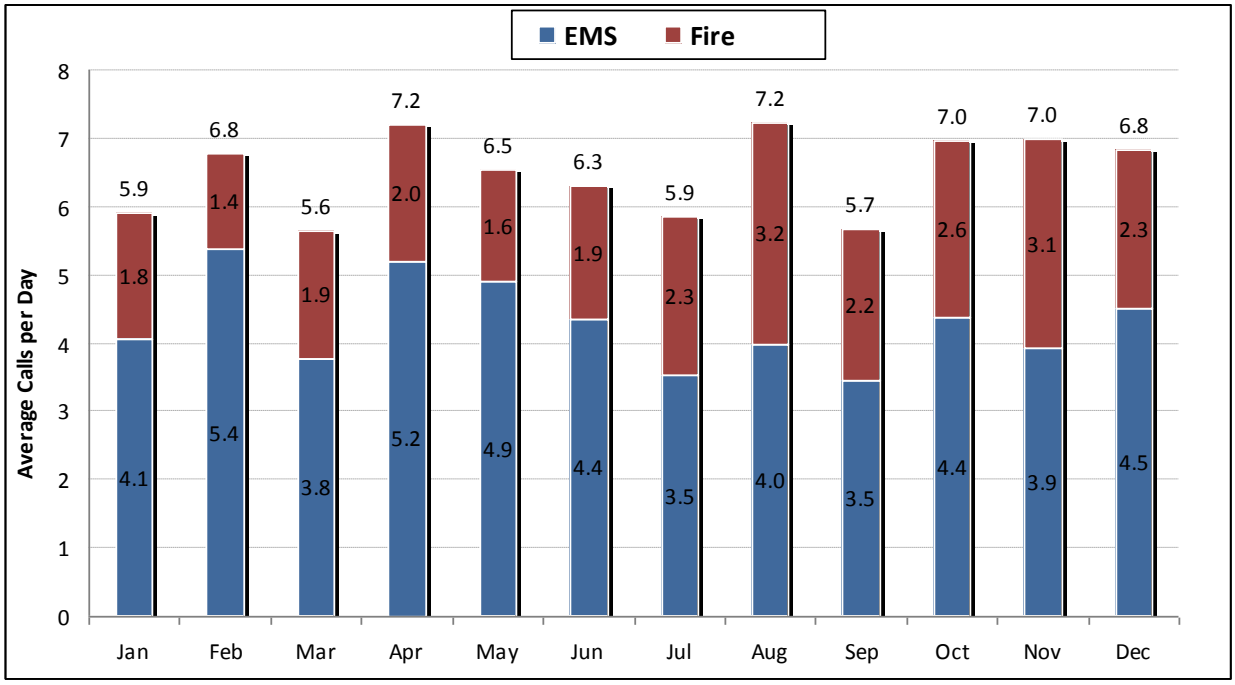




Observations:

- A total of 422 structure fire and outside fire calls accounted for 52% of the fire category total.
- The single largest category was alarm calls, which were 40% of the fire category total.
- Hazardous condition and service calls were 8% of the fire category total.
- The largest category in EMS was injury calls, which were 34% of the EMS category total.
- Cardiac symptoms and stroke calls accounted for 16% of the EMS category total.
- Respiratory distress calls accounted for 16% of the EMS category total and medical other calls accounted for 34% of this total.

Figure 3—Calls by Month



Observations:

- Average calls per day varied by month and ranged from a low of 5.6 calls per day in Mar to a high of 29% more in Apr and Aug, which averaged 7.2 calls per day.
- Average EMS calls per day varied between 3.5 calls per day in Jul and Sep and 5.4 calls per day in February.
- Average fire category calls per day varied between 1.4 and 3.2 calls per day in Feb and Aug, respectively.

