Village of
Northbrook

PUBLIC SAFETY COMMITTEE

Northbrook Village Hall, 1225 Cedar Lane
January 10, 2023, 6:00 P.M., TERRACE CONFERENCE ROOM

The Public Safety Committee of the Village of Northbrook Board of Trustees will hold a meeting on Tuesday, January 10, 2023 at 6:00 p.m. in the Terrace Conference Room of the Village Hall, 1225 Cedar Lane, Northbrook, Illinois. The following will be discussed.

MEETING AGENDA

1. Call To Order

2. Hear From The Audience

3. Presentation and Review of Fire Department Organizational Assessment
   - Staff Memo
   - Comprehensive Fire Department Organizational Assessment (Nov. 2022)
   - Addendum One to the Comprehensive Fire Department Organizational Assessment (Nov. 2022)

4. Adjourn

Dan Pepoon, Chairman
Public Safety Committee

Members: Trustee Collison
Trustee Ebhomielen

Village of Northbrook
Cook County, Illinois
January 10, 2023

The Village of Northbrook is subject to the requirements of the Americans with Disabilities Act of 1990. Individuals with disabilities who plan to attend this meeting and who require certain accommodations in order to allow them to observe and/or participate in this meeting, or who have questions regarding the accessibility of this meeting or the facilities, are requested to contact Debbie Ford (272-5050, extension 4014) promptly to allow the Village of Northbrook to make reasonable accommodations for those persons. Hearing impaired individuals may call the TDD number, 564-8645, for more information.

MEMORANDUM
VILLAGE OF NORTHBROOK
FIRE DEPARTMENT

TO: CARA PAVLICEK, VILLAGE MANAGER

FROM: ANDY CARLSON, FIRE CHIEF

CC: VILLAGE BOARD OF TRUSTEES

DATE: JANUARY 5, 2023

SUBJECT: JANUARY 10, 2023 MEETING OF THE PUBLIC SAFETY COMMITTEE OF THE VILLAGE BOARD

In FY21 the Village Board provided direction that an outside assessment of several Village departments should be completed. Funds were included in the FY22 budget and the Fire Department was selected to be first. After an RFP process in the fall of 2021, Polaris Public Safety Solutions, LLC of Niles, Illinois was selected as the consultant to conduct the organizational assessment. The Village Board approved a professional services contract with Polaris on January 25, 2022. In November, the Fire Department received the final report and copies were distributed to the Board of Trustees.

On December 13, 2022, the Village Board accepted the report and referred it to the Public Safety Committee of the Village Board to review the report and receive a presentation from the consultant.

The Public Safety Committee Meeting will allocate the following time for the discussion as follows:

1. A high level presentation of the report by Polaris Public Safety Solutions (30 – 45 minutes)
2. Summary by Fire Chief Andy Carlson to identify which elements of the report are currently being addressed, considerations for the FY23/24 budget process, etc. (15 -20 minutes)
3. Committee Q&A (25 – 45 minutes)

The Committee will also be asked to identify a schedule for informing the Village Board at an upcoming meeting of the Committee's review and any additional steps that are recommended.

Comprehensive Fire Department Organizational Assessment Study

Northbrook Fire Department

Village of Northbrook, Illinois

November 2022

Polaris Public Safety Solutions, LLC

Table of Contents

Executive Summary

The Village of Northbrook retained Polaris Public Safety Solutions LLC (PolarisPSS) to conduct a Comprehensive Fire Department Organizational Assessment of the Northbrook Fire Department (NFD), including operations and staffing levels of the entire Department with emphasis on ensuring that the Fire Department is meeting the community fire, rescue, medical, fire prevention, and emergency management needs and expectations.

PolarisPSS found the NFD to be a professional, highly skilled, and progressive organization. The personnel with whom PolarisPSS interacted are genuinely interested in serving the Village to the best of their abilities and demonstrated a goal of achieving excellence in service delivery. The challenges for the NFD are not unique nor are they insurmountable. In this report, PolarisPSS provides a series of findings and recommendations that will enable the NFD to become more efficient and effective in the execution of emergency and non-emergency responsibilities. Findings and recommendations are based on nationally accepted industry standards.

PolarisPSS recommends that the NFD embark on a strategic planning process to prioritize the short- and long-term resources required to execute the recommendations contained within. In addition, the development of a Community Risk Reduction Plan focused on populations of advanced age and identified high-risk target hazards is recommended to both mitigate potential increases in emergency call volume and ensure the Department maintains capability for all-hazard response.

The current three station configuration enables the Department to meet the national standard of a 4-minute travel time for only 70% of the total response area, with travel times for some geographic areas exceeding seven minutes. Therefore, PolarisPSS recommends that the Village of Northbrook adopt a three-step plan to add a fourth fire station and relocate two of the existing fire stations in order to increase the 4-minute travel time coverage to 83% of the total response area and decrease response times by 2 minutes and 20 seconds for 90% of the total response area.

The sustainment of the many organizational strengths and best practices identified, combined with new resource investments to address the study findings and recommendations will position the NFD to continue delivering efficient and effective services to those who live, work, and visit the Village of Northbrook and the Northbrook Rural Fire Protection District.

Purpose

This study's purpose is to conduct an efficiency and effectiveness analysis of the NFD's current resource deployment strategy. Predictive modeling with anticipated community growth estimates are used to identify and forecast future demand for services. Study findings informed recommendations to improve current-day service delivery and prepare the Village of Northbrook to meet the prospective demands for services.

Method of Study

This comprehensive assessment contains two components: a quantitative Geographic Information System (GIS)-based performance analysis with predictive modeling and a functional analysis. The findings from both analysis components are used to develop short- and long-term recommendations to improve service delivery and work toward full compliance with industry standards.

Geographical Information-Based Performance Analysis

The GIS-based performance analysis focuses on assessing current fire station locations and NFD's operating model and strategy. NFD's current deployment model and call types are used to analyze general fire service delivery, response performance, and the optimal number of stations, station locations, apparatus, and staffing. Predictive modeling processes applied to expected community growth provides the anticipated impact of such future growth.

A risk assessment to identify general service demand was conducted through analysis of historical incident type, incident location, and incident frequency data. Service demand was used to analyze the response system performance and evaluate the NFD's effectiveness and efficiency in providing emergency services. Distribution of resources (e.g., apparatus, staffing, supervisory, fire station), concentration of resources, and reliability of resources were used to measure response system performance. Information provided by the NFD about anticipated community development within the next five and 10 years was used to create likely predicted scenarios for service demand. Using service demands and analysis tools, likely predicted scenarios for anticipated community development and population changes were analyzed to establish predictions for future response system requirements and performance benchmarks. The assessment includes a workload and unit hour utilization analysis.

Functional Analysis

The functional analysis focuses on strategic processes that affect fire service operations. These areas include Department administration, facilities, apparatus and fleet management, fire prevention, training, and emergency management. Data utilized for analysis includes document review, interviews with Department staff members, facility and apparatus inspections, and research on industry best practices and

standards. Benchmarking standards for review and comparison include data from the Insurance Services Office (ISO), NFPA, and CPSE, and research conducted by the National Institute of Standards and Technology (NIST).

Fire Service National Standards and Benchmarks

This section provides an overview of the fire service national standards and benchmarking comparisons used in this study.

Insurance Services Office

The Insurance Services Office is primarily concerned with property risk. The ISO's Fire Suppression Rating Schedule's (FSRS) 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, required fire flow, and fire company locations.

The ISO grade is broken down into three elements:

- Fire department accounts for 50% of the total classification
- Water supply accounts for 40% of the total classification
- Emergency communications accounts for 10% of the total classification

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 United States is graded from 1 to 10, with one being the best. An ISO rating is one factor used by insurance companies to establish their company-specific homeowner insurance rates within a community.[1] Generally, lower scores yield lower rates. In 2017, ISO conducted a Public Protection Classification (PPC) survey within the Village of Northbrook. ISO's final analysis placed the Village into a Class 1 category; NFD became one of 29 public entities in Illinois and one of 459 public entities countrywide with a Class One rating.

[1] Commercial property insurance rates are calculated differently than homeowner insurance rates and generally fall within a class rating or specific rating methodology. The specific rating methodology is comprised of four elements: construction, occupancy, protection, and exposure. A community's ISO rating is one of the factors considered by insurance companies when assessing "protection".

Figure 1: Number of Illinois Fire Departments within ISO Classifications

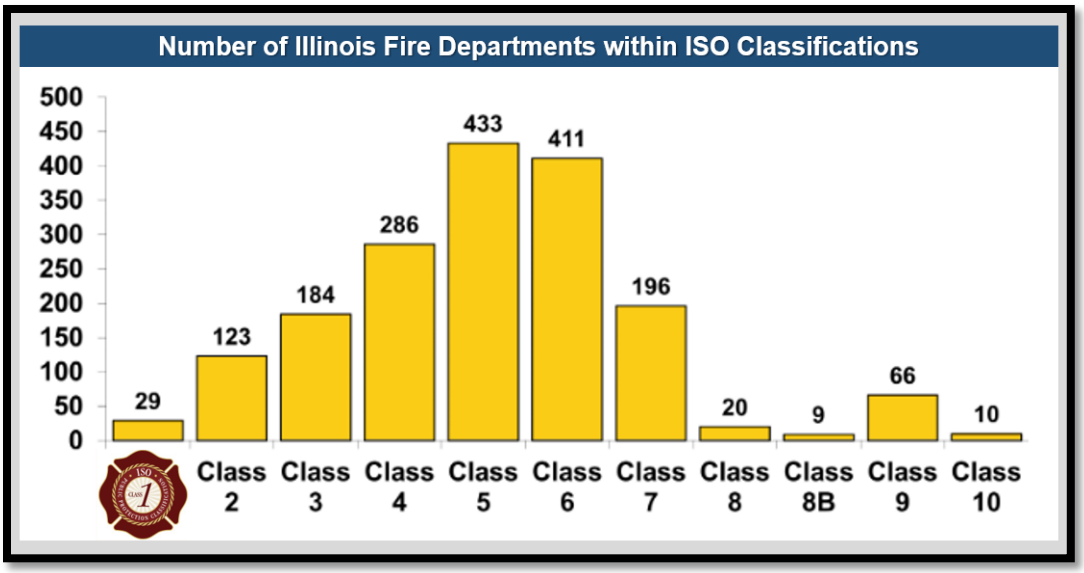
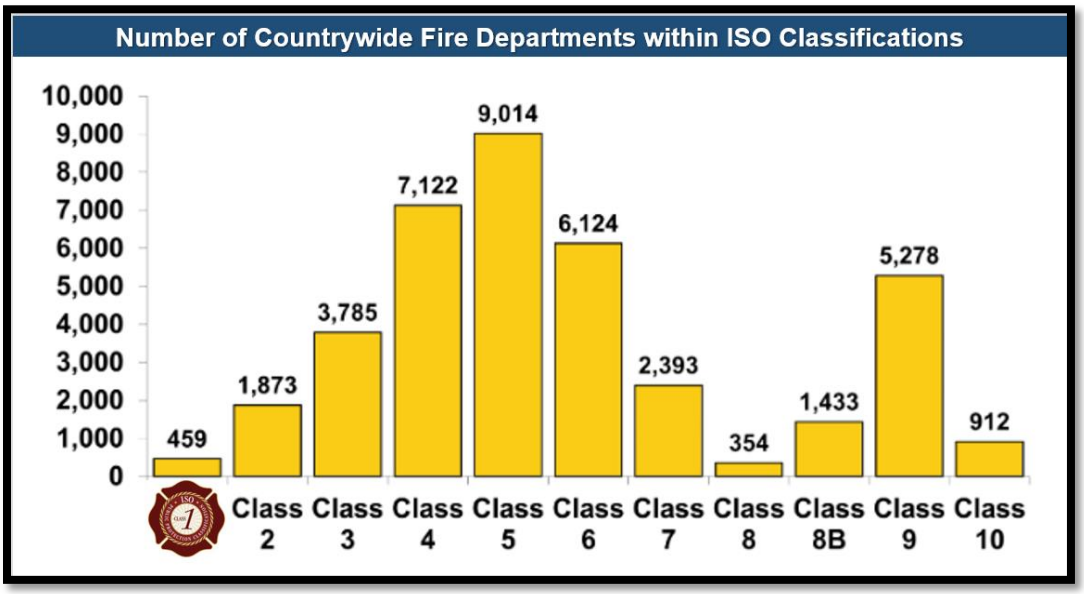


Figure 2: Number of Countrywide Fire Departments within ISO Classifications



Once widely used by fire departments to evaluate system performance, the FSRS's use is somewhat limited in that it only evaluates fire protection and not Emergency Medical Services (EMS). The FSRS does not consider efficiency.[2] Although not widely used, ISO ratings are still appropriate to consider as part of a comprehensive system performance review and are useful in combination with other assessments.

[2] The number of resources deployed in comparison to the number of actual calls.

National Fire Protection Association

The mission of the National Fire Protection Association[3] 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. As 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.[4] These codes and standards are developed by technical committees comprised of over 6,000 volunteers, and are adopted and enforced throughout the world. Therefore, applicable NFPA standards and codes are applied in this study.

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

The NFPA has many standards that affect fire departments. Compliance with these standards helps fire departments protect fire and rescue personnel from unnecessary workplace hazards. In most cases, compliance with NFPA standards is voluntary. However, the Illinois Occupational Safety and Health Administration (IL-OSHA) has incorporated wording from NFPA standards into its regulations. IL-OSHA regulations in 29 CFR Part 1910 apply to all municipal fire departments and fire protection districts in the State of Illinois. IL-OSHA enforces these regulations.

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 fire department may be liable for the negligent

[3] 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 which was another new and fast-growing technology, and then all aspects of building design and construction.

NFPA’s 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. In 1905, the New York City Fire Department became the first fire department to be represented in the NFPA. Today, the NFPA includes representatives from many fire departments, insurance companies, manufacturing associations, unions, trade organizations, and community residents.

[4] NFPA

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 frequently look to the "voluntary" standards issued by NFPA and other organizations. Although "voluntary" in name, these standards can be utilized as evidence of an existing standard of care for which fire or rescue departments may be responsible to comply. Accordingly, fire and rescue departments should pay close attention to applicable standards.

Office of the Illinois State Fire Marshal, Division of Personnel Standards and Education

The Division of Personnel Standards and Education (DPSE) is responsible for promoting, encouraging and assisting local governments to improve levels of education and training standards for local firefighters. DPSE is responsible for standardizing and enhancing levels of education and training for Illinois firefighters and professionals, with the highest priorities placed on safety and career advancement. DPSE is the certifying agency for all fire departments in the State of Illinois.

Center for Public Safety Excellence

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

In 1996, The International Association of Fire Chiefs (IAFC) and the International City/County Management Association (ICMA) executed the *Master Trust Agreement*, establishing the Commission on Fire Accreditation International (CFAI) to promote agency self-assessment to facilitate an agency achieving accreditation and to pursue scientific research and education in the fields of fire and emergency medical services. The goal of the CFAI is to assist fire and emergency medical service agencies throughout the world in achieving excellence through accreditation and continuous quality improvement.

The comprehensive self-assessment and evaluation model enables organizations to examine past, current, and future service levels and internal performance and compare them to industry best practices. This process leads to service delivery improvements. The CPSE accreditation program, administered by the CFAI, allows fire and emergency medical service agencies to compare their performance to industry best practices in order to:

- Determine community risk and safety needs and develop community-specific standards of cover (SOC).
- Evaluate fire department performance.

- Establish a method for achieving continuous organizational improvement.

Particularly for emergency medical services, local officials need criteria to assess professional performance and efficiency. The CFAI accreditation process provides a well-defined, internationally recognized benchmark system to measure the quality of fire and emergency medical services. The CFAI model includes detailed processes for conducting a community risk assessment, developing SOC, establishing a community-driven strategic plan, and self-assessing all segments of the fire department.[5]

CPSE has established benchmarks regarding staffing and deployment. CPSE sets standards for agencies desiring accreditation through the CFAI. CFAI uses standards set forth in its *Community Risk Assessment Manual: Standards of Cover*, sixth edition, to provide staffing and deployment guidance to agencies desiring accreditation through core competencies. Table 1 illustrates CFAI minimum emergency incident staffing recommendations.

Table 1: Staffing Recommendations Based on Risk[6,7]

Incident Type	High Risk[8]	Moderate Risk[9]	Low Risk[10]
Structure Fire	29	16	6
Emergency Medical Service	12	4	2
Rescue	15	8	3
Hazardous Materials	39	20	3

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

[5] Quality Improvement for the Fire and Emergency Services, 10th ed. (2009). Center for Public Safety Excellence.
[6] Fire Service Deployment: Assessing Community Vulnerability. Urban Fire Forum and Metropolitan Fire Chiefs. Retrieved on June 10, 2022 from UrbanFireVulnerability.Page 7.pdf
[7] Minimum Fire Training Guide, 2021. Illinois Fire Service Institute
[8] High risk incidents involving fires in larger commercial properties with sustained attack (fire flows more than 1,000 gallons per minute), multiple patient medical incidents, major releases of hazardous materials, high-risk rescues, and wildland fires with extreme weather or fire behavior.
[9] Moderate risk incidents involving fires in single-family dwellings and equivalently sized commercial office properties (fire flow between 250 gallons per minute to 1,000 gallons per minute), life-threatening medical emergencies, hazardous materials emergencies requiring specialized skills and equipment, rescues involving specialized skills and equipment, and larger wildland fires.
[10] Minor incidents involving small fires (fire flow less than 250 gallons per minute), single patient non-life-threatening medical incidents, minor rescues, small fuel spills, and small wildland fires without unusual weather or fire behavior.

service agencies if the findings from performing the self-assessment are applied to planning and implementation activities.

Standards of Cover

One of the major issues the fire service has struggled with in the past decade is defining the standards of cover. This concept has evolved in concert with other components of the CPSE 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.

CFAI defines the 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, SOC is the delivery of resources within a timeframe a majority of time that is useful or effective to the residents of a defined area. The ultimate outcome of a SOC analysis is to have measurable standards of effective response to predictable emergencies.

Level of service (LOS) and SOC form the basis of service to the community and response to emergencies. These are often-overlooked details in the process of evaluation, a process that must start with the community looking at itself.

CFAI defines LOS as “the resources needed to meet the stated service level objectives”. LOS is defined only in terms of what is provided and not in terms of effectiveness or quality. LOS 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 (ALS) over Basic Life Support (BLS); 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; effectiveness is the concept of SOC.

EMS National Standards and Benchmarks

National Fire Protection Association

The EMS component of the emergency services delivery system is more heavily regulated than fire suppression and rescue. In addition to NFPA 1710, NFPA 450 *Guidelines for Emergency Medical Services (EMS) and Systems, (2017 edition),* provides a framework for designing and/or evaluating a comprehensive EMS system that includes guidelines, resources, and recommendations.

Many of the EMS performance standards and benchmarks established by national organizations are directly related to the provision of care to patients with specific injuries or reported symptomatology. The detailed assessment of the NFD's alignment with these standards exceeds the scope of this study. Fire-based EMS is addressed in the CFAI accreditation model. Therefore, NFPA 1710 and NFPA 450 and CFAI are the three EMS standards used for this study.

National Institute of Standards and Technology Studies on Fire Service Acceptable Standards and Benchmarks

The United States Department of Commerce's National Institute of Standards and Technology conducted research on service expectations placed on the fire service, including EMS, response to natural disaster, hazardous materials incidents, and acts of terrorism. Balancing service expectations, finite resources, and fiscal responsibility has become a greater challenge for local policymakers.[11] Therefore, it is prudent to evaluate all available information regarding staffing and deployment of resources while maintaining the highest level of safety for firefighters and the public alike. PolarisPSS consultants analyzed two NIST studies to provide the Village of Northbrook with the quantitative scientific data for response force deployment when developing and finalizing fire and emergency medical response policies and operating guidelines for their organizations. This section provides an overview of this research.

Report on Residential Fireground Field Experiments[12]

This report is the first to quantify the effects of crew sizes and arrival times on the fire services' lifesaving and firefighting operations for residential fires. The study found that fire risks grow exponentially and that each minute of delay is critical to the safety of the occupants and firefighters, and is directly related to property damage. These experiments directly addressed 22 fireground activities that routinely occur on the scene of a typical residential fire.

Table 2: 22 Fireground Activities

22 Fireground Activities	
Stop @ hydrant, wrap hose	Advance back-up line stairwell
Position Engine 1	Conduct primary search
Conduct size-up	Ground ladders placed
Engage pump	Horizontal ventilation
Position attack line	Horizontal ventilation (2nd story)
Establish 2 in/2 out	Control utilities (int.)
Supply attack engine	Control utilities (ext.)
Establish RIT	Conduct secondary search
Gain/force entry	Check for fire extension (walls)
Advance attack line	Check for fire extension (ceiling)
Advance back-up line-front door	Mechanical ventilation

[11] Averill, J. , Moore-Merrell, L. , Barowy, A. , Santos, R. , Peacock, R. , Notarianni, K. and Wissoker, D. (2010), Report on Residential Fireground Field Experiments, Technical Note (NIST TN). National Institute of Standards and Technology, Gaithersburg, MD. Retrieved on May 25, 2022 from https://tsapps.nist.gov/publication/get_pdf.cfm?pub_id=904607

[12] Ibid

Scope of Report

The scope of this NIST study was limited to understanding specific variables of response and staffing configuration to "low hazard" residential structure fires as defined by NFPA Standard 1710. The experiments utilized a residential structure of 2,000 square feet, two story, single family dwelling with no basement and no exposures.

For the purpose of analysis and evaluation of the study, the data reflected the apparatus response and staffing distribution of three engines, one truck, and one battalion chief with an aide. In an effort to simulate real-time response, arrival times of companies were staggered at 1- and 2-minute intervals,[13] close and far,[14] respectively, were incorporated into each experiment segment.

Study limitations 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; an overview of this study will be presented later in this section.

Primary Findings

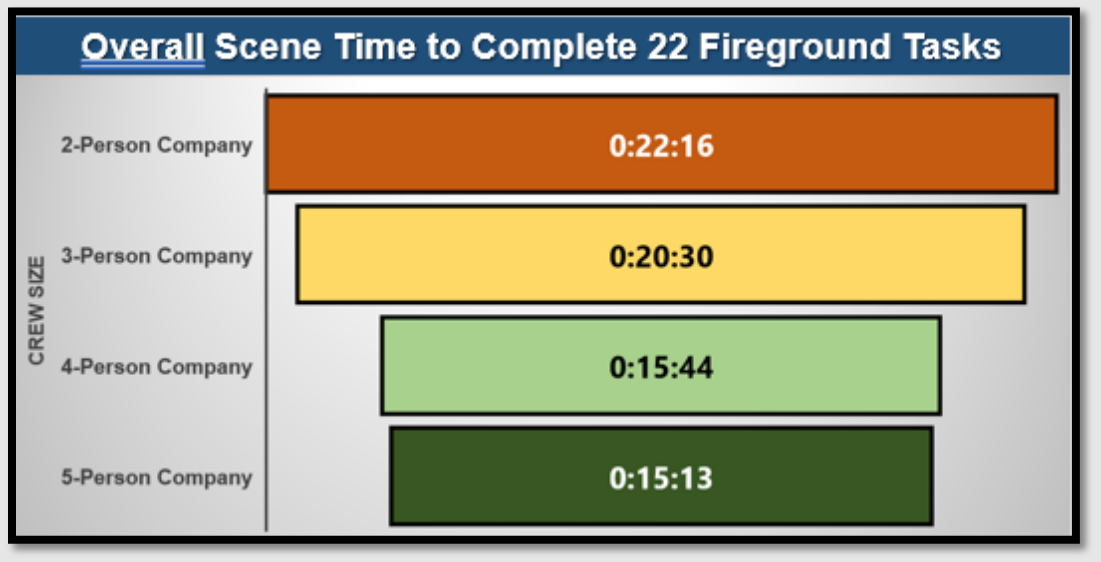
Of the 22 firefighting tasks measured, results indicated that overall scene time, time to water application, and rescue effectiveness had the most impact on overall firefighting operation success.

Overall Scene Time

Four- and five-person crews were able to complete the 22 essential firefighting and rescue tasks in a residential setting 30% faster than two-person crews and 25% faster than three-person crews. Figure 3 shows how overall scene time, the time that it takes the firefighters to complete all 22 tasks, is affected by the number of responders assigned to a crew.

[13] One-minute and 2-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 IAFC and the International Association of Firefighters (IAFF).
[14] Close stagger was defined as a one minute difference in the arrival of each responding company. Far stagger was defined as a two minute time difference in the arrival of each responding company.

Figure 3: Overall Time to Complete 22 Fireground Tasks[15]



The overall scene time measure is critical to the fire crew's ability to complete their work safely and return to the station in order to be available for the next fire call. Furthermore, the study found that when firefighter crews complete several of the tasks simultaneously, rather than consecutively, they 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,[16] unlike the low-hazard residential fire scenario examined in this study.

Time to Water Application

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

Results show that five-person crews were able to apply water to the fire 22% faster than two-person crews. Four-person crews were able to apply water to the fire 16% faster than two-person crews, and 6% 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 MW in size.

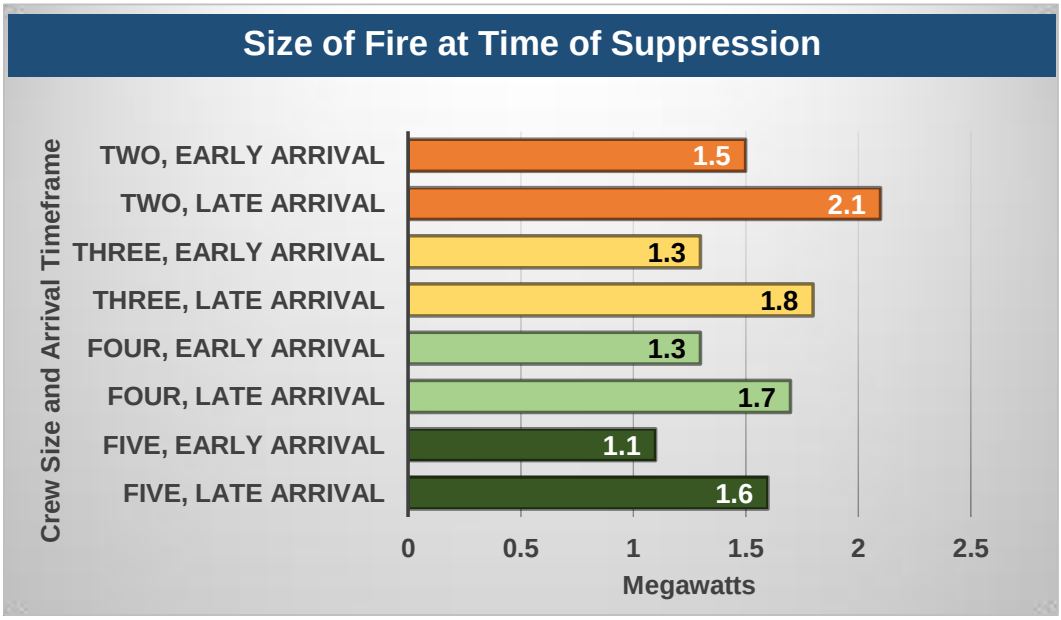
[15] Ibid
[16] Dallas, TX Fire Department Study, 1969; Dallas, TX Fire Department Study 1984

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 MW. For context, an example of a 1 MW fire is a fully-involved upholstered chair burning at its peak. A 2 MW fire, however, would be sufficient to produce near-flashover conditions in the 12 foot by 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. 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.

Figure 4: Size of Fire at Time of Suppression[17]



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 exposure 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-,

[17] Produced by NIST Fire Dynamic Simulator Software

and three-person crews show that the crews would likely be able to locate and rescue an occupant before sensitive populations would be incapacitated.

Summary

The NIST study applies specifically to firefighting crew sizes in a low-hazard residential setting and not to larger, more hazardous structures, outdoor, or transportation fires. These NIST studies also held apparatus response to a constant complement of firefighting vehicles. Decisions about crew size and the number of apparatus to deploy in a specific community depend on multiple variables inclusive of 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.

Report on EMS Field Experiments[18]

The fire service has become the first line medical responder for all types of medical emergencies throughout 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.

Scope of Report

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. The study does not address the efficacy of any patient care intervention. However, this study does quantify first responder crew size and the number and placement of ALS trained personnel resources on time-to-task measures for EMS interventions. Upon recommendation of technical experts, the study's investigators selected trauma and cardiac scenarios for the experiments as these incidents are resource intensive and likely reveal relevant differences in regard to the research questions. The applicability of the conclusions from this report to a large-scale hazardous or multiple-casualty incident 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

[18] Moore-Merrell, L., Santos, R., Wissoker, D., Benedict, R., Taylor, N., Goldstein, R., Brice, J., Mears, G., Averill, J., and Notariann, K. (2010). Report on EMS Field Experiments. National Institute of Standards and Technology. Gaithersburg, MD. Retrieved on May 25, 2022 from NIST Deployment Report on EMS Field Experiments (iafc.org)

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 (e.g., human bodies − both conscious and unconscious), manipulating injured body parts, and carrying heavy equipment. Several tasks included in the experiments fall into this category, including splinting extremities, spinal immobilization/back boarding, and patient packaging. Similar to the lifting or heavy workload tasks, larger crews were able to complete the labor intensive tasks using multiple crew members on a single task to assure the use of safe procedures that reduce 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 fall in this category. These include checking vital signs, splinting extremities, intubation with spinal restriction, establishing 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.

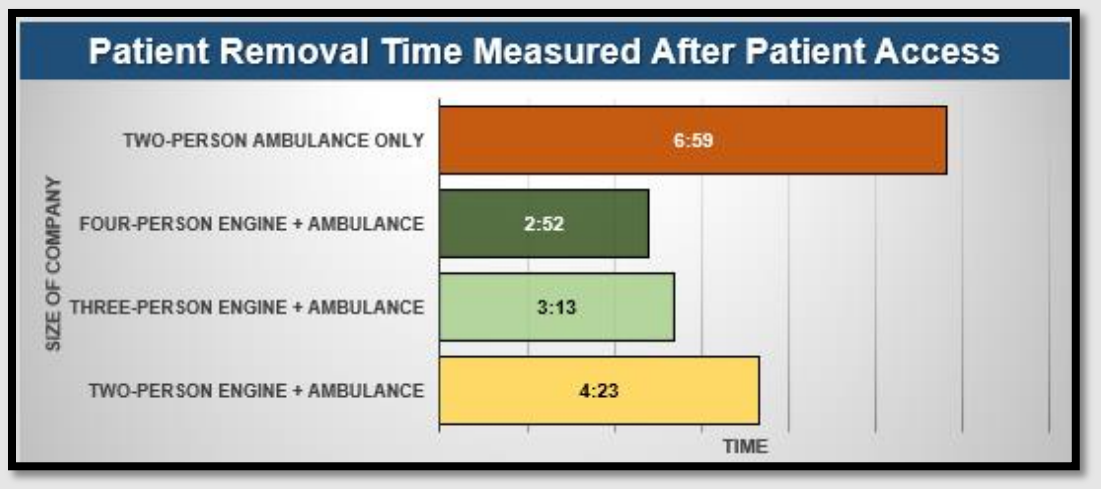
Finally, there are opportunities on an EMS scene to reduce scene time by completing tasks simultaneously rather than sequentially, thus increasing operational efficiency. For the experiments, crews were required to complete all tasks in each scenario regardless of their crew size or configuration. Therefore, 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 comprised of three- or four-person first responders completed removal 1.2 - 1.5 minutes faster than smaller crews with two first responders; all crews with

additional first responders complete removal 2.6 - 4.1 minutes faster than the ambulance-only crew.

