Fire Operations and Data Analysis

Grand Island, Nebraska

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ICMA

Leaders at the Core of Better Communities

General Information

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 Center for Public Safety Management

The ICMA's Center for Public Safety Management is one of four centers within ICMA Programs which is designed to provide technical assistance, education and training, research and development, publications, and assistance with the chief selection process. It focuses on police, fire, EMS, and homeland security issues which often consume a substantial portion of municipal budgets.

Performance Measures

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

on an individual basis by the ICMA specialists and uniquely represent the compiled information for that community.

Methodology

The ICMA *Center for Public Safety Management* team follows a standardized approach to conducting analyses of departments involved in providing safety services to the public. We have developed this standardized approach by combining the experience sets of dozens of subject matter experts who provide critical roles in data and operations assessments in the areas of police, fire, and EMS. Our collective team has more than a combined 100 years of conducting such studies for cities in the United States and internationally.

We begin most projects by extracting calls for service and raw data from an agency's computer-aided dispatch system. The data are sorted and analyzed for comparison to nationally developed performance indicators. These performance indicators (response times, workload by time, multiple unit dispatching) are valuable measures of agency performance regardless of departmental size. The findings are shown in tabular as well as graphic form and are organized in a logistical format. While most of our documents' structure as well as the categories for performance indicators are standard, the data reported are unique to the cities. Due to the size and complexity of the documents, this method of structuring the findings allows for simple, clean reporting.

We then conduct an operational review alongside the data analysis. Here the performance indicators serve as the basis for those operational reviews. Therefore, and in addition to the standardized reporting process, the review process follows a standardized approach comparable to that of national

accreditation agencies. Prior to any on-site arrival of an ICMA *Public Safety Management team*, we ask agencies to compile a number of key operational documents (e.g., policies and procedures, assets lists, etc.). Most on-site reviews consist of interviews with management and supervisors as well as rank-and-file officers; and city staff.

As a result of any on-site visits and data assessments, our subject matter experts produce observations and recommendations which highlight strengths, weaknesses, opportunities, and threats of all areas under review, including personnel, interviews, research, relevant literature, statutes, regulations, comparative evaluation of industry standards, meetings and other areas specifically included in a project's scope of work.

We have found that this standardized approach ensures that we measure and observe all of the critical components of a fire or police agency, which in turn provides substance to benchmark statistics for cities with similar profiles. We are able to do this because we recognize that while agencies may vary in size and challenges, there are basic commonalities and best practices in use throughout the country.

We liken this standardized approach to the manner 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 on site to research the uniqueness of each environment; perform data modeling and share preliminary findings with the jurisdiction; assess any inconsistencies reported by client jurisdictions; and finally, communicate our results in a formal, written report, and occasionally through an in-person presentation by the project team and other key contributors.

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I. A paradigm change

This report will provide a benchmark for Grand Island, Nebraska in its delivery of fire and EMS services. For definition purposes, "baseline" is the existing performance of the agency. "Benchmarks" are performance measures that are identified in various local, state, or national policies, standards, and programs. Benchmarks often reflect the best in service delivery and are something which can be targeted through adjustments to service delivery. The specific baseline performance details of Grand Island are identified in Section III and will be used for comparative purposes with benchmark recommendations in Sections I and II.

In addition to the baseline performance provided by the department and which we analyzed, we also looked at the department's operational performance.

Fire departments tend to deploy using traditional methods that, in many cases, were developed in the last centuries. In many pieces of literature and at most fire conferences, some reference is made to the moniker: "One hundred years of service, unhampered by progress."

Grand Island is not just any community; it is an All-American Award winner that seeks to not just copy tradition but, instead, serve as an example of outstanding service delivery. This opinion was confirmed during interviews with appointed officials and department staff.

The fire service in the United States has used a traditional model known as "Standards of Response Coverage" (SOC) in order to deploy resources – both physical and mechanical. An understanding of how this process developed is necessary to develop a method for change that will guide Grand Island into a role of leadership for the future.

Begun in the United Kingdom during the 1930's, the SOC process was developed to ensure that resources would survive the predicted blitz that was to hit the island during World War II. Resources were deployed in various areas so as to survive the blitz and then deploy to fight fires and rescue survivors that were anticipated after watching the German march across Europe.

Following World War II, the process underwent repeated studies to refine and define the roles necessary to deploy emergency resources to serve and protect the public during peacetime. Studies were released in 1955, 1971 and 1985 that researched the method but failed to analyze what outcome could be expected should such methodology be followed. When the added dimension of outcome was studied, it was found that the SOC process was linear. In other words, you could add stations, add equipment, and add personnel but the outcome was largely unchanged. Additions did not improve safety or health but rather resulted in the same outcome. The focus was on property rather than people.

Only through prevention and a paradigm shift that views an incident as a failure of the system would outcomes be affected. The research resulted in the issuance of "The National Report" which required beginning in 2001, all fire brigades in the United Kingdom develop aggressive prevention efforts that would result in an adjustment of deployed resources. In many cases, fewer resources would be dedicated to fighting fire after it began but would instead fight fire BEFORE it occurred.

In the eleven years since the change, significant outcome changes have occurred: double digit reductions in numbers of fires, a safer environment for citizens and responders, improvement to quality of life issues, and a decrease in the cost of many fire brigades, some as much as 25%.

Merseyside Fire District has become the example of success and is regularly featured at conferences and training of fire chiefs in the United States. The ICMA is facilitating such a symposium just prior to its annual conference this year in Phoenix, following up on an initial presentation at last year's International Association of Fire Chief's conference in Atlanta. An example of Merseyside's IRMP is attached in the annex to this report. The department's work is the centerpiece of a U.S. initiative, "Vision 20/20" that seeks to introduce the same concepts. A copy of a powerpoint is contained in the annex.

Merseyside possessed all demographics not desired in a city: high illiteracy rate, high crime rate, high poverty rate, etc. By focusing on the problems which led to fire, significant improvements were made across the board. The new process is named: "Integrated Risk Management Planning" or "IRMP."

"Integrated Risk Management Planning, The National Document," published by the Fire Brigades Union, states, "IRMPs are not only about replacing national fire-cover standards with local ones. They involve shifting the focus in planning to put people first, looking at the risks arising from the full range of fires and other emergency incidents, and at the options for their reduction and management. To be effective, IRMPs will need to provide a fully integrated, risk-managed approach to community safety, fire safety inspection and enforcement, and emergency response arrangements that will contribute to a safer environment. In order to provide a fair and equitable service it will be necessary for fire and rescue authorities to take into account in their IRMPs the diverse needs of the population they serve and to assess how best to meet these needs, particularly in relation to community safety provisions. Local authorities already have a duty to prepare strategies and plans for a number of other purposes, e.g. community strategies, Equality Action Plans, etc. IRMPs will need to be

coordinated with these and the plans of other relevant agencies if they are to have maximum effect.

A department still must analyze its existing baseline performance level; it still must regularly monitor the performance; it must quantify its risks and hazards; but it must do so in context of applying a rigorous prevention program that mitigates as many of the risks and hazards as possible before an incident occurs. While most U.S. Fire Departments conduct education during a "Fire Prevention Week," the IRMP model seeks to analyze causes and continually train and retrain residents of all ages and demographics to eliminate preventable incidents. Through pre and post testing, it quantifies whether training is occurring or whether information is not taking place so that future programs can be modified to achieve desired outcomes.

It moves prevention into every aspect of a department, including communications and emergency management. Stations emulate the "Community Oriented Policing" model and become mini substations within the community. Staff no longer wait for calls but are assigned and must conduct inspections and one-on-one technical assistance at all levels of the community. Policies are assigned through the Battalion Chief (or other similar command) to captains at the stations who will be evaluated on the basis of performance. Grand Island has a very limited prevention program which has shrunk. Inspections of all commercial establishments do not regularly take place although high risk locations are annually inspected.

By applying the IRMP model, crews will deploy from the station on a daily basis and inspect every facility in the district. Studies of major fire tragedies such as the "Super Sofa Store" in Charleston, South Carolina, show that unfamiliarity with the buildings and protected structures can lead to catastrophic failure when emergencies occur. In that case, nine firefighters were killed when they became trapped in a building that had never been

inspected and contained a host of violations. Recent fatalities in Chicago and Houston pointed to the same lack of knowledge as one of the contributors to firefighter deaths.

ICMA strongly recommends the Grand Island Fire Department adopt the IRMP model and become a leader in rolling out the system in all aspects of the department. The ramifications impact communication, emergency management, EMS, and will engage other departments within the city to coordinate service to citizens.

ICMA has worked with the group from the International Association of Fire Engineers (IFE) on "Vision 20/20". The fire engineers – or fire marshals – shared the concern that preventive efforts in the U.S. had reached a plateau and in some cases had begun to regress. Easy improvements such as fire resistant bed clothes, mattresses and smoke detectors had been developed. The results showed in lower fire deaths.

From the IRMP process, many of the questions asked by Grand Island elected and appointed officials may reach a different conclusion. If the traditional model is used, little change can occur because of the linear aspect of such a methodology. Using the IRMP process, fires are prevented from occurring and the same concepts can be applied to EMS which is the driver of existing fire department workload.

Efforts in the U.S. are progressing with assistance from private firms such as Buxton and Motorola. Buxton Group has used the research from the United Kingdom and analyzed outcomes using existing demographic data regularly collected for commercial business. The result is a software product that shows areas of a community that are likely to experience fire and EMS calls for service. The City of Philadelphia just began using the process with a goal of eliminating all fires in that city. Ft. Lauderdale, Florida is looking to use Geographic Information System (GIS) data to enhance the trend capability.

Private ambulance services have been using the concepts for more than a decade. They have developed the concept "Dynamic Deployment" or "System Status Management" as a term for the resulting deployment. You may have driven through a community and noticed an ambulance parked on a corner or in a shopping area. The research showed that calls for service and times were quite predictable – sometimes as high as 95 percent or more. By combining the data and information layers, calls can actually be predicted for a given area and resources deployed on a fluid basis. The old method would build fixed facilities with the continually incurring costs of maintenance and improvement; the new method moves resources to where calls are likely to occur and eliminates the need for fixed base investment. Too often stations are built and then found to have been built in the wrong location or in anticipation of development occurring. In cities like Grand Island, property use changes or populations shift resulting in the wrong resources being positioned in the wrong location at the wrong times. Dynamic Staffing allows adjustments to occur not just over years but on an hour by hour basis.

A very successful use of the process in EMS has taken place in Fargo, ND and Moorehead, MN. There, EMS is deployed across two urban areas in two states from a single fixed base. A Motorola-developed software program is used to continually adjust the deployment. A powerpoint presentation on the method can be found in the annex to this report.

IRMP, particularly in EMS, does not stop with deployment. A recent report from the University of Oklahoma for the City of Tulsa found that without a comprehensive education program for all age groups, outcomes in EMS were much like "Chasing a Dream." The study by a prestigious group of Emergency Room physicians and the creator of the software program used in most dispatch centers titled "Priority Medical Dispatch" showed that for a successful outcome, action must occur within four minutes of the onset of a

sudden cardiac arrest, bleeding injury or breathing stoppage. No fire department is deployed to meet that time element. As a matter of fact, the national standard that is used to guide deployment allows four minutes of travel time to reach a patient's address (not patient side). This is in addition to the time it took to react, call, answer, process, and turnout. It also does not include the time element to reach the patient side that is rarely measured or reported. As will be discussed later, the times for handling call processing and turnout time in Grand Island often approaches 4 minutes.

The same study has information for Grand Island which supported a study by the National Institute of Science and Technology. The studies showed that having all personnel be trained as paramedics was not just inefficient, it was often counterproductive. The NIST study, for instance, showed that one paramedic and one EMT on an ambulance or rescue was most effective. It could be supported by a paramedic on an engine for the most serious cases – that are a small fraction of the calls received by the department. Having all paramedics resulted in a dilution of skills because personnel did not get enough hands on experience with patients to maintain and develop emergency skills.

Grand Island has a difficult time attracting candidates that are fire and paramedic certified. By adjusting the deployment to a paramedic on an ambulance and one on a support vehicle, it will not only be more cost effective but may reduce the necessary training to maintain skills and certifications. A number of communities are finding much better outcomes with sending a lone paramedic in an SUV to begin triage with the rescue unit then transporting and ultimately having the patient undergo treatment at an appropriate trauma center. ICMA found that the workload in stations varied significantly and that cross staffing could occur which would result in a decrease in staff necessary to maintain quality. Further modeling, priority medical dispatch policy, and call grouping will allow support engines to only

be dispatched on the most critical calls and reduce risk to the community and responders.

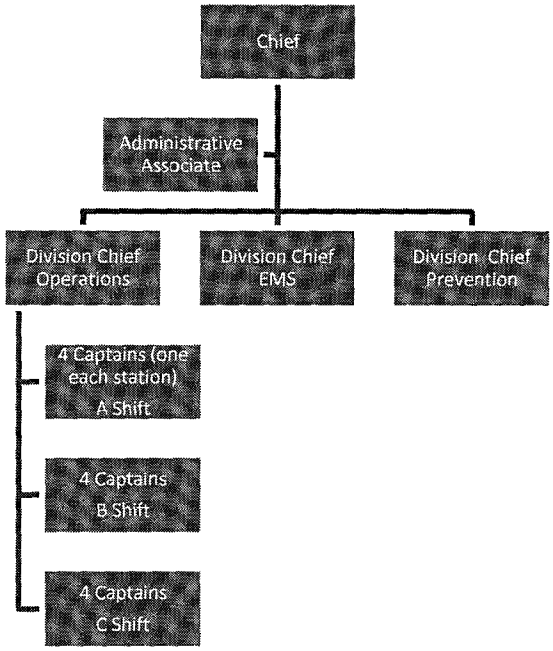
Grand Island Fire Department prides itself on training. It has conducted and participated in a great array of training. However, the outcome of that training is not clear and, lacking clear outcomes, may dilute the effectiveness of so much training.

There was no succession plan or program. The prior administration was in the process of training and evaluating a number of captains for promotional consideration. The interim chief that was named is limited in position by the state's employment system. It also resulted in a number of captains which created a very flat chain of command.

ICMA stresses that the new chief candidate be evaluated on skills necessary to guide operations or guide administration. The candidate should be knowledgeable about the IRMP process, the Vision 20/20 initiative, and station-based prevention programs.

II. Executive Summary

Recommendations on adopting the IRMP process as well as selecting a leader to guide the department are contained in the prior section. This is a substantive change that affects all aspects of service delivery and is a major paradigm shift for the organization that moves it from one of a reactive nature to one of aggressive proactive position. It would transition the department to a national leadership role in fire service delivery and will not be easy or fast. ICMA further recommends that the administrative structure be adjusted to the following model with refinements depending on the skills of the new chief:



Most recommendations require a change in policy which is the role of the authority having jurisdiction or AHJ. The recommendations may be adopted in whole, in part, or rejected. ICMA does advocate that any recommendations that are undertaken be assigned to specific individuals

who should use a reporting/report card process to deliver input to the city administration and elected officials.

The following are additional recommendations that are either part of or compliment the IRMP process. They may also support existing structures and models used by the department and city. Additional recommendations, based on best practices and the collective experience and knowledge of ICMA reviewers, include:

1. Develop a city all-hazard mitigation and response plan that incorporates emergency management and integrates with all city services (transportation, public works, utilities, admin, etc).

2. Conduct a community risk analysis as part of a comprehensive needs assessment and identify what tasks and in what order will be necessary to manage a fire failure should it occur. When developing the response scenario, a "casting" approach should be used whereby assignments are determined and then staff placed for the assignment. The tasks should be sequential and identify how many resources are necessary should a call be received from a location.

3. Analyze if transport for EMS were contracted and who would perform transport if the fire department did not provide the service.

4. Cross-staffing in fire stations 3 and 4 reducing staffing levels (two FTE positions) to one three-person crew per station. Because of vacations and sick time, this normally takes place but should be reflected in policy.

5. Implementation of Medical Priority Dispatch System in the Communications Center.

6. Monitor EMS and develop a quality/time review system to minimize the amount of time EMS units are deployed.

7. Develop a plan to achieve accreditation through the Commission on Fire Accreditation International.

8. Review and revise the department's strategic plan and have it approved by city administration and elected officials.

9. Consider the use of customer response cards for gathering customer satisfaction information.

10. Establish performance measures to meet NFPA standard for dispatch and turnout time and monitor for compliance.

11. Evaluate CAFS for use on all fire suppression apparatus. The evaluation and any decision should include training of all staff on the benefits of CAFS and in what situation it is to be used.

12. Consider acquisition of multipurpose apparatus for fire stations 3 and 4. (Possibility of CAFS/Ambulance)

13. Implement Public Access Defibrillation program within community starting with police vehicles. Funding may be available through the Rural Health Initiative of National Institute of Health, Medtronic Foundation, or Walmart Foundation.

14. Consider purchase of mobile data terminals for all emergency response vehicles.

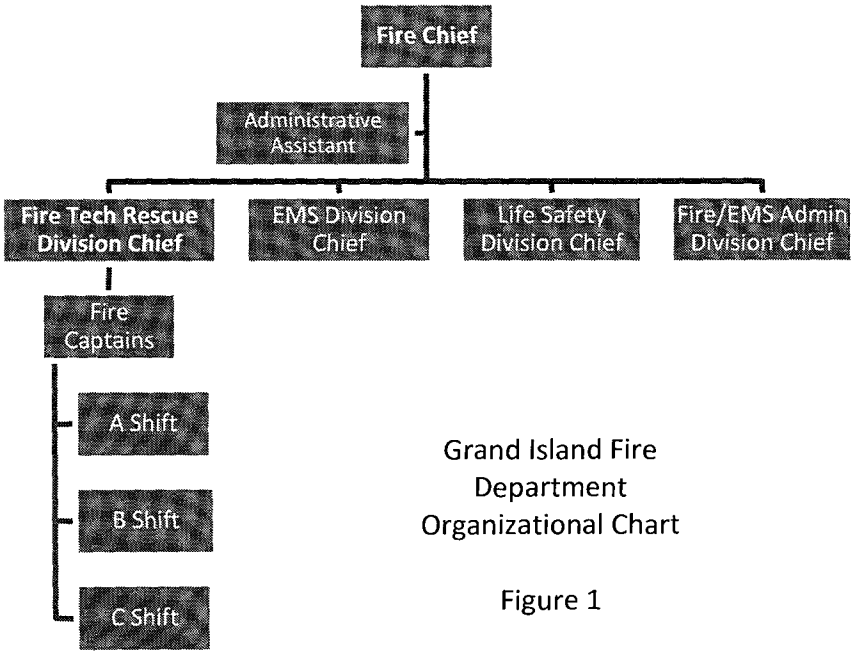
15. Consider purchase of an automatic vehicle locator system for communications center computer aided dispatch system.

III. Operational Analysis

A. Governance and Administration

Legal authority for the GIFD is obtained through Article XIII of the city charter, State Statute 18-1706 and 35-302. The fire chief is appointed by the mayor after top candidates pass written test, in-basket exercise and formal interview. Ethics ordinances and department rules and regulations are in place. The communication process within the department is good with weekly directors' meeting passing information from council through city administrator. Job descriptions are on record and standard operating procedures and standard operating guidelines are updated yearly. Figure 1 shows the department organizational chart.

Figure 1. Grand Island Fire Department Organizational Chart



Grand Island Fire Department Organizational Chart

Figure 1

RECOMMENDATION: ICMA has recommended a change to the administrative structure for the Grand Island Fire Department reflecting a change to Integrated Risk Management Planning instead of the traditional "Standard of Response Coverage" for deployment.

A proposed organization change was contained in the first section of this report that restructured assignments and command. Captains would be assigned to stations and be an integral part of command. When at the station, captains would be assigned inspections from the Battalion Chiefs and would be responsible for staff conducting daily outreach to the Community. In addition, proposed changes in medical training and the way health care is delivered in the community would be incorporated into the station service delivery model, helping to create a safer community.

The method for appointing the fire chief should be reviewed with state lawmakers and state law should be amended to allow for additional time for selecting the leader of the department. Current process allows for a limited interim chief appointment time which, if an outside candidate is chosen, will not allow sufficient time to review, advertise, conduct an assessment center, and then for the candidate to give sufficient notice to be hired by Grand Island. ICMA recommends that the time for an interim chief to operate and/or a successor to be named the department be lengthened to at least five months.

RECOMMENDATION: Allow additional time for appointment of the fire chief and develop a succession plan.

B. Assessment and Planning

Regardless of whether the city and department utilize the traditional model of resource deployment, the IRMP model, or some combination of standards and models -- all require a comprehensive assessment and plan for all-hazards. Any effort to change the service delivery of fire or EMS is likely to experience problems if the assessment and planning step is eliminated or reduced. Similarly, the assessment and planning impacts the delivery of emergency management response and the communications division is critical to the success of the organization.

Many agencies indicate that the NFPA 1710 standard will be used for deployment; the standard is not a prescription for staffing but rather is designed to evaluate the effectiveness of the decisions that are made. Prior to deploying any resources, the standard requires a comprehensive risk management process be conducted.

