Illinois Fire Chiefs Association Consulting Service

An Assessment of Deployment and Staffing

Bloomington Fire Department

January 2013

Terms of Use

TABLE OF CONTENTS

TABLE OF FIGURES

PURPOSE

In March of 2012, the City of Bloomington contracted the **Illinois Fire Chiefs Association Consulting Services** for the purpose of an independent study to assess and analyze the fire department in the following areas: operational staffing levels, fire station locations, and emergency response times.

METHOD OF STUDY

The Consulting Team conducted onsite meetings with various department heads for the City of Bloomington: City Manager David Hales, Fire Chief Mike Kimmerling and Dispatch Director Darren Wolf for the purpose of collecting data and to further identify additional departmental resources related to the study. With their assistance and the support of their administrative staff, the Team collected both soft information and hard data to evaluate against national standards. Staff expressed their opinions and judgments relating to the issues being studied by the Team. Meetings took place at various locations within the City for the purpose of gathering and clarifying the compiled information and data.

The Consulting Team commends City Manager David Hales, Fire Chief Mike Kimmerling, Dispatch Director Darren Wolf and their respective staffs for their open access and high level of support in providing the requested information in a timely manner.

INTRODUCTION

The following report is an evaluation of emergency services of the Bloomington Fire Department (BFD) by the Illinois Fire Chiefs Association Consulting Team. This report serves as a brief snapshot of ongoing service delivery to the citizens and visitors of the community. Our assessment will provide a guide to measure progress towards nationally recognized standards of service. It is our belief, however, that the real work of evaluation rests with the agency itself as it defines its service delivery within the context of its city.

While standards exist, it is the commitment and resources of the city that must be evaluated against the threat of city risks. There are three concepts that come into play: adequacy, reasonable costs and acceptable risk. Each agency and community will define this for its own locale.

First, adequate fire protection should look at "optimal" levels which take into account need and funding, versus "minimal" which may not meet needs and "maximal" which may not be affordable.

Second, in defining reasonable costs, the city must look not only at the cost of the fire department but also at the cost of fire losses (deaths, injuries, property, tax revenues) and built-in fire protection (sprinklers). Costs beyond what the city is willing to bear can be deferred to property owners.

Third, and maybe most importantly, each agency and community/city/village must define its "acceptable level of risk" or the loss it will accept because resources are **not unlimited**. To adequately define the level of risk, the agency should develop a written Standards of Cover for service. This will be explained later in this report.

When evaluating service levels, the Team looks at the most common functions of fire protection agencies:

- Fire suppression and life safety
- Emergency Medical Services (EMS - ALS, BLS, First Responder)
- Specialized emergency and disaster services (Rescue, Hazardous Materials, Water Rescue, Technical Rescue)
- Fire Prevention (Inspection, Code Enforcement)
- Fire Safety Education
- Community Relations

These basic functions affect the city's risk both directly and indirectly. Attention to all aspects of fire protection makes the community safer.

EVALUATION

Over the past 100 years, various methods have been used to evaluate fire protection agencies. The majority of these originated with the insurance industry to protect property due to the devastating fires of the late 1880s. Insurance ratings started with the National Board of Fire Underwriters and the American Insurance Association, which merged in 1971 into the Insurance Services Offices, Inc. (ISO).

In evaluating a fire protection agency, the IFCA Consulting Team looks at applicable federal, state and local regulations and nationally recognized standards. The purpose of this is to follow guidelines that meet the latest protocols on fire protection in order to have legally defensible positions. National standards are "minimum" standards and should be defined as the least needed to be done. It is certainly responsible and practical to consider the actual community needs and go beyond the minimum recommendations when necessary.

The IFCA Consulting Team uses three nationally recognized models as a basis for evaluation of a fire department. These are the Insurance Services Office (ISO), the National Fire Protection Association (NFPA), and the Center for Public Safety Excellence (CPSE). Each has a specific point of view and each brings a set of evaluation tools to the process. They each offer a unique but complementary prism to view effective fire department operations.

Insurance Services Office (ISO)

ISO is mainly concerned with property risk. The Insurance Services Office's purpose is to review and categorize a community's ability to fight fires. ISO measures major elements of a

community's fire suppression system, such as personnel training; staffing levels of engine and ladder companies; water supply and distribution systems; receiving and dispatching fire alarms; firefighting equipment; needed fire flow; and fire company locations.

The ISO grade is broken down into three sections:

1. Fire department – 50%
2. Water Supply – 40%
3. Communications: receiving and handling alarms – 10%

By analyzing the data and using criteria outlined in a rating schedule, ISO produces a final classification number for a community. Each of the 43,000 plus communities evaluated by ISO across the U.S. is graded from 1 to 10, with 1 being the best. The ratings determine insurance rates for property owners. Generally, lower scores yield lower rates.

However, using only the insurance company criteria may produce unrealistic expectations about how effectively the fire department can reduce loss of life. ISO states that their regulations are not intended to design fire departments. Yet, in a practical way they do, for two reasons:

- Fire departments have been intensely influenced by ISO criteria in the past; therefore, the rating process is ingrained into a city's beliefs about fire safety. For instance, ISO stated that a 20 year old fire truck had to be replaced due to its age regardless of the unit's front line ability.
- Insurance grading remains a strong political influence because the general public and/or elected officials do not understand the limitations of fire protection operations. If the public perceives it pays lower insurance rates because of the ISO rating (current fire department design), then they will not pressure the fire protection agency to become more cost effective, regardless of its limitations.

Tragically, some recent fires resulting in loss of life have shown that cities with low ISO ratings did not meet legal requirements and current standards for fire agencies.

National Fire Protection Association (NFPA)

The National Fire Protection Association uses consensus standard rule making. The NFPA was formed in 1896 by a group of insurance firm representatives with the stated purpose of standardizing the new and burgeoning market of fire sprinkler systems. The scope of the NFPA's influence grew from sprinklers to include building electrical systems (another new and fast-growing technology), and then all aspects of building design and construction.

Its original membership consisted of, and was limited to, insurance underwriting firms. NFPA did not allow representation from the industries it sought to regulate. This changed in 1904 to allow other industries and individuals to participate actively in the development of the

standards promulgated by the NFPA. The first fire department to be represented in the NFPA was the New York City Fire Department in 1905. Today, the NFPA includes representatives from many fire departments, insurance companies, manufacturing associations, unions, trade organizations, and average people.

NFPA consensus standards establish widely accepted standards of care and requirements for certain practices. *Standards* are an attempt by an industry or profession to self-regulate by establishing minimal operating, performance, and/or safety standards which establish a recognized "standard of care." Committees composed of industry representatives, fire service representatives, and other affected parties, who seek consensus in their final rule, write these standards. The outcome is a "minimum" - that everyone can agree on, rather than an "optimum" - that is the best case.

The NFPA has many standards that affect fire departments. These standards should be followed by fire departments to protect fire and rescue personnel from unnecessary workplace hazards. The NFPA standards establish the standard of care that may be used to evaluate fire department performance in civil lawsuits against fire and rescue departments (NFPA, 1995). In most cases, compliance with NFPA standards is voluntary. However in some cases, federal or state OSHA agencies have incorporated wording from NFPA standards into regulations. In these cases, compliance with the standards is mandatory.

Regardless of whether compliance with an NFPA standard is voluntary or mandatory, fire and rescue departments must consider the impact of "voluntary" standards on private litigation. In some states, a department may be liable for the negligent performance of its duties. Even in states that protect rescue workers under an immunity statute, most state laws do not protect fire or rescue departments for grossly negligent or willful and wanton acts. Essentially, negligence involves the violation of a standard of care that results in injury or loss to some other individual or organization.

In establishing the standard of care for fire and rescue operations, the courts will frequently look to the "voluntary" standards issued by NFPA and other organizations. Although "voluntary" in name, these standards can be utilized as evidence of the existence of a standard of care that fire or rescue departments may be responsible to comply with. Accordingly, fire and rescue departments should pay close attention to applicable standards.

The mission of the NFPA, established in 1896, is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating consensus codes and standards, research, training, and education.

The world's leading advocate of fire prevention and an authoritative source on public safety, NFPA develops, publishes, and disseminates more than 300 consensus codes and standards intended to minimize the possibility and effects of fire and other risks.

These codes and standards are developed by technical committees staffed by over 6,000 volunteers, and are adopted and enforced throughout the world (NFPA, 2012). Therefore, applicable NFPA standards and codes will be applied within this study.

Center for Public Safety Excellence (CPSE)

The Center for Public Safety Excellence, or the "Accreditation" model, is outcome-based performance supported by best practices.

Over the last decade, there has been an increased concern by fire professionals that the insurance industry criterion, by itself, is unrealistic (CPSE, 1997). Although ISO and NFPA standards are extremely valuable for the purposes for which they were created, the fire service needed to elevate its level of performance and professionalism in another way.

A process was created where citizens, elected and appointed officials, and fire and emergency service personnel would assess all the activities and programs related to a modern Fire/EMS service. On October 27, 1988, the International City/County Management Association (ICMA) and the International Association of Fire Chiefs (IAFC) Executive Boards signed a Memorandum of Understanding that committed both organizations to the development of a voluntary national fire service accreditation system titled, Commission on Fire Accreditation International (CFAI). On December 13, 1996, a trust was executed creating the Commission on Fire Accreditation International to award accreditation to fire and emergency service agencies and to pursue scientific research and educational purposes in the public interest.

In November 2001, the original trust was dissolved and the Commission on Fire Accreditation International was incorporated as a nonprofit 501(c) (3) corporation. Then in March 2006, to reflect the organization's larger focus and its importance to all-hazard response, the corporation's name was changed to the Center for Public Safety Excellence (CPSE). The Commission on Fire Accreditation International (CFAI) became an entity under CPSE; however, it continues to assist organizations in making the transition from tactical deployment to strategic response.

The cornerstone of the CPSE is the role of self-assessment. This self-conducted performance evaluation results in increasing the efficiency and effectiveness of fire service agencies—if the findings from performing the self-assessment are applied to planning and implementation activities. There are four major reasons why an in-depth evaluation of fire service agencies is critical today (CPSE Assessment Manual, 2006):

- To assist organizations trying to cope with change;
- To provide for periodic organizational evaluations which ensure effectiveness (outcomes) and efficiency (cost);
- To raise the level of performance and professionalism within the organization and ultimately within the profession; and
- To provide an organizational benchmark when there is a change in leadership.

One of the major issues that the fire service has struggled with in the past decade is defining the Standards of Cover. This concept has evolved in concert with the other components of the

accreditation model because it is essential to determine whether a fire agency is prepared to provide a level of service commensurate with its responsibilities and risks.

STANDARDS OF COVER

Two critical concepts to understand before we move on are the Standards of Cover and level of service. These standards form the basis of service to the community and response to emergencies. It is an often-overlooked detail in the process of evaluation. **It must start with the community looking at itself.**

The Commission on Fire Accreditation International (CFAI) defines Level of Service (LOS) as "the resources needed to meet the stated service level objectives. LOS is defined only in terms of what is provided and not in terms of effectiveness or of quality." Level of service is the community's plan to deploy resources to deliver a range of solutions or services. For example, a community/fire department may choose to deliver Advanced Life Support over Basic Life Support; they may choose to have four firefighters per engine rather than three; they may send one engine to a car fire. However, LOS does not measure effectiveness; that is the concept of Standards of Cover (SOC).

The CFAI defines the Standards of Cover (SOC) as being those **adopted written policies and procedures** that determine the distribution, concentration and reliability of fixed and mobile response forces for fire, emergency medical services, hazardous materials and other forces of technical response." In other words, Standards of Cover is the delivery of resources within a timeframe a majority of time that is useful, or "effective," to its citizens. This makes it measurable.

So that is the ultimate outcome of this process: to have measurable standards of effective response to predictable emergencies.

NATURE OF THE FIRE SERVICE

The NFPA estimates that there were approximately 1,103,300 firefighters in the U.S. in 2010. Of the total number of firefighters 335,150 or 30% were career firefighters and 768,150 (70%) were volunteer firefighters. Most of the career firefighters are in communities that protect 25,000 or more people. Most of the volunteer firefighters (95%) are in departments that protect fewer than 25,000 people. There are an estimated 30,125 fire departments in the U.S. Of these, 2,495 departments are all career, 1,860 mostly career, 5,290 are mostly volunteer and 20,480 are all volunteer. In the U.S., 13,440 or 45% of departments provide EMS service, 4,515 departments or 15% provide EMS service and advanced life support, while 12,170 departments or 40% provide no EMS support (NFPA, 2012).

The main difference by definition between a career firefighter and a paid-on-call or volunteer is that the career firefighter is assigned to a duty shift and is compensated on a regular basis. Paid-on-call personnel and volunteers are not normally required to be available except for

meetings, training, and emergency calls and may or may not receive compensation for their services.

Small town and/or rural fire departments may have a full-time fire chief, fire marshal, and company officers, but rely on paid-on-call personnel to supplement the staffing needs for effective fire and EMS services. Another staffing plan uses career or part-time personnel during daytime hours when additional duties such as fire inspections, vehicle maintenance, preplanning, fire suppression and EMS services can be accomplished.

The proper mix of career, paid-on-call, part-time, or volunteer staffing depends on a number of important factors, including:

- The frequency of and potential for emergency calls;
- The availability of paid-on-call personnel for immediate response;
- The range of services expected of the fire department;
- The type and level of service preferred by the community; and
- The financial resources of the community.

It is important to remember that what might work well in one community, might not work well in another. Thus, there are no absolute standards to be followed. However, the ultimate goal is to have trained people ready to respond with appropriate equipment when the emergency call occurs. Personnel can be in a fixed location (station) or in vehicles roaming a coverage area.

CURRENT FIRE AND EMS STAFFING RESEARCH MODELS

National Institute of Standards and Technology (NIST) has recently conducted research on service expectations placed on the fire service, including emergency medical service, response to natural disaster, hazardous materials incidents, and acts of terrorism. It becomes a greater challenge for local policymakers to balance service expectations, finite resources and fiscal responsibility (NIST Technical Note 1661, Report on Residential Fireground Field Experiments, 2010). Therefore, it is prudent to evaluate all available information in regard to making decisions on the staffing and deployment of resources while maintaining the highest level of safety for firefighters and the public alike.

In addition to the standards and guidelines developed by ISO, NFPA and CPSE, the Consulting Team analyzed two recent studies (September 2010) published by the United States Department of Commerce National Institute of Standards and Technology (NIST) to provide the policymakers of the Bloomington Fire Department with quantitative scientific data for response force deployment when developing and finalizing fire and emergency medical response policies and operating guidelines for their organization. The information presented in the following two sections provides an overview of the research.

Overview of NIST Fireground Field Experiments Report

This report is the first of its kind to quantify the effects of crew sizes and arrival times on the fire service's lifesaving and firefighting operations for residential fires. It is imperative that decision-makers understand that fire risks grow exponentially. Each minute of delay is critical to the safety of the occupants and firefighters, and is directly related to property damage (NIST Technical Note 1661, Report on Residential Fireground Field Experiments, 2010). These experiments directly addressed 22 fireground activities that routinely occur on the scene of a typical residential fire (Figure 1).

22 Fireground Activities	
Stop @ hydrant, Wrap Hose	Advance Back Up Line Stairwell
Position Engine 1	Conduct Primary Search
Conduct Size-up	Ground Ladders Placed
Engage Pump	Horizontal Ventilation
Position Attack Line	Horizontal Ventilation (2nd Story)
Establish 2 In/2 Out	Control Utilities (Int.)
Supply Attack Engine	Control Utilities (Ext.)
Establish RIT	Conduct Secondary Search
Gain/Force Entry	Check For Fire Extension (Walls)
Advance Attack Line	Check For Fire Extension (Ceiling)
Advance Back Up Line-Front Door	Mechanical Ventilation

Figure 1: 22 Fireground Activities, NIST 2010

Scope of NIST Fireground Study

The scope of the study was limited to understanding specific variables of response and staffing configuration to "low hazard" residential structure fires as defined by National Fire Protection

Association Standard 1710. The experiments utilized a residential structure of 2,000 square feet, two story, single family dwelling with no basement and no exposures.

For the purposes of analysis and evaluation of the study, the data reflected the following apparatus response and staffing distribution: three engines, one truck and a battalion chief with an aide. In an effort to create "real time" response, staggering times of arrival companies at one- and two-minute intervals, close and far, respectively, were incorporated into each segment of the experiments

Some limitations to consider include that the study did not expand to include "medium" and "high" hazard occupancies, commercial or multifamily structures. Additionally, special responses such as hazardous materials, technical rescue, natural disasters or response to emergency medical requests were not addressed. A separate emergency medical experiment/study was conducted and its overview is included following this section.

Primary Findings

Of the 22 firefighting tasks measured, results indicated that the following phases of all fireground activities had the most impact on overall firefighting operation success.

Overall Scene Time

Four- and five-person crews were able to complete the 22 essential firefighting and rescue tasks in a residential setting 30 percent faster than two-person crews and 25 percent faster than three-person crews. Overall scene time is the time that it takes the firefighters to complete all 22 tasks (Figure 2).

The overall scene time measure is critical to the fire crew's ability to complete their work safely and return to the station in order to be available for the next fire call. Furthermore, firefighter crews that complete several of the tasks simultaneously, rather than consecutively, are able to complete all tasks and are less fatigued. It is important to note that previous studies have documented significant benefits for five-person crews for medium- and high-hazard structures, particularly in urban settings, unlike the low-hazard residential fire scenario examined in this study.

In addition to varying crew sizes, the NIST experiments assessed the effects of time stagger between the arriving companies. Close stagger was defined as a 1-minute difference in the arrival of each responding company. Far stagger was defined as a 2-minute time difference in the arrival of each responding company. One-minute and two-minute arrival stagger times were determined from analysis of deployment data from more than 300 U.S. fire departments responding to a survey conducted by the International Fire Chiefs Association and the International Association of Firefighters.

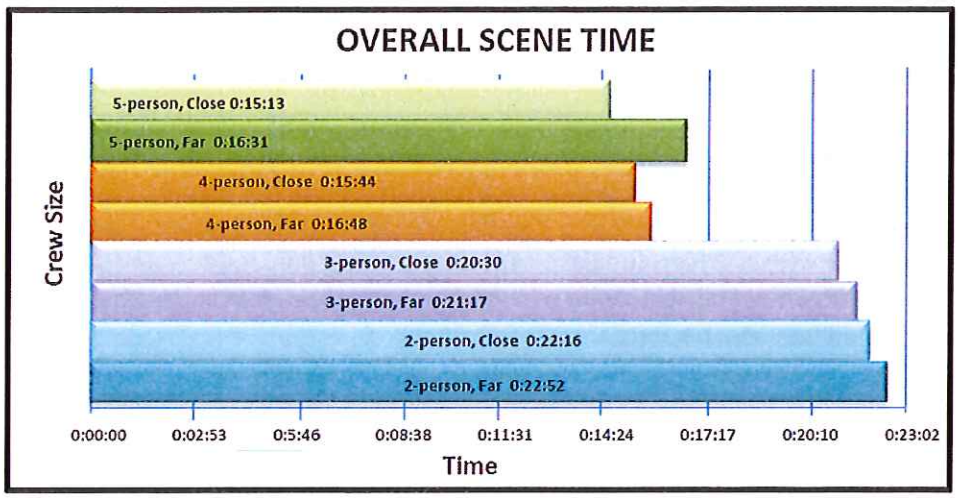

Figure 2: NIST Overall Scene Time, 2010

Time to Water Application

In this study the term megawatt (MW) is used to measure the amount of energy that is released by fire. This unit of measurement is a key predictor of the hazard of a fire, directly related to the rate at which heat and toxic gases build up in a compartment or the rate at which they are driven into more remote spaces. Heat release rates on the order of 1 MW to 3 MW are typical in a room that has flashed over or from a single large object such as a bed or sofa. Fire risks grow exponentially. Each minute of delay is critical to the safety of occupants and firefighters and is directly related to property damage.

Results show that five-person crews were able to apply water to the fire 22 percent faster than two person crews. Four-person crews were able to apply water to the fire 16 percent faster than two-person crews and 6 percent faster than three-person crews. What this means for firefighter safety is that two-person crews arriving later to the scene faced a fire about 2.1 megawatts in size.

On the other end of the spectrum, five-person crews arriving earlier to the scene faced a fire about half as big at 1.1 megawatts. For context, a 1 megawatt fire would be a fully-involved upholstered chair burning at its peak. A 2 megawatt fire, however, would be sufficient to produce near-flashover conditions in the 12 by 16 foot room of fire origin used in our experiments. Facing a fire of twice the intensity greatly increases the danger to both firefighters and civilians and increases the likelihood that the fire will spread beyond the room of origin.

Rescue Effectiveness

To estimate how various crew sizes would affect the exposure of occupants to toxic gases, slow-, medium-, and fast-growth rate fires were simulated using NIST's Fire Dynamic Simulator software (Figure 3). The simulation assumed an occupant unable to escape on his own from an upstairs bedroom with the bedroom door open. Occupant exposures were calculated both when firefighters arrive earlier to the scene, representing crews from fire stations nearby the

burning structure, and those arriving later, representing crews arriving from more distant locations.

The simulations showed that for a medium-growth fire, two-person crews would not be expected to complete essential tasks in time to rescue occupants from exposures to toxic gases that would incapacitate sensitive populations such as children and the elderly. Two-person crews arriving later would also likely find a significant portion of the general public incapacitated by the time of rescue. The simulations for early arriving five-, four- and three-person crews show that they would likely be able to locate and rescue an occupant before sensitive populations would be incapacitated.

Summary

The NIST study specifically applied to firefighting crew sizes in a low-hazard residential setting and not to larger, more hazardous structures, outdoor or transportation fires. These studies also held apparatus response to a constant compliment of firefighting vehicles. Decisions about crew size and how many apparatus to deploy in a specific community depend on a number of variables, including population density, the distribution of structures, age and type of construction, the size of the fire station's first due response coverage area, and the resources available to that jurisdiction. The Operational Review, Response Time and Staffing sections of this report will provide a comprehensive analysis of the BFD response with related recommendations.