Figure 5: Patient Removal Time Measured After Patient Access[19]



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. 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

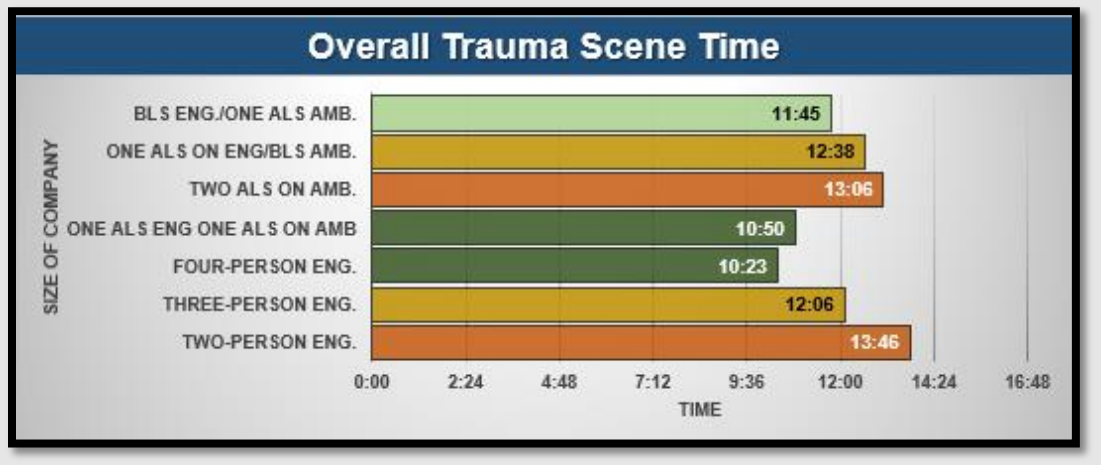
Overall, field experiments reveal that four-person first responder crews completed a trauma response faster than smaller crews. Towards the latter part of the task response sequence, four-person crews start tasks significantly sooner than smaller crews of two or three persons. Additionally, crews with ALS providers 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 in general suggests that 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 one ALS provider on the engine and one ALS provider on the ambulance completed all required tasks 2 minutes 16 seconds faster than crews with a BLS engine and two ALS providers on the

[19] Ibid

ambulance. Additionally, first responders with four-person engines completed all required tasks 1 minute 43 seconds faster than three-person engines and 3 minutes and 23 seconds faster than two-person crews.

Figure 6: Overall Trauma Scene Time[20]



Cardiac

The overall results for cardiac mirror those of trauma. Regardless of ALS configuration, crews responding with four first responders completed all cardiac tasks (e.g., 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 one ALS provider on the ambulance completed all scene tasks (e.g., from at-patient to packaging) more quickly than a crew with a BLS engine and one ALS provider 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.[21] A

[20] Ibid

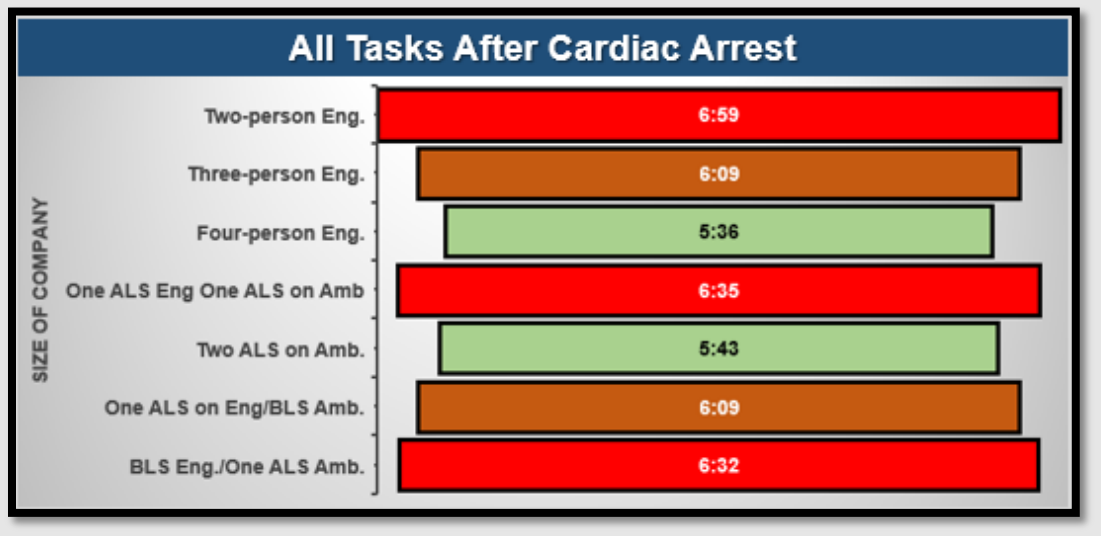
[21] The 12-lead ECG task end time was the arrest start time. In this scenario, there were instantaneously two ALS providers present at the arrest rather than the one ALS provider placing the 12-lead ECG device in the ALS engine/ALS ambulance crew. A review of the patterns of significant findings across task start times showed mixed results. An ALS provider on an engine showed an advantage (sooner task starting times) over an ALS provider on an ambulance for a few tasks located earlier in the cardiac response sequence, specifically ALS vitals and 12-lead ECG through IV access.

first responder company with four-person crew also showed shorter start times for a few early tasks in the cardiac response sequence.[22]

More importantly, a sequential time advantage appears for the last three tasks of the sequence; analyze shock through patient packaging. 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 "at patient time" through "completion of patient 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 engine crews completed all required tasks 33 seconds faster than three-person engine and 1 minute 23 seconds faster than two-person crews.

Figure 7: Time to Complete All Tasks After Cardiac Arrest*[23]*



Summary

Although resource deployment is addressed in the context of three basic scenarios,[24] it is recognized that public policy decisions regarding the cost-benefit of specific

[22] These tasks are inclusive of initial airway, breathing and circulation (ABCs) assessment, ALS vital signs, 12-lead ECG and expose chest sequence.
[23] Ibid
[24] The three scenarios addressed are: patient access and removal, a victim of systemic trauma due to a long distance fall, and a patient with chest pan leading to a cardiac arrest.

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.

Recommendation: *As outlined in the EMS Field Experiments, some EMS call types present situations that cannot be adequately addressed by a two-person ambulance crew. The current NFD practice of dispatching either an ALS fire engine or ALS tower ladder along with the ambulance is a best practice to ensure that patient care needs are met in a timely and safe manner. The same holds true 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., minimizing the need for small-sized crews to repeatedly ascend and descend stairs). This current practice should continue.*

Village of Northbrook

Governance

The Village of Northbrook comprises approximately 13 square miles. The Village operates with a managerial form of municipal government as established by Article 5 of the Illinois Municipal Code, 65 ILCS 5/5-1-1. The Manager is the administrative and executive head of the government for some purposes. The Manager appoints and removes all non-elected officers. Under the code of ordinances, a Fire Chief is appointed by the Manager and serves as the head of the NFD.

The NFD is legally established under the Illinois Municipal Code and Village of Northbrook Code of Ordinances. The Fire Chief is directly responsible for the proper administration and operation of the Department. The Code of Ordinances authorizes the Fire Chief to establish and promulgate binding rules and regulations approved by the Village Manager (§2-252 of Northbrook Code of Ordinances). The established Department structure provides a framework for achieving the NFD's mission, purposes, goals, strategies, and objectives. The organizational structure can only be reorganized with by approval of the Village Board.

All items to be considered by the Village Board are heard in scheduled semi-monthly public sessions. The Fire Chief submits material to the Village Manager for consideration and meets periodically with the Village Board of Trustees to address the legislative needs of the Department. The Chief and his team provide follow-up reports and proposals specific to issues identified during those consultations.

The Village Board reviews and approves programs and basic Department policies through reviews and audits conducted by the Village Manager and Human Resources. The NFD organizational chart submitted by the Fire Chief as part of the annual budget proposal becomes part of the approved budget document. The budget also includes personnel allocation levels; all positions are specified by job descriptions.

Northbrook Rural Fire Protection District

Governance

The Northbrook Rural Fire Protection District (NBRFPD) was established for the purpose of providing fire and emergency medical transport services to residents and businesses in areas outside the Village of Northbrook's corporate limits. NBRFPD was created by State of Illinois statute as a taxing mechanism to generate revenue for fire department services. The NBRFPD is an independent governmental body that is comprised of three township appointed trustees, with the Northbrook Fire Chief and Village's Chief Financial Officer serving as liaisons. The NBRFPD Trustees administer the funds through a contract for services with the Village of Northbrook.

The NBRFPD is comprised of three and a half square miles that includes tollways, forest preserves, residential and commercial land. The District includes the unincorporated areas of Northfield Township bordered by Lake Cook and Willow Roads, and from the Des Plaines River to the Eden's Expressway[25] and incorporated areas of the Village of Deerfield south of Lake Cook Road. This geographic area is included in the response area of the NFD.

The NBRFPD pays for services through a long-standing intergovernmental agreement (IGA) which reflects total emergency service call load generated by the District as compared to the total emergency call load the NFD responds to within Village corporate limits. The District's emergency call load contributes approximately 13 to 14% of the total NFD's call volume and, therefore, is responsible for the same percent of the total Fire Department budget and other supporting services including Public Works mechanics, Finance Department, and pension funding. Property tax revenue is the District's sole revenue source.

[25] The bulk of the areas served include unincorporated Cook County parcels in Glenbrook Countryside, Mission Hills, Citation Lake, Northbrook West, Mission Hills Estates, pockets of properties along Techny Road and Sunset Ridge Road, and portions of the Village of Deerfield south of Lake Cook Road.

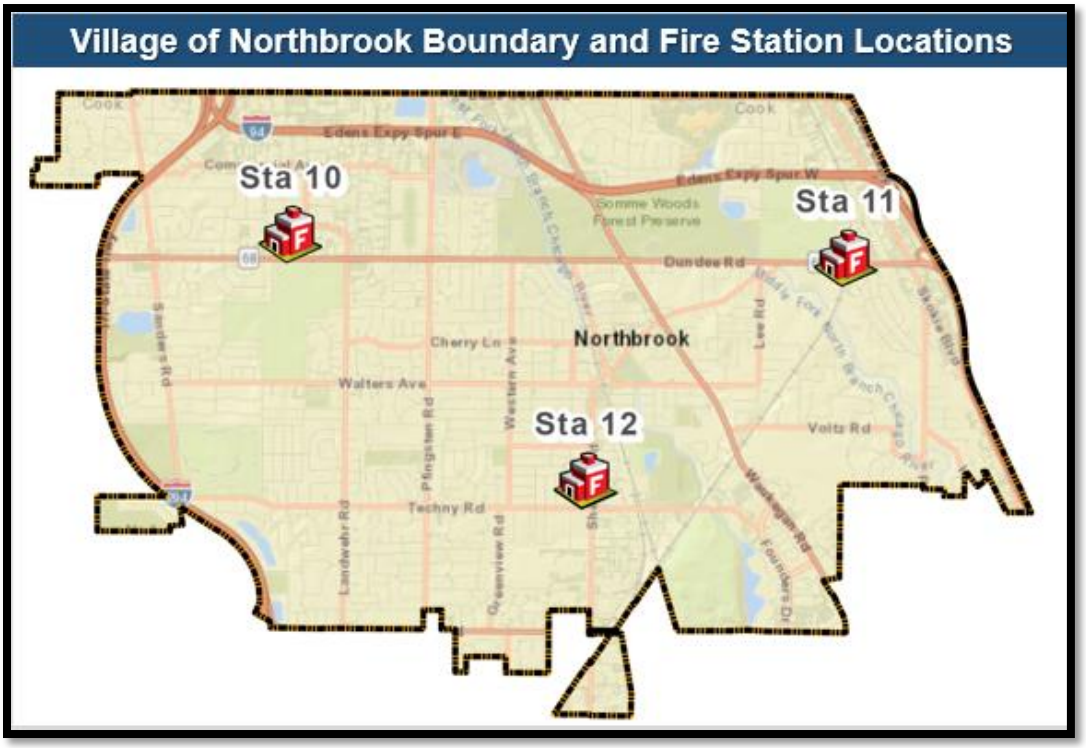
Northbrook Fire Department

Overview

The NFD is a full-service fire and EMS organization designed to provide essential public safety and emergency services to a growing population base. The Department's command staff is comprised of one Fire Chief and two Deputy Chiefs. The command staff is supported by a Management Analyst and two Administrative Clerks.

Since August 1996, the Department has deployed a three-fire station plan[26] and staffs on each shift a minimum of one Battalion Chief, two advanced life support (ALS) engine companies, one ALS tower ladder company, and three ALS ambulances. When possible, a rescue company is staffed. The Department operates a three-shift system and has established a minimum staffing of 16, optimal staffing of 18, and maximum staffing of 22 firefighters per shift, per day. All stations are currently staffed by full-time firefighter paramedics, with a minimum of three firefighters per company assigned to all front-line engine and tower ladder companies.

Figure 8: Village of Northbrook Boundary and Fire Station Locations



[26] Station #10 is located at 650 Huehl Rd., Station #11 is located at 740 Dundee Rd, and Station #12 is located at 1840 Shermer Rd.

NFD Public Protection Classification

The ISO last surveyed NFD in September 2017 and assigned the NFD a Class 1 rating, which is the rating for the best level of service. A rating breakdown of the most recent ISO survey is shown in Table 3.

Table 3: Northbrook Fire Department 2017 ISO Survey Rating Breakdown

ISO Criteria	Earned Credit	Credit Available
Emergency Communications	8.72	10.00
Fire Department	49.96	50.00
Water Supply	32.50	40.00
Divergence	-3.73	0.00
Community Risk Reduction	4.27	5.50
Total Credit	**91.72**	**105.50**

NFD received a total credit of 91.72 points out of a possible 105.50. The fire department section of the FSRS reviews engine and ladder-service companies, equipment carried, response to fires, training and number of available firefighters. Table 4 shows a detailed breakdown of the classification assigned to NFD from the September 2017 ISO survey.

Table 4: Northbrook Fire Department 2017 ISO Survey Apparatus Classification Credit

Fire Department Credit Given	Earned Credit	Credit Available
Engine Companies	6.00	6.00
Reserve Pumpers	0.50	0.50
Pumper Capacity	3.00	3.00
Ladder-Service Companies	3.95	4.00
Reserve Ladder-Service Companies	0.49	0.50
Deployment Analysis	8.19	10.00

Fire Department Credit Given	Earned Credit	Credit Available
Company Personnel	17.80[27]	15.00
Training	8.03	9.00
Operational Considerations	2.00	2.00
Total Credit	**49.96**	**50.00**

Budget

The NFD's FY 2022/23 budget is $13,665,780.00, which represents 28% of the Village's General Corporate Fund allocations for the fiscal year. The NFD's budget is primarily consumed by personnel expenses inclusive of salaries, overtime, benefits, and other compensation. The second largest budget expense is for contractual services that are largely comprised of costs for the operation and repair of facilities, equipment, and dispatching services, followed by commodity expenses and capital outlay.

Table 5: Northbrook Fire Department Budget[28]

Account Category	FY19 Actual	FY20 Actual	FY21 Actual	FY22 Estimate	FY 23 Approved
Personal Services	8,508,313	8,624,452	8,824,960	8,993,740	9,492,305
Fringe Benefits	1,269,824	1,271,353	1,281,053	1,341,025	1,459,180
Contractual Services	1,278,751	1,297,715	1,290,722	1,317,015	1,456,705
Commodities	441,808	427,214	413,685	451,970	467,590
Foreign Fire Insurance	61,646	61,633	70,866	399,775	395,000
Total Operating	**11,560,342**	**11,682,367**	**11,881,286**	**12,503,525**	**13,270,780**
Capital Outlay	1,728,627	736,348	437,962	738,970	0
Total For Department	**13,288,969**	**12,418,715**	**12,319,248**	**13,242,495**	**13,270,780**

[27] ISO provides credit for firefighters who staff ambulances or other units that serve the general public if they participate in firefighting operations, allowing the earned credit to exceed the credit available.
[28] The annual budget reflects operations and capital expenses but does not include pension contributions.

Capital Assets

Fleet

NFPA standard 1901 is used by the fire service for fire apparatus.[29] NFPA 1901 states that:

> *"To maximize firefighter capabilities and minimize risk of injuries, it is important that fire apparatus be equipped with the latest safety feature and operating capabilities. In the last 10 to 15 years, much progress has been made in upgrading functional capabilities and improving the safety features of fire apparatus. Apparatus more than 15 years old might include only a few of the safety upgrades required by the recent editions of the NFPA fire department apparatus standards. Because the changes, upgrades, and fine tuning of NFPA 1901 have been truly significant, especially in the area of safety, fire departments should seriously consider the value or risk to firefighters of keeping fire apparatus more than 15 years in first-line service.*
>
> *It is a generally accepted fact that fire apparatus, like all types of mechanical devices, have a finite life. The length of that life depends on many factors, including vehicle mileage and engine hours, quality of preventative maintenance program, quality of driver training program and rules enforcement, whether the vehicle was used within the design parameters, whether the fire apparatus was manufactured on a custom or commercial chassis, quality of workmanship by the original manufacturer, quality of the components used, and availability of replacement parts, to name a few. In the fire service, there are fire apparatus with eight to 10 years of service that are just plain worn out or are not within emission standards. Alternatively, there are also fire apparatus that were manufactured with quality components, that have had excellent maintenance, and that have responded to a minimum number of incidents that are in serviceable condition after 20 years. Most would agree that the care of fire apparatus while being used and the quality and timeliness of maintenance are perhaps the most significant factors in determining how well a fire apparatus ages."*

NFPA 1901 points out many key elements that should be considered when assessing the useful life of fire department apparatus, with firefighter safety and vehicle emission standards being primary factors to consider when assessing apparatus life span. Many older apparatuses do not meet the current safety and emission standards for newer fire

[29] NFPA 1901 Standard (2016 Ed.) Annex D Guidelines for First Line and Reserve Fire Apparatus

apparatus. Newer fire apparatuses incorporate many technological, safety, and emission changes that are consistent with commercial automotive industry standards.

Apparatus

Fire apparatus are unique and expensive pieces of equipment, customized to operate efficiently for a specifically defined mission. Table 6 profiles the apparatus assigned to each NFD fire station. PolarisPSS determined mechanical condition rating through visual inspection and a review of the records provided by NFD.

Table 6: Northbrook Fire Department Stations and Apparatus[30,31]

NORTHBROOK FIRE DEPARTMENT – STATION #10											
Designation	**Type**		**Year**		**Make**	**Model**				**Front Line/Reserve**	
Engine 10[32]	ALS Engine		2021		Pierce	Impel Pumper				Front Line	
	Pump Capacity	1500	**Tank Capacity**	500	**Mechanical Condition**	Excellent					
Designation	**Type**		**Year**		**Make**	**Model**				**Front Line/Reserve**	
Engine 10-R	ALS Engine		2004		Pierce	Saber Pumper				Reserve	
	Pump Capacity	1250	**Tank Capacity**	500	**Mechanical Condition**	Excellent					
Designation	**Type**		**Year**		**Make**	**Model**				**Front Line/Reserve**	
Ambulance 10	Ambulance		2018		Horton	Freightliner				Front Line	
Designation	**Type**		**Year**		**Make**	**Model**				**Front Line/Reserve**	
Ambulance 10-R	Ambulance		2014		Horton	Freightliner				Reserve	

[30] All apparatus are ALS-equipped.
[31] Staff vehicles are excluded.
[32] An ALS engine is a primary response unit for most types of service requests equipped with a pump and ability to carry water.

NORTHBROOK FIRE DEPARTMENT - STATION #11											
Designation	**Type**		**Year**	**Make**		**Model**			**Front Line/Reserve**		
Pumper/Squad 11	ALS Pumper/Squad		2017	Pierce		Impel Pumper Squad			Front Line		
	Pump Capacity	1500	**Tank Capacity**	500	**Mechanical Condition**	Excellent					
Designation	**Type**		**Year**	**Make**		**Model**			**Front Line/Reserve**		
Engine 11	ALS Rescue Pumper		2015	Pierce		Impel Pumper			Reserve		
	Pump Capacity	1500	**Tank Capacity**	500	**Mechanical Condition**	Excellent					
Designation	**Type**		**Year**	**Make**		**Model**			**Front Line/Reserve**		
Tower 12-R[33]	ALS Truck		2009	Pierce		Velocity Platform			Reserve		
	Pump Capacity	1500	**Tank Capacity**	300	**Mechanical Condition**	Excellent					
	Aerial Type	Platform	**Height (FT)**	100							
Designation	**Type**		**Year**	**Make**		**Model**			**Front Line/Reserve**		
Ambulance 11	Ambulance		2017	Horton		Freightliner			Front Line		
Designation	**Type**		**Year**	**Make**		**Model**			**Front Line/Reserve**		
Battalion 11	Command Vehicle		2017	Ford		Expedition			Front Line		
Designation	**Type**		**Year**	**Make**		**Model**			**Front Line/Reserve**		
Battalion 10	Command Vehicle		2015	Ford		Expedition			Reserve		

[33] A tower ladder is specialized apparatus used for structure fires, rescues, and other service requests equipped with long ladders, salvage, overhaul equipment, rescue tools, and ALS equipment.

NORTHBROOK FIRE DEPARTMENT - STATION #12											
Designation	**Type**	**Year**	**Make**		**Model**		**Front Line/Reserve**				
Engine 12	ALS Engine	2008	Pierce		Impel Pumper		Reserve				
	Pump Capacity	1250	**Tank Capacity**	500	**Mechanical Condition**		Excellent				
Designation	**Type**	**Year**	**Make**		**Model**		**Front Line/Reserve**				
Rescue 12[34]	ALS Rescue	2018	Custom Rescue		Freightliner		Front Line				
	Pump Capacity	None	**Tank Capacity**	None	**Mechanical Condition**		Excellent				
Designation	**Type**	**Year**	**Make**		**Model**		**Front Line/Reserve**				
Tower 12	ALS Truck	2019	Pierce		Velocity Platform		Front Line				
	Pump Capacity	1500	**Tank Capacity**	300	**Mechanical Condition**		Excellent				
	Aerial Type	Platform	**Height (FT)**	100							
Designation	**Type**	**Year**	**Make**	**Model**		**Front Line/Reserve**					
Ambulance 12	Ambulance	2021	Horton	Freightliner		Front Line					
Designation	**Type**	**Year**	**Make**	**Model**		**Front Line/Reserve**					
Ambulance 12-R	Ambulance	2016	Horton	Freightliner		Reserve					

Fleet Maintenance

The Village's Public Works Department is responsible for maintaining all apparatus in the NFD's fleet.

NFPA standard 1901 documents proper vehicle maintenance requirements. Proper maintenance in accordance with the manufacturer's guidelines is strongly recommended to optimize apparatus performance, maintain warranty coverage opportunities, and provide legal protection if the apparatus were to malfunction. Documentation on all maintenance and repair activities must be maintained for each apparatus.

[34] A rescue apparatus is specialized vehicle that is designed to transport and provide the specialized equipment necessary for use at the emergency scene.

Underwriters Laboratories (UL) conducts the annual inspection and testing of the NFD's tower ladders and all ground ladders. UL's procedures conform to the highest standards in the industry.

NFD has a regular preventive maintenance (PM) plan in place. As additional work order repairs are requested, provided that there is no immediate safety issue, work orders are added to the PM schedule, allowing for apparatus down time to be minimized.

PolarisPSS conducted a visual inspection of the apparatus to confirm the apparatus conditions reported by Village of Northbrook's Public Works Department Fleet Maintenance Division and determined that the units are in very good to excellent condition based on their individual age. The older apparatus showed no signs of fluid leaks typical of apparatus 10 years of age. All exteriors are well maintained and interiors are very clean, showing signs of dedicated effort to maintain cleanliness.

Recommendations:
Continue to use UL for annual testing of NFD's tower ladder apparatuses and all ground ladders.

All mechanics who work on fire apparatus should obtain the Emergency Vehicle Technician (EVT) certification as recommended by the manufacturer of each apparatus so that the maintenance performed supports peak performance.

Include the provision of apparatus-specific training for EVTs in vehicle purchase contracts.

Apparatus Replacement Schedule

The cost of fire and EMS apparatus continues to increase. Recently, several PolarisPSS consultants attended the International Fire Department Instructors Conference in Indianapolis, Indiana and spoke with several large manufacturers about the changing market. One manufacturer stated that during 2022 there have been significant increases in the cost of the various apparatus, reductions in availability, and increases in production time. The lead time for fire apparatus from the design phase through order processing and delivery is currently estimated to be 18 to 24 months. Manufacturers of ambulances are also facing lengthy production timelines secondary to the extremely limited availability of chassis and parts.

Many of the fire apparatus once considered a 25-year investment no longer have that expected useful service life. More frequent dispatch of fire apparatus to respond to the increased EMS call volume increases the daily wear and tear on these apparatuses. For many fire departments, 10 years as a front-line apparatus followed by 10 additional

years as a reserve apparatus tends to be a more realistic planning factor for apparatus useful service life.[35]

The NFD's current ambulance replacement plan anticipates seven years of front-line service and four additional years in a reserve status.

After review of the NFD's current Apparatus Replacement Plan (ARP)[36] (Appendix E) and confirming the current apparatus inventory assessments, PolarisPSS recommends that the current ARP should remain in place.

Recommendations:
Continue to support the current ARP that includes a replacement schedule consistent with NFPA 1901 Standard for Automotive Fire Apparatus recommendations.

NFD should routinely review and adjust the ARP to ensure the anticipated service demand increases can be met with the current fleet. Expected delays between order submission and delivery of a new apparatus, as well as cost increases affecting the marketplace should continue to be considered during the plan review.

Facilities

Fire department facilities must be designed and constructed to accommodate both current and forecasted trends in fire service vehicle type and manufactured dimensions. A facility must have sufficiently sized bay doors, circulation space between garaged vehicles, departure and return aprons of adequate length and turn geometry to promote safe response, and floor drains and oil separators to satisfy environmental concerns. Station vehicle bay areas should consider rotating assets of MABAS Division 3 that are required to be housed, even if this consideration merely incorporates civil design that ensures adequate parcel space for future construction of additional bays.

Fire facilities must support responders in performing daily duties while minimizing exposure to and cross-contamination of administrative and living spaces with hazardous substances such as diesel exhaust and fire contaminants on the outside of bunker gear. Fire station facilities must have storage areas for essential equipment and supplies; space and amenities for administrative work, training, physical fitness, laundering, meal preparation, and personal hygiene; and, where a fire department is committed to minimize "turnout time," bunking accommodations.

[35] Anticipated timeframes assume compliance with apparatus manufacturer's maintenance recommendations.
[36] Revised January 26, 2022

Community fire-rescue protection requires strategic distribution of fire station facilities to ensure effective service area coverage is achieved, predicted response travel times satisfy prevailing community goals and national best practices, and the facilities are capable of supporting mission-critical personnel and vehicle-oriented requirements and needs.

Findings

The NFD operates three fire-service facilities. Each shift has a minimum staffing of 16 personnel, five firefighters/officers at each station and one Battalion Chief. Each station has a minimum of a three-person engine or tower ladder company and a two-person ALS ambulance. All three stations house auxiliary response rolling stock such as specialty response apparatus, trailers, reserve fire apparatus, MABAS Division vehicles on rotation, and support vehicles. On an as needed basis, specialty apparatus are staffed with qualified personnel.

The Village has changed and grown dramatically in the last 26 years. It is important to note that during the past 33 years the Village of Northbrook has experienced population growth, increased residential housing, and commercial and retail business expansion. In 1989 the Village determined that Station #11, built in 1971, was in need of a major addition. In 1996, Station #10 was relocated and Station #12 was constructed to meet the increasing demands for emergency services and improve response times. In 2001 the NFD added a third ambulance to reflect the growing demand of the community.

Table 7 provides a profile and brief overview of each fire station location. An assessment of the physical adequacy and condition of each fire station is outside the scope of this report.

Table 7: Fire Station Locations[37]

Station #10	650 Huehl Rd. , Northbrook, IL 60062	
	**Year Built**	1996
	Year Remolded (if applicable)	N/A
	Number of Apparatus Bays	3
	Dormitory Capacity	8
Station #11	**740 Dundee Road, Northbrook, Il 60062**	
	**Year Built**	1971
	Addition Built	1989
	Number of Apparatus Bays	3
	Dormitory Capacity	9
Station #12	**1840 Shermer Road, Northbrook, IL 60062**	
	**Year Built**	1996
	Year Remolded (if applicable)	N/A
	Number of Apparatus Bays	3
	Dormitory Capacity	8

[37] The facilities were not studied as part of this report

Recommendation: *The Village of Northbrook should conduct a space needs analysis that is inclusive of a current condition assessment to determine long term facility needs and inform recommendations for refurbishment/remodeling of current facilities and/or for new facility construction.*

See Section Ideal Station Locations, page 124, for station location recommendations.

Administrative Functional Responsibilities and Structure

All line and staff officers have been given the opportunity to assume additional duties within the Department. Officer-level personnel have functional work responsibilities in addition to emergency response. For example, additional duties include vehicle maintenance and fleet management, respiratory protection compliance, and training. Beyond ensuring the NFD achieves compliance with performance and industry standards, additional duties serve to prepare individuals for future promotion and advancement opportunities.

Table 8: Fire Department Functional Assignments

Fire Department Functional Assignment	Rank of Staff Person Responsible	Schedule
Fire Prevention Bureau	Fire Marshal	full-time (40 hrs./week)
• Fire Inspector (2)	Inspector	full-time (40 hrs./week)
• Fire Inspectors (4)	Firefighter/Paramedics	part-time position (7g)
• Public Education Officer	Firefighter/Paramedic	part-time position (7g)
• Training & Safety	Battalion Chief	full-time (40 hrs./week)
• Assistant Training Officer	Lieutenant	part-time position (7g)
• Drill Masters (3)	Firefighter/Paramedics	part-time position (7g)
Logistics/Facilities/Grounds	Battalion Chief	Line Officers (24-hour shift) with additional responsibilities and duties
EMS Medical Officer	Battalion Chief	
• Assistant Medical Officer	Captain	
• EMS Supplies/AED	Lieutenant	
Fleet	Captain	
• Tools and Equipment	Lieutenant	
• Thermal Imaging Cameras (TIC)/Meters	Lieutenant	
• Foam/Hose & Appliances	Lieutenant	
Special Operations	Captain	
• Haz Mat Team Leader	Lieutenant	
• Technical Rescue Team Leader	Lieutenant	
• Dive/Underwater Rescue Team Leader	Lieutenant	

• Fire Investigation Team Leader	FT Inspector	
Plans/Reporting/QA	Battalion Chief	
• Site Plans	Lieutenant	
Respiratory Protection/SCBA/Fit Testing	Lieutenant	
Radio/Communications	Lieutenant	
Turnout Gear/PPE	Lieutenant	
Quarter Master/Uniforms/Awards	Lieutenant	

Recommendations:
Complete a strategic planning process to establish a shared understanding of the Department's strategic priorities, objectives, key outcomes, and action initiatives.

Conduct an in-depth analysis of job responsibilities for each position once the second Deputy Chief position is filled.

Update written job descriptions for each position, including qualification requirements of the person filling the position.

Establish a project management reporting system to track the monthly progress with project and program implementation progress.

Submit monthly and annual reports to Village management to provide updates on activities within each NFD division.

NFD currently operates with several non-sworn personnel assigned to administrative support. The administrative support positions include one Management Analyst and two Administrative Clerks. These three positions provide critical support for all Department administrative functions. The value of administrative support cannot be overstated as the work of these staff members enables Department leadership to concentrate on other areas of operation.

Table 9: Fire Department Administrative Support Functions

Fire Department Administrative Support Positions	Primary Responsibilities
Management Analyst[38]	• Budget administration • Capital Improvement Plan (management) • Document/inventory disposal • Scheduled leave • Personnel files • Advice of Status • FOIA Officer • Payroll oversight
Administrative Clerk	• Ambulance billing • Accounts payable • Petty cash • PO processing • EMS FOIA
Administrative Clerk	• Desk reception • Payroll entry • Fire Permit Coordinator • Notary • FPB scheduling/filing • Department rosters • False alarm billing • Department photos

Recommendation: *Conduct a job task analysis to provide management with objective criteria needed to identify current job responsibilities and tasks assignments. As necessary, realign tasks and/or hire additional support personnel to address workload issues.*

[38] With the addition of the second Deputy Chief position, effective November 1, 2022, some of the Management Analyst's primary responsibilities are anticipated to change.