Figure 4—Calls by Hour of Day

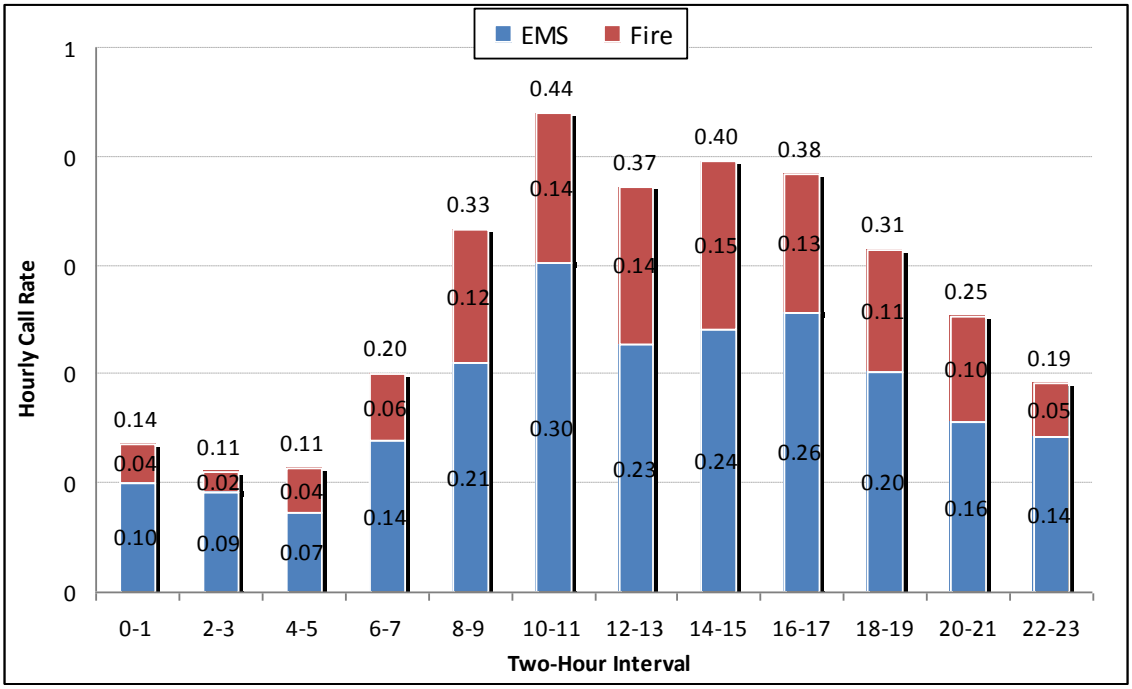


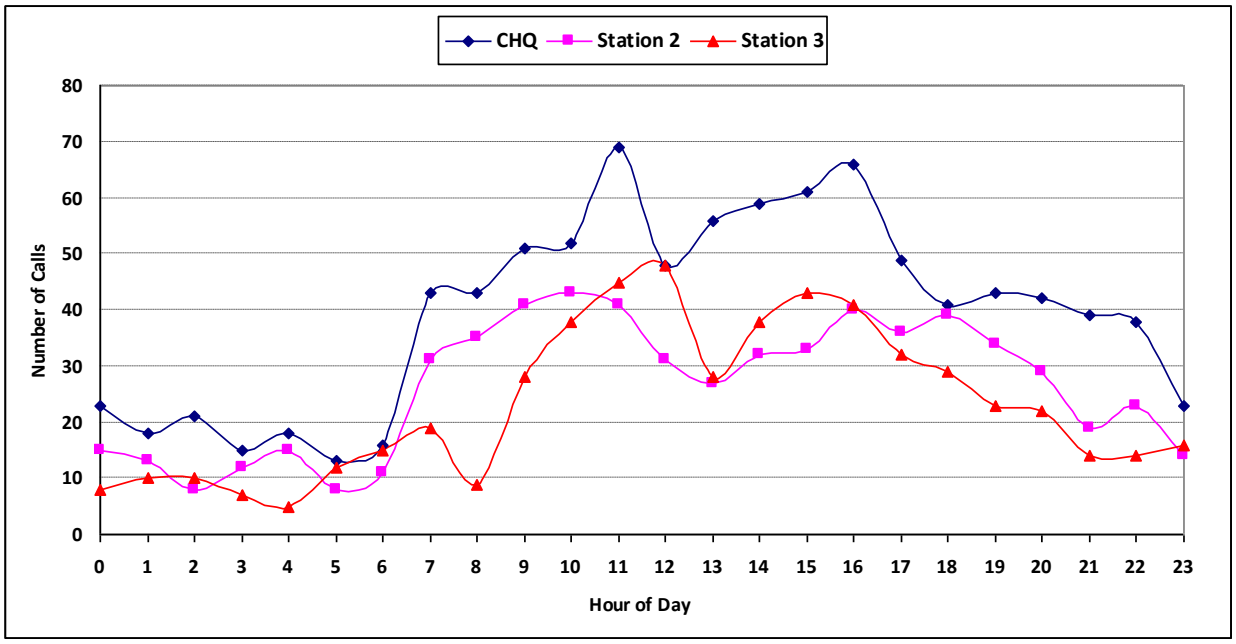
Table 2—Calls by Hour of Day

	Hourly Call Rate		
Two Hours Interval	EMS	Fire	Total
0-1	0.10	0.04	0.14
2-3	0.09	0.02	0.11
4-5	0.07	0.04	0.11
6-7	0.14	0.06	0.20
8-9	0.21	0.12	0.33
10-11	0.30	0.14	0.44
12-13	0.23	0.14	0.37
14-15	0.24	0.15	0.40
16-17	0.26	0.13	0.38
18-19	0.20	0.11	0.31
20-21	0.16	0.10	0.25
22-23	0.14	0.05	0.19
Calls/Day	4.29	2.20	6.49

Observations:

- Hourly total call rates averaged more than 0.3 calls per hour between 8 AM and 8PM.
- The call rate was lowest between midnight and 6 AM, less than 0.15 per hour.

Figure 5—Calls by Hour of Day by Station



Note: The number of calls was counted based upon the station of the first dispatched units.

BFT refers to Beaufort's fire department unit designations used during storm mode or as needed by dispatch.

Table 3—Calls by Hour of Day by Station

Hour	CHQ	Station 2	Station 3	BFT	Total
0	23	15	8	8	54
1	18	13	10	5	46
2	21	8	10	5	44
3	15	12	7	3	37
4	18	15	5	6	44
5	13	8	12	6	39
6	16	11	15	3	45
7	43	31	19	9	102
8	43	35	9	12	99
9	51	41	28	25	145
10	52	43	38	18	151
11	69	41	45	16	171
12	48	31	48	12	139
13	56	27	28	23	134
14	59	32	38	17	146
15	61	33	43	7	144
16	66	40	41	7	154
17	49	36	32	10	127
18	41	39	29	13	122
19	43	34	23	8	108
20	42	29	22	9	102
21	39	19	14	11	83
22	38	23	14	5	80
23	23	14	16	8	61
Total	947	630	554	246	2377

Observations:

- The call rate was lowest between 11PM and 6AM for all stations.
- Headquarter had the largest number of first responses each hour of a day.
- Headquarter was the first to respond 50% more often than Station 2 and 71% more often than station 3.

Figure 6—Number of Units Dispatched to Calls

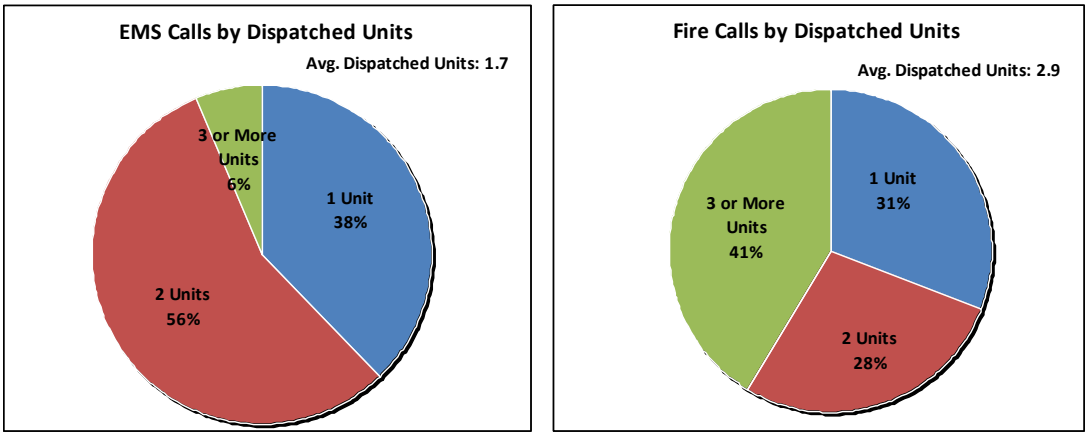


Table 4—Number of Units Dispatched to Calls

Call Type	1 Unit	2 Units	3 or More Units	Total
Cardiac Symptoms/Stroke	110	126	11	247
Injury	175	319	51	545
Respiratory Distress	114	126	10	250
Medical Other	192	308	28	528
EMS Total	**591**	**879**	**100**	**1570**
Structure Fire	16	29	67	112
Outside Fire	131	145	34	310
Alarm	78	11	232	321
Hazard/Service	24	38	2	64
Fire Total	**249**	**223**	**335**	**807**
Grand Total	**840**	**1102**	**435**	**2377**
Percentage	**35.3%**	**46.4%**	**18.3%**	**100%**

Note: This table includes cancelled units.

Observations:

- Overall, more than one unit was dispatched to 65% of calls.
- On average, 1.7 units were dispatched per EMS call.
- On average, 2.9 units were dispatched per fire category call.
- Three or more units were dispatched to 67 (60%) structure fire calls. Alarm calls accounted for more than half of incidents in which three or more units were sent.
- A single unit was dispatched to 131 of the 310 outside fire calls (42%) and two units were dispatched to 145 (47%) outside fire calls.

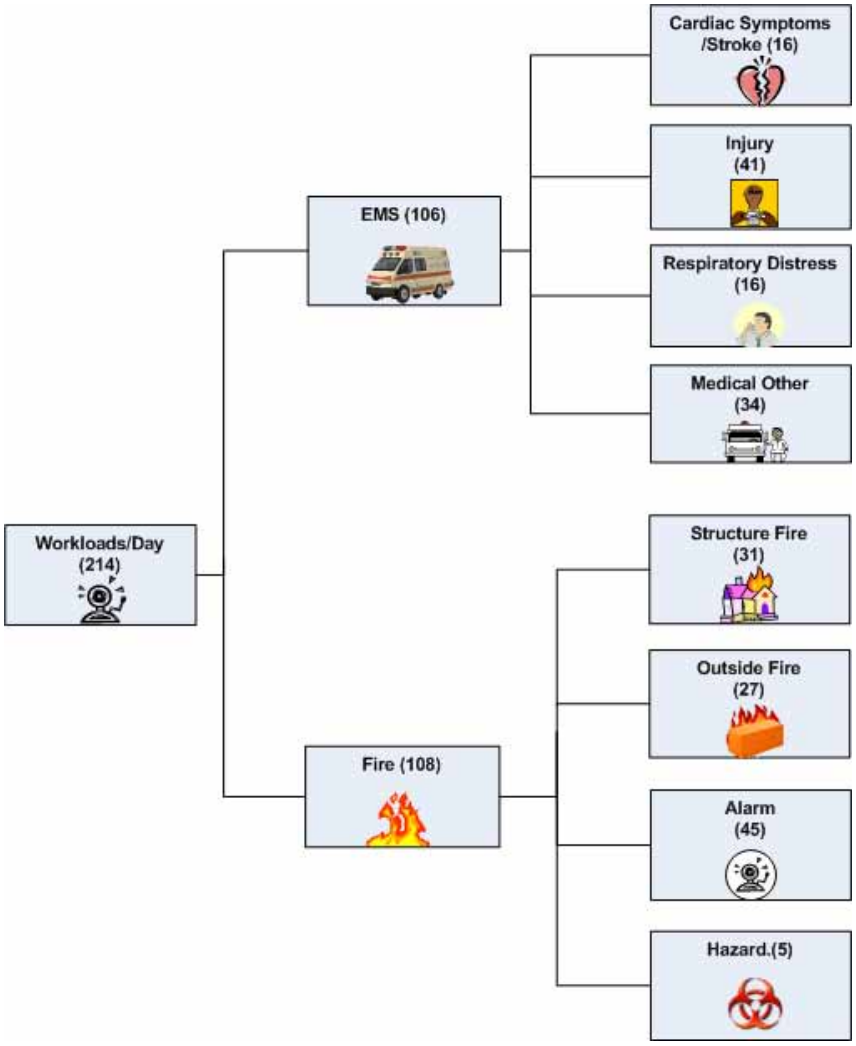
Table 5—Annual Total Deployed Time by Call Type

