Mission Statements

Beach Park Fire Protection District

We strive to maintain integrity and pride, with a strong sense of duty and respect for everyone we serve.

Zion Fire & Rescue Department

It shall be the function of the Fire and Rescue Department and the duty personnel thereof to prevent and extinguish accidental or destructive fires occurring in the city; to provide

FUNCTIONAL COOPERATION STUDY

for the

Beach Park Fire Protection District

and

Zion Fire & Rescue Department

FINAL REPORT

SEPTEMBER 25, 2018

emergency medical treatment to those persons in need in the city; to transport such persons when necessary to a hospital; and to enforce all ordinances relating to fire hazards.

TERMS OF USE

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EXECUTIVE SUMMARY OF RECOMMENDATIONS

The primary purpose of this study is to determine the impact on emergency services' response if the Beach Park Fire Protection District (BPFPD) and Zion Fire & Rescue Department (ZFRD) were to functionally consolidate into a single response Agency. This project applied nationally accepted response and staffing standards to each department identified in this study and will evaluate the effectiveness of a consolidated response effort.

The results found within this report supports a functional consolidation between the BPFPD and ZFRD. The proposed functional consolidation would provide a better service level to the community and should create financial efficiencies. The data dictated overall improvement in service levels for fire and emergency medical incidents for both fire agencies in a functional consolidation model. In addition, it would further maximize response levels while utilizing the current staffing and apparatus to share the workload.

Fire Station Distribution

After extensive analysis of the data contained within this report, the IFCA Consulting Team finds that only three (3) fire stations would be needed to operate the proposed Joint Agency Fire Department when properly placed within the combined response area instead of the current four (4) stations. Based upon the call volume and the response data found in this report, we believe the BPFPD Station 2 can be placed out of service. By doing so, there will be improved distribution of apparatus as it would have a minimum impact on the overall agency's initial response times. A minimal increase of 8 seconds to the ninetieth percentile would be realized.

The proposed Joint Agency Fire Department Station numbering system could be as follows:

- Zion Station 1 = Joint Agency Fire Station 1
- Zion Station 2= Joint Agency Fire Station 2
- Beach Park Station 1 = Joint Agency Fire Station 3

Apparatus Distribution & Concentration

The IFCA Consulting Team finds that BPFPD and ZFRD should combine stations and implement an Advanced Life Support (ALS) program which includes all frontline fire apparatus.

Though response time impact is negligible, reducing the number of stations will increase the calls for service workload on the remaining stations by concentrating ALS ambulance companies in the busiest locations. Based on the collective data, removing BPFPD Station 2 and consolidating with ZFRD, the call for service workload for Zion Station 1 will increase from 0.31 to 0.37 equating to a 0.06 increase in requests for service at the ninetieth percentile but should be offset by the placement of the Beach Park ambulance in the JAFD

Station 1. As calls for service will continually increase over the years, the service demands for station one will increase. Continuous monitoring of the calls for service in correlation to station response will need to be addressed. Redistribution of existing personnel and apparatus will be required and will assist to balance the workload and response. To achieve the most efficient coverage and best overall response for fire and EMS requests, ALS capabilities should be implemented on the engines located at JAFD Stations 1, 2 and 3. To achieve the most efficient coverage of providing EMS transports, the combined agencies should maintain two (2) dedicated ALS ambulances at JAFD station 1. JAFD Station 2 and 3 should maintain an ALS engine and ALS ambulance jump company. Recognizing the JAFD Station 2 and 3 will not have a dedicated ALS ambulance assigned to it, an ALS engine is necessary to comply with the response coverage recommendation. Should call volume for EMS service increase through the years, a third dedicated ALS ambulance could be assigned to JAFD Station 3 as funding became available.

Operational Staffing Concentration & Distribution

Current shift staffing levels should be redistributed and maintained with a minimum of 11 personnel (including the Battalion Chief).

Joint Agency Fire Department apparatus would be distributed as follows:

JAFD Station 1: BC (1); ALS Engine (2); Zion ALS Amb (2); Beach Park Amb (2) - Staff of 7
JAFD Station 2: Jump Company = ALS Engine or ALS Amb - Staff of 2
JAFD Station 3: Jump Company = ALS Engine or ALS Amb - Staff of 2

Reduction in shift staffing is not recommended for ZFRD and the BPFPD to accommodate the proposed JAFD response plan.

The JAFD would benefit from having all dedicated frontline ALS units. The Team acknowledges that jump companies can result in companies being shut down as a result of an ambulance or engine response to another incident. However, the suggested staffing model would allow ALS coverage throughout the entire JAFD response district; even with several ambulances committed, the JAFD would have ALS engine response capabilities to EMS calls after the second (or more) ambulance calls. When responding to fire requests (even when ambulances are committed), there would still be a dedicated first response suppression vehicle(s). Unlike current modeling - there may not be a suppression vehicle in service (based upon the EMS demand). This recommended model allows the agencies to be flexible in their response deployment while maintaining ALS capabilities.

Administrative Staffing

The IFCA Consulting Team finds an opportunity to combine and potentially eliminate duplicative positions that would be redundant with functional consolidation. Centralizing fire management reduces administrative costs through the elimination of duplicate command, human resource, and support functions. Each position should be reviewed and scrutinized to determine feasibility and cost.

Recommended Joint Area Fire Department (JAFD) Administrative Staffing

1 Fire Chief
1 Deputy Fire Chief - Operations
1 Deputy Fire Chief - Support* (Part-time)
3 Battalion Chiefs - Shift Commanders
1-2 Administrative Assistants (based upon work load)

*This position (final decision on rank to be established by JAFD) could have a primary responsibility to Beach Park's administrative oversight duties, i.e., payroll, policy, procedure, budget, purchasing provide overall training program management, etc. Additionally, this position will work in collaboration and provide support to/with the Fire Chief to further establish the goals and objectives of the Joint Agency Fire Department.

Agency Commitment

The data supports the functional response consolidation of both the BPFPD and the ZFRD into a JAFD. Realizing there is a nominal increase in response times for the JAFD, positive financial impact should be realized by removing a fire station from service; reassignment of apparatus and manpower to provide a greater distribution of the current workload, and create redundancy into areas of high call volume (ZFRD). Reducing the number of administrative staff will also positively impact BPFPD financially and allow for a single position to coordinate administrative duties for BPFPD and provide consolidating training for the JAFD.

The IFCA Consulting Team is recommending that a resolution is agreed upon and adopted by both governing agencies committing to a functional consolidation.

To further the efforts of a functional consolidation, the IFCA Consulting Team recommends the formation of a steering committee to oversee the process. The committee should be comprised of at least one Trustee, at least one chief officer, one management level staff person and a representative of the collective bargaining unit from each entity. The steering committee's first task should be to develop an organizational chart to illustrate and identify reporting relationships and responsibilities. There should be an emphasis placed on assigning appropriate subject matter personnel to subcommittees to develop a transition plan for their area of expertise.

Suggested subcommittees include but are not limited to the following areas:

- Communications
- Information Technology
- Training
- Fire Prevention
- Emergency Medical Services
- Station development and maintenance
- Vehicle Maintenance
- Finance
- Civilian Employees
- Collective Bargaining Agreement

The steering committee should review the previously authored 2016 BPFPD and ZFRD Feasibility Study as guidance for their transitional strategy. It is vital to construct timelines for the completion of objectives from each of the subcommittee assignments.

The IFCA Consulting Team recommends that each department should seek legal advice from attorneys familiar with the functional consolidation process to ensure legal compliance throughout the project.

Finally, it is understood that a full consolidation is a major undertaking that could result in years of administrative and legal proceedings.

PURPOSE

Every day local leaders, managers, and fire chiefs are faced with decisions that relate to providing fire protection, emergency medical services, and other services for their community. Now, more than ever, these leaders are faced with the constant pressure of doing more with less. Many local government executives are hard-pressed to justify any increase in expenditures unless directly attributed to improved or expanded service delivery in their community. This effort has been hampered by the lack of a nationally accepted set of performance criteria by which a community can evaluate the level and quality of fire, EMS, and other services it provides to its constituents.

The primary purpose of this study is to determine the impact on emergency services response if the BPFPD and ZFRD were to consolidate into a single response area. This project applied nationally accepted response and staffing standards to each department identified in this study and will evaluate the effectiveness of a consolidated response effort.

In March of 2016, the BPFPD and ZFRD contracted the **Illinois Fire Chiefs Association Consulting Service** to conduct an independent study of deployment and concentration analysis to determine the feasibility of a consolidation between the two Fire Departments. The overall goal is to increase the efficiency and effectiveness of fire, emergency medical services, and specialty response service delivery for the residents of both Departments. The result of the Feasibility Study identified a potential increase of effectiveness and efficiencies for the delivery of services for both agencies.

In January of 2018, both agencies contracted the IFCA to conduct further analysis to determine the impact of combining the BPFPD and ZFRD at a functional level of consolidation. The International Association of Firefighters (IAFF) supported the study through a financial donation to the agencies.

ACKNOWLEDGMENTS

The Illinois Fire Chiefs acknowledges the Stakeholders group for their participation and input into this study. The development of this document was truly a “team effort,” and we thank you.

Participating Stakeholders:

John Lewis	Fire Chief	Zion Fire and Rescue Department
Eric Montellano	Deputy Chief	Zion Fire and Rescue Department
Paul Tierney	Fire Chief	Beach Park Fire Protection District

Fred Friedl	Deputy Chief	Beach Park Fire Protection District
Ted Zelek	President	Beach Park Fire Protection District
Mike McDowell	Commissioner	City of Zion
David Knabel	City Administrator	City of Zion
Jon Kinseth	Village Administrator	Village of Beach Park
Art Thompson	Chairman	AFFI Consolidation Committee
Rick Reich	President	Zion IAFF Local 1999
Chris Samuels	Union President	Beach Park IAFF Local 4806

METHOD OF STUDY

The IFCA Consulting Team worked with various staff members from the BPFPD, ZFRD and their respective dispatch agencies to collect data and to further identify additional departmental resources related to the study. With their assistance and the support of their administrative staffs, 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.

The IFCA Consulting Team commends BPFPD Fire Chief Paul Tierney, ZFRD Fire Chief John Lewis for their open access and high level of support in providing the requested information in a timely manner.

SCOPE OF PROJECT

The objective of this project was to conduct an analysis to determine the impact of combining the BPFPD and the ZFRD at a functional level of consolidation. This report includes optimal fire station locations, staffing/apparatus deployment for the objective of increasing the effectiveness and efficiency of fire, emergency medical and specialty response services' delivery, identifying current work loads of current operating companies of both agencies and recommendations for sharing of applicable resources.

In this study, a Geographic Information System (GIS) analysis using incident data was assessed by the IFCA Consulting Team to determine the level of fire and EMS services and efficiency of scale that may be gained by consolidating the BPFPD and ZFRD.

The Analysis determined the following:

- Current and ideal station placement/ locations
- Apparatus typing, placement and reserve capabilities
- Closest responses (response plan analysis)
- Travel time analysis
- Operational staffing of apparatus
- Station and company availability

The following report is the result of a three-step systematic evaluation of emergency services of the BPFPD and the ZFRD by the IFCA Consulting Team**.**

Step 1 analyzed the deployment capabilities and emergency resources provided by the BPFPD. Time−distance travel maps were created for each station and response within the District; time data and on-scene performance expectation were collected and analyzed; effective response force information was reviewed, as well as response reliability.

In Step 2 we analyzed the deployment capabilities and emergency resources provided by the ZFRD. We reviewed the distribution and concentration of fixed and mobile resources within the District. Response reliability and effective response force were analyzed and further analysis of time−distance mapping of fire stations within the ZFRD's response area was completed.

In Step 3, we combined all data from both Departments to formulate recommendations for vehicle responses, staffing levels, station locations, and resource-sharing methodologies thereby ensuring optimum service delivery for the entire combined area.

Our assessment will provide a guide to measure progress toward nationally recognized standards of service. It is our belief, however, that the real work of evaluation rests with the agencies themselves as they define their service delivery within the context of each response area.

While standards exist, it is the commitment and resources of the two Departments that must be evaluated 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 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 entities 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 entities are willing to bear can be deferred to property owners.

Third, and maybe most importantly, the district and the city 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, each agency should develop a written Standards of Cover for service if not already completed.

PREVIOUS STUDIES

The March 2016 study, completed by the IFCA, indicated that if both agencies enter into a functional consolidation, they would be able to provide an initial emergency response that meets the “best practices” standard of the National Fire Protection Association (NFPA). Cost saving would also be possible by eliminating the duplication of positions and functions and the possible closing of one station. Apparatus and equipment inventories could be combined reducing the need for new and additional equipment. It should be noted that even with a response consolidation model and the possible closing of a station, shift staffing would remain below the recommended minimum for the current volume of emergency calls that would be experienced by the combined agencies. Current shift staffing levels should not be reduced. If a transition from 4 to 3 stations takes place, shift personnel from the closed station should be reassigned to another station.

As opposed to a functional consolidation a full consolidation could also be pursued. A full consolidation is a model where two or more fire organizations legally merge into one larger organization with its own governance structure. A full consolidation presents some major obstacles. It is suggested that if both entities want to pursue a full legal consolidation that they consult with an attorney experienced in these matters. The process of legally consolidating would most likely be lengthy, and it is suggested that in the interim, both agencies can begin a functional consolidation.

CONSOLIDATION LEGISLATION

There have been several legislative efforts to mandate consolidation of special taxing districts in Illinois. These efforts have been at the County level as well as the State level. In the spring of 2012, DuPage County government launched an Accountability, Consolidation and Transparency Initiative, with county officials vowing to focus on reducing waste while

finding efficiencies and ways for local agencies to collaborate. Included in this initiative was the concept of exploring the feasibility of a county-wide fire district.

In August 2013, PA 98-0126 (SB 0494) was signed into law granting authority to counties with a population of more than 900,000 and less than 3 million which are contiguous to a county with a population of over 3 million (DuPage County) to undertake the mandated dissolution of units of local government, including fire protection jurisdictions, by ordinance after having enacted an audit of the unit of government made.

In August 2014, Senate Bill 1681 was signed by the Governor and became Public Act 98-1095. This Act is titled "The Regional Fire Protection Agency Act." The purpose and creation is written as follows:

> *Sec. 5. Purpose and creation.*
> *(a) Purpose. The General Assembly finds the consolidation of fire protection services on a regional basis provided by fire departments throughout the State of Illinois to be an economic benefit. Therefore, this Act establishes procedures for the creation of Regional Fire Protection Agencies that encompass wider service areas by combining existing fire departments and extending service areas of these departments into under-served geographic areas. It is the expressed intent of the General Assembly that Regional Fire Protection Agencies shall achieve a net savings in the cost of providing fire protection services, emergency medical services, and related services in the expanded service area by reducing and eliminating costs including, but not limited to, duplicative or excessive administrative and operational services, equipment, facilities, and capital expenditures, without a reduction in the quality or level of these services.*
> *(b) Creation. A Regional Fire Protection Agency may be formed by filing voter-initiated petitions for the purposes of integrating existing service areas of contiguous units of local government providing fire protection services to achieve the purposes of this Act.*
> *(Source: P.A. 98-1095, eff. 8-26-14.)*

In 2015, House Bill 229 was introduced to again amend the Counties Code. This time the amendment was to be statewide. However, in its final version, it was only subject to McHenry and Lake Counties. This bill would give the McHenry and Lake County Boards the power to consolidate government taxing entities where the county appoints more than 50 percent of the membership of that board. This would directly affect appointed fire district boards in both counties. This legislation is based almost exactly on a bill successfully implemented in DuPage County in 2013 and is part of a larger effort they initiated and call

the Accountability Consolidation Transparency (ACT) Initiative. This bill has passed both the House and Senate and is undergoing final revision before sending it for Governor Rauner's signature.

Current legislative efforts have been bi-partisan and have the support of the general public. Illinois has between 7,000 and 8,500 units of local government, many of which are special districts including fire protection districts. It is generally believed that reducing the number of special districts will streamline operations and reduce duplicity of services. It is also believed that consolidation will save taxpayers' money and possibly reduce property taxes.

From these actions, it is clear that the movement toward consolidation is gaining momentum politically. It is likely that mandated consolidation will take place in the future. It would be in the best interests of the fire service to implement consolidation strategies in a proactive manner where it is feasible rather than having changes made from outside sources.

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 with the American Insurance Association, both of 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 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.

CURRENT FIRE AND EMS STAFFING RESEARCH MODELS

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 the 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 frontline 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 (NFPA) 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 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 for complying 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, 9th ed.):

- 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 significant 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 regarding what is provided and not regarding the 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 the time that is useful, or "effective," to its citizens. This makes it measurable.

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

National Institute of Standards and Technology (NIST) has recently researched 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 regarding 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 IFCA 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 BPFPD and ZFRD with quantitative scientific data for response force deployment when developing and finalizing fire and emergency medical response policies and operating guidelines for their organizations. 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 Backup Line Front Door	Mechanical Ventilation

Figure 1: 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 the 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.

The purpose 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. 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 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.

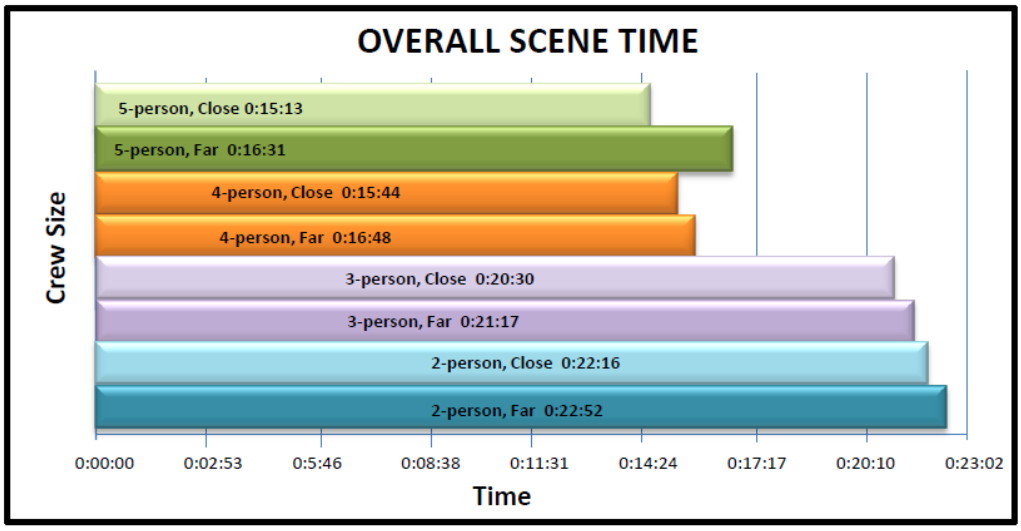


Figure 2 NIST Overall Scene Time, 2010

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 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 more quickly 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 a 16-foot room of fire origin used in the 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 complement 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.

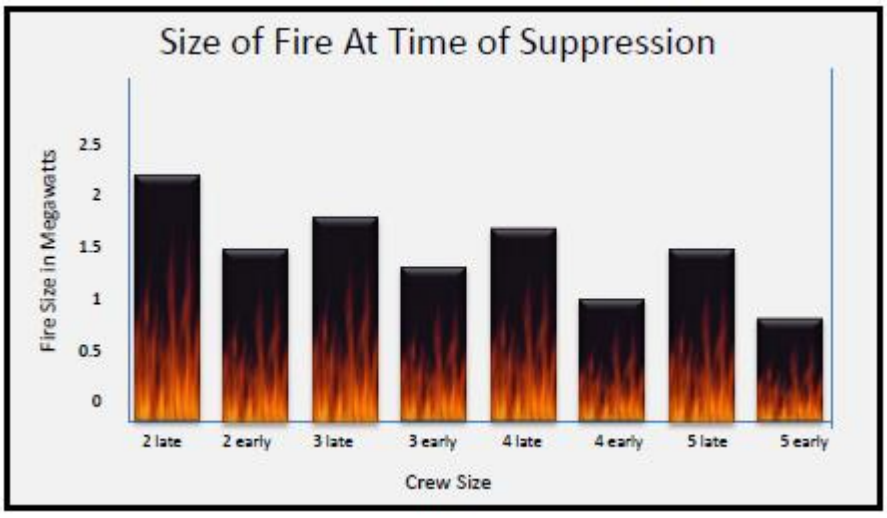


Figure 3: Size of Fire at Time of Suppression NIST, 2010

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 the 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 regarding 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 of 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).

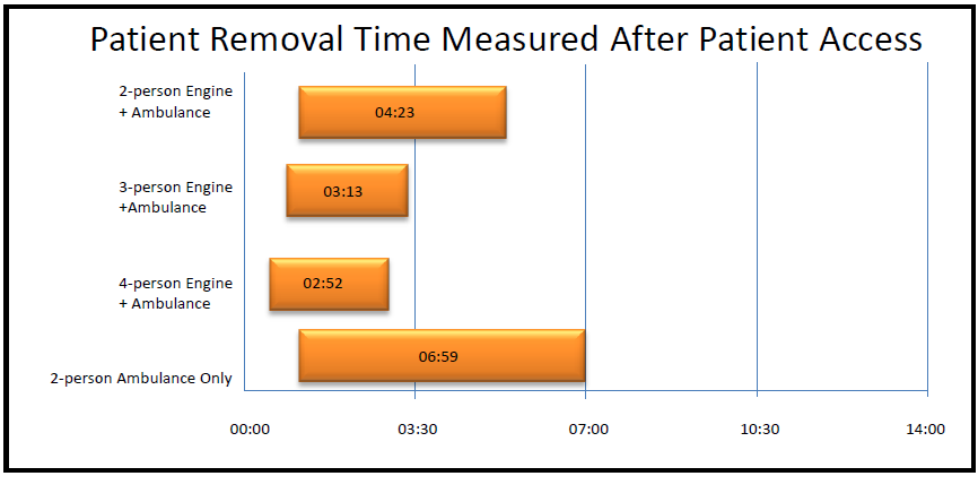


Figure 4 Patient Removal Measured After Patient Access, EMS Field Experiments, NIST, 2010

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).

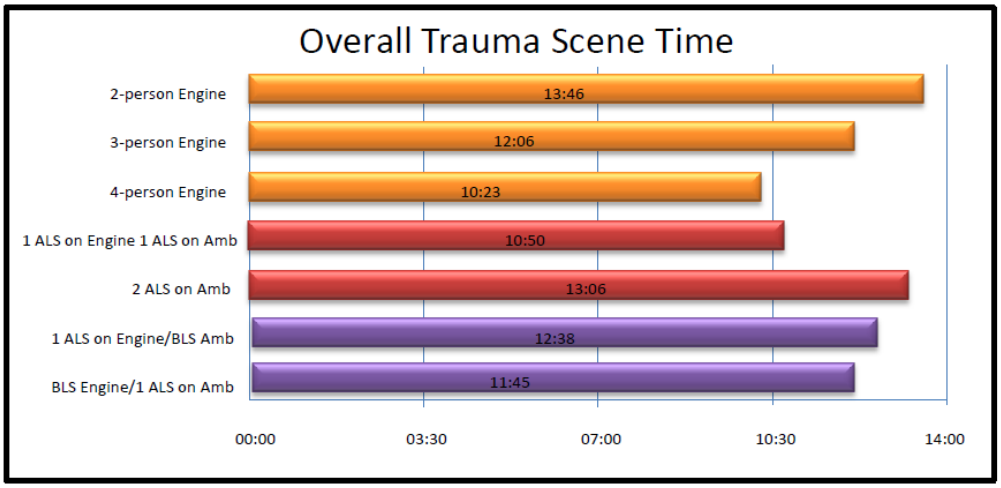


Figure 5 Overall Trauma Scene Time, EMS Field Experiments, NIST, 2010

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).

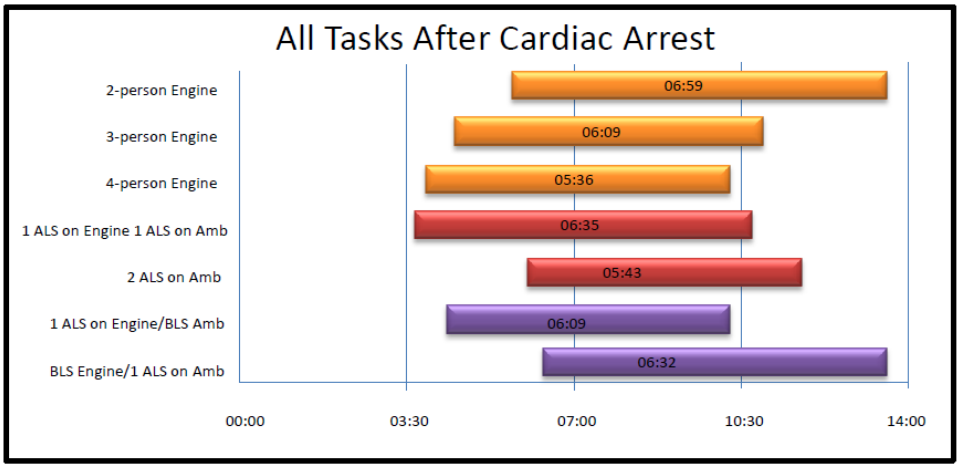


Figure 6 All Tasks after Cardiac Arrest, EMS Field Experiments, NIST, 2010

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 PROFILES

Introduction

A risk assessment includes determining and defining the distinct threats in the community based on occupancy such as single-family, multifamily, 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, 2009).

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 establish the set of events upon which policy and procedural 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, 9th ed.).

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.

The mission of the fire service is to protect life, property, and natural resources from fire and other emergencies. With increasing demands, the fire service must utilize the best tools, techniques, and training methods to meet public expectations. Risk management, preparedness, and mitigation have taken on new importance with challenges facing fire departments today. One emerging tool that is helping the fire service optimize emergency services delivery is geographic information system (GIS) technology.

GIS supports planning, preparedness, mitigation, response, and incident management. GIS extends the capability of maps—intelligent, interactive maps—with access to all types of information, analysis, and data. When a fire occurs, any delay of responding fire companies can make the difference between the rescue of occupants versus serious injury or death. The critical time between fire containment and flashover can be measured in seconds. From the moment an emergency call is received through the deployment of tactical resources, GIS helps reduce the critical time and increases efficiency. GIS technology brings additional power to the fire personnel whereby hazards are evaluated, service demands are analyzed, and resources deployed. The IFCA Consulting Team has applied GIS technology in this study to identify the needs of both agencies as exhibited throughout the report.

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.

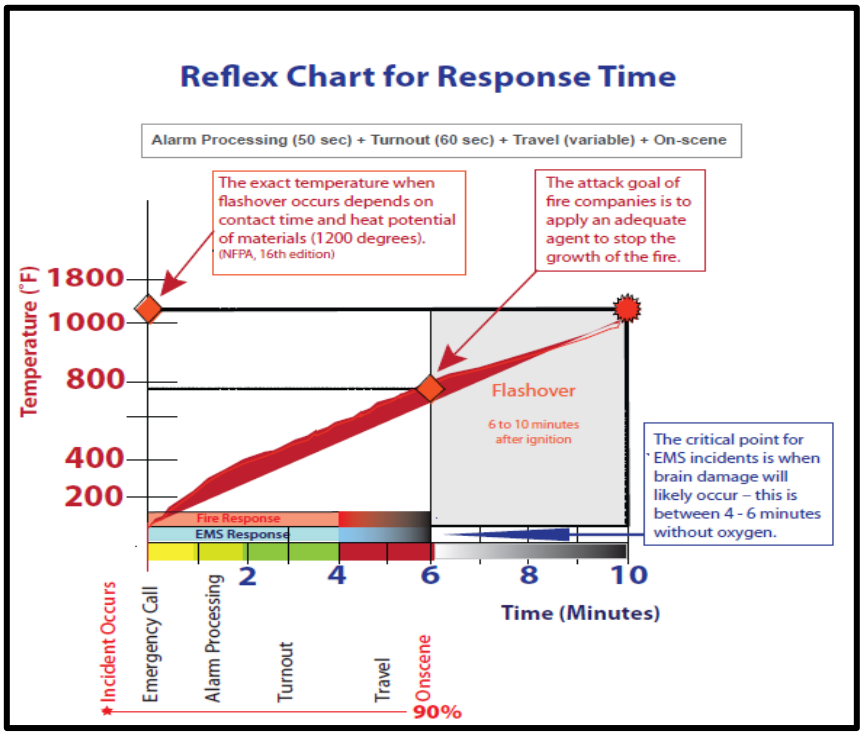


Figure 7 Reflex Chart for Response Time

The Reflex Chart provides emergency responders with a general rule of time over events and highlights significant benchmarks where there are variations of fire growth that must also be taken into consideration when developing a response strategy. As discussed in Underwriter's Laboratory Studies Tactical Implications, fires in the contemporary environment (as opposed to traditionally constructed buildings) progress from ignition and incipient stage to growth, but often become ventilation controlled and begin to decay, rather than continuing to grow into a fully developed fire. This ventilation induced decay continues until the ventilation profile changes (e.g., window failure due to fire effects, opening a door for entry or egress, or intentional creation of ventilation openings by firefighters. When ventilation is increased, heat release rate again rises, and the temperature climbs with the fire potentially transitioning through flashover to the fully developed stage. The purpose of this study is not to discuss the strategy and tactics involved in firefighting in structure fires. However, it is important to create an awareness of recent data in the correlation of fire growth, building construction and its relationship between response times and firefighter intervention.

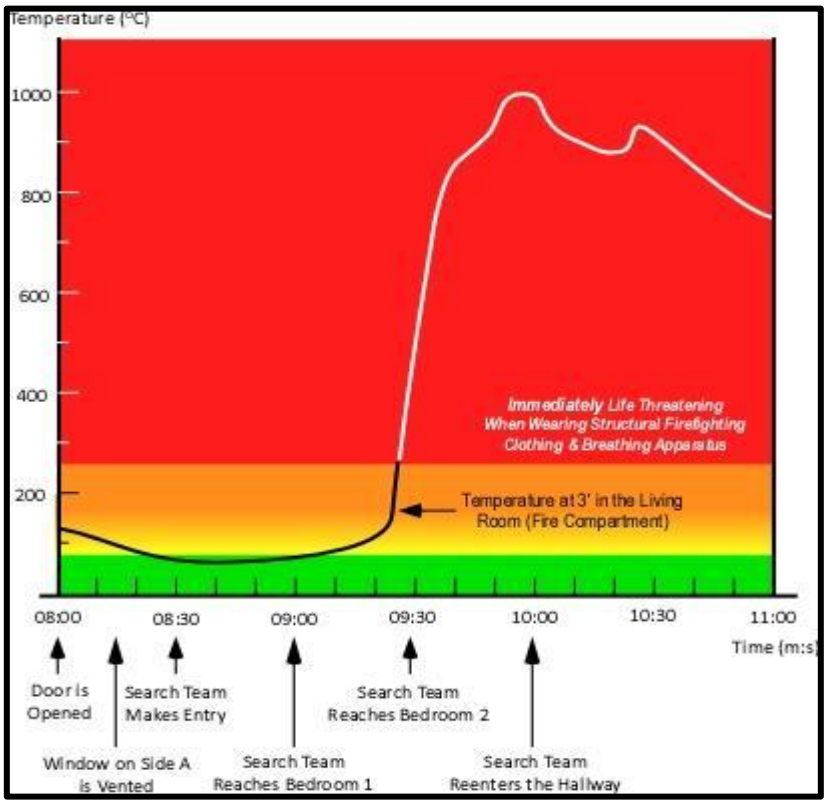


Figure 8 UL Temperature/Time after 8 minutes/Ventilation Application

Note: Figure 8 illustrates temperature conditions starting eight minutes after ignition. The fire previously progressed through incipient and growth stages before beginning to decay due to lack of ventilation.

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.

In discussions where the UL, ISO, NFPA, CPSE and NIST standards and 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 *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 combustibles 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 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.

Risk assessment includes determining and defining the distinct threats in the community, based on occupancies such as single-family, multifamily, 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).

Linking Community Risk Assessment to Response Force and Deployment

The IFCA Consulting Team reviewed each community's fire department personnel deployment practices since they are integral to the overall capability of the departments 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 regarding the 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 a significant risk because they offer the potential for large loss of life and catastrophic fire.

The second step is to assess the fire protection response system (deployment resources) to meet the worst-case scenario, which may be costlier 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 9 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, and commercial properties.	**NIL**
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.	**NIL**
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.	**NIL**
Low Risk - <.01% (<1,000 GPM fire flow required)	Small commercial structures that are remote from other buildings, such as detached residential garages, and outbuildings.	**NIL**

Figure 9 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.

Regarding staffing, NFPA guidance on company response time and minimum staffing provide 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.

A measure of response effectiveness is the time from call received to apparatus arrival. We will go into more detail later. However, the basics of time study are summarized here. For this study, the IFCA 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 10**.**

NFPA 1710 RESPONSE BENCHMARKS	
Task	**Time**
Turnout Time (EMS)	1 minute
Turnout Time (non-EMS)	1 minute 20 seconds
Arrival of First Engine Company (Travel Time)	4 minutes or less
Arrival of Full Alarm Assignment (Travel Time)	8 minutes or less
Arrival of First Responder Unit (Travel Time)	4 minutes of less
Arrival of ALS Unit (Travel Time)	8 minutes or less

Figure 10 NFPA 1710 Response Benchmarks

Effective Response Force (ERF)

The IFCA Consulting Team conducted 4 minute and an 8-minute travel time analysis from each station as the benchmark for determining an effective fire unit response. The 4-minute travel time standard defines the benchmark for initial company response to an emergency and is the standard used by the National Fire Protection Association (NFPA 1710) and the Center for Public Safety Excellence (CPSE). The NFPA and CPSE utilize an 8-minute response time standard as the benchmark for an effective response force (initial full alarm assignment) to arrive on the emergency scene for a residential structure fire.

These times are based on a time-temperature curve that illustrates that flashover can occur as early as 8 minutes after its initiation. This benchmark ideally would be achieved 90 % of the time.