EMS Billing Program

NFD utilizes an in-house billing program. An Administrative Clerk spends approximately 70% of the time administering this program. EMS billing collection revenue generates approximately $1.6 million annually. The Department has enrolled in the Ground Emergency Medical Transport (GEMT) Program and will become an active participant on January 1, 2023.

Recommendations:

Provide Certified Ambulance Coder training to staff members responsible for EMS billing.

If time spent by the Administrative Clerk processing EMS billing approaches 80% full-time equivalent, the Village should evaluate whether an outside contractor would be more cost effective for processing EMS billing.

Conduct one-year evaluation of GMET participation.

Northbrook Fire Department Services and Programs

Fire Prevention Bureau

The Northbrook Fire Prevention Bureau (FPB) is comprised of three full-time members,[39] a Fire Marshal and two Inspector/Investigators. An Administrative Clerk splits time between the FPB and Fire Administration. Staffing is supplemented by off-duty firefighters who are permitted to work as Fire Inspectors per the Department's 7G Side Letter Agreement (Appendix E) with the Collective Bargaining Unit, IAFF Local 1894;[40] five firefighters are currently working per the terms of this agreement. The hire-back Fire Inspectors are commonly known as 7G Fire Inspectors.

The three full-time FPB employees handle most of the day-to-day administrative functions and core FPB tasks. These tasks include, but are not limited to:

- **Annual Inspections:** The schedule of the estimated 3,850 inspections that should be performed annually is currently on an 18-month cycle.[41]
- **Certificate of Occupancy Inspections:** When a new business is being built or renovated, an inspection is required to determine compliance with the code and submitted drawing.
- **System Acceptance Testing (Commercial):** System testing consists of sprinkler hydro-testing, verifying sprinkler head placement, and fire alarm device testing which requires the activation of every installed device.[42] When testing, the Fire Inspector determines compliance based upon the adopted Village Code and NFPA Guidelines.
- **System Testing – Residential:** The Village adopted the NFPA 13D sprinkler requirements for single family homes in 2007. There are now approximately 1000 homes with residential sprinklers.

[39] The Village of Northbrook is a robust community with a large commercial and industrial area that requires significant interaction with the FPB. In the 2023 Budget, a second full-time Fire Inspector was approved. This position will have a positive impact in the productivity of the FPB and will allow the Fire Marshal to focus more on the administrative functions of a supervisor and work on streamlining business processes and improving the use of technology.

[40] The 7G Agreement allows shift personnel to work in the FPB while being paid a special hourly rate that is different from their regular shift rate in order to comply with the Fair Labor Standard Act (FLSA). According to the FLSA, firefighters may not perform "additional" fire related activities for their employers without that time being included as hours worked for FLSA pay computation purposes. The 7G Agreement allows them to perform the duties of a Fire Inspector without violating FLSA requirements.

[41] The number of inspectional properties varies secondary to the determination of the unit of measurement. For example, an office building with 20 suites can count as 21 inspections - one for each business and one for the public areas.

[42] This test includes smoke alarms, heat detectors, flow switches, tamper switches, battery backup, audio-visual devices, and kitchen hood and duct testing.

- **Fire Investigations:** State of Illinois statutes require an investigation for every fire.[43] See *Specialty Teams, Fire Investigations* section.
- **Public Education:** Public education is a unique way to reach out to the residents to share knowledge and provide them with a value-added service from their fire department. Public education includes providing fire safety instruction to primary school-aged children and safety classes such as CPR, baby-sitter safety classes, and Stop the Bleed.
- **Complaint Initiated Inspections:** Complaint initiated inspections occur when a member of the public or building occupant notifies the NFD of what the person believes to be a hazard and requests follow-up.[44]
- **Freedom of Information Act (FOIA) Request Processing:** FOIA requests have increased considerably over the last few years since the law makes it easy to request information from a government entity. Each request takes time to process and ensure the appropriateness of information being shared. Typical types of FOIA requests received include fire reports, ambulance reports, underground storage tank research, and fire inspection history.
- **Special Events Coordination:** The FPB is responsible for the safety of the public during highly populated events in the Village such as the 4th of July, Northbrook Days, and other similar events that occur throughout the summer. Event preparations include meetings with other departments, evaluation of any fireworks displays and carnival rides, tent inspections, and site evaluation for egress and pedestrian safety.
- **Plan Reviews and System Submittals:** Plan review and fire alarm and sprinkler system plan submittals are reviewed for code compliance by a third-party plan reviewer who reviews most of the approximately 300 plans processed by the Village annually.[45] Upon the return of reviewed plans and prior to final approval, the FPB uses the plan for system acceptance testing to ensure the system was installed according to the approved plans.
- **Other Duties:** Addressing FPB work orders initiated by fire companies responding to incidents, resolving fire alarm panel faults, responding to public inquiries, attending meetings, implementing and maintaining software, billing for false fire alarms, preparing budgets, reports, staffing schedules, and complying with FEMA NFIRS reporting requirements.

[43] Fire Safety (425 ILCS 25) Fire Investigations Act
[44] An example of this type of inspection is when someone is burning leaves or using a fire pit and the smoke becomes a nuisance to a neighbor.
[45] The cost of the third-party plan review process is passed along to the developer or submitting party, plus an administrative fee of 10% or $70 whichever is greater.

The Administrative Clerk assists the FPB with scheduling inspections, tracking plan reviews, and processing payments, Freedom of Information Act requests, and alarm billing. Task sharing between these positions appears to work well in this Department.

7G Agreement Staffing

The 7G Fire Inspectors are each assigned an area to inspect. Their productivity contributes to the FPB's ability to work toward completion of the annual inspection cycle.

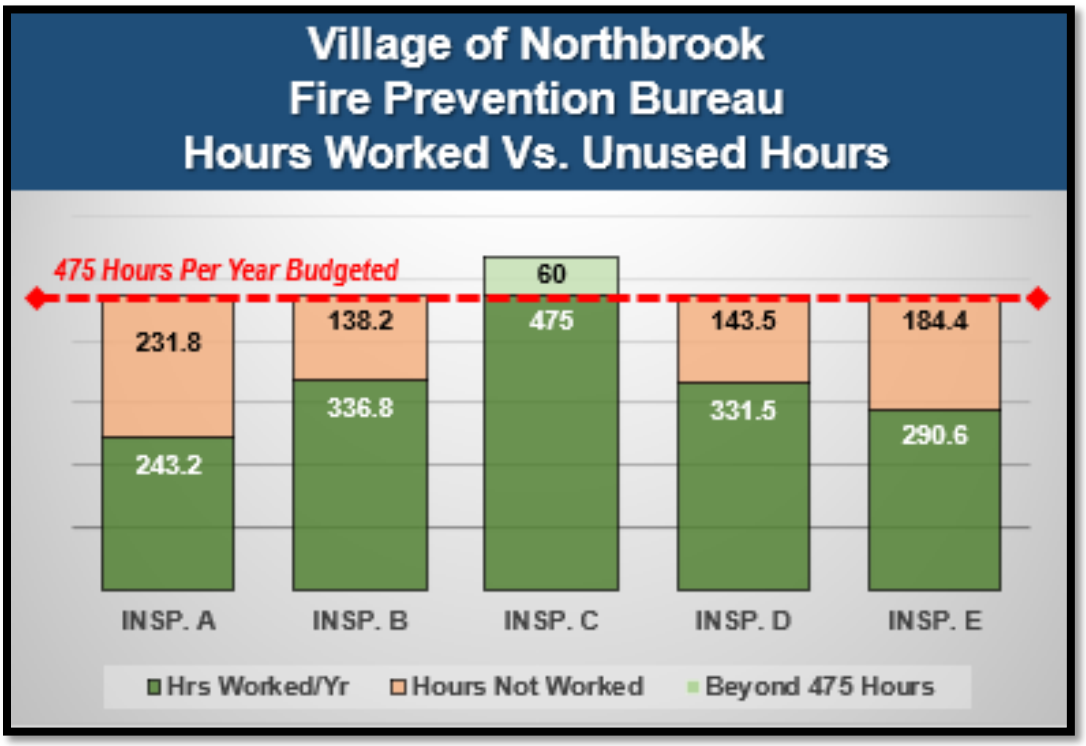
One 7G Fire Inspector is also assigned to Public Education. However, staffing limitations and competing priorities for personnel time continue to plague the Fire Department's Public Education Program.

The 7G Agreement benefits participating firefighters by increasing their knowledge of the duties of a Fire Inspector, how to apply the adopted code, and various systems within a structure. The program also promotes a positive relationship between the Fire Suppression Division and the FPB and serves to support career development.

However, some 7G Fire Inspectors have at times reportedly treated the position as a second priority and their attendance has not always been reliable,[46] causing annual inspections to fall behind. Although the cost to train and equip a firefighter to become a certified Fire Inspector is roughly $15,000, there are no requirements for personnel who receive the Department-funded certification to serve in the capacity as a 7G Fire Inspector for a specified period of time.

[46] Time off to attend to personal matters and opportunities to work an additional fire suppression shift were cited as two reasons 7G Inspectors did not work their scheduled shifts.

Figure 9: Fire Prevention Bureau Hours Worked vs. Unused Hours



Recommendations:

Evaluate the 7G Side Letter Agreement to include a time commitment requirement by individuals applying for the position and pay increases for time in grade. Update FPB ordinances to reflect current practices (e.g., report issuance for code violations).

Increase the focus on education programs that target the age 65 years and older population and identified high-risk target hazards in an effort to enhance occupant safety and preparedness.

Establish a self-re-inspection program for minor violations that allows the occupant to submit written and photographic documentation of violation correction.

Establish a program to allow basic storefronts to complete and certify a checklist every "X "number of years in-lieu of an annual in-person inspection. This program will enable Fire Inspectors to prioritize the in-person inspection of more complex occupancies.

Recommendations Continued:
Continue to pursue partnerships with community groups and businesses to assist with sponsorship and participation in public events. Fire prevention and education programs can reduce the risk of fires and injuries effectively when used as part of the Department's overall prevention strategy. However, it may take months before the prevention and education initiatives become fully effective.

Publish an annual report on the NFD's activities from the preceding year to inform and educate the community about the Department's role in community safety. Documenting the Department's accomplishments will also help to show members the difference they have helped to make within the community.

Fire/Rescue Services

The NFD operates a fire suppression program directed toward controlling and extinguishing fires to protect people from injury or death and reduce property loss. The Department has implemented an incident management system for all emergency responses, regardless of the size or incident complexity, and has adopted and follows the constructs of the National Incident Management System (NIMS). NFD's standard operating procedures (SOP) guide operations during fire incidents.

The NFD's response and deployment standards are based upon the population density and fire demand of the community. Response to a reported fire is primarily two engine companies, two tower ladder companies, two ambulances, a rescue company if staffing allows, and two command officers. Additional resources are deployed as needed. The total response force is reliant on automatic aid from surrounding communities. The NFD has longstanding automatic aid agreements with neighboring fire departments and is part of MABAS Division 3. As such, NFD provides resources to requests for aid within the region and state.

In accordance with the Battalion Chief's job description, the Battalion Chief is responsible for the day-to-day management of their shift. Battalion Chiefs are responsible for identifying trends and factors that may contribute to public and firefighter injuries and deaths and related property and environmental issues. Recommendations resulting from these reviews are typically acted upon by staff, and as appropriate, adjustments to operations and practices are institutionalized through changes to departmental guidelines.

Findings

Based on analysis of information gathered through staff interviews, review of the company training program and current SOPs, PolarisPSS finds NFD's fire suppression companies well prepared to execute their responsibilities in support of the Department's

fire suppression goals and objectives. The physical resources assigned to fire suppression are adequate and inventory records are maintained to ensure the presence of required equipment and supplies.

Emergency Medical Services

The NFD delivers fire protection and ALS emergency medical response in an integrated fashion. The Department operates its EMS service under the rules and regulations set forth by the Illinois Department of Public Health (IDPH).

Personnel Licensure

IDPH is the licensing body for EMT-Basic (EMT-B), EMT-Intermediate, Advanced EMT (A-EMT), and Paramedic (EMT-P) within Illinois. All NFD sworn personnel possess a minimum licensure of A-EMT; sixty-six NFD members hold an EMT-P license. Paramedic licensure is part of the collective bargaining agreement pay grade structure up to and including the rank of Lieutenant/ Paramedic. Ranks above Lieutenant/Paramedic receive a stipend to maintain their EMT-P license.

NFD members receive EMS training through the Highland Park Hospital EMS System. IDPH requires each paramedic to successfully complete 100 hours of continuing education every four years as a condition of re-licensure.[47] To maintain their standing within the Region 10 EMS System, each paramedic must successfully complete 30 hours of annual continuing education inclusive of classroom education and in-hospital training. Currently, NFD has a contractual agreement with the Highland Park Hospital Emergency Medical Services Department to deliver continuing monthly education training at each fire station. The current practice of providing “in-house” training has saved the NFD from paying wages for personnel to attend training sessions when off-duty.

EMS Staffing

IDPH licenses EMS provider agencies and their transport and non-transport vehicles to ensure compliance with equipment and staffing requirements and minimum build standards as adopted by the State. Ambulance staffing models require a minimum of one paramedic per ambulance,[48] Region 10’s EMS System Plan requires two paramedics per ambulance.[49]

NFD operating guidelines require each ALS ambulance to be staffed with two firefighter/paramedics (FF/PM) and each ALS fire apparatus to be staffed with at least

[47] EMS Systems are permitted to establish annual training requirements in excess of IDPH minimums.
[48] 210 ILCS 50/3.85 Vehicle Service Providers
[49] EMS Region 10 Policies and Procedures

one FF/PM,[50] resulting in a minimum requirement of three FF/PM per fire station assigned each shift. NFD consistently complies with its staffing requirements. NFD protocol requires an ALS fire suppression company be dispatched in tandem with the ambulance for all EMS medical calls to provide manpower assistance to the ambulance crew. The ambulance crew is authorized to hold up or defer the suppression company if they think the suppression unit is not needed.

EMS Program Administration

NFD procedures document the administrative management for the EMS program.[51] A Battalion Chief fills the EMS Medical Officer position and serves as the NFD's Designated Infection Control Officer (DICO).[52] The EMS Medical Officer is also responsible for EMS incident investigations, ALS/BLS vehicle licensing, Resource Hospital EMS inspections, hospital/IDPH reporting, new paramedic student coordination, the EMS budget, Northbrook Pharmaceutical Distribution Plan,[53] and serving as the EMS Committee chair.[54] A Captain fills the Assistant Medical Officer position and is responsible for managing the Department's Health Promoting Hospital (HPH) Quality Assurance (QA) and Quality Improvement (QI) Program,[55] paramedic continuing education, tracking paramedic licensures, and blood borne pathogens training. The Assistant Medical Officer also leads the routine review and update of SOPs/Standard Operating Guidelines (SOGs) and development of new SOPs/SOGs, as appropriate. The Lieutenant who fills the EMS Supply/Automatic External Defibrillator (AED) position is responsible for ordering and maintaining EMS supplies and maintaining the AEDs in all Village buildings and vehicles.

The Department maintains a Health Insurance Portability and Accountability Act (HIPPA) Compliance Program and all personnel receive training in complying with the provisions of this Act. Department members are responsible for maintaining privacy and confidentiality of an individual's personal health information in accordance with local, state, and federal requirements. All new employees receive training on HIPPA

[50] NFD Operating Guidelines Subject; Staffing and Region 10 Policies and Procedures
[51] Paramedic licensure is not required to fill the EMS Medical Officer, Assistant Medical Officer, and EMS Supply/AED positions, but individuals holding these positions have historically been an EMT-P.
[52] Person or persons who are responsible for managing a fire department's infection control program and coordinating efforts surrounding the investigation of an exposure (NFPA 1581 3.3.30)
[53] Cook County Department of Public Health's plan developed in collaboration with MABAS Division 3 allows communities to estimate the number of medication doses that may be needed during a public health emergency.
[54] Committee oversees the continuous improvement of NFD's EMS Program.
[55] HPH QA and QI aims to improve the overall quality of health services provided. The Society of Hospital Medicine asserts that one of the key principles of an effective EMS system is demonstrating a commitment to continuous QI and actively participating in initiatives directed at quality and patient safety. This program is used to review calls that NFD responds to and evaluate whether proper protocols and procedures were followed. The reviews are used to improve services and create future training opportunities.

compliance procedures during initial training and all members receive continuing education training on HIPPA.

Recommendation: *Research and evaluate the costs and benefits of a Mobile Integrated Healthcare Program to mitigate the unnecessary use of Village ambulances for non-emergency transports to the hospital.*

Training Division

NFD's Training Division is led by a full-time Battalion Chief who is in-charge of Training and Safety. This Battalion Chief is a member of the administrative staff and works a traditional 40-hour week.

NFD is one of the 15 member agencies participating in a regional training center known as the Northeast Illinois Public Safety Training Academy (NIPTSA). NIPSTA conducts basic training courses and in-service training for all companies and officers, delivers officer development programs, provides specialty training courses, and addresses certification program requirements. NIPSTA's facility is outfitted with many of the resources and structures consistently found in other modern firefighter training facilities. NIPSTA is operated by two full-time staff members and a large roster of contracted subject matter experts.

The NFD maintains a training and education program for all sworn personnel that is consistent with the goals and objectives for operations and training established in the Department's three-year training plan. Program areas and required training needs are identified based upon federal, state, and local laws and administrative requirements, as well as the essential job functions, working conditions, knowledge, skills, and abilities needed to perform anticipated emergency functions as defined in each job position description. The Training Division utilizes monthly training, annual core competencies, and compliance with the Illinois Fire Protection Training Act.

The NFD training program is well organized and meets the needs of the Department and its members. The NFD's programs exceed the state certification requirements. All NFD members complete the *National Fire Protection Association (NFPA) 1001: Standard for Fire Fighter Professional Qualifications - Basic Firefighter* requirements prior to the end of initial recruit training. The use of a comprehensive set of technical competencies that have been established by the Office of the State Fire Marshal (OSFM) is one of the Department's main training program strengths. PolarisPSS' review and analysis of the NFD's Training Division record keeping and reporting process discloses that the NFD does an excellent job in tracking the training status and capabilities of all personnel. Supplemental training programs with mandatory recertification in various disciplines, specialized training, and targeted fire suppression

training are ongoing. Mandatory training and certification levels for all personnel are monitored; updates are provided to identify the training needs for all personnel.

All MABAS special rescue teams have annual minimum training requirements set forth by the MABAS Team Leaders and Fire Chiefs. MABAS personnel are responsible for ensuring that all special rescue team members complete annual training requirements. Each team has its own annual training audit that is reviewed by the Team Leaders and Fire Chiefs responsible for oversight. This system works well to ensure team member training is current and meets MABAS standards.

Table 10: State Certifications of Fire Department Personnel

Village of Northbrook Fire Department: State Certifications of Personnel					
Basic Operations Firefighter	32	Fire Service Instructor III	1	Trench Technician	11
Airport Firefighter	1	Training Program Manager	3	Structural Collapse Operations	12
Advanced Technician Firefighter	60	Basic Fire Prevention Officer	0	Structural Collapse Technician	11
Fire Apparatus Engineer	53	Fire Inspector I	5	Vehicle and Machinery Operations	46
Fire Officer I	30	Youth Fire-setter Intervention Specialist	1	Vehicle and Machinery Technician	13
Company Fire Officer	2	Fire Inspector II	0	Rope Operations	27
Fire Service Executive Support	0	Public Fire and Life Safety Educator I	1	Fire Service Vehicle Operator	42
Fire Department Incident Safety Officer	14	Advanced Fire Prevention Officer	0	Rope Technician	7
Fire Department Health and Safety Officer	3	Fire Investigator	8	Water Operations	4
Fire Officer II	13	Arson Investigator	0	Watercraft Technician	2
Advanced Fire Officer	0	Hazardous Materials Operation	68		
Chief Fire Officer	1	Hazardous Materials Technician	12		
Fire Department Safety Officer	3	Hazardous Materials Incident Command	12		
Fire Service Instructor I	38	Rescue Specialist – Confined Space	12		
Fire Service Instructor II	19	Trench Operations	11		

The NFD utilizes a skills-based evaluation system to ensure firefighters and companies are competent and confident to perform job functions. Individual performance is evaluated during company in-service, officer in-service, post-incident analysis, and annual departmental proficiency training.

Training and education resources, printed and non-printed library materials, media equipment, facilities, and staff are available in sufficient quantity, relevancy, and diversity, and are current. The Department maintains an inventory of its training materials including written manuals, videos, software, and lesson plans. The Battalion Chief of Training and Safety continually evaluates training materials to ensure the materials meet Department goals and reflect the latest information available. Training materials are evaluated based on current applicable NFPA and OSFM standards. Most lesson plans meet the national training requirements. The Battalion Chief of Training and Safety and on-duty and off-duty (7g) shift instructors evaluate all materials as part of the annual budget process. The Battalion Chief of Training and Safety is a member of the MABAS Division 3 Fire Training Committee and the NFD Fire Chief is a member of the NIPSTA Board of Directors. The Fire Training Committee plans the purchase of training props, materials, and conducts training that is based on local fire department needs.

Recommendation: *The Training Division should continue to provide both practical and hands-on learning opportunities and consider an on-line training provider portal for the purpose of accomplishing EMS and fire continuing education requirements.*

Specialty Teams: Fire Investigations, Dive and Water Rescue, Hazardous Materials, Technical Rescue

The NFD operates an adequate, effective, and efficient program for rescuing trapped or endangered persons from any life-endangering incident and is committed to supporting four specialty teams: Fire Investigations, Dive and Water Rescue, Technical Rescue, and Hazardous Materials Response. With the exception of the Fire Investigations Team, the NFD has designated six positions to each team (two per shift). A Captain leads the entire specialty team program; a Lieutenant serves as the Team Leader for each team.

All firefighters are state certified in technical rescue awareness operations and the Department has seven certified rescue technicians that serve as part of the MABAS Division 3 Technical Rescue Program. In addition, all personnel receive regular cold water and ice rescue training consisting of survival suit and swift water awareness training. The Department has designated six certified public safety divers who are outfitted with self-contained underwater breathing apparatus (SCUBA) and underwater communication equipment. All first due companies have awareness level training. MABAS Division 3 has specialized apparatus to support special teams including Air 3,

Rescue 3, and Decon 3, all of which are regional apparatus. Rescue technicians are also available upon request from over 100 other MABAS Divisions.

Standard operating guidelines are written and used for different types of technical rescue incidents such as structural collapse, above ground, confined space, trench collapse, high angle, swift water and submersion, cave-ins and vehicle accidents. All personnel who are part of the Technical Rescue Program are required to complete competencies and training programs annually as part of Department procedures and as part of the MABAS Division 3 Team. MABAS Division 3 command-level personnel are also involved in the review and audit of the program

The Department maintains on its apparatus an inventory of special rescue and heavy rescue equipment. The heavy rescue squad is equipped to initiate a rescue in all technical rescue categories.

Specialty Team Training

The special operations teams represent a group of firefighters that in addition to their firefighting duties and training have elected to diversify and train to meet the challenges and dangers of specific rescue environments. Because of the specialized, often complex, and dangerous nature of special operations, it is imperative that the personnel who engage in these endeavors are well-trained and given opportunities to maintain their skills at the highest level possible. This requires both cognitive and physical training on a regular basis.

Fire Investigations

NFD created a Fire Investigation Team to investigate all reported fires within the Village; and currently has eight Village employees trained to the OSFM Fire Investigator certification. NFD team members include the Fire Marshal, one full-time Fire Inspector, and three part-time Fire Inspectors. The team also includes one individual from the Northbrook Police Department and one from the Village's Department of Planning and Development.

The NFD Fire Marshal is responsible for administering the Fire Investigation Program under the supervision of the Fire Chief.

The Department operates an adequate, effective, and efficient program directed toward origin and cause investigation and determination for fires, explosions, and other emergency situations that endanger life or property. The Village's Code of Ordinances and OSFM regulations have described and defined the responsibility to investigate fires and determine fire origin and cause. The Fire Investigation Team works closely with the Northbrook Police Department, as needed.

The Fire Investigation Program meets the Department's needs for the type of incidents occurring in the Village. It operates under State of Illinois, MABAS Division 3, and the

Department's fire investigation guidelines. Additional staffing and equipment can be requested as needed from MABAS Division 3 and other local, state, and federal resources.

The current staffing level allows the Department to meet its mandate for conducting fire cause determination and fire injury investigations. Investigations are conducted consistent with the *NFPA 921: Guide for Fire and Explosion Investigations, 2008 edition*. Fire investigators are equipped with personal investigative equipment and gear.

The Fire Marshal reviews all fire investigation reports to evaluate the quality of the report and to determine the effectiveness of procedures used by personnel to conduct each investigation. The Department takes appropriate steps as a result of the review.

Hazardous Materials Response Team

The NFD has a comprehensive approach to hazardous materials emergencies wherein personnel on all first-due companies are trained to the operations level. As part of MABAS Division 3 and through scheduled rotation, the Department houses a well-equipped, dedicated hazardous materials unit. Most of the NFD team members are trained to the technician and specialist levels.

In 1986, the Federal Government passed the Emergency Planning and Community Right-to-Know Act (EPCRA) for the purpose of helping communities plan for chemical emergencies. Illinois law requires owners of facilities with specific types and quantities of hazardous chemicals to submit *Tier II* forms to the Illinois Emergency Management Agency (IEMA), Local Emergency Planning Committees (LEPC), and local fire department. For the Village, the Fire Chief is responsible for collecting and disseminating the *Tier II* forms.

The Department's response and deployment standards are based upon the population density and hazardous materials response demands of the community. The targeted service level objectives in the standards of cover benchmark statements are based on industry standards and best practices, as identified earlier in this report.

The NFD operates an adequate, effective, and efficient hazardous materials program directed toward protecting the community from the hazards associated with fires and uncontrolled releases of hazardous and toxic materials. The Department equips all front-line engines, the tower ladder, and the rescue squad with a small equipment cache to handle minor gas and fuel leaks. Larger hazardous materials responses are handled by the two scheduled on-duty technicians and personnel from the MABAS Division 3 hazmat team.

The Department and MABAS SOGs describe what is expected of its members during hazardous incidents. MABAS requires a complete annual review of SOGs; hazmat team members complete the initial review and senior management reviews and approves any

recommended changes. The emergency incident type response plan and a tactical worksheet are used during hazmat incidents to ensure that the company officers consider all appropriate elements of hazmat response to keep responders safe while mitigating the incident.

The Department uses multiple systems to document the activity of team members and capture information from hazardous material incidents for post-incident analysis. Hazmat post incident reviews and regular hazmat team leader meetings also provide ongoing and regular evaluation of the hazardous material response program.

All personnel who are part of the hazardous materials team are required to complete annual competencies and training programs as part of departmental procedures and as part of the MABAS Division 3 Team. MABAS Division 3 command-level personnel are also involved in reviewing and auditing the program.

Recommendation: *Enter information contained in the hazardous materials statistical data sheets into the Department's Firehouse Record Management System so that it is available to Department and specialty team leadership to use this information as part of the annual evaluation of hazmat program performance.*

Emergency Management Program

Staffing

The Village of Northbrook's Fire Chief was appointed by the Village Manager to serve as the Village's Coordinator of the Emergency Management Agency (EMA) (Northbrook Ordinance Article IV §3-98). There are no additional budgeted positions within the Fire Department or another Village department that are dedicated to performing EMA functions. The Fire Chief, however, may assign a staff member to assist as needed.

Recommendation: *To enable the Village to operate a fully functioning Emergency Management Agency pursuant to Northbrook Ordinance Article IV §3-96, the Village should identify existing positions that will assume responsibility for the functions identified in Northbrook Ordinance Article IV §3-99. The Village should consider dedicating and budgeting additional positions to ensure performance of and compliance with IEMA requirements such as emergency management planning, training, and exercise functions.*

Planning

In a resolution dated September 28, 2004, the Village officially committed to adopting the use of NIMS and managing all emergency incidents and preplanned events through use of the incident command system (ICS) organizational structure, doctrine, and procedures. NFD leadership reported that the Department's SOPs for incident response

conforms to ICS doctrine and that established training plans ensure Department members remain compliant with NIMS training requirements. All firefighters are required to complete IS-100, IS-200, and IS-700 and all sworn personnel at the rank of Captain or above must also complete ICS-300 and ICS-400. However, the Village does not maintain a designated NIMS Coordinator and the status of NIMS training compliance for other Village employees is unknown. Village departments maintain comprehensive inventories of all apparatus and equipment, but these resources are not typed according to NIMS standards provided in *NIMS Guideline for Resource Management Preparedness, June 2021*.

The Village's Emergency Operations Plan (EOP) was last updated and certified in 2011 by the Cook County Emergency Services and Disaster Agency (ESDA), now known as the Department of Emergency Management and Regional Security (DEMRS). Pursuant to 29 Il Administrative Code 301.520(b) the certification is effective for at least two years, but no longer than four years. The Cook County certification has lapsed, but since the Village is not a mandated EMA pursuant to 20 ILCS 3305/10, it is not required by state law to have a certified EOP. IEMA permits municipalities to submit EOPs for recertification to the county ESDA every 2-4 years.

Although provided for in the EOP, the Village does not formally engage in an annual review and exercise of the Plan. PolarisPSS noted a number of content areas within the EOP that require update in order to reflect current standards. Please see Appendix D.

The Village's Emergency Operations Center (EOC) is located in the lower level of Station #11. Although it has not been activated for an emergency in a number of years, the Village continues to invest resources to maintain its EOC capability. The EOC supports six fully operational workstations and has the space to support 2-4 additional reduced-technology workstations. The Village's Emergency Management Coordinator maintains pre-packaged boxes of information and resources (e.g., phone, job checklists, ICS forms) that upon EOC activation are distributed to personnel staffing each workstation to assist staff with execution of their duties and responsibilities. EOC capabilities have not been exercised within the past five years.

The EOC facility has a back-up generator to provide emergency power. The EOC's communication capabilities have not been upgraded within the last five years. The hardware at each workstation supports access to phones, the internet, and the Village's Police Department radio system, which includes the Illinois STARTCOM21 system. Fiber lines are used to support internet and telephone capabilities. The EOC houses a fully functional police dispatch console that can be used to maintain 911 police dispatch capabilities if the primary dispatch capability were to be compromised.

The Village does not formally maintain a Joint Information System, but the Village's Communication Coordinator is responsible for information and communications

functions on behalf of the Village government during large scale incidents. As dictated by incident circumstances, the Communication Coordinator works with Village agencies and community stakeholders to manage information release and distribution and serves as the Village's lead point of contact for public information coordination.

During the COVID-19 pandemic and in response to Emergency Management Assistance Compact requests, the Fire Chief worked with the Village's Finance Department to track and/or project the cost of response activities. The Village currently does not have a defined written procedure for the real-time tracking of expenses from the start of an incident.

The Village of Northbrook actively participates in the Cook County Hazard Mitigation planning process and maintains a Village-specific plan. In his capacity as the Village's Emergency Management Coordinator, the Fire Chief coordinates with other Village departments to annually update the Village's Hazard Mitigation Plan. Village departments continue to actively work toward achieving defined mitigation objectives.

Recommendations:

The Village EOP requires a comprehensive review and update. See Appendix D for an overview of requirements that must be addressed in the EOP update. Once updated, the EOP should be submitted to the Cook County Department of Emergency Management and Regional Security for re-certification.

Document EOC operational procedures (e.g., process for how incident action plans are developed, briefings conducted) and assign responsibility for the performance of emergency management functions within the EOC (e.g., EOC management, routine testing to communication equipment, conduct of after action reviews).

Incorporate opportunities to test EOC functionality, both in terms of operational procedures and technology resources, to aid the Village in identifying areas that require additional planning, training, and/or resourcing.