All Runs	Avg. Deployed Min./Call	Total Deployed Hours	%	Avg. Deployed Min./Day	# of Runs	# of Cancelled Runs	Avg. Runs / Day
Cardiac Symptoms/Stroke	14.6	98	7.5%	16	401	22	1.1
Injury	15.0	248	19.0%	41	988	60	2.7
Respiratory Distress	14.5	97	7.4%	16	400	30	1.1
Medical Other	13.6	206	15.8%	34	910	70	2.5
EMS Total	**14.4**	**648**	**49.7%**	**106**	**2,699**	**182**	**7.4**
Structure Fire	26.8	188	14.4%	31	420	20	1.1
Outside Fire	17.4	166	12.8%	27	573	72	1.6
Alarm	12.5	272	20.9%	45	1310	54	3.6
Hazard/Service	14.8	31	2.3%	5	124	17	0.3
Fire Total	**16.2**	**657**	**50.4%**	**108**	**2,427**	**163**	**6.6**
Total	**15.3**	**1,304**	**100.0%**	**214**	**5,126**	**345**	**14.0**

Observations:

- The various units were deployed a combined 1,304 hours including 2 hours for all cancelled units. The average total department workload per day was 3.6 hours. This is the total deployment time of all the units that were deployed on service calls.
- There were a total of 5,126 runs, an average of 14 runs per day. This total includes runs that were cancelled. A total of 345 (7%) runs were cancelled, averaging about 1 cancelled run per day.
- Medical calls combined accounted for 50% of the total workload.
- Cardiac symptoms and stroke calls were 7.5% of the total workload and respiratory distress were 7.4% of this total.
- Injury calls were 19% of the workload and medical other calls were 16% of this total.
- Structure and outside fire calls combined were 27.2% of the total workload.
- Hazardous condition and service calls combined accounted for 2% of the total workload, while alarm calls accounted for 21% of the total workload.

Figure 7—Department Total: Average Deployed Minutes per Day by Call Type



Observations:

- The various units combined spent 108 minutes for fire calls per day, including 31 minutes for structure fire calls and 27 minutes for outside fire calls.
- The various units spent 106 minutes on EMS calls per day, including 41 minutes for injury, 16 minutes for cardiac symptoms and stroke, 16 minutes for respiratory distress and 34 minutes for medical other calls.

Table 6—Workload by Unit

Station	Unit Type	Unit ID	Avg Deployed Min. per Run	# of Runs	Runs / Day	Deployed Min. / Day	Total Deployed Hours
	Dummies (BFT)	BFT	16.8	259	0.7	11.9	72
CHQ	Pumper	E1	17.6	1093	3.0	52.6	320
	Reserve Pumper	E10	15.3	204	0.6	8.6	52
	Rescue Unit	Q1	15.7	989	2.7	42.4	258
	Tower/Ladder	T1	12.5	199	0.5	6.8	41
2	Pumper	E12	15.5	876	2.4	37.2	226
	Reserve Pumper	E11	13.0	50	0.1	1.8	11
3	Pumper	E5	17.8	793	2.2	38.7	235
	Reserve Pumper	E4	15.7	248	0.7	10.7	65
	Ford E550	S6	20.9	9	0.0	0.5	3
	Tower/Ladder	T2	17.4	61	0.2	2.9	18

Dummies are BFT units, which refers to Beaufort's fire department unit designations used during storm mode or as needed by dispatch.

Observations:

- Pumper unit E1 was deployed 320 hours, averaging 3 dispatches and 53 minutes per day. In addition, reserved unit E10 was dispatched 204 times with a total deployed time of 52 hours in a year.
- Pumper unit E12 was deployed 226 hours, averaging 2.4 dispatches and 37 minutes per day. In addition, reserved unit E11 was dispatched 50 times with a total deployed time of 11 hours in a year.
- Pumper unit E5 was deployed 235 hours, averaging 2.2 dispatches and 39 minutes per day. In addition, reserved unit E4 was dispatched 248 times with a total deployed time of 65 hours in a year.
- Rescue unit Q1 was deployed 258 hours, averaging 2.7 dispatches and 42 minutes per day.
- Tower/ladder units combined (T1, T2) were deployed 59 hours, averaging 0.7 dispatches and 10 minutes per day.

Table 7—Total Annual Number and Daily Average Number of Runs by Call Type

Runs	Pumper			Ladder		Rescue	Dummy
	E1	E12	E5	T1	T2	Q1	BFT
Cardiac Symptoms/Stroke	89	105	107			66	12
Injury	299	164	189			253	23
Respiratory Distress	94	116	90			63	7
Medical Other	263	158	181			197	41
EMS Total	**745**	**543**	**567**			**579**	**83**
Structure Fire	97	76	97	40	13	60	13
Outside Fire	146	66	105		2	103	78
Alarm	270	237	258	158	45	218	66
Hazard/Service	39	4	14	1	1	29	19
Fire Total	**552**	**383**	**474**	**199**	**61**	**410**	**176**
Fire Calls %	**42.6%**	**41.4%**	**45.5%**	**100%**	**100%**	**41%**	**68%**
Total	**1297**	**926**	**1041**	**199**	**61**	**989**	**259**
Avg. Runs / Day	**3.5**	**2.5**	**2.8**	**0.5**	**0.2**	**2.7**	**0.7**

Note: reserved units are treated as their respective primary units (E10 = E1, E11=E12 and E4=E5)

Observations:

- Engine E1 and its reserve unit responded to 552 fire category calls (43% of the calls to which it responded), including 97 structure fire calls and 146 outside fire calls.
- Engine E12 and its reserve unit responded to 383 fire category calls (41% of the calls to which it responded), including 76 structure fire calls and 66 outside fire calls.
- Engine E5 and its reserve unit responded to 474 fire category calls (46% of the calls to which it responded), including 97 structure fire calls and 105 outside fire calls.
- Rescue unit Q1 responded to 579 EMS category calls (59% of the calls to which it responded).

Table 8—Daily Average Deployed Minutes per Day by Call Type

Avg. Deployed Minutes / Day	Pumper			Ladder		Rescue	Dummy
	E1	E12	E5	T1	T2	Q1	BFT
Cardiac Symptoms/Stroke	4.1	4.5	5.2			1.6	0.5
Injury	14.1	6.3	9.0			10.5	0.6
Respiratory Distress	3.9	5.7	4.3			1.9	0.1
Medical Other	11.8	5.8	8.5			5.5	1.9
EMS Total	**33.8**	**22.3**	**27.0**			**19.5**	**3.2**
Structure Fire	8.2	4.6	8.3	2.0	0.9	5.8	0.6
Outside Fire	8.2	4.2	5.8		0.2	6.2	2.6
Alarm	8.9	7.6	7.7	4.7	1.7	9.1	4.7
Hazard/Service	1.8	0.1	0.5	0.1	0.1	1.7	0.7
Fire Total	**27.1**	**16.5**	**22.3**	**6.8**	**2.9**	**22.8**	**8.7**
Fire Calls %	**44.4%**	**42.4%**	**45.3%**	**100%**	**100%**	**54%**	**73%**
Daily Average	**61.0**	**38.9**	**49.2**	**6.8**	**2.9**	**42.3**	**11.9**
Yearly Deployed Hours	**372**	**237**	**300**	**41**	**18**	**258**	**73**

Observations:

- Engine Company E1 including its reserve unit was deployed 27 minutes per day on fire category calls (44% of its daily average deployed minutes), including 16.4 minutes on structure and outside fire calls.
- Engine Company E12 including its reserve unit was deployed 17 minutes per day on fire category calls (42%), including 8.8 minutes on structure and outside fire calls.
- Engine Company E5 including its reserve unit was deployed 22 minutes per day on fire category calls (42%), including 14.1 minutes on structure and outside fire calls.
- Rescue unit Q1 was deployed 19.5 minutes per day on EMS category calls (46%).