According to NFPA 1710, the full alarm assignment for a residential structure (2 story 2000 square feet) fire would include the following minimum staffing for each function (Figure 11):

NFPA 1710 Full Alarm Assignment-Residential Structure Fire		
Task	**Firefighters Required**	**Company Assigned**
Incident Command	1	Chief Officer
Water Supply	1	Engine
Attack Lines x 2	2/2	Engine
Back-Up-Line	2	Engine
Support Line-Attack Line	1/1/1	Engine or Truck
Search & Rescue	2	Engine or Truck
Ventilation	2	Truck
Truck/Aerial Operator	1	Truck
RIT	2	Engine or Truck
Total Personnel	**17**	

Figure 11 Assignment-Residential Structure Fire

The typical response to fill this minimum staffing and perform the necessary fireground tasks would include a Command Vehicle, two Pumpers, a Truck and an additional support vehicle with a total of 18 personnel.

For EMS responses, the NFPA 1710 benchmark is to have an EMS response with a minimum of an Automated External Defibrillator (AED) within 240 seconds (4-minute) travel time to 90 % of incidents. This response should be followed by an ALS emergency response with a minimum of 2 paramedics that arrives on the scene within a 480 second (8 minute) travel time to 90% of the incidents. This benchmark time is established using the probability of survival for a non-breathing patient. It is also based on the survivability of a severely injured trauma patient.

Community Risk Assessment Profiles

Community Life Risk

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 anticipation of needs before they arise. To understand the customer base and its makeup within both fire districts, the figures on the following pages exhibit critical information as using GIS/ESRI's and the most current US Bureau of Census data, June 2013. The following pages provide statistical information and population data for both communities through a variety of maps and charts.

Beach Park

GENERAL POPULATION CHARACTERISTICS, 2013

	Community	Lake County**	CMAP Region
Total Population	13,716	702,099	8,459,768
Total Households	4,730	241,072	3,050,372
Average Household Size	2.9	2.8	2.7
Population Change, 2000-10	35.4%	9.2%	3.5%
Median Age*	38.5	37.0	36.0

Source: 2000 and 2010 Census, 2013 American Community Survey five-year estimates.

*Note that all Regional Medians were calculated based on Grouped Frequency Distributions.
**For municipalities located in more than one county, data provided is for the county containing the largest portion of the municipality.

Figure 12 Beach Park Population Characteristics 2013

Zion

GENERAL POPULATION CHARACTERISTICS, 2015

	Community	Lake County**	CMAP Region
Total Population	24,251	702,898	8,505,977
Total Households	8,106	242,426	3,067,594
Average Household Size	2.9	2.8	2.7
Population Change, 2000-10	6.8%	9.2%	3.5%
Median Age*	31.5	37.6	36.5

Source: 2000 and 2010 Census, 2015 American Community Survey five-year estimates.

*Note that all Regional Medians were calculated based on Grouped Frequency Distributions.
**For municipalities located in more than one county, data provided is for the county containing the largest portion of the municipality.

Figure 13 Zion Population Characteristics, 2015

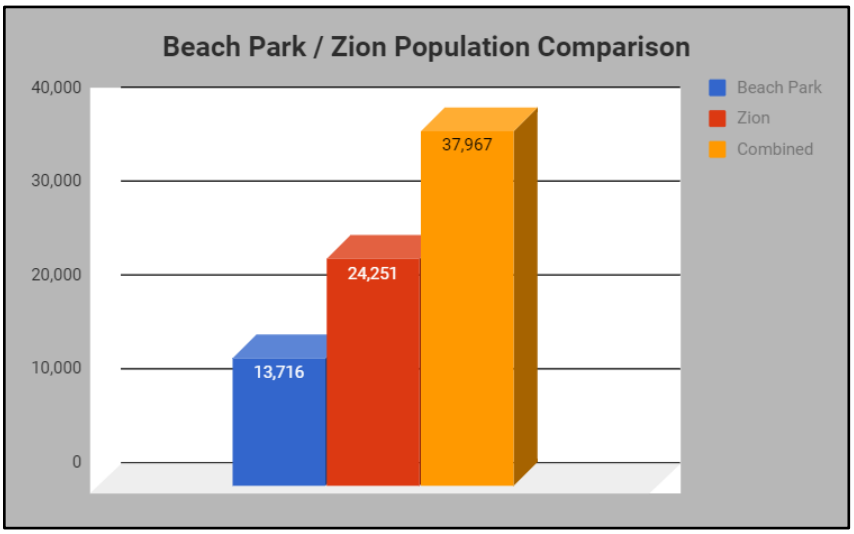


Figure 14 Beach Park / Zion Population Comparison

Each agency's reported population is represented. The Beach Park Fire Protection District services a population of 13,716. In addition, services are provided to approximately 2,000 citizens in portions of unincorporated Beach Park. The Zion Fire & Rescue Department serves a larger population of 24,251. However, when combining the fire departments, the population rises to 37,967. This does not include transient populations of employees and visitors to the area.

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

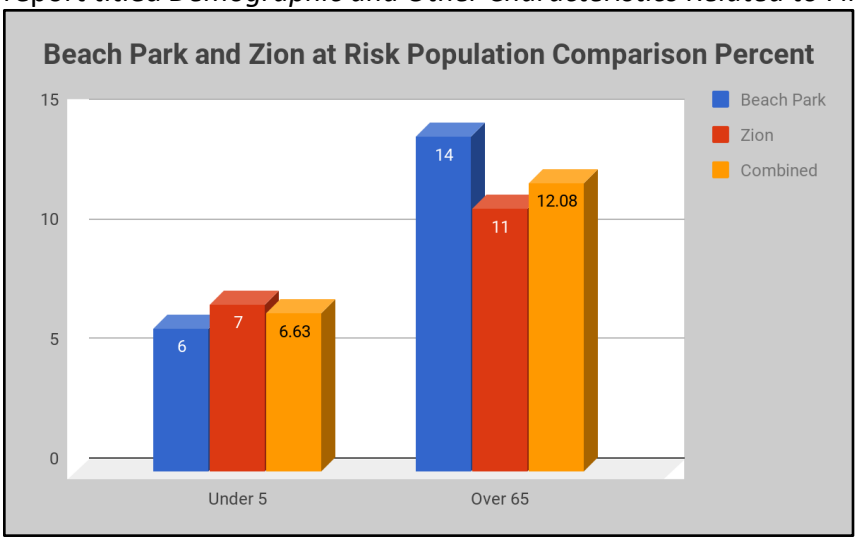


Figure 15 Beach Park & Zion at Risk Population Comparison Percent

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 in injury is highest for those between 20 – 49 (March 2010).

The BPFPD's population at risk under the age of five is approximately 6% and the population at risk age 65 and older is 14%. The ZFRD's population risk group under five years of age is very similar to BPFPD. However, there is a slight decrease in the over 65 years of age community that is at risk in the ZFRD. In the combined agency, the over 65 at-risk population is approximately 12.08 percent and the under 5 at-risk population is approximately 6.63 percent. 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.

FIRE DEPARTMENT OVERVIEWS:
BEACH PARK FIRE PROTECTION DISTRICT

Beach Park Fire Protection District is responsible for providing fire protection, rescue, and emergency medical services to a district of approximately 8.7 square miles that encompasses the majority of The Village of Beach Park and some of the immediate unincorporated area surrounding the Village of Beach Park. The population serviced is approximately 15,000 residents as well as daily commuter traffic between Wisconsin and the Chicago area.

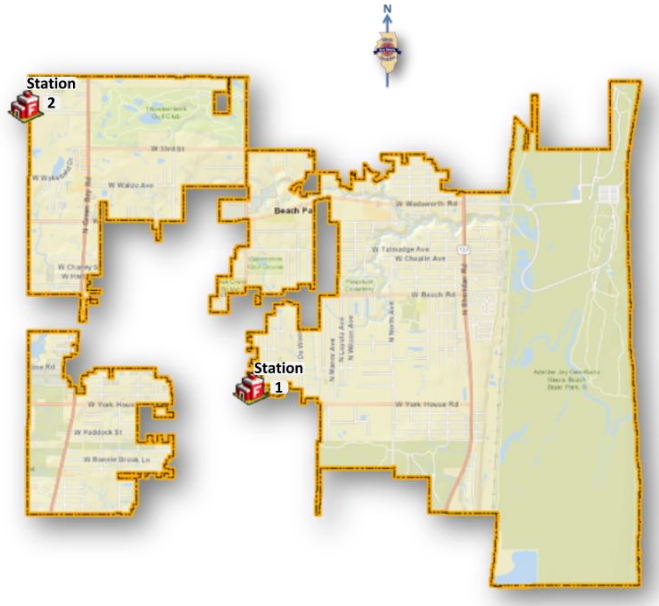
Station 1 (Headquarters Station)
3233 N. Lewis Avenue
Beach Park, IL 60087

Station 2

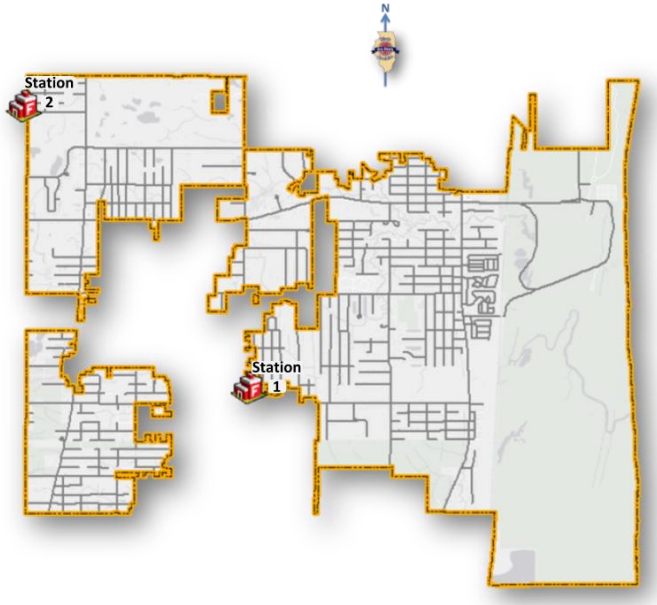
13110 W. Major Avenue
Beach Park, IL 60087

Beach Park Jurisdiction/ Response Area

The Beach Park Fire Protection District covers approximately 8.7 square miles. The response area is separated into two districts; Station 1's area is 7.1 square miles, where Station 2's primary response area is considerably smaller at 1.6 square miles. Beach Park is a combination department with both full-time career and full-time/part-time employees, paid-on-premise supplemented by paid-on-call firefighter-paramedics. Full-time employees are represented by the International Association of Firefighters, IAFF Local 4806. All members must attain a minimum of a State of Illinois certification of Firefighter II, and EMT-B level Emergency Medical Service certification. Full-time members are required to be a paramedic. BPFPD personnel must also maintain a high level of continuing fire and EMS education along with ongoing specialized team training. BPFPD are members of the Lake and McHenry Counties Specialized Response teams. The department responds to over 1,250 calls for service per year.



TRA: 8.7 sq miles
Station 1: 7.1 sq. miles
Station 2: 1.6 sq. miles



TRA: 69.4 miles
Station 1: 55.9 miles
Station 2: 13.5 miles

The following chart identified the apparatus fleet for the Beach Park Fire Department (Figure 16).

BEACH PARK FIRE DEPARTMENT APPARATUS					
STATION 1	**Engine**	**Truck**	**Tender**	**Brush**	**Ambulance**
Apparatus Number	1222	1231	1265	1275	1242
Make	Seagrave	Pierce	Freightliner	Ford	Ford
Year Purchased	2008	1991	2003	1993	2012
Pump Capacity	1500	1500	500	500	
Tank size	1000	300	3000	200	
Aerial Length		105’			
Status					ALS
STATION 2	**Engine**	**Brush**	**Ambulance**		
Apparatus Number	1212	1272	1243		
Make	Alexis	Hummer	Ford		
Year Purchased	2003	1997	2013		
Pump Capacity	1500	-			
Tank Size	1250	-			
Aerial Length	-	-			
Status			ALS		
Staff Vehicles					
Apparatus Number	1201	1200	BAT122		
Make	Chevy	Ford	Ford		
Year Purchased	2014	2017	2009		
Apparatus Number	1280	1294			
Make	Chevy	Polaris ATV			
Year Purchased	2014	2010			

Figure 16 BPFPD Fire Apparatus

The chart below (Figure 17) identifies minimum and maximum staffing levels for each station as well as the designation of position for BPFPD.

BEACH PARK FIRE PROTECTION DISTRICT STAFFING				
Station	Personnel			
	Minimum Staffing Levels			
	Jump Company		**Administrative**	
Station 1	Firefighter/EMT-P (FT)	1	Fire Chief (FT)	1
	Firefighter/EMT-P (PT)	1	Deputy Chief (PT)	.5
			Admin. Assistant (PT)	.5
			Training OFC	.5
Station 2	Firefighter/EMT-P (FT)	1		
	Firefighter/EMT-P (PT)	1		
	Total Min	**4**	**Total Max (Daytime only)**	**2.5**

Figure 17 BPFPD Staffing Arrangement by Position/Station

ISO Public Protection Classification of the BPFPD

In November of 2015, the BPFPD was evaluated by the Insurance Services Office (ISO) who collects and evaluates information from communities in the United States on their structure fire suppression capabilities. The data is analyzed using their Fire Suppression Rating

FSRS Item	Earned Credit	Credit Available
Emergency Communications		
414. Credit for Emergency Reporting	1.95	3
422. Credit for Telecommunicators	2.80	4
432. Credit for Dispatch Circuits	2.10	3
440. Credit for Emergency Communications	6.85	10
Fire Department		
513. Credit for Engine Companies	5.84	6
523. Credit for Reserve Pumpers	0.00	0.5
532. Credit for Pumper Capacity	3.00	3
549. Credit for Ladder Service	1.38	4
553. Credit for Reserve Ladder and Service Trucks	0.00	0.5
561. Credit for Deployment Analysis	5.54	10
571. Credit for Company Personnel	9.65	15
581. Credit for Training	4.67	9
730. Credit for Operational Considerations	2.00	2
590. Credit for Fire Department	32.08	50
Water Supply		
616. Credit for Supply System	23.44	30
621. Credit for Hydrants	3.00	3
631. Credit for Inspection and Flow Testing	3.93	7
640. Credit for Water Supply	30.37	40
Divergence	-2.35	--
1050. Community Risk Reduction	3.49	5.50
Total Credit	70.44	105.5

Figure 18 ISO Report - BPFPD

Schedule (FSRS™) and then a Public Protection Classification (PPC™) number is assigned to the community.

ISO's PPC program evaluates communities according to a uniform set of criteria, incorporating nationally recognized standards developed by the National Fire Protection Association and the American Water Works Association (ISO, 2007). The ISO evaluation has determined that the Department merits a **Public Protection Class 03** rating.

2017 to 2015 Response Time Assessment

During the three-year period, 2017 - 2015 the BPFPD responded to 4,319 emergency calls.

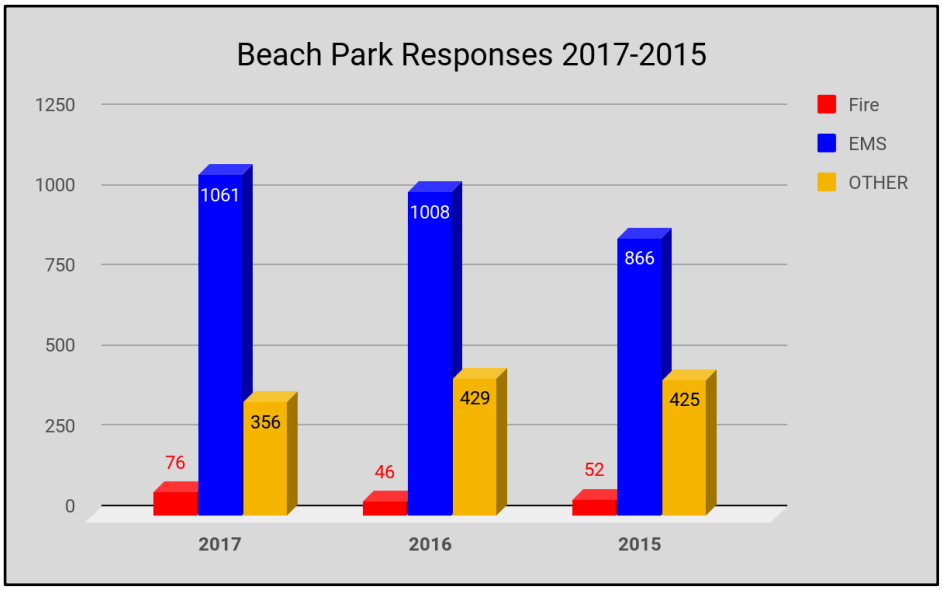


Figure 19 Beach Park Responses 2017-2015

The Consulting team analyzed 3,080 incidents that occurred within the TRA. Response Time was used to calculate the service areas of each fire station. The Consulting Team reviewed

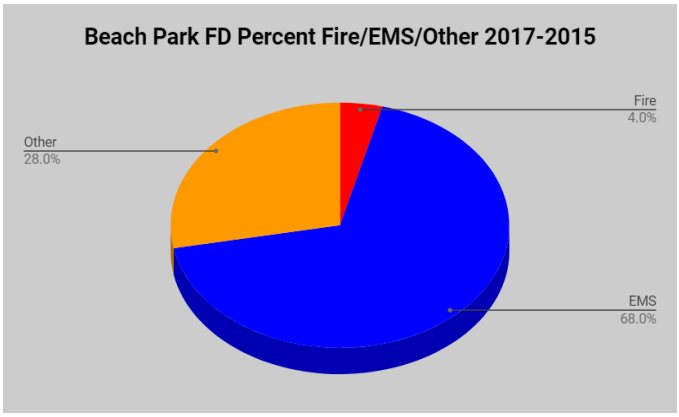


Figure 20 Beach Park Percent Fire/EMS/Other 2017-2015

the data provided on EMS and Non-EMS incidents (those incidents that qualified as true emergency requests) for the first-due fire suppression unit and ambulance/ALS unit for calls within each of the three response areas or still districts.

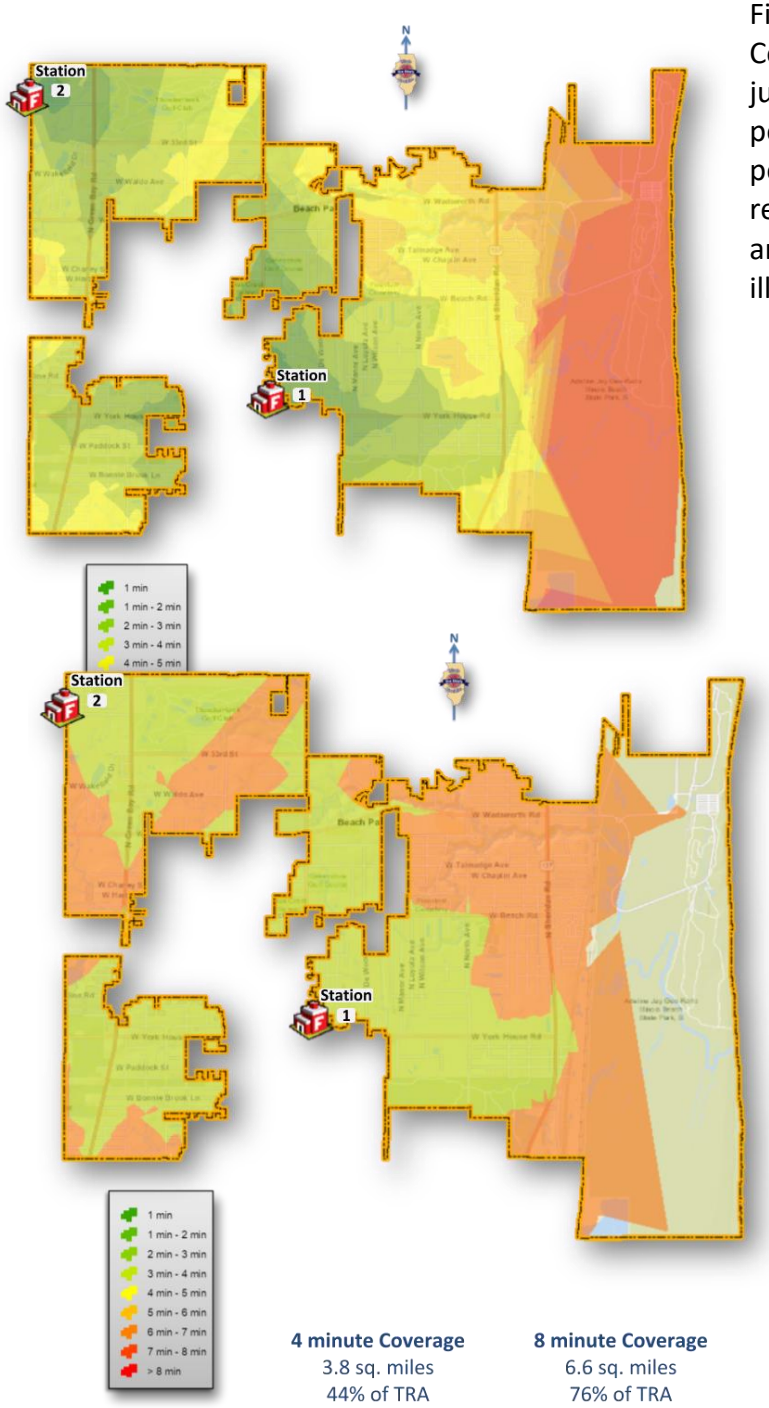
EMS and Non-EMS Defined

In defining EMS and non-EMS incidents, we reference the National Fire Incident Reporting System (NFIRS). Nationally, most fire departments use NFIRS to document their incidents. NFIRS is a system established by the National Fire Data Center of the United States Fire Administration (USFA), a division of the Federal Emergency Management Agency. This system provides a template for uniform data reporting. All incidents are coded by type into categories. Emergency Medical Service (EMS) incidents have a separate category with the defining characteristic that these incidents are a response involving injury or illness to the individual(s). EMS incidents normally have an ambulance and EMS engine response. EMS calls account for the most calls for service to fire departments. NFIRS has several categories for non-EMS responses. For data analysis and recordkeeping, most fire departments separate their incidents into EMS and non-EMS responses. Non-EMS calls are all other emergencies that do not involve patient care. These incidents include but are not limited to: structure fires, car fires, brush fires, technical rescues, hazardous materials incidents, dive related rescues and recovery, and a variety of other calls for service.

The IFCA Consulting Team reviewed the time it takes for responding crews to acknowledge receipt of the call from the dispatch center until the point of arriving on the scene of the incident. The National Fire Protection Association (NFPA) standard or benchmark for EMS incidents is 5:00 minutes and Non-EMS incidents is 5:20 minutes.

Beach Park FPD - Area Served by Drive Time

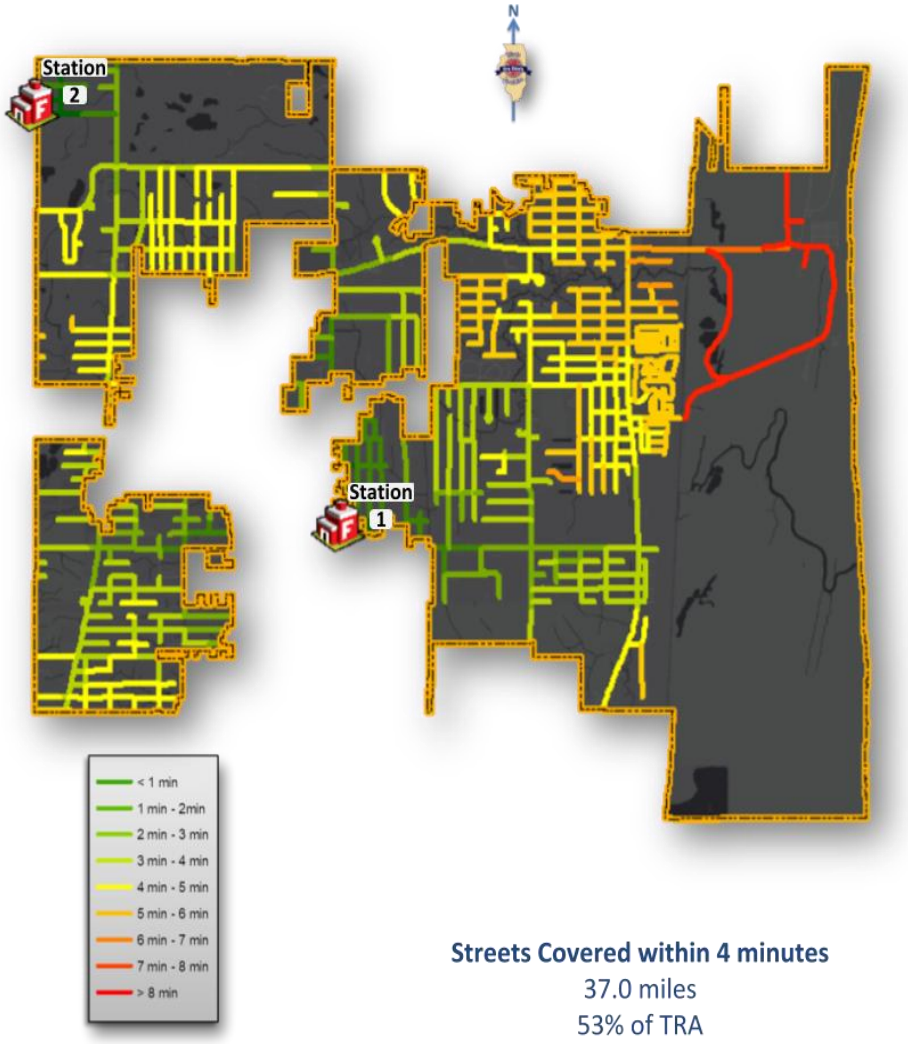
The following pages contain mapping results for drive time performance for the Beach Park Fire Protection District. The IFCA Consulting Team analyzed the jurisdiction for drive times in overall performance as well as break out performance for individual station response areas. The drive time analysis also provides 4 and 8-minute illustrations.



4 minute Coverage
3.8 sq. miles
44% of TRA

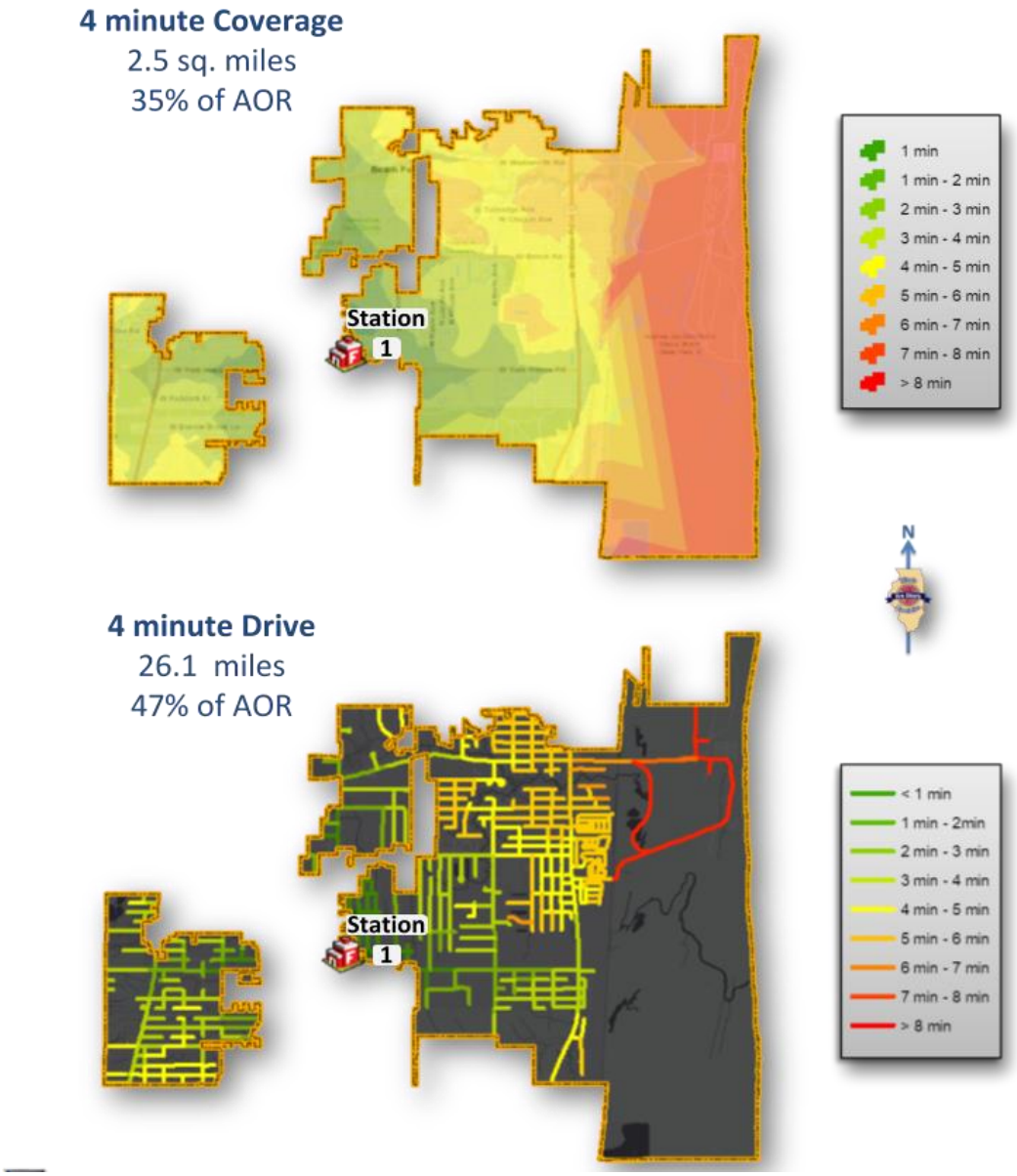
8 minute Coverage
6.6 sq. miles
76% of TRA

Streets Covered by Drive Time

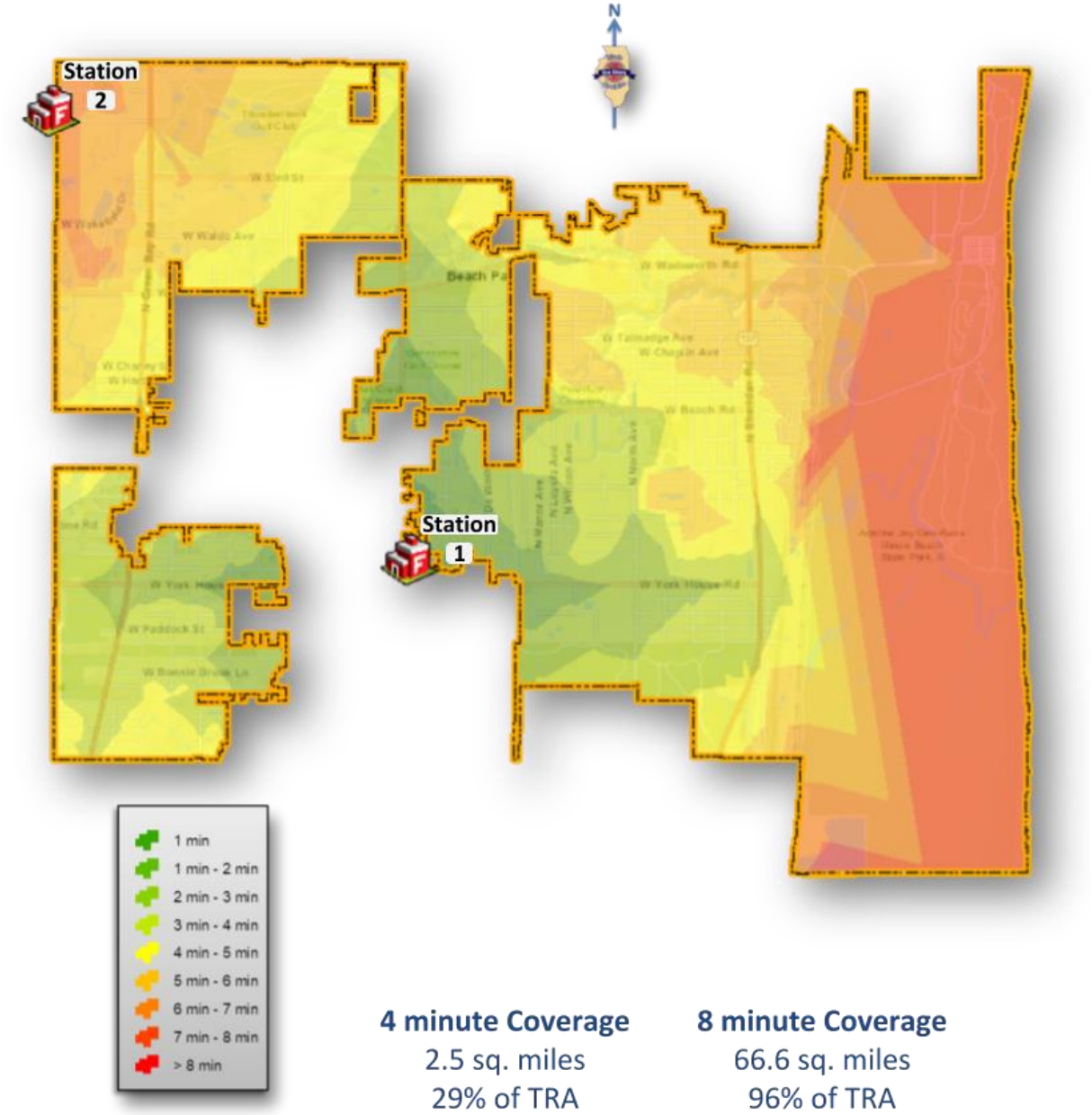


Streets Covered within 4 minutes
37.0 miles
53% of TRA

Beach Park FPD - Station 1 Area & Streets by Time



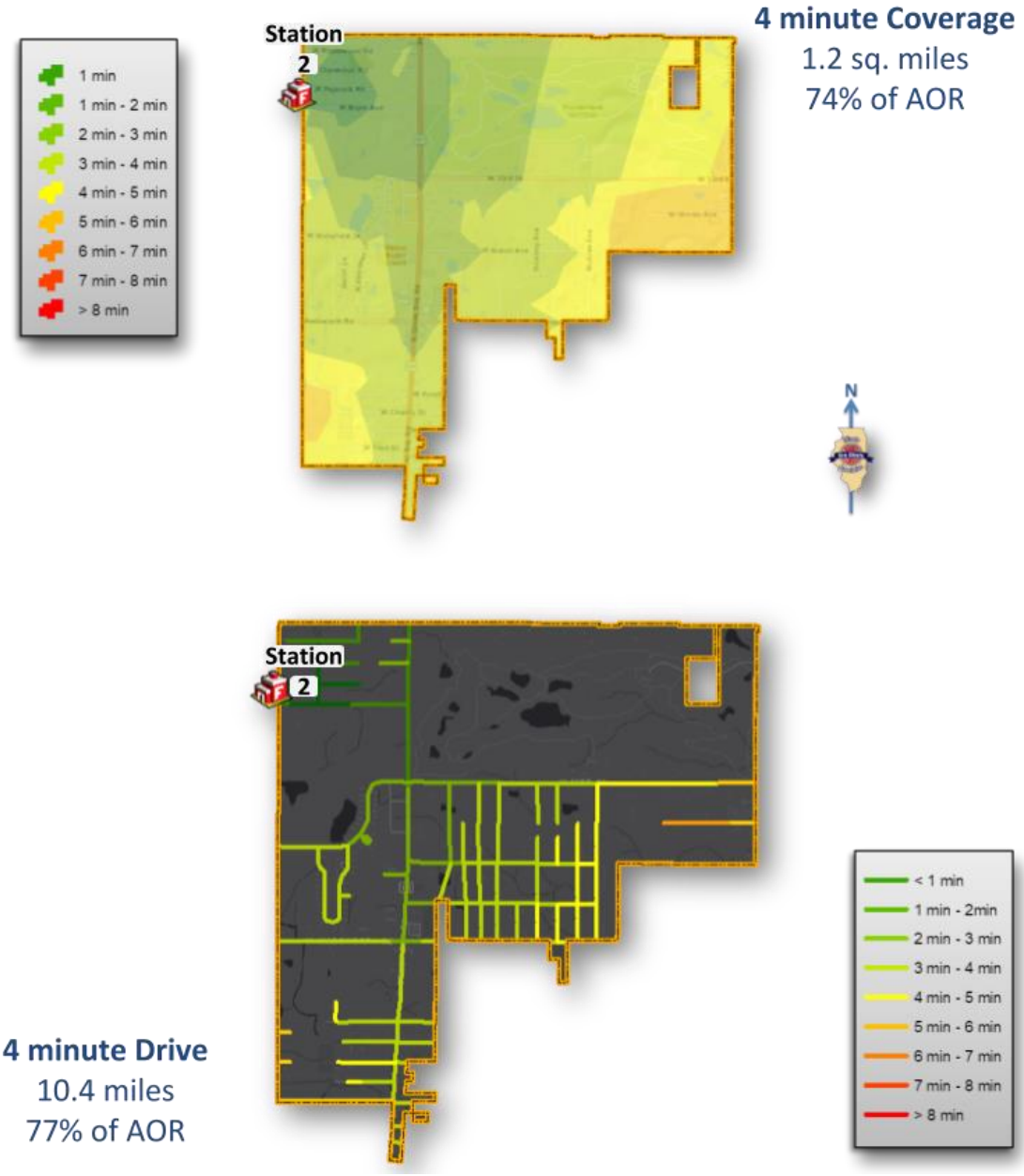
Beach Park FPD Station 1 - Total Response Area Coverage