ICMA recommends that the risk assessment and planning process be conducted by a task force created by the authority having jurisdiction – the city council. ICMA can assist with education and conducting the analysis but the decisions made as part of a risk analysis must be locally driven and locally adopted.

The IRMP as well as the traditional SOC method require active participation of service providers in continually assessing and planning for incidents that might occur. One size should not fit all; each property should be reviewed and a plan created for tasks necessary to mitigate, respond, recover from, and prevent future incidents. It is critical that the fire department and building department work together as well as all other city disciplines.

Deciding how many emergency response resources to deploy, and where, is not an exact science. The final decision on a deployment model is based on a combination of risk analysis, professional judgment, and the city's willingness to accept more or less risk. Accepting more risk generally means that fewer resources are deployed, though deploying more resources is no guarantee that loss will be less, especially in the short term. Many sources are available for use in the evaluation and analysis of public fire protection. The following can be referenced by city administrators and elected officials to help in the decision-making process.

National Fire Protection Association. The National Fire Protection Association (NFPA) is an international, nonprofit organization dedicated to reducing the worldwide burden of fire and other hazards on the quality of life by developing and advocating scientifically based consensus codes and standards, research, training, and education. It is important to note that not all NFPA standards are scientifically based. NFPA 1710, "Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments, 2010 Edition," is not based on scientific research. Rather, it has been adopted by a majority vote reflecting the experience and opinion of a committee, within which there is much disagreement. There is no published information on the expected reductions in losses or injuries as a function of increased staffing and only recently, a little on the effect of increased response times. Even though it was formulated largely on the basis of expert opinions and task sequencing (what must be done and how many people it takes to do it) rather than research, NFPA 1710 has become the de facto benchmark for the emergency response community. However, the NFPA standard has not been embraced by some groups, including ICMA. Within the fire community, there continues to be much misunderstanding of

NFPA 1710. At the most recent meeting of the Technical Working Group, Richard Duffy, IAFF Representative, noted he has to continually correct misinterpretations of the standard. "1710 is an evaluation document, not a tactical document. If you analyze your department and report, you have complied with 1710," he stated.

The NFPA recommendations are standards and guidelines developed by committees of chief officers, volunteer representatives, union officials, and industry representatives. Although the NFPA's standards are not legally binding, they are often codified into local ordinances. It is important therefore to consider NFPA standards whether or not they are adopted locally. They remain a widely used criterion for evaluating different levels of fire and emergency service organizations.

Commission on Fire Accreditation International (CFAI). Another highly influential group, the CFAI consists of representatives from the International Association of Fire Chiefs (IAFC) and ICMA. The CFAI and its accreditation process were designed to establish industry-wide performance measures for overall organizational performance. Implementing the standard for a jurisdiction is purely voluntary. While a small fraction of fire departments across the nation have gone through the accreditation process and others are working toward that goal, most departments are focusing on the creation of a standards of cover (SOC) document (one of four items required for accreditation). The SOC concept has become so useful that the CFAI has expanded the original 44-page chapter into a 190+ page "how-to" self-assessment manual.

The CFAI does not make many explicit recommendations on standards for fire/EMS departments to adopt. Rather, it encourages a thorough

assessment of risks in the community, public expectations, and the resources needed to meet expectations given the risks. The creation of written standards should be based on that assessment.

Occupational Safety and Health Administration(OSHA). OSHA develops regulations to protect workers from occupational injuries and illnesses. Of the many regulations that apply to firefighting operations, one of the most critical is 29 CFR 1910.134, which addresses requirements for respiratory protection in environments that are immediately dangerous to life or health (IDLH), including structural firefighting. In such cases, personnel are required to work in teams of two, with two personnel operating inside the IDLH environment and two personnel standing by outside the IDLH environment in the event the entry team becomes incapacitated. This regulation is most commonly referred to as the "Two-in/Two-out" rule.

Insurance Services Office (ISO). The ISO is a national insurance engineering service organization that assigns a public protection classification (PPC) to jurisdictions based on fire department services. Insurance companies typically establish insurance rates for individual occupancies or groups of occupancies based on the PPC. PPCs are established using ISO's Fire Suppression Rating Schedule (FSRS). Once widely used by fire departments to evaluate system performance, the use of the FSRS is somewhat limited in that it only evaluates fire protection (not EMS, which most fire departments now provide to some degree). Also, the FSRS does not consider efficiency (e.g., how many resources are deployed in comparison to the number of actual calls). Though no longer widely used, ISO ratings are still appropriate to consider as part of a more comprehensive

system performance review. ISO standards are useful, not by themselves, but in combination with other assessments.

Many insurance companies have opted to utilize the accreditation model or some hybrid because of the way ISO grades departments. Using the ISO as a template may not result in any monetary gain for the community or its citizens as insurance companies have banded the rating numbers and assign one premium to departments within a range of 1-5; one for 7-8; and one for 9 or 10.

Inter-jurisdictional Comparisons. Part of the methodology for setting standards includes looking at what similar communities are doing. Comparisons between departments that are similar in size, scope, and complexity and that offer the same range of services are important for assessing why one department falls below or above the average. Even though each community can be quite different with regard to demographics, population density, hazards, and environment, to name a few comparable factors, comparisons are still useful in raising questions related to system performance. ICMA's Center for Performance Measurement can be a resource for comparing performance to other jurisdictions based on size as well as other factors. A new CPM 101 is available at a nominal cost.

Community Risk Analysis

Conducting a community risk analysis is the most difficult and time-consuming task that a fire department will perform. But it is the most primary and critical foundation upon which community policy decisions is made. NFPA, ISO, and other important industry professional organizations only influence the policy decisions – the risk contained within the community

today, and tomorrow, is the primary driver.[1] The importance of risk analysis will be reflected in reviews of prevention, education, staffing, and equipment.

Too often fire departments deploy "one size fits all." The same equipment; same staffing; same tools are all deployed equally across a community. Unfortunately, this fails to reflect the differences that are found across communities. While less people may be on pieces of apparatus in low risk, low volume areas; the opposite may be true in high risk locations. In addition, the expanding use of sprinklers may affect deployment decisions as may the presence of alarm systems that detect fires and report at an earlier point.

A review of the community by the operations team characterized much of the community as low hazard and low risk. Housing could be characterized as smaller bungalow units that were erected in the late 1940's to early 50's and are often called "Sears' Houses" because the packages could be purchased and shipped through a catalog program. Tornados that ravaged the community in the 80's as well as growth in the community led to many ranch-style structures. Newer subdivisions feature the open space desired by many and which was not present in the earlier structures.

The area has some heavy industry that should be regularly inspected and relationships developed to minimize risk as any fire could be catastrophic to the community both in human as well as financial loss. Older, historic structures are clustered in the downtown area.

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[1] Center for Fire Accreditation International (8th Ed.). (2009) Chantilly, VA: Center for Public Safety Excellence, page 41.

The community is fortunate to control its electric utility system. It provides an opportunity to review and improve the electrical systems in facilities which are one of the leading causes of fire in the United States. However, it requires coordination of the electrical, building, code enforcement, and fire departments to maximize the return on investments.

The GIFD has undertaken an informal assessment of risks; however the process should be formalized and involve a broad section of city interests. By bringing together others outside the fire department, different perspectives on risk, hazards, and mitigation are often identified. From a risk assessment, tasks for mitigating all hazards are analyzed and assigned. It is on this basis that a determination of whether two, three, four or more persons should be assigned to initial units. These statements which are applicable to the SOC process as well as IRMP, form the basis for a comprehensive Integrated Risk Management Plan. Ideally, the risk assessment should be all-hazard and meet the requirements for Department of Homeland Security standards utilized by the Emergency Management department. It should not be a surprise that response may require all departments within Grand Island to participate or have a role in the response. The assessment for fire (which includes EMS, Hazmat, confined space, etc) should then form the framework to be used to develop action plans for dealing with calls for service.

Risk statements are policy statements that come after, and are based upon, clearly identified hazards and risks to which a community is exposed. The document – SOC or IRMP -- contains policy statements which include service level objectives aimed at emergency response programs. Service level objectives are defined as the number, type, and spacing of resources

necessary to meet the response time, on-scene staffing, and risk mitigation objectives set by the authority having jurisdiction.[2]

The department should conduct and periodically update a community fire risk analysis as part of a comprehensive needs assessment. This process enables the department to determine what assets within the community are at risk and what resources are available or needed to effectively deal with those risks. Although the Emergency Management Department has mitigation and response plans in place through a local emergency operations plan, the department should develop its own all-hazard mitigation and response plan for the purpose of directing the essential activities of its members.

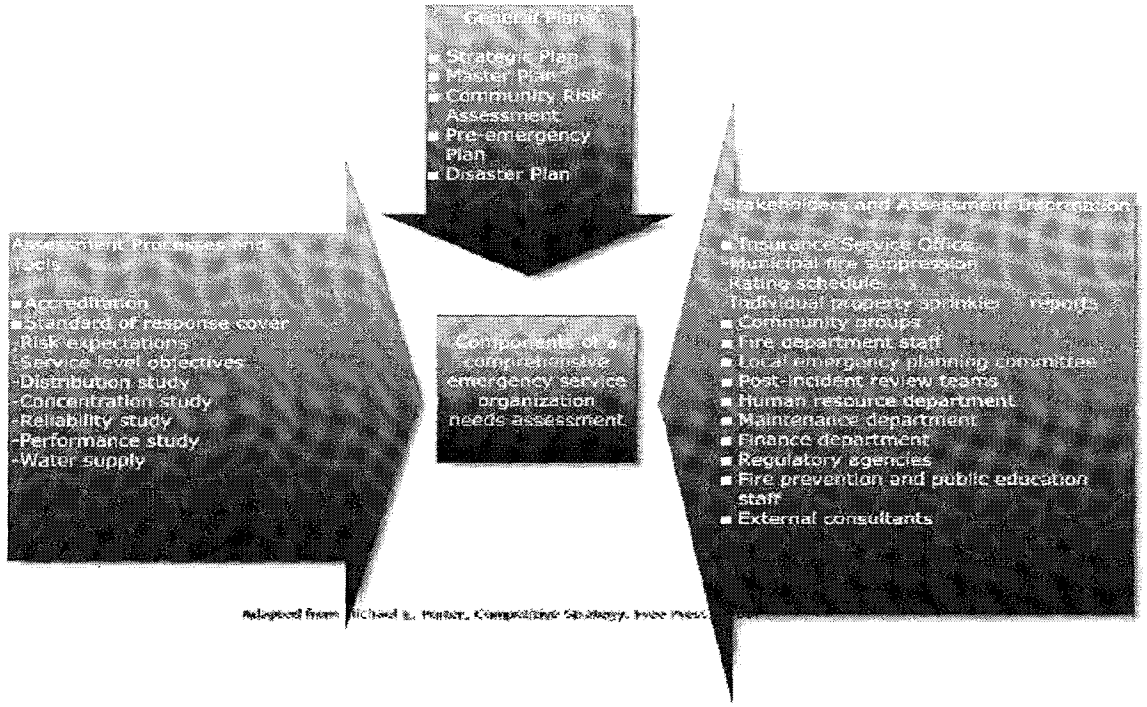
Recommendation: Develop a department all-hazard mitigation and response plan. Integrate with the Emergency Management System for Grand Island to create an Integrated Risk Management Plan (IRMP).

The use of a standard methodology for classifying and recording a community's risks could be beneficial in a number of ways. First, the information gathered can be assembled into a database for use when needed and for training and routine communication. Second, because fire is not the only risk faced by a community, asset information can be used in the development and revision of disaster plans. Finally, the information can be used for the purpose of meeting fire department accreditation requirements. According to the National Fire Protection Association there are several assessment processes and tools available to help in the analysis of hazards and determination of needs. Figure 2 highlights the components of a comprehensive emergency service organization needs assessment.

[2] Ibid, page 41.

It is important to note that the first component mentioned in the NFPA 1710 document for deploying personnel is the completion of an all-hazard risk assessment. Without knowing the risks, deployment is likely to revert to the "one size fits all" mentioned earlier.

Figure 2. Components of a Comprehensive Emergency Service Organization's Needs Assessment



A universal tool that can be used to evaluate an entire community in relation to the risk of fire is called Vision™ Risk Assessment, which is available through a private company called Emergency Reporting™. This product replaced the Risk, Hazard and Value Evaluation (RHAVE) software once developed and made available at no cost through the U.S. Fire Administration. Although mentioned here, ICMA does not directly endorse

this product. It only serves as an example of what may be available on the open market for this purpose.

Several cities are using a new software tool developed by the Buxton Company which merges the response data to demographic information regularly collected and analyzed by commercial firms. A wealth of data also exists within the U.S. Census Bureau and together the information has allowed cities to identify target populations and areas of the community in which to enhance prevention efforts and eliminate fire/EMS calls. ICMA continues to evaluate the program.

Recommendation: Conduct a community risk analysis as part of a comprehensive needs assessment.

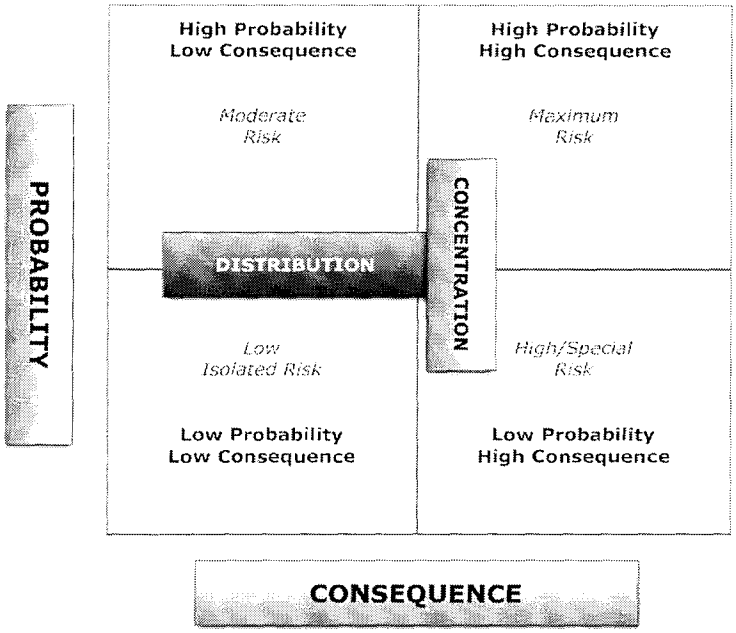
The basic premise of the assessment process is to enable a department to derive a fire risk score for each property, which can then be used to categorize the property as one of low, moderate, or high/maximum risk. These ratings are then used to determine what staff is required to perform tasks to mitigate events that might occur at the property. Lower ratings may be handled with smaller crews or with different tactics than higher risk locations. It also provides the opportunity to identify what steps can be taken to mitigate risk at each location and resources appropriately assigned.

Risk Assessment and Management

Risk assessment in a community may include determining and defining the differences in risk between a detached single family dwelling, a multiple family dwelling, an industrial building, and a high-rise building by placing each in a separate category. Conversely, fire station location and staffing patterns must be aligned to respond to a need that requires a higher

concentration of resources for worst-case scenarios.[3] Figure 3 is representative of the considerations of risk assessment, that is, the probability of an event occurring and the consequences of that event occurring. This probability and consequence matrix divides the risk assessment into four quadrants. Each quadrant of the chart creates different requirements in the community for commitment of resources.

Figure 3 . Probability and Consequence Matrix[4]



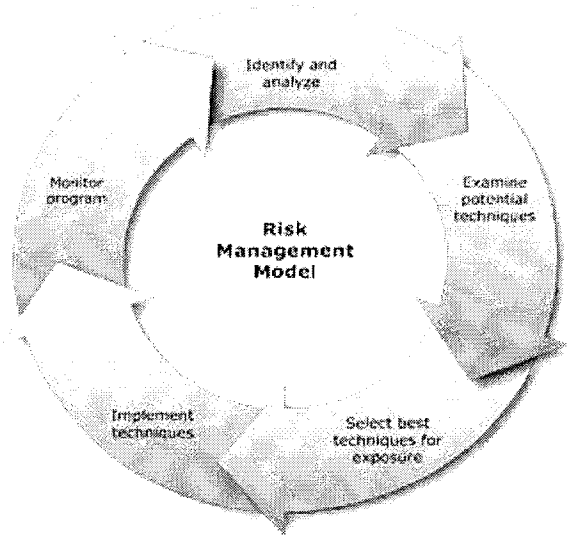
The second half of the risk evaluation process—determining severity—requires deciding what constitutes a severe loss. Cost or dollar amount of a fire is not the sole factor in deciding what constitutes a severe fire loss. Other economic factors must be taken into account. Among these are what economic impact a course of action will have in terms of jobs and wages,

[3] Fire and Emergency Service Self-Assessment Manual, Eighth Edition, (Commission on Fire Accreditation International, 2009), 49.
[4] Ibid.

and overall economic growth should a fire occur. Risk control measures can now be implemented to deal with identified community risks.

Risk identification was conducted as part of the traditional SOC process but steps were not taken to actively mitigate such risks. The IRMP requires steps be taken to mitigate to the extent possible and prevent incidents from occurring. Such steps take many forms and include such things as the demolition of abandoned buildings, marking the exterior of abandoned buildings to indicate exterior firefighting only, community planning, and pre-incident planning. In addition to examining the risks faced by the community at large, the department needs to examine its internal risks in an effort to protect all assets, including personnel, resources, and property. This concept is not new to the fire service and can be an excellent tool for strengthening existing health and safety guidelines. The GIFD does not have a written internal risk management program in place at this time. However, the seeds of such a program exist within its current policies and procedures.

Figure 4. Standard Risk Management Model



Recommendation : Develop an external and internal risk management program for the purpose of linking appropriate control measures to identified community and internal hazards and departmental resources.

Fire Service Accreditation

The accreditation process managed by the Commission on Fire Accreditation International (CFAI) and established through the Center for Public Safety Excellence provides an analytical self-assessment process to evaluate ten categories of fire department performance. This detailed self-assessment causes managers to examine more than 240 separate performance indicators, 98 of which are considered core, or required, competencies. The ten categories of performance indicators are: governance, risk assessment, goals and objectives, finance elements, program elements, human resource practices, physical assets and facilities, training and competency assurance, internal support structure, and external support.

Integrated within these categories is an expectation for the community to analyze itself by planning zones and for each planning zone to identify the hazards posed. The community then ranks the hazards by potential severity to ensure that the appropriate resources are available to manage the hazards. There is a cost associated with the accreditation process conducted by the CFAI; however, a department can purchase the SOC manual and its accompanying self-assessment manual at a nominal fee of less than $200. Even if the department chooses not to pursue formal accreditation, it should consider using self-assessment reference materials as a blueprint for improving overall fire department administration and operations.

Recommendation: Develop a plan to achieve accreditation through the Commission on Fire Accreditation International.

Strategic Plan

The department's 2011–2014 strategic plan capsulated main issues facing the organization. This is a department created tool without community involvement or input. The department acknowledges in its 2010 Annual Report that this is a work in progress and it should continue to move forward with its completion. The most important element of a department strategic plan is its link back to the city's overall strategic plan and the priorities it has established for itself. In order for the GIFD to be effective in carrying out its mission, it must have the approval not only of the city administration, but of elected officials and the citizens of Grand Island. It is then that the city's financial resources will be made available to accomplish the department's goals.

The accreditation model and programs developed by ICMA for "High Performance Organizations" (HPO), advocate the use of community in developing strategic plans. The community is the user of the services provided by the department and those services are delivered via a monopolistic approach. Not reflecting the expectations or demands of the community can often lead to friction between the community and department as well as elected/appointed officials and the department.

Using the community also provides an opportunity to identify solutions that may not have been contemplated by the agency.

Recommendation: Review and revise the department's strategic plan through a community-involved process and have it approved by city administration and elected officials.

Another improvement to the overall planning process involves the development of an accompanying business plan. According to ICMA, business planning in fire and rescue organizations is:

> *The process of arriving at a document that outlines how the organization will achieve its objectives in conjunction with the fiscal constraints set by the budget process. The document outlines both the major tasks to be performed to a specified level of service (e.g., responding in a certain number of minutes in at least a certain percentage of calls, or having a certain number of firefighters on the scene within a certain number of minutes for at least a certain percentage of all reported working fires) and the associated costs.*[5]

There are many benefits associated with a business plan. For one, it is an outline of performance measures that makes it an accountability document. Performance measures and their significance will be discussed later in the report. The business plan in concept is developed in conjunction with the department's budget.

In addition to the need for a business plan, the department should develop an action or work plan. To its credit the department has identified within its strategic plan the need for this planning tool. This should be initiated at the operational level within each functional area. An action plan supports the strategies outlined in the strategic plan by identifying the specific tasks (tactics) to be carried out, what person or persons is responsible for their completion, and within what timeframe. This is absolutely necessary for monitoring the progress toward goal achievement. Because of the absence

[5] Dennis Compton and John Granito, editors, *Managing Fire and Rescue Services*, (Washington, DC: International City/County Management Association, 2002), 173.

of a business plan, it is unclear whether or not stated goals within the strategic plan have been completed or are still a work in progress.