Figure 8—Average Dispatch Time, Turnout Time, Travel Time and Response Time of First Arriving Units by EMS Call Type

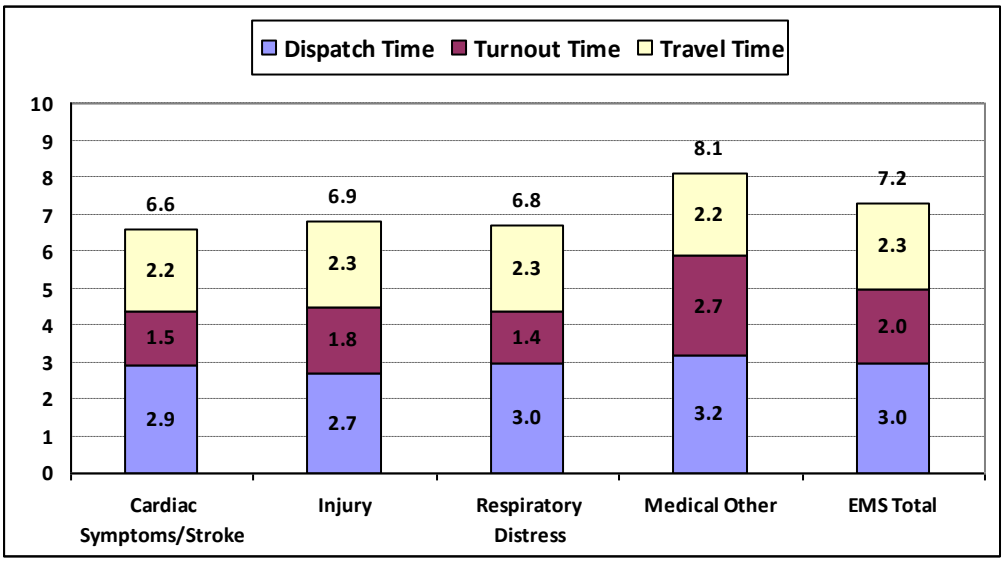


Table 9—Average Dispatch Time, Turnout Time, Travel Time, and Response Time of First Arriving Units by EMS Call Type

Call Type	Dispatch Time	Turnout Time	Travel Time	Response Time	90th Percentile Response Time	No. of Calls
Cardiac Symptoms/Stroke	2.9	1.5	2.2	6.6	8.9	247
Injury	2.7	1.8	2.3	6.9	10.2	545
Respiratory Distress	3.0	1.4	2.3	6.8	9.5	250
Medical Other	3.2	2.7	2.2	8.1	11.6	528
EMS Total	3.0	2.0	2.3	7.2	10.0	1570

Observations

- The average dispatch time for EMS calls was 3 minutes.
- The average turnout time was 2 minutes, and average travel time was 2.3 minutes.
- The average response time for EMS calls was 7.2 minutes.
- The 90th percentile response time for EMS calls were 10 minutes.

Figure 9—Average Dispatch Time, Turnout Time, Travel Time, and Response Time of First Arriving Units by Fire Call Type

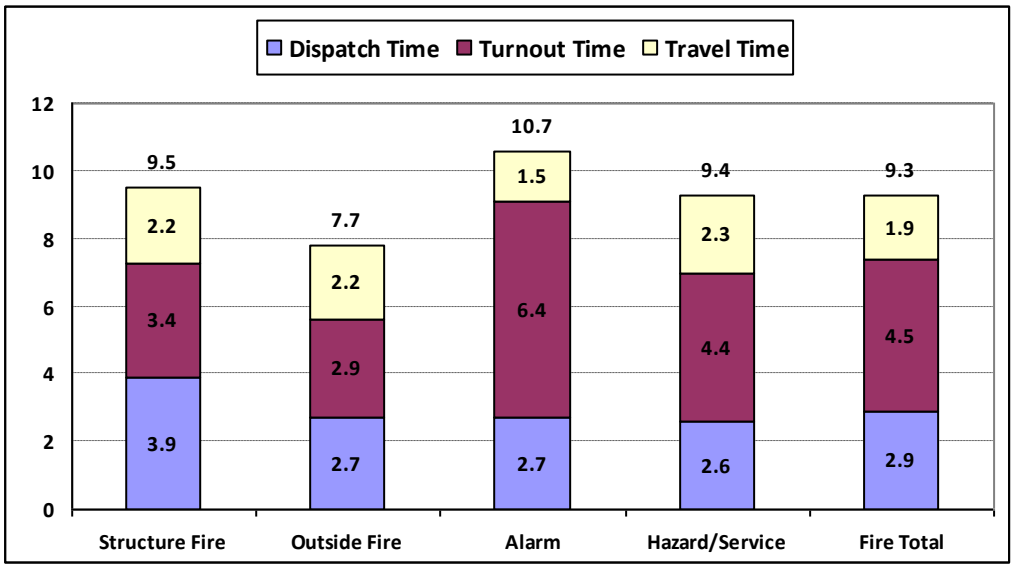


Table 10—Average Dispatch Time, Turnout Time, Travel Time, and Response Time of First Arriving Units by Fire Call Type

Call Type	Dispatch Time	Turnout Time	Travel Time	Response Time	90th Percentile Response Time	No. of Calls
Structure Fire	3.9	3.4	2.2	9.5	15.8	112
Outside Fire	2.7	2.9	2.2	7.7	15.1	310
Alarm	2.7	6.4	1.5	10.7	30.8	321
Hazard/Service	2.6	4.4	2.3	9.4	23.3	64
Fire Total	**2.9**	**4.5**	**1.9**	**9.3**	21.8	**807**

Observations

- The average dispatch time for fire calls was 2.9 minutes.
- The average turnout time was 4.5 minutes, and average travel time was 1.9 minutes.
- The average response time for fire calls was 9.3 minutes.
- The 90th percentile response time were 15.8 minutes for structure fire calls and 15.1 minutes for outside fire calls.
- The 9^{0th} percentile response time for hazardous condition and service calls were 24 minutes.