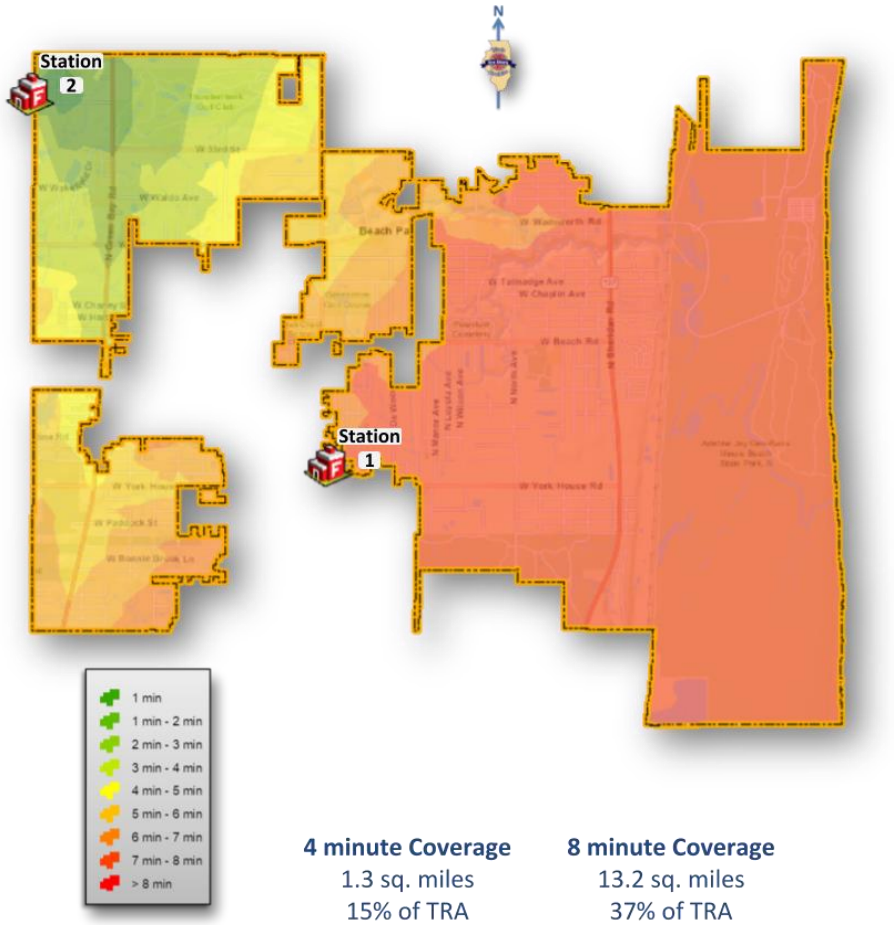
4 minute Coverage
2.5 sq. miles
29% of TRA

8 minute Coverage
66.6 sq. miles
96% of TRA

Beach Park FPD Station 2 Area & Streets by Time



Beach Park FPD Station 2 - Total Response Area Coverage



4 minute Coverage
1.3 sq. miles
15% of TRA

8 minute Coverage
13.2 sq. miles
37% of TRA

Area Overview Summary

	Area Sq. Miles	% of Area w/in 4 min	Street Miles	% of Streets w/in 4 min
TRA	8.7	44%	69.4	53%
Station 1	7.1	29%	55.8	39%
Station 2	1.6	15%	13.6	15%

Call Volume Density Analysis

Using Geographic Information Systems (GIS) software the IFCA Consulting Team was able to create call volume density maps to visualize data and identify patterns and hot spots.

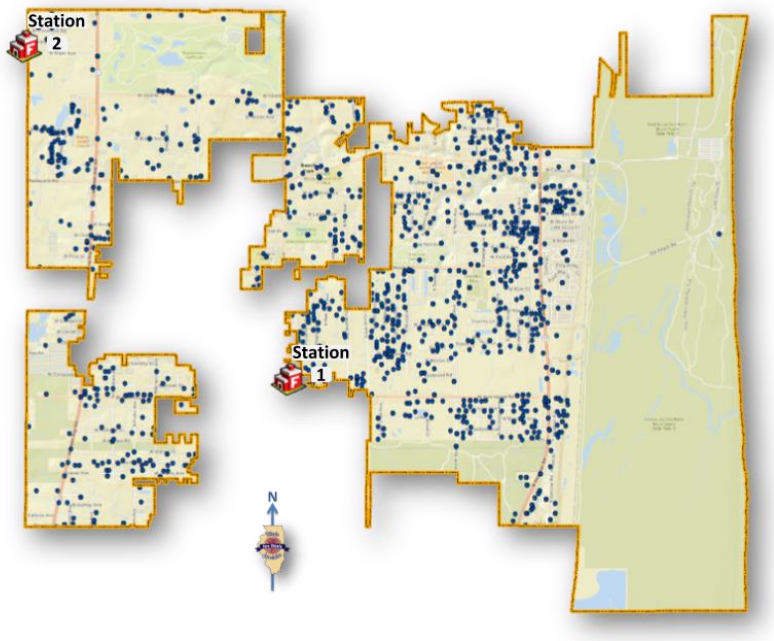
To accurately assess the information, the IFCA Consulting Team used incident data and call-for-service data in developing the hot spot analysis. Call-for-service data capture reports of EMS, fire and non-EMS incidents that are not collected in standard incident reporting software. Using Geographic Information Systems (GIS) software the IFCA Consulting Team was able to create call volume density maps to visualize data and identify patterns and hot spots.

The following maps exhibit EMS and non-EMS incidents as they vary continuously across space without boundaries. By using these types of maps, the IFCA Consulting Team can identify incident hot spots for all NFIRS Group codes. The area of the map with the highest number of incidents is shaded bright red, to indicate a higher density of response to that area.

BEACH PARK: ALL INCIDENT DATA

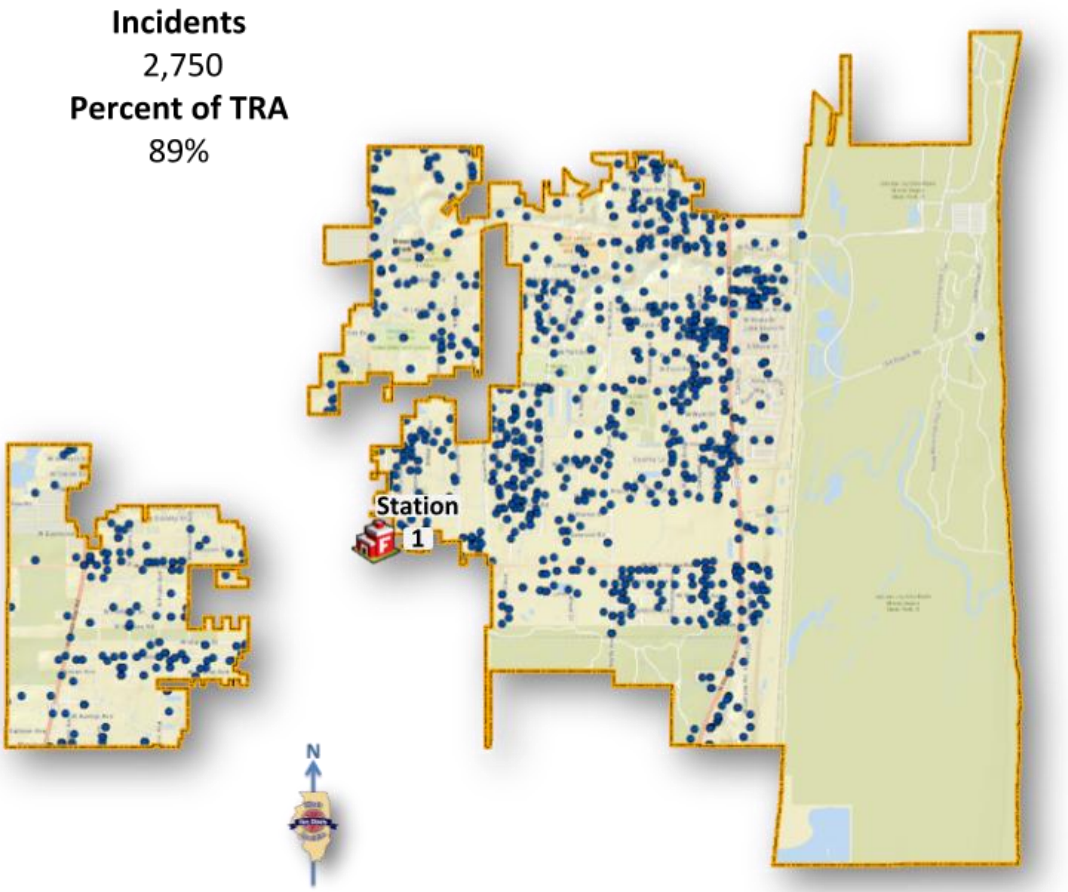
Total Response Area: All Incidents

TRA Incidents
3,080



100	200	300	400	500	600	700	900
85	2	2,282	80	309	135	168	19
2.8%	0.1%	74.1%	2.6%	10.0%	4.4%	5.5%	0.6%

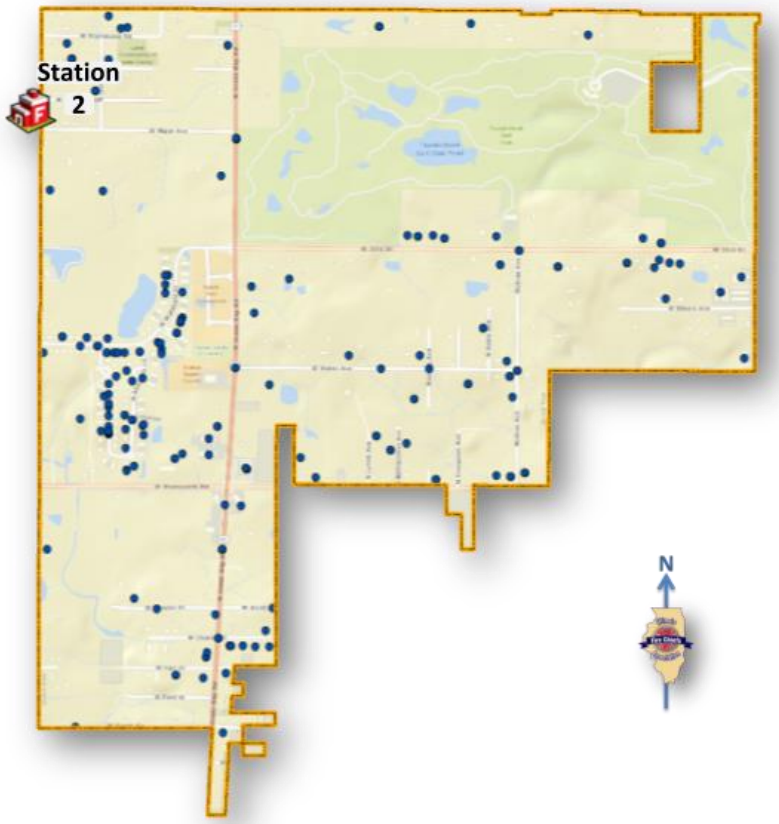
Beach Park Station 1 - All Incidents



100	200	300	400	500	600	700	900
75	2	2,023	65	296	128	143	18
2.7%	0.1%	73.6%	2.4%	10.8%	4.7%	5.2%	0.7%

Beach Park Station 2 - All Incidents

Incidents
330
Percent of TRA
11%



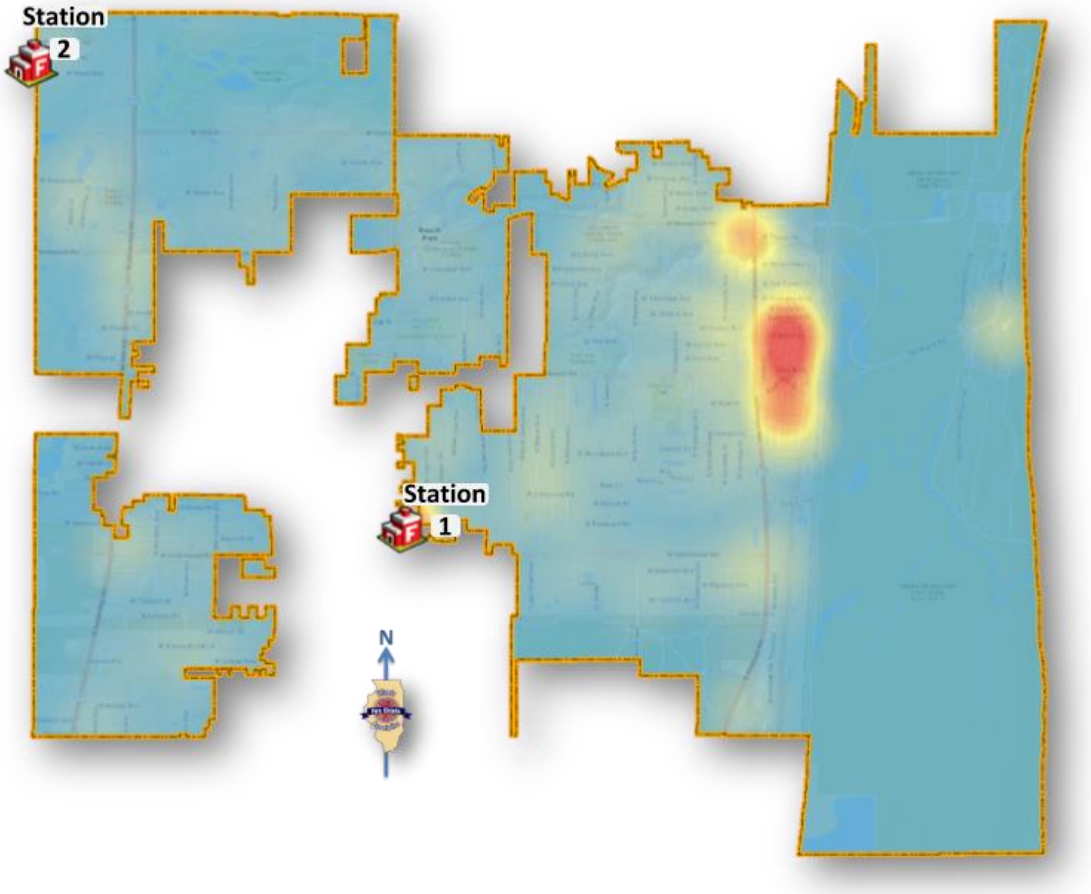
100	300	400	500	600	700	900
10	259	15	13	7	25	1
3.0%	78.5%	4.5%	3.9%	2.1%	7.6%	0.3%

All Incidents Mapping

NFIRS Group 100 - Fire
NFIRS Group 200 - Overpressure Rupture, Explosion, Overheat (No Fire)
NFIRS Group 300- Rescue and Emergency Medical Service (EMS)
NFIRS Group 400 - Hazardous Condition (No Fire)
NFIRS Group 500 - Service Call
NFIRS Group 600 - Good Intent Call
NFIRS Group 700 - False Alarm
NFIRS Group 800 - Severe Weather and Natural Disaster
NFIRS Group 900 - Special Incident Type

Beach Park - All Incidents Hot Spots

Total: 3,080

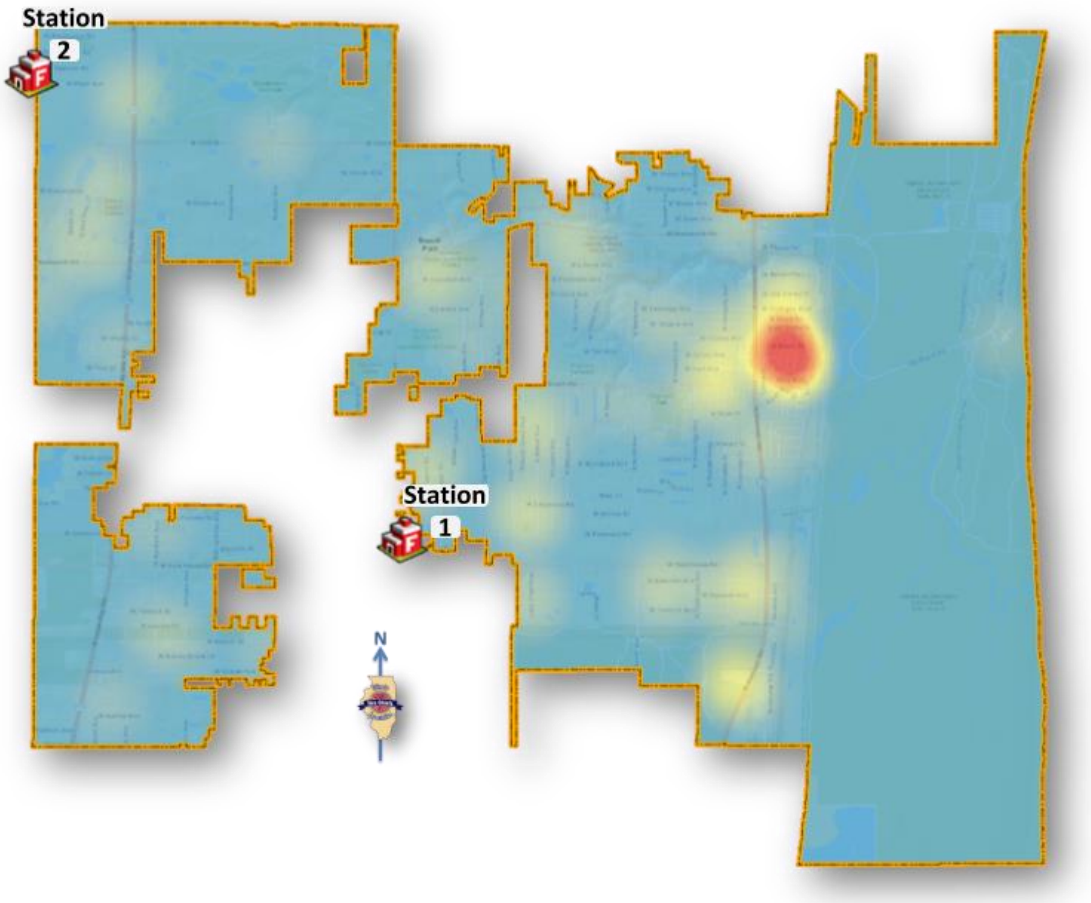


Percentage of TRA Incidents

Station 1: 89%
Station 2: 11%

Beach Park - NFIRS Group 100 - Fire

Total: 85



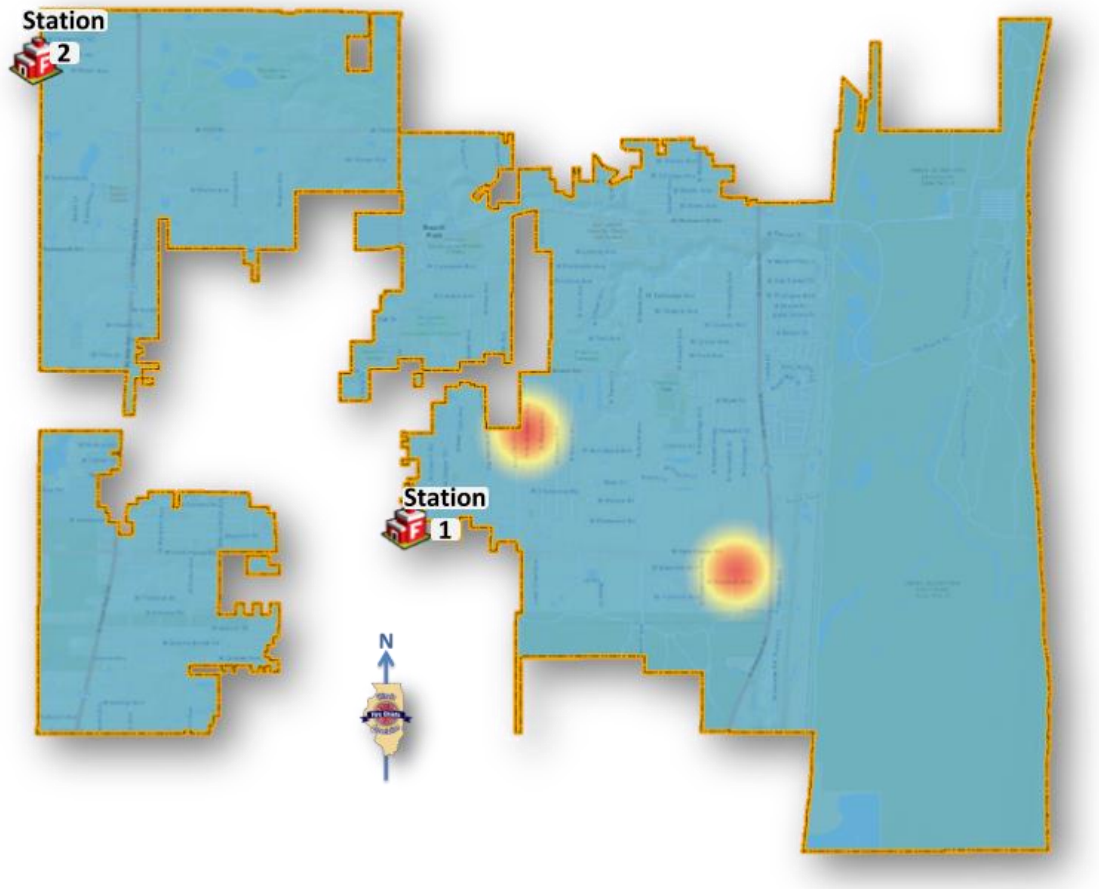
Percentage of TRA Incidents

Station 1: 88%
Station 2: 12%

NFIRS 100: Fire

Beach Park - NFIRS Group 200-Overpressure Rupture, Explosion, Overheat (No Fire)

Total: 2



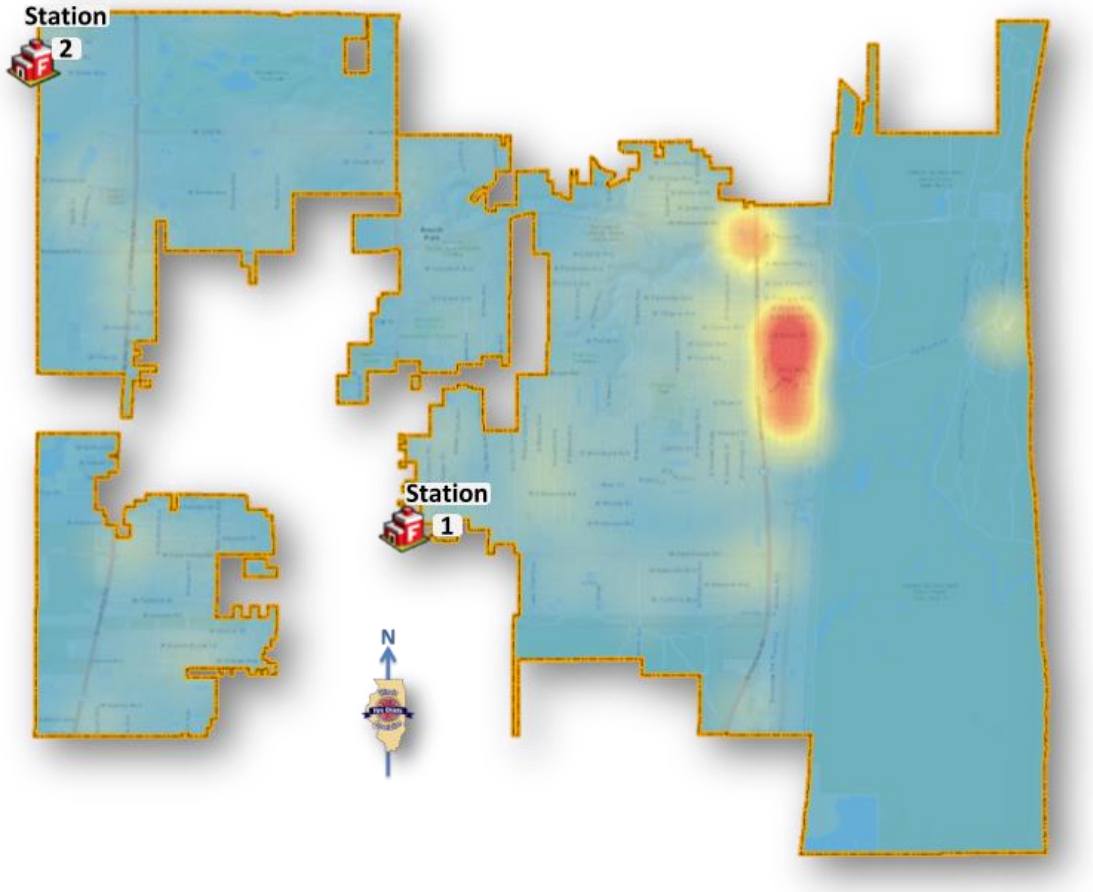
Percentage of TRA Incidents

Station 1: 100%
Station 2: 0%

NFIRS 200: Overpressure Rupture Explosion Overheat No Fire

Beach Park - NFIRS Group 300-Rescue and EMS Incidents

Total: 2,282



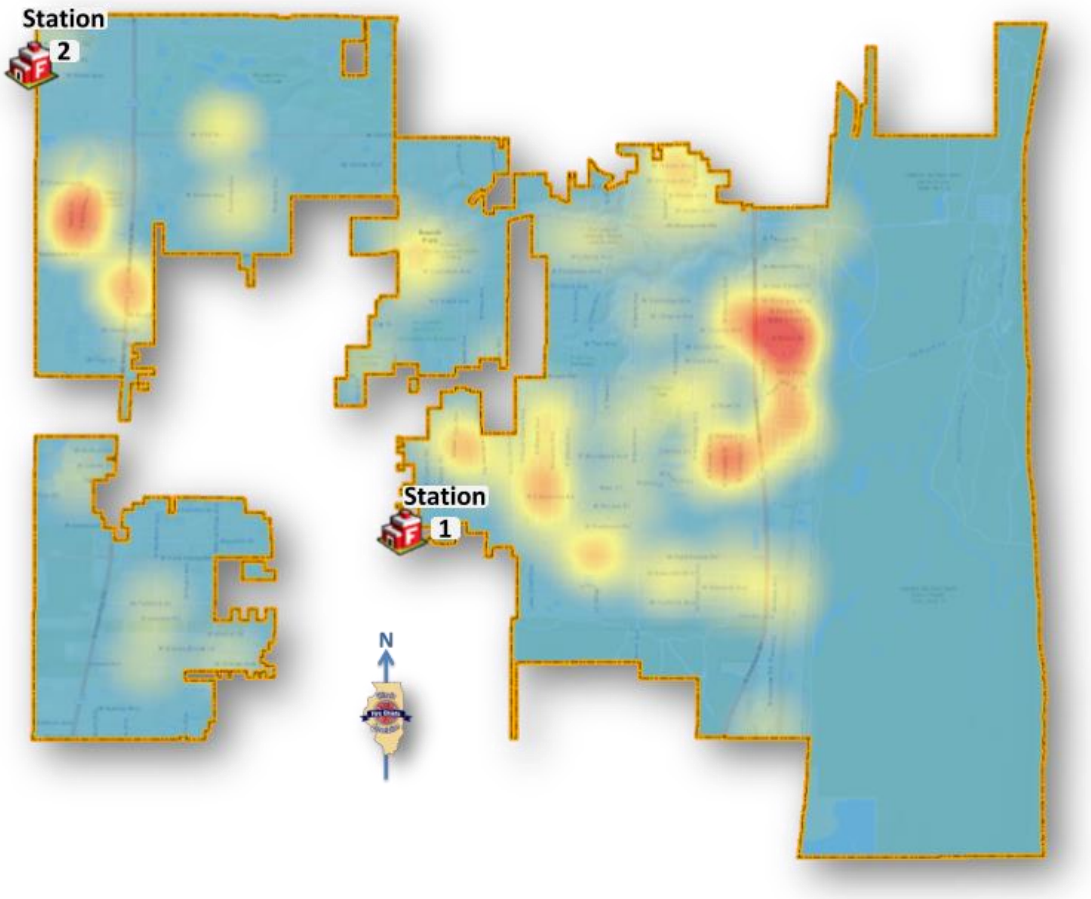
Percentage of TRA Incidents

Station 1: 89%
Station 2: 11%

NFIRS 300: Rescue EMS

Beach Park - NFIRS Group 400-Hazardous Condition (No Fire)