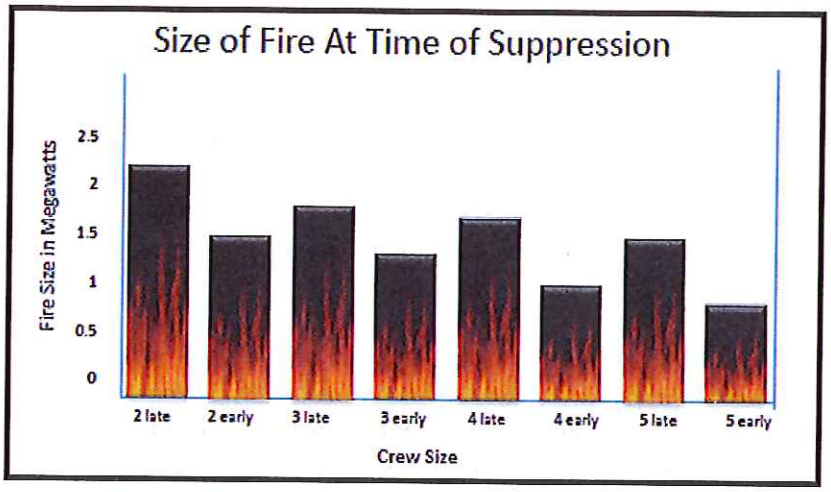

Figure 3: Size of Fire at Time of Suppression NIST, 2010

Overview of NIST EMS Field Experiments Reports

The fire service has become the first line medical responder for all types of medical emergencies in the majority of the United States. Increased demands for service, including the rising number of emergency medical responses, point to the significance of broadening the focus from suppression activities to include personnel configurations, crew size and apparatus response for emergency medical intervention (Report on EMS Field Experiments, 2010).

Scope of NIST EMS Field Study

The EMS portion of the Firefighter Safety and Deployment of Resources Study was designed solely to assess the personnel number and configuration aspect of an EMS incident for responder safety, effectiveness, and efficiency. This study does not address the efficacy of any patient care intervention. This study does however quantify first responder crew size, i.e., the number and placement of ALS trained personnel resources on the time-to-task measures for EMS interventions. Upon recommendation of technical experts, the investigators selected trauma and cardiac scenarios to be used in the experiments as these events are resource intensive and will likely reveal relevant differences in regard to the research questions. The applicability of the conclusions from this report to a large-scale hazardous or multiple-casualty event has not been assessed and should not be extrapolated from this report.

Primary Findings

The objective of the experiments was to determine how first responder crew size, ALS provider placement, and the number of ALS providers is associated with the effectiveness of patient care. EMS crew effectiveness was measured by task intervention times in three scenarios, including patient access and removal, trauma, and cardiac arrest. The results were evaluated from the perspective of firefighter and paramedic safety and scene efficiency rather than as a series of distinct tasks. More than 100 full-scale EMS experiments were conducted for this study.

Hundreds of firefighters and paramedics are injured annually on EMS responses. Most injuries occur during tasks that require lifting or abnormal movement by rescuers. Such tasks include lifting heavy objects (including human bodies both conscious and unconscious), manipulating injured body parts and carrying heavy equipment. Several tasks included in the experiments fall into this category, including splinting extremities, spinal immobilization (back boarding) and patient packaging. Similar to the lifting or heavy workload tasks, larger crews were able to complete the labor intensive tasks using multiple crew members on a single task to assure safe procedures were used reducing the likelihood of injury or exposure.

A number of tasks are also labor intensive. These tasks can be completed more efficiently when handled by multiple responders. Several tasks in the experiments are in this category. These include checking vital signs, splinting extremities, intubation with spinal restriction, establishing I.V. access, spinal immobilization, and patient packaging. **During the experiments, larger crews completed these tasks more efficiently by distributing the workload among more people thereby reducing the likelihood of injury.**

Finally, there are opportunities on an EMS scene to reduce scene time by completing tasks simultaneously rather than sequentially thus increasing operational efficiency. For the experiments, crews were required to complete all tasks in each scenario regardless of their crew size or configuration. Therefore, patterns in task start times and overall scene times reveal operational efficiencies. When enough hands are available at the scene to complete tasks simultaneously, this leads to overall time reductions relative to smaller crews that are forced to complete tasks sequentially.

Patient Access and Removal

Patient access is an important component of the time sequence. It is defined as the time segment between apparatus/vehicle arrival on the scene and the responder's first contact with the patient. With regard to accessing the patient, crews with three or four first responders reached the patient around half a minute faster than smaller crews with two first responders. With regard to completing patient removal, larger first responder crews in conjunction with a two-person ambulance were more time efficient. The removal tasks require heavy lifting and are labor intensive. The tasks also involve descending stairs while carrying a patient, carrying all equipment down stairs, and getting patient and equipment out multiple doors, onto a stretcher and into an ambulance. The patient removal results show substantial differences associated with crew size. **Crews with three- or four-person first responders completed removal 1.2 – 1.5 minutes faster than smaller crews with two first responders.** All crews with first responders complete removal substantially faster (by 2.6 - 4.1 minutes) than the ambulance-only crew (Figure 4).

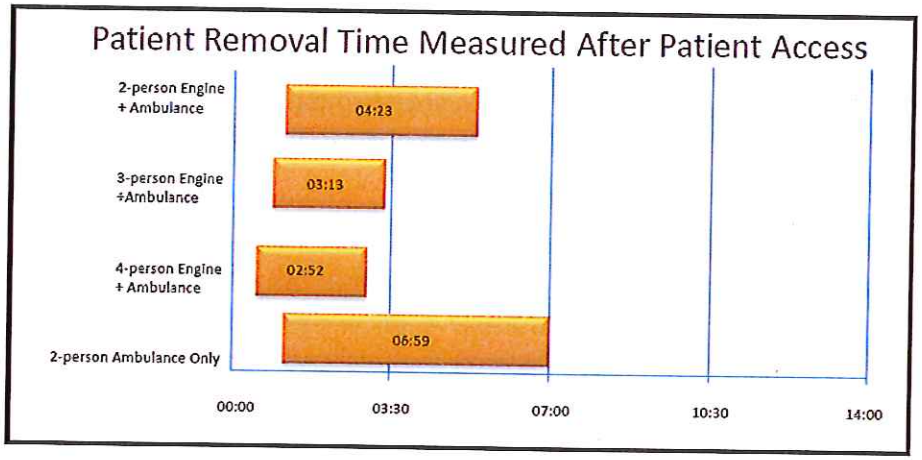

Figure 4: Patient Removal Time Measured After Patient Access, EMS Field Experiments, NIST, 2010

These results suggest that time efficiency in access and removal can be achieved by deploying three- or four-person crews on the first responding engine (relative to a first responder crew of two). To the extent that each second counts in an EMS response, these staffing features deserve consideration. Though these results establish a technical basis for the effectiveness of first responder crews and specific ALS crew configurations, other factors contributing to policy decisions are not addressed.

Trauma

Overall, field experiments reveal that four-person first responder crews completed a trauma response faster than smaller crews. Towards the latter part of the task response sequence, four-person crews start tasks significantly sooner than smaller crews of two or three persons. Additionally, crews with one ALS provider on the engine and one on the ambulance completed all tasks faster and started later tasks sooner than crews with two ALS providers on the ambulance. This suggests that getting ALS personnel to the site sooner matters. A review of the patterns of significant results for task start times reinforced these findings and suggests

that (in general) small non-significant reductions in task timings accrue through the task sequence to produce significantly shorter start times for the last third of the trauma tasks.

Finally, when assessing crews for their ability to increase on-scene operational efficiency by completing tasks simultaneously, crews with an ALS provider on the engine and one ALS provider on the ambulance completed all required tasks 2.3 minutes (2 minutes 15 seconds) faster than crews with a BLS engine and two ALS providers on the ambulance. Additionally, first responders with four-person first responder crews completed all required tasks 1.7 minutes (1 minute 45 seconds) faster than three-person crews and 3.4 minutes (3 minutes and 25 seconds) faster than two-person crews (Figure 5).

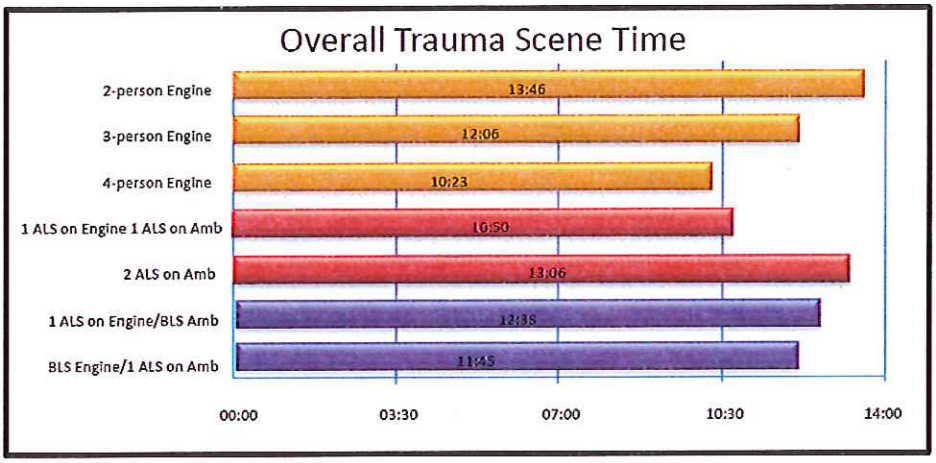

Figure 5: Overall Trauma Scene Time, EMS Field Experiments, NIST, 2010

Cardiac

The overall results for cardiac echo those of trauma. Regardless of ALS configuration, crews responding with four first responders completed all cardiac tasks (from at-patient to packaging) more quickly than smaller first responder crew sizes. Moreover, in the critical period following cardiac arrest, crews responding with four first responders also completed all tasks more quickly than smaller crew sizes. As noted in the trauma scenario, crew size matters in the cardiac response. Considering ALS placement, crews responding with one ALS provider on both the engine and ambulance completed all scene tasks (from at-patient to packaging) more quickly than a crew with a BLS engine and two ALS providers on the ambulance. This suggests that ALS placement can make a difference in response efficiency. One curious finding was that crews responding with a BLS engine and an ambulance with two ALS providers completed the tasks that follow cardiac arrest 50 seconds sooner than crews with an ALS provider on both the engine and ambulance. As noted, this counter-intuitive difference in the results may be attributable to the delay of the patient arrest time based on the arrival of the 12-lead ECG monitor with the two-person ALS Ambulance crew.

The 12-lead ECG task end time was the arrest start time. In this scenario, there were instantaneously two ALS providers present at the arrest rather than the one ALS provider placing the 12-lead ECG device in the ALS engine /ALS Ambulance crew. A review of the

patterns of significant findings across task start times showed mixed results. An ALS on an engine showed an advantage (sooner task starting times) over an ALS on an ambulance for a few tasks located earlier in the cardiac response sequence (specifically, ALS Vitals 12-lead through IV access). A first responder with four-person crew also showed shorter start times for a few early tasks in the cardiac response sequence (initial airway, breathing and circulation (ABCs), and the ALS Vitals 12-lead and expose chest sequence).

More importantly, a sequential time advantage appears for the last three tasks of the sequence (analyze shock #2 through package patient). Finally, when assessing crews for their ability to increase on-scene operational efficiency by completing tasks simultaneously, crews with an ALS provider on the engine and one ALS provider on the ambulance completed all required tasks 45 seconds faster than crews with a BLS engine and two ALS providers on the ambulance. Regardless of ALS configuration, crews responding with four first responders completed all cardiac tasks from the 'at patient time' to completion of packaging 70 seconds faster than first responder crews with three persons, and 2 minutes and 40 seconds faster than first responder crews with two persons.

Additionally, after the patient arrested, an assessment of time to complete remaining tasks revealed that first responders with four-person crews completed all required tasks 50 seconds faster than three-person crews and 1.4 minutes (1 minute 25 seconds) faster than two-person crews (Figure 6).

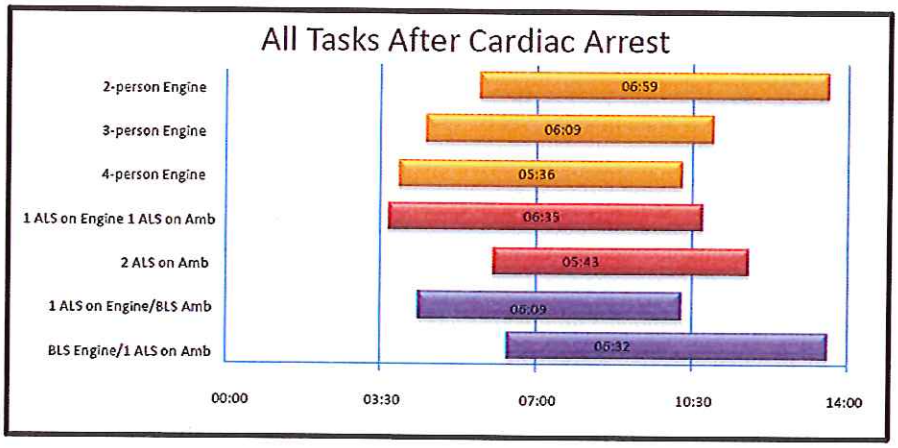

Figure 6: All Tasks after Cardiac Arrest, EMS Field Experiments, NIST, 2010

Summary

While resource deployment is addressed in the context of three basic scenarios, it is recognized that public policy decisions regarding the cost-benefit of specific deployment decisions are a function of many factors including geography, resource availability and community expectations as well as population demographics that drive EMS call volume. While this report contributes significant knowledge to community and fire service leaders in regard to effective resource deployment for local EMS systems, other factors contributing to policy decisions are not addressed. The results, however, do establish a technical basis for the

effectiveness of first responder crews and ALS configuration with at least one ALS level provider on first responder crews. The results also provide valid measures of total crew size efficiency in completing on-scene tasks some of which involve heavy lifting and tasks that require multiple responders to complete. These experimental findings suggest that ALS provider placement and crew size can have an impact on some task start times in trauma and cardiac scenarios, especially in the latter tasks leading to patient packaging. To the extent that creating time efficiency is important for patient outcomes, including an ALS trained provider on an engine and using engine crew sizes of four are worth considering. The same holds for responder safety – for access and removal and other tasks in the response sequence, the availability of additional hands can serve to reduce the risks of lifting injuries or injuries that result from fatigue (e.g., avoid having small crews repeatedly having to ascend and descend stairs) (Report on EMS Field Experiments, 2010).

RISK ASSESSMENT & COMMUNITY PROFILE

A risk assessment includes determining and defining the distinct threats in the community, based on occupancy such as single-family, multi-family, and industrial structures. Each scenario presents unique problems and requires an appropriate fire protection response. Fire stations, staffing and apparatus need to be distributed within the community to provide an initial response force capable of dealing with each unique problem (CPSE Assessment Manual, 2006).

When determining the location of a fire station, apparatus placement and staffing levels, a particular point in a fire's growth that marks a significant shift in its threat to life and property must be considered. This shift, or "flashover point," makes conditions non-survivable. The Standards of Cover are intended to put enough firefighters on the scene in time to prevent flashover as a means to protect both the occupants and the firefighters.

Therefore, response time becomes a critical component in measuring the level of service in the mitigation of significant life safety events. In order to analyze response time and shorten the time of the essential activities that make it up, we can deconstruct response time into key time intervals. Using standard terms and descriptions to describe the time segments will clearly establish the set of events upon which policy and procedure questions are based. Based on the concept of the Utstein Criteria (Time/Temperature Curve), the CPSE produced a similar response baseline for fire and emergency medical services agencies when defining their policies relative to the concentration and distribution of fire companies, emergency medical service units, hazardous materials response, and other resources that are routinely dispatched to the scene of emergency events (CPSE Assessment Manual, 2006).

Similarly, from an emergency medical perspective, the use of a four to six-minute time frame as the Standards of Cover measurement is critical. Brain damage is very likely to occur with cardiac/respiratory arrest patients after six minutes without oxygen flow to the brain.

Figure 7 identifies the measurable events that constitute the individual time segments of an emergency response and the importance of time with respect to intervention and the initiation of corrective action.

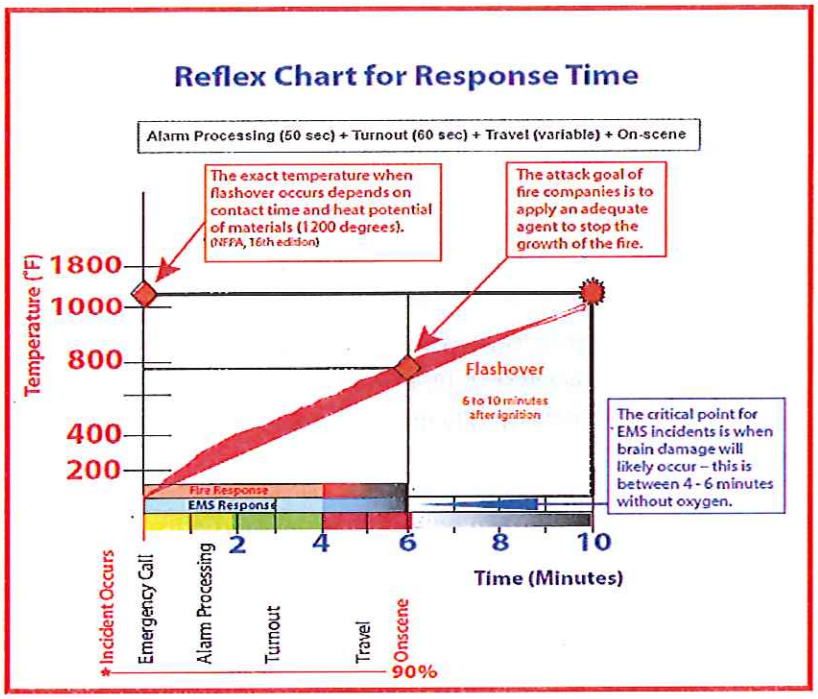

Figure 7: Reflex Chart for Response Time

While there are many other components to the CPSE self-assessment program, the previously mentioned components of the assessment review will be applied in this study.

Additional Resources

In areas where the ISO, NFPA, CPSE and NIST (National Institute of Standards and Technology) standards and/or research are not appropriate or do not exist, the Team will use its experience, knowledge, research, judgment and reasoning to present a best-case recommendation.

Identifying and Categorizing Community Risks

Community risk level is typically established through an overall profile of the community based on the unique mixture of demographics, socioeconomic factors, occupancy risk, fire management zones, and the level of services currently provided.

Community hazards and associated risks may be divided into 3 categories.

- Property
- Life
- Critical infrastructure

The property category is of particular interest to the fire service. Each property or structure in a community can be considered a hazard that carries inherent risks based on occupancy type and fire load. Occupancy risk is a sublevel of property risk and is established through an

assessment of the relative risk to life resulting from a fire inherent in a specific building/structure or in generic occupancy classes (e.g. high rise residential).

The NFPA Fire Protection Handbook defines hazard levels of occupancies by types. Each hazard level carries inherent risks.

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

Fire service leaders assess the number and location of each type of occupancy and its associated hazard level and then plan resource deployment to assure that sufficient fire department resources are dispatched to adverse events that occur in the occupancies.

Community Profile

Studies of population are an essential part of planning and establishing the need for fire protection and emergency services. Being aware of the changes in population and forecasting changes assists in the decision-making process in the anticipation of needs before they arise. In order to understand the customer base and its makeup within the City of Bloomington, Figure 8 exhibits the basic population by age (US Bureau of the Census, 2000 Census of Population and Housing, ERSI Forecasts for 2010 and 2016).

Population by Age	2010		2011		2016	
	Number	Percent	Number	Percent	Number	Percent
0 - 4	5,377	7.0%	5,372	7.0%	5,642	7.1%
5 - 9	5,402	7.1%	5,434	7.1%	5,606	7.0%
10 - 14	4,964	6.5%	4,976	6.5%	5,185	6.5%
15 - 19	5,226	6.8%	5,181	6.7%	5,045	6.3%
20 - 24	5,734	7.5%	5,806	7.6%	5,740	7.2%
25 - 34	12,581	16.4%	12,723	16.6%	13,492	17.0%
35 - 44	10,606	13.8%	10,695	13.9%	10,701	13.4%
45 - 54	10,918	14.3%	10,796	14.1%	10,231	12.9%
55 - 64	8,107	10.6%	8,107	10.6%	8,978	11.3%
65 - 74	3,883	5.1%	3,941	5.1%	4,956	6.2%
75 - 84	2,587	3.4%	2,535	3.3%	2,670	3.4%
85+	1,225	1.6%	1,209	1.6%	1,343	1.7%

Figure 8: Bloomington Population/Forecast by Age to 2016

The National Fire Protection Association, Fire Analysis and Research Division publishes a report titled *Demographic and Other Characteristics Related to Fire Deaths and Injuries* that evaluates the risk of fire death and injury which varies by age group, race, region, and community size.

Children under five and adults 65 or older face the highest risk of fire death, although they do not account for the majority of fire fatalities. The risk of non-fatal fire injury is highest for those between 20 and 49 (March 2010). Based upon the statistical information and population data, the City of Bloomington population under the age of five is approximately 7.0% and the population age 65 and older is at 10.1%. In total, approximately 17.1% of the City's population falls within the statistical high risk for possible loss of life or injury.

It is understood that the risk of death and injury varies by region and community size and that the statistical data reflects the possible risk.

Other statistical information that warrants review regarding the highest risk group in respect to fire and EMS service level demands comes from the National Association of Area Agencies on Aging. Their census data reflects that the number of persons 60 years of age and older in Illinois is projected to increase by 73% from 2.1 million in 2007 to 3.6 million in 2030. That means that one in every five Illinoisans will be 60 years of age and older by 2030. Local governments need to assess their communities aging profile and plan appropriately to make their community "elder friendly."

Population Status

According to the United States Census Bureau, the population of the City of Bloomington is not anticipated to increase substantially over the next four years. The U.S. Census Bureau, Census 2010 Data, Esri forecasts of population projects a 3.9% increase in population for the City of Bloomington by 2016 (Figure 9). The areas surrounding are anticipated to grow by an average of 72% over for the same period (US Census Bureau, 2010).