Test all EOC resources (e.g., resources in the information boxes) for functionality on a routine basis and updated as necessary. Document the role of the Finance Section Chief and train personnel to fill this position.

Develop a procedure for the real-time tracking of incident expenses that can be universally implemented by all Village Departments.

Training

Apart from NIMS training required by their positions within the Fire Department, neither the Fire Chief nor Deputy Fire Chief have completed training to prepare them to fulfil their emergency management roles. It is unknown whether other Village personnel have completed any formal emergency management training.

Recommendations:

The Illinois Emergency Management Agency (IEMA) and the federal Emergency Management Institute (EMI) offer free training on a wide range of emergency management topics. At a minimum, the Village's Emergency Management Coordinator(s) should complete IEMA's 8-hour New Coordinator's Workshop and the Illinois Professional Development Series training requirements. The workshop is designed to provide new local emergency management agency coordinators an overview of their responsibilities in relationship to their local government and the state and covers how the content of the Illinois Emergency Management Act and current requirements outlined in the Illinois Emergency Management Agency Administrative Rules affect local jurisdictions. The seven on-line and six discussion-based classroom courses that comprise the Professional Development Series are designed to provide an introduction to the wide range of responsibilities for which emergency managers must be prepared. The Village may wish to consider requiring position-specific emergency management training for certain Village positions that have a specialized role in supporting emergency management operations (e.g., public information officer, finance director).

Centralize the management of emergency management and NIMS-compliance training to ensure that all Village positions that have a defined emergency management role maintain the minimum training required for their position. The development of individual training plans for positions with defined emergency management functions is necessary. Dedication of personnel hours to support the scheduling and tracking of emergency management training is required.

The National Domestic Preparedness Consortium (NDPC) is a partnership of several nationally recognized organizations whose membership is based on the urgent need to address the counter-terrorism preparedness needs of the nation's emergency first responders within the context of all hazards including chemical, biological, radiological, and explosive Weapons of Mass Destruction (WMD) hazards. Acceptance into a training course is coordinated through IEMA.

Exercises

The most recent interagency exercise was conducted three years ago and focused on an active shooter incident at a local middle school. The Village hosted a 16-hour training

course for local school personnel about active shooter incidents in May 2022. Although the Fire Department routinely conducts drills to exercise its internal response capabilities, the Village currently does not have any inter-disciplinary exercises scheduled.

Recommendation: *Establish an emergency management exercise program with the intent of validating emergency response plans and identifying areas for improvement. At the onset, the Village may consider prioritizing command, control, and communications for incidents that require multi-agency/multi-disciplinary support, inclusive of multi-jurisdictional incidents and incidents that require EOC activation, as the exercise program focus. Establishing the Village's exercise program to be consistent with the Homeland Security Exercise and Evaluation Program (HSEEP) will provide the Village with an established set of guiding principles and validated approach for exercise program management, design and development, conduct, evaluation, and improvement planning.*

Community Engagement

The Village maintains a Community Emergency Response Team (CERT) Program, but staffing limitations have largely prevented the Village from actively engaging with Team members for training. NFD leadership reported that there have been limited opportunities to use CERT members in the capacity intended by the national CERT Program.

Recommendation: *Review and evaluate to determine how and whether the CERT Program should be retained or restructure.*

Review of Current Communications

Dispatching/Communication Services

All 911 calls are initially received at the **primary** Public-Safety Answering Point (PSAP) or call center located at the Northbrook Police Department. Calls requiring a fire service or EMS response are immediately transferred to the ***secondary*** PSAP center, Regional Emergency Dispatch Center (RED Center), where they are processed and dispatched to the appropriate companies.[56]

The Village of Northbrook has entered into an intergovernmental agreement with RED Center for dispatching services. RED Center is an integrated, multi-jurisdictional dispatch center capable of providing the closest Northbrook station response regardless of assigned response area. Existing Automatic Vehicle Location (AVL) capabilities provide dispatchers with the information required to find and dispatch the closest appropriate vehicle, track its location, and keep callers and first responders apprised of arrival times. When a company calls for backup, dispatchers can respond instantly and dispatch the nearest suitable company.

RED Center staffs 20 full-time telecommunicators, two alarm-monitoring technicians, and four administrative staff. Information Technology and GIS services are provided for RED Center by outside vendors through contracts. The dispatch office is staffed 24-hours a day, with a minimum of four telecommunicators per shift. All telecommunicators are certified in Emergency Medical Dispatch (EMD) and Emergency Fire Dispatch (EFD) and equipped to provide key medical assistance during emergencies, including pre-arrival instructions for CPR, choking, and childbirth. RED Center was the first dispatch center in Illinois certified to perform EMD. A detailed quality assurance process to monitor EMD performance is in place. RED Center continues to excel in this area.

RED Center serves as the headquarters and divisional dispatching center for MABAS Division 3, which is comprised of 17 fire departments in an area north of Chicago and immediately west of Lake Michigan. RED Center maintains capabilities to cross patch radio frequencies utilized by field units from responding agencies.

Dispatching Benchmarks and Criteria for Primary PSAPs

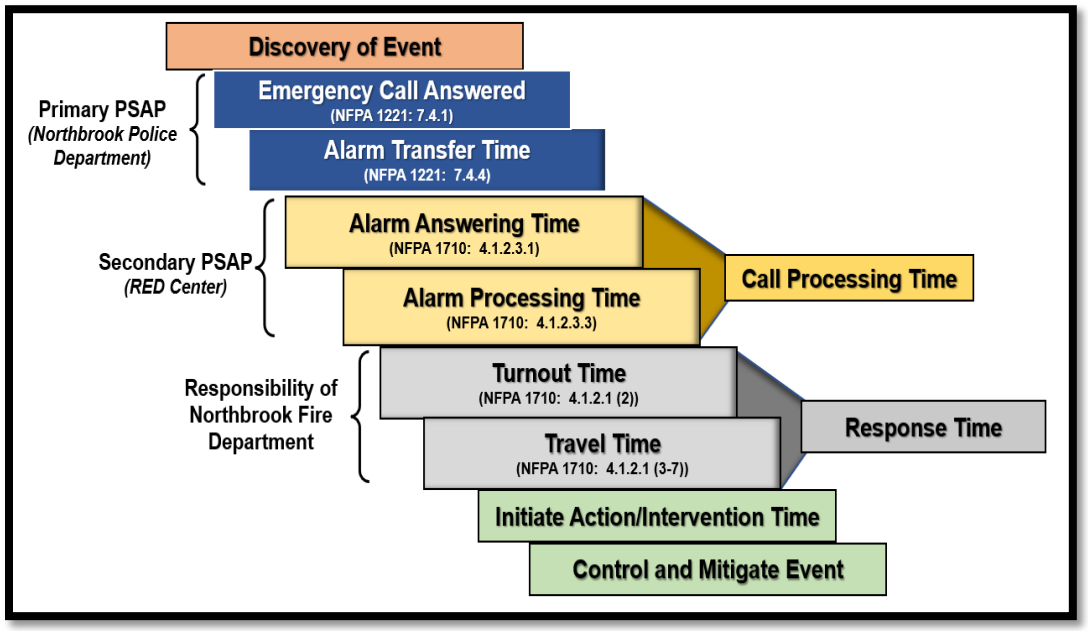
NFPA 1221 Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems provides PSAP centers with information regarding the installation, operation, and performance standards for the purpose of enhancing the reliability of the emergency service communication system.

More specifically, Standard 1221 establishes two key performance criteria for the primary PSAP center. The first performance standard addresses the amount of time it should take to answer a 911 call and the second standard addresses the amount of

[56] RED Center is located at 1842 Shermer Rd in Northbrook, IL

time it should take to transfer a 911 call to the secondary PSAP center. For both tasks combined, the performance standard is less than 50 seconds, 95% of the time.

Figure 10: NFPA 1710 Cascading Events



NFPA 1221 performance standards for ***primary*** PSAP centers:

- *90% of events received on emergency lines shall be answered within 15 seconds, and 95% of alarms shall be answered within 20 seconds.*[57]
- *Where alarms are transferred from the primary PSAP to a secondary answering point, the transfer procedure shall not exceed 30 seconds for 95% of all alarms processed*.[58]

Findings

PolarisPSS was unable to obtain dispatching data to identify the primary PSAP center's[59] current baseline for answering emergency calls and the current baseline for transferring calls to the secondary PSAP center (RED Center).

Dispatching Benchmarks and Criteria for Secondary PSAPs

Secondary PSAP Center Call Processing Time includes two core performance-based events, Alarm Answering Time and Alarm Processing Time. NFPA 1710 describes call processing time as "*The time interval from when the alarm is acknowledged at the*

[57] NFPA 1221 Section 7.4.1
[58] NFPA 1221 Section 7.4.4
[59] The Village of Northbrook's primary PSAP center is operated by the Northbrook Police Department.

communication center until response information begins to be transmitted via voice or electronic means to emergency response facilities and emergency response units (ERUs)." NFPA 1710 4.1.2.3.3 establishes two performance-based criteria.

- 90% of all emergency calls must be processed within 64 seconds (01:04) or less.
- 95% of all emergency calls requiring special handling must be processed within 106 seconds (01:46) or less.[60]

Call Processing Time Findings

This study compares call processing data to determine compliance with the current NFPA 1710 standard for call processing.

As illustrated in Table 10, in 2021 RED Center processed ***90% of all calls within 80 seconds, placing RED Center performance at the 80th percentile and well within the performance criteria of 95% at 106 seconds.***

Table 11: RED Center Call Processing Times for Village of Northbrook, 2021

2021 Emergency Calls	NFPA 1710 Benchmark Criteria	RED Center: Observed Compliance	Median Average Max
4,867	64 seconds	80 seconds	0:00:47 0:00:52 0:04:57
	(1 minute:04 second)	*(1 minute: 20 seconds)*	
	90%	90%	
	* 106 Seconds	* 101 Seconds	
	(1 minute:46 second)	*(1 minute:41 second)*	
	95%	95%	

RED Center is enhancing their Records Management System (RMS) system with the application of a software package called First Watch. With this software, the NFD will be able to gain real time and accurate reports on operational performance criteria including call handling times, call processing times, and fire and EMS response times.

When reviewing the 2021 response data, PolarisPSS observed a difference in the types of incidents that are used for statistical analysis by RED Center and NFD. This

[60] Call that require special handling include those requiring emergency medical dispatch questioning and pre-arrival medical instructions, language interpretation or the use of a TTY/TDD device or audio/video relay services; calls of criminal activity that require information vital to emergency responder safety prior to dispatching units; hazardous material incidents; technical rescue; the determination of the location of the alarm due to insufficient information; and calls received by text message.

observation indicates that an agreement between RED Center and NFD on the classification of emergency incidents and the priority levels given to those incidents is needed. An important component of call-taking protocols and processes is the degree to which they ensure that calls are classified accurately and reliably. The significant number of codes that are currently used to classify calls by type and priority level can become problematic when call takers and dispatchers are tasked with coding calls very quickly, particularly when callers are in distress. Despite the current array of options, or perhaps because of it, different call takers and dispatchers may code the same type of call at a higher or lower priority level, and many calls of an uncertain nature may be classified in "other" categories and possibly be given a different "level of priority".

Recommendations:

The Village of Northbrook should review with RED Center the guidelines call takers and dispatchers use to classify calls by type and priority level. Call takers and dispatchers have an important role in interpreting and documenting the information that enables them to identify the incident type and set the incident's priority level. It is essential for the NFD to have input on the guidelines to ensure the accuracy of the data produced and enable the NFD to reliably analyze current trends and use the information to inform staffing and service delivery decisions.

The Village of Northbrook should look at the processing times in a comprehensive manner. Call transfers between the primary and secondary PSAP centers have an impact on the overall processing time standard. Given the life safety implications for critical incidents, both Village of Northbrook and RED Center PSAPs should make every effort to reduce/eliminate transfers, thereby reducing the amount of time required to answer, process, transfer, and dispatch alarms. Potential strategies to reduce transfers include consolidation, either physical or virtual, CAD to CAD integrations, improved wireless call routing, and improved compliance with call answering standards.

Fire Department Staffing

Sworn Personnel

As of the date of this study, 70 full-time sworn personnel provide service to the Village. Company-level officers and firefighters comprise the largest contingent of NFD personnel. The NFD operates three shifts that work a schedule of 24 hours on/48 hours off, with a minimum of 16 personnel always on duty.[61] This schedule results in an average 56-hour workweek for firefighters.

Table12 details the number of NFD personnel by rank.

Table 12: Line Personnel and Rank[62]

Line Personnel & Rank	
Position	Number
Fire Chief	1
Deputy Chief	2
Battalion Chief	4
Captains	3
Lieutenants	9
FF/Engineer	9
FF/Paramedics	42
TOTAL	**70**

[61] The 16 personnel per shift includes one Battalion Chief who provides day-to-day company and station oversight and serves as the incident commander in accordance with the Department's SOG.
[62] The table represents the current FY 2022 staffing. An additional Deputy Chief position is budgeted for FY 2023.

Table 13 details NFD's minimum concentration and distribution of personnel and apparatus.

Table 13: Current Concentration and Distribution of Personnel and Apparatus

Current Concentration and Distribution of Personnel & Apparatus								
AOR	Apparatus	Minimum to Maximum Staffing						
		16	17	18	19	20	21	22
Station #10	ALS/Engine #10	1- LT/PM 1-Eng/PM 1-FF/PM	1- LT/PM 1-Eng/PM 1-FF/PM	1- LT/PM 1-Eng/PM 1-FF/PM	1- LT/PM 1-Eng/PM 1-FF/PM	1- LT/PM 1-Eng/PM 2-FF/PM	1- LT/PM 1-Eng/PM 2-FF/PM	1- LT/PM 1-Eng/PM 2-FF/PM
	Ambulance #10	2-FF/PM	2-FF/PM	2-FF/PM	2-FF/PM	2-FF/PM	2-FF/PM	2-FF/PM
Station #11	ALS/Pumper/Squad #11	1- LT/PM 1-Eng/PM 1-FF/PM	1- LT/PM 1-Eng/PM 1-FF/PM	1- LT/PM 1-Eng/PM 1-FF/PM	1- LT/PM 1-Eng/PM 1-FF/PM	1- LT/PM 1-Eng/PM 1-FF/PM	1- LT/PM 1-Eng/PM 2-FF/PM	1- LT/PM 1-Eng/PM 2-FF/PM
	Ambulance #11	2-FF/PM	2-FF/PM	2-FF/PM	2-FF/PM	2-FF/PM	2-FF/PM	2-FF/PM
	Battalion #11	1-BC/PM	1-BC/PM	1-BC/PM	1-BC/PM	1-BC/PM	1-BC/PM	1-BC/PM
	Battalion #10							1-CP/PM
Station #12	ALS/Tower #12	1- LT/PM 1-Eng/PM 1-FF/PM	1- LT/PM 1-Eng/PM 2-FF/PM	1- LT/PM 1-Eng/PM 1-FF/PM	1- LT/PM 1-Eng/PM 2-FF/PM	1- LT/PM 1-Eng/PM 2-FF/PM	1- LT/PM 1-Eng/PM 2-FF/PM	1- LT/PM 1-Eng/PM 2-FF/PM
	Ambulance #12	2-FF/PM	2-FF/PM	2-FF/PM	2-FF/PM	2-FF/PM	2-FF/PM	2-FF/PM
	ALS/Rescue #R-12			2-FF/PM*	2-FF/PM*	2-FF/PM*	2-FF/PM*	2-FF/PM*
*When all five officers are on duty (3 Lieutenants, 1 Captain, 1 Battalion Chief) a Lieutenant is assigned to R12								

Resource Deployment

Current Deployment of Resources

Table 14 depicts each of the NFD's core services, general resource capability, and minimum staff resources per service.

Table 14: Resource Staffing and Capabilities

Service	Resource Capabilities	Basic Staffing Capacity Per Shift
Fire Suppression	1 staffed ALS engine 1 staffed ALS pumper/squad 1 staffed ALS tower 3 staffed ALS ambulances 1 Battalion Chief	Minimum daily staffing of 16 with additional personnel from auto aid departments.
Emergency Medical Services	3 staffed ALS ambulances 2 ALS equipped engines 1 ALS-equipped tower 1 Battalion Chief	Minimum daily staffing of 16
Vehicle Accident	3 staffed ALS ambulances 2 staffed ALS engines 1 staffed ALS pumper/squad 1 Battalion Chief	Minimum daily staffing of 16
Special Team Response • Trench and Collapse Rescue • High Angle Rescue • Confined Space Rescue • Water Rescue • Hazardous Materials Response	3 staffed ambulances 2 staffed engines 1 staffed rescue 1 Battalion Chief 1 ALS-equipped tower	Minimum daily staffing of 16

Automatic Aid

NFD participates in automatic aid agreements with surrounding departments. Automatic aid is defined as assistance that is dispatched automatically by a contractual agreement between two fire departments, communities, or fire districts and at the same time as the units from the jurisdiction where the incident is occurring. The first basic principle for automatic aid is that all jurisdictional boundaries are essentially erased, which allows for

the closest, most-appropriate company to respond to an incident regardless of the jurisdiction to which the company belongs. The second principle is that to provide, immediately and at the time of initial dispatch, additional personnel or resources that may be needed to mitigate the reported incident.

ISO recognizes an automatic aid plan under the following conditions:

- Agreements are in writing.
- Departments are notified on first alarm according to a defined plan.
- Departments train together quarterly, semiannually, and annually. Drills with automatic aid companies must be half-day in length.
- Automatic aid personnel respond with a needed company.

Mutual Aid

Mutual aid is defined as an agreement between fire departments to help each other across jurisdictional boundaries. Mutual aid only occurs when local emergencies exceed local resource capabilities.

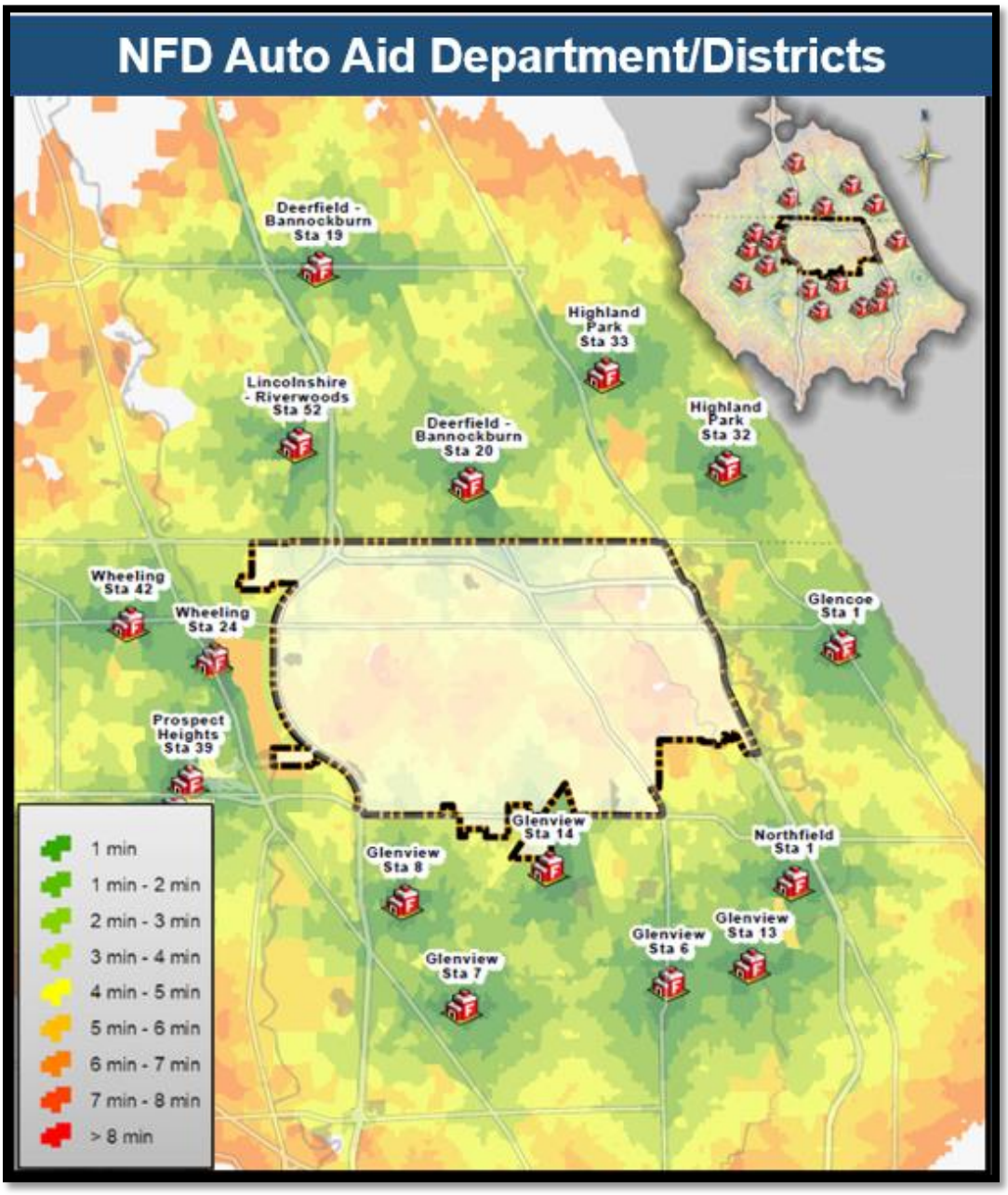
The Village is a member of MABAS Division 3.[63] MABAS, in partnership with IEMA, has established a statewide, nondiscriminatory mutual aid response system for fire, EMS, and specialized incident operational teams.[64] Sharing the effort are representatives from OSFM, IDPH- EMS Division, and the Illinois Fire Chiefs Association. MABAS defines a resource response plan to any location within the state when the Governor orders a declaration of disaster. The MABAS Division 3 command vehicle is available for deployment to support planning, coordination, and implementation of incident action plans.

Figure 11 illustrates the location of automatic aid departments and the response times to the Village.

[63] A memorandum of understanding was signed on January 16, 2001, a first in Illinois history.

[64] Mutual aid is an essential component of almost every fire department's operation. Except for the largest cities, no municipal fire department can, or should, be expected to have adequate resources to respond to and safely, effectively, and efficiently mitigate large-scale and complex incidents. Mutual aid is shared between communities when their day-to-day operational fire, rescue, and EMS capabilities have been exceeded, ensuring that the residents of the communities are protected even when local resources are overwhelmed.

Figure 11: Automatic Aid Departments/Districts



Findings

Between the years 2018 to 2021, the NFD has received automatic aid and mutual aid an average of 381 times per year. During the same time period, NFD has provided automatic and mutual aid an average of 326 times per year.

Table 15: Summary of Automatic and Mutual Aid Received, 2018 - 2021

NFD: Summary of Auto-Aid and Mutual Aid Received (2018-2021)				
	2018	2019	2020	2021
Auto Aid	220	310	168	118
Mutual Aid	268	186	120	132
Total	488	496	288	250

Table 16: Summary of Automatic and Mutual Aid Given, 2018 - 2021

NFD: Summary of Auto-Aid and Mutual Aid Given (2018-2021)				
	2018	2019	2020	2021
Auto Aid	66	96	55	47
Mutual Aid	296	250	217	278
Total	362	346	272	325

The NFPA 1710 performance standard for all initial alarm companies to be within eight minutes of travel for all low- and medium-hazard incidents must be considered when determining the efficacy of automatic aid and mutual aid agreements. Therefore, PolarisPSS analyzed how well automatic aid and mutual aid companies meet this performance standard. As exhibited in Table 17, PolarisPSS found that all primary companies listed on the NFD box alarm cards meet the 8-minute travel time standard 47% to 85% of the time.

Table 17: Automatic/Mutual Aid Companies within 8-Minute Travel Time, 2018-2021

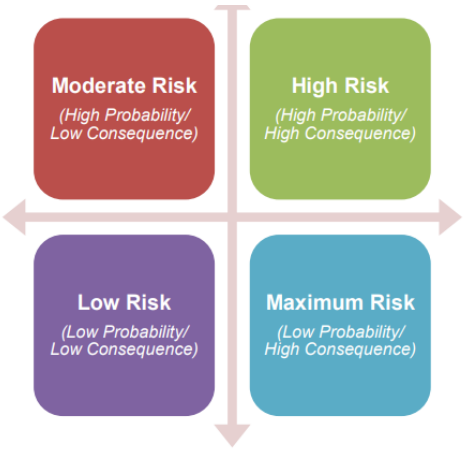
NFD Auto/Mutual-Aid Departments	Station Number	Percentage of all incidents within 8 Minute Travel Time
Deerfield-Bannockburn FPD	Station #20	85%
Lincolnshire-Riverwoods FPD	Station #52	62%
Glenview FD	Station #8	47%
Wheeling FD	Station #24	43%
Wheeling FD	Station #42	43%
Glenview FD	Station #14	42%
Glenco PS	Station #1	31%
Deerfield-Bannockburn FPD	Station #19	26%
Highland Park FD	Station #33	25%
Highland Park FD	Station #32	20%
Glenview FD	Station #6	19%
Glenview FD	Station #13	19%
Glenview FD	Station #7	17%
Prospect Heights FPD	Station #39	15%
Northfield FRD	Station #1	5%

Recommendation: *Annually assess the response time performance of all automatic aid companies to ensure that the assembly of an effective response force is occurring within the NFPA 1710 standards.*

All Hazards Risks and the Community

Introduction

Figure 12: Risk Probability and Consequence



Managing community risks includes assessing "risk factors" that are known to potentially increase the severity of an emergency and developing a mitigation strategy to minimize the impact of the risk event. Not all risks are equal. Some risk events are more likely to occur than others, and the cost of a risk event can vary greatly. The goal is to ensure sufficient resources are distributed throughout the community in a manner to provide adequate response without over committing limited resources that could be used elsewhere. Evaluating risk for *probability of occurrence* and the *severity* or the *potential loss* are important factors to consider when developing a fire and EMS service deployment plan. Probability is the likelihood that a particular incident will occur in a given time period. An incident that occurs daily is highly probable; an incident that occurs once every century has low probability. Consequences measure the impact of an incident to individuals, the community, and the agency. The three areas of concern when evaluating consequences are:

- Life safety: danger to occupants
- Economic: loss of property, income, historic or irreplaceable assets
- Environmental: irreplaceable or long-term damage to the environment

From the risk analysis, a matrix can be developed to evaluate hazards based on the probability and consequences.

Hazard identification involves recognizing the kinds of natural, technological, and other human-made conditions that can create a risk to the community. Natural hazards result from uncontrollable, naturally occurring incidents such as flooding, severe thunderstorms, and snowstorms. Human-made hazards include buildings, hazardous materials, transportation systems, and the like. Finally, people who create demands for fire department services for emergency medical incidents, human-caused fires, and more are a risk factor.

Community risk assessment evaluates several factors inclusive of service area population, population density, and population demographics; local land use and development; and the geography and natural risks present within the community. These

factors affect the number and type of resources - both personnel and apparatus - necessary to mitigate an emergency.

- **Population is a risk factor.** Population demographics present another unique risk since over 5.6% of the Village's population is under five years of age and 25.6% is over 65 years of age.
- **The physical characteristics of the area and the resultant natural hazards are risk factors.** Northbrook is at risk of seasonal storms, flash floods, snow, and tornadoes.
- **Land use and zoning** can also affect risk. Risk can be characterized as low (e.g., open spaces); moderate (e.g., low-density residential, small commercial and office); or high (e.g., large commercial, industrial, and high-density residential).

The risk assessment process goal is to match the deployment of resources with the identified risk in the most effective manner possible. The Village of Northbrook has a wide range of risks, some of which create greater challenges or require a greater deployment of resources to control during an emergency. Each specific incident dictates the overall deployment of personnel and equipment to achieve the desired outcome.

Population Risk Factors

Population Density[65]

The population density in the United States is approximately 90 people per square mile. However, most people live in cities, causing cities to have a much higher density. The population density inside U.S. cities is approximately 1,600 people per square mile but can vary considerably from one city to another and even across different neighborhoods within a single city. Unincorporated areas typically have a population density of about 35 people per square mile.

Table 18: U.S. Census Bureau Population Categories

Population Category	Population Density
Urban	Population >2,000 people per square mile
Suburban	Population =1,000-2,000 per square mile
Rural	Population <1,000 people per square mile

The United States Census Bureau classifies the Village of Northbrook as an urban area of 13.24 square miles. The Village's 2020 estimated population is 35,222 people who reside in 14,209 housing units. The Village has an average population density of

[65] United States Census Bureau, Understanding Population Density, March 04, 2015

2,660.00 persons per square mile, with the population concentrated in the central parts of the community in neighborhoods and planned development communities surrounded by open spaces and light community retail sections. The Village's Residential Zoning map in Figure 13 illustrates the residential areas in the Village.

Figure 13: Village of Northbrook Residential Zoning Map

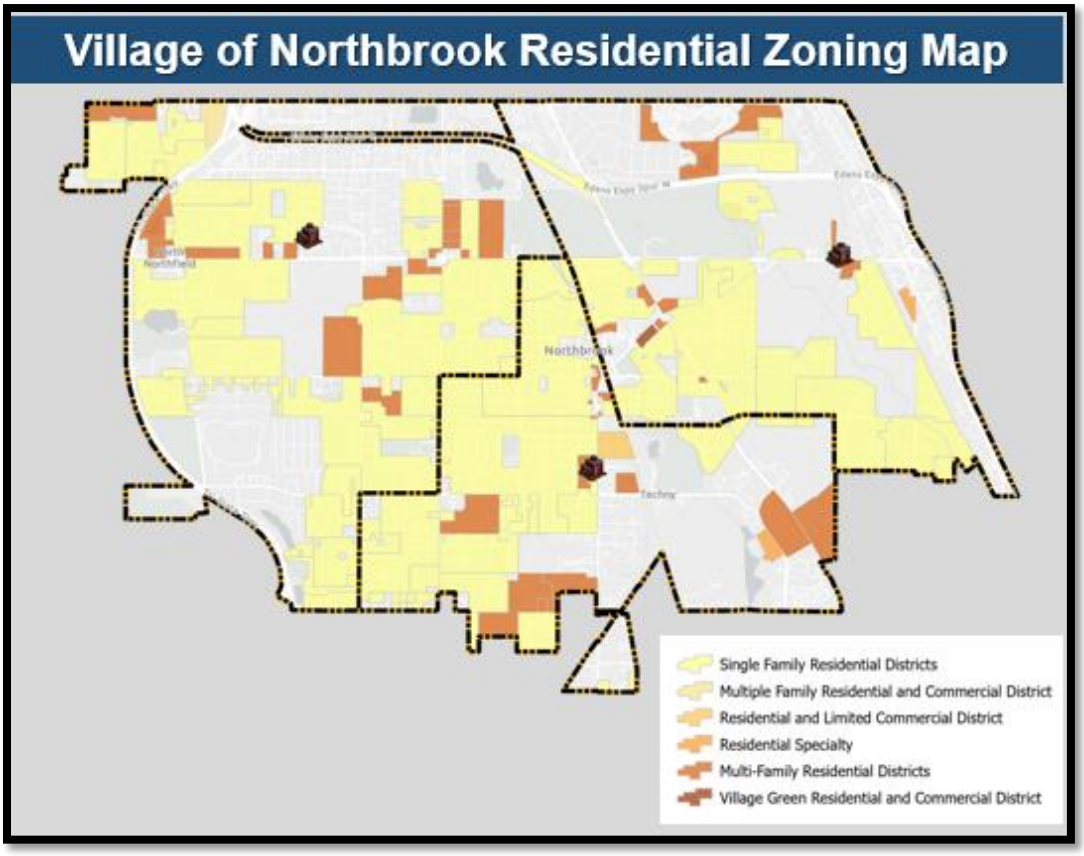
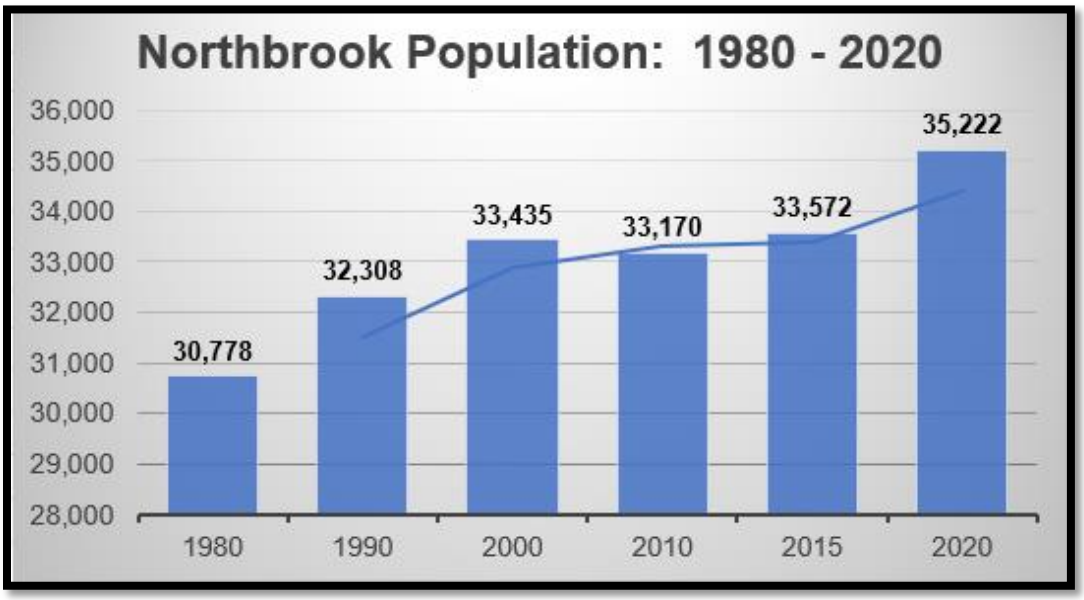


Figure 14 shows population growth over the past 40 years. The Village's population grew by 6.2% between the years of 2010 and 2020.