Figure 10—Which Unit Arrived First for Each EMS Call Type

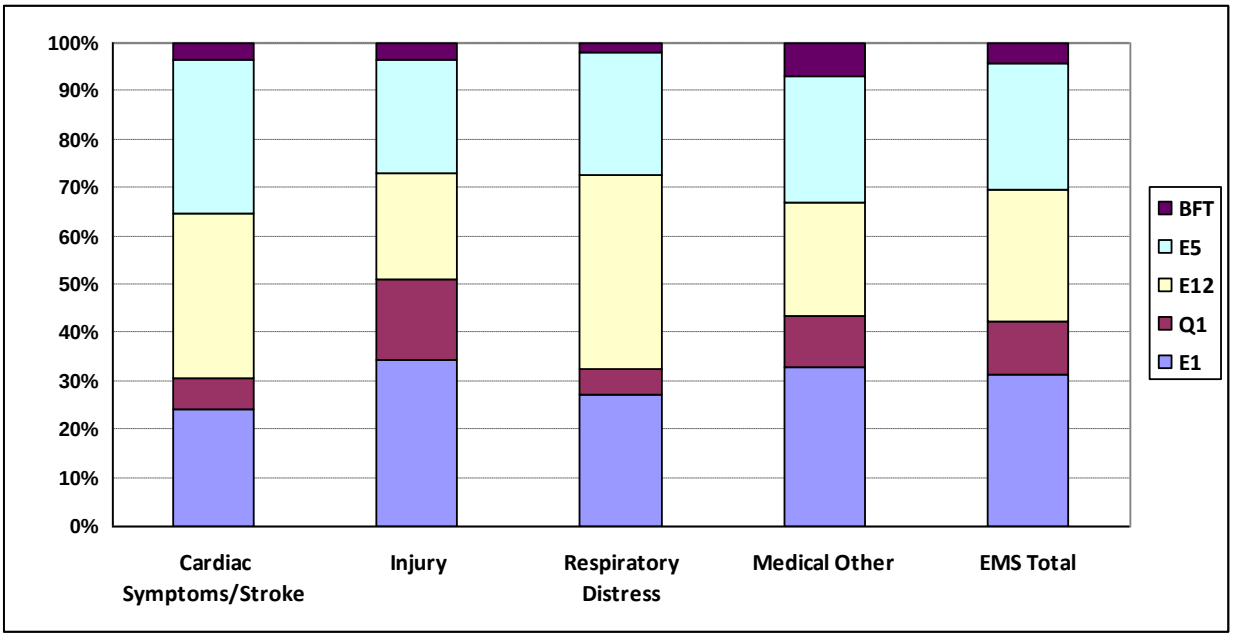


Table 11—Which Unit Arrived First for Each EMS Call Type

Station	CHQ		2	3	
	E1	Q1	E12	E5	BFT
Cardiac Symptoms/Stroke	24%	6%	34%	32%	3%
Injury	34%	17%	22%	24%	3%
Respiratory Distress	27%	5%	40%	25%	2%
Medical Other	33%	10%	24%	26%	7%
EMS Total	31%	11%	27%	26%	4%

Note: Each row sums to 100%.

Observations:

- For total EMS calls, pumper unit E1 arrived first on scene 31% of the time, followed by pumper unit E12, which arrived first about 27% of the time.
- For total EMS calls, rescue unit Q1 arrived first on scene 11% of the time.

Figure 11—Which Unit Arrived First for Each Fire Call Type

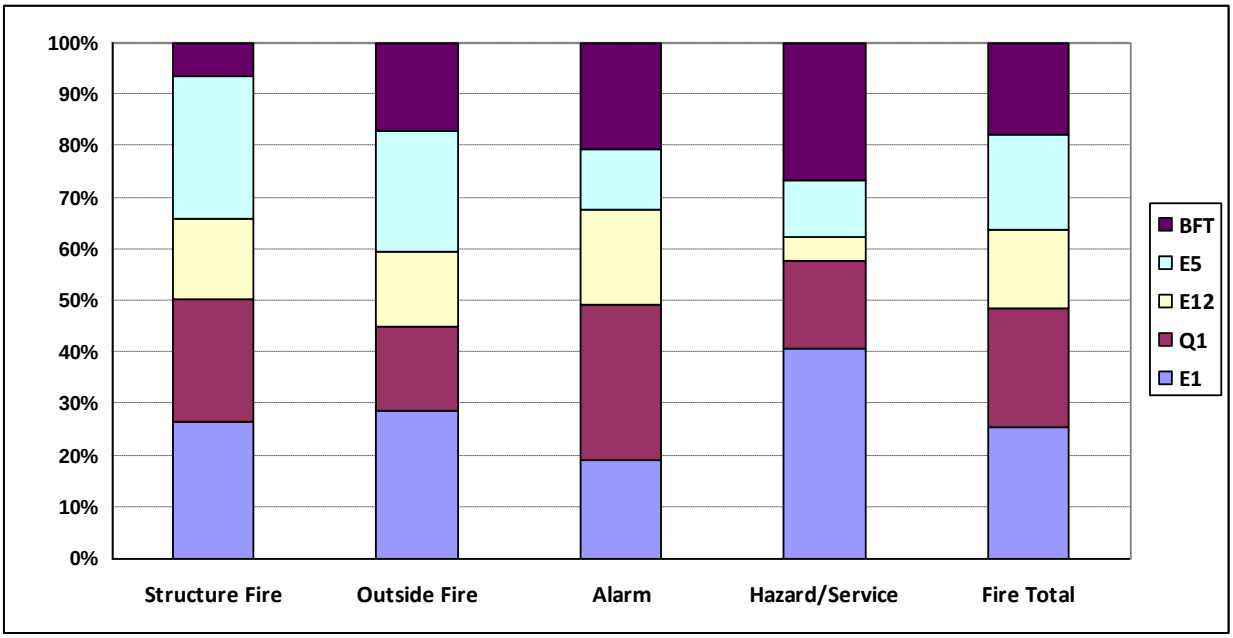


Table 12—Which Unit Arrived First for Each Fire Call Type

Station	CHQ		2	3	
Unit	E1	Q1	E12	E5	BFT
Structure Fire	27%	24%	16%	**28%**	6%
Outside Fire	**29%**	17%	15%	23%	17%
Alarm	19%	30%	18%	12%	21%
Hazard/Service	41%	17%	5%	11%	27%
Fire Total	26%	23%	15%	18%	18%

Note: Each row should sum to 100%.

Observations:

- For total fire calls, pumper unit E1 arrived first on scene 26% of the time, followed by rescue unit Q1, which arrived first about 23% of the time.
- For structure fire calls, pumper unit E5 arrived first on scene 28% of the time. This was slightly more frequent than E1.
- For outside fire calls, pumper unit E1 arrived first on scene 29% of the time.

Figure 12—Average Dispatch Time, Turnout Time, Travel Time, and Response Time of First Arriving Units by Hour of the Day for EMS Calls

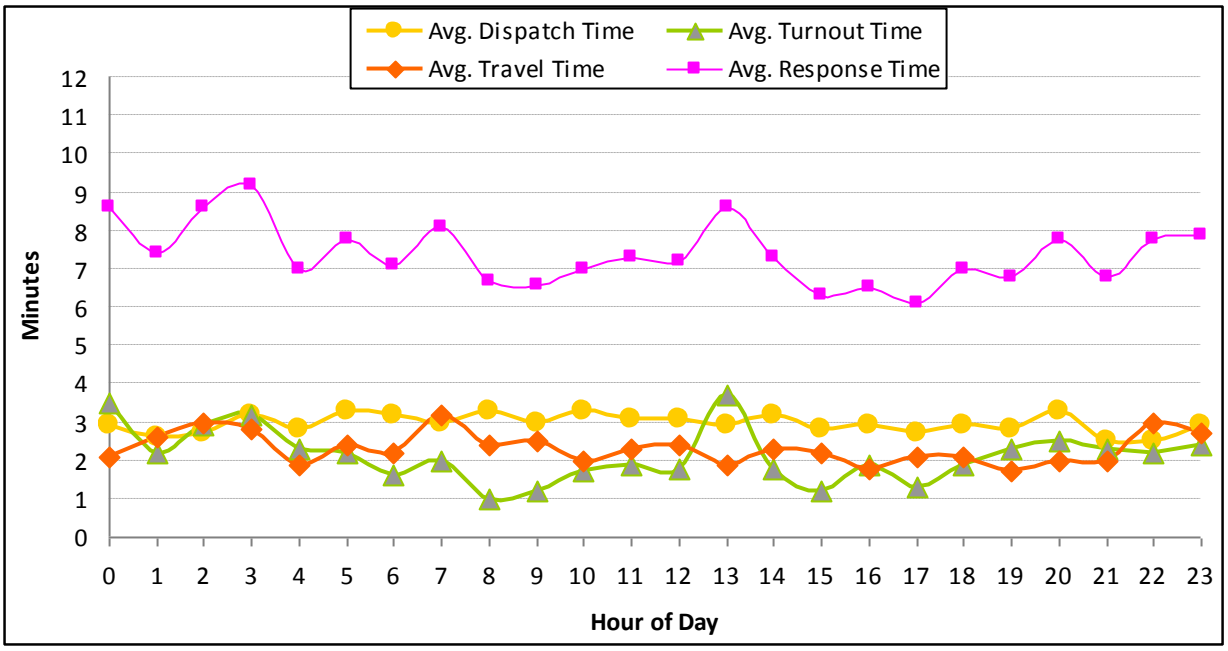


Table 13—Average Dispatch Time, Turnout Time, Travel Time, and Response Time of First Arriving Units by Hour of the Day for EMS Calls