City of Bloomington Projected Growth			
Summary	**2010**	**2011**	**2016**
Population	76,610	76,773	79,590
Households	31,663	31,709	32,943
Families	18,872	19,019	19,547
Average Household Size	2.35	2.35	2.35
Owner Occupied Housing Units	19,904	19,614	20,753
Renter Occupied Housing Units	11,759	12,095	12,190
Median Age	34.2	34.1	34.3
Trends: 2011 - 2016 Annual Rate	**Area**	**State**	**National**
Population	0.72%	0.16%	0.67%
Households	0.77%	0.25%	0.71%
Families	0.55%	0.08%	0.57%
Owner HHs	1.14%	0.50%	0.91%
Median Household Income	3.84%	3.37%	2.75%

Figure 9: Bloomington Projected Growth to 2016

City of Bloomington Revenue

The City of Bloomington's General Fund is the primary operating fund of the City. It accounts for the resources used to pay for the services traditionally associated with local government. Included are police and fire protection, parks and recreation, planning and economic development, general administration of the City and any other activity for which a special fund has not been created (City of Bloomington, 2012). Figure 10 illustrates the City's General Fund Resources by Category.

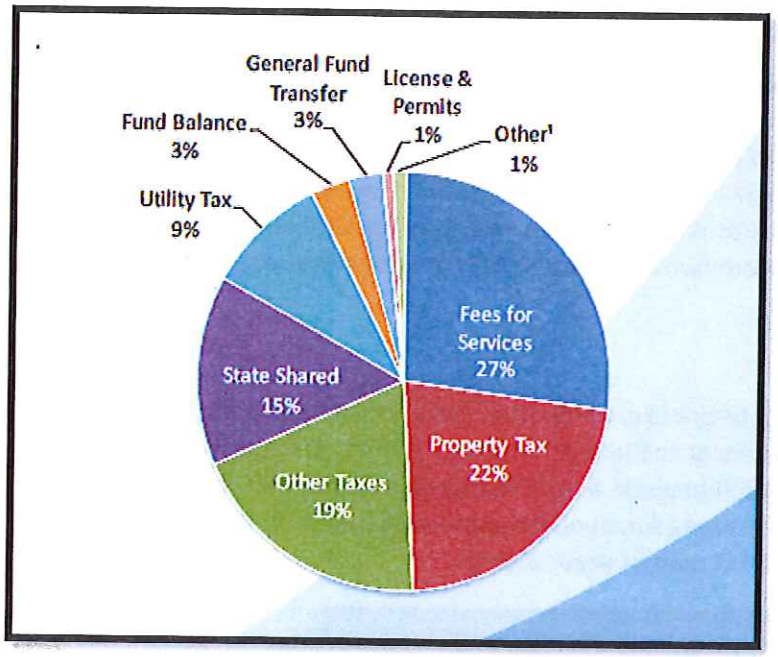

Figure 10: City of Bloomington General Fund Resources by Category

Community Risk Analysis

The fire service assesses relative risk of properties based on a number of factors. Properties with high fire and life risk often require greater numbers of personnel and apparatus to effectively mitigate a fire emergency. Staffing and deployment decisions should be made with consideration of the level of risk within geographic sub-areas of a community.

City of Bloomington - Total Businesses Distribution by Type	Businesses		Employees	
	Number	Percentage	Number	Percentage
Agriculture & Mining	67	2.1%	300	0.4%
Construction	267	8.4%	1,226	1.6%
Manufacturing	77	2.4%	2,344	3.1%
Transportation	73	2.3%	1,201	1.6%
Communication	30	0.9%	419	0.6%
Utility	12	0.4%	37	0.0%
Wholesale Trade	146	4.6%	1,174	1.6%
Retail Trade Summary	733	23.2%	9,712	12.9%
Finance, Insurance, Real Estate Summary	331	10.5%	37,460	49.9%
Services	1,295	41.0%	19,220	25.6%
Hotels & Lodging	22	0.7%	319	0.4%
Automotive Services	94	3.0%	647	0.9%
Motion Pictures & Amusements	104	3.3%	911	1.2%
Health Services	185	5.9%	5,214	6.9%
Legal Services	83	2.6%	425	0.6%
Education Institutions & Libraries	67	2.1%	2,059	2.7%
Other Services	740	23.4%	9,645	12.8%
Government	104	3.3%	2,021	2.7%
Other	26	0.8%	24	0.0%
Totals	***3,161***	***100%***	***75,138***	***100%***

Source: Business data provided by Infogroup, Omaha NE Copyright 2010, all rights reserved. Esri forecasts for 2010.

Figure 11: City of Bloomington Business Distribution by Type

It is evident from the business data provided above (Figure 11) that the BFD protects a significant percentage of commercial and industrial businesses that support the local, state, and global economy.

In order to explore a community's future risk, an assessment has been developed based on potential land use within its anticipated future boundaries. These potential uses are found in each City's development plans and zoning designations. The zoning map (Figure 12) translates land use (potential scale and type of development within geographic sub-areas) to categories of relative fire and life risk.

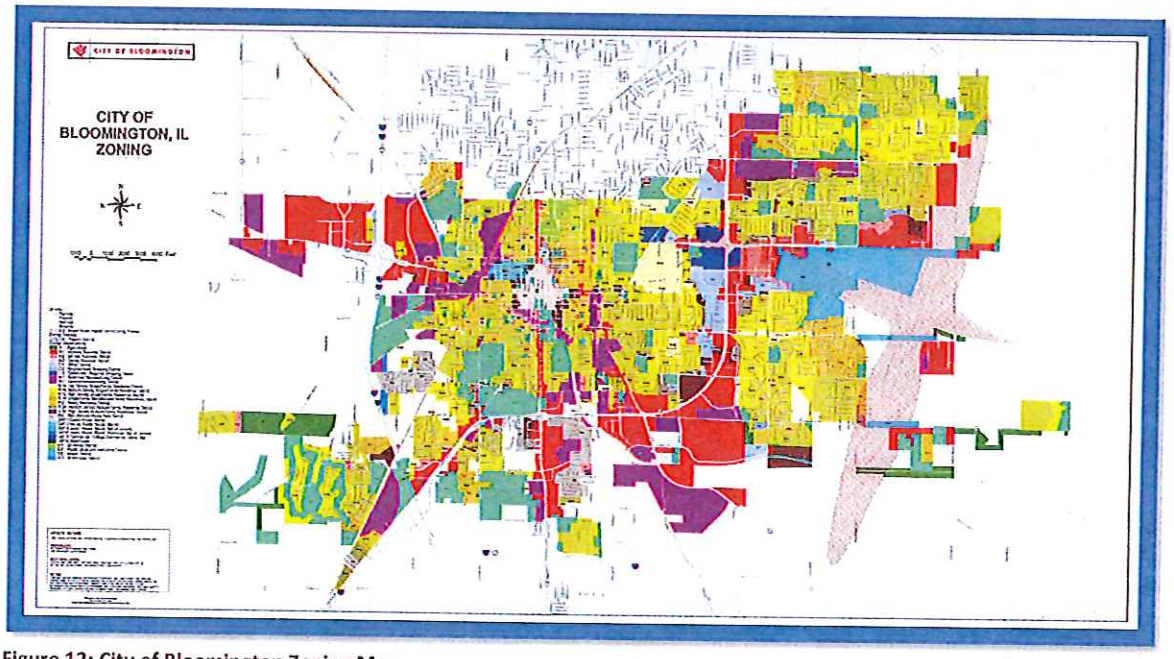

Figure 12: City of Bloomington Zoning Map

The property category is of particular interest to the fire service. Each property or structure in a community can be considered a hazard that carries inherent risks based on occupancy type and fire load. Occupancy risk is a sublevel of property risk and is established through an assessment of the relative risk to life resulting from a fire inherent in a specific building/structure or in generic occupancy classes (e.g. high rise residential).

Matching Resources to Risks

The Fire Protection Handbook is a resource guide for the fire service. The handbook identifies initial attack response capabilities for low, medium, and high hazard occupancies.

- **High-Hazard Occupancies**— Areas zoned for schools, hospitals, nursing homes, explosive plants, refineries, high-rise buildings and other high life hazard or large fire potential occupancies.
  - ✓ Operations response capability — at least 4 engines, 2 ladder trucks (or combination apparatus with equivalent capabilities), 2 chief officers and other specialized apparatus as may be needed to cope with the combustible involved; not less than 24 firefighters and 2 chief officers plus a safety officer and a rapid intervention team. Extra staffing for high hazard occupancies is advised.

- **Medium-Hazard Occupancies**— Areas zoned for apartments, offices, mercantile and industrial occupancies not normally requiring extensive rescue by firefighting forces.

  - ✓ Operations response capability — at least 3 engines, 1 ladder truck (or combination apparatus with equivalent capabilities) 1 chief officer and other specialized apparatus as may be needed or available; not less than 16 firefighters and 1 chief officer plus a safety officer and a rapid intervention team.

- **Low-Hazard Occupancies**— Areas zoned for one-, two- or three-family dwellings and scattered small business and industrial occupancies.
  - ✓ Operations response capability — at least 2 engines, 1 ladder truck (or combination apparatus with equivalent capabilities), 1 chief officer and other specialized apparatus as may be needed or available; not less than 12 firefighters and 1 chief officer plus a safety officer and a rapid intervention team.

Review of Previous Plans and Studies

City of Bloomington's Comprehensive Plan

A review of the City of Bloomington's Comprehensive Plan (adopted by the City of Bloomington in October 2005) identifies several noteworthy predictions for the community's future growth. They are:

- Future growth is expected to require nearly 6,000 acres of land for new developments and infrastructure. This demand is expected to be greatest around the eastern and western edges of the city.
  - The McLean County East Side Highway project seeks to provide a connecting roadway on the east side of Bloomington/Normal between I-74 and I-55. A 2002 Feasibility Study examined the ability to connect I-55 to I-74 east of Bloomington-Normal. It predicted that the future urban expansion of the region will stress the existing roadway networks, and explored the impacts of providing a new major roadway facility that would relieve traffic congestion (Illinois Department of Transportation).
- The City's economic growth is expected to continue for the foreseeable future but at a reduced rate over that of the previous decade, due mainly to the anticipated leveling off of employment growth in the "finance, insurance and real estate" sector and in the "professional and related services" sector.

It is clear that the City of Bloomington Officials had a clear vision of where the community would expand and grow and have done an excellent job of keeping to their Plan.

In respect to the Bloomington Fire Department's risk assessment, the City contains mostly low to moderate risk properties. As noted within the Plan, the predominance of highest risk is located in the commercial core in the downtown area that contains many multiple story buildings; the upper floors of many are being rehabilitated for residential use. According to the Plan, much of the City's development in more recent years is comprised of large single family homes on larger lots on the City's east side and in the southwest, along with commercial and office development situated on large tracts of land on the City's western, eastern and southeastern edges.

As exhibited within the Plan, the projected land use or zoning maps indicate a moderate commercial area located along Veterans Parkway, Route 9 East and West, U.S. 51 South, and the downtown area. Industrial land accounts for over 8 percent of the City's developed area, and for slightly more land per 100 persons than does that of the average city. Most of the

City's industrial classification is comprised of office spaces, most notably the State Farm complex in the southeast. Other concentrations of industrial use, including manufacturing and office complexes, are located along Veterans' Parkway, G.E. Road, West Market Street, and to the southwest along Route 66.

The City's land use patterns generally contribute to the development of an efficient fire resource deployment configuration which is satisfied by the current location of five strategically place fire stations. However, as the demands for service increase with future City expansion, locations for additional fire station(s) will need to be considered to effectively meet a rise in service demands.

Risk assessment includes determining and defining the distinct threats in the community, based on occupancy such as single-family, multi-family and industrial structures. Each scenario presents unique problems and requires an appropriate fire protection response. Fire stations, staffing and apparatus need to be distributed within the community to provide an initial response force capable of dealing with each unique problem (CPSE Assessment Manual, 2006).

The Main Street Transportation Improvement Feasibility Study

In February of 2012, a Feasibility Study was conducted to determine the feasibility of new and previous transportation recommendations for the 9-mile Main Street Corridor through Bloomington-Normal. In review of The Main Street Transportation Improvement Feasibility Study ("the Feasibility Study"), the Consulting Team found that the Study detailed design options that were developed in the form of engineering concept plans. However, the Consulting Team did not find any recommendations or suggestions for road improvements related to emergency vehicle response.

The Consulting Team is suggesting that the Study include the characteristics of emergency vehicles, especially in the design and implementation of any roadway improvements. Emergency vehicle characteristics that merit special attention include temporal and spatial distribution of emergency vehicle travel; frequency and duration of preemption requests; fire and police responses; and crashes involving emergency vehicles.

Over the past few years, various EMS and fire rescue journals reported some very interesting findings pertaining to emergency response. Emergency response times in many states are threatened by a growing population, outdated technology and tight budgets. Getting there quickly is priority Number 1, but sometimes staffing, traffic and the location of the emergency can be roadblocks to the timeliest response. A shortage of paramedics is recognized as a key reason why ambulances have been taking too long to arrive at medical emergencies. Heavy traffic is also considered a detriment to responding firefighters and paramedics. With several construction projects on major roadways and an increasing population, emergency vehicles are having a more difficult time navigating the crowded streets.

To this end, Emergency Medical Services and Fire and Rescue administrators seek methods to enhance system performance. One component scrutinized is the response time interval between call receipt and arrival on the scene. Emergency Medical Services and Fire and Rescue

authorities in different regions have considered various methods to improve emergency response time, such as strategic positioning of the new stations, adopting systems of current technology, adding more staff, traffic signal preemption, and prioritizing urgent emergency medical runs versus non-urgent.

One method used with proven success is traffic signal preemption (TSP). TSP is an operational strategy that facilitates the movement of the emergency vehicle through the traffic signal controlled intersection. This strategy reduces the response time for emergency vehicles and improves the safety of the emergency vehicles traveling through the system. Preemption interrupts the normal signal plan and results in an immediate green light being provided for emergency vehicles, including fire and rescue. Some factors that contribute to the need for emergency vehicle preemption (EVP) follow:

- Significant congestion and queuing at intersection approaches. It has been seen that the need of EVP is most needed when the LOS is poor and becomes even worse during the peak hours.

- High volumes on the intersection suggest congestion. Thus traffic volumes and the time of the day are two of the main factors that contribute to delays.

- Lack of shoulders and auxiliary lanes restricts the motorists' ability to pull out and provide a clear path to the emergency vehicle. These vehicles can use the right and left turn lanes. But this may not help when the queue lengths are very long.

- Large sizes of some of the emergency vehicles cause difficulty for the emergency vehicle driver to maneuver. Larger vehicles normally have a low acceleration rate, in which case providing EVP may help.

- Inadequate corner sight distance could affect the need for EVP, particularly when the emergency run is on the side street entering a more major roadway or arterial.

- Complex or unusual intersections with severe skewing may make the safe movement of the emergency vehicle difficult. EVP may be definitely useful in such a case.

Emergency vehicle preemption systems have been widely deployed in the United States. According to a study conducted by Gkritza (2003), the experiences of some agencies operating EVP systems indicate that significant improvements on average emergency vehicle travel time may result. One notable study conducted in the City of Houston, Texas found that the average emergency vehicle travel time decreased 16% in one district, and 23% in the other; Denver, Colorado reported EV response time decreases of 14-23% after the deployment of a traffic signal preemption system; and Addison, Texas claimed a 50% decrease in response time as well (An Evaluation of Emergency Vehicle Preemption Systems, August 1997). It can be suggested that a preemption system will improve the performance of emergency vehicle response times.

City of Bloomington Traffic Count

One issue that stands out in every community is the amount of traffic volume which accounts for longer travel times for emergency vehicles. The definition of high-volume traffic routes varies from federal and state transportation agencies. In fact, there is little evidence in the literature to indicate that state DOTs identify the segments for special emphasis for the annual average daily traffic (AADT) monitoring based only on traffic volumes. An arbitrary definition of 20,000 AADT was used by FHWA in the Highway Information Quarterly Newsletter while others recommend high-volume routes in excess of 50,000 AADT.

To assist the Consulting Team in determining the amount of traffic that the City of Bloomington is experiencing, the Team utilized two sources. The traffic count map in Figure 13 is taken from the City of Bloomington's web site. The Transportation Engineering Section maintains traffic volume records for streets and intersections within Bloomington (City of Bloomington, 2010). The traffic count map in Figure 14 is from the Illinois Department of Transportation website but states that there is a lack of accuracy for site-specific use. In spite of their accuracy or inaccuracies, both sources indicate that the City of Bloomington is experiencing a moderate amount of traffic congestion causing the inability of emergency vehicles to respond to incidents in a timely and safe manner.

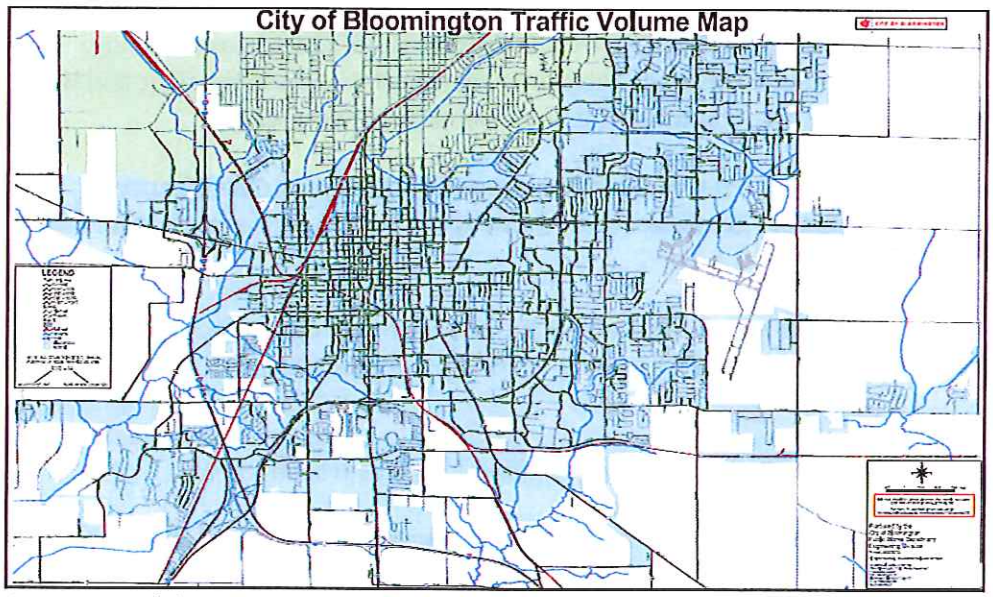

Figure 13: City of Bloomington Traffic Count, 2010

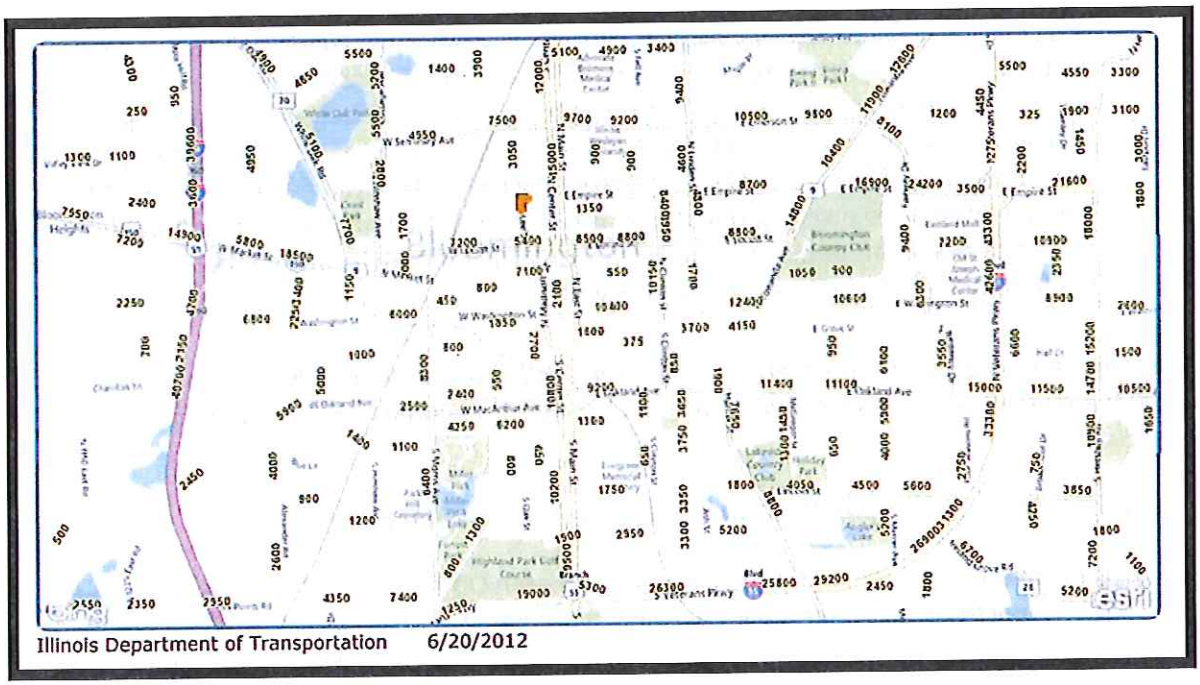

Figure 14: Illinois Department of Transportation Traffic Count, City of Bloomington, 2012

The size of a fire truck is not standardized, although many American fire engines and aerial trucks are at least 24 feet long. The height of most apparatus is approximately 12 feet with aerial apparatus as high as 13 feet 6 inches. The width of a fire engine is approximately 7 to 8 feet. The weight of a fire engine depends on the size and configuration of the apparatus but most fire engines will carry 600 gallons of water and will have a loaded weight between 40,000 to 50,000 pounds. The City of Bloomington has encompassed the recommendations for emergency vehicles load capability, turning radius and width, as specified in NFPA 1, Uniform Fire Code, within their Manual of Practice for all street engineering and construction. Future street development should maintain consistency with the code. The NFPA 1 definitions for each term are provided below:

- **Load Capability:** The roadway, fire lane, driveway or fire apparatus access road shall be capable of bearing the weight of 48,000 pounds (GVWR). Where required aerial ladder truck imposed load capacity shall be no less than 78,000 GVRW. Special provisions are required for the placement of "downrigger" and "jack" stabilization pads of the aerial ladder truck. Bridges, culverts, etc. shall be designed to hold the imposed load of the vehicle most likely to respond to that type of structure. Signs shall be placed at each end of the bridge indicating the load capability.