Figure 14: Village of Northbrook Population, 1980-2020[66,67]



At-Risk Populations

Population demographics can affect service demand and risks within a community. The United States Fire Administration (USFA) identifies population groups facing a higher risk of injury or death from a fire:[68]

- Children under 5 years of age
- Older adults over 65 years of age
- People with disabilities
- People with a language barrier
- People in low-income communities

A significant number of Northbrook residents fall within one or more at-risk population group and are more likely to use fire department services, especially EMS. [69]

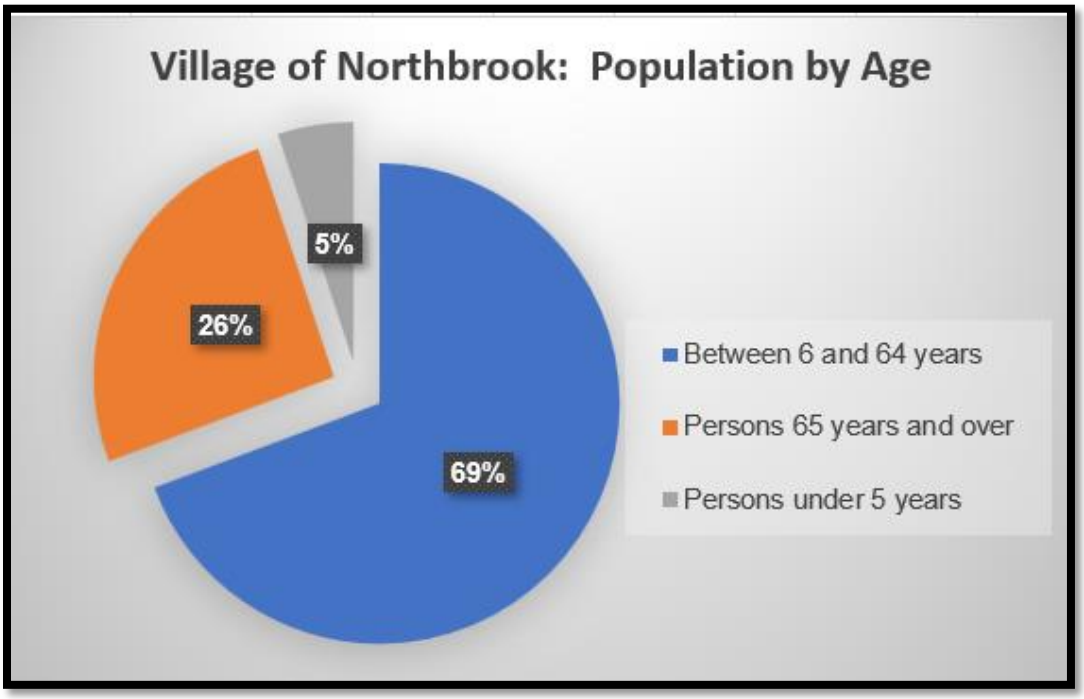
Age

The median age of the Northbrook population is 50.2 years old; the average age of Illinois' population is 38.6 years old.[70] Of concern is the fact that 31% of Northbrook's population is comprised of children less than five years of age and adults over 65 years

[66] Village Comprehensive Plan (2000)
[67] U.S. Census Bureau, retrieved on May 1, 2022 from https://www.census.gov/quickfacts/northbrookvillageillinois
[68] Fire Risk in 2019. USFA Topic Fire Report Series Vol 21, Issue 8, October 2021
[69] U.S. Census Bureau 2019 population estimate
[70] U.S. Census Bureau 2021 Estimated Population Figure

of age.[71] When compared to the overall population of Illinois, Northbrook's population over 65 years old is 10.3% greater than the percentage of the Illinois' population that falls within this age group; the Northbrook population of children less than five years old is 2.1% less than the comparable Illinois population.[72] The percentage of the population five years old or less and 65 years old and older is a factor that affects service demand and, therefore, community risk in the service areas.

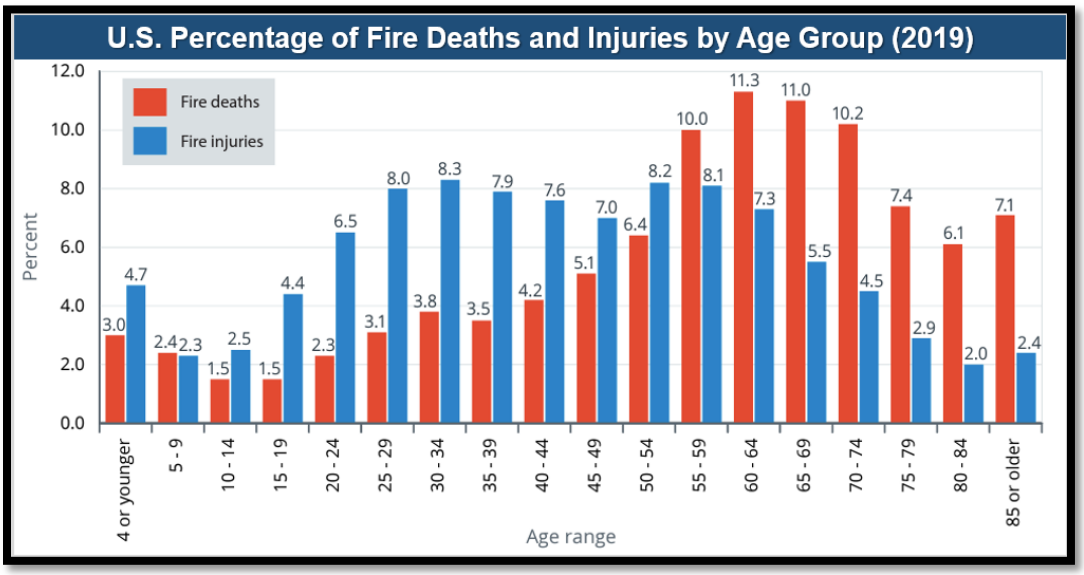
Figure 15: Village of Northbrook Population Percentages by Age



The USFA's National Fire Data Center informs us that adults who are 50 to 69 years old accounted for 38% of civilian fatalities from fires. Children less than 10 years old accounted for 5.4% of fatalities, while adults who are 70 years old and over accounted for 31.3% of fatalities. See Figure 16 for a breakdown of fire deaths and injuries by age group.

[71] Twenty-six percent of Northbrook's population is 65 years of age or older and 5% of the population is under the age of five years.
[72] Population Reference Bureau

Figure 16: U.S. Percentage of Fire Deaths and Injuries by Age Group[73]



Disabilities

Individuals who have a disability may have difficulty with or be incapable of self-preservation during an emergency. According to the Centers for Disease Control and Prevention, approximately 23% or one in four adults in Illinois have a disability; the two most common functional disabilities identified are mobility affecting 11% of the population and cognition affecting 10% of the population.[74] Illinois residents 65 years old and older who have a disability make up 34.6% of the population.[75] Additionally, people under 65 years old with no health insurance are more prone to chronic illness or exhibit poor physical condition simply because they do not seek treatment promptly.

Target Hazard - Senior Living/Medical Facilities[76]

Emergency service organizations in the United States are experiencing increases in service requests received from facilities that serve the aging/frail population. Acute increases in the demand for services and resources can cause a strain on the entire emergency service delivery system. Fire service leadership must evaluate strategies to ensure the facility does not unnecessarily tax the emergency response system.

When examining response trends to health care facilities, it is important to remember that 2020-2021 data includes incidents related to the COVID-19 pandemic and,

[73] National Fire Data Center
[74] CDC National Center On Birth Defects and Developmental Disabilities: Disability Impacts Illinois. Retrieved on May 6, 2022 from www.cdc.gov/ncbddd/disabilityandhealth/programs.html.
[75] Retrieved on June 10, 2022 from https://centerondisability.org/ada_parc/utils/counties.php?state=IL&table=45&colour=1
[76] Retrieved on June 22, 2022 from https://www.ibisworld.com/united-states/market-research-reports/retirement-communities-industry/

therefore, the numbers may be inflated when compared to non-pandemic time periods. Regardless, the NFD should continue to monitor responses to health care facilities. If the number of responses seem high (e.g., one or more responses per day to the same facility), a review of the types of medical incidents for which 911 calls are received may be prudent. If the review shows a high number of non-emergency type requests, a conversation between Department leadership and the facility's administration is warranted to ensure the facility has an agreement with a private ambulance provider to handle their non-emergent responses so that NFD resources can remain available to respond to true emergencies.

Figure 17: Senior Living Locations

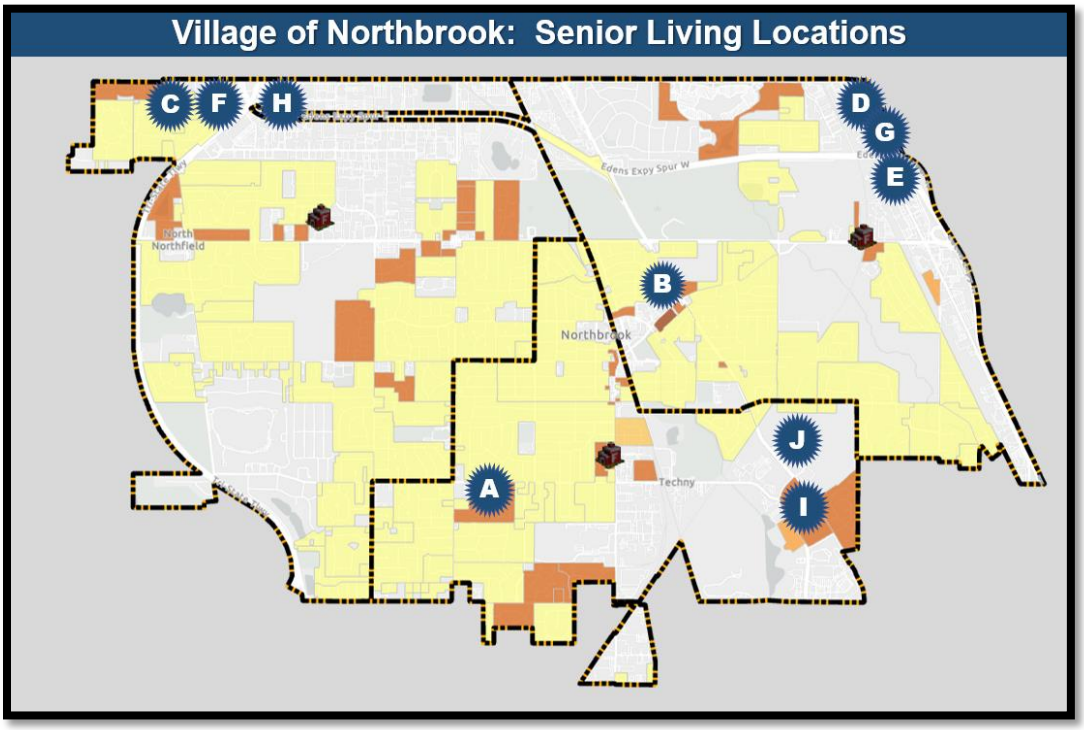


Table 19: Senior Living Locations and 2021 EMS Incidents

Village of Northbrook: Senior Living Locations					
Name	Address	Type	Units	2021 Residents	Map Symbol
Covenant Village	All Mayapple addresses	Independent	322	376	
	All Foxglove addreses except 2195	Independent			
	2625 Techny	Independent			A
	2195 Foxglove	Assisted	58	55	
	2155 Pfingsten	Nursing	102	56	
Crestwood Place	1000 Waukegan Road	Independent	118	130	B
Deerfield Crossing	4101 Lake Cook Road	Nursing	147	88	C
Elevate Care	270 Skokie Blvd	Nursing	298	188	D
North Shore Place	1000 Sunset Ridge Road	Assisted	184	126	E
Northbrook Inn	99 Pointe Dr.	Memory Care	69	48	F
The Grove of NB	263 Skokie Blvd	Nursing	132	109	G
Weinberg	1551 Lake Cook Road	Independent	125	106	
	1601 Lake Cook Road	Memory Care	40	38	H
	1627 Lake Cook Road (New)	Independent			
The Lodge	2150 & 2220 Founders Drive	Independent	311	345	I
Divine Word	1901 Waukegan Road	Assisted	59	31	J

Income and Poverty

The median household income in the Village of Northbrook is approximately $128,883; the medium household income in Illinois is approximately $68,428.[77] Approximately 3.3% of Village residents are classified as living in poverty; 12% of all people who live in Illinois live in poverty. As noted in a recent study conducted in Ontario, Canada, a percentage of this most vulnerable population made frequent calls to request emergency medical services because they could not afford health care insurance.[78]

Community Events

Community events may put additional stress on the emergency response system. Pre-planning must be done for special events to address the "what if" scenarios. Village departments should collaborate to develop incident action plans for large community events to clarify roles, responsibilities, and resources to provide for a coordinated and safe response.

[77] Retrieved on June 10, 2022 from U.S. Census Bureau QuickFacts: Northbrook Village, Illinois

[78] Agarwal, G., Lee, J., McLeod, B. *et al.* Social factors in frequent callers: a description of isolation, poverty and quality of life in those calling emergency medical services frequently. *BMC Public Health* **19,** 684 (2019). https://doi.org/10.1186/s12889-019-6964-1

Physical Hazards

Severe Weather

Severe weather incidents can happen anytime. Severe weather can create hazardous conditions caused by thunderstorms including damaging winds, tornadoes, large hail, flooding, and flash flooding; winter storms can cause freezing rain, sleet, snow, and strong winds. Table 20 summarizes the National Weather Service meteorological advisories, watches, and warnings for the Village of Northbrook between 2018 and 2021.

Table 20: Weather Watches or Warning, 2018-2021[79]

Northbrook: Weather Watches or Warnings 2018-2021				
TYPE	2018	2019	2020	2021
Flood Advisory	39	65	39	20
Severe Thunderstorm Warning	14	32	27	27
Flood Warning	24	17	12	6
Winter Weather Advisory	12	14	10	8
Dense Fog Advisory	14	10	3	6
Severe Thunderstorm Watch	7	7	6	8
Wind Advisory	3	6	13	8
Flash Flood Warning	2	8	7	5
Flash Flood Watch	7	7	2	3
Frost Advisory	2	1	2	4
Tornado Warning	0	3	3	6
Tornado Watch	0	2	2	3
Wind Chill Advisory	1	4	1	2
Winter Storm Warning	3	2	1	4
Winter Storm Watch	2	2	2	4
High Wind Warning	0	2	1	1
Freeze Warning	1	0	2	2
Heat Advisory	1	0	1	2
High Wind Watch	0	2	0	1
Excessive Heat Warning	2	1	0	0
Excessive Heat Watch	2	1	0	0
Freeze Watch	0	0	2	1
Ice Storm Warning	0	2	0	0
Blizzard Warning	1	0	0	0
Wind Chill Warning	0	1	0	0
TOTAL	149	204	149	136

[79] Retrieved in June 2022 from National Weather Service

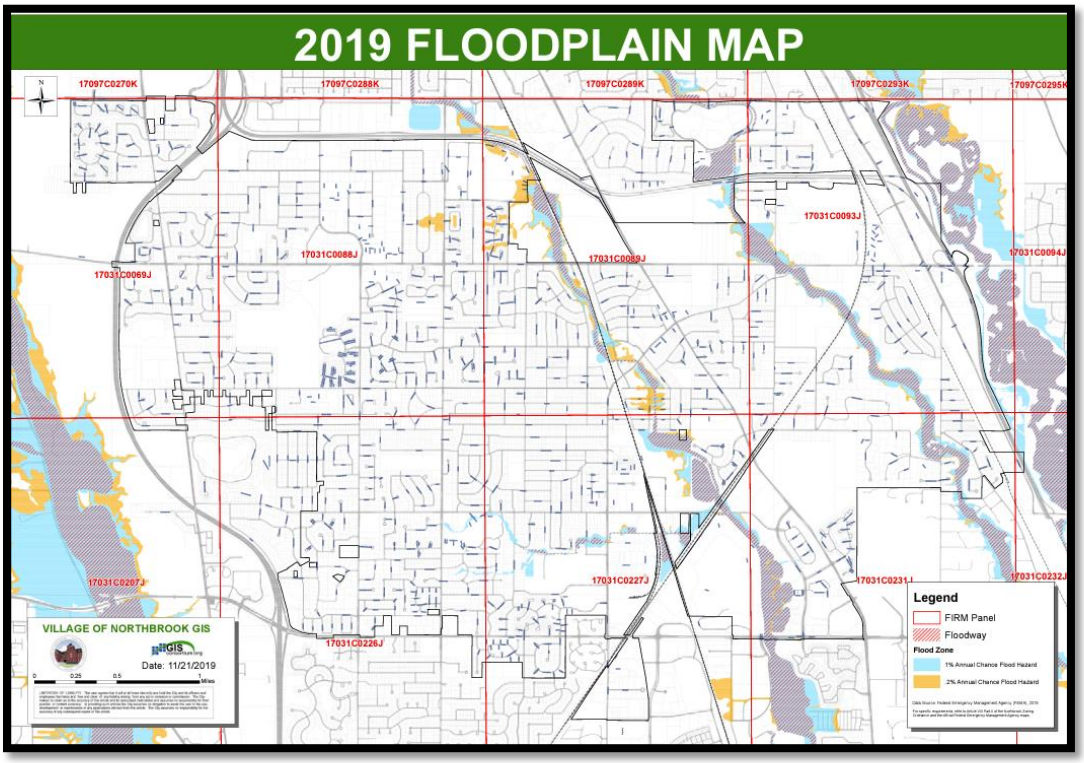
Flooding

The Village of Northbrook has experienced numerous storm water flooding incidents over the past decade. The North Branch of the Chicago River runs north and south on the far-east side of the Village. Heavy rains and early spring snow melt that drain into the river are primary contributors to flooding in subdivisions, flooded properties, and standing water that results in street closures. Flood Factor, a non-profit research and technology group, estimates that there are 1,131 properties in Northbrook that have greater than a 26% chance of being severely affected by flooding over the next 30 years, which represents 1% of all properties in the Village.[80]

Flooding can also cut off access to utilities, emergency services, transportation, and may impact the economic well-being of an area. Overall, Northbrook has a moderate risk of flooding over the next 30 years, which means flooding is not likely to impact day to day life within the community.

NFD should be aware of all locations susceptible to flooding and develop contingency plans for flooding, whether localized or widespread.

Figure 18: 2019 Floodplain Map[81]



[80] Retrieved on June 10, 2022 from Northbrook, IL Flood Factor® | Risk Factor
[81] Village of Northbrook Comprehensive Plan, 2019

Technological Hazards

The most prominent technological, or human-created, hazards faced by residents of Northbrook are transportation emergencies, structural fires, and hazardous materials releases.

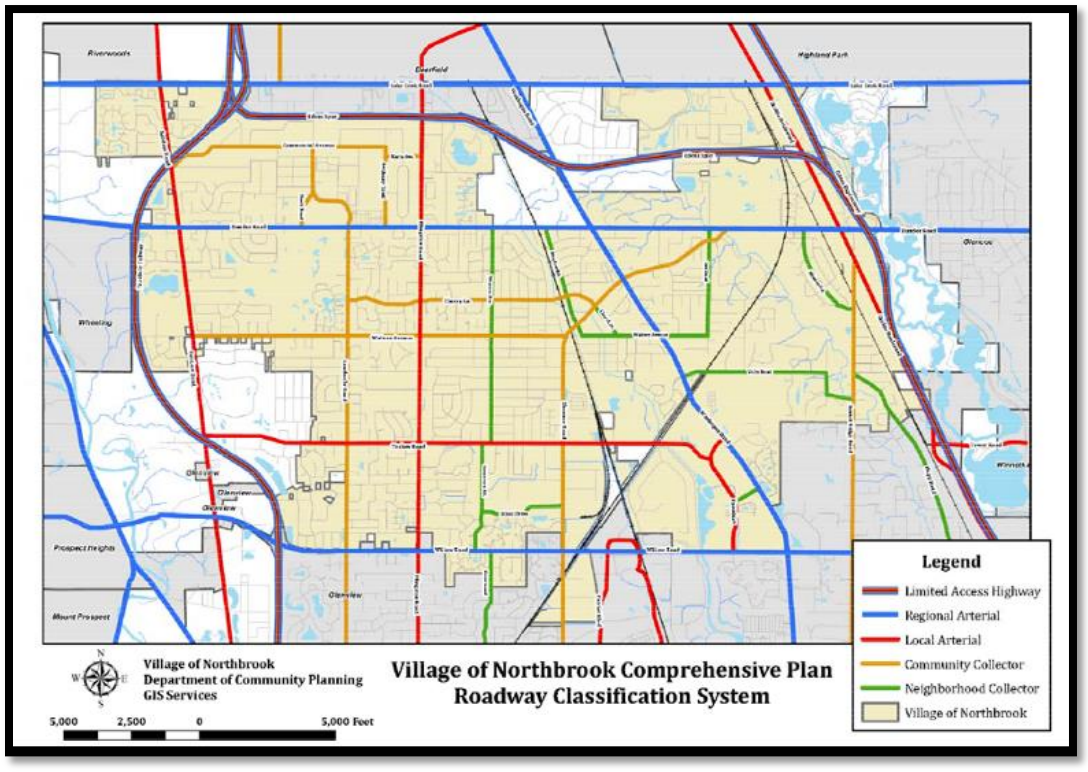
Transportation

Transportation corridors provide necessary access and egress for the NFD apparatus. The configuration of transportation systems can also affect the response capability of emergency service resources. Limited access to the Tri-State Tollway and Eden's Expressway and rail line crossings can interrupt street connectivity and force apparatus drivers to negotiate a circuitous route to reach an emergency scene.

Roads

Surface streets dominate the NFD service area. As illustrated in Figure 19, the Village has three regional arterial highways, Dundee Road, Lake-Cook Road, and Willow Road running east/west and Waukegan Road running diagonally northwest to southeast. The main risks are over-the-road shipments of combustible and hazardous materials and vehicle accidents that occur on either the Tri-State Tollway or Eden's Expressway.

Figure 19: Village of Northbrook Highway System



The balance of NFD's service area is a mix of relatively well-interconnected street networks and disconnected neighborhoods characterized by meandering streets and

cul-de-sacs. All the Village's traffic signals within the service area are equipped with signal pre-emption equipment. Signal pre-emption can provide significant response time performance advantage and improve motorist safety.

Railroads

The Association of American Railroads has identified Chicago as the busiest place for railroads in the nation, a status it has held for 125 years. Nearly 500 freight trains and 760 passenger trains operate throughout the region daily. About 25% of all U.S. freight rail traffic and 46% of all intermodal traffic begins, ends, or travels through the Chicago region.[82]

Rail lines intersecting urban areas create risks for train/vehicle collisions and mass casualty incidents during a collision or derailment. Freight lines over which large quantities of freight, including various quantities and weights of hazardous materials, are transported each year create additional risks. Most rail accidents occur when the trains are traveling at a high rate of speed or during product loading and unloading.

Through Northbrook alone, there are approximately 61 scheduled Metra trains, 16 Amtrak trains, and 20 Canadian Pacific Rail freight trains that use the Metra Milwaukee North Line (MMNL) tracks that run north and south through the Village per day. Between the Village of Northbrook and the Village of Glenview there is a cutoff switch that connects the Union Pacific Rail to the MMNL and allows Canadian Pacific freight trains using the UP line to use MMNL between Metra services.[83]

Most Metra trains travel at a low rate of speed and the number of cars per train is typically low. However, both Amtrak and freight trains will travel average speeds between 40-50 mph and at times they will travel at rates of speed between 70-80 mph. The probability of a derailment is considered low, but the impact high because of increased population density and growth in areas downwind of rail lines.

NFD will not have adequate resources to respond effectively to a major hazardous materials incident and will require MABAS Division 3 assistance. Any release of hazardous materials could result in evacuations of surrounding areas; evacuation perimeters will be determined by the type of product involved and weather conditions.

Development-based Growth Projections[84]

Census-based population projections provide a mathematically calculated estimate of future population based on historical data. However, projections often fail to account for an area's expected growth rate that results from redevelopment, annexation, changes in

[82] Retrieved on June 22, 2022 from AAR-Integrated-Rail-Network-Fact-Sheet.pdf
[83] Village of Northbrook Comprehensive Plan,2010
[84] Retrieved June 22, 2022 from Northbrook Population Increased In 2020 Census Data | Northbrook, IL Patch

employment capacity, or other socio-economic factors. For this reason, PolarisPSS reviewed available local development and business information to project the future population.

Data for development growth specified in the Village of Northbrook Comprehensive Plan was not sufficient to create a population projection. The development-based population forecast is typically higher than the census-based population forecast primarily due to local and regional issues that are expected to expand development opportunities, including annexation, additional transportation improvements, and infrastructure capacity.

This study's intent is not to be a definitive authority for the projection of future population in the service area, but rather to base recommendations for future fire protection needs on a realistic projection of future service demand. The service demand for emergency agencies is almost entirely based on human activity; therefore, it is important to have a population-based projection of the future size of the community. PolarisPSS anticipates that the NFD will be an emergency service provider to a growing population that will likely reach over 37,000 residents within the corporate limits by 2030.[85]

Findings

PolarisPSS identified two community factors that create a moderate risk of increasing the demand for emergency services. The first is the current aging population and the second is the increase in senior living facilities.

PolarisPSS identified two technological hazards that have a high risk probability with potential consequences for life and property. Incidents caused by both risks will have high mitigation costs. The first risk factor is the Tri-State Tollway and the Edens Expressway transportation corridors that pass through the Village. The second risk factor is the railroad lines that move freight and passengers through the Village. PolarisPSS recommends that the Village develops deployment strategies and plans that can be implemented during an emergency or when service demands warrant plan implementation in preparation for incidents caused by each risk.

[85] This projection does not potential population growth within the Northbrook Rural Fire Protection District.

Recommendations:

Develop a Community Risk Reduction Plan (CRRP) that identifies strategies and programs to mitigate the potential increase in emergency services due to an aging population.

Develop a CRRP that identifies strategies and programs in support of the Village's Emergency Operations Plan for the purpose of mitigating the potential requirements for increased emergency services resources in response to transportation and railroad emergencies.

Critical Tasking and Alarm Assignments

The NFD service area is a moderately populated urban environment that contains an elevated number, density, and distribution of risk. As the actual or potential risk increases, the need for greater numbers of personnel and apparatus also increases. Specific critical tasks need to be accomplished for each type of incident and corresponding risk, requiring the dispatch of specific numbers and types of apparatus.

Tasks that must be performed at a fire can be broken down into two key components: life safety and fire flow. Life safety tasks are based on the number of building occupants, and their location, status, and ability to take self-preserving action. Life safety-related tasks involve the search, rescue, and evacuation of victims. The fire flow component involves delivering sufficient water to extinguish the fire and create an environment within the building that allows entry by firefighters.

The number and types of tasks needing simultaneous action will dictate the minimum number of firefighters required to combat different types of fires. In the absence of adequate personnel to perform concurrent action, the commanding officer must prioritize tasks and complete some in chronological order rather than concurrently. These tasks include:

- Command
- Scene safety
- Search and rescue
- Fire attack
- Water supply
- Pump operation
- Ventilation
- Backup/rapid intervention

Critical task analysis also applies to non-fire-type emergencies, including medical, technical rescue, and hazardous materials emergencies. Numerous simultaneous tasks must be completed to effectively control an emergency. The NFD's ability to muster the needed number of trained personnel quickly enough to make a difference is critical to successful incident outcomes.

The NFD has developed mutual aid box alarm response cards to address its critical task analysis needs for various incident types. Based on current unit staffing levels, NFD has defined the number and type of apparatus needed to deliver a sufficient number of personnel to meet the critical tasking identified.

Review of the NFD's box alarm cards indicates that the critical task analysis needs will be met. It is evident that the NFD generally complies with industry standards and provides the minimum number of personnel needed for effective incident operations.

Establishing resource levels needed for various types of emergencies is a uniquely local decision. Factors influencing local decisions for incident staffing include the type of equipment operated, training levels of responders, operating procedures, geography, traffic, and the nature of buildings and other risks protected.

Emergency Activities - National Fire Incident Reporting System

The National Fire Incident Reporting System (NFIRS) is a system established by the USFA National Fire Data Center. NFIRS was established after the 1973 National Commission on Fire Prevention and Control report, *America Burning*, led to passage of the *Federal Fire Prevention and Control Act of 1974*, which authorizes the USFA to gather and analyze information on the magnitude of the nation's fire problem, as well as its detailed characteristics and trends. The Act further authorizes the USFA to develop uniform data reporting methods and to encourage and assist state agencies in developing and reporting data.

The NFIRS has two objectives: to help state and local governments develop fire reporting and analysis capability for their own use and to obtain data that can be used to more accurately assess and subsequently combat the fire problem at a national level. To meet these objectives, the USFA developed a standard NFIRS package that includes incident and casualty forms, a coding structure for data processing purposes, manuals, computer software and procedures, documentation, and a National Fire Academy training course for utilizing the system.

The NFIRS is divided into nine incident groups that are then further defined within the group to gather more specific information. Table 21 defines the NFIRS groups.

Table 21: NFIRS Group Numbers and Incident Types

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

The NFIRS represents the world's largest, national, annual database of fire incident information. Although participation in NFIRS is voluntary, over 23,000 fire departments across all 50 states and the District of Columbia report NFIRS data annually. Thirty-seven fire departments with a population protected of over 500,000 participate in the NFIRS. Participating departments report an average of 23 million incidents each year, with a combined average of one million fires reported annually. The NFIRS database comprises 75% of all fires reported annually.

Emergency Response Data

A fire department's primary function is to respond to and mitigate emergencies that arise within its jurisdiction. Although this activity only takes up a small percentage of the department's overall time, its state of readiness must always be at maximum levels to optimally provide an efficient and safe level of service. Relevant, detailed, and concise data pertaining to the fire department is essential to provide archival documentation of the department's preparedness for and response to emergencies.