Total: 80



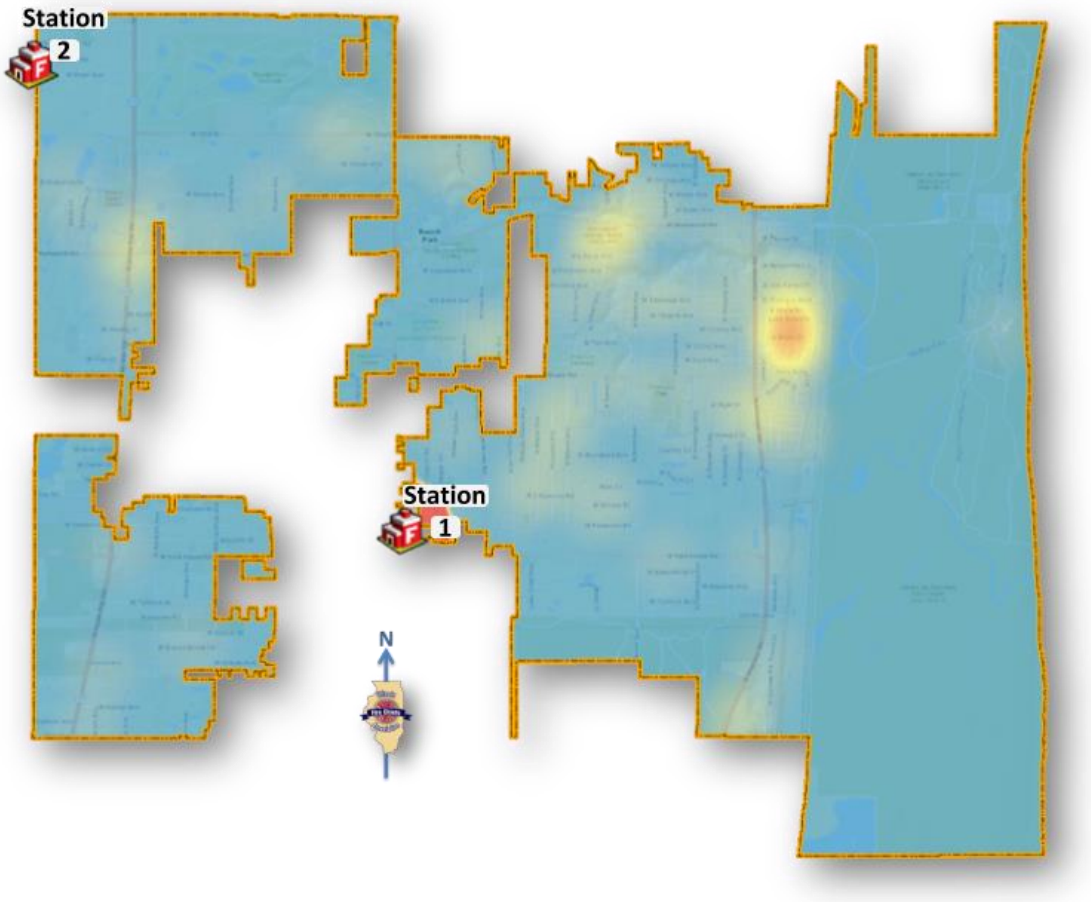
Percentage of TRA Incidents

Station 1: 81%
Station 2: 19%

NFIRS 400: Hazardous Condition No Fire

Beach Park - NFIRS Group 500-Service Call

Total: 309



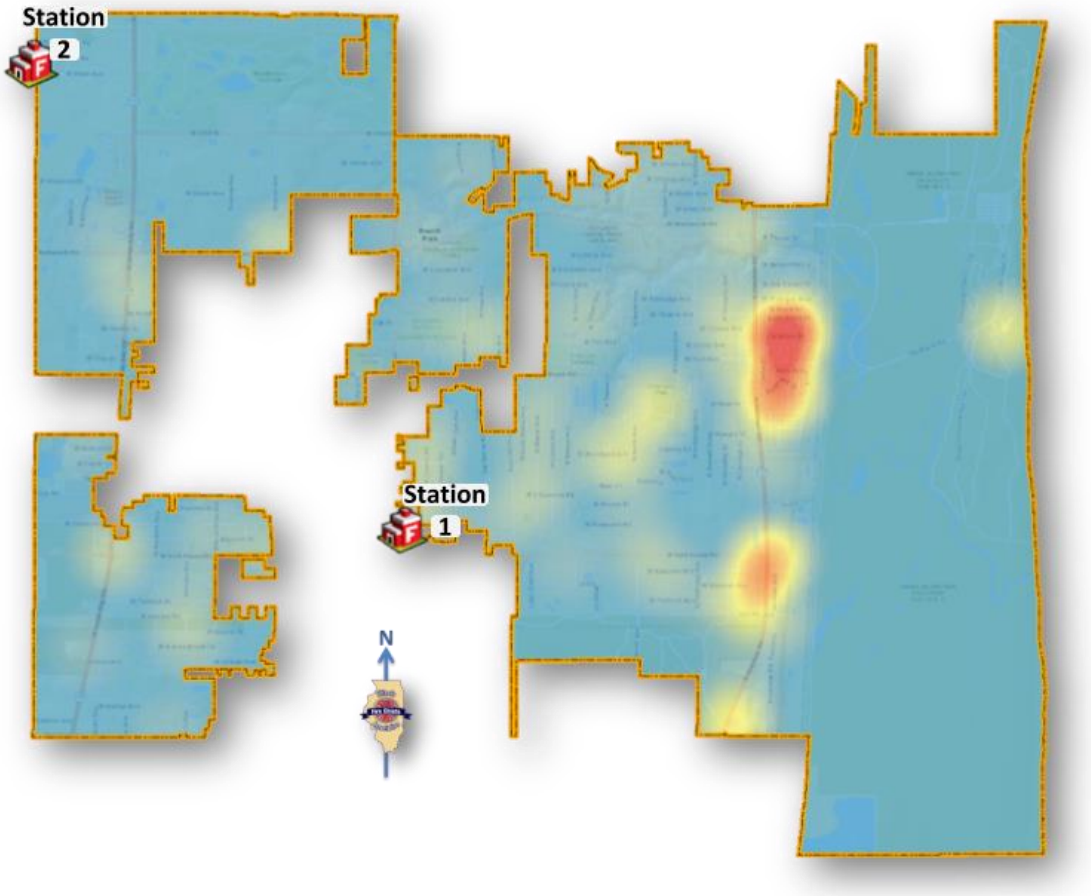
Percentage of TRA Incidents

Station 1: 96%
Station 2: 4%

NFIRS 500: Service Call

Beach Park - NFIRS Group 600-Good Intent Call

Total: 135



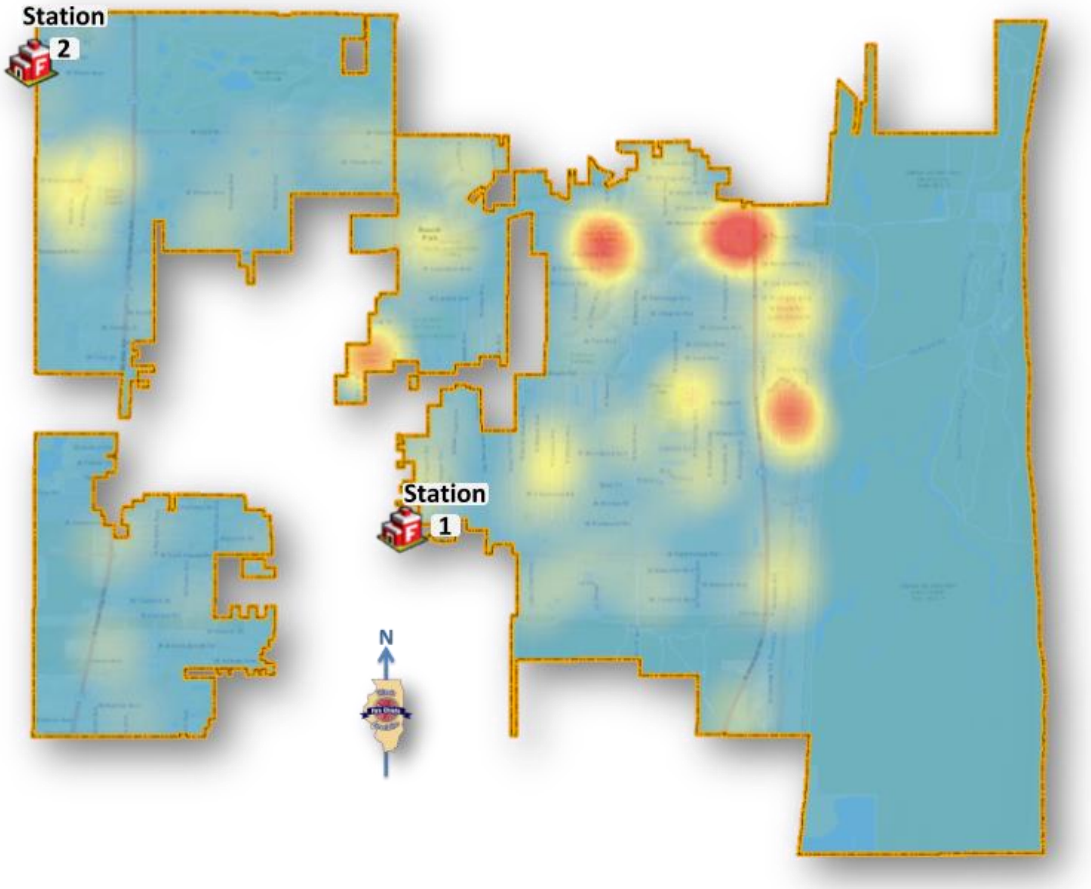
Percentage of TRA Incidents

Station 1: 95%
Station 2: 5%

NFIRS 600: Canceled Good Intent

Beach Park - NFIRS Group 700-False Alarm and False Call

Total: 168



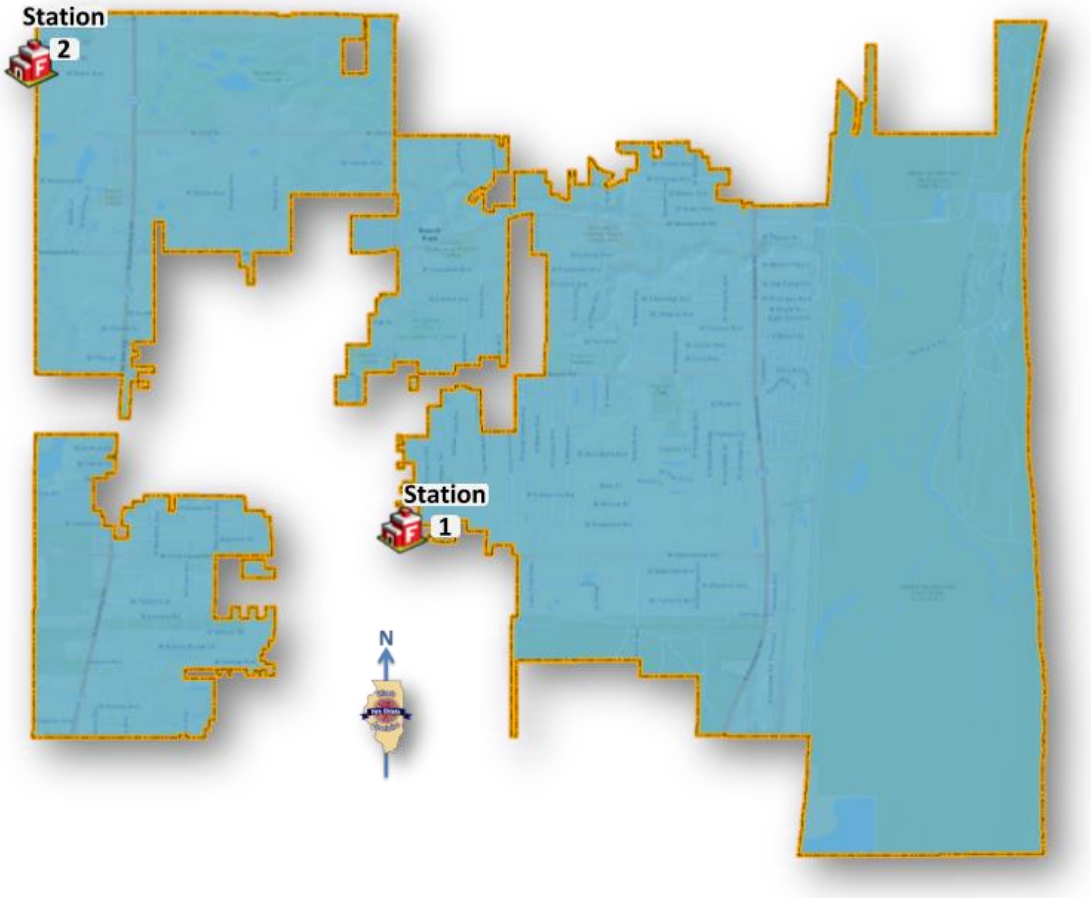
Percentage of TRA Incidents

Station 1: 85%
Station 2: 15%

NFIRS 700: False Alarm False Call

Beach Park - NFIRS Group 800-Severe Weather and Natural Disaster

Total: 0



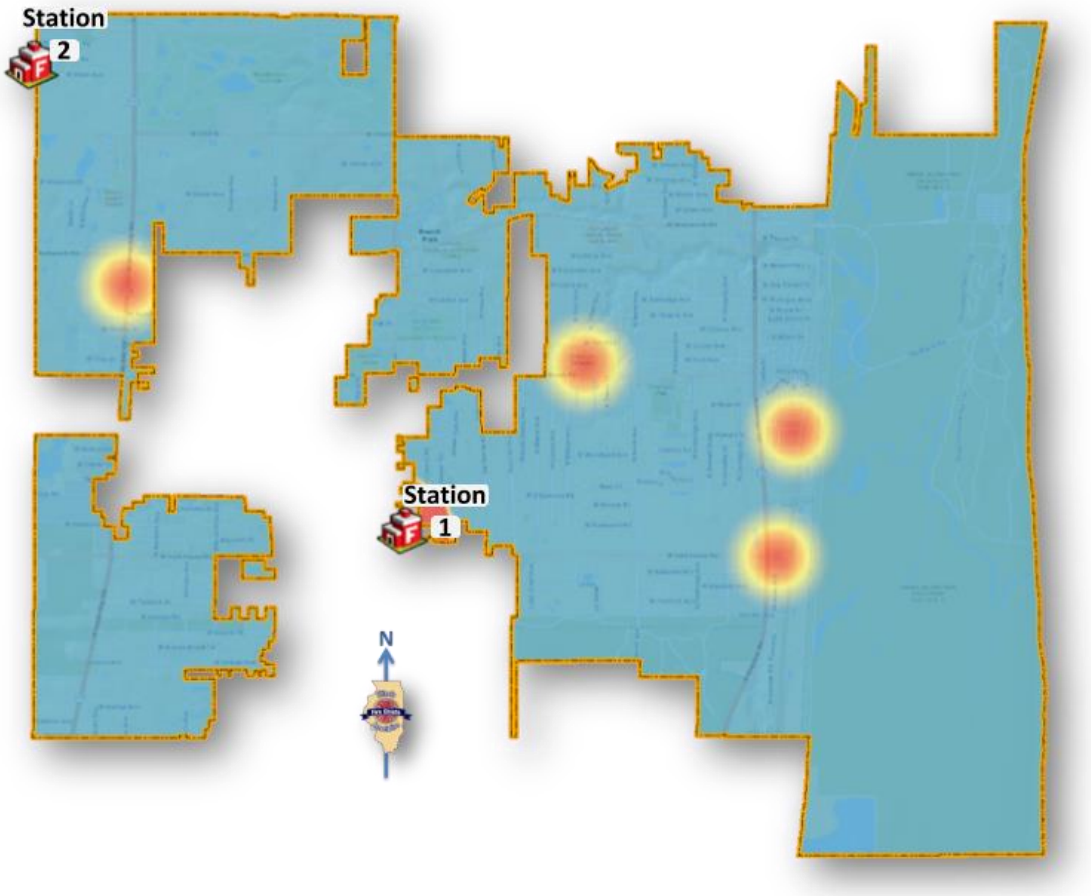
Percentage of TRA Incidents

Station 1: 0%
Station 2: 0%

NFIRS 800: Severe Weather and natural Disaster

Beach Park - NFIRS Group 900-Special Incident Type

Total: 19



Percentage of TRA Incidents

Station 1: 95%
Station 2: 5%

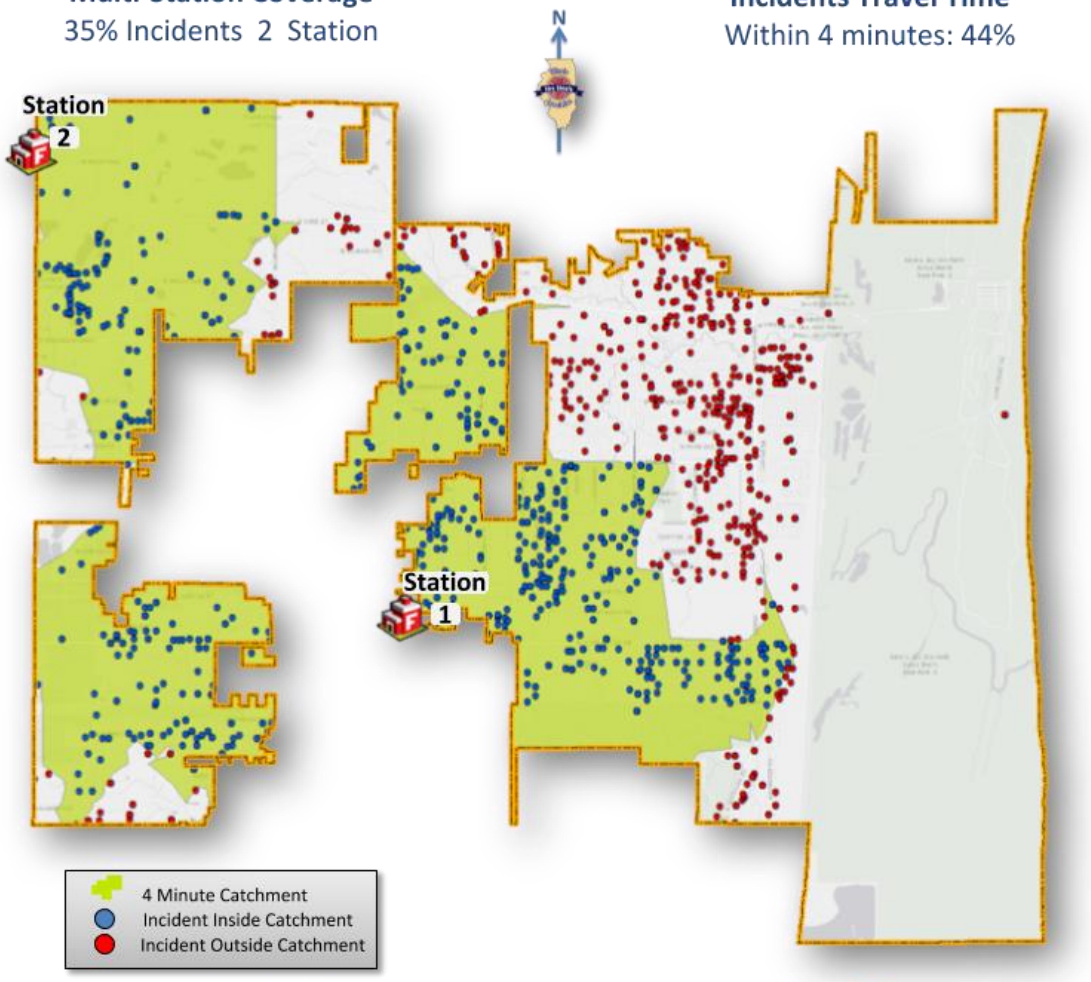
NFIRS 900: Special Incident Type

Beach Park Fire - Service Area Performance

Total Response Area: All Incidents

Multi-Station Coverage
35% Incidents 2 Station

Incidents Travel Time
Within 4 minutes: 44%



Historic Incidents w/in NFPA Response Time Standards

Complete TRA: Fires 20% EMS 27%

Within 4 Minute Catchment: Fires 33% EMS 46%

Response Time (h:mm:ss)

	90th %	80th %	70th %	60th %	50th %
All	0:08:58	0:07:33	0:06:48	0:06:17	0:05:51
Fire	0:08:45	0:08:06	0:07:14	0:06:43	0:06:12
EMS	0:09:00	0:07:39	0:06:54	0:06:24	0:05:59

Illinois Fire Chiefs Association | 2018

Beach Park FPD Response Times - Historic vs Ideal

All Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal	0:06:29	0:06:19	0:06:11	0:05:53	0:05:20
Historic	0:08:58	0:07:33	0:06:48	0:06:17	0:05:51

Fire Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal	0:06:44	0:06:35	0:06:12	0:05:35	0:05:14
Historic	0:08:45	0:08:06	0:07:14	0:06:43	0:06:12

EMS Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal	0:06:29	0:06:24	0:06:14	0:05:59	0:05:39
Historic	0:09:00	0:07:39	0:06:54	0:06:24	0:05:59

Other Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal	0:06:24	0:05:59	0:05:29	0:04:36	0:04:00
Historic	0:08:43	0:07:03	0:06:20	0:05:32	0:04:38

ZION FIRE & RESCUE DEPARTMENT

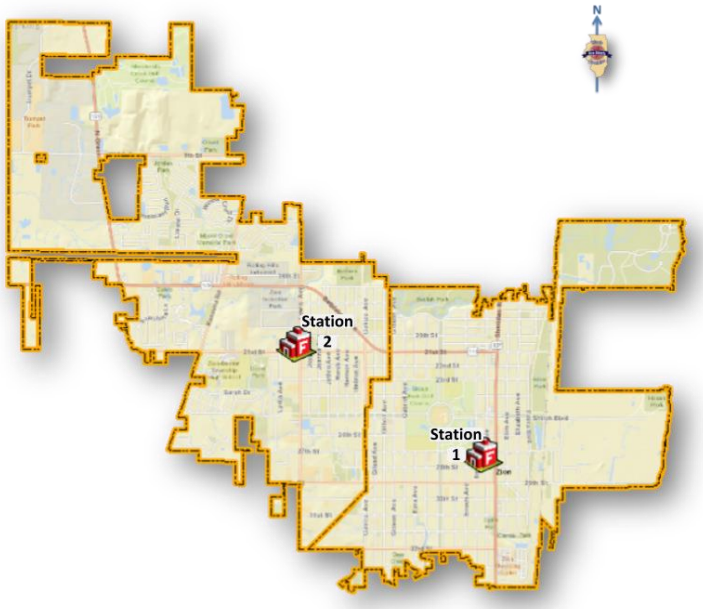
The Zion Fire & Rescue Department currently serves just under 25,000 residents in an approximate 9.8 square mile area. A major function of the Zion Fire & Rescue Department is to extinguish accidental or destructive fires occurring in the city. To ensure this goal the Zion Fire & Rescue Department employs 27 full-time split between three shifts. Each Shift has a minimum staffing of 7 personnel on duty 24 hours a day, 5 at Station One and 2 at Station Two.

Station 1
1303 27th Street
Zion, Illinois

Station 2
2016 Lewis Avenue
Zion, Illinois

Zion Jurisdiction/Response Area

The Zion Fire & Rescue Department covers approximately 9.8 square miles. The response area is separated into two districts; The coverage area for Station 1 is 4.2 square miles, where Station 2's primary response area is somewhat larger at 5.6 square miles. The Zion Fire & Rescue Department has two (2) Engines, one (1) Quint with a 105 ft Ladder, and three (3) Ambulances. Each report of a fire in the city receives a response of the duty crew personnel, one (1) engine, (1) truck, one (1) ambulance and a shift commander. In addition to the on-duty personnel, the off-duty personnel responds to the stations when needed.



TRA: 9.8 sq miles
Station 1: 4.2 sq. miles
Station 2: 5.6 sq. miles

The Zion Fire & Rescue Department also participates in an automatic response program with the four fire departments that surround Zion. The Quad One response includes Beach Park Fire Protection District, Newport Fire Department, Pleasant Prairie Fire Department, and the Winthrop Harbor Fire Department. This provides

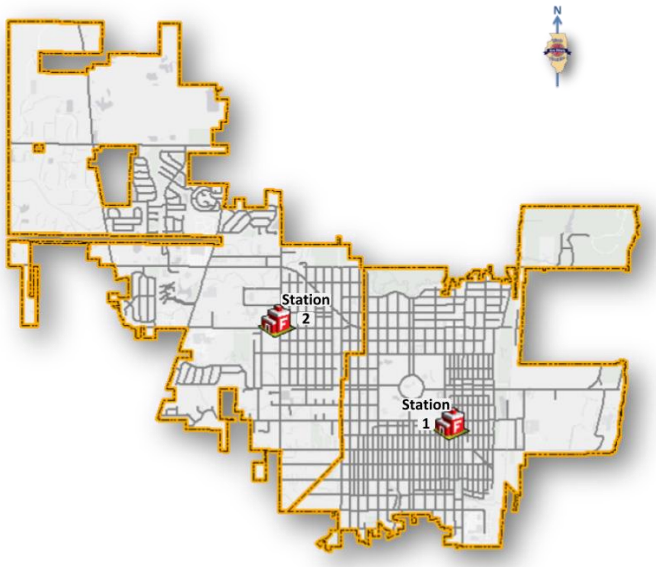
immediate access to additional equipment and personnel.

For major emergencies, the Zion Fire & Rescue Department is part of the statewide Mutual Aid Box Alarm System (MABAS) that makes available equipment and personnel from all departments in Lake County as well as other counties in the state if needed.

Personnel and Equipment

The ZFRD has a minimum daily shift of 7 personnel that staffs 2 ambulances (ALS) and an engine (ALS), and a Command vehicle. Each shift is supervised by a Shift Commander.

Administratively, there is a Fire Chief, Deputy Fire Chief and two (2) part-time Administrative Assistants.



TRA: 119.5 miles
Station 1: 66.6 miles
Station 2: 52.9 miles

ZION FIRE & RESCUE DEPARTMENT FIRE APPARATUS				
STATION 1	**Engine**	**Medic Unit**	**Medic Unit**	**Truck**
Apparatus Number	**Engine 1811**	**MICU 1841**	**MICU 1843**	**Truck 1831**
Make	E-One	AEV	AEV	Pierce
Year Purchased	2018	2014	2012	1999
Administrative/Other	**BAT 18** 2016 Tahoe	**Chief 1890** 2009 Ford Expedition	**DC 1891** 2018 Ford Explorer	**ATV** 2005 Polaris
STATION 2	**Engine**	**Medic Unit**		
Apparatus Number	Engine 1812	MICU 1842		
Make	Pierce	AEV		
Year Purchased	2007	2018		
Administrative/Other	Utility 1892 2007 Ford	HazMat Trailer		

Figure 21 Zion Fire and Rescue Department Fire Apparatus

The following figure illustrates the minimum and maximum staffing levels. Seven shift configuration represents a manpower reduction of two (2) personnel off duty. Nine personnel model is a maximum staffing level without personnel on approved time-off. During the period of multiple ambulance requests (i.e., third consecutive request) Engine 1811's crew becomes a jump company and responds with 1843; leaving the Engine out of service.

ZION FIRE DEPARTMENT STAFFING				
Station	**Personnel**			
	Minimum Staffing Levels		Maximum Staffing Levels	
Station 1	Battalion Chief	1	Battalion Chief	1
	Officer	1	Officer	1
	Firefighter/EMT-P	3	Firefighter/EMT-P	3
Station 2	Officer	1	Officer	1
	Firefighter/EMT-P	1	Firefighter	3
	Total	**7**	**Total**	**9**

Figure 22 ZFRD Staffing

ISO Public Protection Classification of the ZFRD

In January of 2018, the ZFRD was evaluated by the Insurance Services Office (ISO) who collects and evaluates information from communities in the United States on their structure

FSRS Item	Earned Credit	Credit Available
Emergency Communications		
414. Credit for Emergency Reporting	2.55	3
422. Credit for Telecommunicators	0.40	4
432. Credit for Dispatch Circuits	0.90	3
440. Credit for Emergency Communications	3.85	10
Fire Department		
513. Credit for Engine Companies	5.44	6
523. Credit for Reserve Pumpers	0.48	0.5
532. Credit for Pumper Capacity	3.00	3
549. Credit for Ladder Service	1.49	4
553. Credit for Reserve Ladder and Service Trucks	0.00	0.5
561. Credit for Deployment Analysis	8.43	10
571. Credit for Company Personnel	10.51	15
581. Credit for Training	4.08	9
730. Credit for Operational Considerations	2.00	2
590. Credit for Fire Department	35.43	50
Water Supply		
616. Credit for Supply System	24.00	30
621. Credit for Hydrants	3.00	3
631. Credit for Inspection and Flow Testing	2.40	7
640. Credit for Water Supply	29.40	40
Divergence	-0.53	--
1050. Community Risk Reduction	3.95	5.50
Total Credit	72.10	105.5

Figure 23 ISO Report - ZFRD

fire suppression capabilities. The data is analyzed using their Fire Suppression Rating Schedule (FSRS™), and then a Public Protection Classification (PPC™) number is assigned to the community.

ISO's PPC program evaluates communities according to a uniform set of criteria,

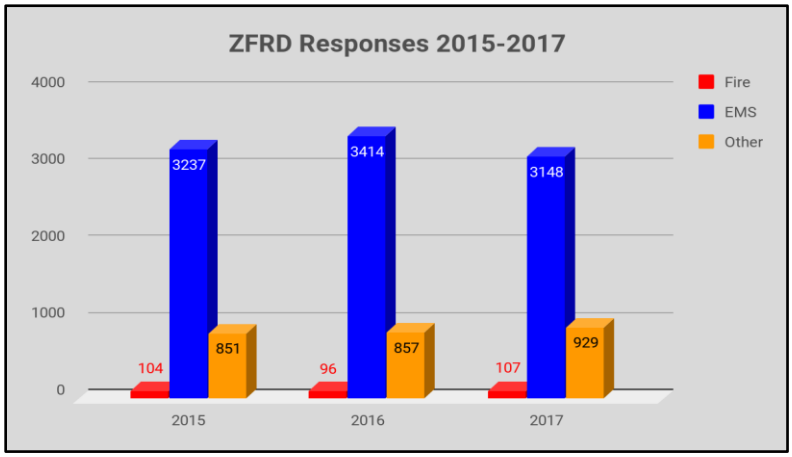


Figure 24 ZFRD Call Volume 2015-2017

incorporating nationally recognized standards developed by the National Fire Protection Association and the American Water Works Association (ISO, 2007). The ISO evaluation has determined that the Department merits a **Public Protection Class 03** rating.

During the three-year period, 2015-2017 the ZFRD responded to 12,743 emergency calls. The Consulting team analyzed 12,295 incidents that occurred within the TRA. Response Time was used to calculate the service areas of each fire station. The Consulting Team reviewed the data provided on EMS and Non-EMS incidents (those incidents that qualified as true

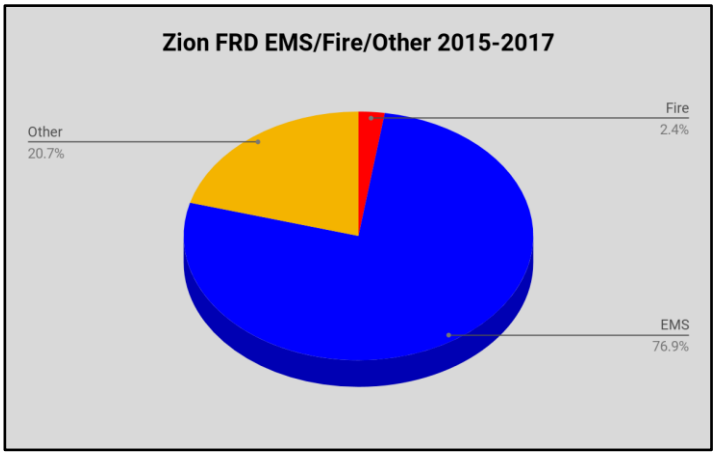


Figure 25 Zion FRD EMS/Fire/Other 2015-2017

emergency requests) for the first-due fire suppression unit and ambulance/ALS unit for calls within each of the three response areas or still districts. The charts above illustrate the total 3-year call volume and percent.

2017 to 2015 Response Time Assessment

Response Time was used to calculate the service areas of each fire station. The IFCA

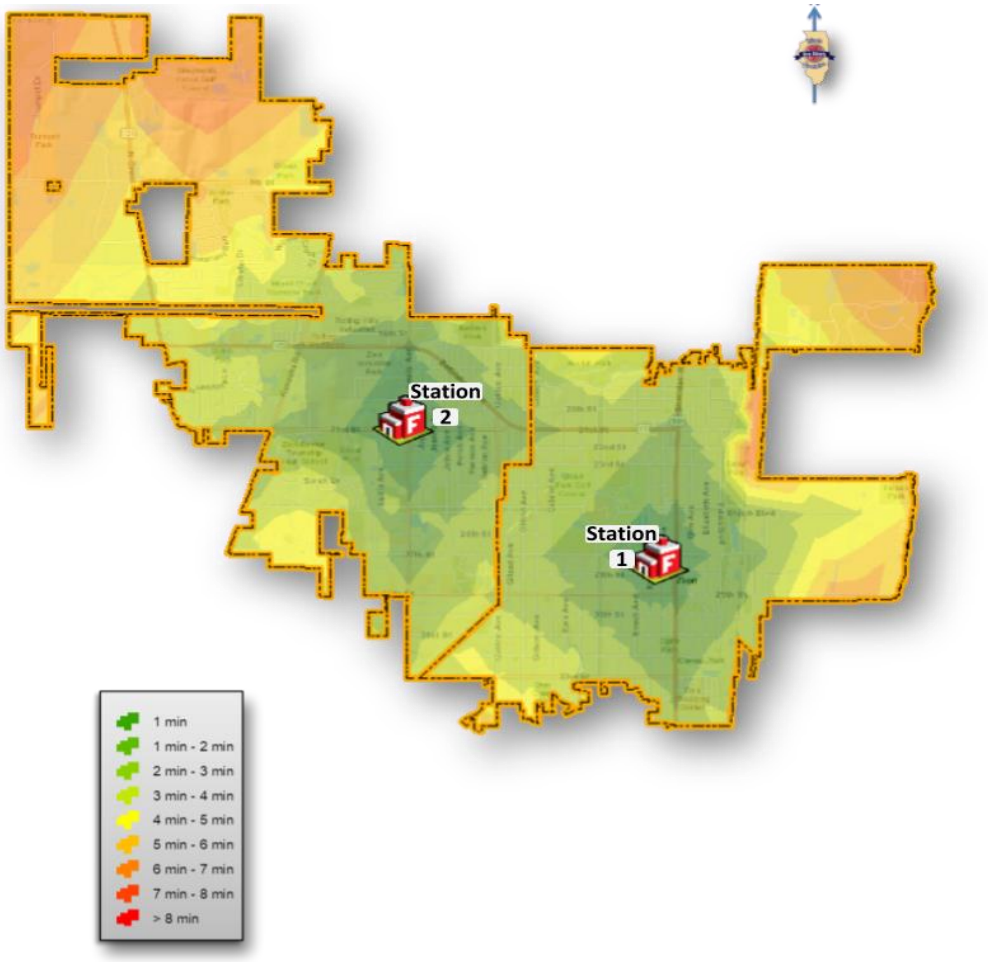
Consulting Team reviewed the data provided on EMS and Non-EMS incidents (those incidents that qualified as true emergency requests) for the first-due fire suppression unit and ambulance/ALS unit for calls within each of the three response areas or still districts.