- **Turning radius:** Fire lanes and fire roads shall be designed to allow the inside turning radius of 28 feet and an outside turning radius of no less than 45 feet. Fire lanes and roads that will be used by aerial ladder apparatus shall be designed to allow the inside and outside turning radius of that particular three-axle vehicle.

- **Width:** One and two-family occupancy fire access roads and lanes shall have no less than 20-feet of approved paved surface. The width may be increased based upon specific department operations and/or apparatus. Alternate designs may be approved on a case-by-case basis. ***Exception:*** When no more than two one or two-family homes are served by a single fire lane, the width may be reduced if the buildings are protected with additional fire protection features as required by the Building Official. A reduction of no less than 16-feet may be approved as a code alternate provided that approved additional fire protection features are added.

Fire apparatus access includes private roads, drives, parking areas and driveways. It is not just for fire engines, and includes medic units, police vehicles and other rescue or emergency vehicles.

Recommendations for Improving Community Risk Assessment (CRA)

- **Recommendation CRA-1**: The City of Bloomington Officials should continue to include the characteristics of emergency vehicles especially in the design and implementation of any roadway improvements. By doing so, the City of Bloomington will continue to experience improved response and emergency crew set-up times at emergency incidents as it relates to road configuration/improvements.

- **Recommendation CRA-2**: The City of Bloomington Officials should consider utilizing their Firehouse Software for conducting a community risk assessment (under the direction of the Fire Department). Up-to-date occupancy information from the Fire Prevention Bureau/Code Enforcement should be merged or linked with existing fire department preplan data (Firehouse Software) that will assist in identifying the critical risks, hazards, and vulnerabilities within the City's jurisdiction and evaluate the current capabilities of the fire department in mitigating the identified risks and hazards.

- **Recommendation CRA-3**: The City of Bloomington Officials should consider (when feasible) the installation of emergency vehicle preemption on all traffic signal devices on the moderate to high traffic count roadways as identified within a valid and reliable traffic count analysis. City Officials should consider use of pre-emption by other City departments (i.e. public works, police, Emergency Management, etc.). Consider cost-sharing with other public and private agencies that would utilize the system.

- **Recommendation CRA-4**: The City of Bloomington Officials should continue with their pre-incident planning program following the recommendation in NFPA 1620 including training to all personnel.

- **Recommendation CRA-5**: The City of Bloomington Officials should continue enforcing building code provisions as previously adopted: 2009 editions of the International Code Council's (ICC) family of Codes which include: the International Building Code (IBC), International Residential Code (IRC), the International Mechanical Code (IMC), International Fuel Gas Code (IFGC), International Fire Code (IFC), the International

Existing Building Code (IEBC), and International Property Maintenance Code (IPC). In addition the City also enforces several NFPA standards when referenced: Fire Sprinklers (NFPA 13), Fire Alarm Code (NFPA 70), and National Electrical Code (NFPA 72). The adoption and enforcement of these codes not only reduce the dependence on the public fire protection assets but also protect the property tax base of the City thus preventing a loss of ability to provide services.

RESPONSE FORCE AND DEPLOYMENT

The Consulting Team reviewed the Fire Department's personnel deployment practices since they are integral to the overall capability of the department to respond to and manage a fire or EMS incident. Typically, a fire department's personnel resources assigned to various stations are dependent not only on population protected, but also on population demographics, geography, climate, environment and types of commercial development.

The first step of the deployment plan, called Risk Analysis, involves categorizing the hazards for each fire hazard category in terms of potential for presenting hazardous situations or conditions (e.g., *low, medium, and high-hazard*) and determining the *optimal* level of response. If a comprehensive Risk Analysis were done, a fire protection survey would be completed to determine the *level of risk* that is a direct consequence of any *hazards* identified.

In this review, we analyzed the street layout, physical features, topography, industries, commercial areas, residential neighborhoods, built-up areas and other characteristics. The objective is to identify buildings where large numbers of people are found and where hazardous industries operate. These target hazards typically present significant risk because they offer the potential for large loss of life and/or catastrophic fire.

The second step is to assess the fire protection response system (deployment resources) to meet the worst-case scenario, which may be more costly than the community can afford. The deployment of these resources should be based on the worst-case scenario (i.e., target hazards) in the designated response area and may be adjusted as appropriate to the risks. An *optimal level* is preferred as it is the more cost-effective approach because it seeks the middle ground between *minimal* (least cost, highest risk) and *maximal* (highest cost, least risk).

The level of service is the product of the deployment of resources and provides a Standards of Cover for the respective community or service area. Figure 15 is a sample risk matrix table that can be used in determining the community's risk assessment.

COMMUNITY RISK MATRIX		
Risk Type	**Definition**	**Risk Profile**
Maximum Risk -1.0% (>5,000 gpm fire flow required)	Heavy concentration of property presenting a high risk of life loss, loss of economic values such as unsprinklered shopping centers, industrial complexes, commercial properties.	**No data**
High Risk – 4.0% (<5,000 gpm fire flow required)	High concentration of property presenting a substantial risk of life loss, a severe financial impact on the community such as high-rise structures, high risk industrial plants, hazardous materials facilities, commercial, mercantile properties.	**No data**
Moderate Risk – 95.0% (<2,000 gpm fire flow required)	Built-up area of average size, where the risk of life loss or damage to property in the event of a fire in a single occupancy is limited such as single family homes, apartment complexes, multifamily, industrial complexes.	**No data**
Low Risk - <.01% (<1,000 gpm fire flow required)	Small commercial structures that are remote form other buildings, detached residential garages, and out buildings.	**No data**

Figure 15: Community Risk Matrix (CPSE, 2000)

Each fire emergency category requires a different amount of firefighting staff and water or fire stream application rates to match the given risk. Fire suppression staffing is determined by the critical tasks that must be performed on the fireground and by the amount of water needed to suppress the fire, which is commonly called the "required fire flow."

Fire flow is the amount of water needed to be directed at specific targets if desired offensive or defensive fire control objectives are to be achieved. Needed fire flow is the amount of water that should be available for providing fire protection at selected locations throughout a community. ISO has prepared a guide for estimating needed fire flow. The publication is only a guide and requires knowledge and experience in fire protection engineering for its effective application. However, there are software programs available that can easily determine fire flow rates for all properties.

In regard to staffing, NFPA guidance on company response time and minimum staffing provides minimum goals based on fractal measures. NFPA 1710 defines a "company" as:

> A group of members: (1) Under the direct supervision of an officer; (2) Trained and equipped to perform assigned tasks; (3) Usually organized and identified as engine companies, ladder companies, rescue companies, squad companies, or multi-functional companies; (4) Operating with one piece of fire apparatus (engine, ladder truck, elevating platform, quint, rescue, squad, ambulance) except where multiple apparatus are assigned that are dispatched and arrive together, continuously operate together, and are managed by a single company officer; (5) Arriving at the incident scene on fire apparatus.

For the purpose of this study the Consulting Team utilized the standards as presented in NFPA 1710 (for departments that are 80-percent career) which identifies benchmarks at 90 percent of the time as illustrated below in Figure 16.

NFPA 1710 RESPONSE BENCHMARKS	
Task	**Time**
Turnout Time	1 minute
Arrival of First Engine Company	4 minutes or less
Arrival of Full Alarm Assignment	8 minutes or less
Arrival of First Responder Unit	4 minutes of less
Arrival of ALS Unit	8 minutes or less

Figure 16: NFPA 1710 Response Benchmarks

Figure 17 identifies the critical tasks that must be completed on the fireground and the corresponding number of fire suppression personnel needed to accomplish the tasks safely and efficiently (CPSE, 2006).

These critical tasks must be completed in order to save lives and property and, more importantly, to ensure the safety of the fire suppression personnel working at the fire scene. Staffing levels should be increased proportionately as the occupancy risk increases. It is generally accepted that a community has the right to determine the overall level of fire protection it wants for each occupancy risk. However, regardless of the level of fire protection chosen, safety of the employees is a key element in making that determination.

STANDARDS OF COVER FOR MODERATE RISK OCCUPANCY		
Task	**Firefighters Required**	**Company Assigned**
Attack Line	2	1st Engine
Search and Rescue	2	Truck/Ladder
Ventilation	2	Truck/Ladder
Back-Up-Line	2	Engine
RIT Team	2	Engine or Ladder
Pump Operator	1	Engine
Water Supply	1	Engine
Utilities/Support	1	Rescue, Truck/Ladder
Command Officer	1	Chief Officer
Safety Officer	1	Rescue, Truck/Ladder
Total Personnel	15	

Figure 17: Standards of Cover for Moderate Risk Occupancy (CPSE, 2000)

RESPONSE TIME

Alarm Processing Time, Turnout Time and Travel Time

An effective response force as defined by CPSE is the minimum amount of staff and equipment that must reach a specific emergency zone within a maximum prescribed travel or driving time that is capable of initial fire suppression, EMS and /or mitigation. Key time factors used to study the response are: alarm notification, call processing, turnout, travel, arrival on scene, initiation of action, and termination of incident. Each of these components is measurable and is used to objectively and quantitatively analyze the relationship between existing and new fire station locations.

National Fire Protection Association Standard 1710 (*Standard for the Organization and Deployment of Fire Suppression and Emergency Medical Operations, 2004 edition*) recommends the Fire Department should establish time objectives that include tracking ***Response Time*** using the sum of ***Turnout Time + Travel Time.*** The Standard also recommends that the department should identify a performance objective of not less than 90 percent for the achievement of each response time objective.

In support of NFPA 1710, but more detailed in their calculation of response time, the Center for Public Safety Excellence (CPSE) identifies a third element in the calculation of the overall response time. The Commission recommends that the sum of the response time include the **Alarm Processing Time**, which is the time it takes for the dispatcher to answer the 911 emergency call to the point at which the responding agency is notified (i.e., "toned out"). In many incidents, dispatchers are not moving the information in a timely manner to the responding agency, which increases the chance of losing lives and property. Dispatch processing time and turnout time can add an additional two to three minutes.

Consequently, the unit's response time may be two to three minutes longer from the point when the call for assistance was received. Therefore, the Commission identifies ***Response Time*** to include the ***Alarm Processing Time + Turnout Time + Travel Time*** to the point when the unit arrives on the scene (Figure 18).

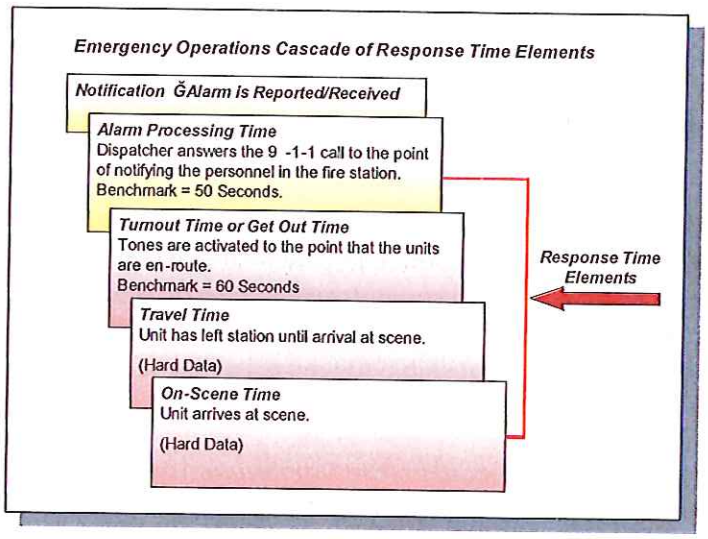

Figure 18: CPSE Emergency Operations Cascade of Response Time Elements

The travel time component is one of the most frequently used methods of determining a fire station location. Policymakers and administrators require a gauge to measure the effectiveness of the overall response times and a method to make decisions regarding the Standards of Cover. Because the economic cost is highly sensitive to travel times, a small change in response time requirements may cause a significant change in cost. Policymakers must therefore consider carefully the balance between the economic cost, the fire suppression costs and benefits, and the social costs of response time requirements.

Review of Current Response Time Data

Introduction

NFPA 1710 (*Standard for the Organization and Deployment of Fire Suppression Operation, Emergency Medical, and Special Operations to the Public by Career Fire Departments, 2004 edition*) establishes an objective of four minutes or less travel time for the first-due engine company with a minimum of four personnel, plus the entire first alarm assignment (15 personnel minimum) within eight minutes, 90% of the time, for fire calls.

The following section serves as a brief snapshot of ongoing service delivery to the citizens and visitors of the community. Our assessment will provide a guide to measure progress towards nationally recognized standards of service. It is our belief, however, that the real work of evaluation rests with the agency itself as it defines its Standards of Cover over time within the context of its community.

While standards exist, it is the commitment and resources of the community that must come to bear against the threat of community risks. There are three concepts that come into play: adequacy, reasonable costs and acceptable risk. Each agency and community will define this for its own locale.

First, adequate fire protection should look at "optimal" levels, which takes into account need and funding, versus "minimal" which may not meet needs, and "maximal" which may not be affordable.

Second, in defining reasonable costs, the community must look not only at the cost of the fire department, but also at the cost of fire losses (deaths, injuries, property, tax revenues) and built-in fire protection (sprinklers). Costs beyond what the community is willing to bear can be deferred to property owners.

Third, and maybe most importantly, each agency and community must define its "acceptable risk" or the loss it will accept because resources are **not unlimited**. To adequately define the level of risk, the agency should develop a written Standards of Cover for service.

Review of Current Incident Count Data

The Bloomington Fire Department uses nationally recognized incident count to better inform management and determine resource allocation and deployment decisions. The use of "incident count" has been the basic reference numbers used by the Department for deployment issues and for collecting the data on response volumes. It is an integral part of the current budgetary process. Incident count data is typically used and reported to describe service demand changes over time because the number and type of resources (i.e., engine, ladder truck, light unit, Urban Search and Rescue, etc.) assigned or committed to each event is subject to operational policy. Thus, data that reflect the number of times a resource is "dispatched" to an event are not suitable for performing trend/historical or comparative analysis of incidents.

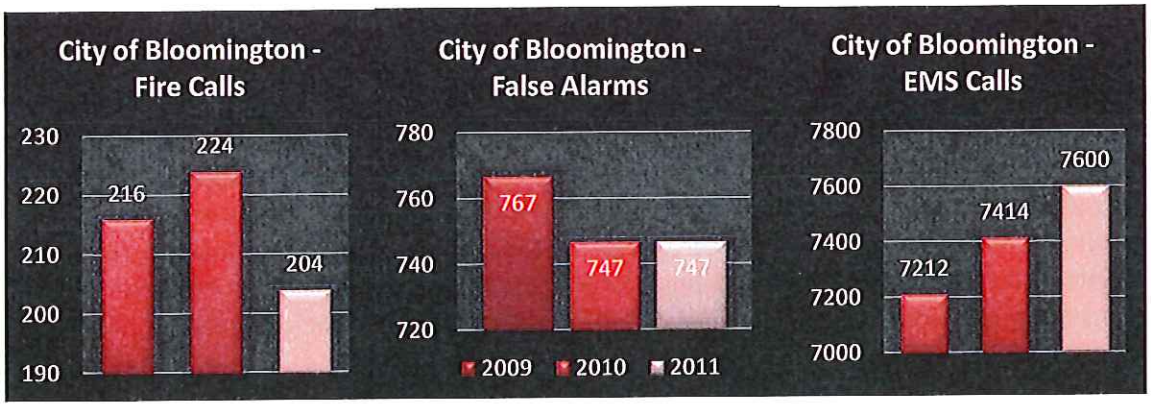

Figure 19: Bloomington Fire Department Three Year Call Volume

However, in review of the incident count (Figure 19), the Consulting Team found that the Bloomington Fire Department has been affected by a high amount of false alarms. This is not unique to this city or region. Nationally, the focus on America's fire problem has turned increasingly toward fire sprinklers as well as early detection and notification system. Codes have significantly increased the requirements, and trade-offs available for installing such systems and their complexity has increased as well.

With the increasing numbers and complexity of the systems, activations are more frequent. As a result, fire departments across the country have seen dramatic increases in the number of automatic alarm responses they handle. For the fire service, this is a problem that is a double-edged sword. The fire service has learned that early detection and sprinkler systems with their associated activation alarms provide some of the best, most dependable fire protection possible. Methods for aggressively pursuing reductions in false activation can ultimately lead to a bias or negative culture against automatic alarms in a community. This would be counterproductive to promoting the best in built-in fire protection. However, the increased workload brought on by automatic alarm activations can have a very real operational and fiscal impact. Particularly for volunteer fire departments, the constant dispatch of response crews to repeated automatic alarms can cause burn-out in personnel. This is far less of a problem with paid firefighting staff, since on-duty personnel simply handle whatever workload they are assigned, whether a false alarm or an actual fire. For career agencies, the problem tends to be the effect on the ancillary workload of personnel, such as non-emergency duties.

Given the current response time and staffing performances of the BFD, the Consulting Team can only anticipate that the additional burden of a dispatched response to all automatic fire alarms would exacerbate any existing manpower and response challenges.

Review of Current Response Time Data

Response times are one of the most frequently used methods of measuring system performance as it relates to the overall response time. In review of the dispatch data, the Fire Department has the ability to track four elements of response—from turnout time through en-route time, on-scene time, and when companies are available.

It is important in the measurement of response time that recognition is given to the passage of time within each element. The degree of life and property loss depends on reducing the overall time by improving each segment incrementally.

The Bloomington Fire Department uses New World Systems, Aegis MSP, interfaced to Firehouse™ as a records management system to document and record emergency calls. A key component of this software enables the Department to produce statistical reports to assist in the assessment of the level of service being provided. Dispatch records on emergency incidents are essential to providing an accurate report of the department's activities.

From the available data, Bloomington Communications Center (BCC) was asked to extrapolate the response time segment data from their software management information systems. The information obtained enabled the Consulting Team to determine, with some high degree of predictability, the call handling time, turnout time and travel time performance for both the first responding engine company and EMS unit from each BFD still district.

Using a fractal response time report, the Consulting Team assessed the data using both NFPA 1710 and the CPSE response objectives to determine the strengths or weaknesses of the current Standards of Cover.

Alarm Processing Time

The Consulting Team reviewed the time it takes for a call-taker/dispatcher (CTD) to process the emergency 911 call (Figure 20). NFPA and CPSE identify a performance measurement of 60 seconds or less—90% of the time, for the CTD to process the alarm. This segment of time is referred to as the Alarm Processing Time. It is one of the five elements that can be assessed and improved with procedural changes and CTD training. BCC data for all calls during 2011 indicated that the benchmark of 60 seconds or less—90% of the time is not being met. However, it is important to note that a progressive improvement has been made in the three year period. ***Alarm Processing Time for 2011: Under 59 seconds: 82.41%***

CITY OF BLOOMINGTON ALARM PROCESSING TIME (2009-2011)		
2009 (5948 calls)	**2010** (6280 calls)	**2011** (4697 calls)
< 60 Seconds — **33.22 %**	< 60 Seconds — **79.55 %**	< 60 Seconds — **82.41 %**
2 Min. 10 sec / 2 Min. 30 Sec. – **92.04%**	1 Min. 16 Sec / 1 Min. 30 Sec – **93.32%**	1 Min. / 1 Min. 15 Sec. – **91.29%**

Figure 20: Alarm Processing Time 2009/2010/2011

Turn Out Time

The Consulting Team reviewed the time it takes for responding crews to acknowledge receipt of the call from the dispatch center until the beginning of the travel time. This segment of time is referred to as the Get-Out Time or Turnout Time. From the BCC data, the Consulting Team found that the benchmark of 60 seconds or less—90% of the time has not being met during 2010 and 2011. An important consideration is that the benchmark is difficult to obtain during evening hours. From the Consulting Team's experience, we find that after 8:00 p.m. turnout times average 1 minute 20 seconds. However, until the standard is adjusted, the 60 seconds or less—90% benchmark for evening hours will be the goal.