One of the challenges faced by fire/EMS leadership is identifying and justifying the financial investment in the resources needed to provide the highest level of service and safety for those who receive and provide such service. Good data is essential and routinely used by fire department leadership to inform these decisions.

The International Association of Fire Chiefs (IAFC) defines three requirements for good data.[86]

- **Relevant**: Information collected on the things that matter, such as response times and the number of calls for service.
- **Accurate:** The processes for data collection must be consistent and trustworthy.
- **Reliable:** A measurement from one company must be equivalent to the same measurement from another company and it is not necessary to adjust your data to accommodate known distortions.

[86] International Association of Fire Chiefs: Weathering the Economic Storm, December 2008

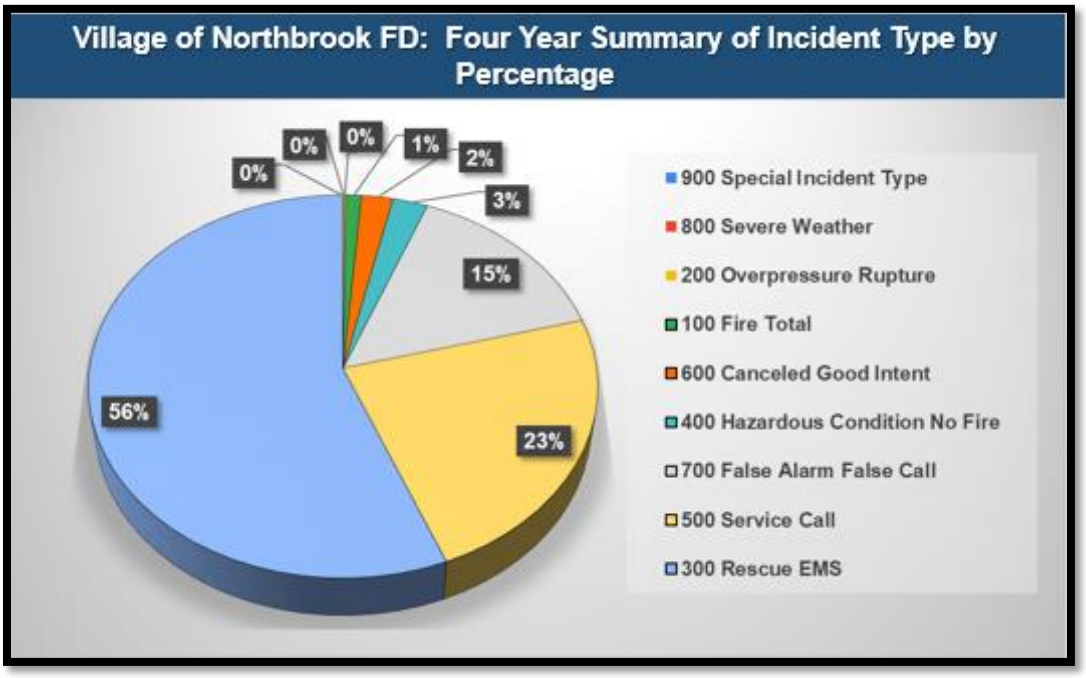
Northbrook Fire Department Response Data

This section highlights the emergency response data for NFD for all incidents between January 1, 2018, and December 31, 2021. A total of 26,401 incidents were recorded, with 1,305 of the recorded incidents being for automatic aid and mutual aid responses. This section of the report focuses only on the 25,096 incidents that originated within the NFD response area.

Incidents by Nature

NFD participates in the NFIRS fire program by reporting all incidents under the authority of the USFA. Figure 20 charts the total percentage of incidents by NFIRS group. Notably, Group 100, which includes all types of fire, accounts for 1% of the overall incidents. Medical incidents, Group 300, which account for the highest percentage of incidents nationally and in Illinois, represent 56% of NFD's total incidents responded to during the four years included in the study data.

Figure 20: Fire Department Four Year Summary of Incident Type by Percentage



Identifying Emergency Service Trends

Examining the historical occurrences of emergencies is necessary to determine a department's efficiency and to estimate future resource needs. The following factors are significant when examining call data:

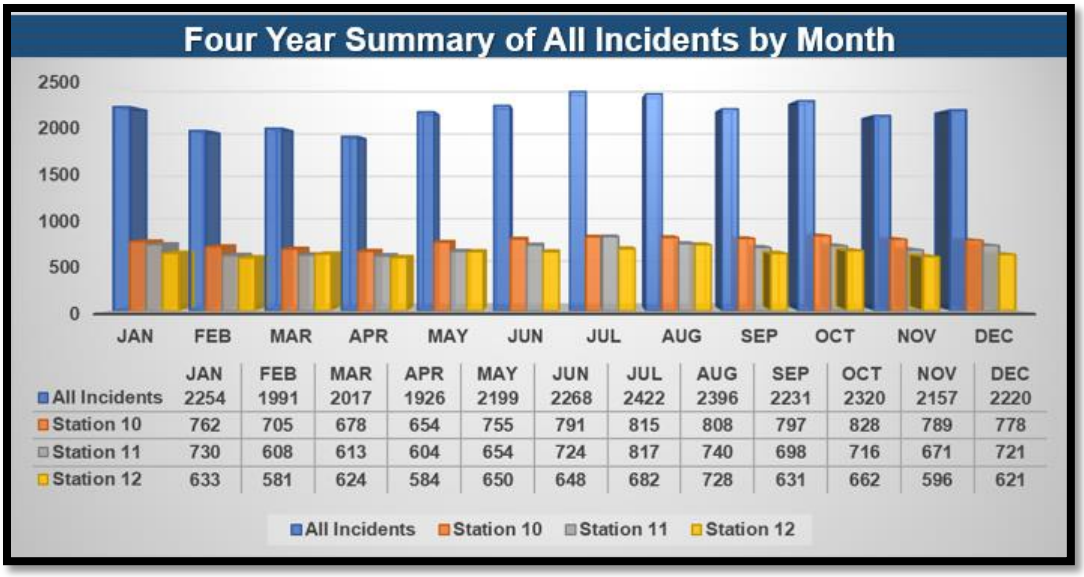
- Calls by month
- Calls by day of the week
- Calls by time of day
- Automatic aid and mutual aid

Incidents by Month

Fire department leadership should recognize when the department is at its busiest for the month, day of the week, and time of day. Patterns of significance indicate the probability that emergencies will occur at a particular time, which enables the department to anticipate staffing levels and make contingency plans for adequate personnel or other resources needed for emergency response.

Like increases in call activity caused by daytime business populations and tourism season, weather can increase call volume and workload. Locally sponsored events like carnivals or fests can also contribute to increases in call volume. Figure 21 charts NFD's incidents by month. This information shows an even distribution of incidents through the four years studied.

Figure 21: Four Year Summary of All Incidents by Month



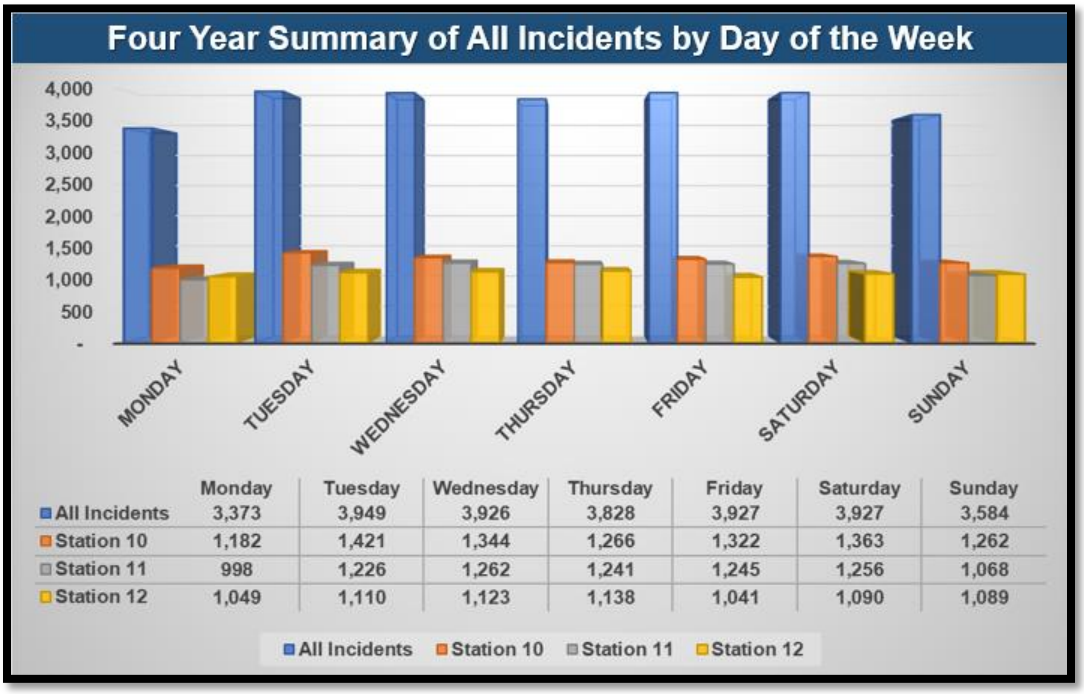
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
All Incidents	2254	1991	2017	1926	2199	2268	2422	2396	2231	2320	2157	2220
Station 10	762	705	678	654	755	791	815	808	797	828	789	778
Station 11	730	608	613	604	654	724	817	740	698	716	671	721
Station 12	633	581	624	584	650	648	682	728	631	662	596	621

Incidents by Day of the Week

Coupled with the time of day and perhaps incidents by month, analyzing incidents by day of the week can identify patterns and indicate that staffing or resource deployment

changes may be needed. Figure 22 charts the calls by day of the week. There are a relatively consistent number of incidents each day of the week.

Figure 22: Four Year Summary of All Incidents by Day of the Week



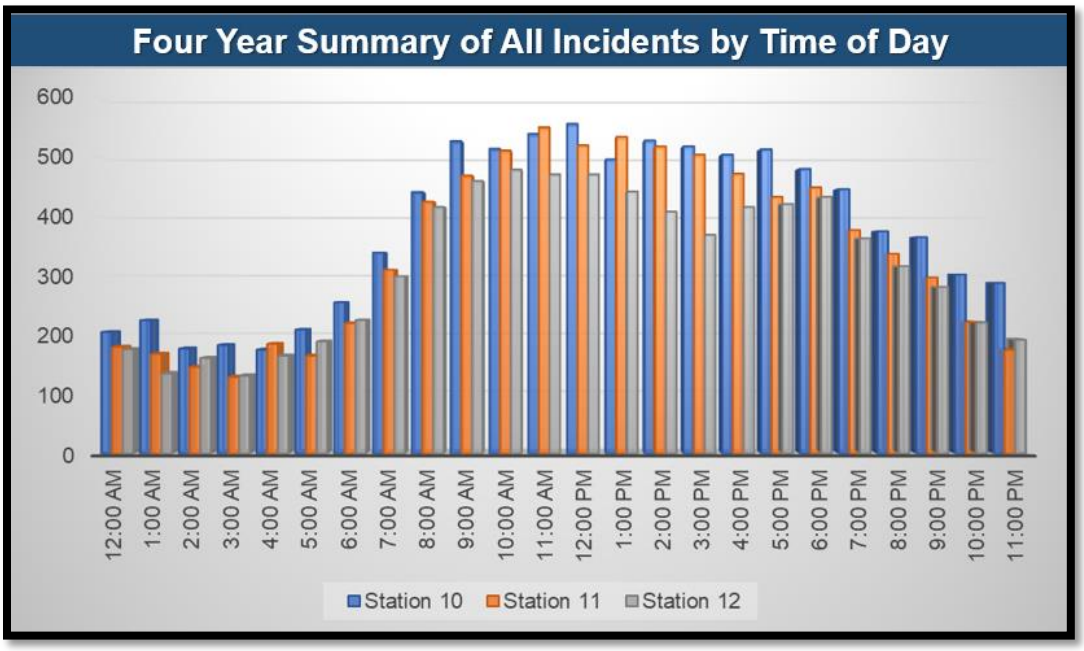
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
All Incidents	3,373	3,949	3,926	3,828	3,927	3,927	3,584
Station 10	1,182	1,421	1,344	1,266	1,322	1,363	1,262
Station 11	998	1,226	1,262	1,241	1,245	1,256	1,068
Station 12	1,049	1,110	1,123	1,138	1,041	1,090	1,089

Incidents by Time of Day

The least busy time of day is typically from midnight to early morning, peaking in the mid to late afternoon, and decreasing in the later evening hours. Although the least busy time of day is from midnight to early morning, it is also when the highest number of civilian fire deaths occurs due to sleeping building occupants.[87] Those most at risk are the very young and old, who are often less able to escape and protect themselves. Figure 23 graphs the incidents by the time of day for calls for in 2018-2021.

[87] Ibid

Figure 23: Four Year Summary of All Incidents by Time of Day



Call/Hour Volume Analysis

Call volume data from 2018-2021 shows that in a 24-hour period NFD experiences its heaviest call volume between 7:00 AM and 6:00 PM. For a shift beginning at 7:00 AM, this indicates companies are at their busiest handling emergency calls during the first 12-hours of a 24-hour shift.

Historic System Response Workload

To engage in a full response time analysis, it is important to first examine the Department's service demand. Higher service demands can strain the resources and may have a negative effect on response times.

Figure 24 shows NFD's 4-year service demand.[88] Total service demand has increased 9.4% over the four years, primarily driven by an increase in "other" incidents.

Figure 24: All Incidents Inside Response Area 2018 – 2021 and All Incidents Outside of Area 2018 – 2021

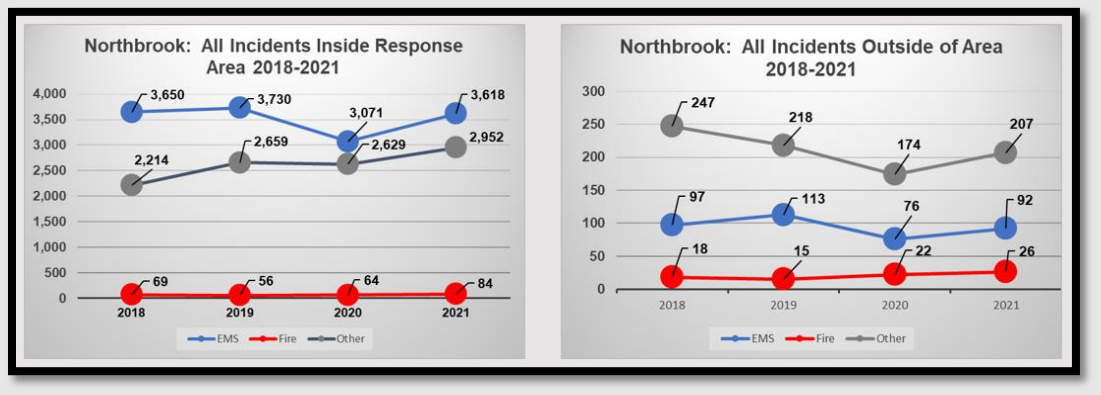
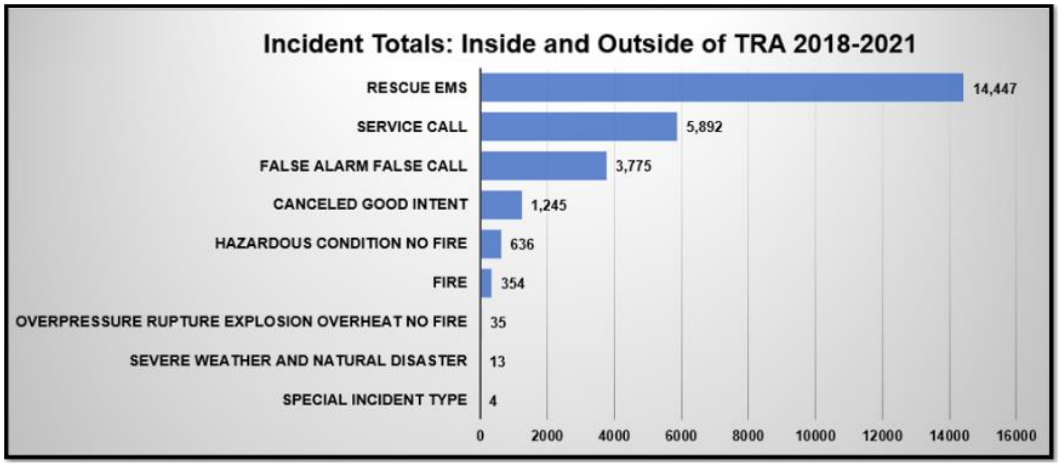


Figure 25 shows responses by type of incident from 2018-2021. Emergency medical responses represent 56% of NFD's total responses.

In 2020, many fire departments and EMS providers experienced a reduction in emergency service calls. The consensus among industry professionals is that the reduction in call volumes was a result of the government-imposed "stay at home" and "social distancing" orders. Comparing EMS data between 2019 and 2020, the NFD experienced an 18% reduction in EMS calls. In 2021, EMS calls rebounded to levels experienced during calendar years 2018 and 2019.

[88] Incident data used for the evaluation of current performance was all responses made from 2018 through 2021. During that four year period, NFD responded to 26,401 incidents.

Figure 25: Incident Counts Inside and Outside the TRA, 2018-2021



Historical System Distribution, Deployment and Concentration Performance

Fire Station Distribution Analysis

In every emergency service delivery system, time becomes the key performance indicator that demonstrates how effectively a department compares to industry standards. The strategic placement of fire stations within a community is vital to providing efficient and effective fire department programs and services. Without informed planning for station locations, response to fires, medical emergencies, and other types of incidents, calls for service made by the public may result in increased response times for first arriving and backup companies. Factors that typically contribute to the number and location of fire stations in a community include:

- Available property
- Budgetary limitations
- Community expectations
- Fire and EMS national benchmarking and standards
- Preexisting locations
- Public's perceived level of risk
- Response times
- Requests for service
- Unique local conditions

Many of these factors have reportedly influenced the location of Village of Northbrook fire stations since the Department's inception.

Time, The Critical Element

Upon receiving a call for emergency service, time becomes the critical element. Fire growth can expand at a rate of many times its volume per minute. Time is the critical factor for the rescue of occupants and the application of extinguishing agents to minimize loss.

The primary criteria used to determine the best locations for a fire station is the built environment and the severity of fire risk to structures and other fixed properties within the designated geographic boundaries. The primary goal is to ensure the fire department can muster sufficient resources in a timely manner to minimize the loss of life and property. The secondary goal is to ensure a sufficient backup force is available to minimize the probability of fire spreading to other areas of a structure, spreading to other structures and escalating into a group fire, or an all-out conflagration where large swaths of the geographic area burn.

Fire Behavior

Acceptable standards and best practices recommend that fire stations and their assigned personnel and apparatus should be strategically placed to arrive at the scene of a structure fire or similar incident in time to mitigate the threat to occupants. Or when no life threat is present, reduce the damage to property due to the direct effect of fire or its byproducts, such as heat and smoke damage.

Flashover

During a structure fire, the point between survivability and minimal property damage and severe harm to occupants with significant damage to a structure and contents occurs at the point of flashover; the sudden involvement of a room or an area in flames from floor to ceiling caused by thermal radiation feedback. Thermal radiation feedback is the energy of the fire being radiated back to the contents of the room from the walls, floor, and ceiling. This thermal radiation confined to the interior of the room will raise the contents to their ignition temperature. When all the contents of the room suddenly ignite the room has reached the point of flashover, or the fully involved stage of a structure fire.

Fire Extension

A quick response by the fire department is usually the most effective strategy to reduce loss of lives and property damage in structures without sprinklers.[89] The faster the fire service can respond and set up, the sooner they can begin to mitigate an incident. This should translate into increased safety for firefighters and occupants, as well as decreased property loss and indirect business loss. Both temperature rise and time represent a rate of fire propagation in a room without sprinklers and roughly corresponds to the percentage of property destruction. At any given point in the fire sequence, the hypothetical room of origin flashes over. Extension outside the room begins at that point and exposes occupants in other parts of the structure to harm.

Built-in Protection

In contrast, between one and two minutes a fire's severity can be greatly diminished and occupants' exposure to harmful conditions reduced through the presence of smoke detection and automatic fire sprinkler systems. According to the NFPA only one sprinkler head operated in 79% of fires in which sprinklers were activated; in 97% of fires with operating sprinklers, five or fewer heads operated. It is widely accepted that most fires that occur in structures with properly designed, compliant, and functioning sprinkler systems will be extinguished before the fire department arrives on the scene.

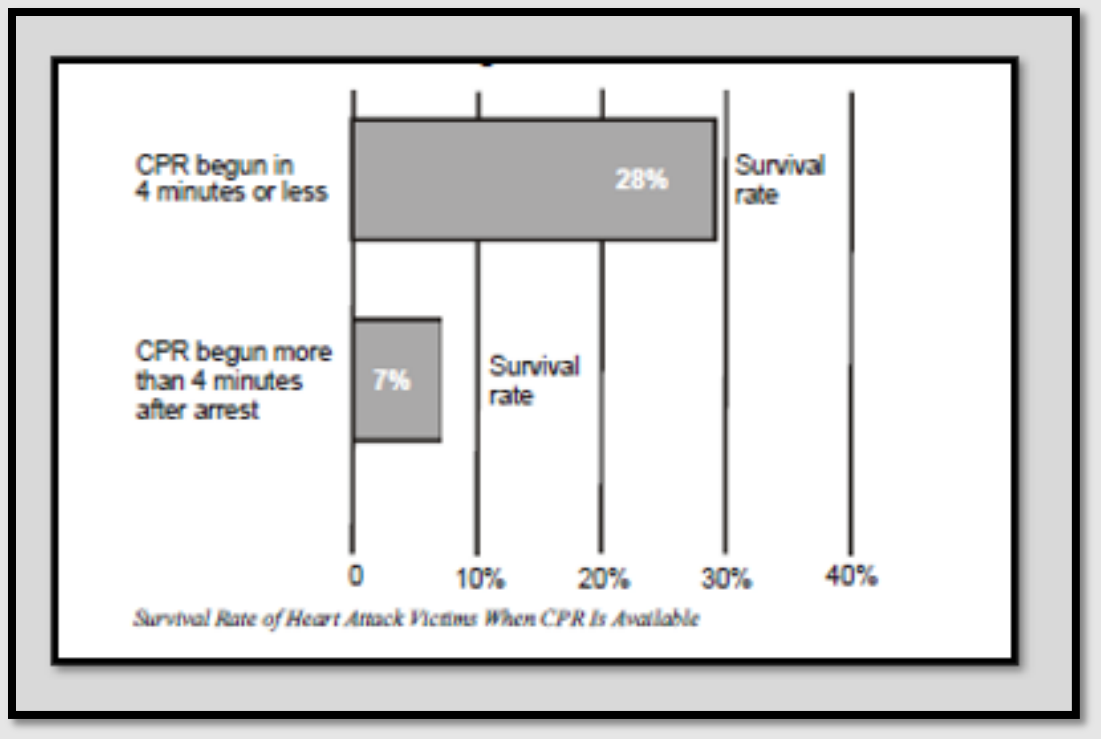
[89] Fire Service Features of Building and Fire Protection Systems. (2015). OSHA 3256-09R. Retrieved on June 6, 2022 from www.osha.gov

Occupants can greatly reduce their risk from fire through the installation of smoke alarms and automatic fire sprinkler systems. These two life safety features, whether installed together or independently and in conjunction with other elements of modern building codes, have greatly reduced the severity of property damage during a fire while improving the survivability of occupants. The system must be compliant and tested with the current use of the structure.

EMS Services

Delivery of EMS is also time critical for many types of injuries and incidents. Out-of-hospital cardiac arrests occur in homes or residences 70% of the time, public settings 18.8% of the time, and nursing homes 11.2% of the time. If performed immediately, CPR can double or triple the chance of survival from an out-of-hospital cardiac arrest.[90]

Figure 26: Survival Rate for Heart Attack Victims When CPR is Available



For both fire and medical emergencies, the basis for the placement of fire stations should be the amount of time that it takes to deliver adequate emergency resources to the point of demand from each fire station or combination of stations.

[90] American Heart Association, CPR and First Aid: Emergency Care. Retrieved on June 6, 2022 from https://cpr.heart.org/en/resources/cpr-facts-and-stats

Fire Station Distribution – GIS Time and Distance Analysis

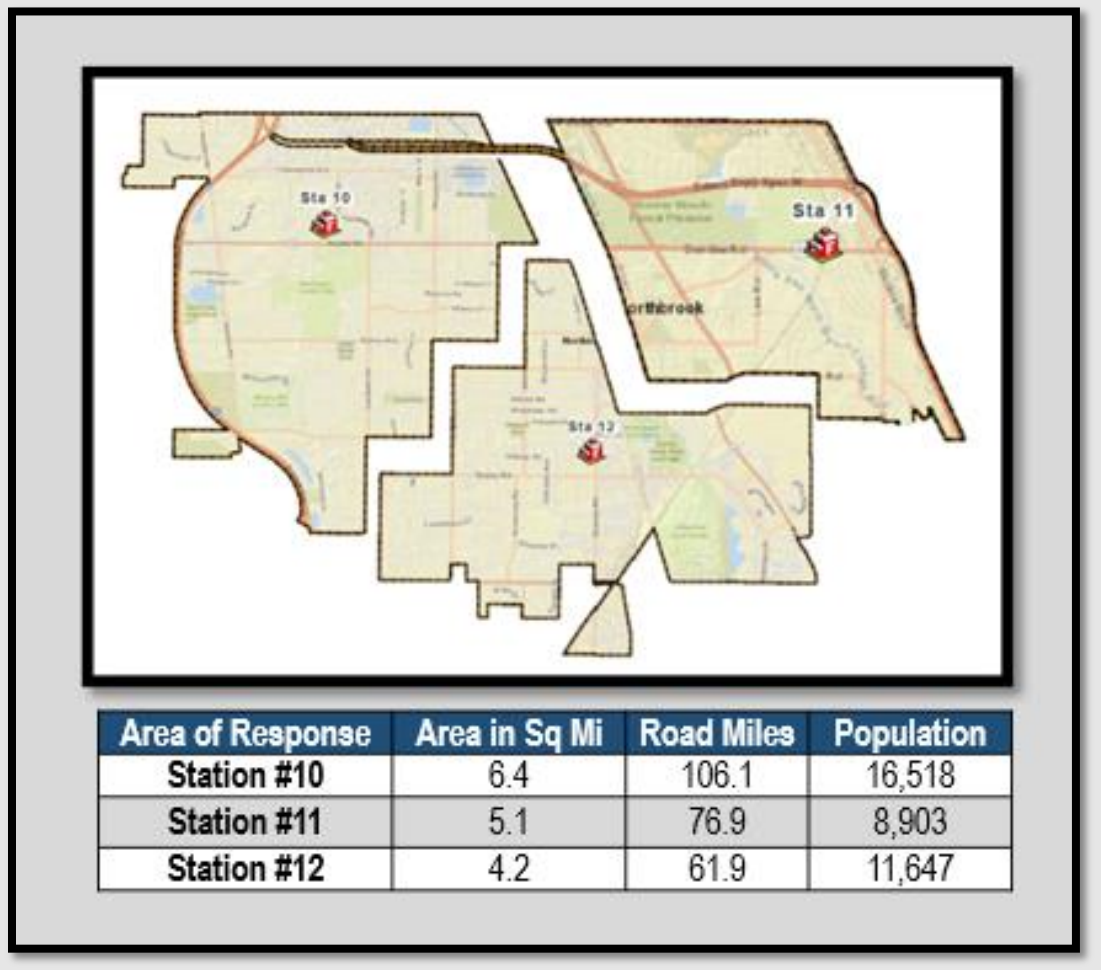
Fire station distribution (distribution) analysis requires locating geographically-distributed first-due resources for all-risk initial intervention. Station location affects rapid deployment to minimize and terminate average, routine emergencies. Distribution is measured by the percentage of the jurisdiction that is covered by the first-due companies within the adopted agency dispatch policy.

Concentration addresses the spacing of multiple resources arranged so that an initial "effective response force" can be assembled on scene within a specified time frame. An initial effective response force is that which will most likely stop the escalation of an emergency in a specific risk type.

Defining Area of Response

Each NFD fire station has an area of response (AOR) that is approximately five square miles of coverage. However, the majority of the population is within Station #10 AOR. Reviewing a map of the Village with each station location exhibited, one could easily assume that all three fire stations are evenly disbursed and provide adequate coverage to their AOR, as well as the entire Village or the total response area (TRA). A time travel analysis discloses disparity between each station's ability to respond to service calls within its AOR.

Figure 27: Fire Department Area of Response



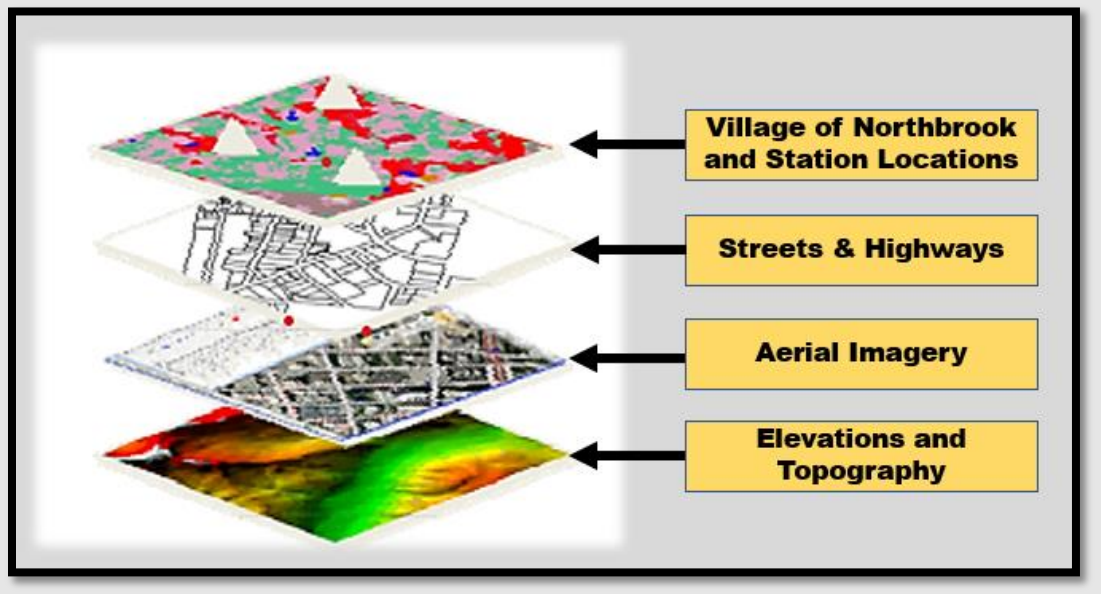
Area of Response	Area in Sq Mi	Road Miles	Population
Station #10	6.4	106.1	16,518
Station #11	5.1	76.9	8,903
Station #12	4.2	61.9	11,647

Travel Time Modeling Assessment – Applied Data

Using GIS technology and time travel modeling software, PolarisPSS produced meaningful and accurate data driven results to analyze NFD's travel and response time performance.

PolarisPSS determined travel times by utilizing the Village of Northbrook GIS mapping data, which includes fire station locations and the latest information detailing each street line segment, intersections, and attribute information such as road type, distance, and travel speeds. This allowed PolarisPSS to identify a station location, specify a travel time, and run a network analysis. The results displayed by an irregular polygon around the station illustrate where the fire apparatus could travel in any direction for the specified time. This analysis was performed on each station and then simultaneously on all three stations to analyze gaps in coverage, establish run orders, and more.