ICMA has worked with several communities that developed this approach. Novi, Michigan created a template which assigned the responsibility and provided for a regular reporting tool to ensure that assignments were completed.

Recommendation: Develop departmental business and action/work plans to implement the recommendations in the Strategic Plan.

C. Goals and Objectives

The department has identified the need to develop goals and objectives as a component of its strategic plan. Currently, goal and objective assignment is an informal process handed down from the fire chief. The need for development of an accompanying business plan and action plan in conjunction with the strategic plan has been previously discussed. As goals and objectives are fleshed out in the development process, each one should be linked to multiple performance measures.

The goals and objectives should also be linked to the overall city master plan and strategic plan to ensure that areas which overlap are met in a responsible manner. In areas where strategies of the fire department conflict with adopted strategies, goals, and objectives of the city, the fire department should be required to develop alternatives which support rather than conflict.

Performance Measurement

Randy Bruegman, president of the Center for Public Safety Excellence, Inc. (which is the umbrella organization for fire accreditation), states in his book "Fire Service Administration", "it is impossible to improve something that you cannot measure." Fire departments are known to report numbers; too often those numbers are not used to affect performance and outcomes of agencies. The IRMP process, as demonstrated in the attached Merseyside Report (Annex), requires agencies regularly analyze performance so that adjustments can be implemented routinely.

These performance measures evolved from the SOC process but were expanded to focus on positive outcomes. One major change was changing how department activity was reported. Most departments evaluate performance based on property loss, fatalities, injuries, and numbers of fires. The move to IRMP looks at incidents that the system failed to perform. ICMA has worked with the Merseyside Fire District in the United Kingdom on a number of projects. The changes enacted in the department resulted in a 25% reduction in staffing but much better outcomes across all measured areas.

A major use of performance information is to establish accountability, so citizens and elected officials can assess what programs have achieved with the funds provided. It is also at least as important to help managers throughout the year.[6] When considering how well a fire department appears to be preventing and suppressing fires within its jurisdiction, it is also important to consider the parts of the overall outcomes they are responsible for, the other parties that share responsibility, and the many other factors that may be contributing to the outcomes.

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[6] Harry P. Hatry, *Performance Measurement: Getting Results, 2nd Edition*, (Washington, D.C.: Urban Institute Press, 2006), 3-4.

The department currently uses raw numbers, averages, and percentages to measure outputs and outcomes. The annual report produced provides a good overview of performance measures currently used to track program performance and effectiveness. An example of various forms of generating program performance satisfaction is surveys and customer response cards. Although the survey requires more expert handling to administer, customer response cards are very brief survey cards containing only a handful of very straightforward questions that are given to customers at the point of service delivery or shortly thereafter, to monitor customers' satisfaction with the service they received in that particular instance. Although there may be a small costs associated with this survey (postage) it is far less expensive than the traditional survey process. In the majority of instances, the information can be gathered and returned at the point of contact.

Recommendation: Consider the use of customer response cards for gathering customer satisfaction information. Link the customer response with outcomes of the department.

There are a number of different performance measures that the department should consider developing depending upon the purpose of a given performance measurement system and the level of detail on which the monitoring may focus. Table 1 provides examples of outcome measures which can be used in the development of a GIFD performance measurement system:[7]

Table 1 Fire Department Outcome Measures

Objective	Quality Characteristic	Specific Measure	Data Collection procedure
Overall loss	Civilian casualties	# of civilian (a) injuries and	Incident reports,

[7] Hatry, H. Fisk, D. et al, How Effective Are Your Community Services? (3rd ed.). (2006) International City County Management Association and the Urban Institute, page 82-83.

minimization		(b) deaths related to fires, absolute and per 1,000 population.	census
	Property loss	Direct dollar loss from fires (a) per $1,000 property protected and (b) per 1,000.	Fire department or insurance company estimates
Prevention and deterrence	Reported fire incidence	# of fires reported per 1,000, (a) overall and (b) property type.	Incident reports
Suppression and mitigation	Property loss control	Average dollar loss for fires not out on arrival, by property type.	Household survey
Citizen satisfaction	Citizen Satisfaction	Percentage of residents receiving direct fire department service who reported the service as satisfactory.	Household or user survey
Emergency medical services		The % of patients for whom agreed-upon medical protocols are followed.	Incident reports, hospital records

One critical evaluation tool that is captured by only a few U.S. fire agencies (but increasing) is the outcome of patient care. All departments report on how many calls for service were responded to by the department. In many cases they provide a breakdown of what the calls were categorized. Few report the outcome of the interaction between the department and citizen. An example is the area of sudden cardiac arrest (SCA), the most common form of "heart attack" that is treated with Automatic Electronic Defibrillation. Most departments report calls to "heart attacks." However, did the patient leave the hospital? Without this important performance piece, a review of

the department cannot be properly conducted. Likewise, what is the actual save rate of the department? In the United States, despite advances in AED placement and technology, the save rate of 9% has not changed in more than 25 years with the exception of a few locations (King County, Washington for instance). The difference is the analysis of outcomes.

This topic will be discussed further under the "EMS" section.

D. Financial Performance

How well an organization uses it financial resources and produces revenue is a general measure of its overall health. Fiscal management views financial resources as a critical input that is required if specific outcomes are to be achieved. As mentioned earlier in the report, financial performance should be linked to the strategic planning process.

ICMA has advocated the use of "Performance Based Budgeting". Performance based budgeting is used to reflect the priorities adopted by elected officials, appointed officials, and the community versus funding of projects which may only be of benefit to the agency.

Part of establishing the priority is also developing why things are done by departments (and cities). An example is the area of homeland security. Many departments created extensive response capabilities to a host of different events and have never used the tools acquired. Many of these tools are now found to be expired or of dubious quality yet agencies continue to seek funding to support upgrades. The question needs to be asked, "why do we do this?" In times of decreasing budgets, it may be that some things are not done by a department any longer which can produce significant savings both in terms of training but also actually improve service delivery. Many

private companies have entered the fields and deploy across regions and have an opportunity to use the equipment in actual applications. Often time contracts can be negotiated to use the service on a call basis and thereby eliminate the training, equipment, and ongoing support costs.

The department is moving toward further development of its plan and should include this important element. There is currently no capital improvement plan for replacement of apparatus or major equipment. The items are replaced as funds become available. The department depends upon various grant funding sources to aid in the procurement of these vital assets.

E. Programs

1. Fire Suppression

The Grand Island Fire Department has three ambulances, two engines, one engine/ladder, and one engine/rescue fully staffed in four stations. Two ambulances are staffed on a full-time basis while one is staffed on a part-time basis. In addition, five ambulances, one engine, and one squad serve as backup units. Personnel are cross-trained to operate in both fire suppression and emergency medical services and whose assignment to apparatus or companies may vary from incident to incident. Cross-staffing is an efficient use of resources based on the unit hour utilization (UHU) of individual companies. Unit hour utilization is the ratio time that an Emergency Medical Service (EMS) unit or in the case of a first responder unit, responds to medical calls, and is engaged on calls compared with the total on-duty time of the unit.

Unit Staffing

Those who propose a national standard for minimum staffing do not take into account the many variations in local fire problems, in addition to

other causal relationships. According to an article by Cortez Lawrence, several other elements affect fire loss and injury rates, including environmental factors, training and fitness levels of response personnel, leadership skills and capacity, firefighter accountability and operational management systems, fuel density and types, and exposures and effectiveness of fire programs and operations.[8] The problem with a jurisdiction adopting a national standard is that it does not take into account the various aspects particular to that community. Therefore, community demands and expectations must be identified before appropriate company size can be determined.

Crew Staffing Size

The question of appropriate crew staffing size for engine companies has long been debated. Until now there has been no substantive data to allow local government leaders to understand the cost / benefit impact of staffing decisions. These staffing decisions have significant impact on costs. Increasing engine crew size from 3 to 4 persons adds an additional 33 1/3% to personnel costs for a fire department. The vast majority of fire departments serving medium sized cities utilize 3 person engine crews. Dr. John Hall, Jr. in an August 2010 presentation to the NFPA, reported that for departments protecting 50,000 to 250,000 population -**67%**- do not staff engines with four or more career firefighters. This is largely unchanged since 2001.

Report on Residential Fireground Experiments

In 2010 the National Institute of Standards and Technology (NIST), part of the United States Department of Commerce, conducted a series of experiments which attempted to quantify the performance of different

[8] Cortez Lawrence, "Fire Company Staffing Requirement: An Analytic Approach," *Fire Technology*, 37 (2001): 199-218.

size fire engine crews. This study was funded by the DHS/FEMA Grant Program Directorate for FY 2008 Assistance to Firefighters Grant Program. Participants in the study included the International Association of Fire Fighters (IAFF) as well as the International Fire Chiefs Association (IFCA). One of the researchers (and a co-author of the study report) is a senior staff member of the IAFF. There were no persons involved in the study from organizations representing local government management or elected officials, such as the National League of Cities (NLC), The United States Conference of Mayors or the International / City County Management Association ICMA).

Two fire departments contributed to the project. The Montgomery County, MD and the Arlington County, VA fire departments provided career personnel to participate in the study. Both departments staff engine companies with four person crews. Although the study was designed to measure the performance of 2, 3, 4 and 5 person engine crews, no departments utilizing crew sizes other than four participated.

The report presents the results of more than 60 laboratory and residential fire ground experiments designed to quantify the effects of various fire department deployment configurations on the most common type of fire — a low hazard residential structure fire. Grand Island reported that it had a total of 15 fires in 1 or 2 family dwellings in 2010 - 2011. This represented only .0033% of the 4,515 total calls received by the department during the study period. The vast majority of work handled by the department is EMS or lower-risk incidents that would require less staffing.

Outcomes

The experiments performed a series of 22 tasks that were timed. Report results quantify the times of crew size, first-due engine arrival time, and

apparatus arrival stagger on the duration and time to completion of the key 22 fire ground tasks and the effect on occupant and firefighter safety. Of the 22 fire ground tasks measured during the experiments, results indicated that only five factors had a statistically significant difference on time to complete.

The four-person crews completed the total 22 fire ground tasks (on average) 5.1 minutes faster — less than 25 % — than the three-person crews. However in evaluating the most critical operations, **Water on Fire** and **Primary Search,** the differences were far less. There was only a 6% difference in the "water on fire" time between the three- and four-person crews. Likewise, a four person crew only conducted a "search and rescue" 6% faster than a three person crew. The four-person crews operating on a low-hazard structure fire completed laddering and ventilation 25 % faster than the three-person crews.

The report conclusion states that "This report quantifies the effects of changes to staffing and arrival times for residential firefighting operations. While resource deployment is addressed in the context of a single structure type and risk level, it is recognized that public policy decisions regarding the cost-benefit of specific deployment decisions are a function of many other factors including geography, local risks and hazards, available resources, as well as community expectations. This report does not specifically address these other factors."

Implications for the Grand Island Fire Department

The department mans four pieces of apparatus with four member crews when no staff is on vacation or out sick. However, during the busier months of the year (spring, summer, fall), leave time results in most apparatus being staffed with three people. This may require management of the vacancies to ensure proper staffing is in place during

peak times of the day. The data analysis confirmed that the department focuses staffing on response to fire yet 85% of its workload is EMS.

A companion study prepared for Tulsa, Oklahoma (contained in the Annex to this report) identified the failures of deployment decisions using traditional approaches.

1. If patient contact does not take place within four minutes in advanced life support calls, the outcome is likely to be negative. Data analysis shows that the time spent on answering, processing, dispatching, and turnout for calls is almost four minutes in Grand Island.
2. Paramedics are not necessary on the majority of emergency calls that can be identified through use of Priority Medical Dispatch which is used in the majority of centers across the U.S.
3. Grand Island EMS times on EMS response are lengthy (more than one hour) for the majority of calls. This may indicate that management needs to assert steps to mitigate the time or actions have to be taken with the medical facilities to speed up intake for patients delivered to the hospital. Comments made in interviews with officials indicate that hospitals regularly make responders wait with patients; penalties should be developed to discourage this type of action.
4. A further analysis may be required to determine if transport functions can be contracted to a private provider. Such a decision requires a comprehensive process to ensure standards of care are monitored and enforced. It is critical that performance measurement be assigned and monitored to achieve compliance with contracted transport. The Oklahoma study is a good basis by which to analyze a decision to transport using fire based or contracted services.

Response Times

NFPA Standard 1710, Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments, 2010 Edition recommends response time standards for turnout times and travel times which can be compared to department data. The following is representative of those standards:

- 240 seconds (6 minutes) or less travel time for the arrival of the first arriving engine company at a fire suppression incident
- 480 seconds (8 minutes) or less travel time for the deployment of an initial full alarm assignment at a fire suppression incident.

ICMA data analysis made the following observations after analyzing Grand Island's data:

- The average response time for the first arriving suppression unit was 7.2 minutes and the 90th percentile response time was 10.1 minutes.
- The average dispatch and turnout time was 3.4 minutes.

The dispatch center began recording separate dispatch times for the fire department on June 16, 2011. During the information gathering process, it was found for the majority of calls; no unit dispatch time was recorded. Thus, the decision was made to report dispatch and turnout time together. Dispatch and turnout time is the difference between the unit time en route and the call receipt time at the dispatch center. Travel time is the difference between the unit on-scene arrival time and the unit time en route. Response time is the difference between the unit on-scene arrival time and call

received time. These times are within the NFPA standards for response time average and 90th percentile.

The NFPA recommended standard for dispatch time and turnout time for first arriving fire suppression unit is 80 seconds and 60 seconds respectively for a total of 2.33 minutes. As seen above, this time is exceeded by 1.1 minutes. These are the two response time intervals which the department has some form of control over and thereby offers opportunities for improvement. It should be noted that response times reflect only those calls within the GIFD jurisdiction and does not apply to calls in which the city has a contractual response agreement.

Recommendation: Establish performance measures to meet NFPA standard for dispatch and turnout time and monitor for compliance.

Station location

Fire station location planning is a critical component of managing local fire protection services. Planning for station locations can be done in various ways. With the help of accurate historical response data and realistic computer modeling, factually based decisions can be made. Figures 5 through 9 depicts city boundaries, fire station locations, and various historical incident data compiled for the study period between September 1, 2010 and August 31, 2011.

Figure 5. Fire Station Locations

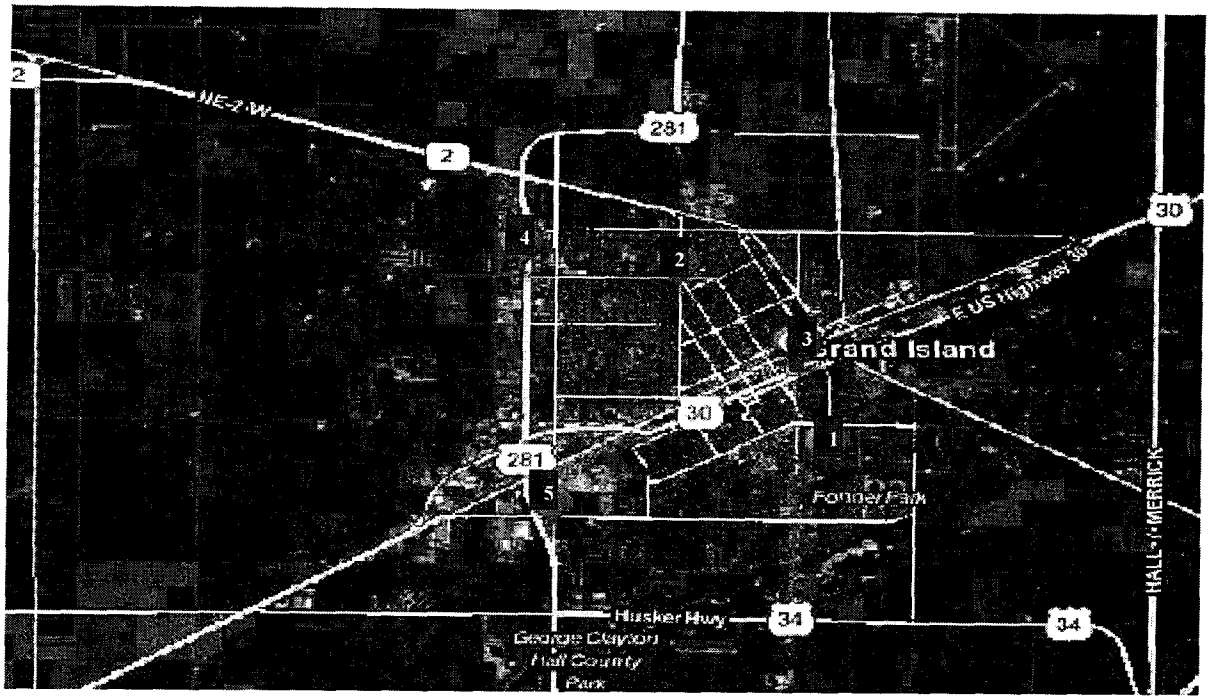


Figure 6.Fire Runs

Figure 7. Fire Grid Density = 701 Runs

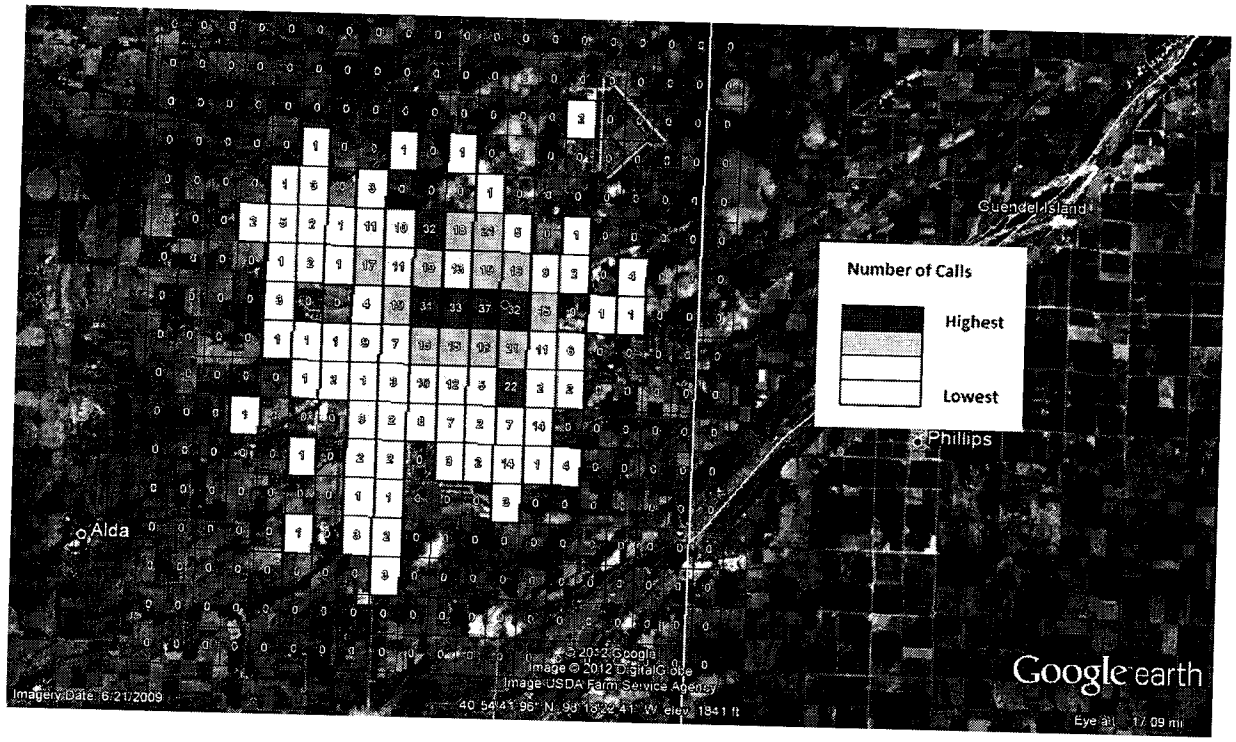
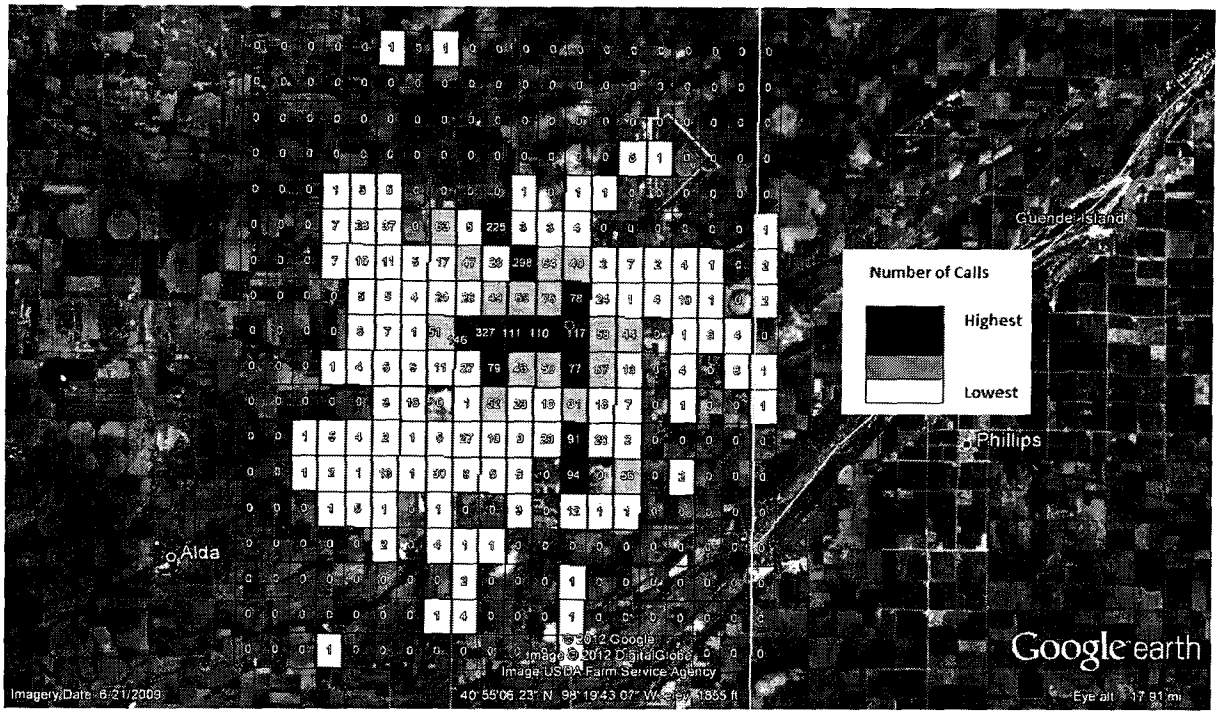


Figure 8. EMS Runs

Figure 9. EMS Grid Density = 3814 Runs



The grid density maps show the highest and lowest number of incidents relative to the overall geographical area and fire station locations. The legends represent those incidents measured in 25 percent quartiles. Based on current service demand, fire station locations are suitable for providing adequate coverage with respect to response times. The recent fire station location study conducted for GIFD evaluated service demand over a two-year period. It showed the current station deployment capable of reaching over 96 percent of the city's fire-related incidents and over 95 percent of the city's emergency medical incidents within a six minute response time.[9] These are well within benchmarks established by NFPA and other standards making bodies. Using rapid response vehicles to triage EMS patients may improve the performance even further and establish Grand Island among the leaders in this area.