Hour	Avg. Dispatch Time	Avg. Turnout Time	Avg. Travel Time	Avg. Response Time	# of Calls
0	2.9	3.5	2.1	**8.6**	40
1	2.6	2.2	2.6	**7.4**	33
2	2.7	2.9	3.0	**8.6**	37
3	3.2	3.2	2.8	**9.2**	30
4	2.8	2.3	1.9	7.0	29
5	3.3	2.2	2.4	7.8	24
6	3.2	1.6	2.2	7.1	38
7	3.0	2.0	3.2	**8.1**	64
8	3.3	1.0	2.4	6.7	63
9	3.0	1.2	2.5	6.6	91
10	3.3	1.7	2.0	7.0	107
11	3.1	1.9	2.3	7.3	115
12	3.1	1.8	2.4	7.2	84
13	2.9	3.7	1.9	**8.6**	83
14	3.2	1.8	2.3	7.3	81
15	2.8	1.2	2.2	6.3	96
16	2.9	1.9	1.8	6.5	105
17	2.7	1.3	2.1	6.1	83
18	2.9	1.9	2.1	7.0	78
19	2.8	2.3	1.7	6.8	70
20	3.3	2.5	2.0	7.8	61
21	2.5	2.3	2.0	6.8	54
22	2.5	2.2	3.0	7.8	59
23	2.9	2.4	2.7	7.9	45
	3.0	2.0	2.3	7.2	1570

Observations:

- Dispatch time was between 2.5 and 3.3 minutes.
- Turnout time was longest between midnight and 4AM, more than 2 minutes, which leads to a longer response time in that period. Between 1PM and 2PM, the average turnout time was also unusually long, 3.7 minutes.
- Travel time was between 1.7 and 3.2 minutes. The highest average was between 7AM and 8AM.
- Average response time peaked between midnight and 4AM. The average for these four hours combined was 8.4 minutes.

Figure 13—Average Dispatch Time, Turnout Time, Travel Time, and Response Time of First Arriving Units by Hour of the Day for Structure and Outside Fire Calls

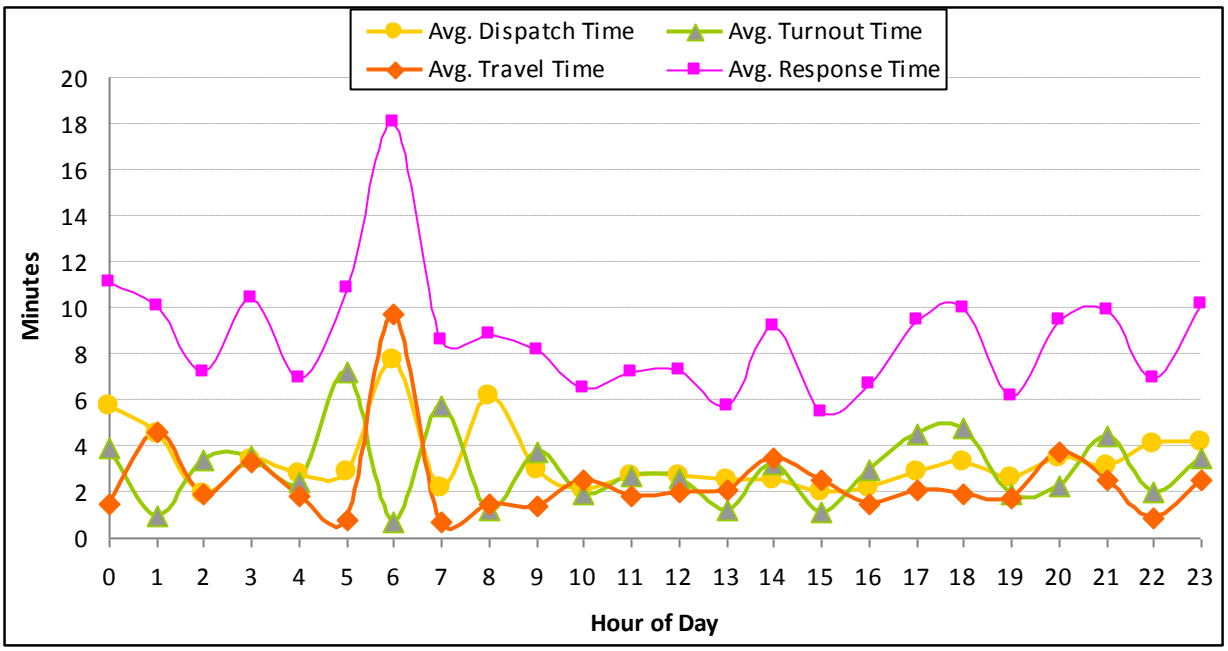


Table 14—Average Dispatch Time, Turnout Time, Travel Time, and Response Time of First Arriving Units by Hour of the Day for Structure and Outside Fire Calls

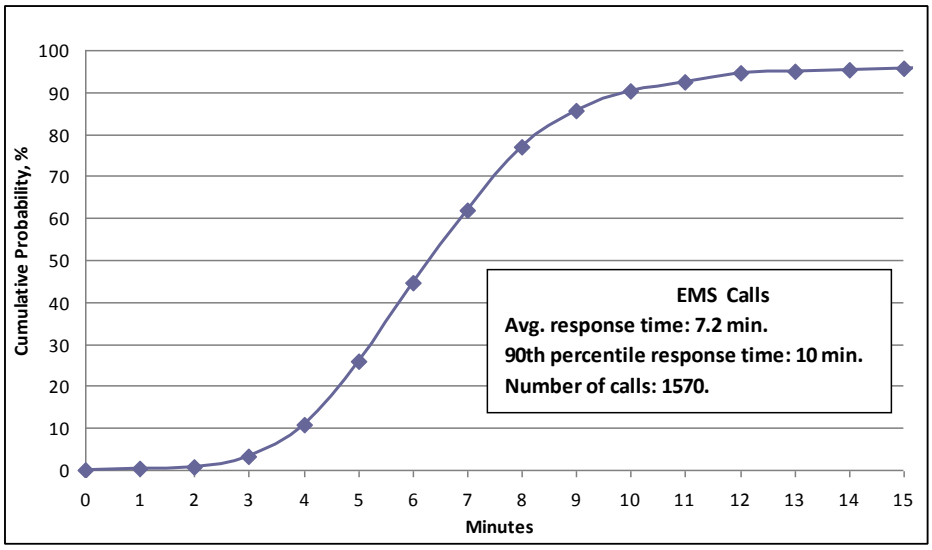
Hour	Avg. Dispatch Time	Avg. Turnout Time	Avg. Travel Time	Avg. Response Time	# of Calls
0	**5.7**	3.9	1.5	11.1	8
1	**4.5**	1.0	4.6	10.1	5
2	1.9	3.4	1.9	7.2	4
3	3.4	3.6	3.3	10.4	4
4	2.8	2.4	1.8	7.0	7
5	2.9	7.2	0.8	10.9	6
6	7.7	0.7	9.7	18.1	4
7	2.2	5.7	0.7	8.6	17
8	**6.2**	1.2	1.5	8.9	13
9	3.0	3.7	1.4	8.2	26
10	2.1	1.9	2.5	6.5	17
11	2.7	2.7	1.8	7.2	24
12	2.7	2.6	2.0	7.3	27
13	2.5	1.2	2.1	5.7	21
14	2.5	3.2	3.5	9.2	35
15	2.0	1.1	2.5	5.5	23
16	2.2	3.0	1.5	6.7	31
17	2.9	4.5	2.1	9.5	29
18	3.3	4.8	1.9	10.0	28
19	2.6	1.9	1.7	6.2	26
20	3.5	2.3	3.7	9.5	25
21	3.1	4.4	2.5	9.9	19
22	**4.1**	2.0	0.9	7.0	14
23	**4.2**	3.5	2.5	10.2	9
	3.0	3.0	2.2	8.2	422

Observations:

- The total number of calls each hour between 11PM and 7AM was less than ten. This small sample means that the averages are very sensitive to even one large value.
- The components of response time for structure and outside fire calls had significant larger variations compared to EMS calls by hour of a day especially between midnight and 8AM.