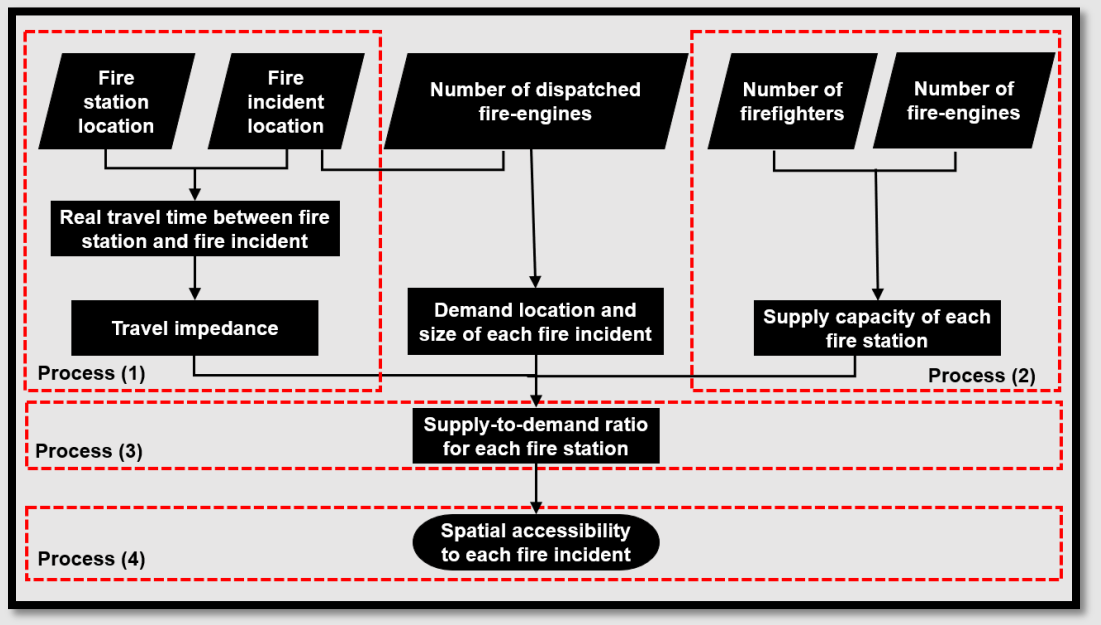
Figure 28: GIS Modeling Method



PolarisPSS conducted a spatial accessibility of emergency incidents for the purpose of determining response efficiencies. Using both statistical and analytical modeling software, PolarisPSS measured and compared historical travel time data sets to specific travel-time thresholds. The results produced accessibility scores that presented the pattern of cluster spatial distribution for the travel-time threshold within a given catchment area.[91] Figure 29 depicts the modeling process. By applying GIS to the numerical patterns and trends, descriptive maps were produced for illustrative assessments.

[91] Catchment areas can be defined **by distance, by travel time, and by mobility patterns**, allowing analysis of travel time in a variety of ways.

Figure 29: GIS Modeling Processes



PolarisPSS applied this technology to the NFD dispatch data for both response and travel time to determine the Department's level of performance by stating the percentage of incidents in which the first due company arrives on scene compared to the national standards and best practices.

Travel and Response Time National Standards and Best Practices

In the United States there are several nationally recognized methods for determining fire station locations. Each method has the same intended goal to strategically place firefighters and their equipment for optimum effectiveness within a community to reduce the risk of life and property damage during a fire, medical emergency, or other type of incident.[92]

Each method is organized as either a standard or best practice derived from standard-making organizations such as the NFPA or the fire insurance industry whose interests in the effectiveness of public fire protection is derived through the ISO, a leading source of information for the industry about property/casualty insurance risk. A similar method that is sometimes used is the CFAI Self-Assessment and Accreditation Program.

PolarisPSS determined the NFD's preference for analysis included both the NFPA and ISO methods. [93,94] See Figure 10 for the cascade of the events of an emergency incident from beginning to end. This report focuses on *five core performance-based events*, three included in **Call Processing Time** and the remaining two included in **Response Time**.

Performance reliability is measured in minutes and seconds and can be measured as the percentage of time the system performs within its stated objective. Due to the nature and scope of the study in relation to the distance from a fire station to any point in the Village, a description of the standard response time criteria is provided for an initial structure fire and emergency medical response.

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[92] All of the methods place particular emphasis on the placement of fire stations and accompanying number and types of units, including engines and ladder trucks, and their level of staffing with regards to structural fire protection. This is understandable due to the potential monetary influence by the fire insurance industry on individual property owners and their community leaders. Optimum municipal fire station locations serve as a major element in the industry's formula for individual and commercial property fire insurance premiums.

[93] The purpose of NFPA 1710, *The Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments* is to specify the minimum criteria for addressing the effectiveness and efficiency in the delivery of public fire suppression operations, EMS, and special operations. With relation to fire station location, a section of this standard focuses on the response time of fire companies to arrive on the scene of a fire or medical emergency to effectively organize and deploy personnel and equipment.

[94] The ISO FSRS views the strategic location of stations based on response distance. The schedule applies a theory whereby developed areas of a community should be no further than 1.5 road miles from the closest engine company and 2.5 miles from the closest ladder company. Using the lesser distance of the two criteria equates to an engine company providing coverage over an area of 4.5 square miles on a flat and uniform street grid.

Response Distance Rationale

ISO field representatives have long used the response distance criterion due to its ease of application. In recent years the method has undergone much scrutiny due to the perceived oversimplification of fire station location and analysis. The research, conducted by the RAND Corporation, revealed an *average* speed of 35 miles per hour for fire apparatus traversing through city streets where heavy traffic, narrow lanes, topography, tight intersections, and other barriers to reach a theoretical location before the 4-to-6-minute time for flashover to occur. The criteria produce an expected travel time of 3 minutes 12 seconds for an engine company and 4 minutes 54 seconds for a ladder-service company.[95]

Table 22: ISO Structure Fire Response

Unit/Company	Maximum Travel Distance *	Travel Time
1st Due Engine Co.	1.5 road miles	3.2 minutes
1st Due Ladder Co.	2.5 road miles	4.9 minutes

* Average travel speed at 35 mph

Structure Fire Response

Both NFPA 1710 and ISO recognize the industry-wide practice of sending a minimum of two engine companies and one aerial ladder company under the supervision of a chief officer to all reported residential structure fires and similar properties. Table 23 shows the NFPA 1710 standard for the maximum travel and response time for the above-mentioned units responding to a typical single family residential structure fire.

Table 23: NFPA 1710 Maximum Travel and Response Time for Structure Fire Response

Unit/Company	Maximum Travel Time	Maximum Response Time
1st Due Engine Co.	4 minutes	5 Minutes 20 Seconds
2nd Arriving Company	6 minutes	7 Minutes 20 Seconds
Initial Full Alarm (low and medium hazard)	8 minutes	9 Minutes 20 Seconds
Initial Full Alarm (high rise)	10 minutes, 10 seconds	11 Minutes 30 Seconds

[95] In its analysis of fire company distribution ISO does not measure or use actual historical response times of individual communities. This is due to many fire departments lacking accurate and reliable response-time information in conjunction with their view that there is no standardized national recordkeeping system that would allow for the determination of fire department response times.

Emergency Medical Response

Similarly, NFPA 1710 identifies travel time criteria for a fire department that provides basic or advanced response to medical emergencies.

Table 24: NFPA 1710 EMS Response

Unit/Company	Maximum Travel Time	Maximum Response Time
Basic Life Support	4 minutes	5 Minutes
Advanced Life Support	8 minutes	9 Minutes

Special Operations Response

NFPA 1710 provides little direction regarding response time criteria for special operations. Examples include response to hazardous materials spills, rescue operations requiring specialized technical expertise such as high angle, confined space, swift water and urban search and rescue. The standard does stipulate the fire department should include criteria for the various types of special operations response and mitigation activities that the fire department is expected to respond to within its organizational statement.

NFD Historic Travel and Response Time Assessment

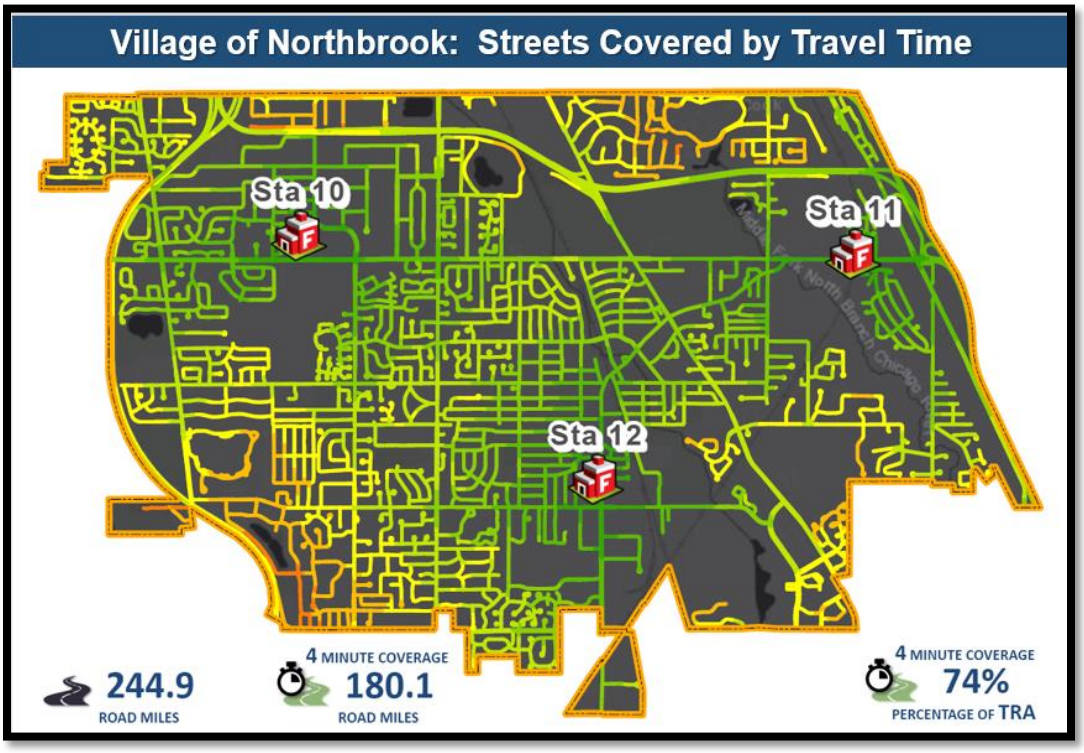
4- and 8-Minute Travel Time Standard

PolarisPSS used NFD emergency run data from 2018 to 2021 to assess historic travel and response times. The first assessment was to calculate spatial accessibility from each of the three fire station locations with a 4-minute travel time threshold and a second spatial accessibility using the 8-minute travel time. Both time thresholds are in accordance with the NFPA 1710 recommended travel time standard of four minutes for the first arriving fire or EMS units and eight minutes to assess the effective response force needed for sustained operations. The purpose of this analysis is to determine the percentage of an area that can be reached within both time thresholds.

Travel Time Findings

PolarisPSS used the current GIS street maps to show that from each of the fire station locations ***74% of the Village can be reached within the 4-minute travel time benchmark*** for an 11.1 square mile area. One hundred percent of the entire response area is within the 8-minute benchmark, which represents an area of approximately 15.7 square miles. It is evident that the current fire station locations will not provide the benchmark of 90% for the first arriving unit within four minutes. A review of the historical response data is presented in *Emergency Response Data* section of this report to support this finding.

Figure 30: Streets Covered by Travel Time - TRA



Overview: Fire Stations Area of Response - Travel and Response Time Assessment

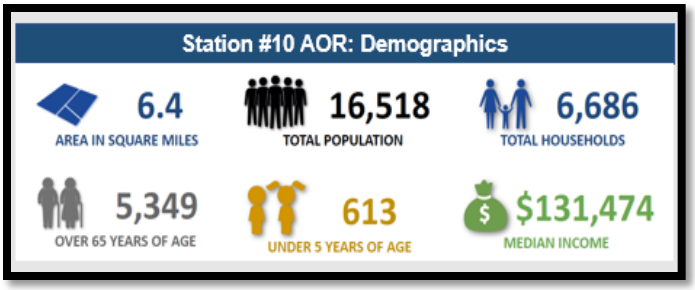
How fast help arrives is the most important measure of performance for any emergency service provider. In this section, the 4-minute and 8-minute travel time catchments are identified and then historical incident data from 2018 through 2021 is applied to conduct a performance measurement of both travel times and response times.

Station #10 – Travel and Response Time Performance Measurement

Travel Time Findings

Station #10 has the largest AOR, consisting of approximately 6.4 square miles with 106.1 road miles. Station #10 AOR also has the highest percentage of Village residents out of the three fire stations' AORs. Many residents meet the "at risk ages" of over 65 years and less than five years old.

Figure 31: Station #10 AOR Demographics



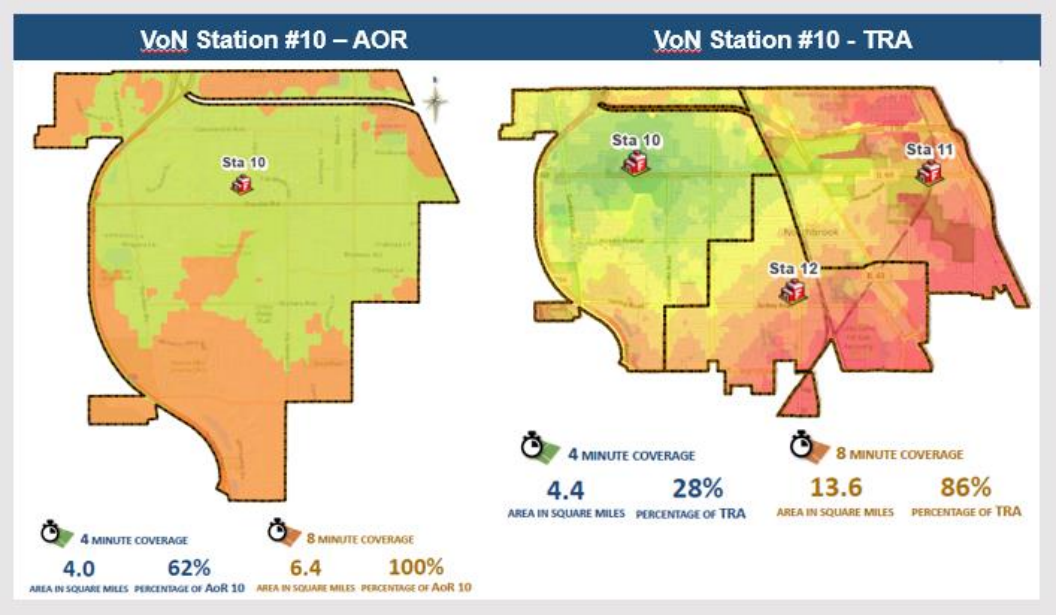
4-Minute Travel Time Assessment

The review of Station #10's AOR 4-minute travel time assessment found that ***62% of the AOR is obtainable within a 4-minute travel time.*** This analysis indicates and supports the fact that Station #10's 6.4 square mile AOR is too large.

8-Minute Travel Time Assessment

PolarisPSS then assessed Station #10's travel times within the entire Village TRA to determine what Station #10's travel time capabilities would be if they were dispatched as part of an effective response force to any location within the Village boundaries. This assessment revealed that ***86% of the TRA is obtainable within an 8-minute travel time.***

Figure 32: Station #10 AOR and TRA



Station #10 Area of Response Performance Findings

Applying the *response time* performance standard of being within 5 minutes and 20 seconds for 90% of all **fire incidents**, PolarisPSS found that in 2021 ***Station #10 was within the 60th Percentile of the 5-minute 20-second benchmark.*** Applying the response time performance standard of being within five minutes for 90% of all **EMS incidents,** PolarisPSS found that in 2021 ***Station #10 was within the 49th Percentile of the 5-minute benchmark.***

Figure 33: Station #10 Area of Response – 2021 Performance Findings

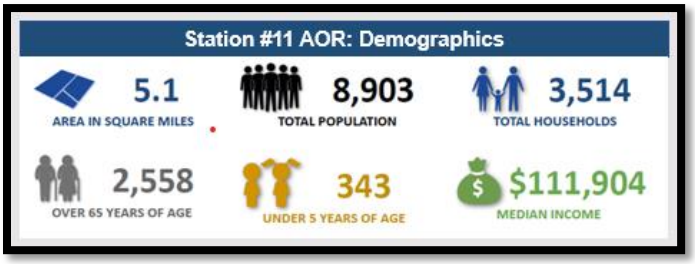
Station #10 Area of Response - 2021 Performance Findings							
Year	NFPA 1710 Performance Criteria	NFPA Performance Objective for at Least 90% of Incidents	VONFD Performance Findings				
			90%	80%	70%	60%	50%
2021	Turn Out Time	1 Min : 20 Secs	0:01:51	0:01:47	0:01:38	0:01:28	0:01:21
31 Fire Incidents	Travel Time	4 Min : 00 Secs	0:06:36	0:04:53	0:04:28	0:03:51	0:03:07
	Response Time	5 Min : 20 Secs	0:08:27	0:06:40	0:06:06	0:05:19	0:04:28
2021	Turn Out Time	1 Min.	0:01:56	0:01:37	0:01:25	0:01:17	0:01:10
1,354 EMS Incidents	Travel Time	4 Min.	0:05:12	0:04:47	0:04:32	0:04:17	0:04:00
	Response Time	5 Min.	0:07:08	0:06:24	0:05:57	0:05:34	0:05:10
2021	Turn Out Time	1 Min : 20 Secs	0:01:51	0:01:47	0:01:38	0:01:28	0:01:21
1,047 Other Incidents	Travel Time	4 Min : 00 Secs	0:06:57	0:05:30	0:04:54	0:04:33	0:04:11
	Response Time	5 Min : 20 Secs	0:08:48	0:07:17	0:06:32	0:06:01	0:05:32

Station #11 – Travel and Response Time Performance Measurement

Travel Time Findings

Station #11's AOR is approximately 5.1 square miles with 76.9 road miles. There are 3,514 households in the AOR that are serviced.

Figure 34: Station #11 AOR Demographics



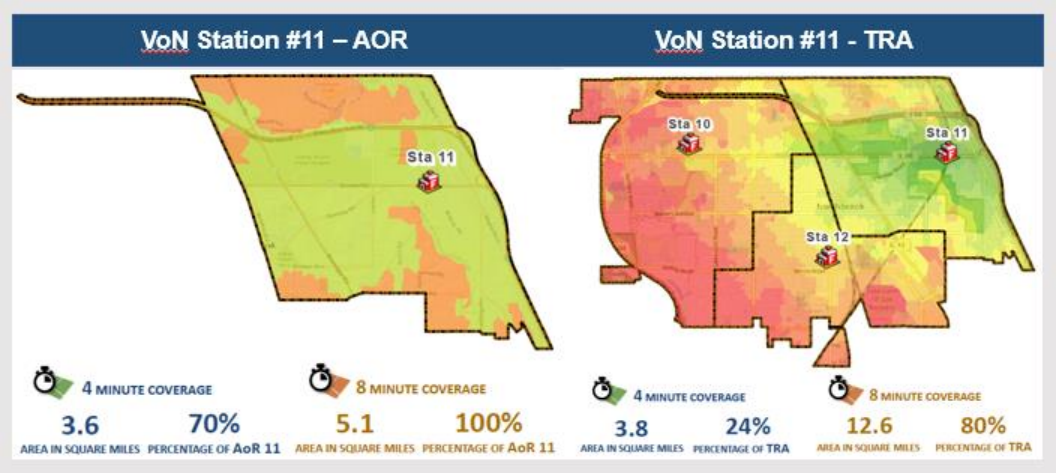
4-Minute Travel Time Assessment

The review of Station #11's AOR 4-minute travel time assessment found that ***70% of their AOR is obtainable within a 4-minute travel time.***

8-Minute Travel Time Assessment

PolarisPSS then assessed Station #11's travel times within the entire Village TRA to determine what Station #11's travel time capabilities would be if they were dispatched as part of an effective response force to any location within the Village boundaries. The assessment revealed that ***80% of the TRA is obtainable within an 8-minute travel time.***

Figure 35: Station #11 AOR and TRA



Station #11 Area of Response Performance Findings

Applying the *response time* performance standard of being within 5 minutes and 20 seconds for 90% of all **fire incidents**, PolarisPSS found that in 2021 ***Station #11 was within the 60th Percentile of the 5-minute and 20-second benchmark.*** The analysis also indicated that Station #11 is within 11 seconds of reaching the 70th percentile benchmarks.

Applying the response time performance standard of being within five minutes for 90% of all **EMS incidents**, PolarisPSS found that in 2021 ***Station #11 was within the 60th***

***Percentile* of the 5-minute benchmark.** Here too, the data indicates that Station #11 is within 18 seconds of reaching the 70th percentile benchmark.

Figure 36: Station #11 Area of Response – 2021 Performance Findings

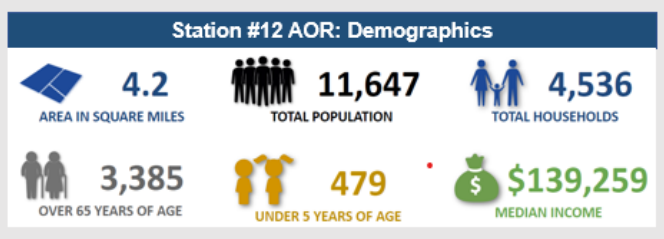
Station #11 Area of Response - 2021 Performance Findings							
Year	NFPA 1710 Performance Criteria	NFPA Performance Objective for at Least 90% of Incidents	VONFD Performance Findings				
			90%	80%	70%	60%	50%
2021	Turn Out Time	1 Min : 20 Secs	0:02:02	0:01:47	0:01:39	0:01:34	0:01:26
25 Fire Incidents	Travel Time	4 Min : 00 Secs	0:06:36	0:04:53	0:04:28	0:03:21	0:03:03
	Response Time	5 Min : 20 Secs	0:06:59	0:05:50	0:05:31	0:04:55	0:04:29
2021	Turn Out Time	1 Min.	0:01:50	0:01:30	0:01:19	0:01:10	0:01:04
1,305 EMS Incidents	Travel Time	4 Min.	0:04:50	0:04:19	0:03:59	0:03:41	0:03:24
	Response Time	5 Min.	0:06:40	0:05:49	0:05:18	0:04:51	0:04:28
2021	Turn Out Time	1 Min : 20 Secs	0:02:09	0:01:48	0:01:36	0:01:25	0:01:16
859 Other Incidents	Travel Time	4 Min : 00 Secs	0:06:51	0:05:52	0:05:07	0:04:38	0:04:07
	Response Time	5 Min : 20 Secs	0:09:00	0:07:40	0:06:43	0:06:03	0:05:23

Station #12 – Travel and Response Time Performance Measurement

Travel Time Findings

Station #12's AOR is approximately 4.2 square miles with 61.9 road miles.

Figure 37: Station #12 AOR Demographics



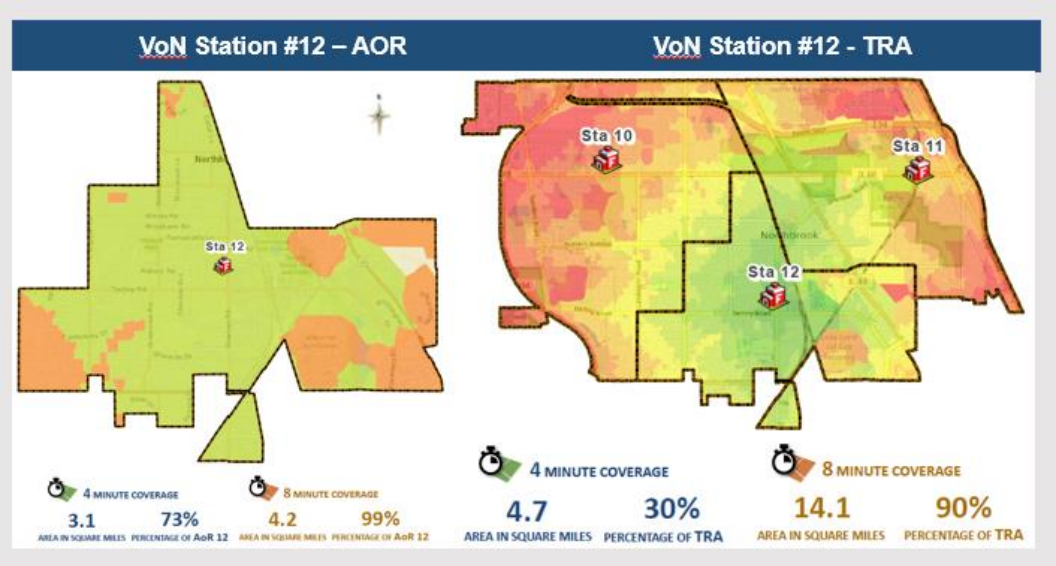
<u>4-Minute Travel Time Assessment</u>

The review of Station #12's AOR 4-minute travel time assessment found that ***73% of the AOR is obtainable within a 4-minute travel time*.**

<u>8-Minute Travel Time Assessment</u>

PolarisPSS then assessed Station #12's travel times within the entire Village TRA to determine what Station #12's travel time capabilities would be if they were dispatched as part of an effective response force to any location within the Village boundaries. The assessment revealed that ***90% of the TRA is obtainable within an 8-minute travel time.***

Figure 38: Station #12 AOR and TRA



Station #12 Response Performance Findings

Applying the *response time* performance standard of being within 5 minutes and 20 seconds for 90% of all **fire incidents**, PolarisPSS found that in 2021 ***Station #12 was within the 70th Percentile of the 5-minute and 20-second benchmark.*** Applying the response time performance standard of being within five minutes for 90% of all **EMS incidents**, PolarisPSS found that in 2021 ***Station #12 was within the 60th Percentile of the 5-minute benchmark.*** Here too, the data does indicate that Station #12 is within 4 seconds of reaching the 70th percentile benchmark.

Figure 39: Station #12 Area of Response – 2021 Performance Findings

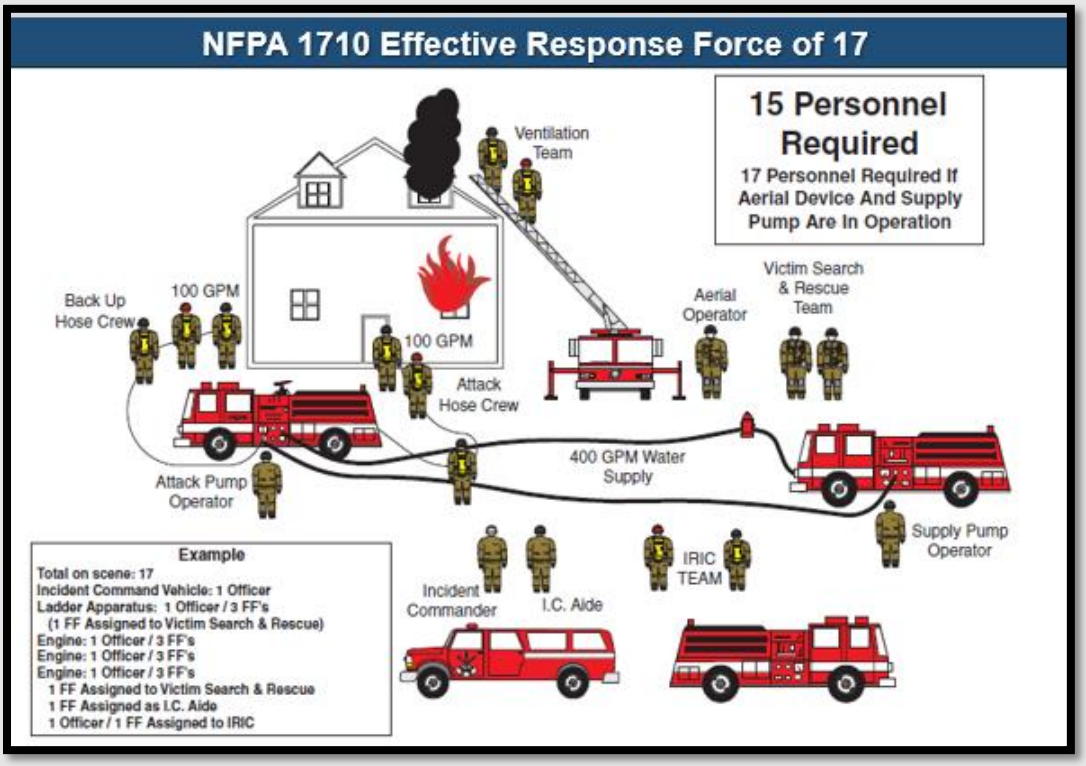
Station #12 Area of Response - 2021 Performance Findings							
Year	NFPA 1710 Performance Criteria	NFPA Performance Objective for at Least 90% of Incidents	VONFD Performance Findings				
			90%	80%	70%	60%	50%
2021	Turn Out Time	1 Min : 20 Secs	0:02:03	0:01:43	0:01:41	0:01:32	0:01:08
28 Fire Incidents	Travel Time	4 Min : 00 Secs	0:06:36	0:04:53	0:04:28	0:03:20	0:03:32
	Response Time	5 Min : 20 Secs	0:06:52	0:06:03	0:05:12	0:04:52	0:04:40
2021	Turn Out Time	1 Min.	0:01:54	0:01:35	0:01:21	0:01:12	0:01:07
989 EMS Incidents	Travel Time	4 Min.	0:04:19	0:04:00	0:03:43	0:03:29	0:03:19
	Response Time	5 Min.	0:06:13	0:05:35	0:05:04	0:04:41	0:04:26
2021	Turn Out Time	1 Min : 20 Secs	0:02:09	0:01:48	0:01:36	0:01:25	0:01:16
1,046 Other Incidents	Travel Time	4 Min : 00 Secs	0:05:46	0:05:01	0:04:29	0:03:59	0:03:29
	Response Time	5 Min : 20 Secs	0:07:55	0:06:49	0:06:05	0:05:24	0:04:45

Effective Response Force

An ERF is defined by NFPA 1710 as the minimum number of firefighters and equipment that must reach a specific emergency location within a maximum prescribed response time.[96] The maximum prescribed response time acts as one indicator of resource deployment efficiency.

NFPA 1710 states that the ERF for a single-family dwelling shall be a total of 17 personnel and that all shall be on-scene within 9 minutes and 20 seconds (560 seconds total). Given that the NFD's minimum staffing per shift is 16 personnel combined with the additional staffing and equipment responding as automatic aid companies, PolarisPSS conducted an ERF response time assessment to determine if apparatus and personnel could meet the *9-minute and 20-second benchmark.*

Figure 40: NFPA 1710 Effective Response Force of 17[97]



Effective Response Force Response Time Findings

Applying the initial full alarm assignment response time performance standard of 9 minutes and 20 seconds, the data shows the percentage of fire incidents that would be covered by two fire stations and the percentage of incidents that would be covered by three fire stations. The purpose of this assessment is to determine the NFD capabilities

[96] Ibid
[97] Illustration Source, IAFF, 2002

for assembling an ERF within 9 minutes and 20 seconds without automatic aid assistance.

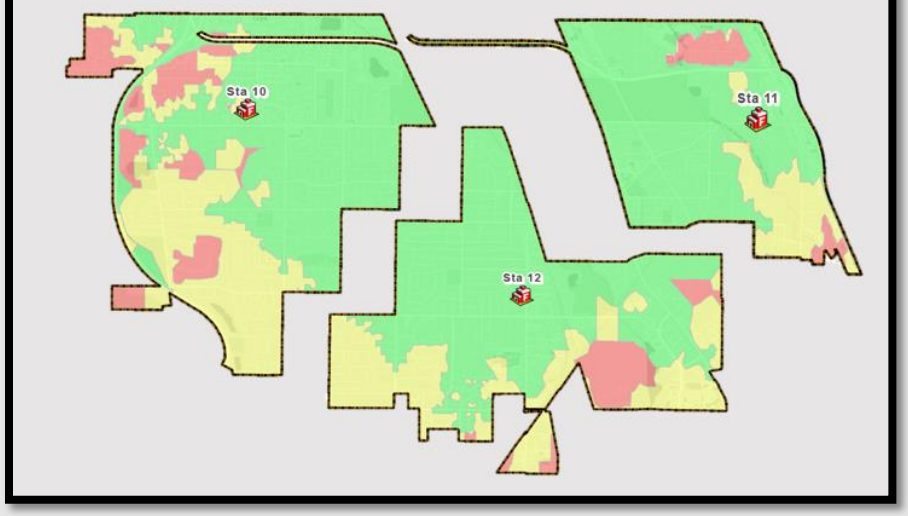
Based upon the percentage of incidents within each station's AOR, PolarisPSS found that:

- **55%** of Station #10's incidents are reachable by Station #11 and Station #12 within 560 seconds (9 minutes, 20 seconds)
- **85%** of Station #11's incidents are reachable by Station #10 and Station #12 within 560 seconds (9 minutes, 20 seconds)
- **68%** of Station #12's incidents are reachable by Station #10 and Station #11 within 560 seconds (9 minutes, 20 seconds)

The data indicates that if all three NFD fire stations were available, the NFD has the ability to assemble the ERF within 55% to 85% of the performance standard of 9 minutes, 20 seconds. As stated in the ***Resource Deployment*** section of this report, efficiencies are gained from the benefit of having automatic aid companies respond to structure fires within the Village boundaries.