CITY OF BLOOMINGTON FD TURN-OUT TIMES FOR EMS RESPONSES Between the Hours of 0700 to 1859 For years 2010 & 2011							
Station	**2010**			**2011**			
	0700 Hours to 1859 Hours			**0700 Hours to 1859 Hours**			
Station #1	Calls (1605)	Less than 60 Seconds	**70.28%**	Calls (1149)	Less than 60 Seconds	**67.71%**
		Less than 2 Minutes	*97.19%*		Less than 2 Minutes	*97.47%*
Station #2	Calls (476)	Less than 60 Seconds	**66.38%**	Calls (300)	Less than 60 Seconds	**68.33%**
		Less than 2 Minutes	*97.89%*		Less than 2 Minutes	*95.66%*
Station #3	Calls (838)	Less than 60 Seconds	**67.66%**	Calls (656)	Less than 60 Seconds	**63.56%**
		Less than 2 Minutes	*96.42%*		Less than 2 Minutes	*97.26%*
Station #4	Calls (596)	Less than 60 Seconds	**71.31%**	Calls (466)	Less than 60 Seconds	**69.01%**
		Less than 2 Minutes	96.14%		Less than 2 Minutes	98.28%

Figure 21: 2010/2011 Turn-out Times for EMS Responses Between the Hours of 0700-1859

CITY OF BLOOMINGTON FD TURN-OUT TIMES FOR EMS RESPONSES Between the Hours of 1900 to 0659 For years 2010 & 2011						
Station	**2010**			**2011**		
	1900 Hours to 0659 Hours			**1900 Hours to 0659 Hours**		
Station #1	Calls (1231)	Less than 60 Seconds	**40.37%**	Calls (998)	Less than 60 Seconds	**45.29%**
		Less than 2 Minutes	*93.25%*		Less than 2 Minutes	*93.88%*
Station #2	Calls (216)	Less than 60 Seconds	**37.50%**	Calls (170)	Less than 60 Seconds	**42.35%**
		Less than 2 Minutes	*90.28%*		Less than 2 Minutes	*92.94%*
Station #3	Calls (365)	Less than 60 Seconds	**32.87%**	Calls (296)	Less than 60 Seconds	**34.12%**
		Less than 2 Minutes	***87.94%***		Less than 2 Minutes	*92.23%*
Station #4	Calls (438)	Less than 60 Seconds	**39.04%**	Calls (328)	Less than 60 Seconds	**45.43%**
		Less than 2 Minutes	93.61%		Less than 2 Minutes	90.55%

Figure 22: 2010/2011 Turn-out Times for EMS Responses Between the Hours of 1900-0659

CITY OF BLOOMINGTON FD TURN-OUT TIMES FOR FIRE RESPONSES Between the Hours of 0700 to 1859 For years 2010 & 2011							
Station	2010 0700 Hours to 1859 Hours			2011 0700 Hours to 1859 Hours			
Station #1	Calls (107)	Less than 60 Seconds	26.17%	Calls (66)	Less than 60 Seconds	27.27%	
		Less than 2 Minutes	93.46%		Less than 2 Minutes	96.97%	
Station #2	Calls (41)	Less than 60 Seconds	17.07%	Calls (16)	Less than 60 Seconds	37.50%	
		Less than 2 Minutes	73.17%		Less than 2 Minutes	100.00%	
Station #3	Calls (90)	Less than 60 Seconds	14.44%	Calls (49)	Less than 60 Seconds	24.49%	
		Less than 2 Minutes	93.33%		Less than 2 Minutes	93.88%	
Station #4	Calls (59)	Less than 60 Seconds	22.03%	Calls (33)	Less than 60 Seconds	33.33%	
		Less than 2 Minutes	69.49%		Less than 2 Minutes	90.91%	

Figure 23: 2010/2011 Turn-Out Times for Fire Responses Between the Hours of 0700-1859

CITY OF BLOOMINGTON FD TURN-OUT TIMES FOR FIRE RESPONSES Between the Hours of 1900 to 0659 For years 2010 & 2011							
Station	2010 1900 Hours to 0659 Hours			2011 1900 Hours to 0659 Hours			
Station #1	Calls (71)	Less than 60 Seconds	16.90%	Calls (56)	Less than 60 Seconds	14.29%	
		Less than 2 Minutes	88.73%		Less than 2 Minutes	78.57%	
Station #2	Calls (24)	Less than 60 Seconds	12.50%	Calls (19)	Less than 60 Seconds	15.79%	
		Less than 2 Minutes	62.50%		Less than 2 Minutes	57.89%	
Station #3	Calls (63)	Less than 60 Seconds	06.35%	Calls (30)	Less than 60 Seconds	00.00%	
		Less than 2 Minutes	74.60%		Less than 2 Minutes	73.33%	
Station #4	Calls (40)	Less than 60 Seconds	15.00%	Calls (33)	Less than 60 Seconds	18.18%	
		Less than 3 Minutes	80.00%		Less than 3 Minutes	90.91%	

Figure 24: 2010/2011 Turn-Out Times for Fire Responses Between the Hours of 1900-0659

Travel Time

The Consulting Team reviewed the data provided on fire suppression and EMS calls (those responses that qualified as true emergency requests) for the first-due fire suppression unit and ambulance/ALS Unit for calls within each of the five still districts. In review of the data, the Bloomington Fire Department is not meeting the benchmark of NFPA 1710 Standard of a four-minute travel time–90% of the time.

CITY OF BLOOMINGTON FD TRAVEL TIME TO ALS CALLS (2010-2011)			
Station	Year	NFPA 1710 Four-minute Travel Time—90% of the time	CPSE Accreditation Six-minute, 30 seconds Travel Time—90% of the time
Station 1	2010	61.03%	90.61%
	2011	64.73%	93.09%
Station 2	2010	49.92%	93.10%
	2011	54.28%	93.18%
Station 3	2010	51.75%	90.37%
	2011	51.89%	92.56%
Station 4	2010	45.52%	87.71%
	2011	47.76%	92.10%

Figure 25: Travel Times to ALS Calls 2010/2011

CITY OF BLOOMINGTON FD TRAVEL TIME TO FIRE CALLS (2010-2011)			
Station	Year	NFPA 1710 Four-minute Travel Time—90% of the time	CPSE Accreditation Six-minute, 30 seconds Travel Time—90% of the time
Station 1	2010	70.22%	97.19%
	2011	75.41%	95.90%
Station 2	2010	29.68%	89.06%
	2011	60.00%	97.14%
Station 3	2010	43.24%	86.47%
	2011	57.69%	84.61%
Station 4	2010	44.33%	88.66%
	2011	55.38%	92.31%

Figure 26: Travel Times to Fire Calls 2010/2011

Considerations for Improving Response Times

Findings

The issue of not meeting the time standard can have several root causes. Each cause requires attention and a decision on how to improve it. The Bloomington Fire Department must make the hard choices to deal with each cause and commit to improvement to meet the needs of all the citizens. Continuous analysis will ensure that the BFD stays aware of changes as they occur and addresses them proactively.

The following causes may have an impact on response time:

- Efficiency of time segment factors on response.
- Staffing.
- Availability of crews and apparatus.
- Size of each response area.
- Number and location of fire stations.

The analysis of each time segment of the total response time shows where improvement can be made. Viewing each segment will show the efficiency of a different component of the operation—from dispatch handling to the responders actions to response area. For example, decreasing the time between receiving the call and dispatching it can improve call-handling time and overall response time.

Overall, staffing and response area size can present challenges with meeting response time standards. The current station staffing for four of the five stations shows three personnel who are assigned to the engine and/or truck and two personnel on the ambulance.

This current baseline model of station staffing of five personnel has three documented advantages of having an engine company and ambulance company in each station. One, it would allow a larger response force. Two, there is redundancy—when one apparatus and crew are on a call, a second is available in that response area. Three, it provides reliability—the station is not placed out-of-service as long as a crew is available to respond.

At a minimum, a quarterly response time performance report should address any weaknesses and strengths within the delivery system. But more importantly, the quarterly report will become the evidence needed to support or refute concerns by anyone regarding response inequity within the BFD.

In regard to the performance measurements of both the Alarm Processing Time and Turnout Time, weaknesses need to be identified and an action plan should be developed to ensure that the 60 second or less, 90% of the time benchmark can be met.

Throughout this study, the focus has been response time and staffing levels. As illustrated in the Reflex Chart for Response Time, travel time is typically longer in duration than the other components of response time such as dispatch processing time and turnout time. The Consulting Team commends Bloomington Fire Department in their diligence to maximize the

effects of pre-emption devices throughout the City. However, the only sure way to make improvements to travel time is to add fire stations in areas where response times exceed recognized standards.

Company Availability (Stations Out of Service)

As defined by the CPSE Manual, response reliability is defined as the probability that the required amount of staff and apparatus will be available when a fire or emergency call is received. If every piece of fire department apparatus were available in its desired location every time a fire/EMS call was received, then the department's response reliability would be 100 percent. If however, a call is received for a particular company but that company is busy at another call, a substitute company must be assigned from another station. If the substitute station is too far away, that company cannot respond in the maximum prescribed travel time.

A fire company unavailable for response provides no service to the community. Basically, if a company is not available 80 percent of the time, it is not reasonable to expect the unit to perform at the 80th percentile. Availability refers to the number of hours the company is able to respond to an incident over the number of hours it is in service. In a 24-hour period, if a unit is committed or unavailable for other reasons for six hours, it has only 75 percent availability remaining.

System analysis requires the use of standard performance measures to calculate success/failure rates within the areas of analysis. An alternate method to calculate the availability threshold is to calculate the Unit Hour Utilization (UHU). The UHU method considers the number of hours a unit is committed on an emergency, or other activity, divided by the number of overall hour's unit is available to respond.

- *A **unit hour** is equal to one hour of service by a fully equipped and staffed fire suppression unit or ambulance available for dispatch or assigned to a call.*
- ***Utilization** is a measure of productivity, which compares the available resources (i.e. unit hours) with the actual amount of time those units are being utilized for emergency calls or productive activity. This measurement is calculated to determine the percentage of unit hours actually consumed in productivity compared with the total staffed unit-hours.*

In most dynamic deployment systems such as the System Status Management program used by private ambulance companies, UHU rates as high as .40 can be achieved. This, however, can lead to paramedic burnout. This is considered to be the point at which a unit is fully committed. For static or fixed deployment systems such as the traditional fire station, the maximum UHU is closer to .25 to .30 depending on factors such as geography or the transportation network and other workload that must be accomplished.

It should be noted at .30 UHU (or 70% of the time), a 24-hour company does not have time for inspections, training of new personnel, public education activities, or personal time for

studying or other self- improvement. Figure 27 reflects the percentage of time each company is out of their station conducting non-emergency daily work activities.

Units Out of Station Conducting Daily Work Activities From 0700- 1800 Hours (One Week Sampling)									Average
Station	Unit	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	
Hdqts	Engine 1	6%	25%	11%	8%	17%	0%	13%	11%
	Engine 5	17%	15%	14%	4%	19%	0%	10%	11%
	3N16	0%	15%	0%	0%	6%	0%	0%	3%
Station #2	Engine 2	0%	29%	23%	54%	15%	4%	0%	18%
	3N53	0%	12%	18%	19%	0%	0%	0%	7%
	M3	6%	22%	35%	58%	4%	4%	2%	19%
Station #3	Truck #3	19%	35%	18%	29%	25%	10%	25%	23%
	3N102	13%	17%	40%	0%	10%	4%	0%	12%
Station #4	Truck #4	23%	42%	29%	19%	17%	33%	25%	27%
	3N51	15%	6%	13%	23%	0%	0%	25%	12%
Station #6	Engine #6	21%	19%	32%	38%	31%	10%	17%	24%

Figure 27: Units Out of Station/Daily Work Activities 0700-1800

The Consulting Team analyzed the availability of the Fire Department's response companies at each fire station for a seven-day sampling period (May 20 through May 26, 2012). The assessment isolated the number of stations available and identified the time of availability. In some instances, when a station was committed to a call for service and a second request was received in that station's primary response district, another station would be dispatched as the "first due" company from a farther distance.

Review of BFD Company Availability & Service Company

Figure 28 (following page) provides a brief summary of unit availability that had significant downtime during the sampling time period. The data was collected by having the company officer document the companies in and out of station times for all incidents and events. The data that was analyzed is reflected as unit hour availability within their 24-hour shift. Again, the benchmark that is used to determine a success/failure standard is at the 80th percentile with a UHU of .25 to .30.

Unit Hour Utilization During a 24-Hour Shift (One Week Sampling)									Average
Station	Unit	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	
Hdqts	Engine 1	.13	.14	.04	.06	.08	.02	.06	.08
	Engine 5	.02	.15	.06	.04	.07	.02	.03	.06
	3N16	.49	.23	.21	.33	.51	.31	.44	.36
Station #2	Engine 2	.15	.06	.00	.04	.07	.00	.03	.05
	3N53	.10	.16	.13	.30	.20	.07	.13	.16
	M3	.03	.04	.10	.00	.18	.12	.06	.08
Station #3	Truck #3	.15	.14	.02	.00	.09	.07	.13	.09
	3N102	.23	.10	.31	.00	.16	.14	.17	.16
Station #4	Truck #4	.20	.19	.03	.08	.15	.00	.02	.10
	3N51	.14	.27	.15	.12	.24	.23	.15	.19
Station #6	Engine #6	.19	.02	.00	.00	.03	.00	.02	.04

Figure 28: Station Down-Time With and Without Service Company

Unit Reliability

Historic reliability is defined as the probability that the required amount of staffing and apparatus will be available when an emergency call is received. Our analysis showed that as calls for service increase, primarily medical, overlapping calls become increasingly frequent. This should be interpreted that there were simultaneous calls occurring but in different station response zones; thus, the ambulance or engine company that was the primary responder handled the call.

In review of the ambulance availability and reliability baseline data, the BFD has a weakness with ambulance availability. Though the BFD staffs four ambulances, they may, in fact, be unavailable for subsequent calls. Figure 29 indicates that the BFD is experiencing longer downtimes and multiple calls making the primary ambulance in a given service area unavailable. When the primary ambulance is unavailable, the second due ambulance is dispatched creating longer travel times which could have a direct impact to patient care.

Ambulance Availability/Reliability (One Week Sampling)							
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Four Ambulances Out of Service		15 Min's	15 Min's		15 Min's		
Three Ambulances Out of Service	1 Hr 30 Min's	1 Hr 15 Min's	1 Hr 15 Min's	45 Min's	2 Hr's	1 Hr	15 Min's
Two Ambulances Out of Service	2 Hr 45 Min's	5 Hr 30 Min's	6 Hr 30 Min's	5 Hr 30 Min's	6 Hr's	3 Hr 30 Mins	6Hr 30 Min's

Figure 29: Ambulance Availability/Reliability (One Week Sampling)

Assembling an Effective Response Force

In order to begin fireground operations, there must be four personnel on the fire scene within six minutes, 30 seconds—90% of time who can initiate the fire attack. This time includes less than 60 seconds for dispatch processing, less than 60 seconds for turnout, and travel time. The rest of the first alarm assignment (15 personnel total) must arrive within eight minutes—90% of time. An effective response force is intrinsically linked to concentration as fire apparatus normally transports firefighters to the emergency scene. Critical tasking determines the number of firefighters required for a particular emergency. Concentration determines the amount of apparatus necessary to transport them to the scene. The department's present response includes 15 firefighters. Pre-flashover vs. post-flashover set up time, or the time required to set up for the extinguishment of fire, is directly related to the time required to advance hose, search and rescue, ventilation, and a myriad of other tasks. These tasks, in essence, are directly related to the number of firefighters on scene to complete the required tasks.

Assembling the required 15-person response force is critical to providing the safety of first responders and citizens who might be in the fire building. Since flashover is believed to occur within six – ten minutes of ignition, having the proper number of personnel on the scene in a short time can act to reduce the chance of flashover and provide time to make rescues.

The Consulting Team reviewed the response data of five structure fires to assess when 15 personnel arrived on the scene and could begin the required fireground operations. In four of the five reviews, arrival of the fifteenth person occurred within the time standard (Figure 30).

EFFECTIVE RESPONSE FORCE		
Date	**Address**	**15 Personnel On-Scene Within 8 Minutes—90% of time**
May 30,2011	2204 Rainbow Ave	**9:04**
June 9, 2011	1314 W. Market Street	**7:06**
June 30, 2011	208 S. Prospect Road	**7:22**
December 15, 2011	1122 E. Olive Street	**5:57**
December 16, 2011	1301 Six Points Rd	**6:48**

Figure 30: Assembling 15 Personnel On-scene Within 8 Minutes—90% of time.

Recommendation for Effective Response (EF):

Recommendation EF-1: The City of Bloomington Officials should consider placing another ambulance company into service staffed with two Firefighter/Paramedics. Further, if and when another ambulance company is placed into service, fire department officials need to consider the reduction of service areas for each in-service ambulance company with the following two objectives:

- Reduction of travel times.
- Ambulance Unit Hour Utilization is not to exceed the UHU of .30.

Recommendation EF-2: The City of Bloomington Officials should consider equipping each front line engine and truck company with Advance Life Support (ALS) equipment. By doing so, the City would reduce the risk of not being able to respond, in a timely manner, to multiple EMS calls within each response area. Further, the City would experience an improvement to the amount of time when two or three ambulances are placed out-of-service due to back-to-back EMS calls.

COMPUTER RESPONSE MAPPING

City of Bloomington

Computer response mapping is provided to illustrate Insurance Services Office (ISO) distances plus travel times reached by responding apparatus traveling from Bloomington's Fire Stations #1, #2, #3, #4, and #6 at average speeds of 32 mph.

A mathematical matrix (ArcView Network Analyst) was used to calculate the travel time on each segment of a road-street network map within the Department's response area. Further, portions of the Recommendations of Coverage were also provided for Normal Fire Stations #1, #2 and #3, to determine their impact on overall travel time.

The following information should be kept in mind as the computer-generated maps are reviewed:

- The computer maps are based on digitized representations of streets and roads within the Bloomington and Normal Fire Departments as prepared for the United States Census Bureau ("Tiger Maps"). The mapping is generally precise for the purposes at hand. In some cases, there may be newer build-out areas not covered in the Census material.
- In the Tiger Map system, the original computerization divided all streets and roads into segments of specific lengths (called "links"). In some cases these links are not necessarily directly useable in the fire-mapping programs. At times, either when determining ISO distances or speed-time calculations, the computer-mapping program for fire coverage analysis may utilize a whole link where it should be using only a part. This is especially true when there are long "links," such as on major roads and highways, where there tend to be fewer intersecting streets. In these instances, there can be occasional distance or time errors. These occur because the fire coverage area mapping software, except in cases where the consultant recognizes these obvious errors and makes the adjustment manually, cannot re-divide the original links. The errors are not significant in the analysis of fire coverage and distance/time maps because the distance and time segments typically used in the mapping are relatively short, with many intersecting streets, and normally coincide quite closely with Tiger Map links. Small errors may occur, and generally happen randomly and across the entire mapping area.
- The overall result is that the errors tend to be canceled out, and there is little, if any, effect on the main analysis. In the case of larger distances and/or time intervals, or the utilization of long links when only short distance/time intervals are desired, mapping distances and times are approximate. For the most part, and based on our experience with many applications, the impacts of any discrepancies which might occur are considered to be insignificant.
- The U.S. Census Feature Classification Code describes street and road characteristics, and a mathematical matrix (ArcView Network Analyst) enables a calculation for driving

time on each segment of a road-street network. Road segments are rated as follows: interstate highway segment classified at a 55-mph average speed; a primary, limited access road at 45 mph; a secondary connecting road at 33 mph, and local neighborhood roads at 25 mph. Considering local street speed limits, the size and weight of fire vehicles, and accident liability considerations, careful review of response speed limits is essential. Very little research, if any, demonstrates that more speed results in less fire loss.

- ISO calls for an engine company within 1.5 miles of every built-on area, and a ladder company within 2.5 miles of any area with five or more buildings of three stories of 35 feet or more in height. Typically, structures more than five miles from a fire station and areas without fire hydrants have extra insurance costs assigned to them.
- NFPA Standard 1720 (*Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Volunteer Departments, 2004 edition*) identifies staffing and response time as shown in Figure 31. It must be understood that NFPA identifies response time from the moment the fire department is toned out to when the first-arriving engine company (or ambulance) is on the scene. It does ***not*** include call-handling time.
- NFPA 1710 (*Standard for the Organization and Deployment of Fire Suppression Operation, Emergency Medical, and Special Operations to the Public by Career Fire Departments, 2001 edition*) calls for a travel time of no more than 240 seconds for the first-due engine company with a minimum of four personnel, plus the entire first alarm assignment (15 personnel minimum) within 540 seconds, 90% of the time, for annual fire calls.

Demand Zone	Demographics	Staffing & Response Time	Percentage
Special risks	Authority Having Jurisdiction (AHJ)	AHJ	90
Urban	1000 people/1 sq. mi.	15/9	90
Suburban	500-1000 people/1 sq. mi.	10/10	80
Rural	Less than 500 people/1 sq. mi.	6/14	80
Remote*	Less than/= Travel Distance 8 mi.	4	90

Figure 31: NFPA Table 4.3.2 Staffing and Response Time

The US Tiger files contained 6526 links for the entire area covered by the Bloomington Fire Department and the Normal Fire Department. Figure 32 illustrates the approximate travel miles to the furthest point in the District and the miles for the total combined coverage area between Bloomington and Normal Fire Departments.

Department	Station	Approximate Miles to Furthest Point in District	Approximate Miles to Furthest Point in Total Map Coverage
Bloomington	#1 HQ	7.7	8.6
Bloomington	#2	8.0	9.0
Bloomington	#3	9.6	9.6
Bloomington	#4	9.9	9.9
Bloomington	#6	11.7	12.5
Normal	#1 HQ	5.9	9.3
Normal	#2	6.4	10.9
Normal	#3	8.3	10.6

Figure 32: US Tiger Links, Coverage in Miles.

Review & Findings of Current Travel and ISO Maps

Figure 33 illustrates a four-minute travel time coverage area for each of the BFD fire stations and Figure 34 illustrates six-minute travel time for each station.

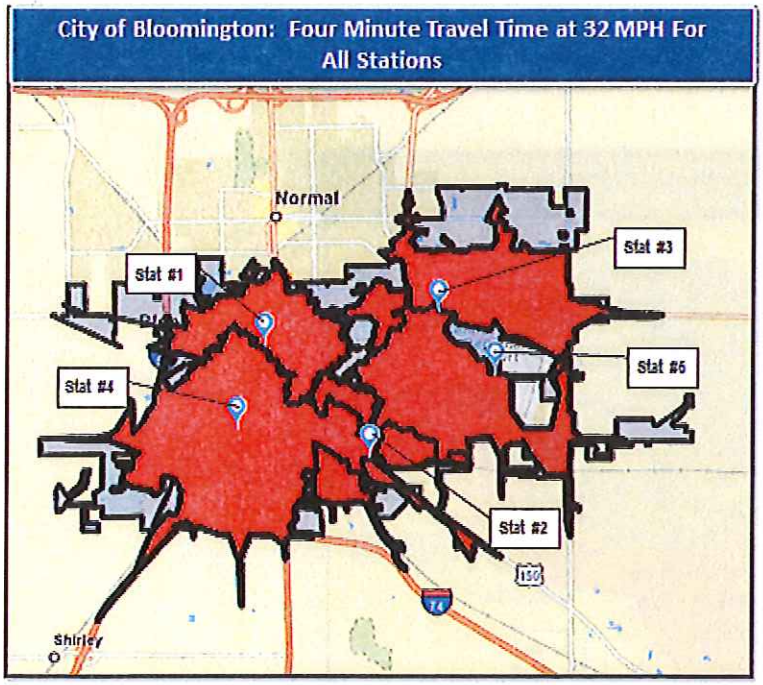

Figure 33: City of Bloomington Four Minute Travel Times at 32 MPH for All Stations

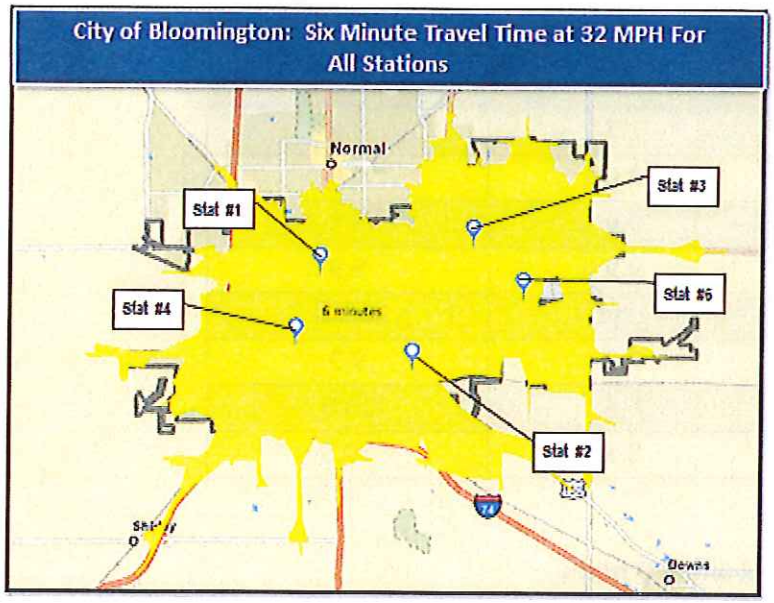

Figure 34: City of Bloomington Six Minute Travel Times at 32 MPH for All Stations

ISO distances were also assessed based upon the current distribution of both engine and truck companies. Figure 35 illustrates the current ISO coverage based upon the current placements of the BFD engine companies (RED): Station #1, #2, and #6 and truck companies (BLUE): Station #4 and Station #3.