EMS and Non-EMS Defined

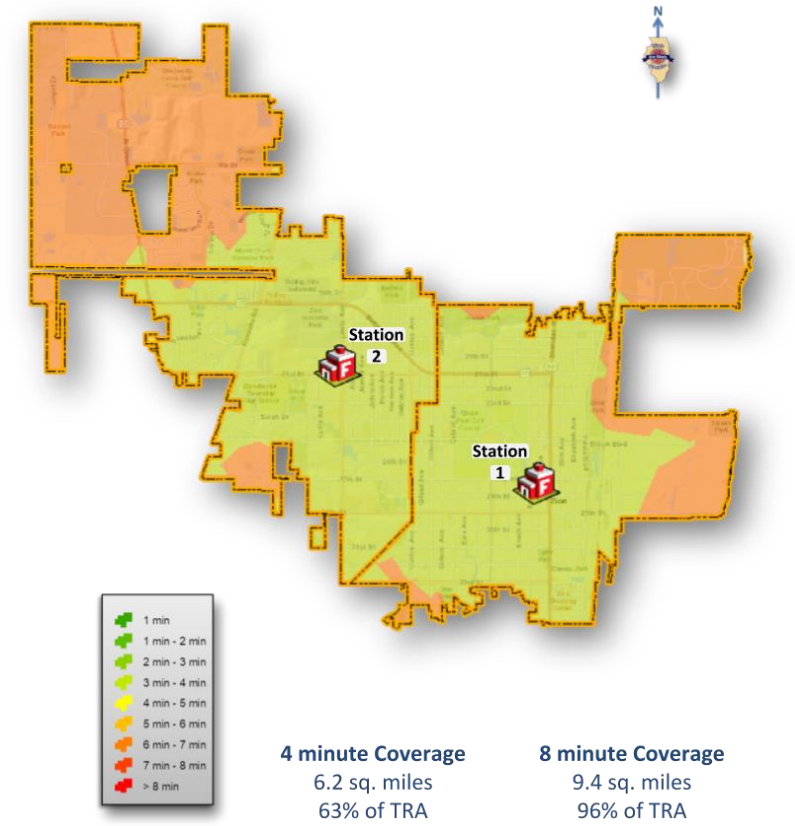
In defining EMS and non-EMS incidents, we reference the National Fire Incident Reporting System (NFIRS). Nationally, most fire departments use NFIRS to document their incidents. NFIRS is a system established by the National Fire Data Center of the United States Fire Administration (USFA), a division of the Federal Emergency Management Agency. This system provides a template for uniform data reporting. All incidents are coded by type into categories. Emergency Medical Service (EMS) incidents have a separate category with the defining characteristic that these incidents are a response involving injury or illness to the individual(s). EMS incidents normally have an ambulance and EMS engine response. EMS calls account for the most calls for service to fire departments. NFIRS has several categories for non-EMS responses. For data analysis and recordkeeping, most fire departments separate their incidents into EMS and non-EMS responses. Non-EMS calls are all other emergencies that do not involve patient care. These incidents include but are not limited to: structure fires, car fires, brush fires, technical rescues, hazardous materials incidents, dive related rescues and recovery, and a variety of other calls for service.

The following several pages contain mapping results from the drive time performance for the ZFRD. The IFCA Consulting Team analyzed the jurisdiction for drive times in overall performance as well as break out performance for individual station response areas. The drive time analysis also provides 4 and 8-minute illustrations.

Zion Fire & Rescue Department Area Served by Drive Time



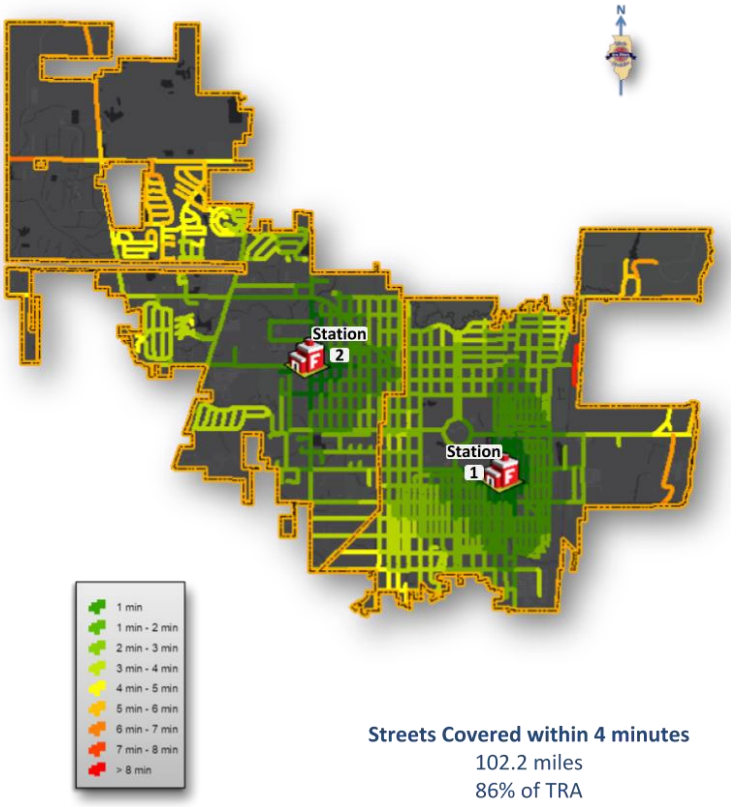
Service Area - Total Response Area - 4 & 8 Minute Catchment



4 minute Coverage
6.2 sq. miles
63% of TRA

8 minute Coverage
9.4 sq. miles
96% of TRA

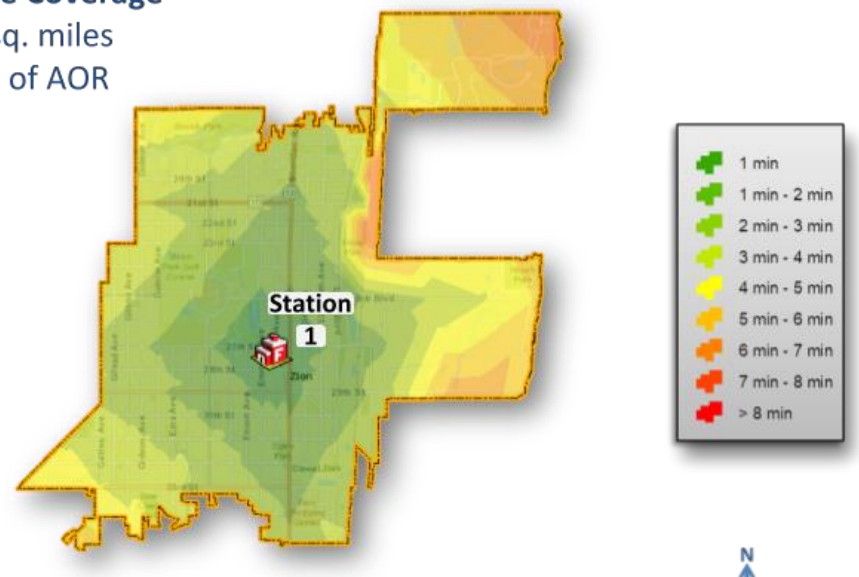
Streets Covered by Drive Time



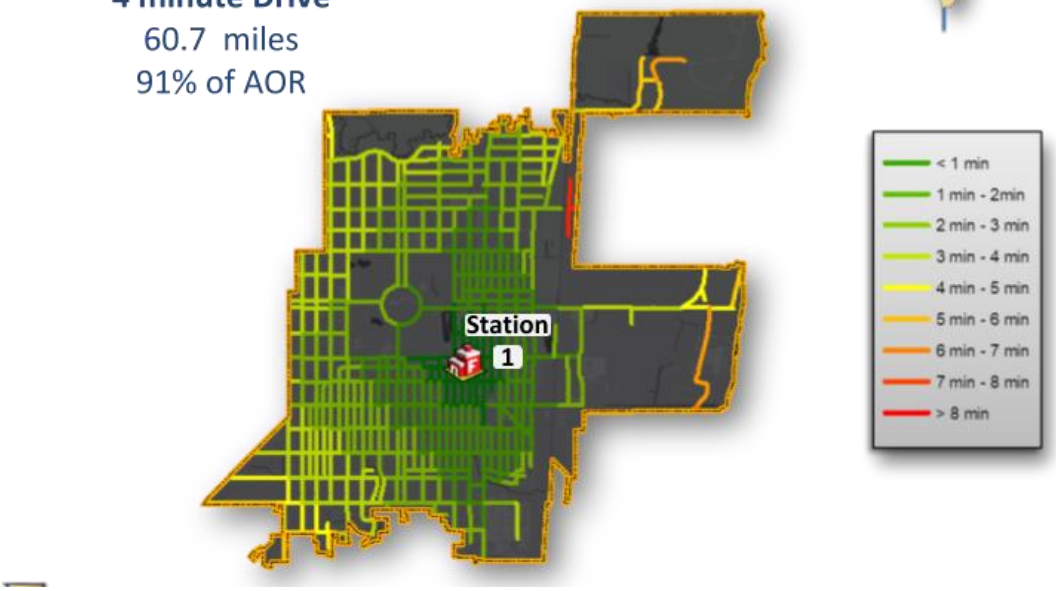
Streets Covered within 4 minutes
102.2 miles
86% of TRA

Zion Fire & Rescue Department Station 1 - Area & Streets by Time

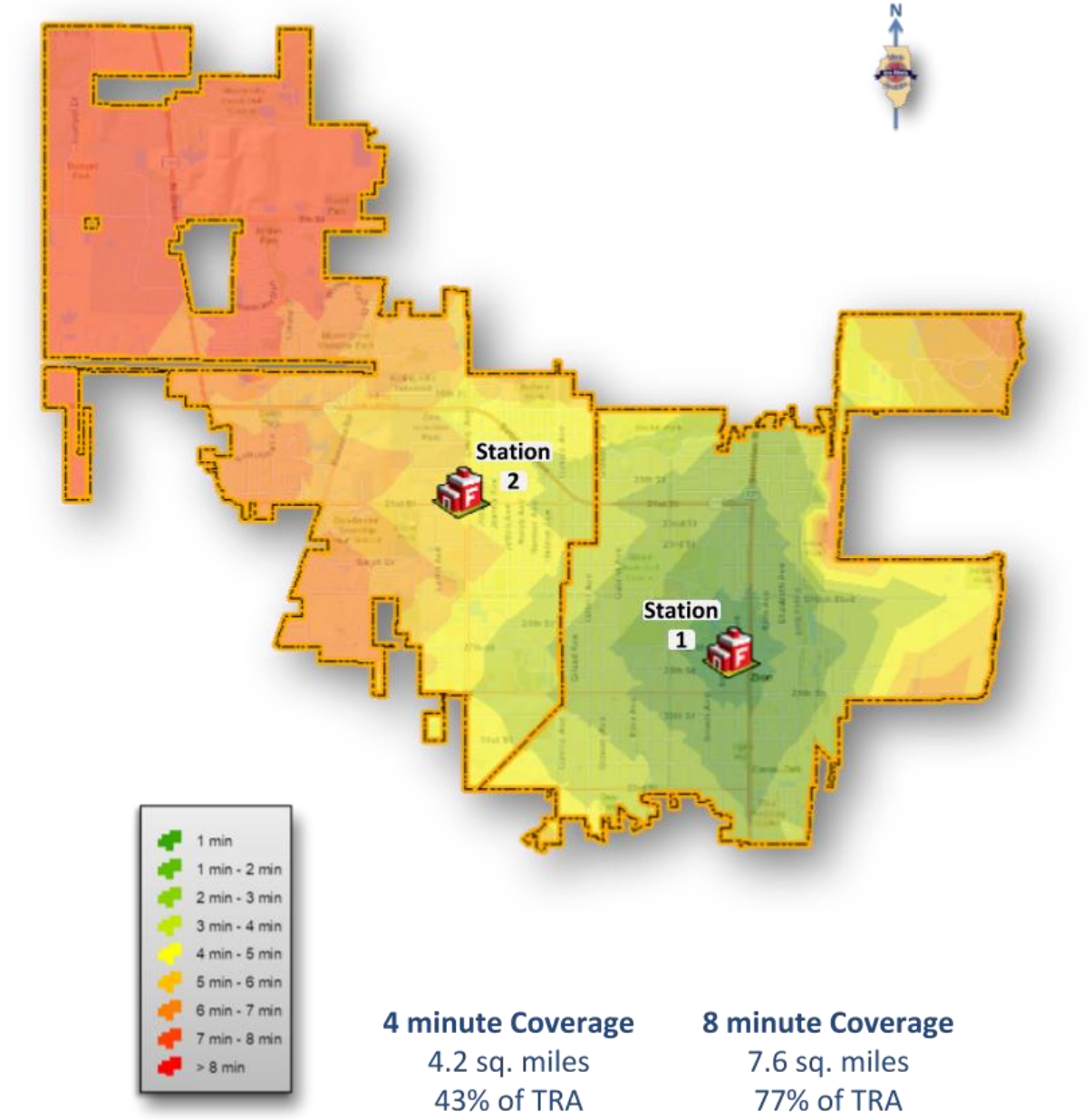
4 minute Coverage
3.0 sq. miles
72% of AOR



4 minute Drive
60.7 miles
91% of AOR



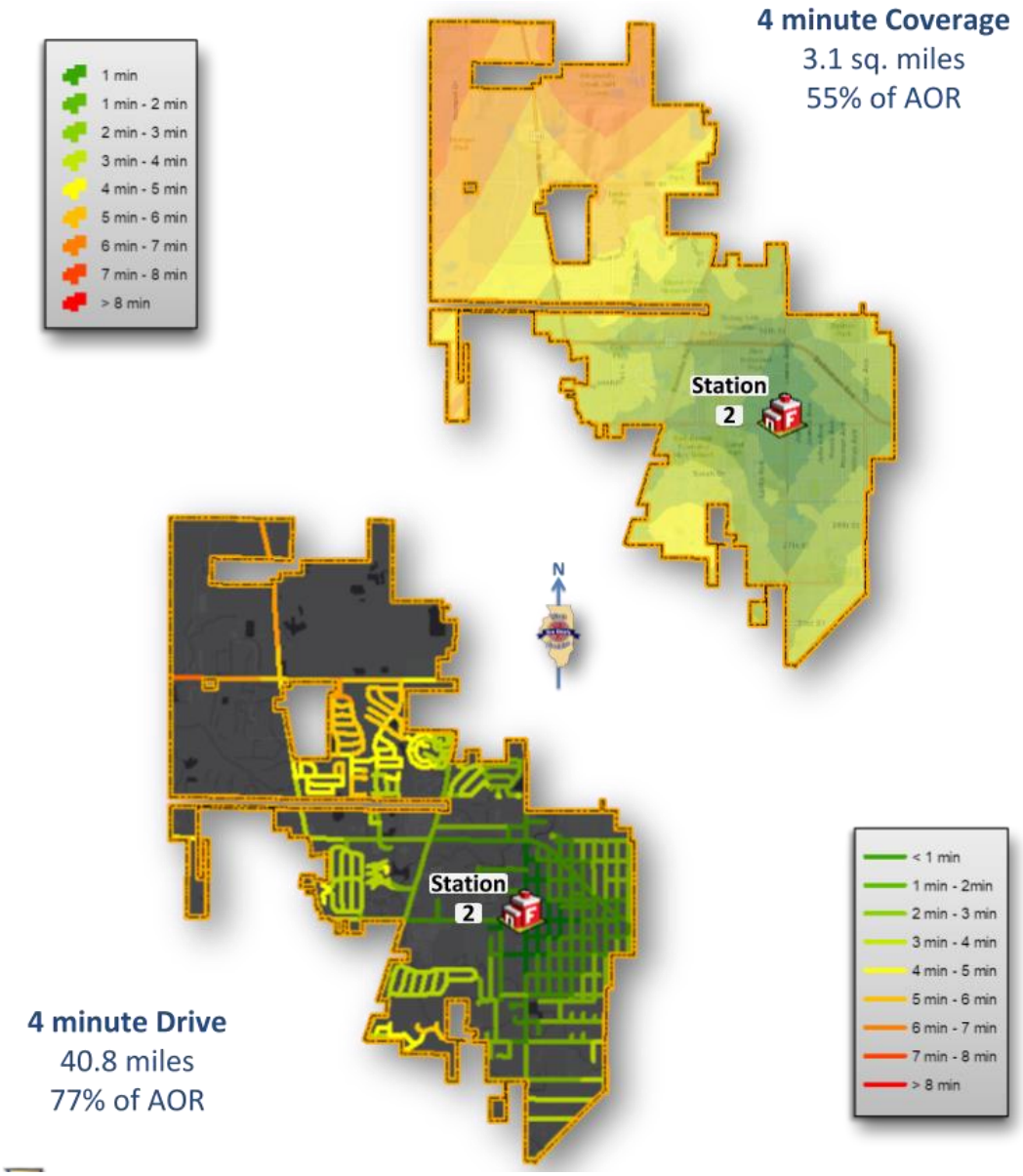
Zion Fire & Rescue Department Station 1 - Total Response Area Coverage



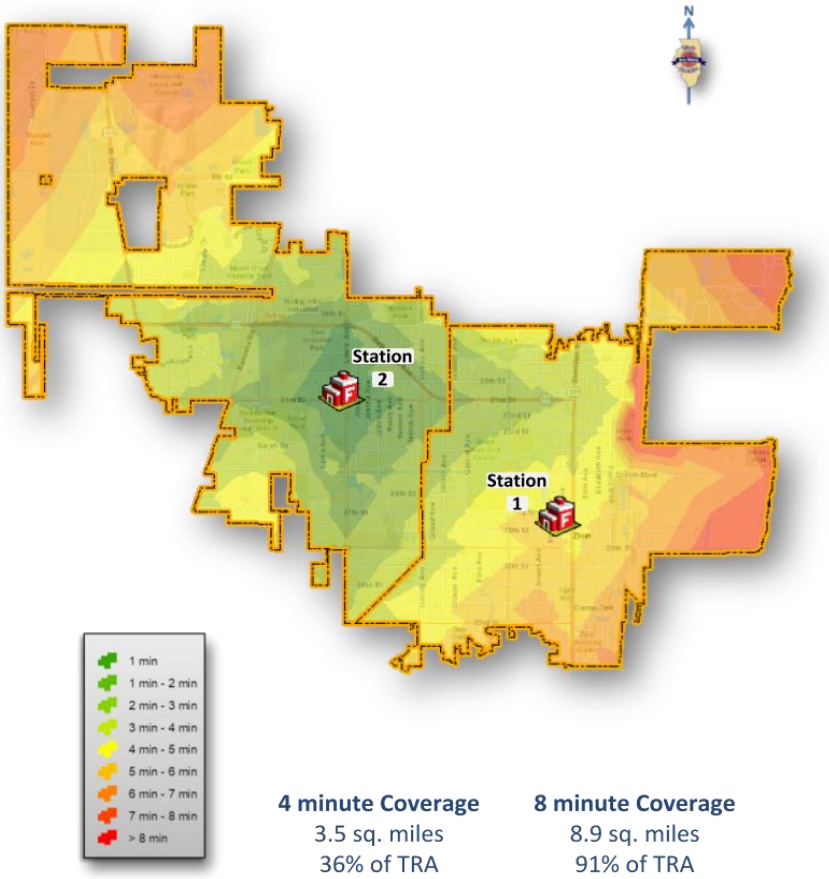
4 minute Coverage
4.2 sq. miles
43% of TRA

8 minute Coverage
7.6 sq. miles
77% of TRA

Zion Fire & Rescue Department Station 2 Area & Streets by Time



Zion Fire & Rescue Department Station 2 - Total Response Area



4 minute Coverage
3.5 sq. miles
36% of TRA

8 minute Coverage
8.9 sq. miles
91% of TRA

Zion Fire & Rescue Department Area Overview Summary

	Area Sq. Miles	% of Area w/in 4 min	Street Miles	% of Streets w/in 4 min
TRA	9.8	63%	119.4	86%
Station 1	4.2	43%	66.6	55%
Station 2	5.6	36%	52.9	51%

Call Volume Density Analysis

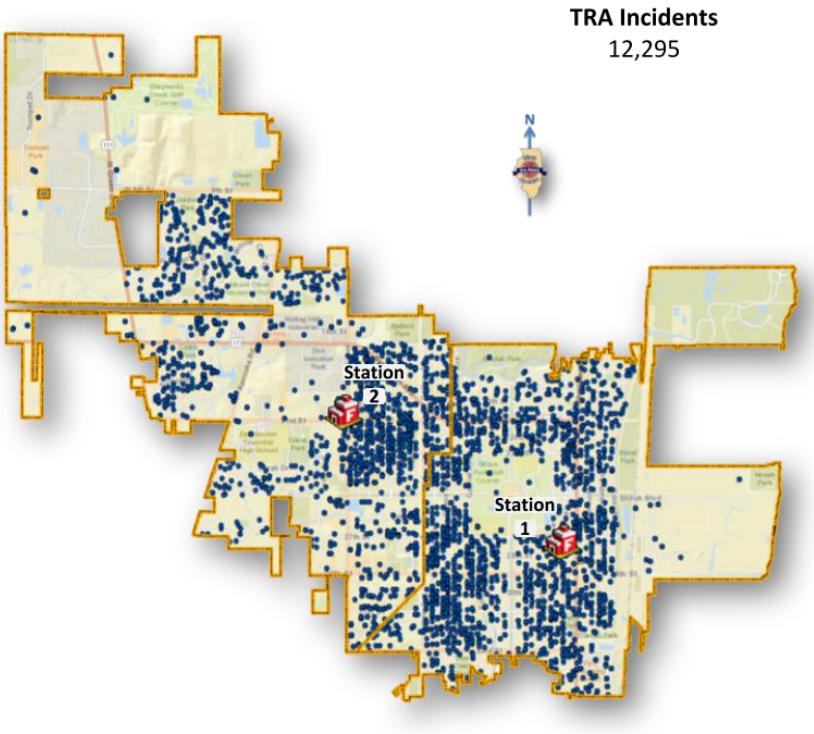
Using Geographic Information Systems (GIS) software the IFCA Consulting Team was able to create call volume density maps to visualize data and identify patterns and hot spots.

To accurately assess the information, the IFCA Consulting Team used incident data and call-for-service data in developing the hot spot analysis. Call-for-service data capture reports of EMS, fire and non-EMS incidents that are not collected in standard incident reporting software. Using Geographic Information Systems (GIS) software the IFCA Consulting Team was able to create call volume density maps to visualize data and identify patterns and hot spots.

The following maps exhibit EMS and non-EMS incidents as they vary continuously across space without boundaries. By using these types of maps, the IFCA Consulting Team can identify incident hot spots for all NFIRS Group codes. The area of the map with the highest number of incidents is shaded bright red, to indicate a higher density of response to that area.

ZION FIRE & RESCUE DEPARTMENT: ALL INCIDENT DATA

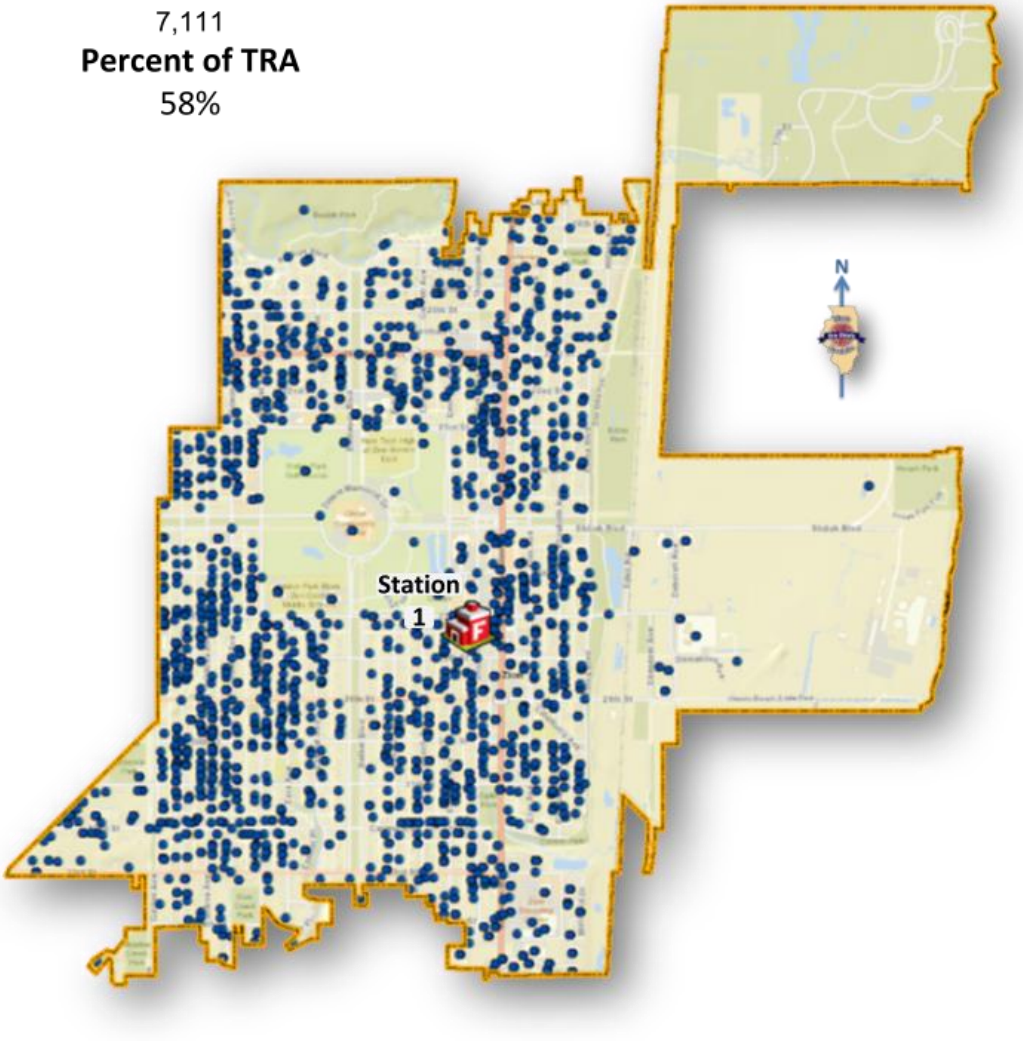
Total Response Area
- All Incidents



100	200	300	400	500	600	700	800	900	Grand Total
239	5	9,623	287	718	470	851	1	99	12,293
1.9%	0.0%	78.3%	2.3%	5.8%	3.8%	6.9%	0.0%	0.8%	

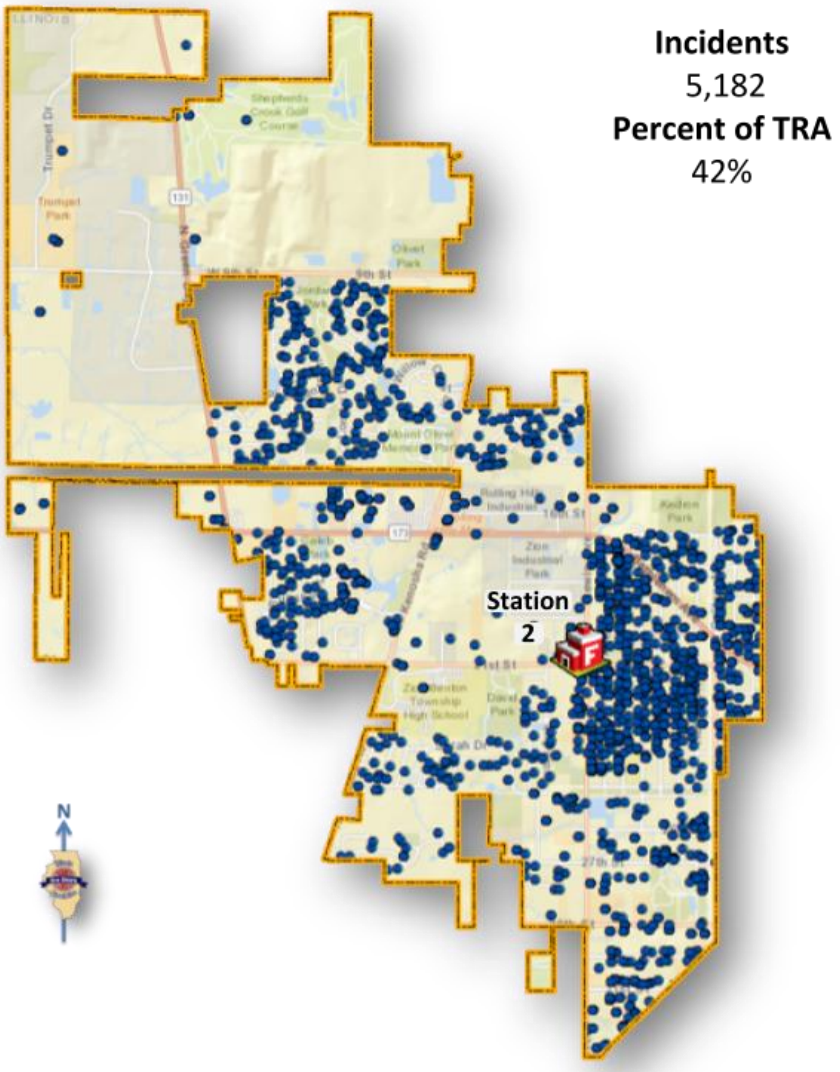
Zion Fire & Rescue Department Station 1 - All Incidents

Incidents
7,111
Percent of TRA
58%



100	200	300	400	500	600	700	800	900
119	3	5,635	164	421	272	482	1	14
1.7%	0.0%	79.2%	2.3%	5.9%	3.8%	6.8%	0.0%	0.2%

Zion Fire & Rescue Department Station 2 - All Incidents



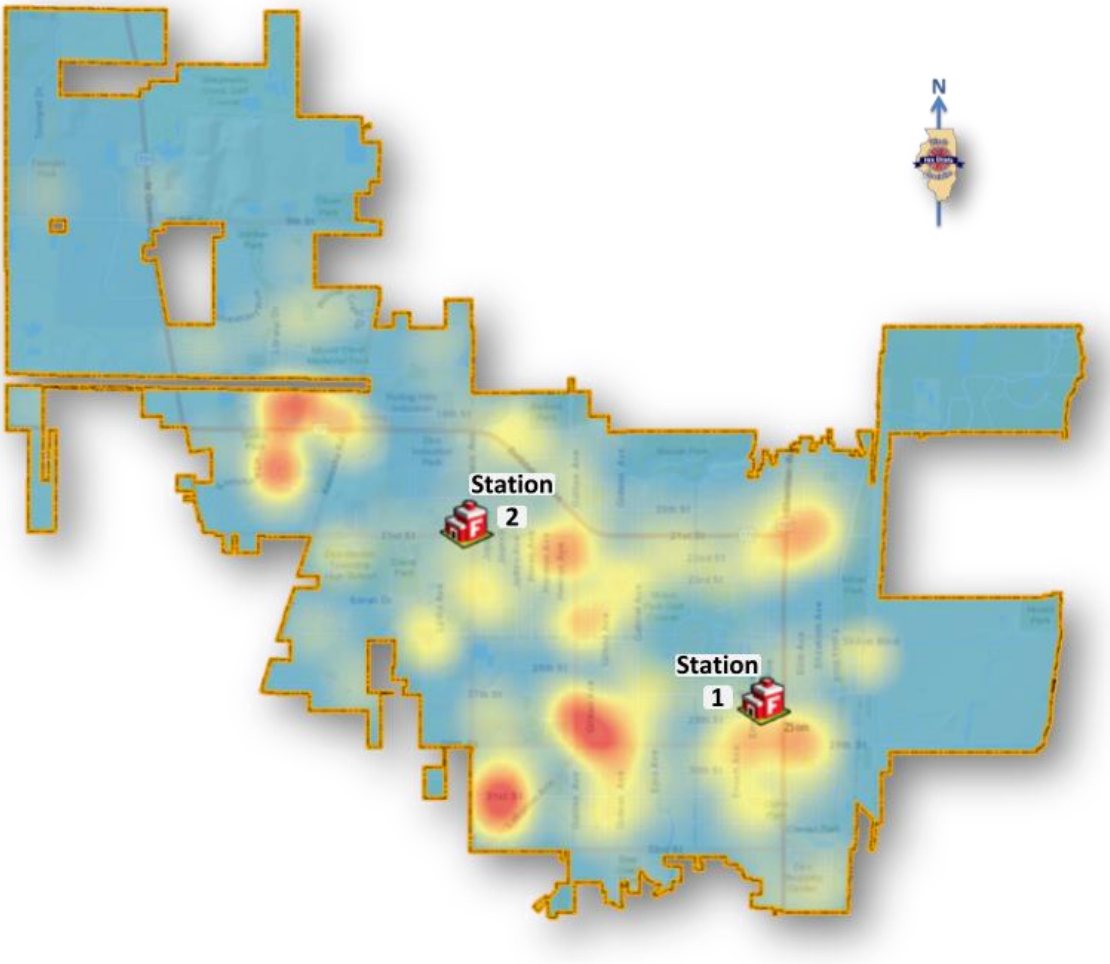
100	200	300	400	500	600	700	900
120	2	3,988	123	297	198	369	85
2.3%	0.0%	77.0%	2.4%	5.7%	3.8%	7.1%	1.6%

All Incidents Mapping

NFIRS Group 100 - Fire
NFIRS Group 200 - Overpressure Rupture, Explosion, Overheat (No Fire)
NFIRS Group 300- Rescue and Emergency Medical Service (EMS)
NFIRS Group 400 - Hazardous Condition (No Fire)
NFIRS Group 500 - Service Call
NFIRS Group 600 - Good Intent Call
NFIRS Group 700 - False Alarm
NFIRS Group 800 - Severe Weather and Natural Disaster
NFIRS Group 900 - Special Incident Type