- Dispatch time was highest between 10PM and 2AM, consistently more than 4 minutes. Between 8AM and 9AM the average was more than 6 minutes.
- Average response time was high between 11PM and 2AM at more than 10 minutes. The average between 6AM and 7AM was very high but includes only four calls.

Figure 14—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 a time mark at about 10 minutes. This means that EMS units responded to 90% of these calls in 10 minutes or less.

Table 15—CDF of Response Time of First Arriving Unit for EMS Calls

Response Time	Frequency	Cumulative Percent
0 min	0	0.0
1 min	3	0.2
2 min	10	0.8
3 min	38	3.2
4 min	119	10.8
5 min	236	25.9
6 min	296	44.7
7 min	272	62.0
8 min	234	76.9
9 min	135	85.5
10 min	72	90.1
11 min	36	92.4
12 min	34	94.6
13 min	6	95.0
14 min	7	95.4
15 min	7	95.9
16 min	1	95.9
17 min	7	96.4
18 min	6	96.8
19 min	2	96.9
20 min	3	97.1
20 - 25 min	7	97.5
> 25 min	39	100.0

Observations:

- The average response time for EMS calls was 7.2 minutes.
- For 45% of EMS calls, the response time was less than 6 minutes.
- For 90% of EMS calls, the response time was 10 minutes or less.

Table 16—Average Response Time for Structure Fire and Outside Fire Calls by First Arriving Fire Units

1st Arriving Fire Unit		Outside Fire		Structure Fire		Total	
		Avg. Response Time	# of Runs	Avg. Response Time	# of Runs	Avg. Response Time	# of Runs
Pumper	E1	7.5	112	9.2	47	8.0	159
	E12	6.7	50	8.5	21	7.2	71
	E5	7.1	73	9.9	33	7.9	106
Ladder	T1			10.4	2	10.4	2
	T2	35.1	2	6.9	2	21.0	4
Dummy	BFT	12.0	53	19.3	7	12.9	60
	Total	8.3	290	9.9	112	8.7	402

Observations:

- Pumper unit E12 had the shortest response time, 6.7 minutes, for outside fire calls when it arrived first.
- Pumper unit E1 had the shortest response time, 9.2 minutes, for structure fire calls when it arrived first (T2 only had two runs and therefore not comparable).
- The average response time of the first arriving fire unit for outside fire calls was 8.3 minutes.
- The average response time of the first arriving fire unit for structure fire calls was 9.9 minutes.

Table 17—Average Response Time of All Arriving Fire Units for Structure and Outside Fire Calls

All Arriving Units		Outside Fire		Structure Fire		Total	
		Avg. Response Time	# of Runs	Avg. Response Time	# of Runs	Avg. Response Time	# of Runs
Pumper	E1	9.4	146	14.3	97	11.3	243
	E12	8.5	66	15.3	76	12.1	142
	E5	9.9	105	13.9	97	11.8	202
Ladder	T1			18.2	40	18.2	40
	T2	35.1	2	17.2	13	19.6	15
Dummy	BFT	15.1	78	21.3	13	16.0	91
	Total	10.6	397	15.2	336	12.7	733

Note: This table includes all runs of fire units.

Observations:

- Pumper E12 had the shortest response time, 8.5 minutes for outside fire calls.
- Pumper E5 had the shortest response time, 13.9 minutes for structure fire calls.
- For outside fire calls, the average response time of the first arriving unit was 8.3 minutes. The overall average response time of all fire units sent to the same call was 10.6 minutes.
- For structure fire calls, the average response time of the first arriving unit was 9.9 minutes. The average of all units sent to the same call was 15.2 minutes.

Figure 15—CDF of Response Time of First and Second Arriving Fire Units for Structure and Outside Fire Calls

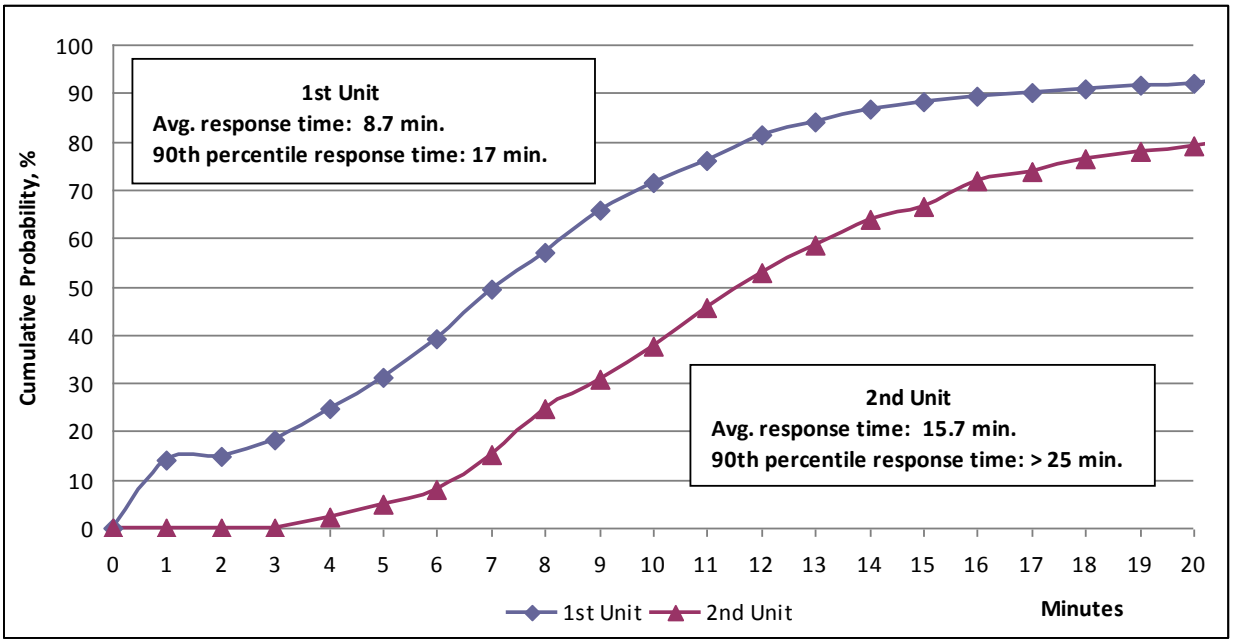


Table 18—CDF of Response Time of First and Second Arriving Fire Units for Structure and Outside Fire Calls

Response Time	1st Unit		2nd Unit	
	No. of Calls	Cumulative Percent	No. of Calls	Cumulative Percent
0 min	0	0.0	0	0.0
1 min	56	13.9	0	0.0
2 min	3	14.7	0	0.0
3 min	14	18.2	0	0.0
4 min	26	24.6	4	2.2
5 min	26	31.1	5	4.8
6 min	33	39.3	6	8.1
7 min	40	49.3	13	15.1
8 min	31	57.0	18	24.7
9 min	36	65.9	11	30.6
10 min	23	71.6	13	37.6
11 min	18	76.1	15	45.7
12 min	21	81.3	13	52.7
13 min	11	84.1	11	58.6
14 min	10	86.6	10	64.0
15 min	6	88.1	5	66.7
16 min	5	89.3	10	72.0
17 min	3	90.0	3	73.7
18 min	3	90.8	5	76.3
19 min	3	91.5	3	78.0
20 min	2	92.0	2	79.0
20 - 25 min	8	94.0	7	82.8
> 25 min	24	100.0	32	100.0

Observations:

- The average response time of the first arriving fire unit for structure and outside fire calls was 8.7 minutes.
- 39% of the time, the first fire unit arrived on scene in 6 minutes or less.
- 90% of the time, the first fire unit arrived within 17 minutes.
- The response time pattern of the second arriving unit on average was 7 minutes longer than the first arriving unit.