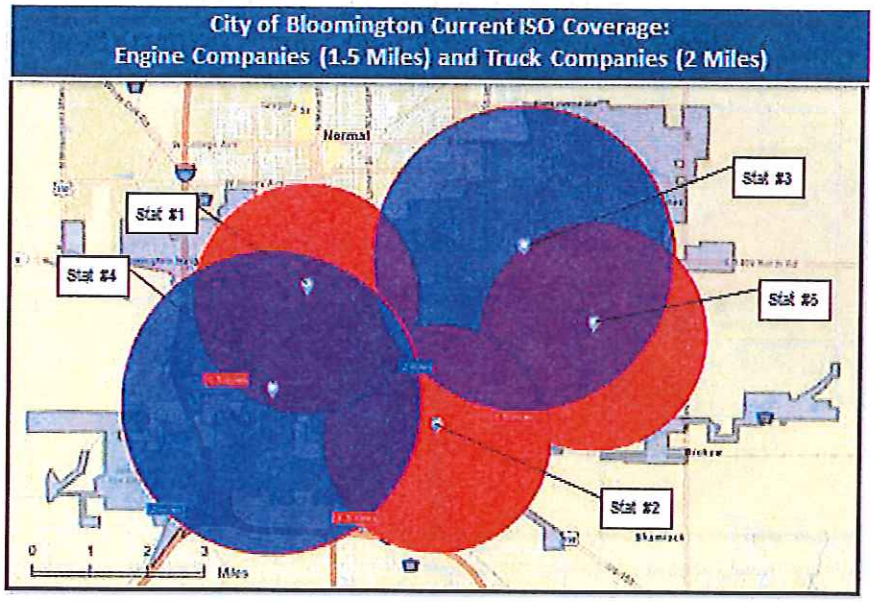

Figure 35: BFD Current ISO Coverage: Engine and Truck Companies

What is evident from Figure 36 is that the vast majority of the developed streets within the Northeast and Southwest quadrant of the response area are not within the ISO 1.5 mile distribution range. The current distribution of engine companies reflects a weakness in respect to the area of coverage recommended by ISO. Further, if we apply the NFPA travel time coverage of four to six minutes to all three of the BFD engine companies, we find in Figure 37 that a significant area of the response area (Northeast and Southwest quadrants) is not within an adequate area of coverage.

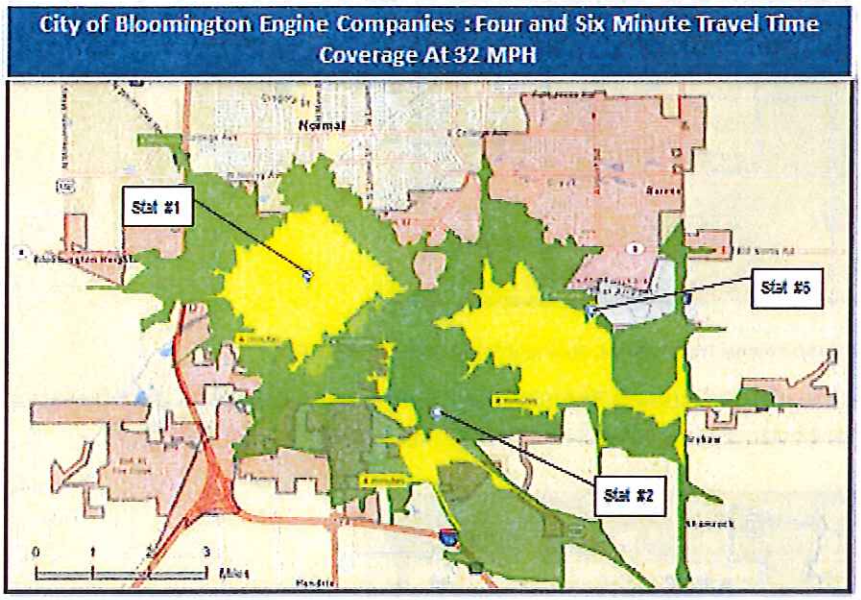

Figure 36: BFD Engine Company Travel Times, Four and Six Minutes @ 32 MPH

To assess the possibility of improving the area of coverage to the Northeast area, the Consulting Team conducted a Time Travel Analysis from the Town of Normal to determine if an auto-aid engine response (and using the four to six-minute travel time assessment) would improve the level of service. Figure 37 exhibits an improvement to the coverage but there is still a significant area that does not fall within the recommended benchmarks of both ISO and NFPA.

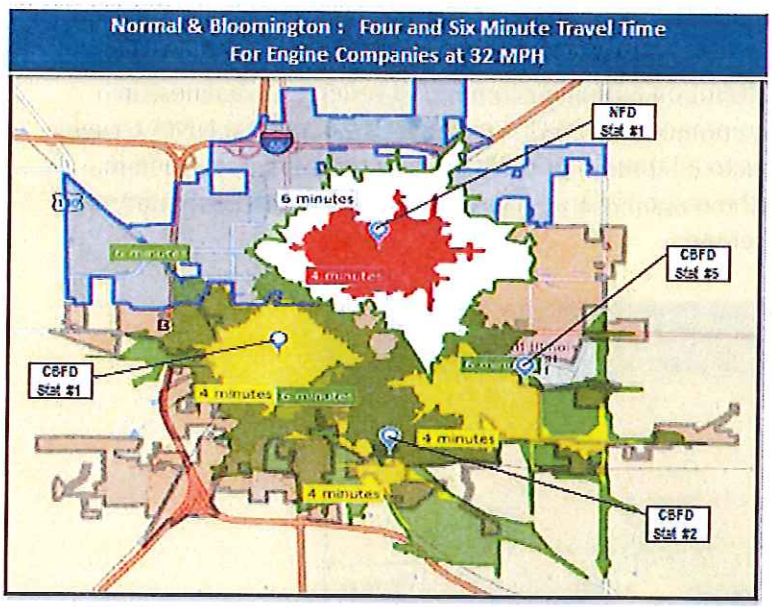

Figure 37: Normal FD and Bloomington FD Engine Travel Times, Four and Six Minutes @ 32 MPH

In conducting a further analysis, the Consulting Team placed an engine company in BFD Station #3 and found that the area of coverage improved significantly as exhibited in Figure 38.

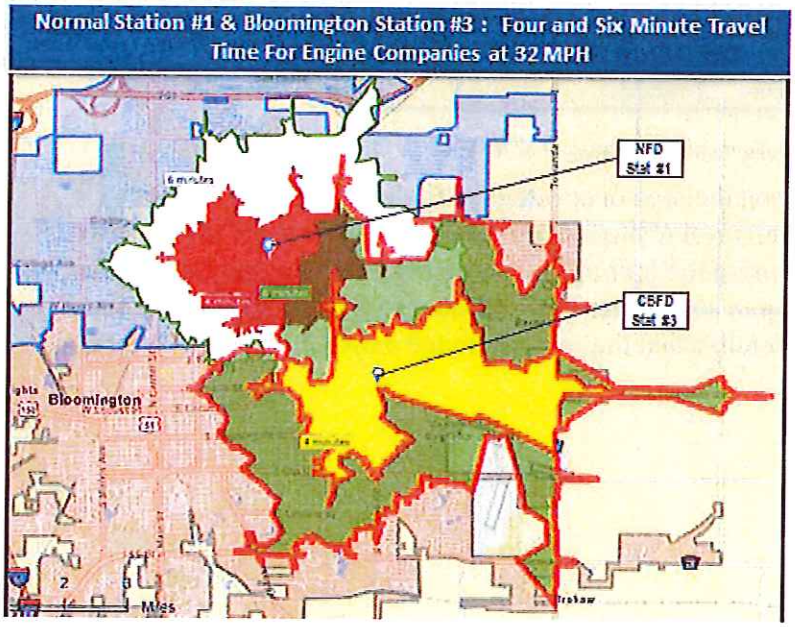

Figure 38: Normal FD #1 and Bloomington FD #3 Four & Six Minute Travel Times for Engine Companies@32 MPH

In regard to the Southwest quadrant of the BFD, the Consulting Team conducted an analysis of placing the station in service with an engine company and conducted a four and six-minute Travel Time Analysis. Figure 39 exhibits an improvement to the response area in question but the City would not benefit by placing the station in service since over 90% of its coverage area

does not fall within the City limits. The BFD would be better served by seeking auto-aid assistance to the Southwest quadrant.

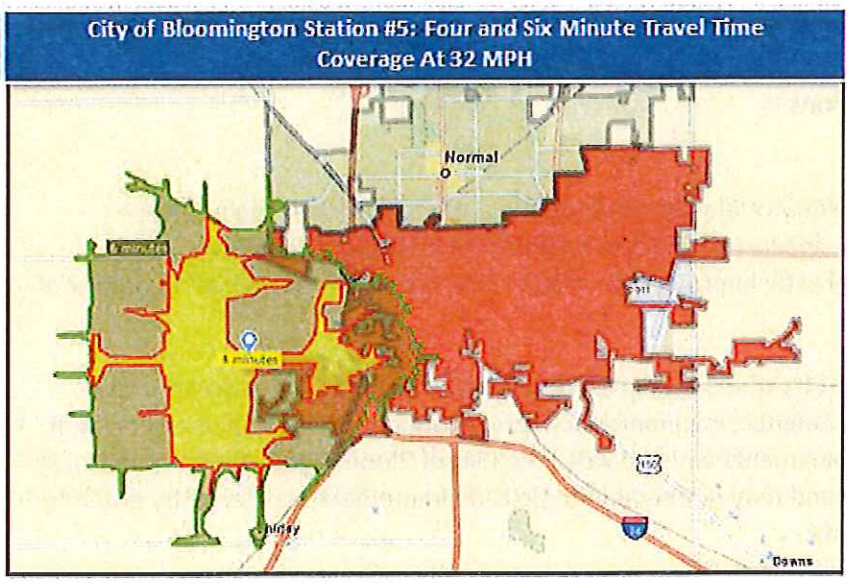

Figure 39: Bloomington #5: Four and Six minute Travel Times @32 MPH

Recommendations for Improving Response Times (RT)

Recommendation RT-1: The City of Bloomington Officials should continue to monitor the established performance measurement criteria standards, response time standards and related performance measurement criteria for both fire and EMS response times. Further, regular reporting and review of the response times should be established to assist in identifying weaknesses within each response time element on a quarterly basis.

Recommendation RT-2: The City of Bloomington Officials should monitor, on a quarterly basis, the company and station availability. By monitoring the baseline data of station availability, the District will be able to create benchmark performance standards to support vehicle and personnel distributions for the entire response area.

Recommendation RT-3: The City of Bloomington Officials should consider the installation of a turnout timer that would be installed at each station in the apparatus bay area. The turnout timer provides a visual readout of the time elapsed since the call was received at the fire station. The timer is used to assist firefighters in meeting the department's response time goals and equips them with the information they need to continue working towards decreasing turnout times and getting out of the station quickly.

Recommendation RT-4: The City of Bloomington Officials should consider placing/creating an engine company at Station Three to ensure that the Northeast quadrant has adequate coverage. The current distribution is not likely to receive full ISO and NFPA response time credit.

Recommendation RT-5: The City of Bloomington Officials should investigate the option of implementing a quint program, or quintuple combination pumper that will serve the dual purpose of an engine and a ladder truck. The objectives of the investigation should include:

- Budgetary cost
- Efficiencies in operations
- ISO grade impact

Recommendation RT-6: The City of Bloomington Officials should consider the need to eventually relocate Station 5 approximately one-mile east of its present location. The proposed relocation would greatly improve the area of coverage to the southwest quadrant of the response area.

Recommendation RT-7: The City of Bloomington Officials should review all automatic and mutual aid agreements with neighboring emergency service organizations on a yearly basis. It is understood that those departments which border the City of Bloomington to the south, east and west are volunteer-only and may not be able to provide immediate assistance by entering into automatic aid agreements.

Recommendation RT-8: City of Bloomington Officials should consider the creation of ALS engines and truck companies that will help to support the growing demand for emergency medical services. Further, in areas of extended response times for ambulance companies, the ALS engine or truck company would shorten the time between the call for assistance and patient care.

Recommendation RT-9: The City of Bloomington Officials and the Town of Normal Officials should consider the creation of a joint emergency liaison committee (JELC) to explore an integrated partnership for emergency responses. The JELC objectives would be as follows:

A. Investigate the creation of a single EMS and fire suppression response card for the overlapping response coverage areas for the Town of Normal Station #1 and the City of Bloomington Station #3 (Figure 38).

B. Investigate the creation of an EMS First Responder Squad (non-transporting unit) with two cross-trained firefighter/paramedics who would respond to all EMS emergencies with the overlapping response coverage areas.

C. Subscribe to a common AVL system or provide a workable interface to facilitate the "closest unit" responding to calls for service.

STAFFING MODELS AND FULL TIME EQUIVALENCY (FTE)

The economic slowdown has caused many local governments to review their staffing models to justify personnel cost. One staffing model calls for keeping a large enough crew so as to not pay overtime to cover leaves (overstaffing). Another model calls for having smaller staff and using overtime to cover leaves (constant staffing).

In an overstaffing or constant staffing model, the fiscal savings would come from the cost difference between full-time employees and annual overtime liability for operational staffing. As an example, a fully loaded employee (salary plus benefits) costs 163% and decreases to 161% as the employee steps out of his salary step program. Overtime costs are 150%. Therefore the savings equals the full-time employees multiplied by the annual salary savings of a fully loaded employee less overtime costs. The savings comes by not having to overstaff to cover for vacation relief, work reduction day relief, or sick relief. Also, there are days when they are not needed, and they bring their own leave liability to the equation.

However, when using the constant staffing model, there comes a point in the process where it is financially more prudent to hire full time equivalents (FTE) than continue to pay the overtime.

The FTE formula is a statistical measure that estimates the real workforce needed to cover full-time positions, including negotiated time-off for the current staff and the hours needed to meet the minimum daily staffing levels.

It is important to note that there is no homogenous deployment or a standard staffing formula implemented that is applied across the fire service. Nonetheless, careful contemplation of the pros and cons of staffing models and strategies, along with a clear understanding of the local government's financial stability, will determine which model to apply.

Labor Agreement Staffing References

In order to assess the staffing level needs of the BFD, the Consulting Team reviewed the Labor Contract between International Association of Firefighters Local 49 and the City of Bloomington Fire Department, May 1, 2009 – April 30, 2012, which provided the information or baseline data that was needed to assess the current staffing levels.

The Labor Management Agreement revealed Article 9, *Recall Pay and Call-in Procedure*; Section 9.2. *Recall Procedure* addresses the minimum staffing levels for the Department. The Section is summarized in Figure 40.

Fire Station Staffing Section Summary:

- Three (3) personnel on each front-line, in-service fire apparatus
- One (1) ARFF Engineer
- Two (2) EMS Personnel for each front-line, in-service dedicated ambulance
    - One (1) person for each EMS alternative response vehicle
- One (1) Shift Commander

Minimum Shift Level Staffing Summary

- Three (3) personnel assigned to each frontline, in-service fire apparatus
    - One (1) officer/acting officer
    - One (1) engineer
    - One (1) firefighter
- One (1) ARFF Engineer
- Two (2) EMS Personnel for each frontline, in-service dedicated ambulance
- One (1) Assistant Chief on duty

Figure 40: Minimum Staffing Levels per Current Labor Agreement

The BFD authorized shift strength for the department is 99 (three shifts of 33). The department currently maintains a minimum staffing level of 28 per shift. Figure 41 on the next page is a summary of the current staffing at each of the five stations per shift.

Staffing Configuration per Current Running Procedures					
Station	**Personnel**			**Apparatus**	**Response Type**
	Minimum Staffing Levels		**Maximum Staffing Levels**		
	Engine or Truck	**Ambulance**			
Station 1	Captain: 2 Engineer: 2 Firefighters: 2	EMS Person: 2		Engine Engine Ambulance	Fire/ALS
Station 2	Captain: 1 Engineer: 1 Firefighters: 1	EMS Person: 2 ALS Car: 1		Engine Ambulance	Fire/ALS
Station 3	Captain: 1 Engineer: 1 Firefighters: 1	EMS Person: 2		Truck Ambulance	Fire/ALS
Station 4	Captain: 1 Engineer: 1 Firefighters: 1	EMS Person: 2		Truck Ambulance	Fire/ALS
Station 6	Captain: 1 Engineer: 1 Firefighters: 1 ARRF: 1			Engine	Fire
Total	**28**		**33**		

Figure 41: Staffing Configuration per Current Running Procedures

In regard to time off, the Labor Management Agreement revealed several Articles and Sections that addressed the current maximum and minimum staffing of the City. Those sections are exhibited beginning on the next page.

ARTICLE 3: VACATION

Section 3.1: Eligibility for vacation.

Employees covered by this Agreement shall be entitled to vacation as follows:

Years of Continuous Service	A-B-C Shift Employee	40 Hr. Wk.
DOH but less than 2 yrs.	3 duty days	1 week
2 yrs. but less than 8 yrs.	5 duty days	2 weeks
8 yrs. but less than 15 yrs.	7 duty days	3 weeks
15 yrs. but less than 20 yrs.	10 duty days	4 weeks
20 yrs. or more	12 duty days	5 weeks

Figure 42: Bloomington Fire Department Employees' Vacation Schedule

All said vacation periods shall be given in each calendar year with pay and may be split into periods of not less than one (1) duty day.

There shall be a total of three (3) slots available per shift within which vacation and personal days may be picked. Additional slots shall be available at the beginning of each shift provided no overtime is created as a result of granting the additional time off.

Section 3.2: Personal Days.

Shift employees shall be entitled to one (1) twenty-four (24) hour personal day each calendar year. Shift employees shall be permitted to take personal time in twelve (12) hour increments starting at 7:00 a.m. and 7:00 p.m. Forty (40) hour employees shall be entitled to two (2) eight (8) hour personal days each calendar year. Forty (40) hour employees shall be permitted to take vacation or personal time in increments not less than one (1) hour and subject to the needs of the Department. Any PC time remaining at the end of the calendar year shall be converted to sick leave. Probationary Employees hired prior to July 1 will receive twenty-four (24) hours of personal time. Probationary Employees hired on July 1 or thereafter shall receive twelve (12) hours of personal time.

Section 7.2: FLSA Work Cycle.

The City shall establish an individual FLSA work cycle for each employee covered by this agreement which commences at 7:00 p.m. on the first day of the cycle and concludes at 7:00 p.m. on the 21st day of the cycle. Each employee's work cycle shall be established so that the employee's Kelly Day (14th shift) falls on the shift starting at 7:00 a.m. on the 21st day of their work cycle and ends at 7:00 a.m. on the first day of the succeeding work cycle.

Scheduled Time Off Section Summary:

- Limitation of five to six shift personnel are permitted to schedule vacation and/or Kelly Days (Three on vacation and two or three on Kelly)

Using the operational staffing level of 99 (18 Captains, 21 Engineers, 24 Firefighters, 36 Paramedics) there is a total platoon strength of 33 personnel. Taking into account the amount of personnel allowed off for each shift day (five to six personnel), the minimum staffing level for each shift becomes 28.

An analysis of emergency service staffing begins with a comparison of available emergency service personnel to other communities of similar size and organization. The following chart, using NFPA benchmark data for the region, provides an overview of the staffing level of the BFD on the basis of firefighters per 1,000 population (City of Bloomington Population of 76,610).

Rates of Career Firefighters per 1,000 People By Region and Population Protected 2010					
Population Protected	Low	Median	High	Midwest Median	City of Bloomington (99 FF's)
250,000 or more	.42	1.17	2.30	1.44	
100,000 to 249,000	.50	1.33	3.23	1.30	
50,000 to 99,999	.00	1.29	3.36	1.25	1.29
25,000 to 49,999	.00	1.25	5.03	1.08	

Figure 43: NFPA Survey of Fire Departments for U.S. Experience, 2010

Figure 43 provides a good indication that BFD is experiencing a normal level of emergency response staff in comparison with other cities of similar size in the region. As an additional note, the International City Manager's Association (ICMA) places the nationwide average city fire department strength at 1.59 per 1,000 population.

Regardless of the raw number of personnel available to a department, what matters most is the actual number of emergency responders the agency is able to produce at an emergency scene.

Staffing Model A (Current Base-Line Staffing)

Staffing Level of 99 and with a minimum of 28 per shift

The Consulting Team began their review with an operational staffing level baseline of 99 personnel (33 personnel per shift). Applying the Labor Agreement language of allowing five (5) personnel off per shift, the shift minimum would be 28 personnel per shift.