Zion Fire & Rescue Department - NFIRS Group 100

Total: 239



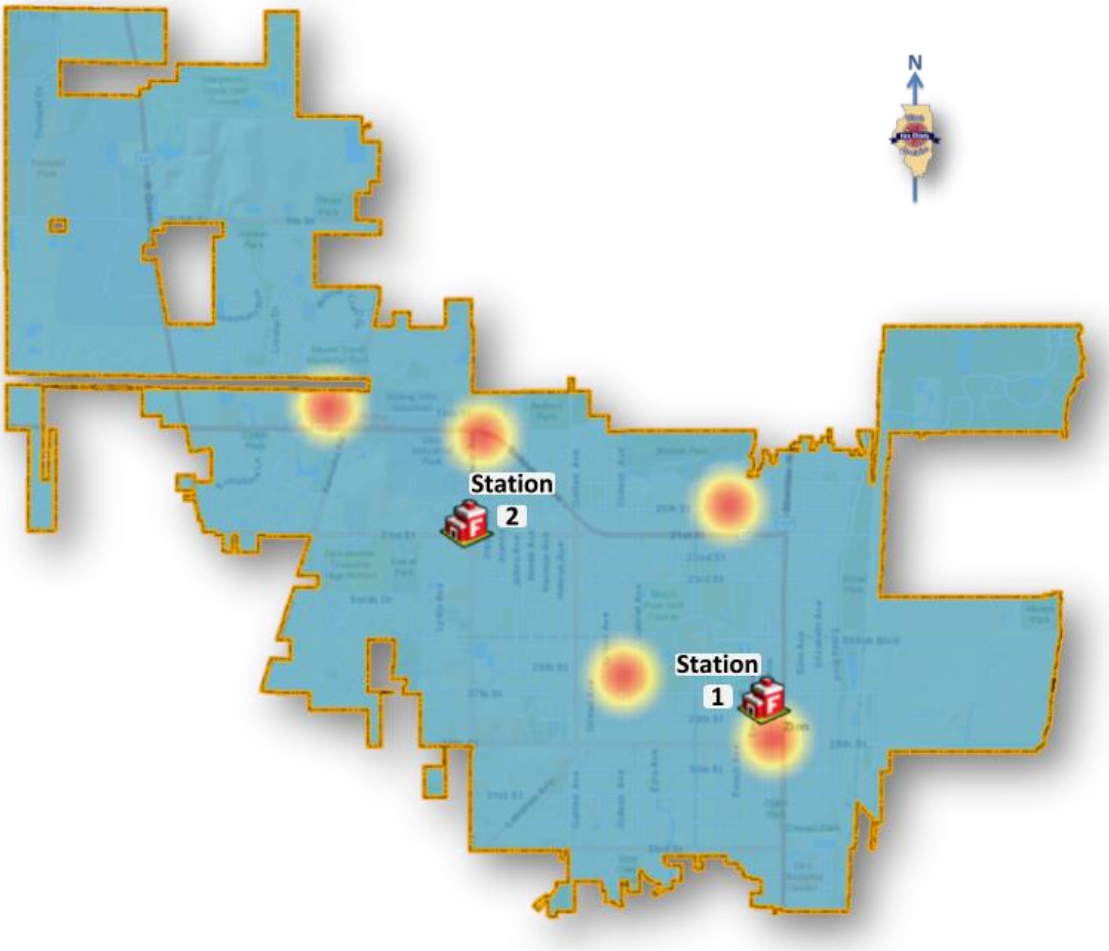
Percentage of TRA Incidents

Station 1: 50%
Station 2: 50%

NFIRS 100: Fire

Zion Fire & Rescue Department NFIRS Group 200

Total: 5



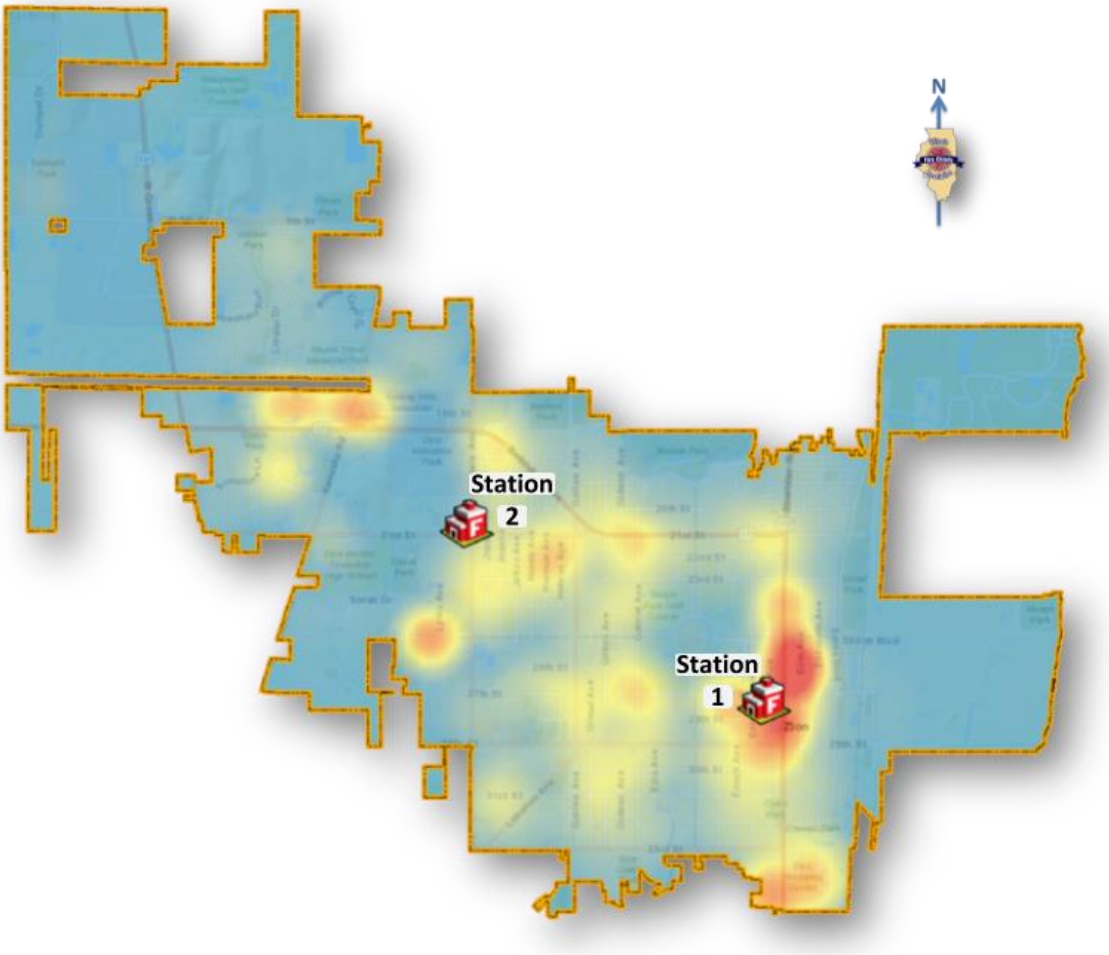
Percentage of TRA Incidents

Station 1: 60%
Station 2: 40%

NFIRS 200: Overpressure Rupture Explosion Overheat No Fire

Zion Fire & Rescue Department - NFIRS Group 300

Total: 9,623



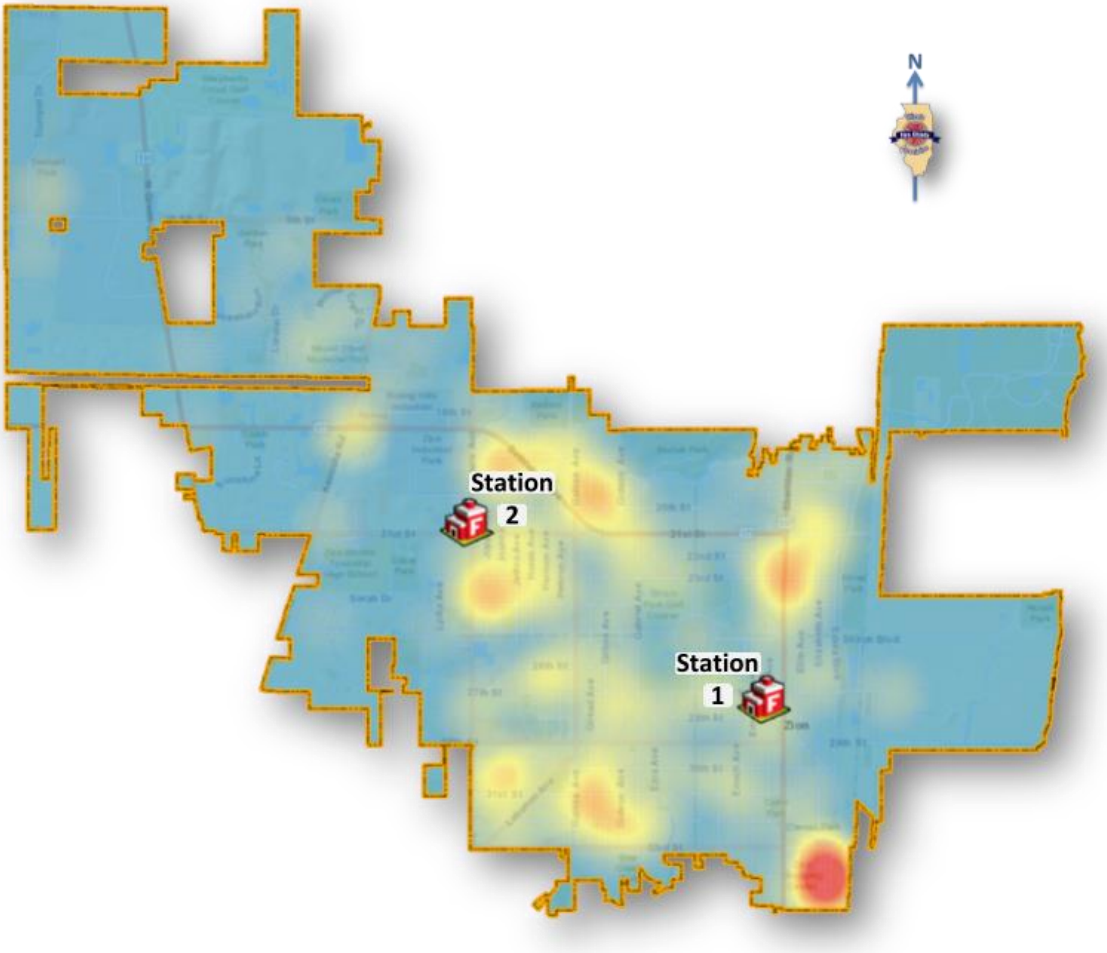
Percentage of TRA Incidents

Station 1: 59%
Station 2: 41%

NFIRS 300: Rescue EMS

Zion Fire & Rescue Department - NFIRS Group 400

Total: 287



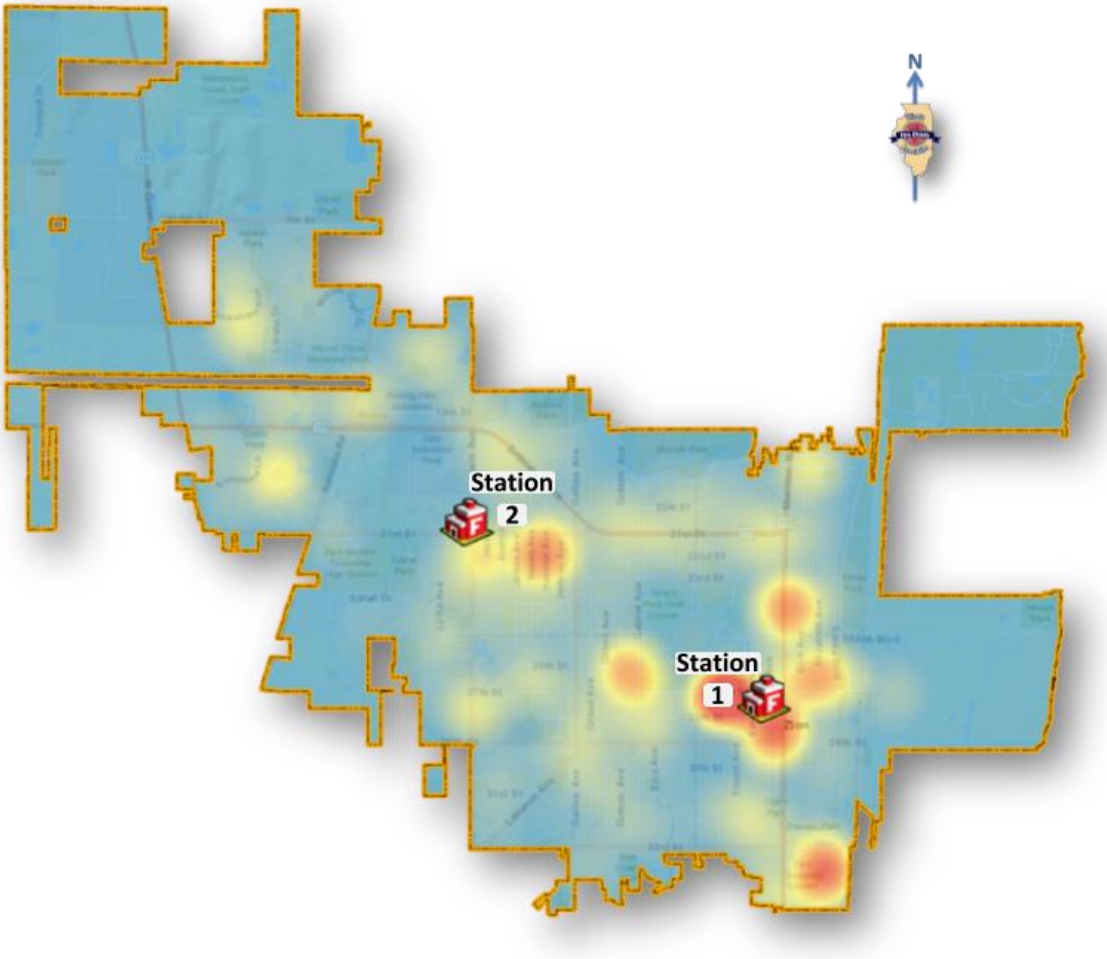
Percentage of TRA Incidents

Station 1: 57%
Station 2: 43%

NFIRS 400: Hazardous Condition No Fire

Zion Fire & Rescue Department - NFIRS Group 500

Total: 781



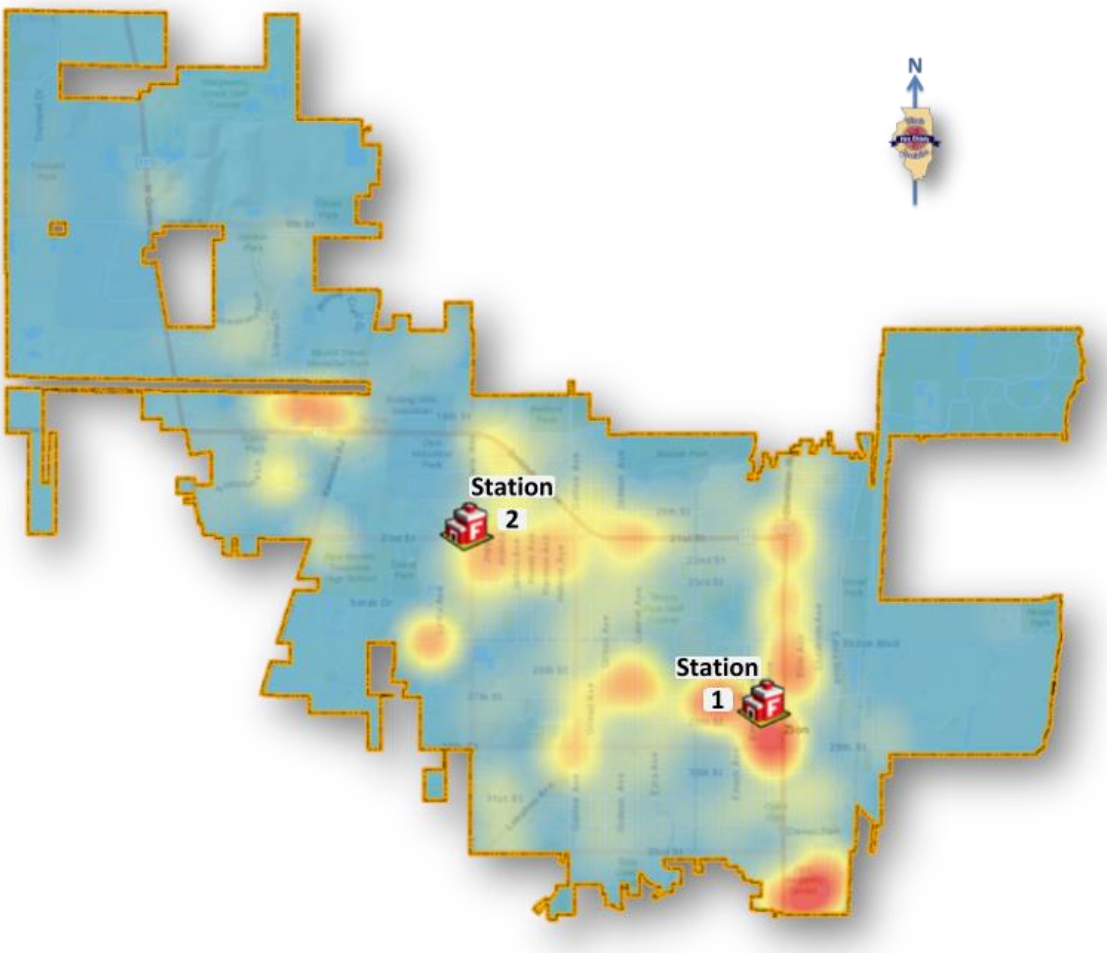
Percentage of TRA Incidents

Station 1: 59%
Station 2: 41%

NFIRS 500: Service Call

Zion Fire & Rescue Department - NFIRS Group 600

Total: 470



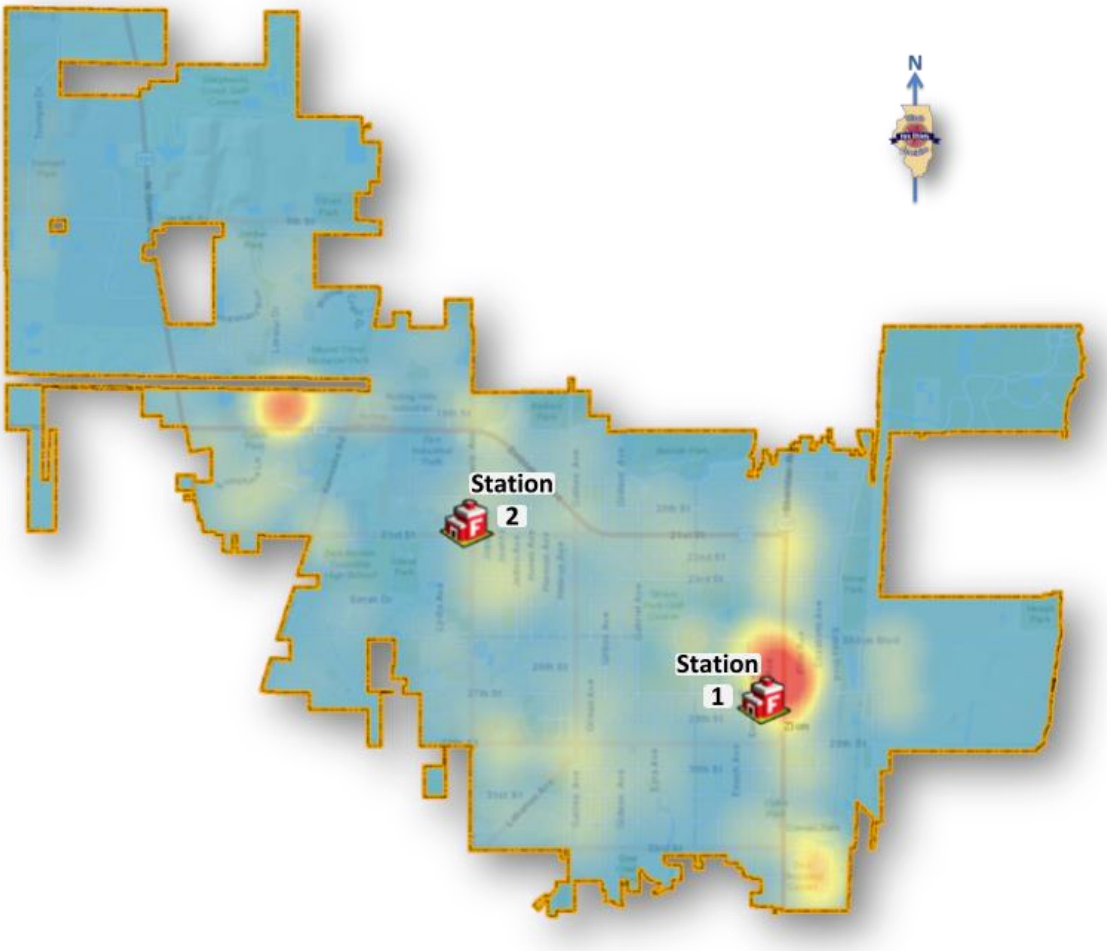
Percentage of TRA Incidents

Station 1: 58%
Station 2: 42%

NFIRS 600: Canceled Good Intent

Zion Fire & Rescue Department - NFIRS Group 700

Total: 851



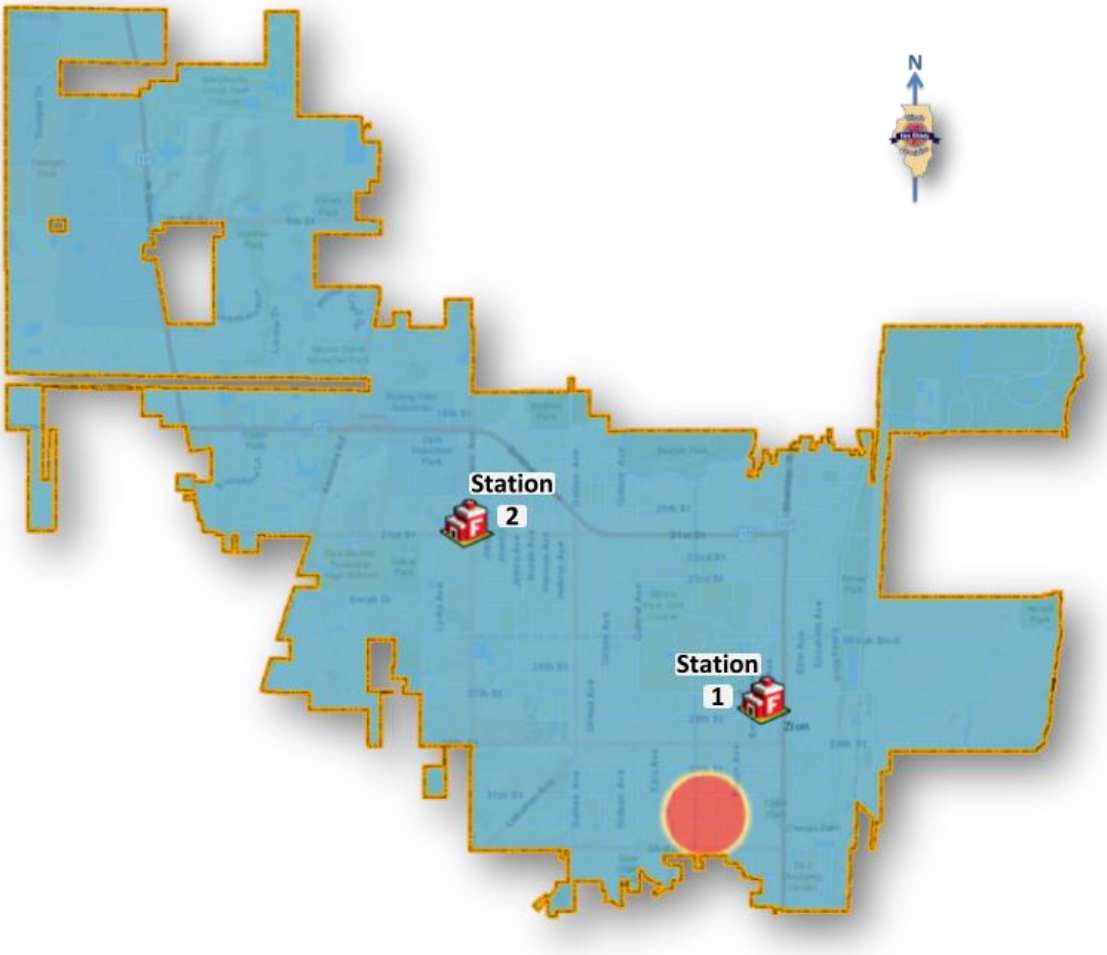
Percentage of TRA Incidents

Station 1: 57%
Station 2: 43%

NFIRS 700: False Alarm False Call

Zion Fire & Rescue Department - NFIRS Group 800

Total: 1



Percentage of TRA Incidents

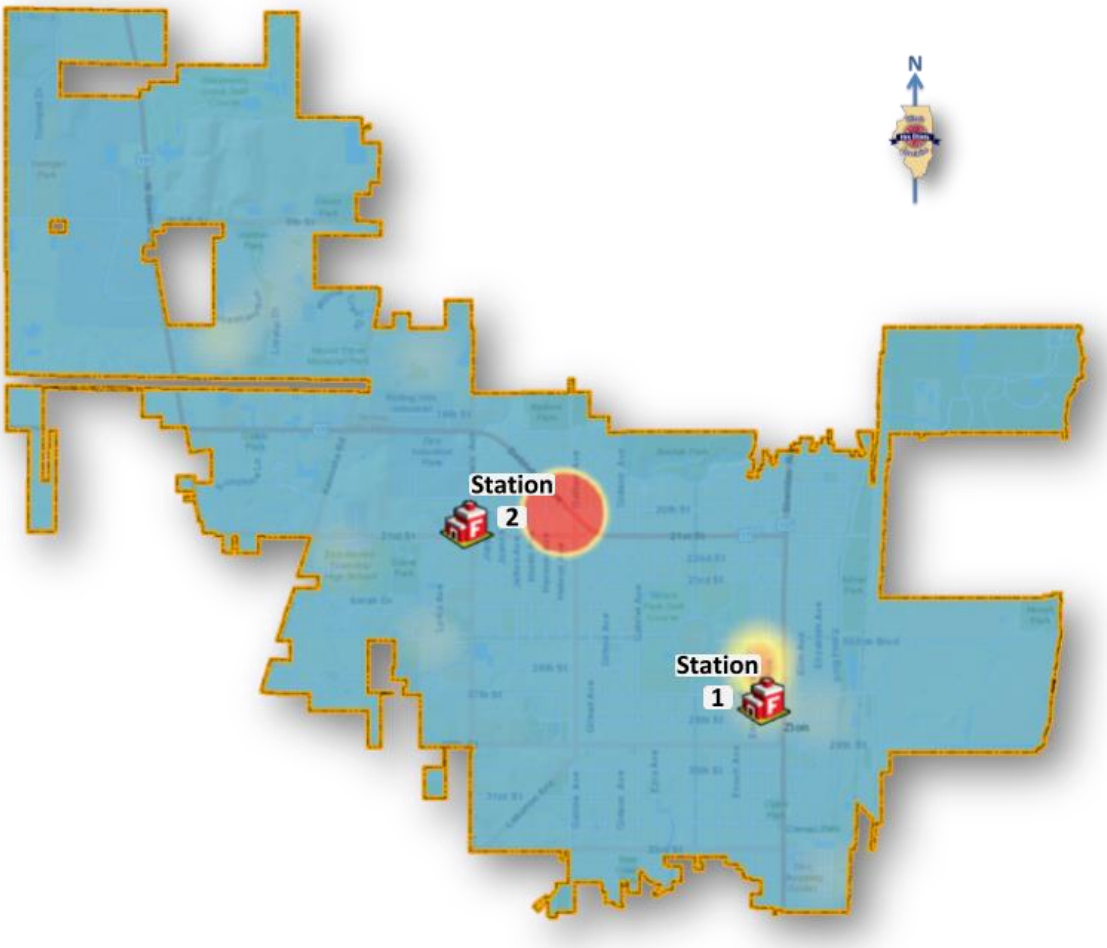
Station 1: 100%

Station 2: 0%

NFIRS 800: Severe Weather and Natural Disaster

Zion Fire & Rescue Department - NFIRS Group 900

Total: 14



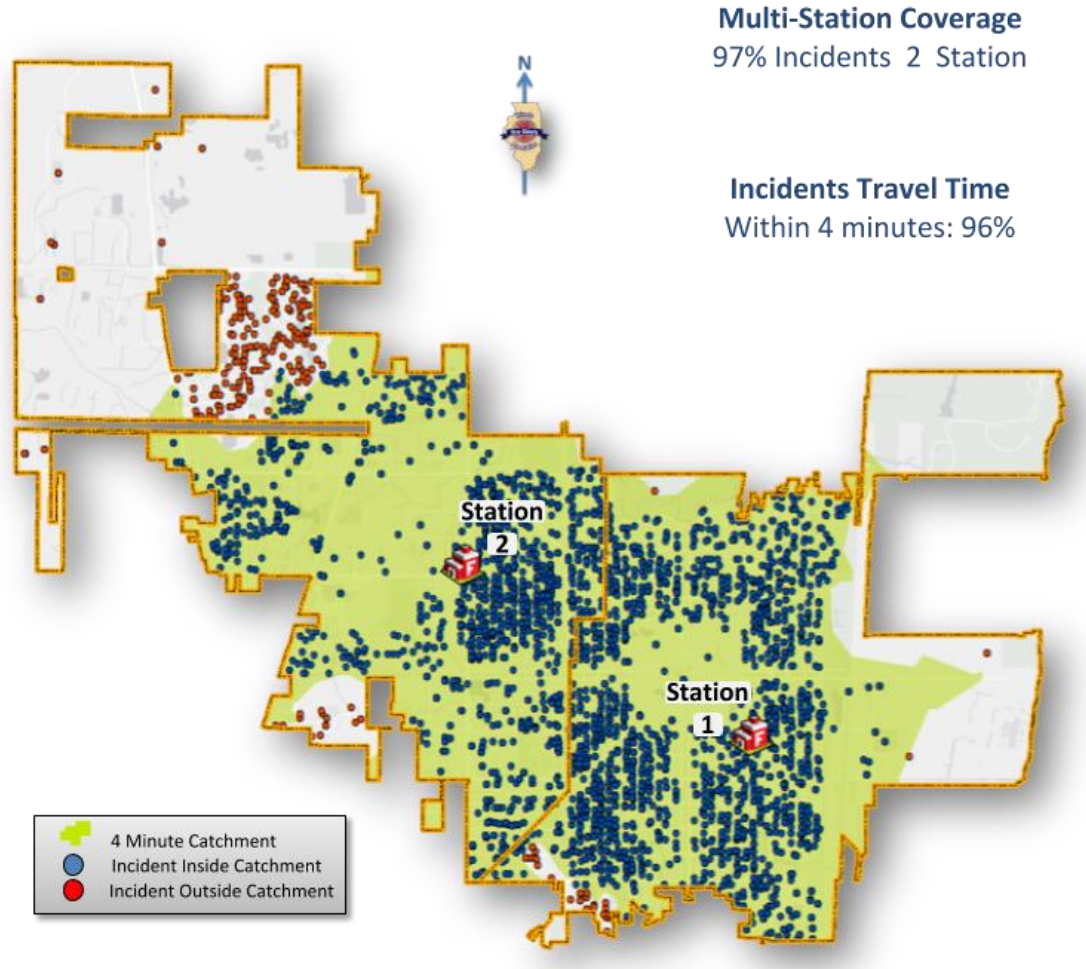
Percentage of TRA Incidents

Station 1: 14%
Station 2: 86%

NFIRS 900: Special Incident Type

Zion Fire & Rescue Department - Service Area Performance

Total Response Area: All Incidents



Historic Incidents w/in NFPA Response Time Standards

Complete TRA: Fires 77% EMS 41%

Within 4 Minute Catchment: Fires 81% EMS 82%

Response Time (h:mm:ss)

	90th %	80th %	70th %	60th %	50th %
All	0:06:22	0:05:13	0:04:36	0:04:07	0:03:45
Fire	0:06:57	0:05:29	0:04:47	0:04:14	0:03:46
EMS	0:06:09	0:05:03	0:04:30	0:04:03	0:03:42

Illinois Fire Chiefs Association | 2018

Zion Fire & Rescue Department Response Times - Historic vs Ideal

All Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal	0:04:28	0:04:05	0:03:47	0:03:22	0:03:03
Historic	0:06:22	0:05:13	0:04:36	0:04:07	0:03:45

Fire Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal	0:05:00	0:04:34	0:04:13	0:03:59	0:03:31
Historic	0:06:57	0:05:29	0:04:47	0:04:14	0:03:46

EMS Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal	0:04:26	0:04:05	0:03:47	0:03:22	0:03:03
Historic	0:06:09	0:05:03	0:04:30	0:04:03	0:03:42

Other Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal	0:04:29	0:04:03	0:03:42	0:03:19	0:02:59
Historic	0:06:54	0:05:49	0:05:00	0:04:28	0:04:00

ASSESSMENT OF THE BPFPD AND THE ZFRD AS A COLLABORATIVE ENTITY

The purpose of this study was to assess the effects of a functional consolidation of the Beach Park Fire Protection District and the Zion Fire & Rescue Department to enhance fire and emergency medical service delivery and creating efficiencies as one collaborative entity.

Within this section of the study, the IFCA Consulting Team will assess the service level demands if both agencies were to operationally consolidate and respond to fire and EMS incidents as one agency using current resources and station locations. Also, and for the sake of clarity for the reader, this and all future sections will refer to the Beach Park Fire Protection District and Zion Fire & Rescue Department as the **Joint Agency.**

To clarify, functional consolidation is a model which embraces a unified operations framework under which the "closet unit responds" regardless of municipal or district boundaries, but which retains each organization as separate entities with independent personnel, vehicles, and governance. This differs from a full consolidation model whereby two or more (fire) organizations merge into one large organization with its governance structure, budget, personnel, equipment, and operational framework.

Mutual aid and automatic aid are currently provided regularly between the agencies. As a result, the responders have become accustomed to working with each other on the emergency scene. This would be an incremental step toward unifying all aspects of both departments.