[9] Emergency Services Consulting, Inc., Fire and EMS Services Facility Location Study, page 13.

Two concepts are useful in local suppression considerations: capability and capacity. Capability deals with a fire department's response within a short time with sufficient trained personnel and equipment to rescue any trapped occupants and confine the fire to the room or building of origin.[10] ICMA data analysis makes the following observations regarding to capacity:

- On average, two or more engines and/or a ladder truck are simultaneously involved at calls for one hour every 2.1 days or 50 hours.
- On average, three or more engines and/or ladder truck are simultaneously involved at calls for one hour every 6.9 days or 167 hours.
- On average, two or more units are simultaneously involved at calls for 29 minutes per day.
- On average, three or more units are simultaneously involved at calls for 9 minutes per day.

The analysis shows a significant amount of capacity exists within the system at the current resource deployment levels.

In many communities ICMA has found that station deployment was based upon the adage, "if you build it, they will come." This deployment method creates several problems:

1. Cost. Most fire stations today cost in excess of $2 million. Once built, they are impossible to move and remain a long term asset of the city requiring an ongoing commitment to maintenance, but more important, staffing.

[10] NFPA Handbook, 20th ed., vol. II, 2008, p. 12-8

2. Locating and building stations prior to the area building out may result in the improper deployment of equipment or staffing which is incapable of meeting the needs of the surrounding area. Also, by approaching with an underlying strategy of "one size fits all," there may be too much dedicated to the location.
3. What is the risk in the area? If a decision is made on deploying for an unknown or unquantified risk, it is likely there will not be a proper match and this can be expensive to change.
4. If the area is new construction with sprinkler-protected buildings and built in fire reporting systems, the need for heavy deployment may not be necessary.
5. Since most of the calls for service by the department are for EMS, private firms and some departments are now using the concept known as "System Status Management" or "Dynamic Deployment" by which resources are deployed. Software models, created in the UK and fine-tuned for more than 12 years, have shown predictability can be achieved to a factor of 95 to 99% (based on good data). Resources are thereby deployed based on time of day, time of year, and adjusted to reflect demographic changes which negates the need for fixed base buildings while improving the actual response times of units.

   Examples of this being used can be found in Fargo, ND and Moorhead, MN where EMS is deployed across two cities in two states from a central location. Another example is in Plymouth, MI where ambulance service is provided across seven counties using the methodology.

Use of Technology in Staffing and Deployment Strategies

Technological advances have been made in fire extinguishment to supplement the overall effectiveness and efficiency of a reduced workforce.

These advances have introduced viable alternatives to meeting NFPA minimum staffing recommendations, however misconceived they may be. Two primary innovations to be considered in limited staffing situations are a compressed air foam system (CAFS) and the Ara Safety Pro™ Fire Interruption Technology® (FIT) knockdown tool. Both are available commercially and both have amassed vast anecdotal references substantiating their effectiveness within the firefighting community.

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

So what is CAFS? It is a pumping and delivery system that mixes water, foam solution, and compressed air.

The use of CAFS as a primary fire attack tool is now being proposed in the United Kingdom; the East Sussex Fire & Rescue Brigade has two years of experience in operational trials in structure fires. The brigade has several front-line fire engines equipped with the German-made Schmitz GmbH 'One Seven' system. Other brigades across the UK are fast following this innovative approach.

The growing acceptance of CAFS is being driven by fire leaders who see an opportunity for a simple system of primary fire attack that will replace the high-pressure water-fog system. CAFS appears to offer increased performance in fire suppression of post-flashover fire and possibly pre-flashover situations. It reduces the amount of water needed to suppress a vast majority of fires, so primary water tanks and fire engines can become smaller, possibly fewer firefighters are needed, and attacks on a fire can be

made from a safer distance. Further still, the costs associated with training firefighters in primary fire attack may well be reduced substantially.[11]

Closer to home, the effects of CAFS on needed manpower for suppression activities are well documented in the literature and have been consistently observed, both in actual fireground situations and in simulated exercises.[12] For example, controlled room and contents fire tests utilizing CAFS were performed at Wallops Island, Virginia, and Salem, Connecticut, by Hale Fire Pump, the Atlantic Virginia Fire Department, Ansul Fire Protection, the International Society of Fire Service Instructors, Elkhart Brass, the National Aeronautics and Space Administration-Goddard Flight Center Fire Department, the Charlotte, North Carolina, Fire Department, the Fairfax County, Virginia, Fire Department, F.I.E.R.O. (Fire Industry Equipment Research Organization), and the Salem Connecticut Fire Department. Table 2 shows the results of these tests.[13]

Table 2. Temperature Drops: High Level-1000 Degrees F. Down To 212 Degrees F.

Medium	Time (Seconds)	Drop Rate (Degrees F. per Sec.)
Water	222.9	3.5
Foam solution	102.9	7.6
Compressed air foam	38.5	20.5

The table shows the significant difference in temperature drop rate using CAFS as compared to the other extinguishing mediums of plain water and a simple foam solution.

[11] http://www.firetactics.com/CAFS.htm.
[12] http://www.cafsinfo.com/cafs_limited_staffing.html.
[13] http://www.firetactics.com/CAFS.htm.

In 1990, the Los Angeles County Fire Department began an intensive evaluation of Class A foam. That led to the specification of direct-injection, multiple-outlet foam proportioners on all new engines starting in 1992. In 1995, the department purchased three engines equipped with compressed-air foam systems. Today, the LACFD has 224 front-line engines, 10 reserve engines, and 15 front-line quints equipped with Class A foam proportioners. An additional 19 front-line engines are equipped with CAFS.[14]

An article entitled "Bubbles Beat Water" in the July 2001 issue of *Fire Chief* reported the LA County Fire Department conducted a series of tests in an effort to provide hard numbers on the use of CAFS. One of the misconceptions associated with the use of foam solutions in fire extinguishment is its cost. In the Class A foam/water solution test, LA County personnel used only thirty-one fluid ounces of concentrate to knock down and overhaul a fire in four rooms. At an average cost of $13 per gallon, the test used only $3.10 worth of concentrate. The CAFS test used even less—only six fluid ounces of concentrate, or about sixty cents worth.

Many fire professionals are starting to advocate the benefits of foam as a first-line extinguishing agent compared to water. The A-Foam Authority is a nonprofit trade association created to provide accurate, generic information about the benefits of Class A foam. The A-Foam Authority is comprised of end users (fire chiefs, officers, and firefighters); equipment and foam manufacturers; technical and training specialists; wildland and urban agencies; and other experts in the field of safety and prevention. The A-Foam Authority believes that through research and third-party testing, it can offer statistical data verifying the many benefits of Class A foam, including: increased firefighter safety, quicker extinguishment that will benefit the environment with less air pollution and less water usage, quicker return to

[14] http://www.firetactics.com/CAFS.htm.

service, reduced frequency of rekindles, less smoke and water damage to structures, and less financial impact on the community.[15]

The manufacturer of the Ara Safety Pro™ Fire Interruption Technology® (FIT) knockdown tool claims that it can deployed in a wide variety of structure fire scenarios, from incipient to fully involved, as well as in defensive, offensive, and transitional modes. In some fireground situations, water may be unavailable, the duty commander may be on site before working crews and trucks, or an EMS call may leave the crew short for the two-in and two-out rule.[16] The tool can be used to supplant firefighting forces and mitigate the effects of fire in the incipient stages, thereby reducing the risk of flashover. Reducing the risk to firefighters and the public is always of primary concern. The device is made for use by professional firefighters only and proper training in its deployment is required. Current pricing stands at approximately $1,000 per tool. As with CAFS, use of this new technology permits interior attacks to be initiated through a door or window. This allows greater stand-off distances and thus reduces the risks to firefighters.

The GIFD is not currently using either of these technologies. Incorporating CAFS into the vehicle replacement program should be considered of vital importance.

Recommendation: Consider acquisition of CAFS for use on all fire suppression apparatus.

Vehicles and Equipment

The use of full-size suppression apparatus is giving way to a much more measured approach in vehicle acquisition and deployment. It is no longer

[15] http://afoam.org/about.cfm.

[16] http://www.arasafety.com/products/arasafetypro.htm.

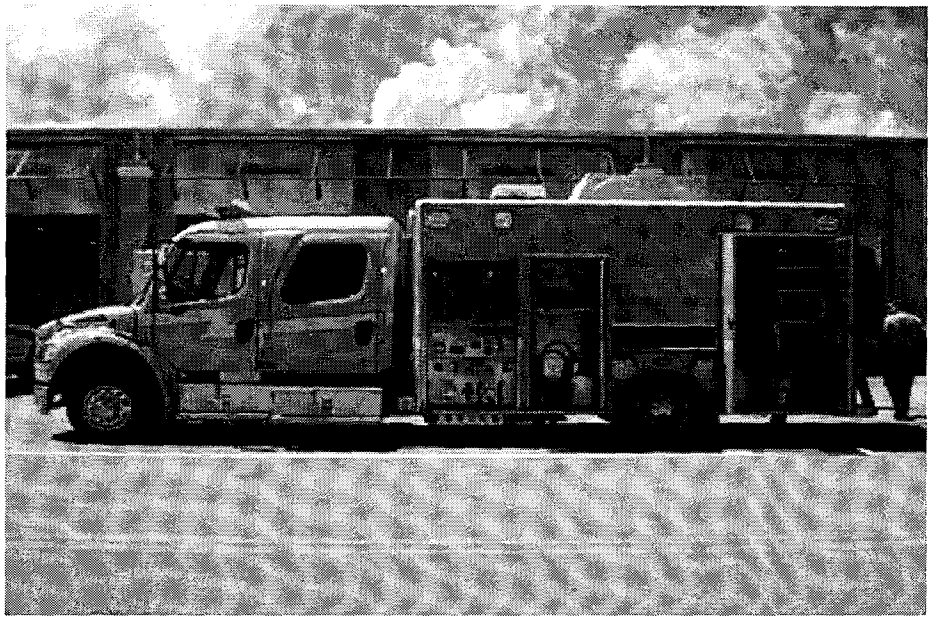
practical to provide each geographic area within a jurisdiction with the traditional suppression apparatus without conducting a comprehensive analysis of what is needed to meet the level of risk assessed. Many departments, both large and small, are beginning to make purchasing decisions for vehicle replacement based on perceived risk rather than using a "one size fits all" mentality. There are a number of manufacturers producing smaller, mid-size pumpers that have all the firefighting functions of their larger counterparts. Water pumps, water tanks, and ladders are all a part of the package. Further, the industry is evolving toward the use of even smaller firefighting apparatus termed "quick response vehicles," or QRV, to use in place of the more traditional vehicles. Figure 10 is a pictorial view of a QRV.

Figure 10. Fire Suppression Quick Response Vehicle Equipped with CAFS

Another shift in paradigms is the use of multipurpose vehicles. Manufacturers have now begun producing apparatus capable of providing both suppression and ambulance services. Figure 11 is an example of a

multipurpose vehicle now in use in some jurisdictions throughout the United States. Figure 11 shows a multipurpose vehicle. ICMA was recently provided a review of a new EMS unit in Volusia County, Florida which incorporates the CAFS foam, a small water supply tank and traditional ambulance. The unit was developed with the assistance of a U.S. manufacturer to reflect staffing cuts that were required to balance the budget and ensure the safety of responders as well as patients.

Figure 11 . Combination Ambulance Suppression Vehicle



The ICMA data analysis resulted in the following observations:

Observations:

- Ambulance unit A1 made 1,729 runs in a year, averaging 4.7 runs and 4 hours and 17 minutes of busy time per 24 hour day.
- Ambulance unit A2 made 2,154 runs in a year, averaging 5.9 runs and 4 hours and 35 minutes of busy time per day.
- Ambulance A3 made 30 runs and was busy 87 hours in a year. This is usually cross-staffed and used Engine 3's crew.

• Ambulance unit A4 made 96 runs and was busy 88 hours in a year. It is not normally staffed and when staffed, cross staffs with the engine.
• Engine E1 and ladder truck L1 were cross staffed and they made 971 runs, averaging 2.7 runs and 1 hour and 13 minutes of busy time per day.
• Engine E2 made 1,425 runs, averaging 3.9 runs and 96 minutes of busy time per day.
• Engine 4, Rescue and Engine 3 and other units' utilization rates are found in the data section of this report.

Unit Hour Utilization (UHU) is calculated by dividing the number of transports by the number of "unit hours," with one unit hour defined as a fully equipped and staffed vehicle in the EMS system. If the system has 10 24/7, there are 240 unit hours in a 24-hour period. If those 10 ambulances do 120 transports in 24 hours, you would calculate your system's UHU as follows:

120 transports/240 unit hours = .5 UHU

Private systems normally vary staffing levels to meet demand, and UHU is typically measured over longer intervals than 24 hours — but UHU is still calculated as the number of transports divided by the total number of unit hours in the measurement interval. Few fire-based EMS systems look at UHU as one of the performance analyses which results in most systems handling only emergency calls. The problem is that emergency calls consume larger amounts of time and normally capitate the amount of reimbursement available. Private systems offset these costs by scheduling transports which reimburse at 100% (or higher) costs and which increase the UHU.

The higher the ratio, the more productive the system, in the sense that you're getting more transports out of fewer ambulances. Measuring UHU also helps an EMS system match the number of on-duty units [supply] that are required to achieve response times [demand].

To fully benefit from using the UHU benchmark, there are a number of modifiers that must be considered. Each of the following could skew a system's UHU:

Population and call density: For example, an urban community with short transport distances will have a significantly different UHU than suburban or rural services.

Geography: Road condition and layout, traffic congestion, bridges and other factors can affect the comparison value of UHU. An EMS system in a city where roads are well laid-out and traffic flows freely will likely experience higher UHU than a similar EMS system in a city with decaying infrastructure, inefficient routes and traffic congestion.

Time-on-Task: This measurement, the time it takes to completely manage each incident, varies and has to be considered to have an accurate UHU. For example, if crews cannot quickly offload patients at receiving hospitals because of bed availability, paperwork or other issues, time-on-task increases.

Scheduling: Shift patterns and crew scheduling practices can also influence a system's UHU. Typically, shorter shifts can tolerate higher UHU than 24-

hour shifts, where high usage coupled with little opportunity for rest could increase risk.

The goal is to fully balance and optimize these variables along with clinical factors, response times, employee satisfaction and fiscal realities. Accurately measuring UHU helps EMS leaders demonstrate that their systems are providing the community exceptional value – or defend their budget if need be

Although some EMS experts differ somewhat on their UHU prescriptions, some suggest a desirable range of 0.25 to 0.50, with several pointing to 0.40 as the optimum. Rates higher than 0.50 risk overuse and employee burnout, lack of available units during simultaneous emergencies, and inadequate preparation for the next call.[17] UHU is determined by dividing the number of hours a unit is engaged on calls by the number of hours in the work shift, which is 24 hours. Even with A2 showing the greatest number of hours worked per day, at 4.35, the UHU is only 0.18. Based on the extremely low UHU rates of response units at Station 3 and 4, it is possible to regularly cross-staff both units using the single three-person crew concept without comprising response times. While this occurs most of the time because of shift vacancies, it should be officially recognized. This is a more efficient approach to resource deployment. When a call for medical assistance is received, a two-person crew would respond leaving the third person in the station to respond with the engine/ladder to any fire call. The closest available engine company would respond with the single member staffed engine/ladder unit should a call arise before the return of the ambulance unit. This would bring a full company suppression response force

[17] Ammons, D. Tools for Decision Making: A Practical Guide for Local Government, 2nd Ed. 2009, Washington, D.C.

capable of initiating an interior attack while maintaining the integrity of OSHA's two-in/two-out rule.

Recommendation: Implement cross-staffing in fire stations 3 and 4 reducing staffing levels (two FTE positions) to one three-person crew per station.

Ambulance response units at these stations can be replaced with multi-purpose vehicles further reducing costs due to high maintenance of two aging front-line pumpers.

Recommendation: Consider acquisition of multipurpose apparatus for fire stations 3 and 4. An example may be units recently built for Volusia County, FL

2. Prevention and Safety

The community has adopted the 2003 edition of the International IFC which are enforced by the authority have jurisdiction (city fire marshal). Fire suppression companies receive on-the-job training in inspections practices and are assigned inspections annually. There is no formal training program. Target hazards are inspected annually and light hazards every three years. The IRMP process requires an aggressive prevention and safety strategy that begins with inspections. Single family residential structures are where most fire loss, injury and death occurs yet most departments never inspect these occupancies but focus on larger commercial and industrial facilities (which are normally equipped with sprinkler systems).

The department could start by creating a self-inspection program now active in many jurisdictions around the country. These programs provide

an opportunity for low-hazard businesses to conduct fire safety inspections on their own without the annual fire department visit. Fees are still collected as before. This allows fire inspectors to focus on high-hazard occupancies. Cities like Santa Maria, California and Sandusky, Ohio have successfully used this program for many years.

The U.S. fire service, through a program named "Vision 20/20" has created a Community Risk Reduction program (CRR). ICMA has been working with the group as a member for several years and will be facilitating an upcoming workshop as well as pre-conference program in Phoenix for Fire and Community leaders.

CRR is the outcome of work done at Merseyside, United Kingdom's fire brigade as well as research throughout the UK. A comprehensive CRR approach:

- Identifies fire and life safety risks
- Prioritizes those risks
- Determines how to prevent or mitigate risks
- Focuses your efforts
- Becomes more of a community player in elimination of risks and hazards.

A CRR is proactive, integrated with a balance of emergency response and prevention, is community-based, data driven, involves community partners, is effective at reducing risks, and is an efficient response to resource constraints.

Private companies have gotten involved with the CRR approach now advocated by the most progressive U.S. fire departments. ICMA has

reviewed the rollout of a software program created by Buxton Analytics which integrates demographic information utilized by most commercial firms with census information and reports it across Geographical Information Systems. The approach has enabled departments to target prevention and public education to areas that are found to have a high-risk profile. The City of Philadelphia has deployed the tool with a goal of eliminating fires. Fort Lauderdale, Florida will be reviewing and rolling out the tool in early April. Police agencies and EMS have been regularly using the same methodology for years to deploy resources with the City of Los Angeles one of the largest. Fire services are just beginning to examine the concepts through the efforts of Vision 20/20.

Recommendation: Consider implementing a comprehensive Community Risk Reduction strategy with a goal of minimizing fire calls and reducing calls for EMS.