Appendix I: Activity Analysis of Other Units

Unit Description	Unit	Number of Calls	Total Busy Hours
Non Beaufort Units	BLF1	1	0.5
	BLF2	1	1.6
	BLUF	1	0.1
	BUR	6	0.4
	BUR2	1	0.4
	E220	1	0.1
	E223	1	0.2
	E321	1	0.1
	E324	1	0.3
	E821	3	0.8
	E822	1	0.0
	E823	8	1.5
	E824	2	0.1
	E825	1	0.4
	F888	**104**	**32.4**
	LIFD	1	0.0
	PIFD	1	0.1
	Z201	1	1.8
	Z25	1	0.0
	Z802	1	0.2
Beaufort "F" number not assigned	F11	1	0.0
Beaufort "F" number not assigned	F14	1	0.0
Beaufort "F" number not assigned	F4	2	1.5
Beaufort "F" number not assigned	F5	1	0.0
Beaufort "F" number not assigned	F9	6	3.8
Beaufort Asst Training/Acting Operation Officer	F2	1	0.0
Beaufort Fire Chief	F1	2	9.7
Beaufort Shift Lt	F7	3	0.0
Beaufort Shift Lt	F8	1	0.6
Old radio unit designation for Beaufort firefighters.	**Z1**	**82**	**23.4**
Old radio unit designation for Beaufort firefighters.	Z10	13	5.0
Old radio unit designation for Beaufort firefighters.	Z11	8	5.0
Old radio unit designation for Beaufort firefighters.	Z12	4	0.0
Old radio unit designation for Beaufort firefighters.	Z13	2	0.0
Old radio unit designation for Beaufort firefighters.	Z14	1	0.0
Old radio unit designation for Beaufort firefighters.	Z15	2	0.7
Old radio unit designation for Beaufort firefighters.	Z2	72	23.6
Old radio unit designation for Beaufort firefighters.	Z20	1	0.1
Old radio unit designation for Beaufort firefighters.	Z3	13	11.1
Old radio unit designation for Beaufort firefighters.	**Z4**	**117**	**40.9**
Old radio unit designation for Beaufort firefighters.	Z5	20	17.2
Old radio unit designation for Beaufort firefighters.	Z6	21	7.1
Old radio unit designation for Beaufort firefighters.	Z7	33	14.2
Old radio unit designation for Beaufort firefighters.	Z8	18	6.8
Old radio unit designation for Beaufort firefighters.	**Z9**	**53**	**37.8**

Old radio unit designation for Tower 1	TW1	3	1.1
Old radio unit designation for Tower 1	TW2	1	1.5
Total		**620**	**251.9**

Appendix II: Correspondence between Call Description and Call Type

Call Type Code	CALL Description	Call Type
E90	FIRE ALARM	Alarm
F90	FIRE ALARM	Alarm
F90T	TEST ALARM	Alarm
FC83	CARDIAC ARREST	Cardiac Symptoms/Stroke
FC86	CHEST PAIN	Cardiac Symptoms/Stroke
FC86	CHEST PAINS	Cardiac Symptoms/Stroke
FC81	CONG HEART FAIL	Cardiac Symptoms/Stroke
FC81	CONGESTIVE HEART FAILURE	Cardiac Symptoms/Stroke
FC80	CORONARY PROB	Cardiac Symptoms/Stroke
FC80	CORONARY PROBLEM	Cardiac Symptoms/Stroke
FC84	CVA / TIA / STROKE	Cardiac Symptoms/Stroke
FC84	CVA/TIA/STROKE	Cardiac Symptoms/Stroke
FC22	DISLOCATION	Hazard/Service
P15	DISTURBANCE	Hazard/Service
FC1	HEAT EXHAUSTION	Hazard/Service
F73O	ODOR OF SMOKE	Hazard/Service
FS33	PLANE CRASH	Hazard/Service
FS105	SERVICE CALL	Hazard/Service
FC102	SEXUAL ASSAULT	Hazard/Service
F73O	SMOKE ODOR	Hazard/Service
F73V	SMOKE VISIBLE	Hazard/Service
F73V	VISIBLE SMOKE	Hazard/Service
FS23	WIRES DOWN	Hazard/Service
90		Hazard/Service
90T		Hazard/Service
E50I	ACC W/INJ	Injury
F50I	ACC W/INJ	Injury
F50I	ACCIDENT WITH INJURIES	Injury
P88	ASSAULT & BATTERY	Injury
FC16	BURN	Injury
FC26	EYE INJURY	Injury
EC23	FRACTURE	Injury
FC23	FRACTURE	Injury
FC15	GUNSHOT WOUND	Injury
EC30	HEAD INJURY	Injury
FC30	HEAD INJURY	Injury
FC17	HEMORRHAGE	Injury
F57I	HIT & RUN WITH INJURIES	Injury
FC13	LACERATION	Injury
FC14	PUNCTURE / STAB WOUND	Injury
FC14	PUNCTURE/STAB	Injury
FC32	SPINAL INJURY	Injury
FC18	ELECTROCUTION	Injury
FC75	ANAPHYLACTIC / TOXIN SHOCK	Medical Other
FC71	CHOKING	Medical Other
FC101	COLD EXPOSURE	Medical Other

F7	DEAD PERSON	Medical Other
EC4	DIABETIC REACTI	Medical Other
FC4	DIABETIC REACTI	Medical Other
FC4	DIABETIC REACTION	Medical Other
FC41	FAINTING	Medical Other
FC51	G.I. PROBLEM	Medical Other
FC82	HYPERTENSION	Medical Other
FC85	HYPOTENSION	Medical Other
FC85	HYPOTENSION (LOW BLOOD PRESSURE)	Medical Other
FC5	INSULIN SHOCK	Medical Other
F82	MAN DOWN	Medical Other
FC109	MED DEVICE FAIL	Medical Other
FC109	MEDICAL DEVICE FAILURE	Medical Other
FC76	NEAR DROWNING	Medical Other
FC62	OB EMERGENCY	Medical Other
FC62	OBSTETRICAL EMERGENCY	Medical Other
FC44	OVERDOSE	Medical Other
FC106	PAIN	Medical Other
FC31	PARALYSIS	Medical Other
FC6	POISONING	Medical Other
FC110	POST OPERATIVE COMPLICATIONS	Medical Other
FC43	PSYC/BEHAVIORL	Medical Other
FC43	PSYCHIATRIC PATIENT	Medical Other
EC3	SEIZURE	Medical Other
FC3	SEIZURE	Medical Other
FC29	STRAINS/SPRAINS	Medical Other
FS13	SUICIDE	Medical Other
FS13	SUICIDE ATT	Medical Other
FS13	SUICIDE/ATTEMPT	Medical Other
FC75	TOXIN SHOCK	Medical Other
FC8	UNCONSCIOUS	Medical Other
PC8	UNCONSCIOUS	Medical Other
FC90	UNKNOWN MEDICAL COMPLAINT	Medical Other
FC50	VOMITING	Medical Other
FC105	WEAK/DIZZY	Medical Other
FC105	WEAKNESS / DIZZINESS	Medical Other
FC105	WEAKNESS/DIZZY	Medical Other
F70A	AUTO FIRE	Outside Fire
P70A	AUTO FIRE	Outside Fire
F70B	BRUSH FIRE	Outside Fire
F70W	FIRE WATCH	Outside Fire
F50I	MISC FIRE	Outside Fire
FS138	MISC FIRE	Outside Fire
FS40	MISC FIRE	Outside Fire
PS40	MISC FIRE	Outside Fire
F70A	VEHICLE FIRE	Outside Fire
EC74	RESP DISTRESS	Respiratory Distress
FC74	RESP DISTRESS	Respiratory Distress
PC74	RESP DISTRESS	Respiratory Distress

FC74	RESPIRATORY DISTRESS	Respiratory Distress
F70	FIRE HOUSE/STR	Structure Fire
F70	FIRE/HOUSE	Structure Fire
F70	STRUCTURE FIRE	Structure Fire
F70B	STRUCTURE FIRE	Structure Fire
FC86	STRUCTURE FIRE	Structure Fire

Proposed Organizational Chart

ICMA Leaders at the Core of Better Communities