The minimum staffing level configuration as exhibited and implemented (Figure 44) is the baseline for both concentration and distribution of personnel. BFD has embraced this model as the acceptable level for staffing for fire and EMS service level demands. However, if the supervisor allows six (6) personnel off per shift, the department may incur overtime costs; or, reduce the level of service to the City by taking down a company in order to meet the staffing minimum of 28. Further, following the recommended standard of NFPA 1710 (four personnel minimum on a company), the staffing of a single engine or truck company should be a total of four personnel. Currently, Station 6 would not be in compliance with the recommended standard.

Staffing Model A: Current Staffing Level of 28 Personnel Per Shift						
	Station #1	Station #2	Station #3	Station #4	Station #6	
Captains	2	1	1	1	1	
Engineers	2	1	1	1	1	
Firefighter	2	1	1	1	1	
Firefighter/Paramedics	2	3	2	2		
ARFF					1	
TOTAL	***8***	***6***	***5***	***5***	***4***	***28***

Figure 44: Staffing Model A: Minimum of 28 Personnel per Shift

Full Time Equivalency Applying Staffing Model A

The definition of FTE (full time equivalent) is the number of working hours that represents one full-time employee during a fixed time period, such as one month or one year. FTE simplifies work measurement by converting work load hours into the number of people required to complete that work. FTE management is the analysis, decision making, and change implementation processes that determine how many employees are needed in order to reduce overtime cost and optimize staffing levels. The Consulting Team reviewed the entire operational roster of scheduled vacation and Kelly Days and found that an average of 7 vacations and 9 Kelly Days are scheduled for the calendar year (Information provided to the Consulting Team from City of Bloomington Compensation and Benefit Manager).

Applying the Full Time Equivalency (FTE) assessment to Staffing Model A, it is evident that the department has been able to control overtime cost. With the current staffing level of 99 full-time positions (33 per shift), and allowing the number of personnel off for scheduled vacations and/or Kelly Days (five per shift), ***the FTE formula equates to -1.36.*** *The formula indicates that in order to reduce overtime costs without taking down companies, the BFD would need to hire three (3) additional Firefighter/Paramedics for a total roster of 102 personnel.*

Full Time Equivalency: Cost / Benefit Applying Staffing Model A

From the payroll information provided to the Consulting Team, it is evident that the BFD could hire three (3) additional personnel which would reduce the overtime figure and more importantly, reduce the cumulative stress on its personnel by reducing the additional hours that they will work to cover the overtime. In visiting the overtime expenses compared to

paying a new employee's salary, the full-time starting salary of a probationary firefighter is on average $45,221.00.

If the City hires three (3) personnel at approximately $46,000.00 each, with benefits, the City will need to budget $69,000.00 per employee. Multiplying this by three firefighter positions will result in a cost of approximately $207,000.00. Upon review of the BFD FY 2012 overtime budget, the City has projected $1.4 million dollars to cover all overtime expenses. The Consulting Team believes that $207,000.00 of the overtime funds could pay for the three new firefighters. In doing so, the firefighter overtime budget would be reduced due to the fact that overtime would not be called in order to comply with the minimum staffing requirements. However, it is understood that the City may still incur some fill-in pay or overtime. The reason is that both the City and the Consulting Team cannot predict the unscheduled time off expenses that would be incurred for workers compensation and other unscheduled time off.

In regard to budgeting for personnel costs, fill-in pay has always been difficult to determine (or predict) along with other unforeseen increases in respect to employee benefits. However, given employees' pensions and the issue of funding pension liabilities, the Illinois General Assembly has provided some relief in a new Tier II pension system. The Commission on Governmental Forecasting and Accountability (COGFA) has published an initial fiscal analysis of P.A. 96-1495. This new law creates a modified benefit structure for newly-hired public safety employees and makes other reforms concerning pension funding and actuarial methodology. The COGFA analysis shows considerable savings for the employer's normal cost going forward. The actuarial analysis of change in normal cost as a percentage of payroll for current employees (Tier I) is at 22.52% and for new employees (Tier II) it will be at 10.20%. It is apparent that the BFD would benefit from the new Act.

Referencing the current ISO Evaluation and Class 3 rating of the City of Bloomington, ISO recognizes 27.59 on-duty personnel responding on first alarm structure fires with a total points earned of 9.85 out of a maximum of 15. If the City chooses to implement Model B staffing and hires the additional personnel as proposed, the City may gain additional credit for company personnel.

Staffing Model B – NFPA 1710 Benchmark Staffing with 5 personnel per Station
Staffing level of 108 with a Minimum of 31 Personnel per shift

The recommended standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to Public by Career Fire Departments (NFPA 1710) recommends a minimum of four personnel assigned to a company. Further, the standard defines a company as:

> *A group of members: (1) Under the direct supervision of an officer; (2) Trained and equipped to perform assigned tasks; (3) Usually organized and identified as engine companies, ladder companies, rescue companies, squad companies, or multi-functional companies; (4) Operating with one piece of fire apparatus (engine, truck, ladder, elevating platform, quint, rescue, squad, ambulance) except where multiple apparatus*

are assigned that are dispatched and arrive together, continuously operate together, and are managed by a single company officer; (5) Arriving at the incident scene on fire apparatus.

In order to meet the NFPA 1710 benchmark of four personnel assigned to a company, the Consulting Team is exhibiting ***Staffing Model B*** *(*Figure 45*)* which would create a five person company in each of the five fire stations. At the beginning of each shift, the Officer could then assign three personnel to engine and two personnel to the ambulance but with the full understanding that if and when a fire emergency call is received, both the engine and ambulance will be dispatched together.

By adopting Model B, the City Officials would improve the level of emergency service to the community while ensuring the reliability that an in-service apparatus will be available when multiple emergencies are received.

Staffing Model B: Benchmark Staffing Level of 31 (Minimum) Personnel Per Shift						
	Station #1	Station #2	Station #3	Station #4	Station #6	
Captains	2	1	1	1	1	
Engineers	2	1	1	1	1	
Firefighter	2	1	1	1	1	
Firefighter/Paramedics	2	2	2	2	2	
ARFF					1	
TOTAL	***10***	***5***	***5***	***5***	***6***	***31***

Figure 45: Staffing Model B: Benchmark Staffing Level of 31

(It is important to note that the distribution of apparatus would be determined by the Administrative staff of the City and that the figure below is just one possible distribution of apparatus).

Applying the Full Time Equivalency (FTE) assessment to Staffing Model B, the department would need to increase staffing to 108 with a per shift staffing of 36 maximum and 31 minimum. By increasing the staffing from 99 to 108 ***(nine additional hires***) and allowing the number of personnel off for scheduled vacations and/or Kelly Days (five per shift), ***the FTE formula equates to .10.***

Full Time Equivalency: Cost / Benefit Applying Staffing Model B

If the City hires nine (9) personnel at approximately $46,000.00 each, with benefits you will have to budget $69,000.00 per employee. Hiring nine (9) additional firefighters will cost approximately $414,000.00. Upon review of the BFD FY 2012 overtime budget, the City has project 1.4 million dollars to cover all overtime expenses. The Consulting Team believes that $414,000.00 of the overtime funds could be used to hire nine new firefighter/paramedics. In doing so, the firefighter overtime budget would be reduced due to the fact that overtime would not be called for in order to comply with the minimum staffing requirements. However, it is understood that the City may still incur some fill-in pay or overtime. The reason is that both the City and the Consulting Team cannot predict the un-scheduled time off expenses that would be incurred for workers compensation and other unscheduled time off.

Staffing levels and manpower distribution create constant challenges for fire service leaders. Balancing emergency service delivery and maintaining financial efficiencies is even more difficult in today's economy. Many fire departments around the country are forced into implementing strategies that reduce costs of operating the fire department. One such strategy is referred to as a "brown-out". A brown-out is defined as the temporary closing of a fire station(s), force reduction and the redistribution of manpower to other fire stations in an effort to lower operating costs (typically overtime).

Brown-out strategies may create financial savings. However, temporarily closing fire stations and/or reducing daily firefighting staff and the subsequent redistribution of existing staffing can have a negative impact on the community as well as the first responders. It will take longer to assemble needed resources at the scene of an emergency; longer response times may result in poor patient outcomes during emergency medical responses; longer response time will also contribute to increased fire growth in structure fires; greater potential for property loss and fire casualties. Additional impacts of brown-outs can include less time for personnel training, performing fire inspections, equipment maintenance and pre-incident fire planning. Injury rates may increase as well.

It is imperative that city leaders carefully conduct risk benefit assessments, review all circumstances and evaluate all potential outcomes prior to committing their fire department to a brown-out strategy. It is an extremely controversial issue; a matter of public safety; one that should never be taken lightly.

Recommendations for Staffing Models & FTE (SM):

Recommendation SM-1: If the City of Bloomington Officials decided to continue with the baseline Staffing Model-A, the Officials should consider the hiring of three (3) additional personnel. In doing so, the City will be able to maintain the current minimum staffing level of 28 but with reduction in overtime cost. More importantly, the amount of risk to employees who work the extra hours will be reduced.

Recommendation SM-2: The City of Bloomington Officials should consider seeking federal grants to assist with career firefighter staffing and various emergency and non-emergency related activities. Most grants are extremely competitive and the applying agency/request must meet specific eligibility criteria in order to qualify for federal funding. Additionally, there are financial obligations (if awarded) that would require the agency to provide a percentage of the total award or matching funding. Below is a listing of some federal grants that are available:

- Staffing for Adequate Fire & Emergency Response Grant (SAFER)
- Assistance to Firefighters Grant (AFG)
- Fire Prevention and Safety Grant (FP&S)
- Pre-Disaster Mitigation Program (PDM)
- Emergency Management Performance Grant (EMPG)
- Interoperable Emergency Communications Grant Program (IECGP)
- Emergency Operations Center Grant (EOC)

- Commercial Equipment Direct Assistance Program (CEDAP)

Recommendation SM-3: The City of Bloomington Officials should consider the **NFPA 1710 benchmark staffing of four to five personal assigned to a company. In order to meet the benchmark, the City would need to hire nine (9) additional personnel (Staffing Model B).** By doing so, fire department officials would have the ability to improve both the concentration and distribution of personnel and apparatus which would better serve the City during high demands for service.

Recommendation SM-4: The City of Bloomington Officials should continue to require a minimum qualification for all future hiring of firefighter/paramedics.

ADMINISTRATIVE REVIEW

General Observations

In every fire department, there are important administrative functions and duties, such as training, fire inspections, vehicle maintenance, preplanning, and EMS services that are provided in addition to operational emergency responses. Some of these duties provide proactive protection, others enhance the response to emergency service requests, and others provide the additional benefit of limiting liability for errors and omissions.

The proper mix of staff officers to line officers depends on a number of important factors including:

1. The frequency of and potential for emergency calls.
2. The range of services expected of the fire district/department.
3. The type of service preferred by the community.
4. The financial resources of the community.

It is important to remember that what might work well in one community might not work well in another. Thus, there are no absolute standards that can be followed.

Findings

The current Bloomington Fire Department organizational chart and structure for both administration and operations were examined to determine if modifications could be made to increase efficiency and effectiveness. It is important to note that the day-to-day administrative functions of a fire department can be very demanding, and it is imperative that the fire chief have the necessary staff to address the issues facing an organization that has an increasing number of requests for service each year.

Coordination of training and certification/re-licensure, continuing education, fire inspections, scheduling of staff, monitoring emergency calls, monitoring treatment of EMS and rescue patients, monitoring procurement and equipment purchases, maintenance and a variety of other duties must be performed if the fire department is to function effectively. These duties require time and attention and key personnel to provide leadership, direction and consistency. Figure 46 exhibits the current administrative structure for the Bloomington Fire Department.

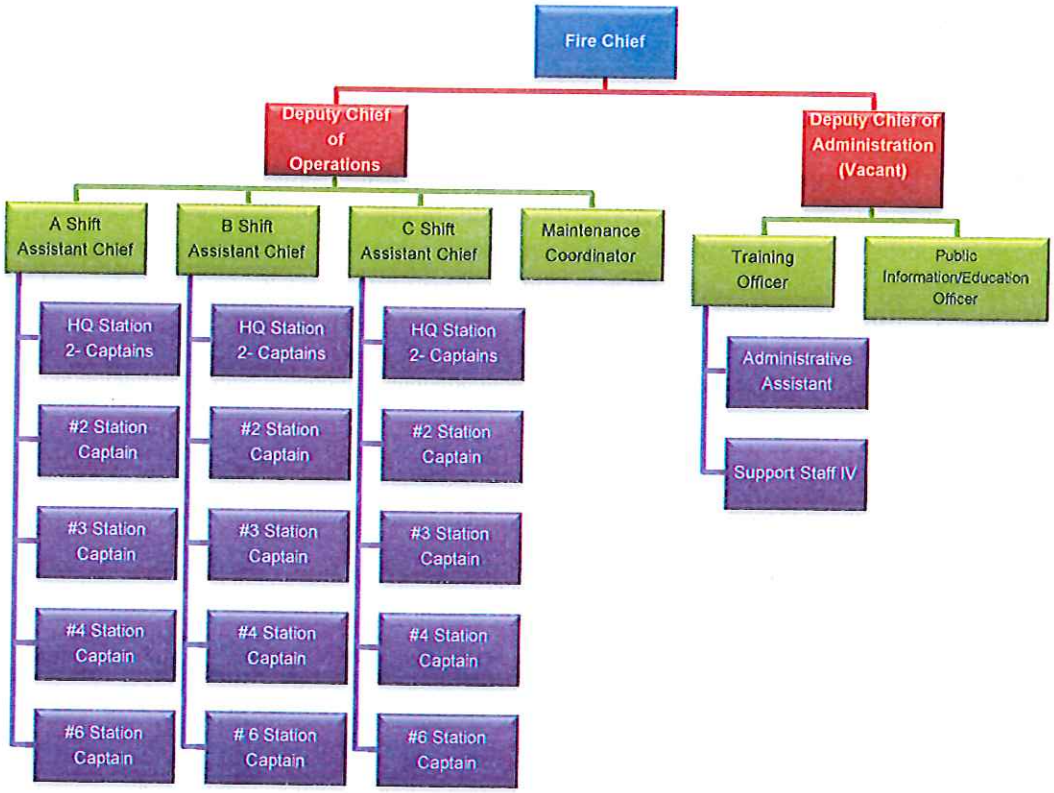

Figure 46: Current Administrative Structure of the Bloomington Fire Department

Bloomington Fire Department Administrative Structure

The Consulting Team, in examining the administrative structure of the Bloomington Fire Department, identified a full-time day staff consisting of the Fire Chief, Deputy Chief of Operations, Training Officer, a Public Information Officer, a Maintenance Coordinator, and an Administrative Assistant.

Consistency and standardization are critical components in administering the functions of the Bloomington Fire Department and it is imperative that the Fire Chief have the necessary support to allow the Fire Chief to focus on the strategic issues of a growing fire department. This includes keeping the City Manager and elected officials aware of policy needs of the department and implementing policy set by the Manager and elected officials within the department.

In a survey of comparable Illinois fire departments, with populations of 70,000 +/- 5,000, we found the Bloomington Fire Department to be in the median percentile of total number of officers (Figure 47).

City	Population	Shift Officers	Staff Officers	Total Officers
Champaign	74,870	30	4	34
Evanston	75,489	27	5	32
Bloomington	76,610	24	2	26
Arlington Heights	73,000	19	5	24
Bolingbrook	68,330	18	5	23

Figure 47: Equivalent Organizations for Population and Number of Fire Officers

The Consulting Team provides a recommended organizational chart for the Bloomington Fire Department (Figure 48). This structure fills the vacant Deputy Fire Chief Administration position. Filling this critical position would allow the Fire Chief to concentrate on policy recommendations to improve the operation and efficiency of the Department.

The Emergency Medical System (EMS) Coordinator position is recommended to be considered as a shared resource between the City of Bloomington and the City of Normal. This position would be included in the administrative staff responsible to manage the administrative and operational aspects of high volume emergency medical responses for both agencies. This position would increase the accountability and effectiveness of emergency medical services delivery to the citizens and visitors of the communities. The EMS Coordinator would be responsible for analyzing, planning, designing, implementing and administering EMS programs as well as other department-wide and community oriented programs. Details of the exact reporting relationship could be determined by each organization's chief.

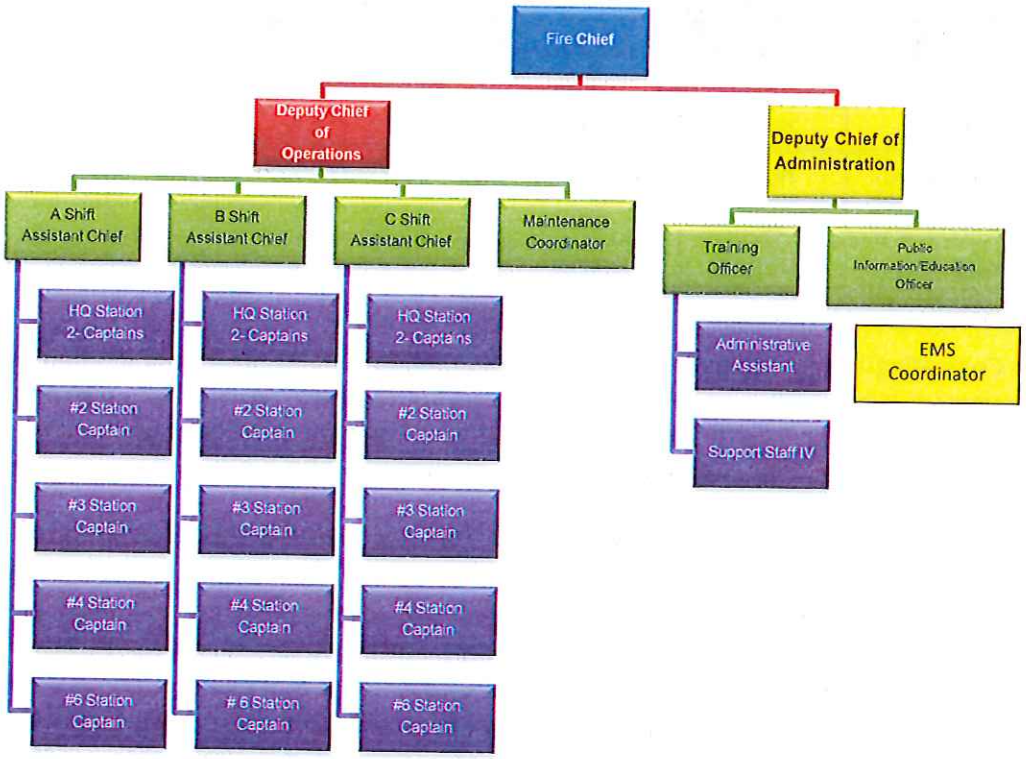

Figure 48: Proposed Administrative Organizational Chart for the Bloomington Fire Department

Recommendations for Administrative Structure:

Recommendation AD-1: City of Bloomington Officials should strongly consider opening dialogue with the City of Normal to create a position of EMS Coordinator that can be shared between both agencies. Financial responsibility as well as time commitment between both departments can be shared equally. There currently is no EMS Coordinator for either agency, which creates a situation where either monitoring of EMS activities is insufficient where the position would result in an increased assessment of activities and training. The coordinator would also be in a position to recommend additional community activities to improve the health of the citizens of Bloomington and Normal. The position could either be civilian or sworn but must be highly qualified to gain credibility.

Recommendation AD-2: City of Bloomington Officials should create a joint committee with the Town of Normal Officials to explore the possibility of creating and sharing EMS Field Supervisors (one for each shift of operation) with job duties that would include: response to all ALS emergencies; training of current and probationary EMS personnel; and quality assurance program oversight.

Recommendation AD-3: City of Bloomington Officials should consider filling the vacant Deputy Fire Chief position so the Chief would not be so involved in day-to-day which would preclude him from being able to see potential policy recommendations to improve the operation and efficiency of the Department.

Recommendation AD-4: The City Managers and Fire Chiefs of both Bloomington and Normal should create a joint committee to explore the possibility of creating and sharing a Fire Suppression Training Supervisor with job duties that would include planning, organizing, implementing and directing fire suppression and special training for both governmental entities.

DISPATCHING SERVICES: HANDLING FIRE AND EMS CALLS

Incoming Emergency Calls and Notification

For the purpose of this study, the Consulting Team will focus on the City of Bloomington's public safety communications center (Center), which is the primary dispatch facility for the Fire Department.

Incoming emergency calls for the Fire Department are handled by the Center, located at 305 S. East Street, Bloomington, Illinois. BCC Manager, Darren Wolf, provided the Consulting Team with the necessary information needed for this review.

The Center is governed by the City of Bloomington and supports the communication needs of the City Police, Fire and EMS. It has five consoles for dispatch services with room for expansion. The Center is in compliance with the criteria of a safe building as defined In NFPA 1961. The security of the facility is provided by tempered glass; and entry is gained through a series of locked doors using a card access system with camera monitoring by the dispatchers. The Center has an automatic suppression and detection system. The ventilation system is zoned to allow for separate control of the environment within the center and other ancillary rooms and offices.

Temporary emergency power is provided by an uninterrupted battery system and a weekly check of the system is conducted. Documentation is made on each inspection of the system. A diesel-powered emergency generator, which is housed outside, provides automatic electrical backup power to the Center. The generator is set to automatically exercise once a week but does not exercise with a full load placed on the system.

The Center currently uses three of the available five call-taker/dispatcher (CTD) positions. When an emergency occurs that warrants additional personnel, off-duty CTDs are called in to assist. It is important to note that there is a designated dispatcher for police and a separate dispatcher for fire/EMS. All CTDs are cross-trained between police and fire/EMS and are capable to work in any position. The current work schedule requires a minimum of three CTDs working an eight-hour shift with three shifts per 24-hour day. A Communication Supervisor is scheduled for each shift to address significant decisions that may be needed. Administrative personnel work a 40-hour workweek but are available to assist with disasters or other types of special events.