3. Public Education

Most fires and fire-related deaths and other injuries occur where people live, for that is where the ability to enforce codes is severely restricted. But most fire deaths occur in residential properties, so public fire and life safety education should be one of the more important strategies of a comprehensive prevention program. Like many fire departments around the country, GIFD provides little support for this vital program.

It was noted earlier that prevention is the key to eliminating fire and EMS incidents from occurring; the focus of the department needs to adjust to this paradigm shift.

ICMA has worked with a number of departments that utilize not only full-time staff but volunteers from within the community. Grand Island is an

All American City which requires a demonstration of community activism as one of the review criteria. Grand Island Fire Department should seek interested candidates, preferably retired teachers or educators that could be trained to assist the department with regular (daily) education opportunities.

There are two approaches which can be used in getting the message out, they are; taking the program to the schools and taking it directly to the public. The NFPA publishes the Learn Not To Burn® and Risk Watch® programs which fire departments can use in conjunction with local schools. Teachers incorporate fire and life safety messages into the school curriculum and firefighters support them by conducting on-site presentations as a means of reinforcing the behaviors being taught in the classroom. This is an extremely efficient method of dealing with the problem of limited department staffing.

The fire department should make better use of the data it collects to develop fire and life safety programs which target specific audiences or messages in connection with certain issues.

By adopting the concepts of the Community Risk Reduction strategy, the department can target audiences based on calls for service and comparable demographic data. In addition, creating pre and post testing for training programs that are offered in the community will create an evaluation tool capable of determining the outcome of educational efforts.

Recommendation: Consider acquisition of NFPA fire and life safety public education program materials. Identify potential volunteers (retirees, teachers) to deliver to all populations and

couple the efforts through the Community Risk Reduction process.

4. Fire Investigation Program/Arson

The department conducts cause and origin fire investigations performed by company officers. The Grand Island Police Department is responsible for the investigation if a determination is made that suspected arson has occurred. The two entities maintain a good working relationship and proper equipment for fire investigators is available to conduct the process in a professional manner.

It is important that the two agencies conduct training together on a regular basis. The fire department should be trained in evidence protection and recovery as well as being equipped with proper storage devices. It is encouraged that fire and police attend training programs together to create a team for handling of arson cases.

5. Haz Mat

Through a memorandum of understanding, the city is not only capable of responding to these emergencies locally, but on a state-wide level through the state Nebraska Emergency Management Administration. Standard operating procedures are in place. Approximately, fifty percent of department members are trained to the technician level, which was provided through a state homeland grant. The department has made excellent use of the grant process acquiring all of their equipment and supply needs. The city has the busiest railroad corridor in the nation with 90 UPRR and 75 BNSF trains passing through or around a day.

Proposals now before Congress and the Department of Homeland Security would move funding to block grants administered through the State. These grants would be scored against risk and may result in many areas losing funding. Proposals are moving forward to eliminate many communities funded through UASI (Urban Areas Security Initiatives).

If grant funding from the federal and state agencies is eliminated, haz mat may be an area for which the department analyzes the opportunities to contract for service. For fire professionals, training to Level I, Operations level is required. Technicians are allowed additional response capability while Specialists are specifically trained for response to tank/rail car incidents. As part of the risk analysis, the department may want to consider whether all need to be trained to the Technician level or should it be a tiered training approach with all trained to Operations and a select squad trained to Technician and Specialist categories. The question of maintaining competency if needed in an actual incident is becoming more acute to the fire service.

6. EMS

The GIFD has extensive medical controls in place and has direct contact with medical control when needed. Approximately fifty percent of the department is certified as National Emergency Medical Technician-Paramedics and the other National Emergency Medical Technician-Basic. All engine companies are staffed with one paramedic. The department uses electronic processing of medical records. It is interesting to note the department can actually track its survival rate among high acuity patients which is currently at 21 percent while the national average is only 7.6 percent. The city does not have Automatic External Defibrillators (AED) in its police vehicles, but does have some in the

electric department's vehicles. AEDs are also located in some city administration buildings.

It is well documented that making AEDs available throughout a community can play a huge role in reducing death from sudden cardiac arrest. Public Access Defibrillation (PAD) should be the first line of defense in improving morbidity and mortality from cardiac arrest. The idea that a community can provide enough resources in the form of EMTs and paramedics toward improving outcomes is unrealistic. Since departments are constantly seeking to reduce response times, they should be on the leading edge of efforts to implement a PAD program in the community. Miami-Dade County, Highland Park, Illinois and Rochester, New York all have long standing successful PAD programs in place. Funding sources are available through various sources at the local, state, and federal level as well as private philanthropic organizations.

Recommendation: Implement Public Access Defibrillation program within community starting with police vehicles.

The Sudden Cardiac Arrest Association, a national group advocating the placement of AED's, also recommends creating a data layer in the GIS system of the Computer Aided Dispatch. The data layer will identify the closest AED when a call for assistance is received.

One issue with placing AED's is knowing where they are located. Rarely are people aware that the closest AED may be only feet away; dispatch also has no information where these are placed. By locating them with a data point, this information can be relayed during critical times when defibrillation will restore the heart beat. In areas that have been aggressively promoting and

educating on the AED use, the rate of use has increased by as much as 3,800%.

The City should review a recent white paper by University of Oklahoma's Emergency Medicine Department. The white paper identifies that by using Priority Emergency Medical Dispatch; many of the emergency calls for service could be dispatch and responded to on a non-emergency basis. This underscores the need to control risk in an agency and the majority of fatalities in the U.S. Fire Service often occurs going to and from emergency incidents.

By prioritizing incidents, it may also be possible to respond with only an ambulance and not require dispatch by multiple units that are costly and lead to breakdowns and maintenance.

The report is critical of training all staff to paramedic level, particularly with recent licensing changes that allow an EMT to perform many of the tasks long associated with paramedics. The issue of not enough paramedics has plagued Grand Island like it has in many parts of the United States. However, the white paper notes that areas with the lowest ratios of paramedics to people have one of the highest outcomes and performance levels. It highlights the need to maintain competency and not create a system of "one size fits all" when that is the most expensive option to consider. Dr. Thomas H. Blackwell, one of the authors, notes, "Another consideration involves the issue of saturating the involved EMS practice of medicine with EMTs and paramedics. Such operational practices, without careful overall clinical impact considerations, may lead to problematic dilution in critical thinking and psychomotor treatment skills across the spectrum of involved professionals.

His colleague, Dr. Marc Eckstein, MD, MPH, FACEP states: "Staffing every ambulance with paramedics in an EMS system where it is known that the majority of patients only require Basic Life Support (BLS) transport is about as efficient as staffing an urgent care center with cardiothoracic surgeons. We must match the need with the response. While there can never be a universal —perfect model, an honest appraisal of one's current EMS system, and a willingness to change, is the first step. Simply measuring the success of an EMS system by tracking response times will only serve to create an expensive, inefficient system that is not focused on the patients whom entrust it to their service.

As the city looks to fill the vacancy in the chief's position, it should question potential candidates on whether they embrace the concepts of the white paper or whether they would advocate for the tradition of "one size fits all."

F. Physical Resources

Fire stations are in generally good condition. The three oldest have had recent upgrades to the mechanicals and insulation in the last year. Kitchens and new roofs have also been installed in some stations.

Apparatus is in serious state of disrepair due to age and without a vehicle replacement plan. The newest engine is reported to be 12 years old with the oldest (the single reserve unit) with 26 years of service. All maintenance is performed by the city vehicle maintenance shop and properly trained emergency vehicle technicians (EVT) are in short supply. There is only one certified EVT working currently. One unit was reportedly down for service for as much as four weeks waiting for parts. This is due to the age of the vehicles and the obsolescence of parts.

As part of the strategic, master, and financial planning processes, an asset management strategy should be developed for equipment replacement. Just as outcomes for patient care in EMS should be reported, outcomes in repairs to vehicles should be tracked and operational costs determined. It may be cheaper to regularly lease-purchase vehicles and achieve the financial savings from lower operational costs to offset the lease charges. The added benefit of lower fuel usage as prices continue to rise could be substantial.

Care should be taken to not just blanket replace vehicles using an arbitrary standard but instead repair costs, down time, estimated improvements and deficiencies, together with hours used should determine the order of replacement. As equipment ages, it should be moved to stations that are utilizing the equipment at a lower rate, thereby preserving the value of the equipment and targeting busier stations with equipment in its prime condition.

The City may look at lease-purchase as an option to eliminate the risks of "lemons" being acquired. Lease purchase allows the department to regularly replace equipment while flattening out the spikes associated with major capital investments. Several communities are using reserve funds in utilities to finance purchases and repay with general funds allocated to the fire department but at a more attractive rate than currently paid by banks and other financial institutions.

A committee of council, administration, and department members should develop the specifications for equipment based upon the risk that will be managed should an incident occur. Standards for placement of equipment and design should be created and adhered to, ensuring interoperability.

G. Education and Training Programs

The city's tuition reimbursement program was recently discontinued, but did see several department members earn their degree. The department recently instituted a scheduled training program that coincides with its technical support stations.

The department should consider affiliating with local colleges and organizations (including employee groups) to identify the necessary competencies required for performing the job of firefighter, and in particular, command. ICMA has found in many departments that promotional opportunities are avoided by rank-and-file members who enjoy fixed hour working conditions with established schedules and no responsibility after a particular shift time. The opportunities for additional financial benefits as a firefighter often exceed what a salary will pay for taking a promotion.

The department conducts a great deal of training for its members. The one problem is that this training may not be focused on specific issues or outcomes. Members are given lots of knowledge but may not be able to become masters of the area for which the training is directed. An example of a lack of focus is the lack of a development process for administration. No succession process had taken place although one was in formation.

Command should be required to become credentialed through the Chief Fire Officer programs offered through the Center for Public Safety Excellence, Inc. These credentials are renewed on a regular basis and require annual education and training as well as community participation.

H. Communication and Emergency Management

The Dispatch and Emergency Management Director positions are held by the same person. In turn, the city and county have partnered to deliver the service which is logical given the locations of both.

The director stated that he has good support staff to assist in major emergencies; the city and county need to commit to always maintaining this capability. In every disaster "after action report", communications is usually the first thing to fail.

Likewise, if the city and department seek to move to using the IRMP process or some hybrid, data is critical to ensuring that quality is maintained and/or improved. The communication center is where the data begins and is ultimately captured. Rarely has ICMA found that data is accurate or being reported routinely to adjust deployment and upon which decisions are based. Instead, emotions or intuitiveness are injected which may or may not produce the desired outcome.

The economic downturn and financial challenges have resulted in more and more of the budget being dedicated to staff and less directed to capital investments. This creates a problem because equipment that helps in the communication center and that would be used in any disaster is short lived. Software and computer equipment do not lend themselves to long term service. Instead, software is almost continually being modified to rectify performance issues and hardware that is on 24/7 breaks down more frequently.

Using people to record information is also inefficient. Mobile Data Terminals, Automatic Vehicle Location devices, and other hardware allow information to be recorded with the touch of a button rather than a voice transmission. Information can be recorded by the human personnel and transmitted electronically which protects patient information as well as allows for additional sharing than would be possible only through voice. The use of technology saving on human resources is best shown by the mobile data terminals used for police processes. By automating the system, it allows a lower staffing level than would be required if the same work took place through voice transmission.

Several studies with which ICMA is familiar have found that the data accumulated regularly through the U.S. Fire Service is of dubious quality. The use of mobile data terminals and accurate response time criteria is critical to ongoing performance measurement and analysis of the Grand Island Fire Department.

Another available technology which would aid in the reduction of response times is automatic vehicle locators. These systems allow for the dispatch of the closest available emergency response unit as opposed to dispatch of a unit from one static fire station location. AVL's are also capable of recording speeds, brake temperatures, and whether warning devices are activated during response. AVL data can be critical in defending the city against allegations of impropriety. The AVL information showed that the allegations could not have occurred as stated by the patient and allowed the community to defend against such allegation.

An advantage of AVL when coupled with smart dispatch programs is that units are alerted that are closest to a scene. If company level inspections are occurring and units are out of the station performing actions in the community, just alerting the closest station may not be effective. The use of smart technology eliminates the guessing on which units are closest to a call and the programs can be loaded with responding units several levels deep. A good example of this technology was in Hilton Head Island, SC. Response times improved, particularly for EMS, because units were dispatched on the way from the hospital or other locations while returning to the station. In disaster management, as units are deployed, dispatch can be alleviated of one more function and concentrate on handling calls for service that will likely overwhelm 9-1-1.

Technology issues aside, the dispatch center does use the Medical Priority Dispatch System developed to provide the delivery of life-saving care through professionally trained emergency medical dispatchers. It is currently in use in over 2,300 agencies in the United States. It can also be a source of efficient system resource management by routing calls to an appropriate response entity when it is determined that it is non-emergent in nature. Moreover, it can reduce unnecessary lights and siren responses and ultimately reduce the risk of serious or injury or death to emergency response personnel as outlined in the Oklahoma EMS report (attached in Annex).

Recommendation: Consider purchase of mobile data terminals for all emergency response vehicles.

Recommendation: Consider purchase of an automatic vehicle locator system for communications center computer aided dispatch system.

Recommendation: Full implementation of Medical Priority Dispatch System in the Communications Center.

Emergency Management

The city and county share funding of the Emergency Management program. As identified earlier in this report, for the best result, all disciplines of both entities will be required to respond to an emergency or crisis.

The area is prone to flooding and is located in the area known as "tornado alley." History has shown that tornadoes are likely with the most recent touching down and destroying considerable property in the 1980's.

The area is a hub of railroad activity with materials that are being transported across the United States rolling through Grand Island. These materials are not always inert coal trains but also contain hazard materials. The community needs to ensure its all-hazard risk management plans and action statements are exercised and acknowledged.

The involvement of local elected officials is critical to the support of the emergency management function. Local elected officials need to know their role in an emergency and be prepared to function within that role. ICMA will be providing a program, "Crisis Leadership for Local Government Officials"

to assist in this process. Also critical is the monetary support for the program.

ICMA represents city and county managers and has found there is frequently friction between these entities. Counties were usually identified to allow citizens access to government through elections and service and were determined by how far horses could travel in a given time. Cities are chartered and acknowledged by action of the State government and encompass areas within counties. Cities normally incorporate because they desire or require additional services beyond what is offered by the county.

Another way to look at it is that counties deliver a baseline of service delivery. Cities, on the other hand, often want to reach a higher benchmark that serves its residents. An example of this approach is that counties deploy sheriff's deputies and elect sheriffs for policing. Cities often want a higher number of levels of service and create city police departments.

Emergency Management (and communications) should be approached in this method. A baseline of service that is adequate to meet the needs of all residents of Hall County should be created and funded. To enhance the service to provide for the higher urban density and population, the City contributions should be targeted to improving the ability either through capital investment or additional staff. If the City did not exist, the county would be required to provide communication and emergency management; it may not be as robust or comprehensive.

Using the same IRMP process and assigning cost based on risk and mitigation may be a better approach than the current 50-50 split. ICMA had an opportunity to sit in the emergency operations center and watch

preparation for an exercise and was impressed by the professionalism and capability that existed. However, as the infrastructure ages, the capacity for dealing with an emergency will be impacted.

The Department of Homeland Security has rewritten and is about to release a new guide for dealing with emergencies on a national basis under Presidential Policy Directive 8. It will guide response, mitigation, prevention, planning, and recovery. The directive is intended to galvanize action by the Federal Government, it is also aimed at facilitating an integrated, all-of-Nation, capabilities-based approach to preparedness.

Moving towards an IRMP process would position the city and all its departments with meeting the anticipated components of the new PPD-8. A copy of the draft, which is to be adopted by the end of April, is attached to this report.

Additional opportunities for funding of emergency management improvements, by integrating, include:

- Assistance to firefighters act grants
- COPS office
- U.S. Department of Transportation through the dial-a-ride bus system that serves the Grand Island area
- Housing and Urban Development
- Walmart Foundation
- Medtronic Foundation (AED's)

III. Data Analysis Sections

A. Introduction

The Grand Island Fire Department has three ambulances, two engines, one engine/ladder, and one engine/rescue fully staffed in four stations. Two ambulances are staffed on a full-time basis while one is staffed on a part-time basis. In addition, five ambulances, one engine, and one squad serve as backup units.

The data in this report cover all calls for service between September 1, 2010 and August 31, 2011. During this period, Grand Island's fire department received 4,515 fire and EMS calls. A total of 8,044 Grand Island units were dispatched to calls during this period. This number is higher than the total number of calls because multiple units often respond to calls. The total combined yearly workload (also called deployed time or busy time) for all units was 5,179 hours.

Lastly, the average total response time was 6.3 minutes for EMS category calls (MED4 and MED5) within the city limits and 7.2 minutes for fire category calls. For the first arriving units of 572 calls which are within the city limits and with unit dispatch time recorded since June 16, 2011, the average dispatch time for EMS calls is 2.2 minutes and the average dispatch time for fire category calls is 2.0 minutes. Dispatch and turnout time is the difference between the unit time en route and the call receipt time at the dispatch center. Travel time is the difference between the unit on-scene arrival time and the unit time en route. Response time is the difference between the unit on-scene arrival time and call received time. Please note that the data in the tables (e.g., percentages or daily average statistics)

may not add up to expected totals due to rounding. Additional details can be found in the response time section of this report.

B. Aggregate Call Totals and Dispatches

During the year studied, the City of Grand Island's Fire Department received 4,515 calls. Of these, 58 were structure fire and 124 were outside fire calls. There were 3,823 emergency medical service (EMS) calls. We categorized the calls based on the nature of call recorded in the CAD system and presented the correspondence table in Appendix I.

Table 1. Call Types

Call Type	Number of Calls	Calls per Day	Call Percentage
EMS	**3,823**	**10.5**	**84.7**
Structure Fire	58	0.2	1.3
Outside Fire	124	0.3	2.7
Hazard	186	0.5	4.1
Alarm	234	0.6	5.2
Public Service	90	0.2	2.0
Fire Total	**692**	**1.9**	**15.3**
Total	**4,515**	**12.4**	**100**

Observations:

- The department received 12.4 calls per day.
- EMS calls for the year totaled 3,823 (85 percent of all calls), or about 10.5 per day.
- Fire category calls for the year totaled 692 (15 percent of all calls), or about 1.9 per day.
- Calls for structure and outside fires combined averaged 0.5 calls per day, which accounted for 4 percent of the total calls received.

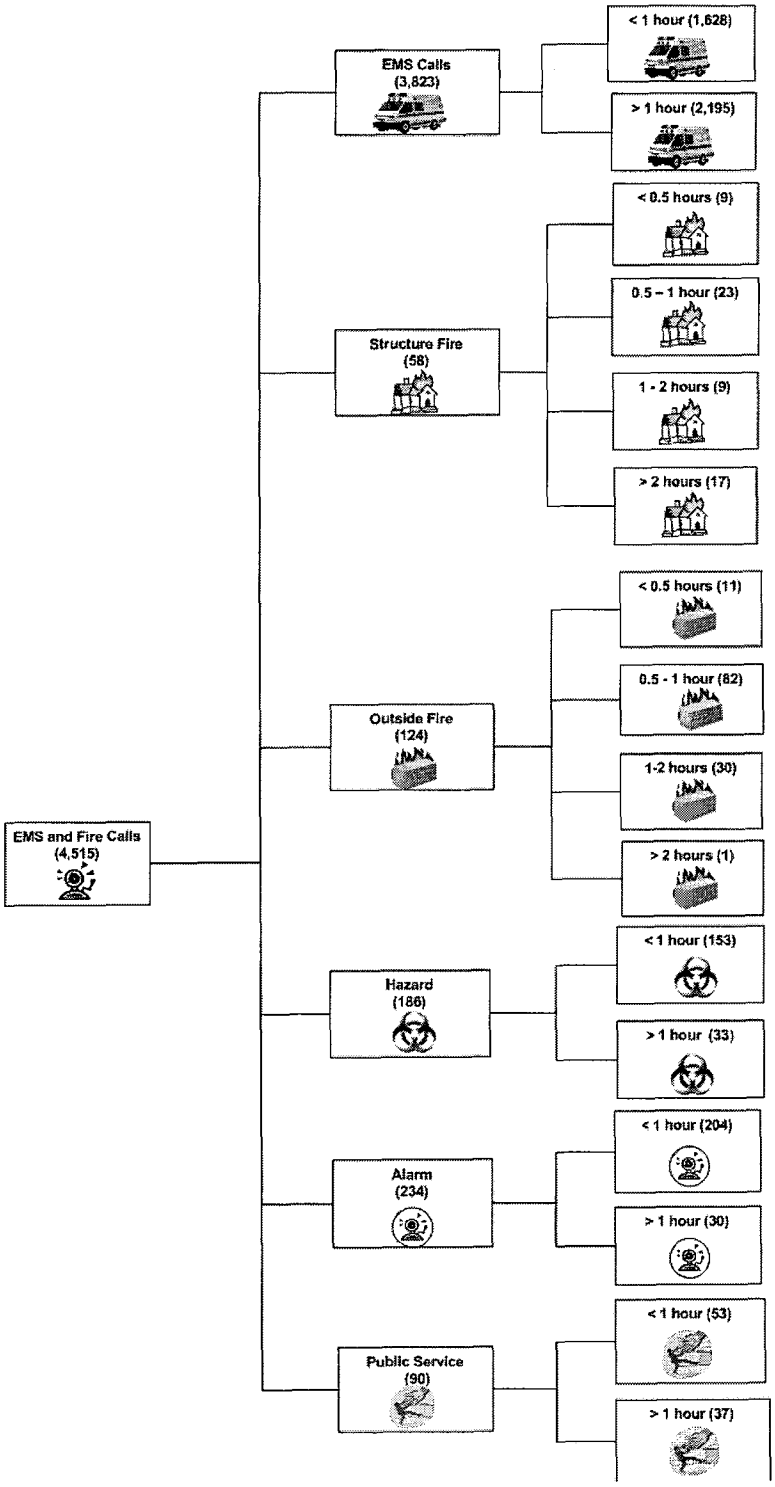
Table 2. Call Types by City Limit

Call Type	Number of Calls	
	City	Outside City
EMS	**3,470**	**353**
Structure Fire	58	0
Outside Fire	124	0
Hazard	186	0
Alarm	234	0
Public Service	90	0
Fire Total	**692**	**0**
Total	**4,162**	**353**
Calls per Day	**11.4**	**1.0**
Percentage	**92.2%**	**7.8%**

Observations:

- The department received 11.4 calls per day within city limit, which accounted for 92 percent of the total calls.
- The department responded to 353 EMS calls outside city, averaging 1 call per day.