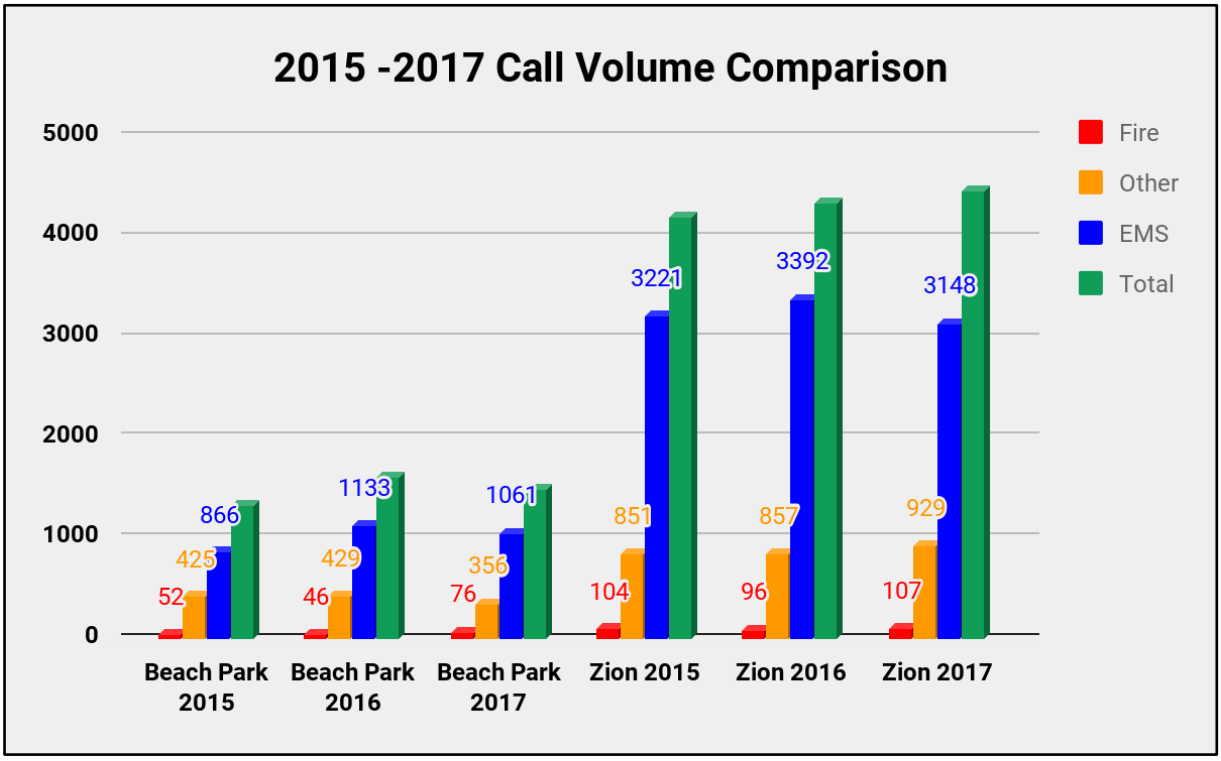
Review of Current Incident Count Data within the Joint Agency Response Area

BPFPD and ZFRD use nationally recognized incident counting to better inform management and determine resource allocation and deployment decisions. The use of "incident count" has been the basic reference numbers used by both departments 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 reflects the number of times a resource is "dispatched" to an event is not suitable for performing trend/historical or comparative analysis of incidents.

A review begins with an aggregate perspective over some years to show a trend in overall service demands for each department. Incident data was collected from both BPFPD and

ZFRD. The data was exported from the CAD database as well as the RMS database. The 2015 through 2017 incident data set was used. The incidents were divided into categories:

Figure 26 2015-2017 Call Volume Comparison



Call Volume Density Analysis

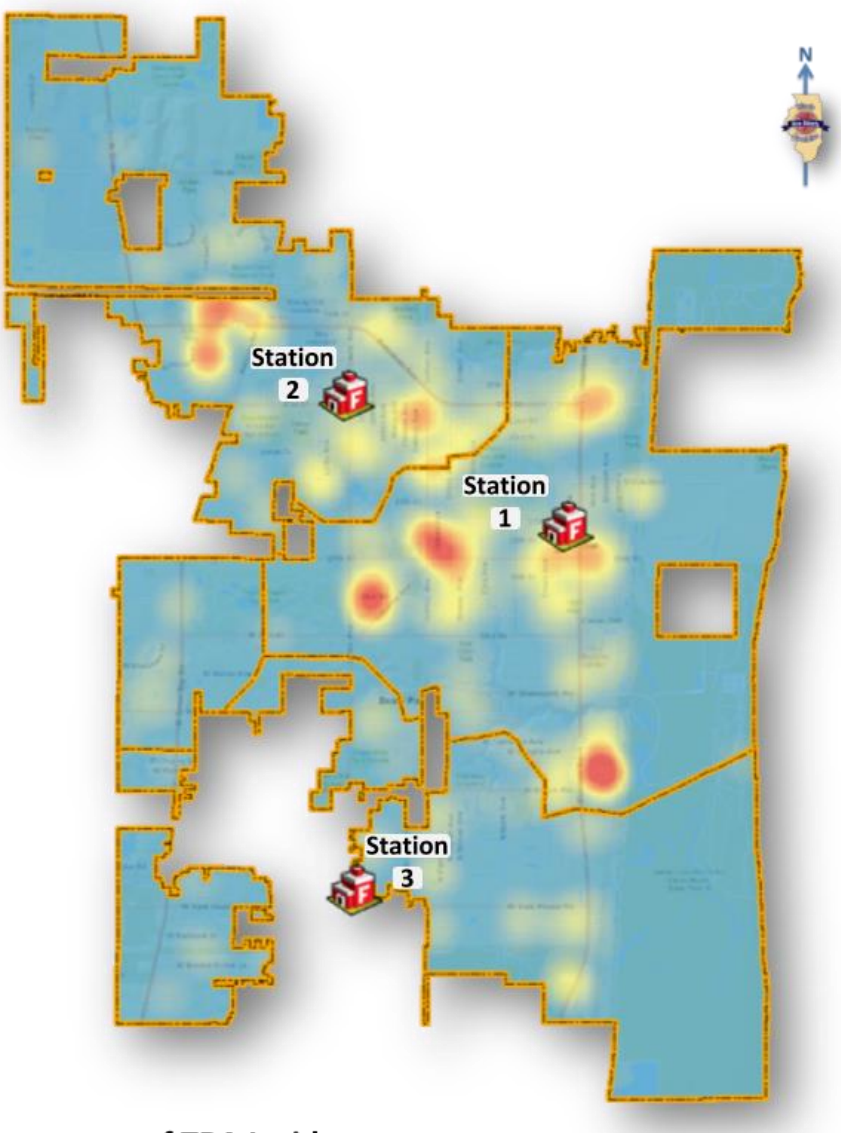
The IFCA Consulting Team conducted an analysis of the EMS and non-EMS incident data to find hot spots and to assess the areas where incidents are occurring.

To accurately assess the information, the IFCA Consulting Team used incident data and call-for-service data in developing the hot spot analysis. Call-for-service data capture reports of EMS, fire and non-EMS incidents that are not collected in standard incident reporting software. Using Geographic Information Systems (GIS) software the IFCA Consulting Team was able to create call volume density maps (also referred to as kernel maps) to visualize data and identify patterns and hot spots. By plotting the incidents geographically, we can obtain a visual of the concentration and distribution of resources about where service demand is occurring.

The following maps exhibit EMS and non-EMS incidents as they vary continuously across space without boundaries. By using these types of maps, the Team can identify incident hot spots. The area of the map with the highest number of incidents is shaded bright red, to

indicate a higher density of incidents while areas with lower levels of incidents are shaded in blue. The following maps utilized incident data from BPFPD and ZFRD.

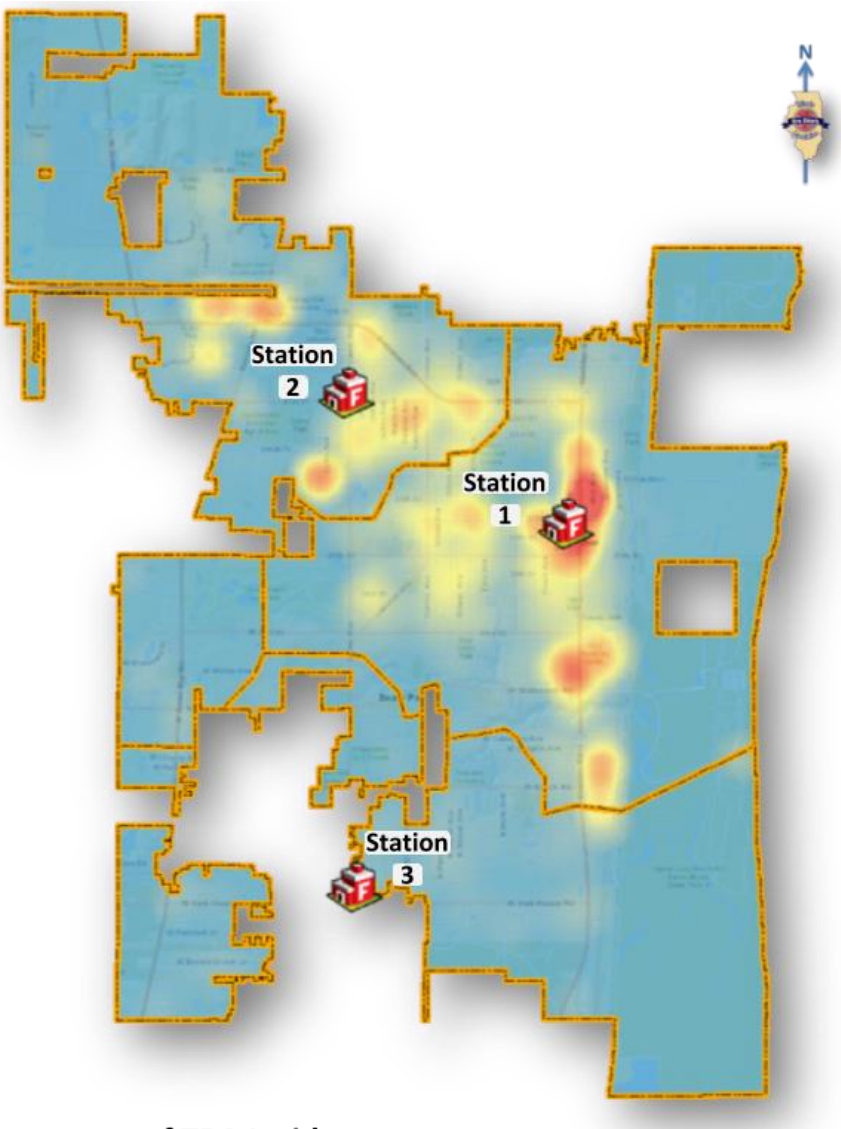
Joint Agency Incident Hot Spots -All Incidents



Percentage of TRA Incidents

Station 1: 50%
Station 2: 36%
Station 3: 14%

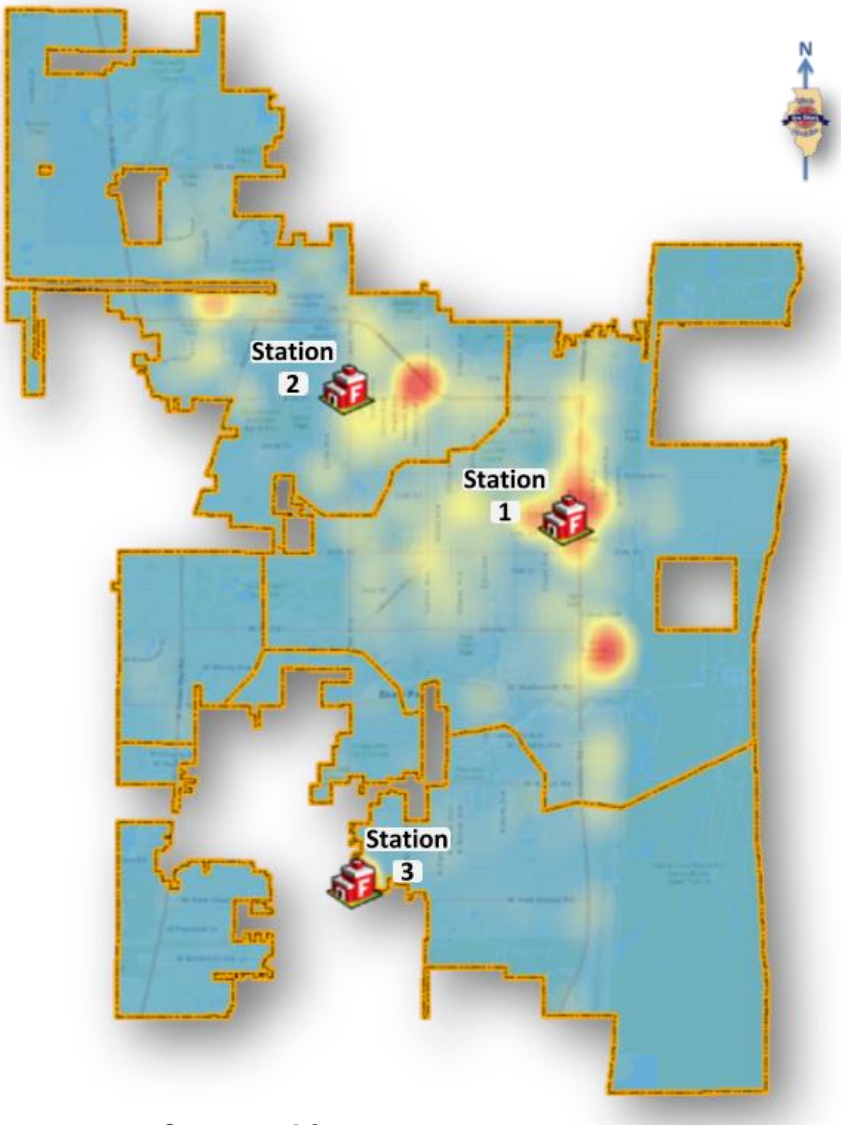
Joint Agency Incident Hot Spots EMS



Percentage of TRA Incidents

Station 1: 56%
Station 2: 35%
Station 3: 9%

Joint Agency Incident Hot Spots -Other Incidents



Percentage of TRA Incidents

Station 1: 50%
Station 2: 34%
Station 3: 16%

JOINT AGENCY DISTRIBUTION ANALYSIS OF FIRE STATIONS

Distribution analysis reviews the deployment of resources to ensure that facilities and apparatus are placed appropriately about service demand and general coverage capabilities. Distribution of resources, like service demand, can be viewed in a number of ways. However, the National Fire Protection Association (NFPA) provides some guidance in this regard. For career fire departments, response units are recommended to be able to reach 90 percent of their overall service demand within four minutes of travel from existing facilities.

Ideal Fire Station Locations

The first step taken by the IFCA Consulting Team was to assess the joint agency service level demands and then build into the distribution model a best-case scenario. The Ideal Station location was calculated using ESRI's Location - Allocation Analysis tool. 503 possible fire station sites were used with a 4-minute drive time as the parameters to reach as many incidents as possible. The result of that analysis becomes the Joint Agency Ideal Station Location or Distribution of fire stations.

This assessment becomes a strategic planning tool for the Joint Agency when developing or devising long-term plans for personnel hiring, assignment, vehicle purchase and placement, as well as facility construction. The recommendations made herein are based on the two communities operating as a single first response entity.

The following maps exhibit Ideal Station Location models using the current 4-station configuration and a Joint Agency model. Current station locations as red markers and ideal station locations are identified with red markers over green circles. While in one case the location is virtually the same (ZFRD 1), the remaining cases illustrate moving the stations provides better service in the future. It is important to keep in mind that these recommendations are made with the goal of a common (single) entity response plan in a perfect scenario.

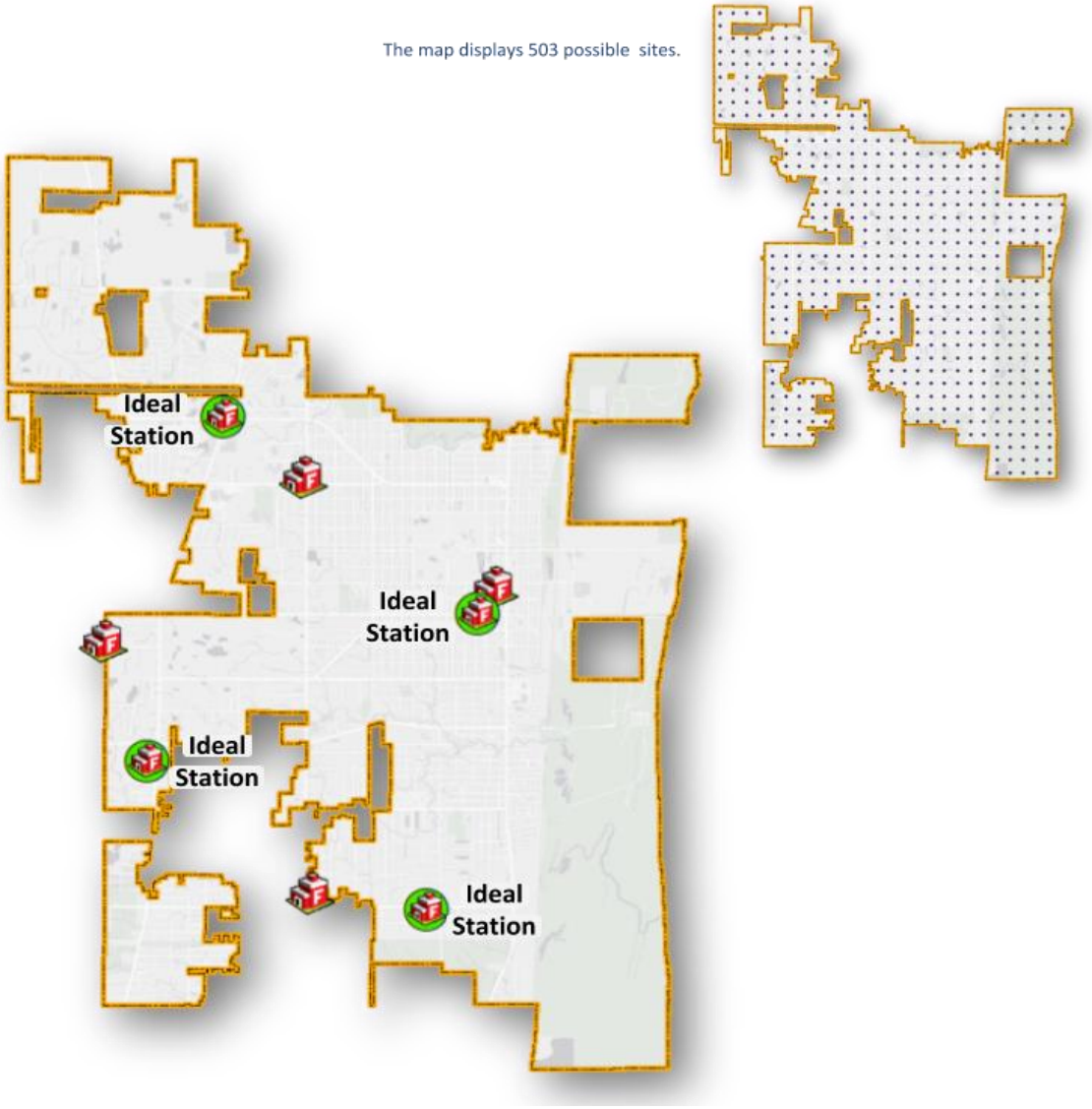
The primary objective of a functional consolidation is to improve the timely delivery of appropriate resources to the scene of emergencies. To analyze the travel time within the Joint Agency response area, the IFCA Consulting Team used a GIS software program that takes into account actual street conditions and existing speed limits. Modeled response time is based on a street network model of both BPFPD and ZFRD and assumes that the fire service vehicles can maintain an average speed equal to the speed limits of the roads within the model.

Each proposed ideal station location is based on the recommended response time, distance, personnel, and time to put an effective force on the scene of an incident. In two (2) of three (3) instances, the current station location serves areas within the response area that have a higher call volume/responses comparatively. The remaining station provides adequate coverage for response time to some but not all areas with less dense call volumes.

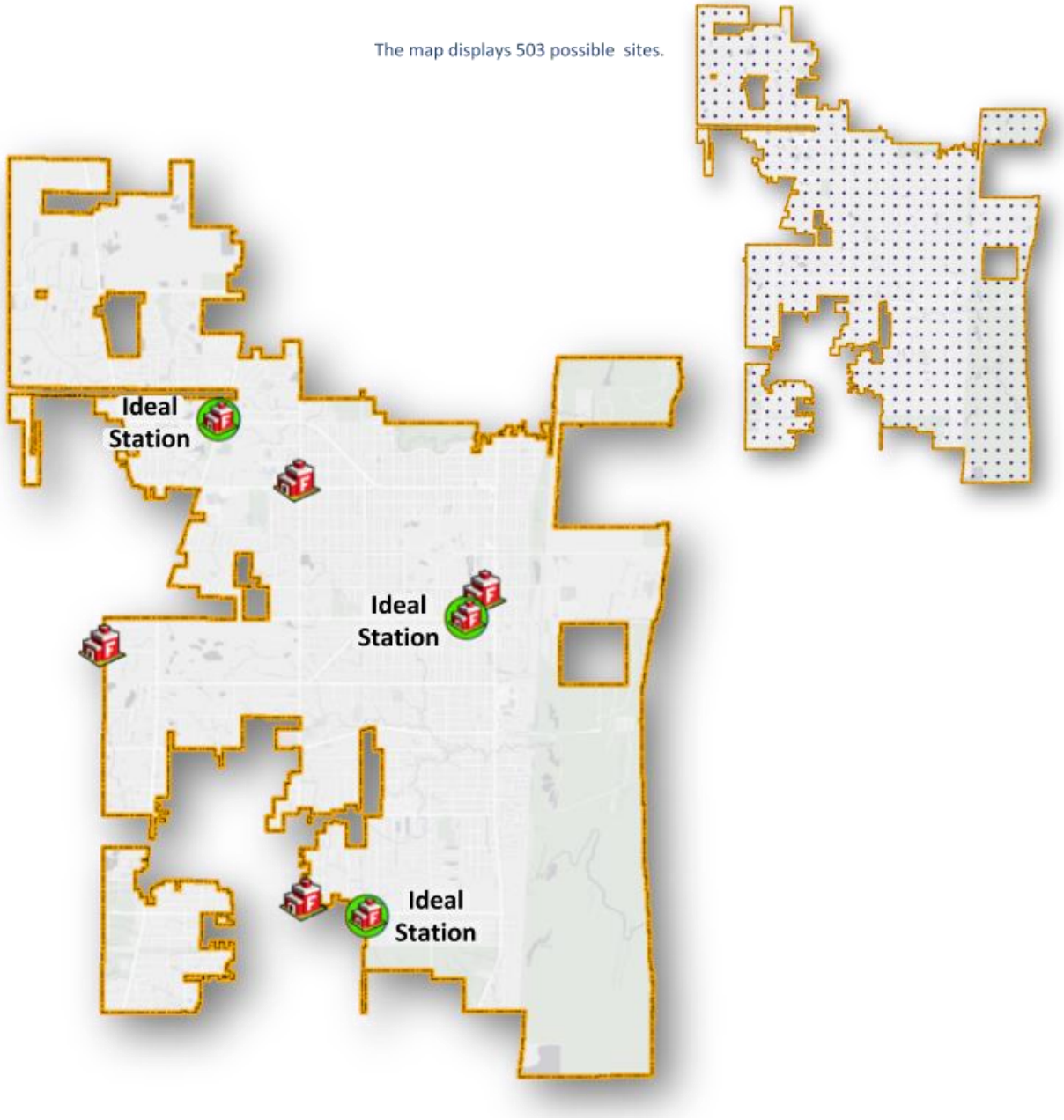
Eliminating a fire station (BPFPD 2) would indicate slightly higher response times for the TRA (eight seconds at the ninetieth percentile). However, it would increase the availability for first and second level responses to the higher density areas for the joint agency. There will still be areas where the four-minute travel time will not be achieved. In considering a cost vs. benefit for station location, the proposed locations will provide the maximum travel time to ninety percent (90%) of the incidents.

After conducting a GIS location review of the Vacant Property listings provided by Zion Fire & Rescue Department, all addresses except one did not result in a strategic placement of a new fire station. Only one location was found to meet the criteria for optimal placement but was located just over one block away from a current fire station.

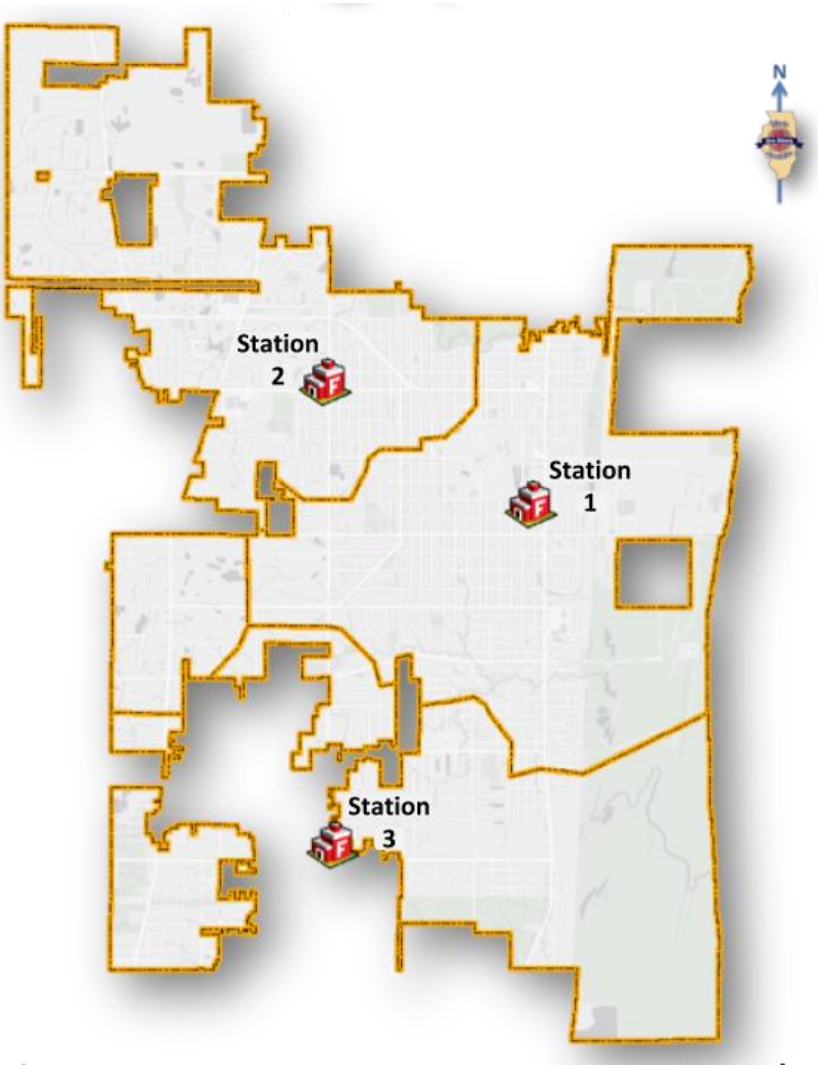
Ideal Fire Station Location - 4 Station Model



Ideal Fire Station Location - 3 Station Model



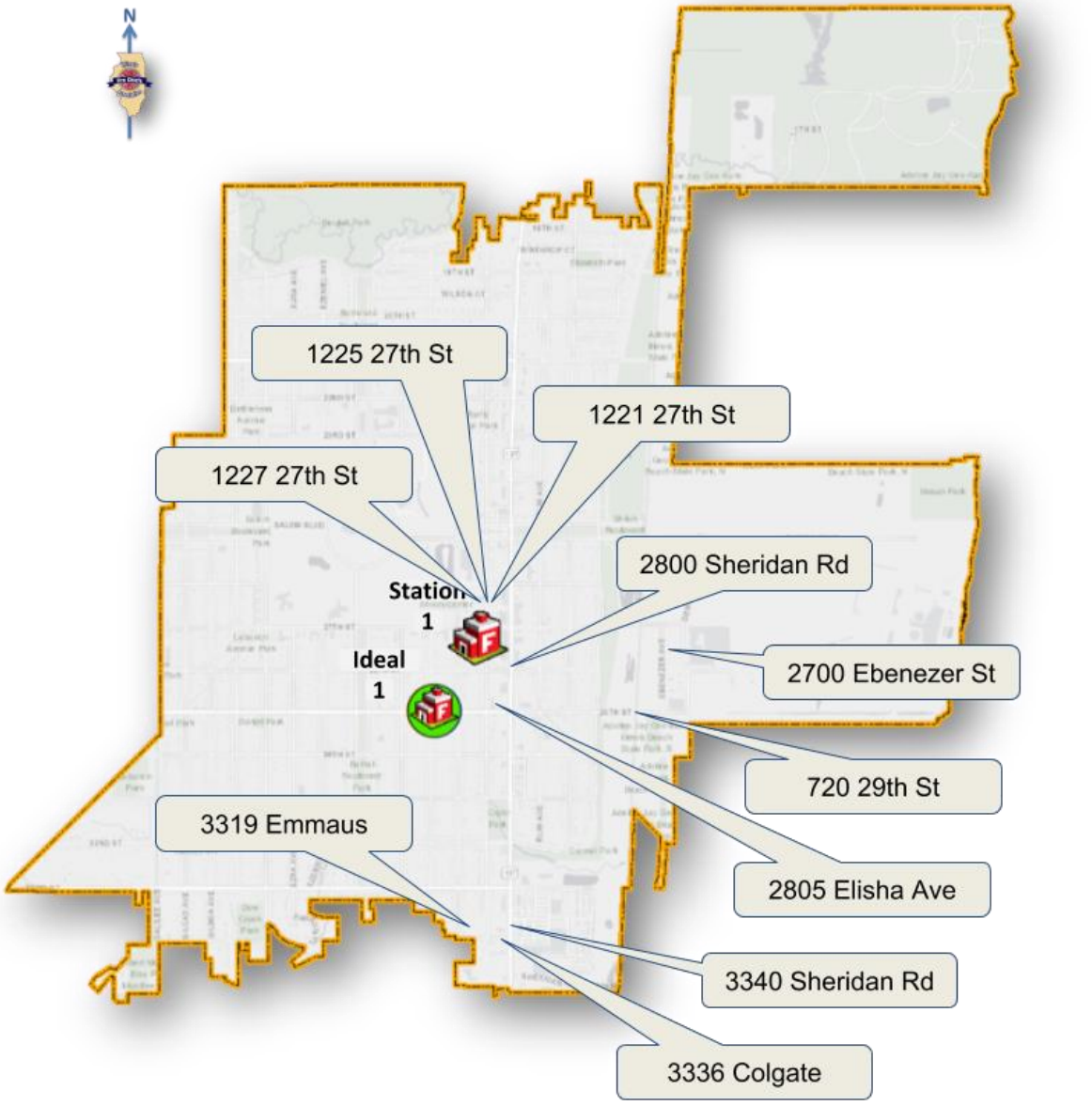
Joint Agency Configuration TRA



The current 4-station configuration total response area is 18.5 square miles and is divided into four distinct primary response districts. When applying a 3-station model, there is an increase in square miles covered for each fire station.

Zion Parcel Placement

Zion Fire & Rescue Department provided a vacant land parcel placement for analysis of potential fire station locations. The Consulting Team analyzed each property for its impact on response. As illustrated below there is only one (1) location that could be considered as a possibility for the construction of a replacement fire station (Station 1) that is proximate to the "ideal station location" and would offer a slight improvement in response (2805 Elisha Avenue).