The Center has an enhanced 911 system and has contracted with New World Systems, Aegis Public Safety Computer Aided Dispatch (CAD) software to track and document all emergency calls. New World software will dispatch and track calls for police, fire, and medical units. Several distinctive features simplify operations and allow agencies to respond quickly to calls with the proper resources. This intuitive and easy-to-use application provides increased efficiency for the responding units and it is configurable for multiple agencies.

In regard to the management information system for fire reporting, the Center has interfaced with Firehouse Software™ which makes it easier to complete the necessary fire and EMS reports that are mandated in Illinois.

In 2010, the Center received and dispatched 9,444 Fire/EMS emergency calls. Emergency phone calls are received directly from the stricken caller except for cellular 9-1-1 calls. Currently, all cellular 9-1-1 calls are received at the McLean County Combined Communications Center (METCOM) and then transferred to the Center.

All incoming calls and radio traffic are recorded at the Center, which has instant playback capabilities. All radio traffic is received and transmitted on VHF radios. All radios have been upgraded to meet the new FCC narrow-band frequency requirements. The Center is the designated backup for Mutual Aid Box Alarm System (MABAS) Division 41 Box Alarms and meets all the requirements in accordance with MABAS protocol.

The Fire Department receives notification of emergency calls from the Center via a radio tone alert and a voice page only. There is no in-house alerting system or direct ring-down line at any fire station to alert station personnel or to allow them to acknowledge the emergency call.

Responding apparatus do have mobile data terminals to receive information directly from the dispatchers. All communications are done by voice over VHF frequencies.

All incoming calls at the Center are recorded, as are all console activities, including radio communications that include instant playback capabilities. The seven-digit emergency telephone number is still in service and rings at the Center, but it is primarily used for incoming fire alarms from central station services.

All emergency call response times are entered by a dispatcher using the CAD system. The current software system documents times for receipt of the call, call-taker handling, and notification of responding personnel, vehicle en-route, and on-scene. As of the date of our review, the Center complies with the provisions of 4-3.1 of NFPA 1221 (*Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems, 1999 Edition*), which identifies a sufficient number of personnel to be on-duty to answer 95% of alarms within 30 seconds, with no initial response by the call-taker to exceed 60 seconds, and for dispatch time not to exceed 60 seconds from the completed receipt of the alarm. Compliance with these provisions of NFPA 1221 is recognized by the Insurance Services Office as meeting staffing criteria of the Fire Suppression Rating Schedule as well as the Standards of Cover and Deployment as identified by the Commission of Fire Accreditation International.

If the Center losses VHF communications with the Fire Department, METCOM will become the primary dispatching agency.

Fire Alarm Monitoring System

In addition to receiving emergency calls, the Center receives notifications of fire alarm activations from Central Station monitoring services. Most of the City's fire alarm systems use

landlines to 3rd party monitoring businesses that notify the Center in case of alarm activation. These notifications generally come through the Center's seven-digit emergency number.

One of the concerns addressed by Fire Department officials was the increase in false alarms by monitored systems. False alarms remove companies from service, pose unnecessary liabilities due to their emergency response, and increase travel times for other emergencies that occur while the units are tied up.

When the Consulting Team met with City Officials, a discussion occurred about the City handling alarm monitoring rather than having private Central Station providers relay the alarm notification to the Dispatch center. In researching the issue of transmission delay, we could find no reliable unbiased data or studies available. Therefore, we turned to the case of **Alarm Detection Systems, Inc. (ADS) v. Village of Hinsdale**, No. 2-00-1393 (2nd Dist. 2001).

> In summary, the case was brought because in 1999 the Village exercised its authority under the Municipal Code to require certain commercial occupancies to connect to the municipal fire alarm monitoring board by January 1, 2000. The Plaintiff, ADS, filed a six-count complaint on November 29, 1999 seeking a permanent injunction preventing the Village from enforcing its ordinance. The trial court and the 2nd District Appellate Court found that the Village, even as a non-home rule community, had expressed statutory authority to adopt such an ordinance and that the required commercial occupancies were required to connect to the Village.

For our purposes it is important to note that both courts took notice that direct connection to the fire department dispatch center "allows for faster response time than if an alarm system is monitored by a private alarm company. Even ADS acknowledges that private central station monitoring adds anywhere from 15 to 40 seconds to fire alarm response times." (**ADS v. Village of Hinsdale,** 2001).

Another public safety consideration regards the maintenance of a private alarm system connected to a private Central Station service. The City relies upon the Central Station to report alarm systems that are out of service. However if the private property owner (who pays the bill) instructs the monitoring service not to inform the City, then no one knows. Again, reliable data was not found and only anecdotal data is available.

Finally, this can be a political issue of some magnitude. Though the public safety advantages are not in dispute, economic advantages to the City and the perceived economic disadvantage to the property owners needs to be considered. There are several successful strategies that can be employed to soften the conversion.

Recommendations for Handling Fire and EMS Calls (DS):

Recommendation DS-1: City of Bloomington Officials should establish procedures to ensure operational readiness of the alternative source of electrical power. NFPA 110, Section 6.4 provides requirements for frequency of operational inspections and testing required standby systems. In general, NFPA 110 requires weekly inspection and monthly testing under load.

Recommendation DS-2: City of Bloomington Officials should consider an in-station alerting system for each fire station. A compliant National Fire Protection Association (NFPA) 1221 system (Standard for the installation, maintenance, and use of emergency services communications systems, dispatching systems, and computer-aided dispatching (CAD) systems) that will provide both primary and secondary dispatch alerting circuit functionality. The system will dramatically improve alerting effectiveness and reduce response times.

Recommendations for Alarm Monitoring (AM):

Recommendation AM-1: The City of Bloomington Officials should consider adoption of Building Code amendments that require commercial occupancies to connect to the City fire alarm monitoring service.

Recommendation AM-2: The City of Bloomington Officials should investigate and consider implementing a wireless alarm network (WAN). In a recent study, the average transmission time for central stations alarms was 137 seconds. Twenty-three of 44 alarms tested above two minutes, 10 tested at or above three minutes, and five of the central station alarms never responded at all. With a WAN, the average transmission time is approximately 6 seconds. Further, WAN will increase reliability and decrease the number of false alarms sometimes by much as 30%. Illinois law clearly authorizes Illinois municipalities to own and establish the new wireless alarm networks.

GUIDE TO IMPLEMENTING RECOMMENDATIONS

The Consulting Team has created the following guidelines to assist the Bloomington Fire Department Officials in implementing the recommendations set forth in this study. This is only a recommended guide for the organization's use.

- Category A: High Priority to be implemented within 12 months.
- Category B: Moderate Priority to be implemented within 12 to 24 months.
- Category C: Low Priority to be implemented within 24 to 36 months.
- Category D: To be considered within a 48 month period.

Recommendations for Improving Community Risk Assessment (CRA)	Recommended Priority
Recommendation CRA-1: The City of Bloomington Officials should continue to include the characteristics of emergency vehicles especially in the design and implementation of any roadway improvements. By doing so, the City of Bloomington will continue to experience improved response and emergency crew set-up times at emergency incidents as it relates to road configuration/improvements.	A
Recommendation CRA-2: The City of Bloomington Officials should consider utilizing their Firehouse Software for conducting a community risk assessment (under the direction of the Fire Department). Up-to-date occupancy information from the Fire Prevention Bureau/Code Enforcement should be merged or linked with existing fire department preplan data (Firehouse Software) that will assist in identifying the critical risks, hazards, and vulnerabilities within the City's jurisdiction and evaluate the current capabilities of the fire department in mitigating the identified risks and hazards.	A
Recommendation CRA-3: The City of Bloomington Officials should consider (and when feasible) the installation of emergency vehicle preemption on all traffic signal devices on the moderate to high traffic count roadways as identified within a valid and reliable traffic count analysis. City Officials should consider use of pre-emption by other City departments (i.e. public works, police, Emergency Management, etc.). Consider cost-sharing with other public and private agencies that would utilize the system.	C
Recommendation CRA-4: The City of Bloomington Officials should continue with their pre-incident planning program following the recommendation in NFPA 1620 including training to all personnel.	A

Recommendation CRA-5: The City of Bloomington Officials should continue enforcing building code provisions as previously adopted: 2009 editions of the International Code Council's (ICC) family of Codes which include: the International Building Code (IBC), International Residential Code (IRC), the International Mechanical Code (IMC), International Fuel Gas Code (IFGC), International Fire Code (IFC), the International Existing Building Code (IEBC), and International Property Maintenance Code (IPC). In addition the City also enforces several NFPA standards when referenced: Fire Sprinklers (NFPA 13), Fire Alarm Code (NFPA 70), and National Electrical Code (NFPA 72). The adoption and enforcement of these codes not only reduce the dependence on the public fire protection assets but also protect the property tax base of the City thus preventing a loss of ability to provide services.	**B**

Recommendation for Effective Response (EF)	**Recommended Priority**
Recommendation EF-1: The City of Bloomington Officials should consider placing another ambulance company into service staffed with two Firefighter/Paramedics. Further, if and when another ambulance company is placed into service, fire department officials need to consider the reduction of service areas for each in-service ambulance company with the following two objectives: • Reduction of travel times. • Ambulance Unit Hour Utilization is not to exceed the UHU of .30.	**B**
Recommendation EF-2: The City of Bloomington Officials should consider equipping each front line engine and truck company with Advance Life Support (ALS) equipment. By doing so, the City would reduce the risk of not being able to respond, in a timely manner, to multiple EMS calls within each response area. Further, the City would experience an improvement to the amount of time when two or three ambulance are placed out-of-service do to back-to-back EMS calls.	**B**

Recommendations for Improving Response Times (RT)	Recommended Priority
Recommendation RT-1: The City of Bloomington Officials should continue to monitor the established performance measurement criteria standards, response time standards and related performance measurement criteria for both fire and EMS response times. Further, regular reporting and review of the response times should be established to assist in identifying weaknesses within each response time element on a quarterly basis.	A
Recommendation RT-2: The City of Bloomington Officials should monitor, on a quarterly basis, the company and station availability. By monitoring the base line data of station availability, the District will be able to create benchmark performance standards to support vehicle and personnel distributions for the entire response area.	A
Recommendation RT-3: The City of Bloomington Officials should consider the installation of a turnout timer that would be installed at each station in the apparatus bay area. The turnout timer provides a visual readout of the time elapsed since the call was received at the fire station. The timer is used to assist firefighters in meeting departments' response time goals and equips them with the information they need to continue working towards decreasing turnout times and getting out of the station quickly.	C
Recommendation RT-4: The City of Bloomington Officials should consider placing/creating an engine company at Station Three to ensure that the Northeast quadrant has adequate coverage. The current distribution is not likely to receive full ISO credit.	A
Recommendation RT-5: The City of Bloomington Officials should investigate the option of implementing a quint program, or quintuple combination pumper that will serve the dual purpose of an engine and a ladder truck. The objectives of the investigation should include: • Budgetary cost • Efficiencies in operations • ISO grade impact	C
Recommendation RT-6: The City of Bloomington Officials should consider the need to eventually relocate Station 5 approximately one-mile east of its present location. The proposed relocation would greatly improve the area of coverage to the southwest quadrant of the response area.	D

Recommendation RT-7: The City of Bloomington Officials should review all automatic and mutual aid agreements with neighboring emergency service organizations on a yearly basis. It is understood that those departments which border the City of Bloomington to the south, east and west are volunteer-only and may not be able to provide immediate assistance by entering into automatic aid agreements.	A
Recommendation RT 8: City of Bloomington Officials should consider the creation of ALS engines and truck companies that will help to support the growing demand for emergency medical services. Further, in areas of extended response times for ambulance companies, the ALS engine or truck company would shorten the time between the call for assistance and patient care.	B
Recommendation RT 9: City of Bloomington Officials and the Town of Normal Officials and should consider the creation of a joint emergency liaison committee (JELC) to explore an integrated partnership for emergency responses. The JELC objectives would be as follows: A. Investigate the creation of a single EMS and fire suppression response card for the overlapping response coverage areas for the Town of Normal Station #1 and the City of Bloomington Station #3 (**Figure 37**). B. Investigate the creation of an EMS First Responder Squad (non-transporting unit) with two cross-trained firefighter/paramedics who would respond to all EMS emergencies with the overlapping response coverage areas. C. Subscribe to a common AVL system or provide a workable interface to facilitate the "closest unit" responding to calls for service.	A

Staffing Models and Full Time Equivalency (SM)	Recommended Priority
Recommendation SM-1: If the City of Bloomington Officials decided to continue with the baseline Staffing Model-A, the Officials should consider the hiring of three (3) additional personnel. In doing so, the City will be able to maintain the current minimum staffing level of 28 but with reduction in overtime cost. More importantly, the amount of risk to employees who work the extra hours will be reduced.	A
Recommendation SM-2: The City of Bloomington Officials should consider seeking federal grants to assist with career firefighter staffing and various emergency and non-emergency related activities. Most grants are extremely competitive and the applying agency/request must meet specific eligibility criteria in order to qualify for federal funding. Additionally, there are financial obligations (if awarded) that would require the agency to provide a percentage of the total award or matching funding. Below is a listing of some federal grants that are available: • Staffing for Adequate Fire & Emergency Response Grant (SAFER) • Assistance to Firefighters Grant (AFG) • Fire Prevention and Safety Grant (FP&S) • Pre-Disaster Mitigation Program (PDM) • Emergency Management Performance Grant (EMPG) • Interoperable Emergency Communications Grant Program (IECGP) • Emergency Operations Center Grant (EOC) • Commercial Equipment Direct Assistance Program (CEDAP)	B
Recommendation SM-3: The City of Bloomington Officials should consider the **NFPA 1710 benchmark staffing of four to five personal assigned to a company. In order to meet the benchmark, the City would need to hire nine (9) additional personnel (Staffing Model B).** By doing so, fire department officials would have the ability to improve both the concentration and distribution of personnel and apparatus which would better serve the City during high demands for service.	D
Recommendation SM-4: The City of Bloomington Officials should continue to require a minimum qualification for all future hiring of firefighter/paramedics.	A

Recommendations for Administrative Structure (AD):	Recommended Priority
Recommendation AD-1: City of Bloomington Officials should strongly consider opening dialogue with the City of Normal to create a position of EMS Coordinator that can be shared between both agencies. Financial responsibility as well as time commitment between both departments can be shared equally. There currently is no EMS Coordinator for either agency, which creates a situation where either monitoring of EMS activities is insufficient where the position would result in an increased assessment of activities and training. The coordinator would also be in a position to recommend additional community activities to improve the health of the citizens of Bloomington and Normal. The position could either be civilian or sworn but must be highly qualified to gain credibility.	B
Recommendation AD-2: City of Bloomington Officials should create a joint committee with the Town of Normal Officials to explore the possibility of creating and sharing EMS Field Supervisors (one for each shift of operation) with job duties that would include: response to all ALS emergencies; training of current and probationary EMS personnel; and quality assurance program oversight.	A
Recommendation AD-3: City of Bloomington Officials should consider filling the vacant Deputy Fire Chief position so the Chief would not be so involved in day-to-day which would preclude him from being able to see potential policy recommendations to improve the operation and efficiency of the Department.	B
Recommendation AD-4: The City Managers and Fire Chiefs of both Bloomington and Normal should create a joint committee to explore the possibility of creating and sharing a Fire Suppression Training Supervisor with job duties that would include planning, organizing, implementing and directing fire suppression and special training for both governmental entities.	A

Recommendations for Handling Fire and EMS Calls (DS):	Recommended Priority
Recommendation DS-1: City of Bloomington Officials should establish procedures to ensure operational readiness of the alternative source of electrical power. NFPA 110, Section 6.4 provides requirements for frequency of operational inspections and testing required standby systems. In general, NFPA 110 requires weekly inspection and monthly testing under load.	A
Recommendation DS-2: City of Bloomington Officials should consider an in-station alerting system for each fire station. A compliant National Fire Protection Association (NFPA) 1221 system (Standard for the installation, maintenance, and use of emergency services communications systems, dispatching systems, and computer-aided dispatching (CAD) systems) that will provide both primary and secondary dispatch alerting circuit functionality. The system will dramatically improve alerting effectiveness and reduce response times.	C

Recommendations for Alarm Monitoring (AM):	Recommended Priority
Recommendation AM-1: City of Bloomington Officials should consider adoption of Building Code amendments that require commercial occupancies to connect to the City fire alarm monitoring service.	C
Recommendation AM-2: The City of Bloomington Officials should investigate and consider implementing a wireless alarm network (WAN). In a recent study, the average transmission time for central stations alarms was 137 seconds. 23 of 44 alarms tested above two minutes, 10 tested at or above three minutes, and five of the central station alarms never responded at all. With a WAN, the average transmission time is approximately 6 seconds. Further, WAN will increase reliability and decreased the number of false alarms sometimes by much as 30%. Illinois law clearly authorizes Illinois municipalities to own and establish the new wireless alarm networks.	B

GLOSSARY

Term	Definition
Alarm Processing Time	The time interval from the point at which a request or alarm is received and transmitted to emergency responders. The benchmark is 60 seconds.
American Heart Association (AHA)	The American Heart Association is a national voluntary health agency whose mission is to reduce disability and death from cardiovascular diseases and stroke.
Automatic Aid	Planned first alarm response of engine and/or ladder-service companies between two or more jurisdictions by prior agreement, so that each department operates substantially as one department.
Built-Up Area	A built-up area shall include city blocks on which 25% of the building lots are built-up, and street front sections 200' back from the road on which a minimum of 25% of the building lots are built-on. However, when hydrants are available, and where lot sizes are large or irregular, a reasonable method of determining built-up area for the purpose of determining fire department response district size, is to count the hydrants and use that count as a representative "size" in other areas having hydrants.
Center for Public Safety Excellence (CPSE)	The CPSE is a non-profit organization dedicated to the improvement of fire and emergency service agencies through self-assessment and accreditation.
Concentration	The spacing of multiple resources arranged so that an initial "effective response force" can arrive on scene within sufficient time frames to mobilize and likely stop the escalation of an emergency in a specific risk category.
Construction Class	Six categories of building construction determined by exterior walls, floors, roof or the structural frame.
Creditable Water Supply	A water system capable of delivering 250 gpm or more for a period of 2 hours or more, plus domestic consumption at the maximum daily rate.
Demand Zone	An area used to define or limit the management of a risk situation.
Distribution	The station and resource locations needed to assure rapid response deployment to minimize and terminate emergencies.

Engine Company	A fire engine (pumper) with equipment and personnel, which may be paid or volunteer.
Fire Flow	The amount of water required to control the emergency, which is based on contents and combustible materials.
First Due Response	That distance prescribed: for an engine company, 1½ distance miles; for a ladder company, 2½ miles.
Flash Over	A critical stage of fire growth where the likelihood of survival and the chance of saving lives drops dramatically. In this stage, greater amounts of water are needed to reduce burning material below its ignition temperature.
Get Out or Turnout Time	The time point at which responding units acknowledge receipt of the call from the dispatch center. Total get out time begins at this point and ends at the beginning of travel time. For staffed fire stations the benchmark is 60 seconds.
Initiation of Action	The point at which operations to mitigate the event begins.
Insurance Services Office(ISO)	ISO is a leading source of information about risk. The organization supplies data, analytics, and decision-support services for professionals in many fields, including insurance, finance, real estate, health services, government, and human resources. Their products help customers measure, manage, and reduce risk.
Ladder Company	A ladder truck with equipment and personnel assigned.
Ladder Truck	Fire apparatus with numerous ladders of varying lengths and types, forcible entry tools and salvage equipment. It may have a hydraulic aerial ladder or elevating platform, generally following NFPA 1901 specifications.
National Fire Protection Association (NFPA)	Established in 1896, NFPA serves as the world's leading advocate of fire prevention and is an authoritative source on public safety. The mission of the NFPA is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating scientifically-based consensus codes and standards, research, training, and education.
Occupancy Risk	An assessment of the relative risk to life and property resulting from a fire inherent in a specific occupancy or in generic occupancy class.
On-Scene Time	The point at which the responding units arrive on the scene.
Pumper (Engine)	Fire apparatus used to deliver water to a fire at pressures necessary for good fire streams; having a pump, equipment and hose; and usually conforming to NFPA 1901 specifications.

Quint	Quint apparatus are equipped with the following five (5) components: water tank, hose, multiple ground ladders, a fire pump and an aerial device such as a ladder or platform.
Required Fire Flow	The estimated flow of water in gallons per minute that may be considered a reasonable rate necessary to fight a major fire in an unsprinklered building under most conditions.
Service / Squad Truck	Fire apparatus carrying ground ladders, tools, and equipment required for a service / squad truck.
Standard Response District	A Standard Response District is a built-upon area which is within satisfactory response travel distance. (See first due response distance).
Standards of Cover	Those adopted written policies and procedures that determine the distribution, concentration, and reliability of fixed and mobile response forces for fire, emergency medical services, hazardous materials, and other forces of technical response.
Total Response Time	CPSE definition: *Alarm Processing Time* + *Turnout time* + *Travel Time* = **Total Response Time.** NFPA definition: *Get Out Time* + *Travel Time* = **Total Response Time.**
Travel Time	The point at which units are in route to the call through when units arrive on the scene. Travel time is based on 38 mph or 55.7 feet per second.
Turnout Time	The time point at which responding units acknowledge receipt of the call from the dispatch center through the point that the apparatus goes in service. The benchmark is 60 seconds.

WORKS CITED

(1997). *Center For Public Safety Excellence*, 8.

(2010). *Firefighter Safety And Deployment Study Report on EMS Field Experiments.* Gaithersburg: United States Department of Commerce.

(2010). *NIST Technical Note 1661, Report on Residential Fireground Field Experiments.* Gaithersburg: United States Department of Commerce.

City of Bloomington. (2010, May 20). *Traffic Counts*. Retrieved January 15, 2013, from City of Bloomington: http://www.cityblm.org/index.aspx?page=135

Illinois Department of Transportation. (n.d.). *District 5 East Side Highway Bloomington/Normal*. Retrieved January 15, 2013, from Illinois Department of Transportation: http://www.dot.state.il.us/css/d5/East%20Side%20Highway/eastsidehighway.html

NFPA. (1995). *National Fire Protection Association.*