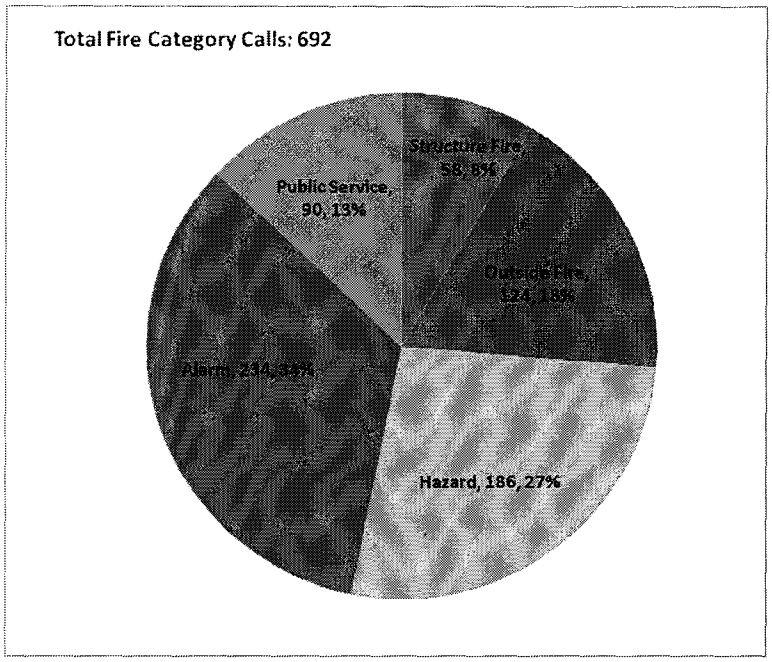
Figure 1. Calls by Type and Duration



Observations:

- A total of 1,628 EMS calls (43 percent) lasted less than one hour, 2,128 EMS calls (56 percent) lasted between one and two hours, and 67 EMS calls lasted more than two hours. On average, there were 6.0 EMS calls per day that lasted more than an hour.
- Of the 58 structure fire calls, 32 (55 percent) lasted less than one hour, 9 (16 percent) lasted between one and two hours, and 17 (29 percent) lasted more than two hours.
- Of the 124 outside fire calls during the year, 93 (75 percent) lasted less than one hour, 30 (24 percent) lasted between one and two hours, and 1 (1 percent) lasted more than two hours.
- A total of 153 hazardous condition calls (82 percent) lasted less than one hour, 33 hazardous conditions calls (18 percent) lasted more than one hour.
- A total of 204 alarm calls (87 percent) lasted less than one hour, 30 alarm calls (13 percent) lasted more than one hour.
- A total of 53 public service calls (59 percent) lasted less than one hour, 37 public service calls (41 percent) lasted more than one hour.

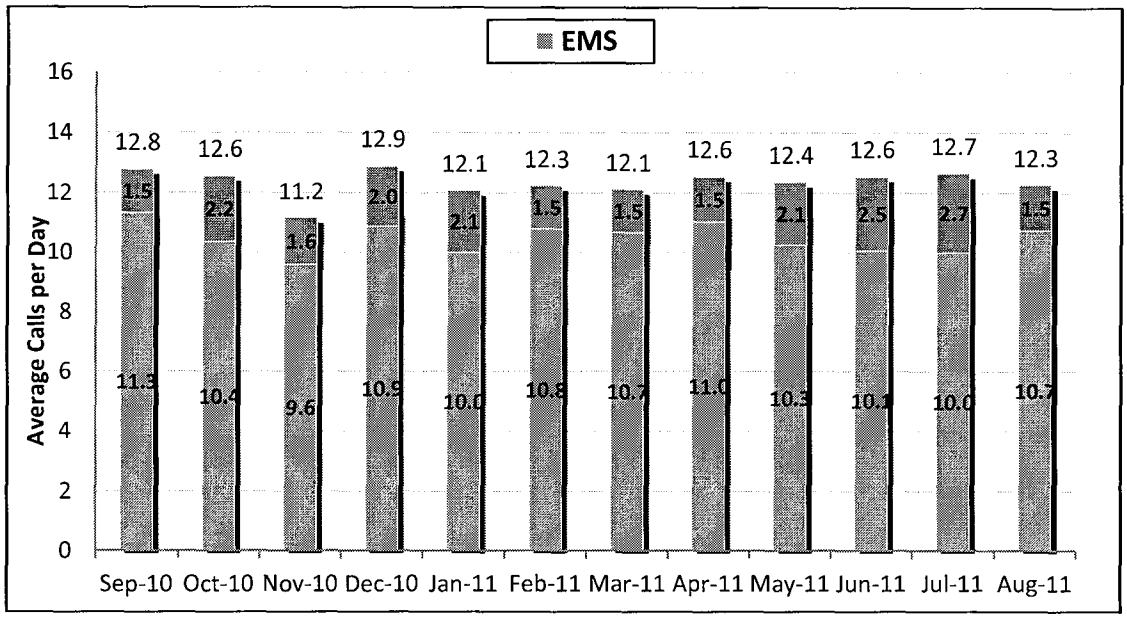
Figure 2. Fire Calls by Type



Observations:

- A total of 58 structure fire accounted for 8 percent of the fire category total.
- A total of 124 outside fire calls accounted for 18 percent of the fire category total.
- Alarm calls were 34 percent of fire category calls.
- Public service calls were 13 percent of the fire category total.
- Hazardous condition calls were 27 percent of the fire category total.

Figure 3. Average Calls per Day by Month



Observations:

- Average calls per day ranged from a low of 11.2 calls per day in November 2010 to a high of 12.9 calls per day in December 2010. The highest monthly average was 15 percent greater than the lowest monthly average.
- Average EMS calls per day varied from a low of 9.6 calls per day in November 2010 to a high of 11.3 calls per day in September 2010.
- Average fire category calls per day varied from a low of 1.5 to a high of 2.7 calls per day (lowest in September 2010 and February, March, April and August 2011, highest in July 2011).
- On June 30th, 2011, a total of 23 calls including 18 EMS calls, 5 fire category calls were received, which is the highest number of calls received in a single day.

Figure 4. Calls by Hour of Day

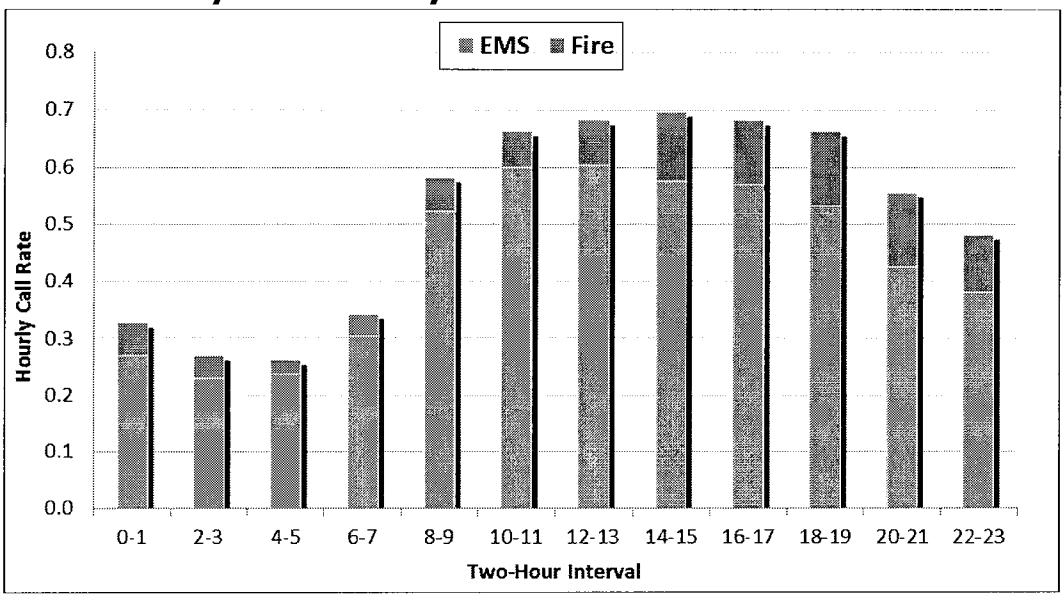


Table 3. Calls by Hour of Day

Two-Hour Interval	Hourly Call Rate		
	EMS	Fire	Total
0-1	0.27	0.06	0.33
2-3	0.23	0.04	0.27
4-5	0.24	0.02	0.26
6-7	0.30	0.04	0.34
8-9	0.52	0.06	0.58
10-11	0.60	0.06	0.66
12-13	0.60	0.08	0.68
14-15	0.58	0.12	0.69
16-17	0.57	0.11	0.68
18-19	0.53	0.13	0.66
20-21	0.42	0.13	0.55
22-23	0.38	0.10	0.48
Calls per Day	**10.47**	**1.90**	**12.37**

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

Observations:

- Hourly call rates were highest between 8 a.m. and 10 p.m., averaging between 0.55 calls and 0.69 calls per hour.
- Call rates were lowest between midnight and 8 a.m., averaging less than 0.34 calls per hour during each hour.

Figure 5. Number of Units Dispatched to Calls

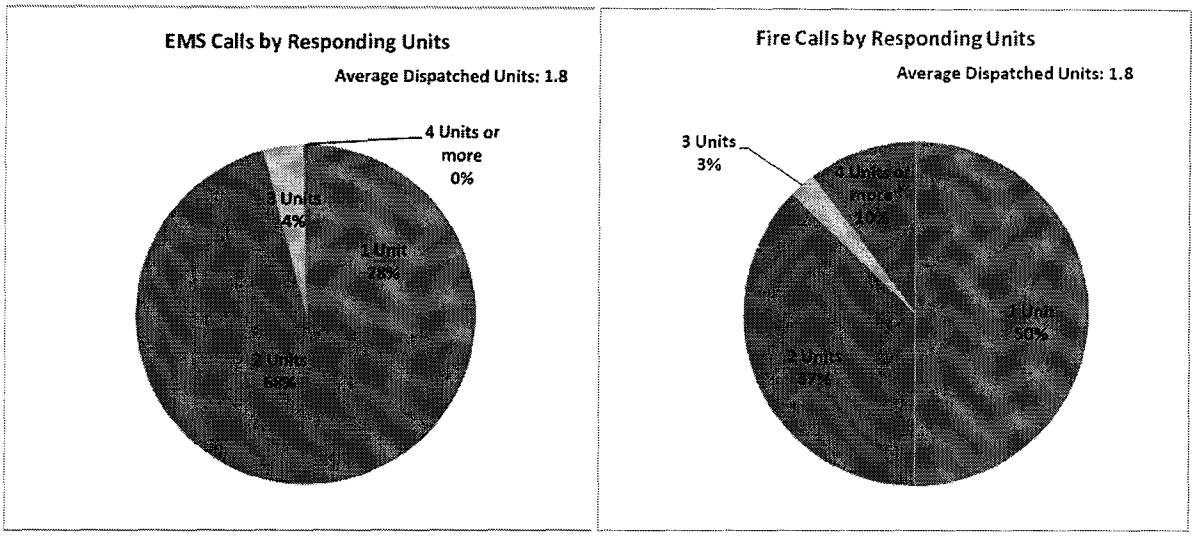


Table 4. Number of Units Dispatched to Calls

Call Type	Unit				
	One	Two	Three	Four or more	Total
EMS	**1,063**	**2,601**	**147**	**12**	**3,823**
Structure Fire	5	1	1	51	58
Outside Fire	89	20	6	9	124
Hazard	141	34	2	9	186
Alarm	58	170	4	2	234
Public Service	53	33	4		90
Fire Total	**346**	**258**	**17**	**71**	**692**
Grand Total	**1,409**	**2,859**	**164**	**83**	**4,515**
Percentage	**31.2**	**63.3**	**3.6**	**1.8**	**100.0**

Observations:

- Overall, four or more units were dispatched to 2 percent of calls.
- On average, 1.8 units were dispatched per fire category call.
- For fire category calls, one unit was dispatched 50 percent of the time, two units were dispatched 37 percent of the time, three units were dispatched 2 percent of the time, and four or more units were dispatched 10 percent of the time.
- For structure fire calls, four or more units were dispatched 88 percent of the time.

- For outside fire calls, one unit was dispatched 72 percent of the time.
- On average, 1.8 units were dispatched per EMS call.
- For EMS calls, one unit was dispatched 28 percent of the time, two units were dispatched 68 percent of the time and three units or more were dispatched 4 percent of the time.
- A total of 83 calls (2 percent) EMS category calls had no ambulance dispatched. For 3,161 (83 percent) EMS category calls, one ambulance unit was dispatched to the same call. For 549 (14 percent) EMS category calls, two ambulances were dispatched to the same call. Three ambulances were dispatched to the same call thirty times (1 percent) in a year.

Table 5. Annual Deployed Time by Call Type

Call Type	Average Busy Minutes per Run	Annual Busy Hours	Percent of Busy Hours	Busy Minutes per Day	Number of Runs	Runs per Day
EMS	**39.5**	**4,460**	**86.1%**	**733**	**6,778**	**18.6**
Structure Fire	73.7	330	6.4%	54	269	0.7
Outside Fire	25.3	80	1.6%	13	191	0.5
Hazard	24.8	105	2.0%	17	255	0.7
Alarm	17.1	119	2.3%	20	420	1.2
Public Service	38.6	84	1.6%	14	131	0.4
Fire Total	**34.1**	**720**	**13.9%**	**118**	**1,266**	**3.5**
Total	**38.6**	**5,179**	**100.0%**	**851**	**8,044**	**22.0**

Observations:

- Total deployed time for the year, or total busy hours, was 5,179 hours. This is the total deployment time of all the units that were deployed on any type of call.
- There were a total of 8,044 runs, averaging 22 runs per day.
- Fire category calls accounted for 14 percent of the total workload.
- There were a total of 460 runs for structure and outside fire calls, with a total workload of 410 hours. This accounted for 8 percent of the total workload. The average busy time for structure fire calls was 73.7 minutes, and the average busy time for outside fire calls was 25.3 minutes.
- EMS calls accounted for 86 percent of the total workload. The average busy time for EMS category calls was 39.5 minutes.

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

Here we look at the actual time spent by each unit on every call. We report two types of statistics: workloads and runs. After the introductory table, we present run data and workload data for every unit, as well as the daily average for engine and ambulance units.

Table 6. Call Workload by Unit and Station

Station	Unit Type	Unit ID	Average Busy Minutes per Run	Number of Runs	Runs per Day	Busy Minutes per Day	Annual Busy Hours
1	Ambulance	A1	54.2	1,731	4.7	257.0	1,563
	Engine/Ladder	E1/L1	27.4	971	2.7	73.0	444
2	Ambulance	A2	46.6	2,152	5.9	271.1	1,649
	Engine	E2	24.5	1,421	3.9	95.4	580
	Rescue	R2	1411.3	1	0.0	3.9	24
3	Ambulance	A3	174.0	30	0.1	14.3	87
	Engine/Rescue	E3/R3	29.5	770	2.1	62.1	378
4	Ambulance	A4	55.2	96	0.3	14.5	88
	Engine	E4	25.2	872	2.4	60.2	366

Note: Workload of A11 and A12 were counted as A1. Workload of A22 and A23 were counted as A2. Workload of E22 was counted as E2. Workload of E42 and E44 was counted as E4. Workload of L2 was counted as L1. Workload of R31 was counted as R3.

Observations:

- Ambulance unit A1 made 1,729 runs in a year, averaging 4.7 runs and 4 hours and 17 minutes of busy time per day.
- Ambulance unit A2 made 2,154 runs in a year, averaging 5.9 runs and 4 hours and 35 minutes of busy time per day.
- Ambulance A3 made 30 runs and was busy 87 hours in a year.
- Ambulance unit A4 made 96 runs and was busy 88 hours in a year.
- Engine E1 and ladder truck L1 were cross staffed and they made 971 runs, averaging 2.7 runs and 1 hour and 13 minutes of busy time per day.
- Engine E2 made 1,421 runs, averaging 3.9 runs and 96 minutes of busy time per day.

Figure 6. Busy Minutes by Hour of Day

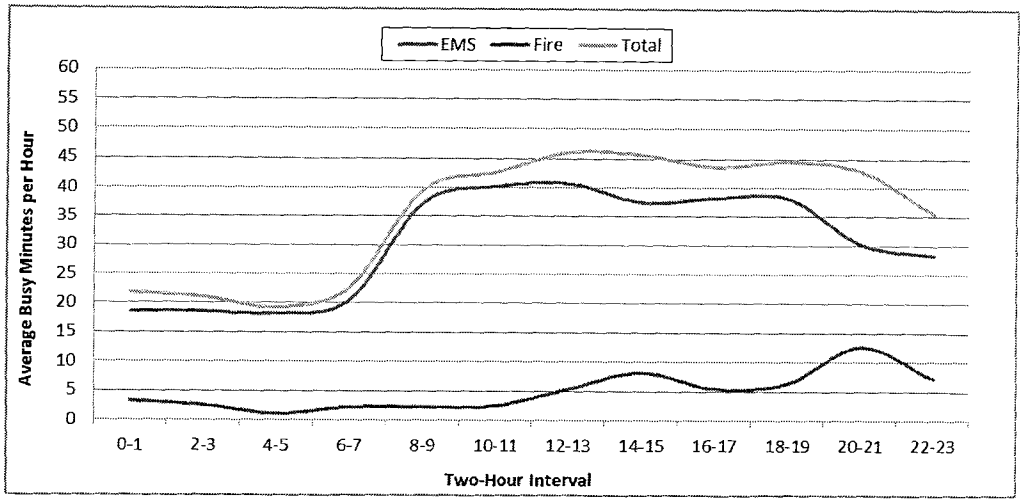


Table 7. Busy Minutes by Hour of Day

Two-Hour Interval	EMS	Fire	Total
0-1	18.6	3.3	21.9
2-3	18.6	2.6	21.1
4-5	18.2	1.1	19.3
6-7	20.6	2.2	22.8
8-9	37.3	2.3	39.6
10-11	40.2	2.5	42.7
12-13	40.7	5.4	46.1
14-15	37.5	8.2	45.6
16-17	38.2	5.4	43.6
18-19	38.1	6.4	44.5
20-21	30.3	12.6	42.9
22-23	28.3	7.2	35.5
Daily Total	**733.1**	**118.3**	**851.4**

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

Observations:

- Hourly busy minutes were the highest between 10 a.m. and 10 p.m., averaging between 42.7 and 46.1 minutes per hour.
- Hourly busy minutes were the lowest between midnight and 8 a.m., averaging fewer than 22.8 minutes per hour.