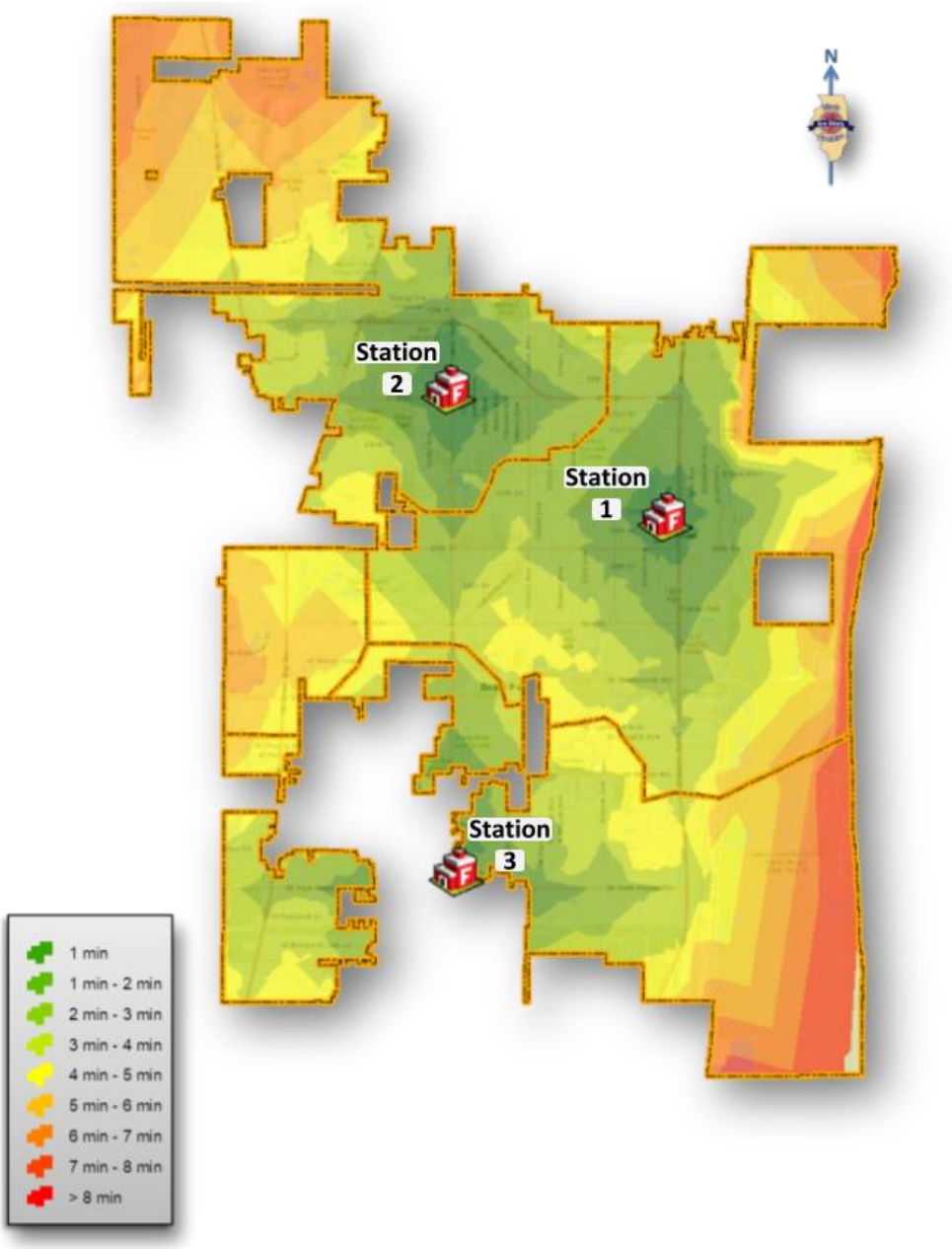


Total Response Area Modeling	
Current 4-Station Model	**3 Station Joint Agency Model**
ZFR Station 1: 4.2 sq. miles	Station 1: 6.6 sq. miles
ZFR Station 2: 5.6 sq. miles	Station 2: 6.4 sq. miles
BPFPD Station 1: 7.1 sq. miles	Station 3: 5.5 sq. miles
BPFPD Station 2: 1.6 sq. miles	
Total Response Area: 18.5 sq. miles	**Total Response Area: 18.5 sq. miles**

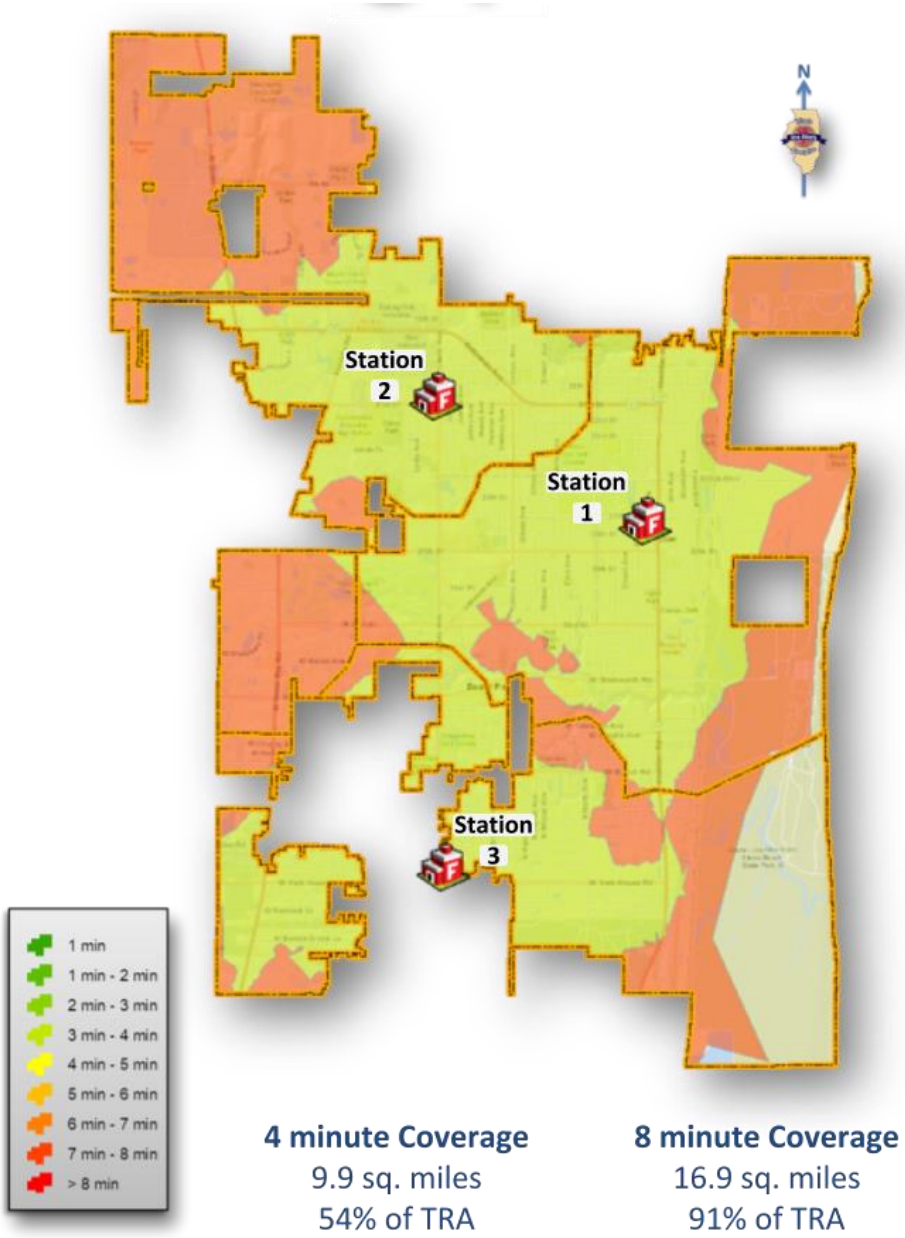
Figure 27 Total Response Area Modeling

The following maps illustrate travel times on each map for the Joint Agency model; Total Response Area; 4 and 8-minute Travel Times if stations were located in the "ideal" locations. Additional maps provided a greater analysis of each response district's area served by drive time. The objective is to apply this travel time standard as part of overall response time formula to ensure that a 6:00 -EMS and 6:20-Fire response time (***Alarm Processing (60 seconds) + Turn-Out (60 seconds EMS; 80 seconds Fire) + Travel Time (4:00)*** to first direct action exists for responses within the joint response area.

Joint Agency: Area Served by Drive Time



Joint Agency: 4 & 8 Minute Catchment

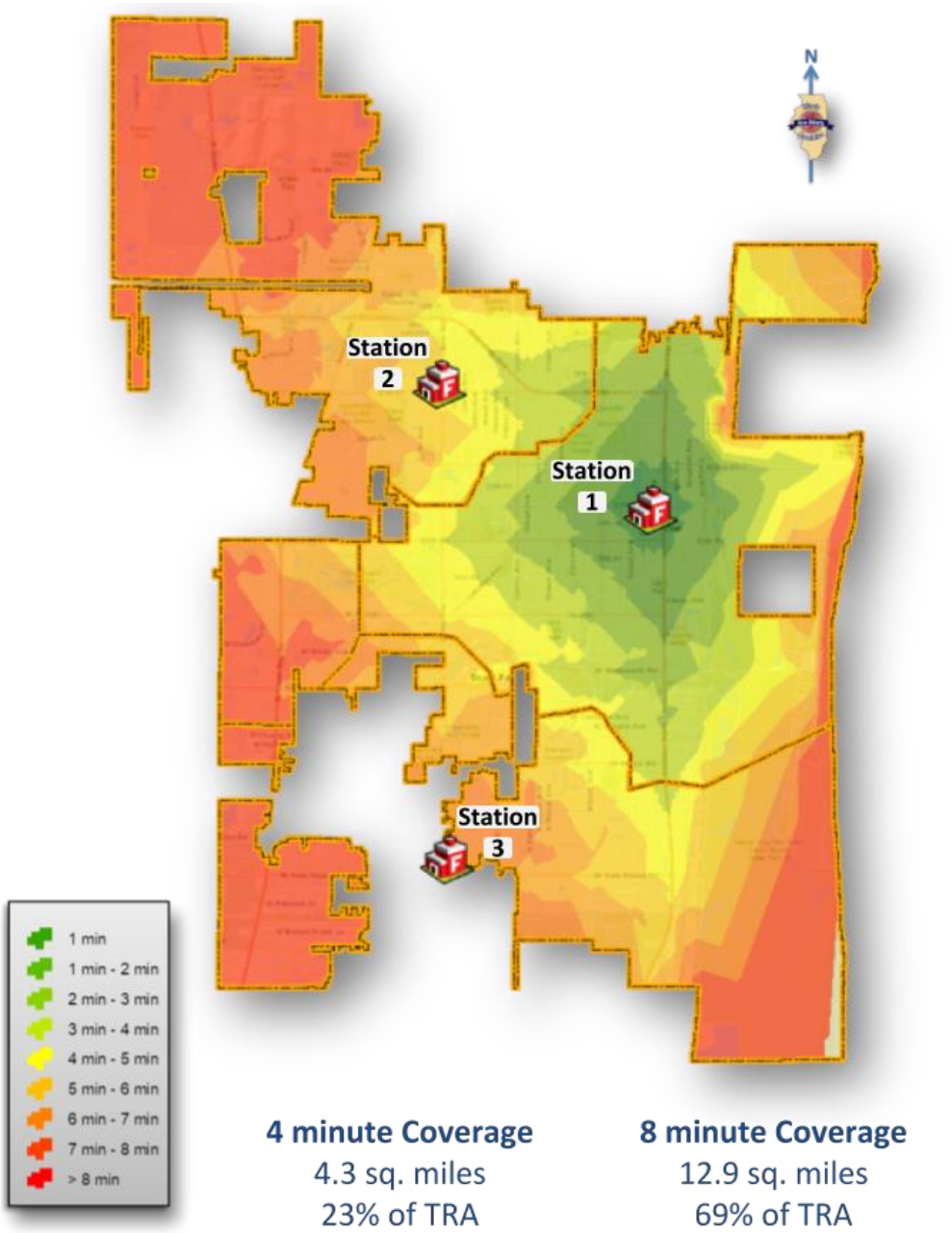


4 minute Coverage
9.9 sq. miles
54% of TRA

8 minute Coverage
16.9 sq. miles
91% of TRA

Analysis of Travel Time Data from Each Current Fire Station

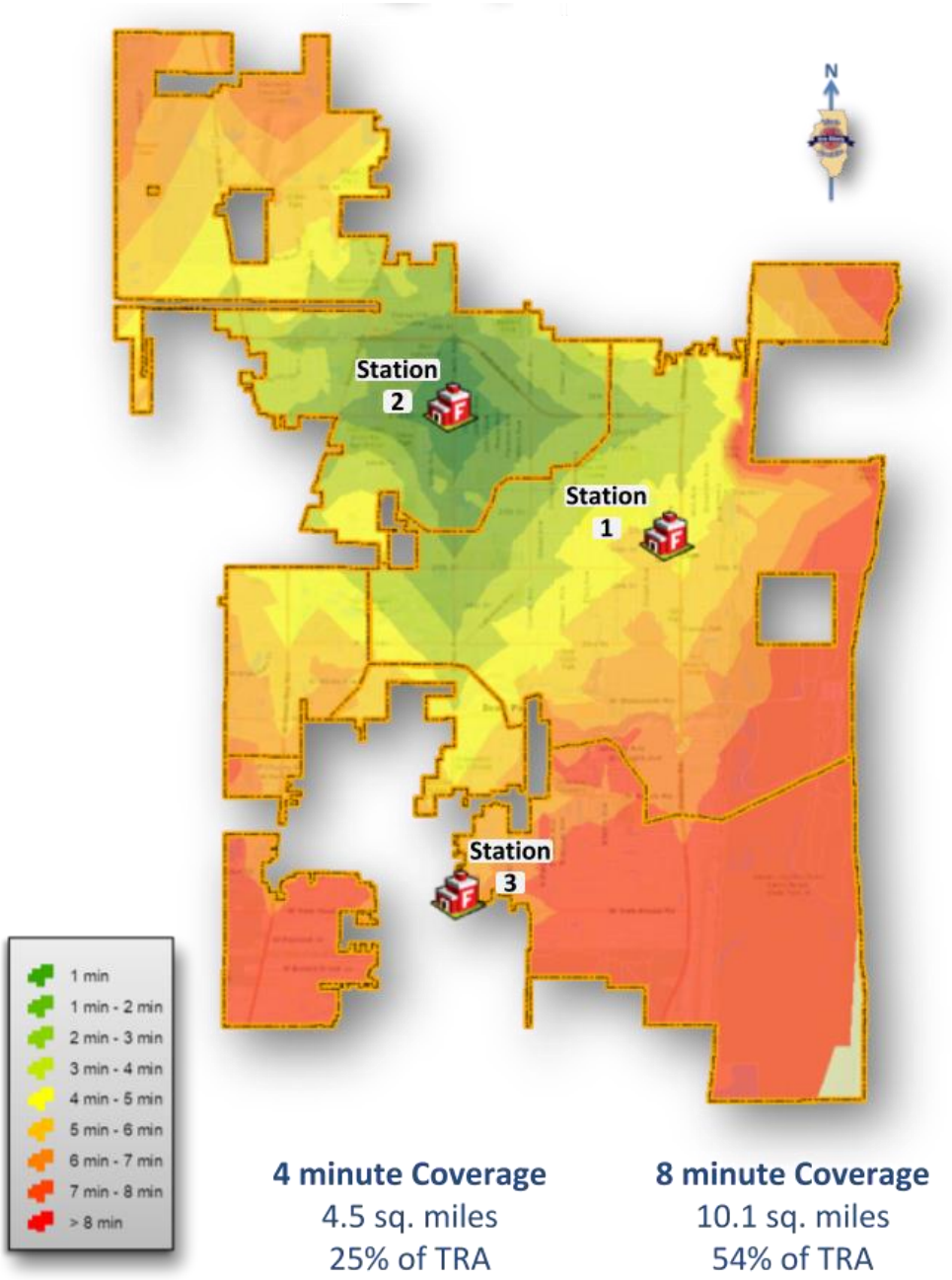
Joint Agency: Station 1 TRA



4 minute Coverage
4.3 sq. miles
23% of TRA

8 minute Coverage
12.9 sq. miles
69% of TRA

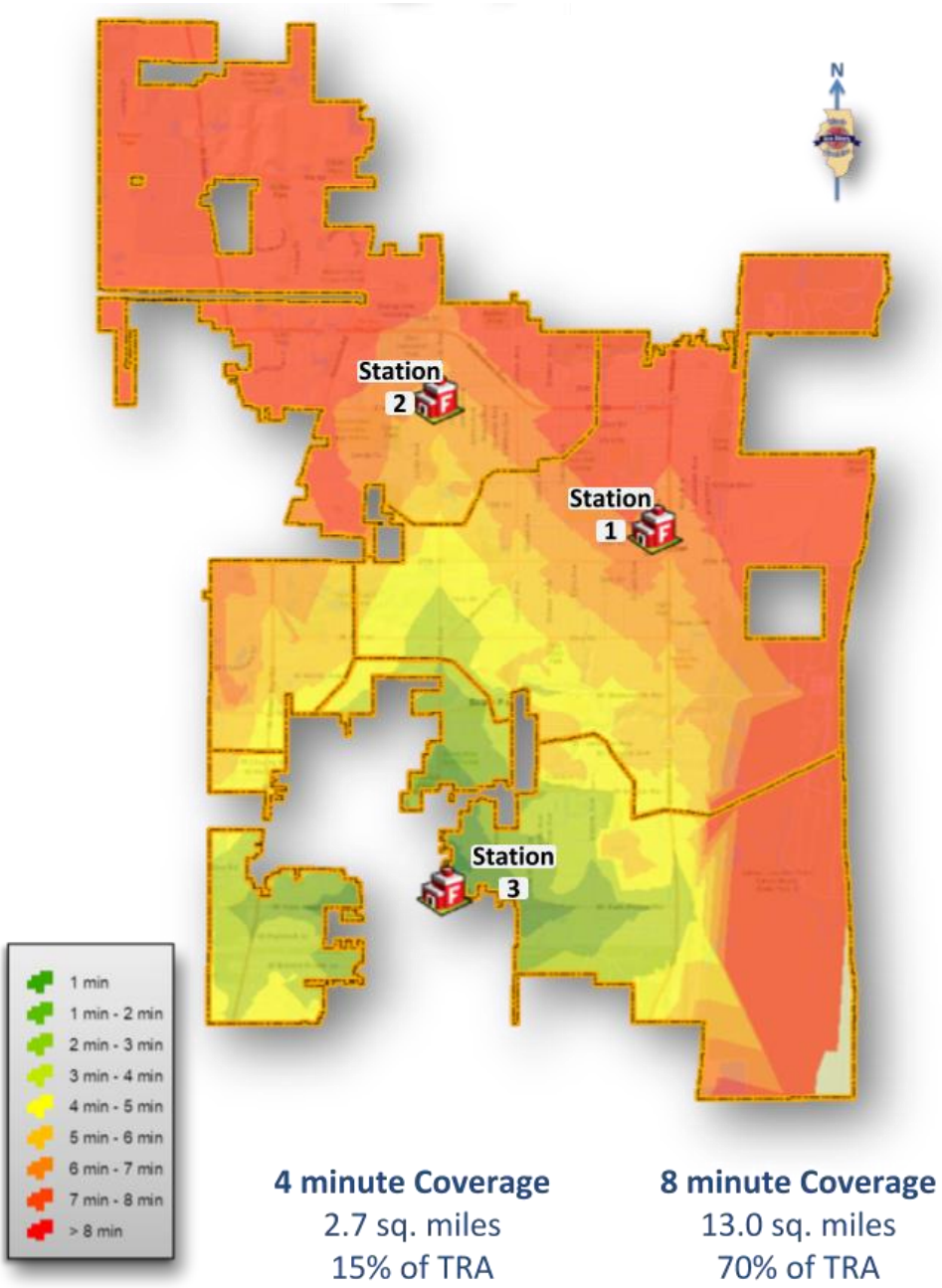
Joint Agency: Station 2 TRA



4 minute Coverage
4.5 sq. miles
25% of TRA

8 minute Coverage
10.1 sq. miles
54% of TRA

Joint Agency: Station 3 TRA



4 minute Coverage
2.7 sq. miles
15% of TRA

8 minute Coverage
13.0 sq. miles
70% of TRA

The following data sets provide a detailed analysis of response time for the proposed 3-station model.

Joint Agency Response Comparison

Total Response Area Incidents

All Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal 3 Station	0:04:39	0:04:14	0:03:56	0:03:39	0:03:19
Current 4 Station	0:04:47	0:04:18	0:03:52	0:03:32	0:03:14
Proposed 3 Station	0:04:55	0:04:21	0:03:53	0:03:33	0:03:14

Fire Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal 3 Station	0:04:59	0:04:41	0:04:24	0:04:10	0:03:55
Current 4 Station	0:05:09	0:04:57	0:04:26	0:04:08	0:03:51
Proposed 3 Station	0:05:29	0:04:57	0:04:32	0:04:09	0:03:52

EMS Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal 3 Station	0:04:41	0:04:15	0:03:57	0:03:42	0:03:21
Current 4 Station	0:04:46	0:04:20	0:03:53	0:03:33	0:03:15
Proposed 3 Station	0:04:55	0:04:21	0:03:54	0:03:34	0:03:16

Other Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal 3 Station	0:04:29	0:04:07	0:03:47	0:03:26	0:03:11
Current 4 Station	0:04:43	0:04:07	0:03:47	0:03:25	0:03:03
Proposed 3 Station	0:04:51	0:04:11	0:03:47	0:03:25	0:03:03

Station 1 Area of Response

All Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal 3 Station	0:04:23	0:04:09	0:03:48	0:03:30	0:03:09
Current 4 Station	0:04:42	0:04:18	0:03:52	0:03:28	0:03:08
Proposed 3 Station	0:04:42	0:04:18	0:03:52	0:03:28	0:03:08

Fire Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal 3 Station	0:04:46	0:04:38	0:04:28	0:04:10	0:03:59
Current 4 Station	0:05:04	0:04:52	0:04:23	0:04:05	0:03:43
Proposed 3 Station	0:05:04	0:04:52	0:04:23	0:04:05	0:03:43

EMS Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal 3 Station	0:04:22	0:04:09	0:03:48	0:03:30	0:03:09
Current 4 Station	0:04:42	0:04:21	0:03:54	0:03:29	0:03:10
Proposed 3 Station	0:04:42	0:04:21	0:03:54	0:03:29	0:03:10

Other Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal 3 Station	0:04:21	0:04:00	0:03:43	0:03:25	0:03:09
Current 4 Station	0:04:35	0:04:03	0:03:43	0:03:25	0:03:04
Proposed 3 Station	0:04:35	0:04:03	0:03:43	0:03:25	0:03:04

Station 2 Area of Response

All Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal 3 Station	0:04:56	0:04:17	0:03:59	0:03:46	0:03:31
Current 4 Station	0:04:49	0:04:07	0:03:47	0:03:24	0:03:12
Proposed 3 Station	0:05:06	0:04:14	0:03:47	0:03:25	0:03:14

Fire Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal 3 Station	0:05:16	0:04:34	0:04:17	0:04:02	0:03:40
Current 4 Station	0:05:09	0:04:40	0:04:13	0:04:04	0:03:41
Proposed 3 Station	0:05:33	0:04:59	0:04:24	0:04:07	0:03:45

EMS Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal 3 Station	0:04:56	0:04:17	0:04:01	0:03:48	0:03:33
Current 4 Station	0:04:45	0:04:01	0:03:46	0:03:24	0:03:12
Proposed 3 Station	0:04:56	0:04:12	0:03:47	0:03:25	0:03:14

Other Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal 3 Station	0:04:34	0:04:08	0:03:51	0:03:35	0:03:13
Current 4 Station	0:04:54	0:04:13	0:03:47	0:03:24	0:03:04
Proposed 3 Station	0:05:31	0:04:20	0:03:48	0:03:28	0:03:11

Station 3 Area of Response

All Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal 3 Station	0:05:34	0:04:45	0:04:37	0:04:14	0:03:46
Current 4 Station	0:04:59	0:04:37	0:04:19	0:04:00	0:03:42
Proposed 3 Station	0:05:29	0:04:54	0:04:31	0:04:10	0:03:51

Fire Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal 3 Station	0:05:19	0:05:03	0:04:37	0:04:20	0:04:11
Current 4 Station	0:05:31	0:05:08	0:04:55	0:04:35	0:04:26
Proposed 3 Station	0:05:34	0:05:20	0:04:59	0:04:41	0:04:34

EMS Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal 3 Station	0:05:49	0:04:59	0:04:38	0:04:34	0:04:11
Current 4 Station	0:05:01	0:04:41	0:04:25	0:04:09	0:03:56
Proposed 3 Station	0:05:31	0:05:03	0:04:39	0:04:21	0:04:05

Other Incidents Response Time (h:mm:ss)

	90th %	*80th %*	*70th %*	*60th %*	*50th %*
Ideal 3 Station	0:04:45	0:04:21	0:03:37	0:03:05	0:02:15
Current 4 Station	0:04:40	0:04:12	0:03:36	0:02:56	0:01:01
Proposed 3 Station	0:04:54	0:04:25	0:03:45	0:03:03	0:01:01

Analysis of Company Availability (Stations Out of Service)

Within the Joint Agency Response Area

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 replacement 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 can 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 seven (7) 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 graphic on the next page illustrates how UHU relates to a 24-hour shift. The UHU method considers the number of hours a unit is committed on an emergency or other activity, divided by the number of overall hours a 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-.30 depending on factors such as geography or the transportation network and another workload that must be accomplished.

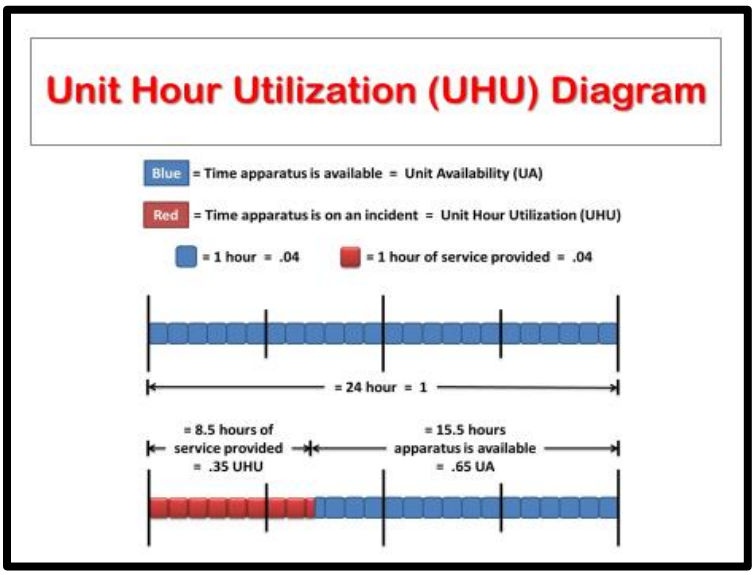


Figure 28 Unit Hour Utilization

Figure : Unit Hour Utilization Diagram

It should be noted that 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.

Joint Agency Service Demand Assessment

To assess each companies UHU, the IFCA Consulting Team analyzed all incidents to determine service demand levels and unit availability. By using the CAD system's incident data, the IFCA Consulting Team was able to review detailed records about service times, which are useful in determining the availability of a specific unit or station. Again, the concept of workload is not merely a count of how many calls to which a unit was dispatched. One unit can have fewer responses than another but remains on the scene longer on average (more working incidents), and so has a greater workload. Evaluating workload is important when looking at the overlaps in coverage to an area that may be required to achieve the response time goals or benchmarks. An analysis of workload also can indicate whether a new station should be built or new apparatus purchased—or if current stations should be closed or units moved.

A review of incidents by time of occurrence reveals when the greatest response demand is occurring. The IFCA Consulting Team began its assessment by breaking down the yearly workload into monthly increments, days of the week, and hours of the day. The final analysis

of historical workload concludes with an examination of call types by hour of day and finally, peak call hours. The hours of peak activity can strain an under-equipped or understaffed department. To determine UHU and ***company availability***, the IFCA Consulting Team reviewed the 2015 through 2017 incidents for the Joint Agency.

Joint Agency UHU Analysis

UHU numbers represent response workload/commitment in a fire station. Multiple companies assigned to a station can "share" the overall work. Therefore if 0.33 represents one company's workload of 6 hours 45 minutes, then two similar type companies can share the workload (16.6) or 3 hours 22 minutes for each company.

Current UHU's at 90th Percentile of Commit Times

	Fire	EMS	Other	Total
ZFRD Station 1	0.01	0.28	0.03	**0.31**
ZFRD Station 2	0.01	0.21	0.02	**0.24**
BPFPD Station 1	< 0.01	0.05	0.04	**0.10**
BPFPD Station 2	< 0.01	0.01	<0.01	**0.01**

Proposed JAFD UHU's at 90th Percentile of Commit Times

	Fire	EMS	Other	Total
Station 1	0.01	0.33	0.03	**0.37**
Station 2	0.01	0.22	0.02	**0.24**
Station 3	< 0.01	0.03	0.03	**0.06**

Current UHU's at 50th Percentile of Commit Times

	Fire	EMS	Other	Total
ZFRD Station 1	<0.01	0.10	0.01	**0.11**
ZFRD Station 2	<0.01	0.07	0.01	**0.08**
BPFPD Station 1	< 0.01	0.05	0.01	**0.07**
BPFPD Station 2	< 0.01	<0.01	<0.01	**0.01**

Proposed JAFD UHU's at 50th Percentile of Commit Times

	Fire	EMS	Other	Total

Station 1	< 0.01	0.11	0.01	**0.13**
Station 2	< 0.01	0.07	0.01	**0.08**
Station 3	< 0.01	0.03	0.01	**0.04**

JOINT AGENCY APPARATUS CONCENTRATION & DISTRIBUTION

Concentration

Concentration analysis evaluates how well an organization can assemble resources for significant incidents; in most cases, structure fires. Understanding that neither of the study departments can generate sufficient personnel individually – producing an effective response force of three engines and one aerial ladder within eight minutes of travel.

Apparatus Typing and Placement

In a consolidated effort, the goal is to maximize the efficiency of emergency response without sacrificing response time. Strategic placement of apparatus and distribution of response personnel are key factors in providing safe and efficient operation.

1. Engine concentration
2. Ambulance concentration and initial EMS response
3. Effective Response Force (ERF)

Ambulance Company Concentration

In analyzing EMS response data, the best ambulance placement with a four-minute travel time response (NFPA, CPSE) for three stations in the consolidated area was determined to be at Station's 1 and 2. Using NFPA standards, the goal for initial EMS response is to have EMS personnel on the scene within a four-minute travel time for 90% of the EMS incidents. The initial EMS response can come from either ALS fire apparatus or ALS ambulances. If the initial response is from an ALS Fire Apparatus, an ALS ambulance should be on the scene within an eight-minute travel time. Since each station has an ALS equipped and staffed apparatus the redistribution of ambulances is primarily focused on providing a timely response for an EMS transport vehicle.

In considering apparatus typing, it is critical that all fire apparatus have ALS capabilities to maximize EMS response.

EMS response times are based on the first arriving EMS unit regardless of the apparatus type. The use of ALS Engines and Quints enhances initial EMS response capabilities. The NFPA standard for initial response is a four-minutes or less travel time for 90 % of all incidents (Fire, EMS and Other) in a suburban population.

Staffing the Effective Response Force (ERF)

Raw staffing numbers do little to indicate how well personnel is deployed to effectively deliver services. Where and when personnel are positioned can greatly impact an organization's ability to meet established response performance objectives. This section

reviews how personnel are to be deployed across the Joint Agency response area and provides a brief explanation of minimum and maximum staffing patterns.

According to NFPA standards, a minimum of 15 personnel need to be on the initial response to a residential structure fire within an eight-minute travel time.

JOINT AGENCY OPERATIONAL STAFFING CONCENTRATION

Operational personnel are those individuals that are involved directly in the provision of services for the Joint Agency. Although staffing numbers and allocation of personnel are important elements to review, how well personnel perform is perhaps the most important element of staffing and personnel management. Without the ability to generate sufficient personnel for emergency incidents, an organization cannot fulfill its mission effectively and efficiently. This produces reduced response performance and poor service delivery.

This is most important for incidents that require large numbers of personnel such as a structure fire. Published recommendations (NFPA 1710), state that a fire department should have 15 personnel on the initial response to a structure fire to effectively mitigate the incident promptly. Based on the region's run cards, the use of Automatic Aid and or Mutual Aid could meet the standard while assuming all resources are available for a structure fire, 15 personnel would be on scene for a working structure fire.

The Figure 23 below is a staffing comparison model for the recommended redistribution of personnel by station.

Minimum Staffing Comparison: Current & Joint Agency Staffing Models					
Zion Station 1	Battalion Chief	1	**JAFD Station 1**	Battalion Chief	1
	Officer	1		Officer	1
	Firefighter/EMT-P	3		Firefighter/EMT-P	5
Zion Station 2	Officer	1	**JAFD Station 2**	Officer	1
	Firefighter/EMT-P	1		Firefighter/EMT-P	1
Beach Park Station 1	Officer	1	**JAFD Station 3**	Officer	1
	Firefighter/EMT-P	1		Firefighter/ EMT-P	1
Beach Park Station 2	Officer	1			
	Firefighter/EMT-P	1			
	Total	**11**		**Total**	**11**

Figure 29 Minimum Staffing Comparison: Current & Joint Agency Staffing Models

The National Fire Protection Association (NFPA) publishes annual data that can be used to compare departments against others serving similar population levels. Based on the current staffing level of 33 personnel servicing a population of approximately 38,000 citizens, the Joint Agency FD would be at 0.86 firefighters. The Joint Agency would be slightly below the median for the Midwest region as illustrated below.

MEDIAN RATES OF CAREER FIREFIGHTERS per 1,000 PEOPLE BY REGION/POPULATION PROTECTED				
Population Protected	Northeast	Midwest	South	West
250,000 or more	2.11	1.50	1.27	0.84
100,000 to 249,000	2.14	1.37	1.50	1.07
50,000 to 99,999	2.00	1.08	1.51	0.92
25,000 to 49,999	1.81	0.94	1.60	1.02

Source: NFPA Survey of Fire Departments for U.S. Fire Experience, 2013.

Figure 30 Median Rates of Career Firefighters per 1,000 by Region/Population

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.
All Incidents	All incidents regardless of NFIRS group codes.
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.
AOR	Area of Responsibility
Automatic Aid	Planned first alarm response of engine and ladder-service companies between two or more jurisdictions by prior agreement, so that each department operates substantially as one department.
AW	Area workload is the percentage of a given time frame in which there is a demand for service within a station's AoR.
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 the built-up area to determine the fire department response district size, is to count the hydrants and use that count as a representative "size" in other areas having hydrants.
Catchment	A geographical area based on travel time.
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.
Drive Time	The time measured from fire company en-route to fire company on scene.
EMS Incidents	Incidents in the NFIRS group codes 300's.
Engine Company	A fire engine (pumper) with equipment and personnel, which may be paid or volunteer.
Fire Incidents	Incidents in the NFIRS group codes 100's.
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.
Full Consolidation	A model under which two or more (fire) organizations merge into one large organization with its own governance structure, budget, personnel, equipment, and operational framework.
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.
Historical	Incidents that have happened in the past. Data that has been collected in the past.

Hotspots	A representation of an area with a statistical higher density than its surrounding area.
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.
Operational Consolidation	A model which embraces a unified operations framework under which the “closet unit responds” regardless of municipal or district boundaries, but which retains each organization as separate entities with independent personnel, vehicles, and governance.
Other Incidents	Incidents in the NFIRS group codes 200’s, and 400’s through 900’s.
Projected	The results that may happen in the future based on analysis
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 is 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.
Response Time	The time measured from fire company notification to fire company on scene.
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 Area	A geographical area where service is provided or demanded.
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**.
TRA	The complete geographical area in which a fire agency is responsible for providing service.
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.

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