Table 8. Total Annual Number and Daily Average Number of Runs by Call Type and Unit

Unit	EMS	Structure Fire	Outside Fire	Hazard	Alarm	Public Service	Total	Runs per Day
A1	1,651	**32**	**6**	6	2	34	**1,731**	**4.7**
A2	2,074	**23**	**8**	4	3	40	**2,152**	**5.9**
A3	30	**0**	**0**	0	0	0	**30**	**0.1**
A4	96	**0**	**0**	0	0	0	**96**	**0.3**
E1/L1	697	**56**	**48**	65	86	19	**971**	**2.7**
E2	1,094	**57**	**44**	84	124	18	**1,421**	**3.9**
E3/R3	534	**51**	**40**	48	87	10	**770**	**2.1**
E4	602	**49**	**45**	48	118	10	**872**	**2.4**
R2	**0**	**1**	**0**	0	0	0	**1**	**0.0**

Observations:

- Ambulance unit A2 was dispatched the most often. It made 2,152 runs during the year, and averaging 5.9 runs per day.
- Ambulance units A1 made 1,731 runs in a year, averaging 4.7 runs per day.
- Ambulance units A3 and A4 combined made 126 runs in a year and all calls were EMS calls.
- Engines E1 and ladder L1 combined made 971 runs in a year, averaging 2.7 runs per day. Actual fire runs occur twice every week.
- Engine E2 made 1,421 runs during the year, averaging 3.9 runs per day. Actual fire runs occurred 101 times in a year.
- E3 and rescue R3 were dispatched 770 times in a year, averaging 2.1 runs per day. Actual fire calls occurred 91 times in a year.
- E4 was dispatched 872 times in a year, averaging 2.4 runs per day. Actual fire calls occurred 94 times in a year.

Table 9. Daily Average Deployed Minutes by Call Type and Unit

Unit	EMS	Structure Fire	Outside Fire	Hazard	Alarm	Public Service	Total	Fire Category Calls Percentage
A1	245.7	**6.1**	**0.2**	0.4	0.1	4.4	**257.0**	**4.4**
A2	260.6	**4.3**	**0.4**	0.5	0.2	5.1	**271.1**	**3.9**
A3	14.3	**0.0**	**0.0**	0.0	0.0	0.0	**14.3**	**0.0**
A4	14.5	**0.0**	**0.0**	0.0	0.0	0.0	**14.5**	**0.0**
E1/L1	47.6	**10.9**	**3.2**	5.0	4.6	1.6	**73.0**	**34.8**
E2	67.7	**13.0**	**2.9**	5.0	5.6	1.3	**95.4**	**29.0**
E3/R3	41.3	**9.1**	**3.2**	3.4	4.5	0.7	**62.1**	**33.5**
E4	41.3	**6.9**	**3.4**	3.1	4.7	0.6	**60.2**	**31.4**
R2	0.0	**3.9**	**0.0**	0.0	0.0	0.0	**3.9**	**100.0**

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

Observations:

- On average, the busiest ambulance A2 was busy 4 hours and 31 minutes per day. EMS calls accounted for 96 percent of its daily workload.
- On average, ambulance A1 was busy 4 hours and 17 minutes per day. EMS calls accounted for 96 percent of its daily workload.
- On average, ambulance units A3 and A4 combined were busy 29 minutes per day.
- Engine unit E1 and ladder truck L1 were cross staffed. They combined were busy 1 hour and 13 minutes per day. For structure and outside fire calls, they averaged 14 minutes per day.
- On average, engine E2 was busy 1 hours and 35 minutes per day. Fire category calls accounted for 29 percent of its daily workload. The unit spent 16 minutes per day fighting structure and outside fires.
- Engine unit E3 and rescue unit R3 were cross staffed. They combined were busy 1 hour and 2 minutes per day. For structure and outside fire calls, they averaged 12 minutes per day.
- On average, engine E4 was busy 1 hour per day. Fire category calls accounted for 31 percent of its daily workload.

Table 10. Fire Equipment: Annual Busy Time by Number of Busy Units

Number of Busy Units	Annual Minutes	Annual Hours	Percent of Time
Zero	455,305	7,588	86.6
One	60,313	1,005	11.5
Two	7,363	123	1.4
Three	2,619	44	0.5
Four	533	9	0.1
Five	0	0	0.0
Total	525,600	8,760	100.0

Observations:

- On average, two or more engines and/or a ladder truck are simultaneously involved at calls for one hour every 2.1 days or 50 hours.
- On average, three or more engines and/or a ladder truck are simultaneously involved at calls for one hour every 6.9 days or 167 hours.
- On average, two or more units are simultaneously involved at calls for 29 minutes per day.
- On average, three or more units are simultaneously involved at calls for 9 minutes per day.

Table 11. Ambulance Units: Annual Busy Time by Number of Busy Units

Number of Busy Units	Annual Minutes	Annual Hours	Percent of Time
Zero	355,330	5,922	67.6
One	127,477	2,125	24.3
Two	34,051	568	6.5
Three	7,464	124	1.4
Four	1,278	21	0.2
Total	525,600	8,760	100.0

Observations:

- On average, two or more medical (ambulances or rescue) units are simultaneously involved at calls for one hour every 12.2 hours.
- On average, three or more medical (ambulances or rescue) units are simultaneously involved at calls for one hour every 2.4 days or 59 hours.
- On average, two or more medical (ambulance or rescue) units are simultaneously involved at calls for 2.0 hours per day.
- On average, three or more medical (ambulance or rescue) are simultaneously involved at calls for 0.4 hours per day.

D. Analysis of Busiest Hours in a Year

There is significant variability in the number of calls from hour to hour. One special concern relates to the fire resources available for hours with the heaviest workload. We tabulated the data for each of 8,760 hours in the year. Approximately once every two days the fire department responded to three or more calls in an hour. This is 2 percent of the total number of hours. Here, we report the top ten hours with the most calls received and provide a detailed analysis of two of them.

Table 12. Frequency Distribution of the Number of Calls

Number of Calls in an Hour	Frequency	Percentage
0	5,316	60.7
1	2,571	29.3
2	708	8.1
3	138	1.6
4	21	0.2
5	6	0.1

Observations:

- During 873 hours (10 percent of all hours) in the year, two or more calls occurred.
- In other words, approximately once every ten hours the fire department will respond to two or more calls in an hour.
- During 165 hours (2 percent of all hours) in the year, three or more calls occurred.
- In other words, approximately once every 2.2 days the fire department will respond to three or more calls in an hour.

Table 13. Top 10 Hours with the Most Calls Received

Hour	Number of Calls	Number of Runs	Total Busy Minutes
09/15/2010, 04 p.m. to 05 p.m.	5	13	375
04/06/2011, 07 p.m. to 08 p.m.	5	12	232
05/21/2011, 07 p.m. to 08 p.m.	5	10	446
06/30/2011, 04 p.m. to 05 p.m.	5	9	336
01/29/2011, 10 p.m. to 11 p.m.	5	8	469
11/14/2010, 08 p.m. to 09 p.m.	5	8	273
12/16/2010, 02 p.m. to 03 p.m.	4	9	312
07/28/2011, 04 p.m. to 05 p.m.	4	8	319
01/29/2011, 08 a.m. to 09 a.m.	4	8	291
05/01/2011, 09 a.m. to 10 a.m.	4	8	275

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

Observations:

- The hour with the most calls received was between 4 p.m. and 5 p.m. on September 15, 2010. The five calls involved thirteen runs. The combined workload was six hours and fifteen minutes. The five calls were all EMS calls. The longest call were responded by four units and lasted 59 minutes.
- The hour with the second largest busy minutes was between 7 p.m. and 8 p.m. on May 21, 2011. The five calls involved ten runs. The combined workload was seven hours and twenty-six minutes. The five calls include two EMS calls, one structure fire call, one hazard call and one alarm call. The longest call was the structure fire call, which involved five units including three engines, one ambulance and one rescue unit. For the structure fire call, both E1 and A1 were busy for one hour and forty-six minutes and were the longest on-scene units. An EMS calls were responded by two units and the other three calls were responded by one unit.

Table 14. Unit Workload Analysis Between 4 p.m. and 5 p.m. on September 15, 2010

Hour	Station	1			2		3		4		Number of Busy Units
	Type	Ambulance	Engine	Ladder	Ambulance	Engine	Engine	Rescue	Ambulance	Engine	
	Unit	A1	E1	L1	A2	E2	E3	R3	A4	E4	
9/15/2010 4 p.m. to 5 p.m.	0-5										2
	5-10										2
	10-15	0.2								0.2	4
	15-20										4
	20-25										4
	25-30										5
	30-35										5
	35-40										6
	40-45								0.8		6
	45-50										4
	50-55										4
	55-60									1.6	4
	Total										

Note: The numbers in the cells are the busy minutes within the 5 minute block. The cell values greater than 2.5 are coded as red.

Observations:

- A total of five EMS calls involved thirteen runs. The longest EMS call lasted 59 minutes.
- During the worst twenty minutes in the hour (4:35 p.m. to 4:45 p.m.), six units were simultaneously busy including three ambulances, one rescue unit and two engines. A total of five units were busy for more than thirty minutes in an hour.

Table 15. Unit Workload Analysis Between 7 p.m. and 8 p.m. on May 21, 2011

Hour	Station	1			2		3		4		Number of Busy Units
	Type	Ambulance	Engine	Ladder	Ambulance	Engine	Engine	Rescue	Ambulance	Engine	
	Unit	A1	E1	L1	A2	E2	E3	R3	A4	E4	
5/21/2011 7 p.m. to 8 p.m.	0-5										0
	5-10			0.1							1
	10-15										1
	15-20			0.6							1
	20-25										0
	25-30										5
	30-35										5
	35-40										6
	40-45										6
	45-50										6
	50-55										6
	55-60										6
	Total										

Note: The numbers in the cells are the busy minutes within the 5 minute block. The cell values greater than 2.5 are coded as red.

Observations:

- A total of five calls including two EMS calls, one structure fire call, one hazardous condition call and one alarm call occurred in the hour. The longest call was the structure fire call occurred in the city zone GI1, which involved five units and lasted one hour and forty-six minutes. The rest of four calls were responded by one or two units.
- During the worst thirty minutes in the hour (7:35 p.m. to 8:00 p.m.), six units were simultaneously busy including three engines, two ambulances and one rescue unit. A total of five units were busy for more than thirty minutes in an hour.

E. Dispatch Time and Response Time

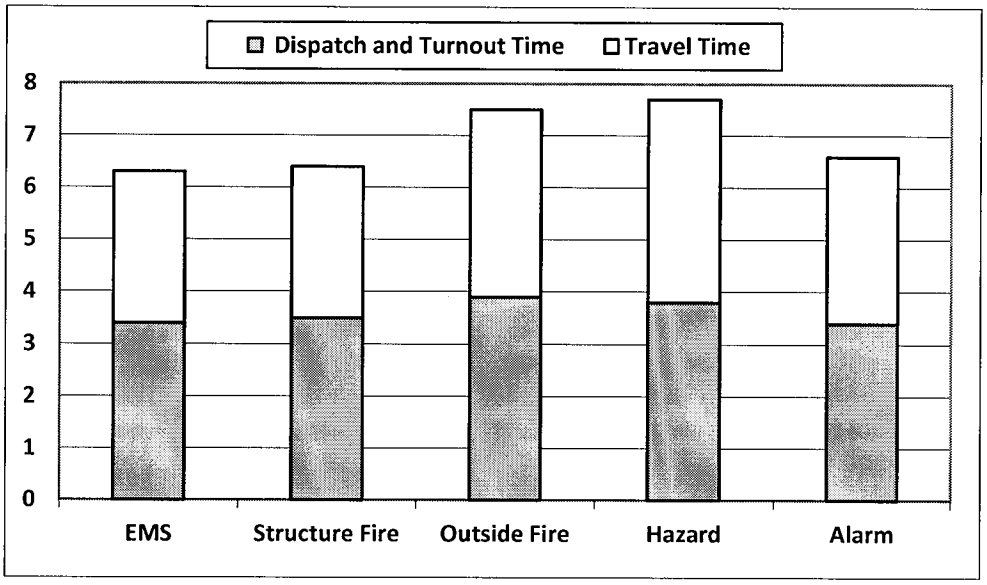
In this section we present dispatch and response time statistics for different call types and fire units. For most types of calls, we are interested mainly in the dispatch time and response time of the first arriving units. However, for structure and outside fire calls, we analyze the response time of the first and the second arriving fire vehicles (no ambulance units). We use different terms to describe the components of response time. Dispatch and turnout time is the difference between the unit time en route and the call receipt time at the dispatch center. The earliest dispatch time recorded is on June 16, 2011. Since for the majority of calls, there were no unit dispatch time recorded and thus we decide to report dispatch and turnout time together. Travel time is the difference between the unit on-scene arrival time and the unit time en route. Response time is the difference between the unit on-scene arrival time and call received time.

In this section, we only report EMS calls (MED4 and MED5) within city limit, which are responded with siren and lights, and fire category calls within city limit. Public service calls were not emergent in nature and thus not included in the analysis. A total of 2,188 EMS and 572 fire category calls were used in analysis. The average dispatch and turnout time is 3.4 minutes, and the average travel time is 3.1 minutes. The average response time for EMS calls is 6.3 minutes and the average response time for fire category calls is 7.2 minutes.

Table 16. Average Dispatch and Turnout, Travel, and Response Time of First Arriving Unit by Call Type

Call Type	Dispatch and Turnout Time	Travel Time	Response Time	90th Percentile Response Time	Sample Size
EMS	**3.4**	**2.9**	**6.3**	**8.5**	**2,188**
Structure Fire	3.5	2.9	6.7	10.0	54
Outside Fire	3.9	3.6	7.5	10.2	117
Hazard	3.8	3.9	7.9	11.5	177
Alarm	3.4	3.2	6.6	8.8	224
Fire Total	**3.6**	**3.5**	**7.2**	**10.1**	**572**
Total	**3.4**	**3.1**	**6.5**	**8.9**	**2,760**

Figure 7. Average Dispatch and Turnout, and Travel Time of First Arriving Unit by Call Type



Observations:

- The average dispatch and turnout time was 3.4 minutes.
- The average travel time was 3.1 minutes.
- The average response time for EMS calls was 6.3 minutes and the 90th percentile response time was 8.5 minutes.
- The average response time for fire category calls was 7.2 minutes and the 90th percentile response time was 10.1 minutes.

- The average response time for structure fire calls were 6.7 minutes, and the 90th percentile response time was 10.0 minutes.
- The average response time for outside fire calls were 7.5 minutes, and the 90th percentile response time was 10.2 minutes.
- For the first arriving units of 572 calls with unit dispatch time recorded since June 16, 2011, the average dispatch time for EMS calls is 2.2 minutes and the average dispatch time for fire category calls is 2.0 minutes.

Figure 8. Average Dispatch and Turnout, Travel, and Response Time of First Arriving Unit by Hour of Day

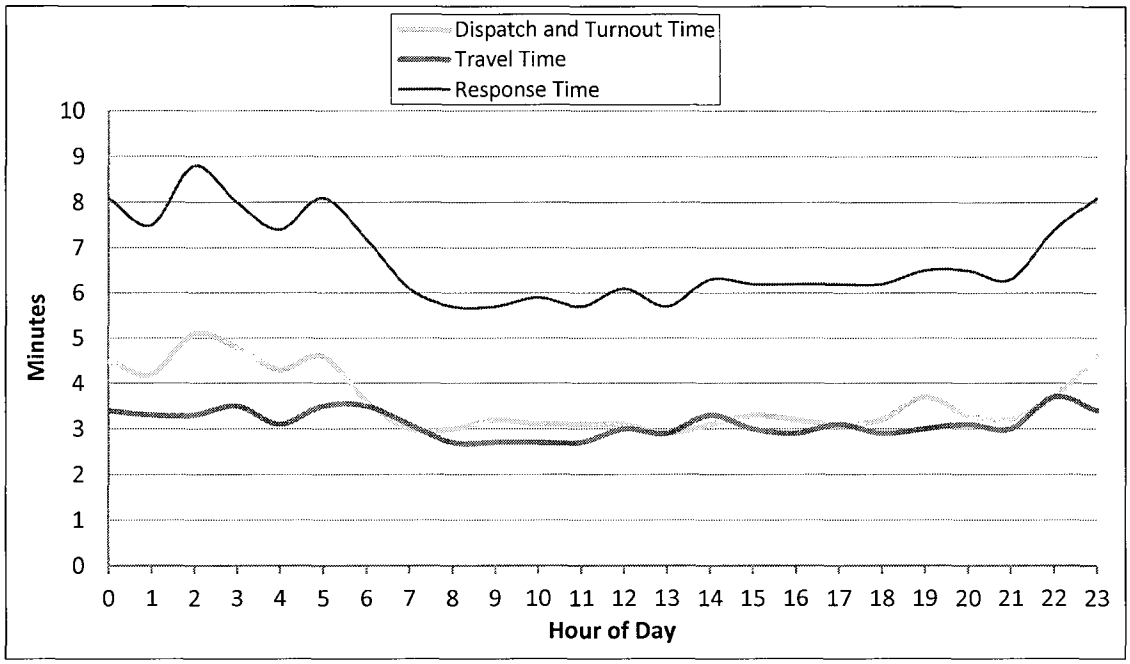


Table 17. Average Dispatch and Turnout, Travel, and Response Time of First Arriving Unit by Hour of Day

Hour	Dispatch and Turnout Time	Travel Time	Response Time	Sample Size
0	4.5	3.4	8.1	65
1	4.2	3.3	7.5	57
2	5.1	3.3	8.8	56
3	4.8	3.5	8.0	58
4	4.3	3.1	7.4	45
5	4.6	3.5	8.1	60
6	3.6	3.5	7.2	67
7	3.0	3.1	6.1	80
8	3.0	2.7	5.7	114
9	3.2	2.7	5.7	143
10	3.1	2.7	5.9	157
11	3.1	2.7	5.7	146
12	3.1	3.0	6.1	145
13	2.9	2.9	5.7	150
14	3.1	3.3	6.3	151
15	3.3	3.0	6.2	179
16	3.2	2.9	6.2	149
17	3.1	3.1	6.2	147
18	3.2	2.9	6.2	170
19	3.7	3.0	6.5	147
20	3.3	3.1	6.5	133
21	3.2	3.0	6.3	130
22	3.7	3.7	7.4	113
23	4.6	3.4	8.1	98
Total	3.4	3.1	6.5	2,760

Observations:

- Average dispatch and turnout time was between 2.9 and 5.1 minutes. Between 11 p.m. and next day 6 a.m., the average dispatch and turnout time were consistently more than 4.2 minutes.
- Average travel time was between 2.7 and 3.7 minutes.
- Average response time was between 5.7 and 8.8 minutes. Between 11 p.m. and next day 6 a.m., the average response time was consistently more than 7.4 minutes.

Figure 9. Number of Total Calls by First Arriving Unit

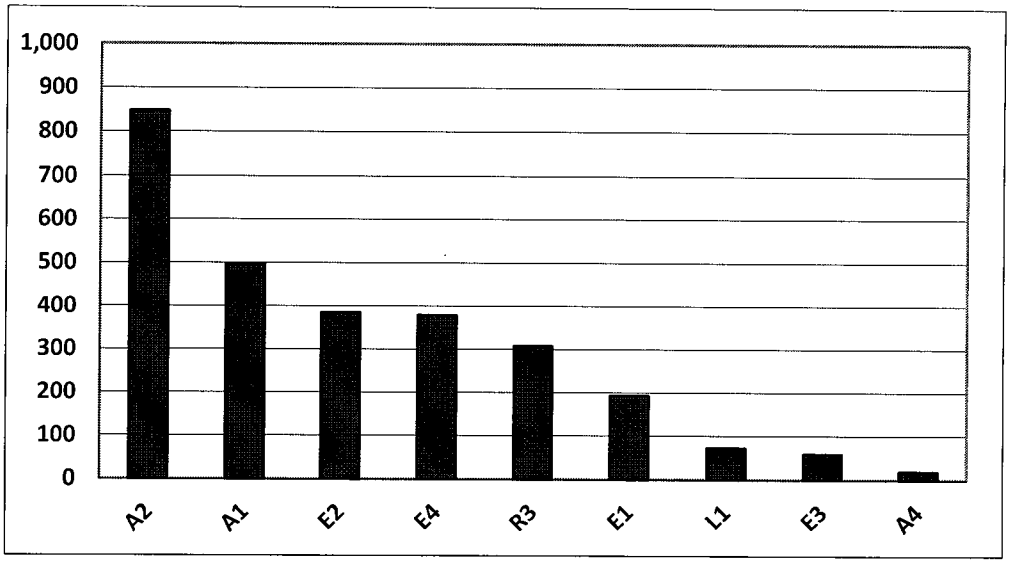


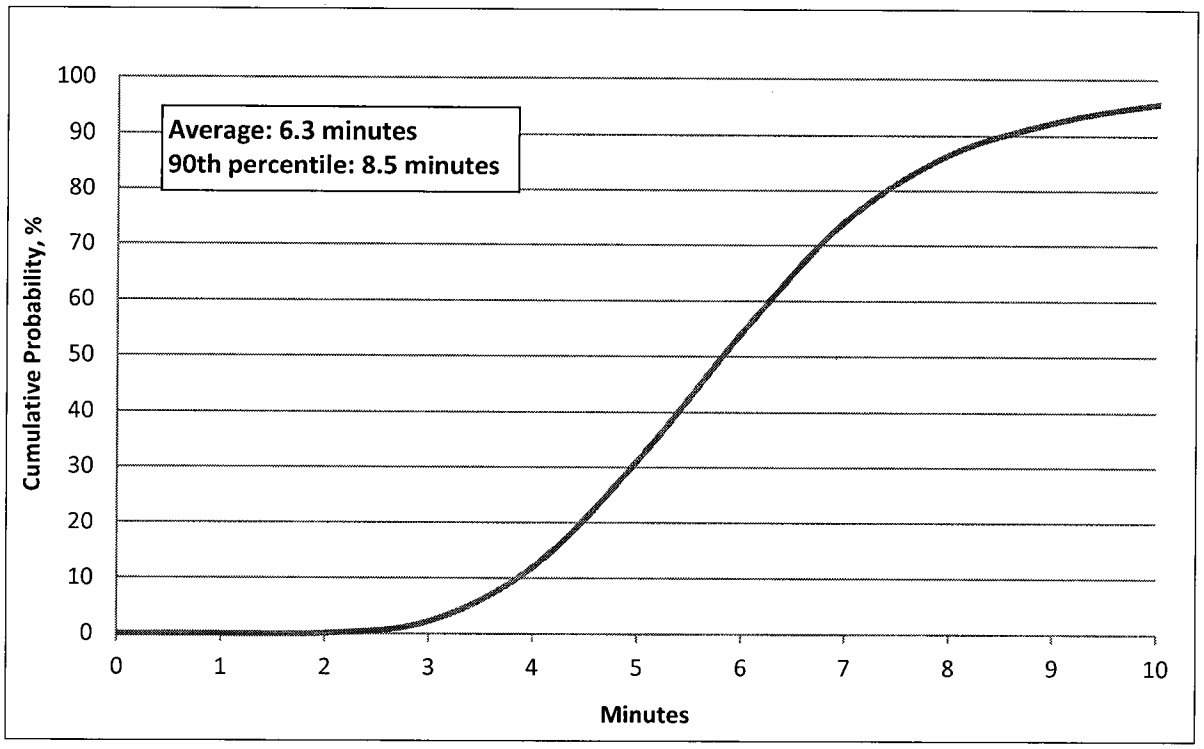
Table 18. Number of Total Calls, by First Arriving Unit

Unit	EMS	Structure and Outside Fire	Fire Other	Total	Percentage	Cumulative Percentage
A2	838	7	2	847	30.7	30.7
A1	488	8	2	498	18.0	48.7
E2	198	47	140	385	13.9	62.7
E4	264	34	81	379	13.7	76.4
R3	275	7	25	307	11.1	87.5
E1	94	38	61	193	7.0	94.5
L1	8	12	52	72	2.6	97.1
E3	2	18	38	58	2.1	99.2
A4	18	0	0	18	0.7	99.9
R1	3	0	0	3	0.1	100.0

Observations:

- Ambulance A2 arrived first on scene most often, followed by ambulance A1, engine E2, engine E4, and rescue truck R3. The top five first arriving units accounted for 88 percent of the first arrivals at calls.
- For structure and outside fire calls, engines E2, E1 and E4 were the first unit on scene most often.

Figure 10. 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 8.5 minutes. This means that units had a response time of less than 8.6 minutes for 90 percent of these calls.

Figure 11. Frequency Distribution Chart of Response Time of First Arriving Unit for EMS Calls

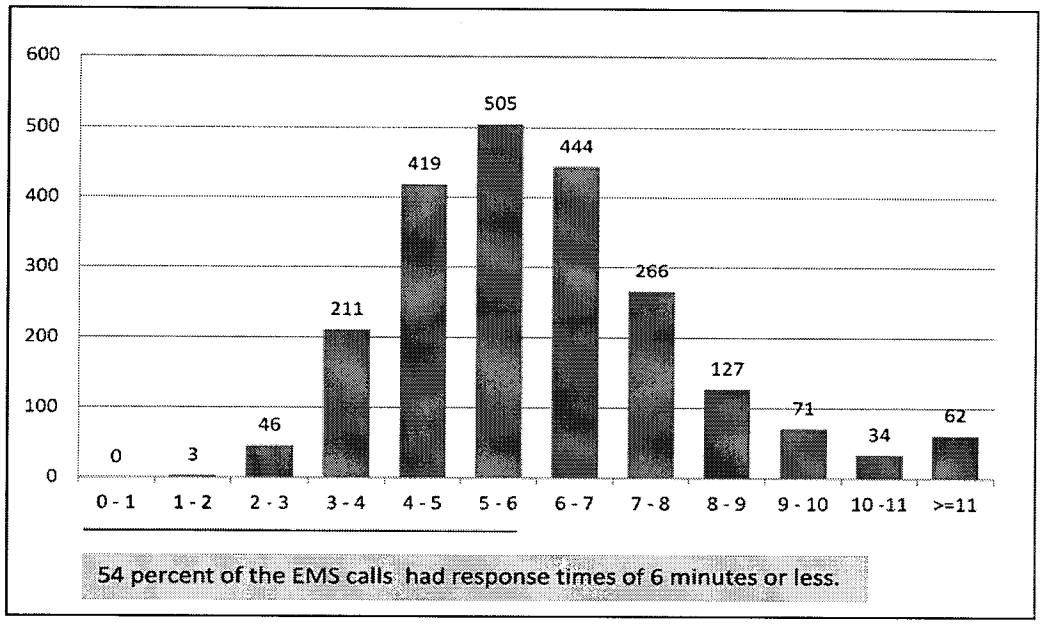


Table 19. Cumulative Distribution Function (CDF) of Response Time of First Arriving Unit for EMS Calls

Response Time (minute)	Frequency	Cumulative Percentage
0 - 1	0	0.0
1 - 2	3	0.1
2 - 3	46	2.2
3 - 4	211	11.9
4 - 5	419	31.0
5 - 6	504	54.1
6 - 7	444	74.4
7 - 8	266	86.5
8 - 9	127	92.3
9 - 10	70	95.5
10 -11	34	97.1
11 - 12	18	97.9
12 - 13	6	98.2
13 - 14	4	98.4
14 - 15	6	98.6
15 - 20	9	99.0
20 - 30	10	99.5
>= 30	11	100.0

Observations:

- The average response time for EMS calls was 6.3 minutes.
- For 54 percent of EMS calls, the response time was less than 6.0 minutes.
- For 90 percent of EMS calls, the response time was less than 8.5 minutes.

Response Time Analysis for Structure and Outside Fire Calls

The following tables and charts report response time analysis of first and second arriving units for structure and outside fire calls. The analysis focuses on the arrival of firefighting equipment, including engines and ladder truck. The response time analysis does **NOT** include a dispatched ambulance for structure and outside fire calls, since it typically arrives along with the engine company based in its station. Structure and outside fire calls with valid unit on-scene time are used in analysis.

Table 20. Average Response Time for Structure Fire and Outside Fire Calls by First Arriving Fire Unit

Unit Type	First Arriving Unit	Outside Fire		Structure Fire		Total	
		Response Time	Number of Calls	Response Time	Number of Calls	Response Time	Number of Calls
Engine	E1	8.3	33	6.5	7	7.9	40
	E2	6.3	30	6.7	22	6.5	52
	E3	9.2	14	8.4	5	8.9	19
	E4	7.1	29	7.2	9	7.1	38
Ladder	L1	7.2	5	7.8	11	7.6	16
Total		7.5	111	7.1	54	7.4	165

Observations:

- There were one structure fire call and five outside fire calls, which had no engine or ladder truck dispatched.
- One structure fire call and two outside fire calls which occurred outside city limit and were not included in this analysis.
- For outside fire calls, engine E1 was the first unit on scene most often and had an average response time of 8.3 minutes.
- The top three first arriving units for outside fire calls were E1, E2 and E4, which accounted for 83 percent of the outside fire calls.
- For structure fire calls, engine E2 was the first unit on scene most often and had an average response time of 6.7 minutes.
- The top three first arriving units for structure fire calls were E2, L1, and E4, which accounted for 78 percent of the structure fire calls.

Table 21. Average Response Time for Structure Fire and Outside Fire Calls by Second Arriving Fire Units

Unit Type	Second Arriving Unit	Outside Fire		Structure Fire		Total	
		Response Time	Number of Calls	Response Time	Number of Calls	Response Time	Number of Calls
Engine	E1	19.0	1	NA	0	19.0	1
	E2	11.1	5	9.7	13	10.1	18
	E3	8.4	1	8.6	1	8.5	2
	E4	31.6	2	9.9	14	12.6	16
Ladder	L1	11.4	2	9.7	5	10.2	7
Total		15.4	11	9.7	33	11.1	44

Observations:

- Engine E2 was the second unit on scene most often for both structure fire and outside fire calls with an average response time of 10.1 minutes.
- The average response time of second arriving unit for outside fire calls was 15.4 minutes.
- The average response time of second arriving unit for structure fire calls was 9.7 minutes.

Figure 12. Cumulative Distribution Function (CDF) of Response Time of First and Second Arriving Fire Units for Structure Fire Calls

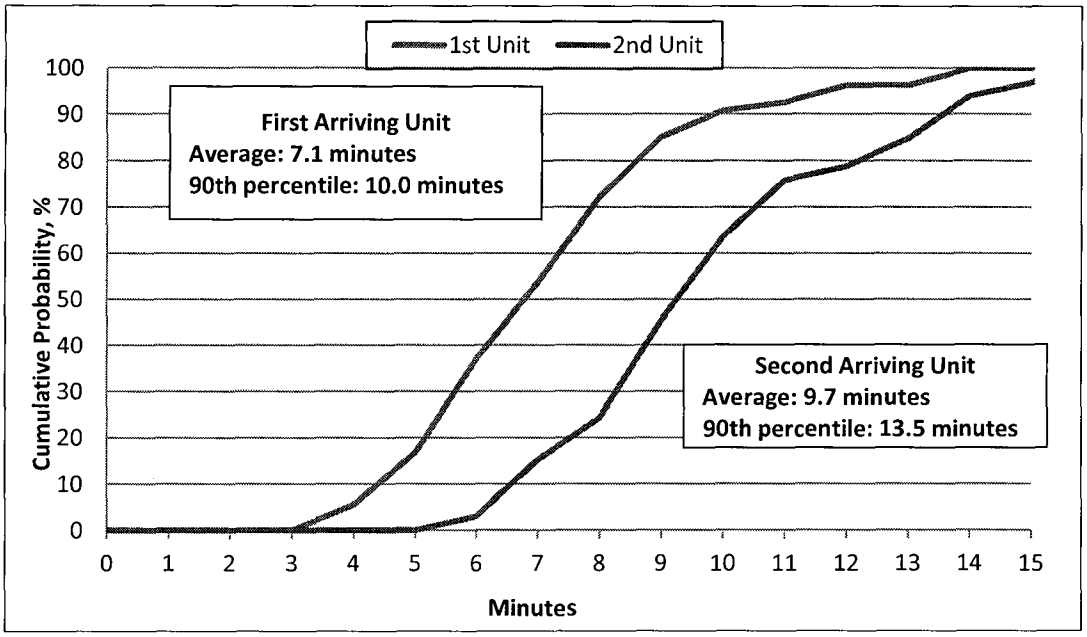


Figure 13. Frequency Distribution Chart of Response Time of First Arriving Unit for Structure Fire Calls

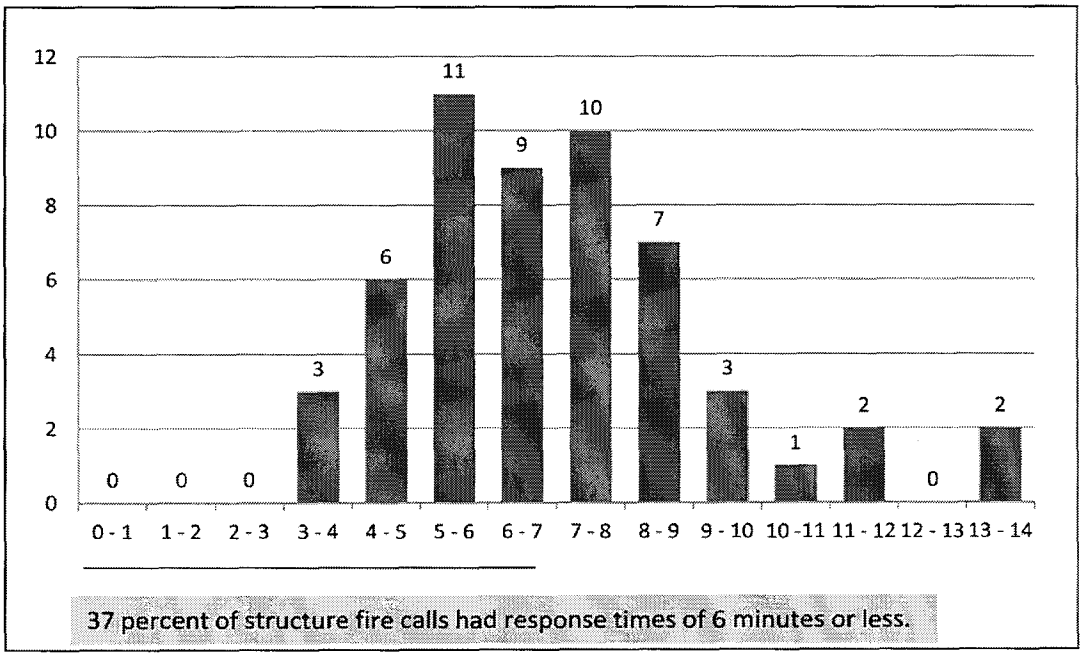


Table 22. Cumulative Distribution Function (CDF) of Response Time of First and Second Arriving Fire Units for Structure Fire Calls

Response Time (minute)	First Unit		Second Unit	
	Frequency	Cumulative Percent	Frequency	Cumulative Percent
0 - 1	0	0.0	0	0.0
1 - 2	0	0.0	0	0.0
2 - 3	0	0.0	0	0.0
3 - 4	3	5.6	0	0.0
4 - 5	6	16.7	0	0.0
5 - 6	11	37.0	1	3.0
6 - 7	9	53.7	4	15.2
7 - 8	10	72.2	3	24.2
8 - 9	7	85.2	7	45.5
9 - 10	3	90.7	6	63.6
10 -11	1	92.6	4	75.8
11 - 12	2	96.3	1	78.8
12 - 13	0	96.3	2	84.8
13 - 14	2	100.0	3	93.9
14 - 15	0	100.0	1	97.0
> 15	0	100.0	1	100.0

Observations:

- The average response time of the first arriving fire unit for structure fire calls was 7.1 minutes.
- 37 percent of the time, the first fire unit's response time was less than 6.0 minutes.
- 90 percent of the time, the first fire unit's response time was less than 10.0 minutes.
- On average, the response time of the second arriving unit was 9.7 minutes, which was 2.6 minutes longer than that of the first arriving unit.

Figure 14. Cumulative Distribution Function (CDF) of Response Time of First Arriving Fire Units for Outside Fire Calls

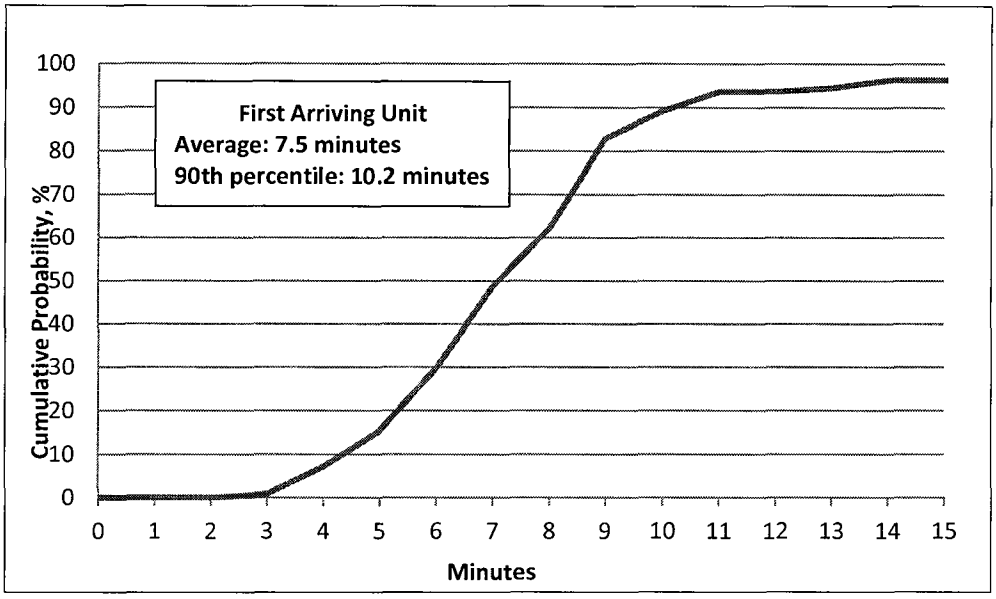


Figure 15. Frequency Distribution Chart of Response Time of First Arriving Unit for Outside Fire Calls

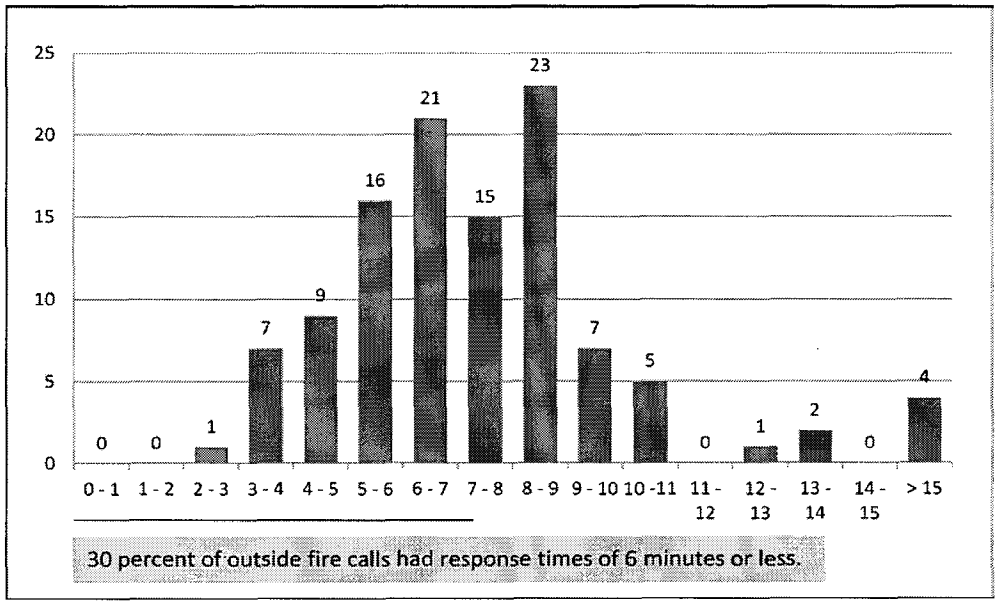


Table 23. Cumulative Distribution Function (CDF) of Response Time of First Arriving Fire Units for Outside Fire Calls

Response Time (minute)	Frequency	Cumulative Percent
0 - 1	0	0.0
1 - 2	0	0.0
2 - 3	1	0.9
3 - 4	7	7.2
4 - 5	9	15.3
5 - 6	16	29.7
6 - 7	21	48.6
7 - 8	15	62.2
8 - 9	23	82.9
9 - 10	7	89.2
10 -11	5	93.7
11 - 12	0	93.7
12 - 13	1	94.6
13 - 14	2	96.4
14 - 15	0	96.4
> 15	4	100.0

Observations:

- The average response time of the first arriving fire unit for outside fire calls was 7.5 minutes.
- 30 percent of the time, the first fire unit's response time was less than 6.0 minutes.
- 90 percent of the time, the first fire unit's response time was less than 10.2 minutes.

Appendix I. Correspondence between CAD Call Description and Call Type

Call Type	Call Description
EMS	Accident injury
	Adult Abuse
	Assault
	Assist Medical
	EPC
	Intoxication
	MED1
	MED3
	MED4
	MED5
	MEDT
	Man Down
	Medical
	Overdose
	PI Accident
	Transport
Structure Fire	Fire Structure
Outside Fire	Fire Grass
	Fire Vehicle
	Fire unknown
	fire gas spill
Hazard	Carbon Monoxide
	Fire Burn Compl
	Fire Odor Inves
	Fire Smoke Inve
	Illegal Burning
	fire gas leak
Alarm	Alarm
	Fire Alarm
Public Service	911 hang up
	Agency Assist
	Animal Problem
	Arson
	Attention Units
	Citizen Assist
	Crim Mischief
	Death Invest
	Dist Domestic
	Distr / Weapons
	Disturb Peace
	Disturbance
	MIP
	PD Accident
	Removal Subject

	Request Officer
	Robbery
	Suspicious
	Suspicious per
	Traffic Stop
	Wanted Person
	Warrant
	Welfare Check

V. Attachments

A. University of Oklahoma EMS study

B. Police Foundation report on shift length

C. Vision 20/20 powerpoint on Community Risk Reduction

D. The National Document, Integrated Risk Management Planning

E. Merseyside IRMP