Figure 41: Effective Response Force – Initial full Alarm

Effective Response Force - Initial Full Alarm (NFPA 1710: 560 seconds)	Station #10	Station #11	Station #12
Percentage of incidents covered by 2 Stations	24%	8%	32%
Percentage of incidents covered by 3 Stations	55%	85%	68%
NFPA 1710: Turnout Time 80 seconds + Travel Time 480 seconds = 9 min/20 sec			



This study conducts a thorough analysis of the NFD's risks and response performance, and compares those performance elements to national standards, specifically NFPA

1710. It is important for the Department to establish performance goals and monitor each goal over time to ensure continued compliance with these standards.

Recommendations:
Based upon the current three station configuration, NFD should establish the following performance goals:

Turnout Time Goals
Goal 1: *NFD will achieve a turnout time goal of 1 minute (1:00) for EMS incidents 90% of the time.*
Goal 2: *NFD will achieve a turnout time goal of 1 minute, 20 seconds (1:20) for fire incidents 90% of the time.*

Response Time Goals
Goal 1: *NFD will achieve a response time goal of 5 minutes (5:00) or less for the first arriving medical unit for medical emergencies 80% of the time.*
Goal 2: *NFD will achieve a response time goal of 5 minutes, 20 seconds (5:20) or less for the first arriving fire suppression company for fire incidents 80% of the time.*

Effective Force Response Time Goals
Goal 1: *NFD will achieve an effective response force of 17 personnel for structure fires in 9 minutes, 20 seconds (9:20) or less, 90% of the time.*

Produce a quarterly measurement report on the NFD's operational performance. Monitor performance measures to ensure the availability, capability, and efficient and effective use of resources. Performance measures should include alarm processing, turnout time, response time, and total response time for each first-due fire and EMS company.

Unit Hour Utilization

Evaluating Unit Workloads

Unit Hour Utilization (UHU) is a calculation that estimates the amount of time a company is occupied on emergency calls as a percentage of the total amount of hours a company is staffed and available for response. A company that is staffed full-time is available 8,760 hours per year. UHU measures the percentage of on-duty time consumed by emergency service field activities. A high UHU means lower availability for calls. Poor availability negatively affects response times.

However, there are other time factors not accounted for by UHU inclusive of time for training, maintenance, public education efforts, and other preparedness-related functions. In other words, when companies are not engaged in emergency response, it does not mean they are not working. There are many daily shift responsibilities that include non-emergency tasks that must be completed within the 24-hour shift, such as:

- Morning muster
- Apparatus and equipment checkout
- Personal details
- Station details
- Physical Training
- Meals
- Daily Training Session

UHU Benchmarks

While there is no NFPA standard for UHU in the fire service, fire and EMS UHU benchmarks have been defined by several sources. One such source is a July 2016 report from Citygate Associates that advocated a maximum UHU commitment to not exceed 30%. In May 2016, Henrico County Division of Fire in Virginia published an article after studying the department's workload that identified a general commitment factor scale for its department. Table 25 is a summary of the findings as it relates to commitment factors.

Table 25: Commitment Factors as Developed by Henrico County, Virginia Division of Fire, 2016[98]

Commitment Factors as Developed by Henrico County (VA) Division of Fire, 2016		
Unit Hour Factor	**Utilization**	**Description**
0.16 – 0.24 (3h50m – 5h45m)	Ideal Commitment Range	Personnel can maintain training requirements and physical fitness and can consistently achieve response time benchmarks. Units are available to the community more than 75% of the day.
0.25 (6h)	Indicates System Stress	Community availability and unit sustainability are not questioned. First-due units are responding to their assigned community 75% of the time, and response benchmarks are rarely missed.
0.26 – 0.29 (6h14m – 6h57m)	Evaluation Range Resulting in Delayed Incident Responses	The community served will experience delayed incident responses. Just under 30% of the day, first-due ambulances are unavailable; thus, neighboring responders will exceed goals.
0.30 (7h12m)	Red Line	Not Sustainable: Commitment Threshold—the community has less than a 70% chance of timely emergency service and immediate relief is vital. Personnel assigned to units at or exceeding 0.3 ***may*** show signs of fatigue and burnout and ***may*** be at increased risk of errors. Required training and physical fitness sessions are not consistently completed.

As identified in the Henrico County study, the 30% benchmark provides a reasonable standard that ensures units are not over-utilized, response times are within the stated performance measurement, and personnel injuries and accidents do not increase, which is a “red flag” for workforce fatigue.

[98] The commitment factors described relate to units staffed 24-hours per day and are included for comparison purposes and information for NFD.

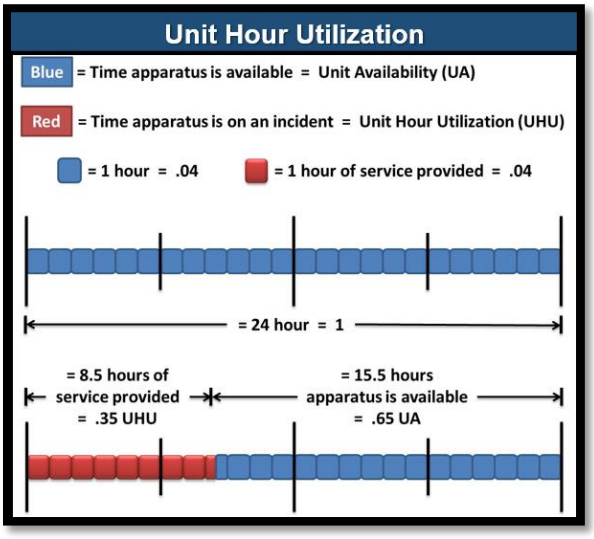
The UHU benchmark that many public safety entities have adopted is **a maximum of 0.35 of a 24-hour shift, which is 8 hours and 30 minutes.** If a company has a UHU of 35%, it most likely will be available for the next call 65% of the time. If a UHU is below 10% units may not be well utilized, but response times may be high too often.

Some communities choose a UHU benchmark in the 0.15 to 0.25 range to improve or maintain response times. If a company is out of its assigned station or AOR more than 25% of the time, then it is unlikely to meet response time goals of 90% of calls within a 4-minute travel time. For the purpose of benchmarking, ***PolarisPSS recommends a benchmark of 0.25 which is equivalent to 6 hours of a 24-hour shift.***

Fire station location is only one factor in determining whether response-time goals will be achieved. The "busyness" factor or workload is also important since companies that are extremely busy may not be available for the next call, thus necessitating the response from a station further away. PolarisPSS' analysis found that none of NFD's fire companies have excessively high workloads. However, several ambulance units are approaching a high workload threshold.

It is important to note that the concept of workload is not merely a count of how many calls to which a company is dispatched. One company can have fewer responses than another but remain on the scene longer on average and, therefore, 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 as part of the CFAI self-assessment process. An analysis of workload can indicate whether a new station should be built, new apparatus purchased, or if current stations should be closed or companies moved.

Figure 42: Unit Hour Utilization



NFD Fire and EMS Company Unit Hour Utilization

This analysis provides an overview of the workload each NFD fire and EMS company experienced during a 24-hour period for shifts starting at 7:00 AM. Response data from 2021 rather than the cumulative or average data from 2018-2021 was used to calculate the UHU since the 2021 data provides a better analysis of current demand because it excludes the COVID-19 variances that occurred in 2020. PolarisPSS used ImageTrend data received from NFD to conduct the UHU analysis.[99,100]

Based upon the NFD's current tandem response plan for EMS incidents, RED Center dispatches a two-person ambulance company with a three-person fire suppression company to assist the ambulance company with patient care, packaging, patient removal, and provide for scene safety at vehicle accidents. However, the actual duration of assignment for the ambulance company and fire company may differ substantially. The fire company is released from the EMS incident once there is no longer a need for their assistance, resulting in the fire company's on-scene time being much shorter than that of the EMS company, especially if the patient has to be transported to a hospital.

This assessment determines each company's ***24-hour workload*** based upon the actual incident times that begin when the call is received to the point the company is back in service. If the company is experiencing incident workloads that exceed the recommended benchmark of 0.25 or 6 hours of a 24-hour shift, then the concentration of staffing and apparatus may not have the capacity for handling back-to-back incidents that may occur within each AOR.

[99] https://www.imagetrend.com/solutions/slate/

[100] PolarisPSS identified reporting differences in data provided by RED Center and NFD. PolarisPSS brought this concern to the attention of NFD leadership. NFD-provided data was used for the UHU analysis.

Figure 43: Station #10: 24-Hour UHU for Calendar Year 2021

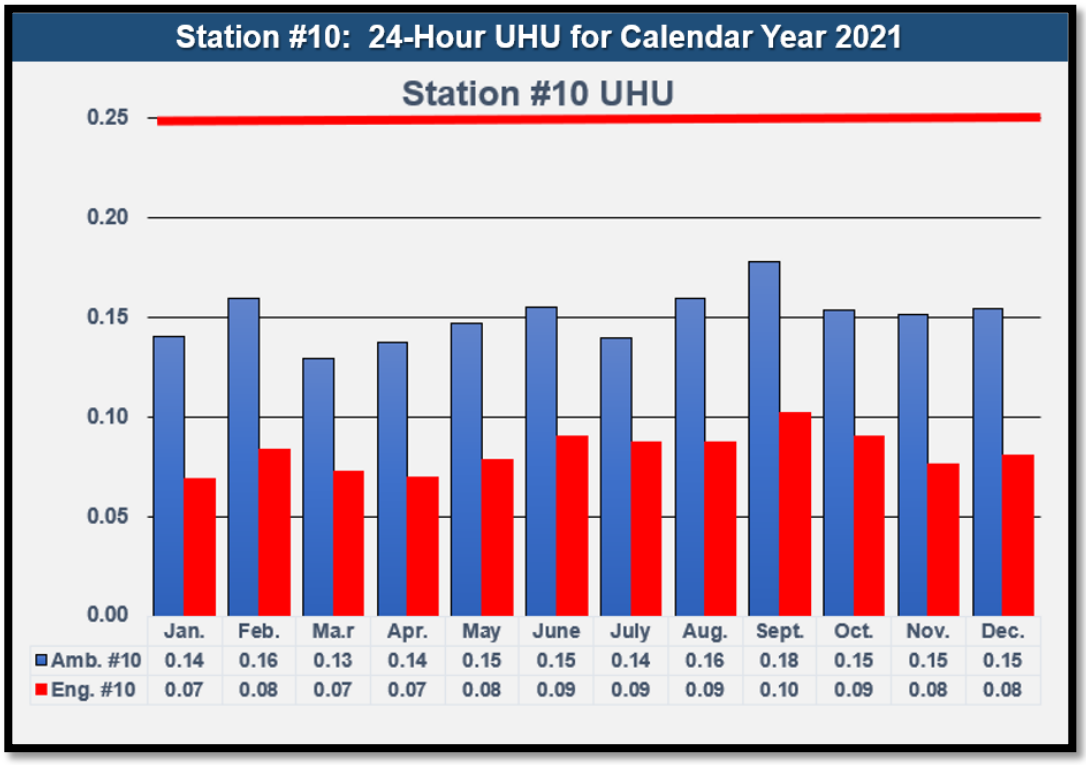


Figure 44: Station #11: 24-Hour UHU for Calendar Year 2021

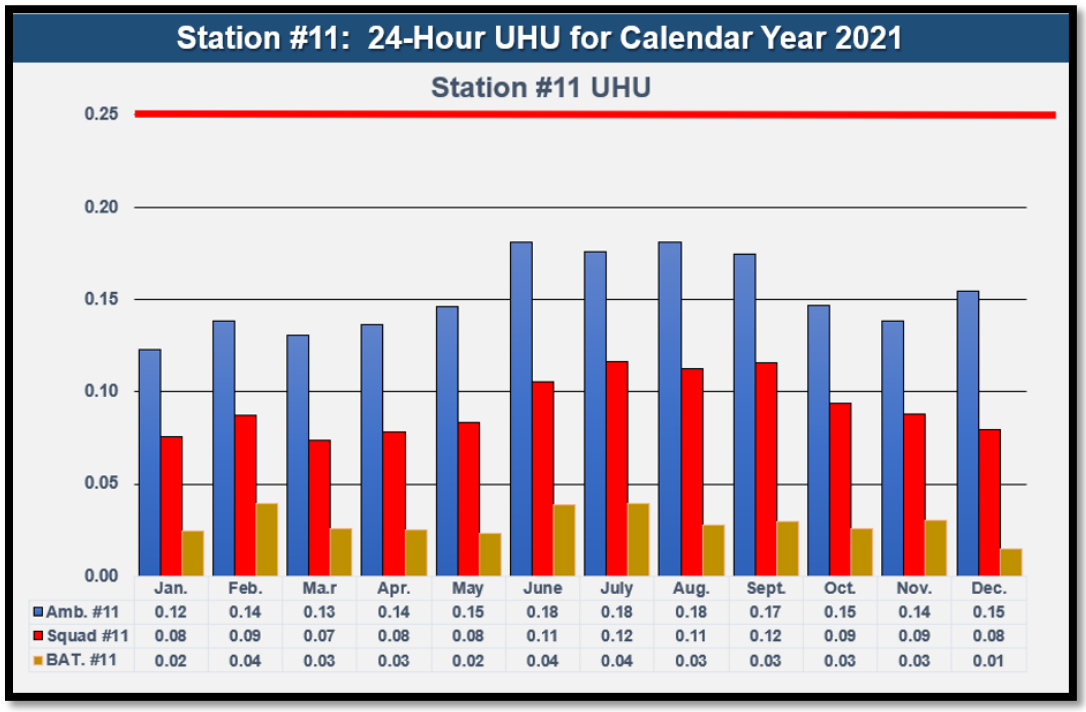
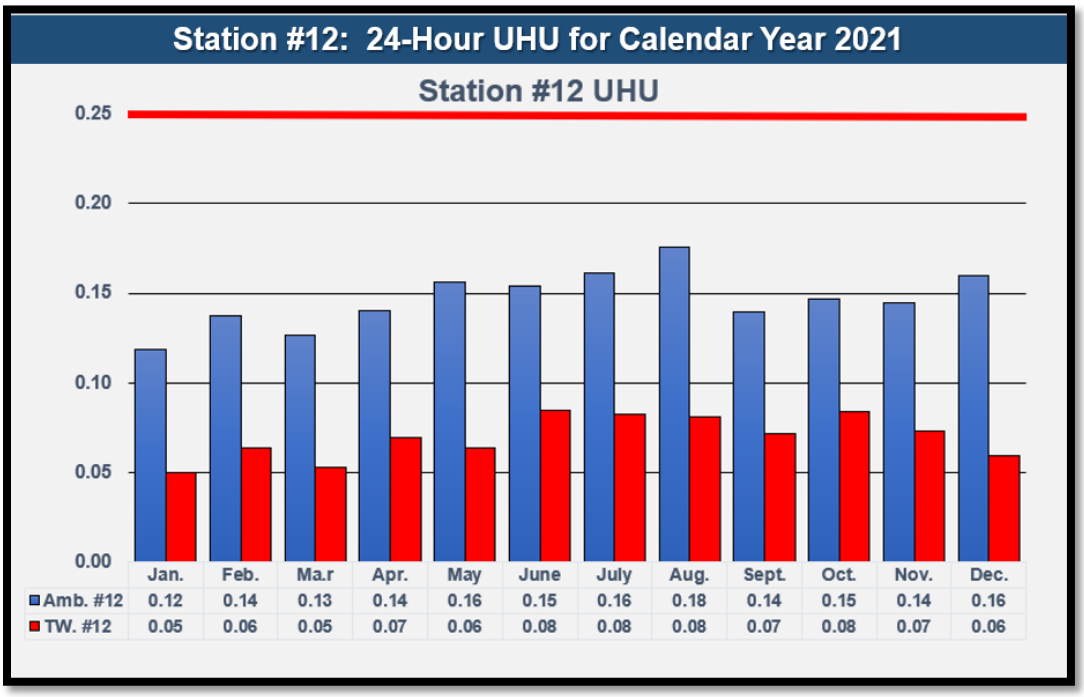


Figure 45: Station #12: 24-Hour UHU for Calendar Year 2021



As exhibited in Figures 43-45, the findings indicate that all fire and EMS companies are working within the benchmark of 0.25 or less, which is classified as an "ideal commitment" level.

Recommendation:
On a quarterly basis, monitor the UHU for each first-due ambulance and fire suppression company within each AOR for the purpose of assessing any increases in both demands for services and company workload fatigue. The acceptable UHU benchmark is 0.25 or less.

In collaboration with RED Center, standardize data metrics to improve the consistency and reliability of reported data.

Fire Prevention Bureau SWOT Analysis

PolarisPSS conducted a SWOT analysis of the Fire Prevention Bureau to assess both internal and external factors. A SWOT Analysis helps to identify internal ***Strengths, Weaknesses,*** and future ***Opportunities, and Threats.***

Strengths

The FPB is a mature Bureau with the infrastructure in place to handle the community's demand for services. The Fire Marshal is very knowledgeable of the codes and their application, understands the dynamics of his community, and knows how to work with individuals to accomplish an objective. The Fire Inspector handles a big portion of the residential sprinkler inspections, attends to fire alarm board issues, addresses FOIA requests, and is well known for his ability to conduct fire investigations.

The 7G Agreement provides resources to assist with conducting annual inspections in a timely manner. Work assignments are divided amongst the full-time and 7G Agreement staff to enable the conduct of annual inspections on an 18-month cycle. Although this timeframe may appear like NFD is behind on inspections, very few departments in communities of similar size are able to complete the annual inspections in a 12-month period.

Weaknesses

The Fire Marshal currently handles all system testing, Certificate of Occupancy Inspections, complaints, meetings, staffs the Electrical Commission, and performs many other job functions. These responsibilities take him away from focusing on supervisory functions and compete with the time needed to implement software modifications and to move the FPB out of the "status quo" state. The FPB staffing and workload limit the amount of time that the Fire Marshal can dedicate to developing new programs.

Scheduling for 7G employees is done on a paper calendar. Opportunities for fire suppression overtime and personal matters are two primary reasons that 7G employees reportedly cancel scheduled shifts. The 7G Agreement does not require employees to commit to a minimum number of work hours per month and employees are paid at the same rate regardless of their time in service as a Fire Inspector.

Tracking re-inspections continues to be a challenge. Consideration should be given to using ImageTrend for tracking and assigning re-inspections. However, some re-inspections may be addressed through a self-re-inspection process that would allow the occupant to send an email and picture of the corrected violation, reducing the need to revisit sites and allow the Fire Inspector to continue performing annual inspections.

Competing commitments have prevented a greater investment of resources in public education. Public education serves the primary purposes of providing an opportunity for NFD personnel to interact with the public during non-urgent events and creates a value-

added interaction for the public with the NFD since most people will not interact with the Department unless they experience an emergency. One part-time 7G Inspector has been assigned to Public Education, but the part-time status limits the amount of time spent on public education. Either part of the third full-time employee's time can be assigned to public education or Bureau leadership may consider splitting the responsibility between two part-time employees.

Opportunities

The FPB has a good foundation upon which to expand its service delivery. The 7G Agreement enables the FPB to use members of the Department who are already familiar with NFD operations and the community to work part-time in the FPB. Leveraging these employees to fill in the gaps for inspections, public education, and other Bureau activity such as System Testing, which is currently handled by the Fire Marshal, will enable the Fire Marshal to focus on enhanced service delivery and supervisory functions. However, a schedule commitment by these employees is needed to ensure scheduled events are not missed or have to be handled by another inspector. As a personnel retention strategy, consider modifying the 7G Side Letter of Agreement to include a time commitment by individuals applying for the position and an annual increase in financial compensation upon working a minimum number of hours per year in combination with length of service in the Fire Inspector role. Incentivizing employees for years of service may encourage them to stay longer in the position.

Daily review of all NFIRS reports should be conducted as this activity is one of the tools that can be used to address Community Risk Reduction. Daily review provides information about patterns or community activities. Without a consistent review, patterns may be overlooked if the incidents are occurring over the three different shifts. Fire departments have historically been able to identify major issues through report reviews. For example, through diligent report monitoring the problems identified with faulty halogen torchier lamps and poorly designed carbon monoxide detectors during the initial production were able to be addressed and corrected. However, the pattern recognition does not stop at fire issues. Bicycle riders being struck by cars or elderly residents having constant falls may dictate public education opportunities for children and the elderly. NFIRS reports provide the best insight as to what is occurring within the community.

The FPB is currently using ImageTrend for some activities, but continues to use a paper form for scheduling its part-time employees. Re-inspections are not currently being populated for reminders. Not all software properties are up-to-date nor have hardware components received the required maintenance. Although the use of spreadsheets is still appropriate for some data collections, integrating all activities into ImageTrend will enable all members of the FPB and Administration to have ready access to information about a property.

There are private companies that provide data collection for the annual maintenance records for commercial sprinkler, fire alarm and hood/duct suppression systems. Maintenance checks are required for all systems,[101] but can easily fall through the cracks and not be completed. These companies can oversee this process and track required maintenance records for a Fire Prevention Bureau; information can then be incorporated into the ImageTrend Records Management System. Pursuing a private agreement to provide these services is an opportunity to strengthen inspection compliance monitoring.

Establishing a self-re-inspection program for minor violations that allows the occupant to send an email or letter with a picture of the violation corrected will decrease demand for Fire Inspector time dedicated to re-inspections. Basic storefronts can also perform the annual inspection with a checklist form to complete, sign, and return. With these inspections, an in-person inspection can then occur every two or three years providing more time for the Fire Inspector to focus on the more complex occupancies.

Develop a new public education program for the Northbrook residents. With the addition of the third full-time employee, the opportunity to implement a new public education program should be possible. Courses to consider offering or expanding upon include:

- Fire safety lessons for primary school grades, especially during Fire Prevention Week when the scheduling is already setup in the school system.
- CPR classes
- Stop the Bleed classes
- Baby-sitter safety classes
- First-aid classes
- Fall Prevention for the Elderly
- Fire Prevention Week Open House

There are opportunities for the FPB to improve the use of social media and the Village website. The information on the website appears to be stagnant and should be updated to answer some general questions that relate to the FPB activity.

The development of a FPB succession plan will help to prepare others for advanced roles in the Bureau. FPB members need exposure to all facets of Bureau work; only assigning one person to a specific task limits the growth of the other members. Including employees in the budgeting process, process for developing and passing an ordinance, and scheduling and conducting meetings with a developer or various boards

[101] Testing requirements are levied by NFPA 13 and 72 which was adopted by the Village of Northbrook Under Article VII. - Fire Prevention Section 6-102 in their local ordinances.

and commissions provides opportunities for learning and prepares employees to assume new responsibilities.

PolarisPSS identified opportunities to strengthen three Village fire prevention ordinances through the amendment process.

- 110.3.1.1: Update this section to allow electronic notification of an inspection order. Electronic notification is the current practice and should be reflected in this section.
- 110.3.1.3: The appeal process should be 48-business hours or two business days instead of just 48 hours to allow the appeal to reach the Fire Chief in a timely manner.
- 503.7 (f) Fire Lanes: Modify this section to state the Fire Chief *or his designee* to give more flexibility for shift personnel to handle this type of situation when the Fire Chief is not present.

Threats

A recession that impacts local government funding creates a possible threat for the FPB. When a fire department is required to reduce its budget, many times the FPB is one of the first programs to be affected. Interestingly, the 1973 America Burning Report prepared under a presidential directive stated that fire departments have not invested enough in fire prevention and that more resources are needed to combat fires and injury prevention. Yet, local governments still minimize staffing for fire prevention to reduce personnel costs in the fire department.

Ideal Station Locations

The level of fire services provided in any community is determined by the elected governing body. The decision is unique to every community and includes factors such as desired response times, growth, increased life risk (e.g., schools, daycares, assisted care facilities), increased commercial and industrial risk, and the desire to maintain or improve services. In essence, fire protection and staffing are a local policy issue and a community must balance local resources against acceptable risk.

Communities may elect to adopt several response time standards for various levels of community risk or they may adopt one single response time standard for all risks. Here, a risk refers to a location of a potential response and the characteristics at that location (e.g., fire potential, occupant exposure). Providing several response/travel times based on the level of risk means that some areas will be reached in a shorter period than other areas. A single response time standard for the community or area served will provide approximately the same level of initial response to all areas of the community. Some of the risks to consider for various response/travel times include:

- Sprinklered versus non-sprinklered structures
- Commercial versus residential structures
- Multifamily versus single family residential structures

In previous sections of this report, PolarisPSS provided a comparison of the NFD's current performance to the industry benchmarks and NFPA 1710 recommended performance standards. Through information and data provided, PolarisPSS conducted an ideal station location analysis to determine if any fire station relocation or building a new fire station would enhance response time performance.

Determining where to build a new fire station involves evaluating factors such as travel times, roadway accessibility, first-due area impact, neighborhood type, and land availability. The factors examined for this study were limited to travel times and first-due area impact, particularly as it relates to the identified risk in the community.

It is understood that in the scenarios presented, land may not be available at the exact location identified. The best option for the Village would be the closest site to the identified location with sufficient land area, topography, and drainage. The analysis was completed assuming that the NFD would continue to operate from the existing stations.

Applied Data

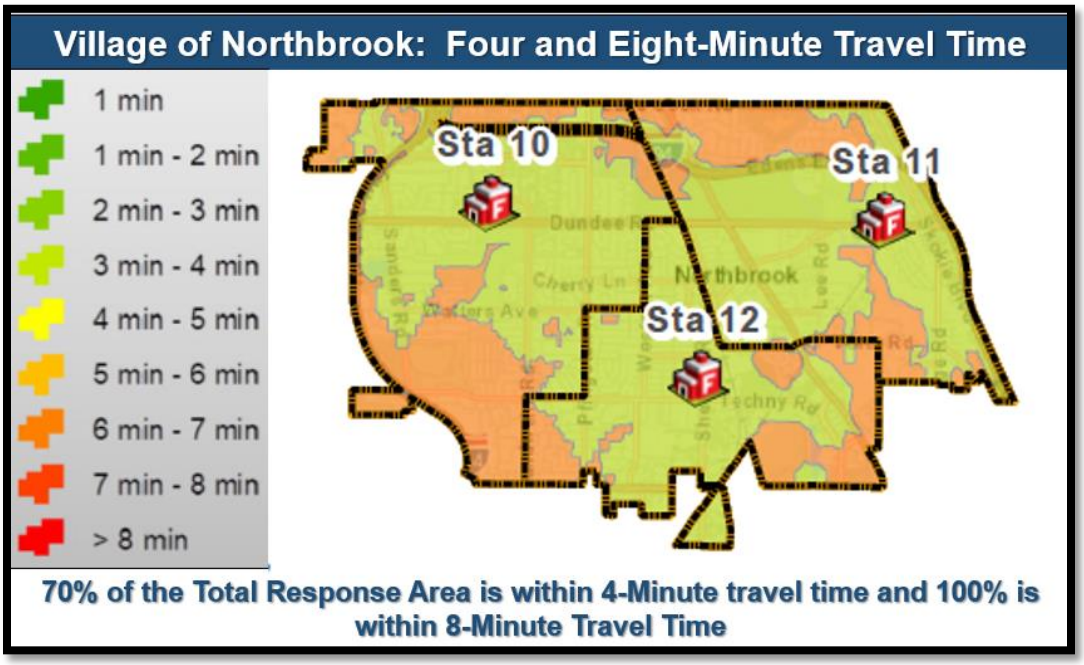
PolarisPSS utilized data provided by RED Center to analyze the NFD response capability. Data included Village GIS data relating to street network, boundaries, physical attributes, and NFD historic response data as reported for the years 2018-2021. Utilizing ArcGIS software in conjunction with Network Analyst and Spatial Analyst, PolarisPSS generated maps, charts, and graphs to visually present the results.

Travel times are used to provide quantifiable and reliable data for analysis and discussion. Travel time is a constant that can be measured accurately and is dependent on the location and deployment of resources. The use of travel time provides the foundation from which to determine how fire station location can influence the Department's total response performance.

Current Stations

The map in Figure 46 shows the current 4-minute and 8-minute travel times throughout the Village from the current three fire stations. Note that 70% of all incidents from 2018 and 2021 are within the NFPA standard of a 4-minute travel time. The area north of the Edens Expressway Spur (I-94), the southwest section of the Village, and areas east of Station #12 have significant areas with 5-minute and 6-minute travel times, including some areas that have a travel time beyond 7 minutes. However, all areas of the Village are reachable within 8 minutes.

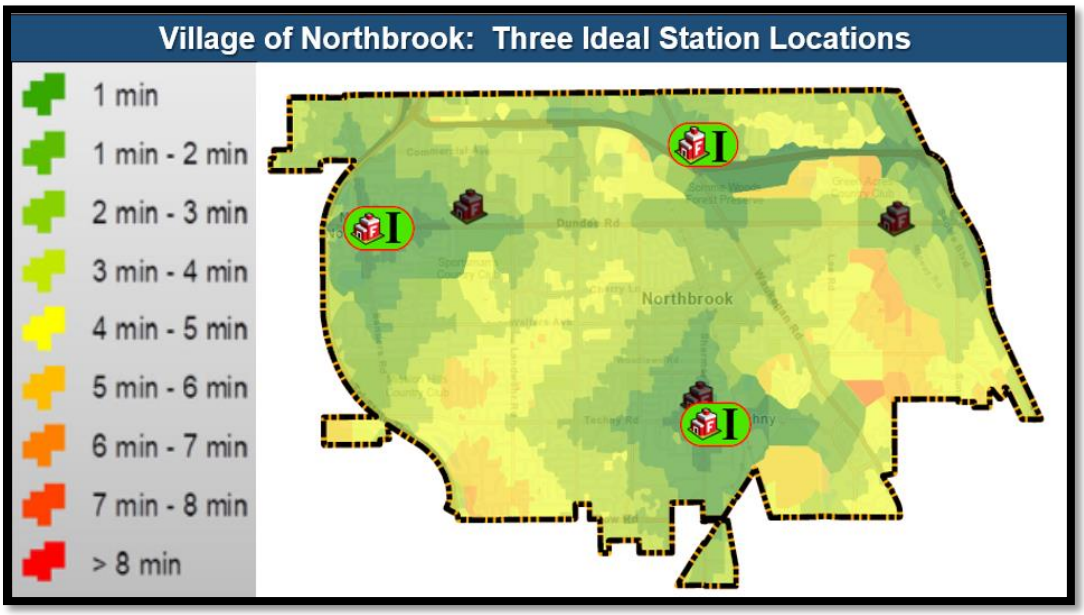
Figure 46: 4- and 8-Minute Travel Time Heat Map



Three Ideal Station Location-Full Relocation Analysis

To determine if the Village could successfully meet the NFPA 1710 travel time performance standard of 90% at a 4-minute travel time or at least to determine if any improvement in coverage could be obtained with three fire stations, PolarisPSS conducted a GIS analysis to determine the ideal station locations. Figure 47 displays the ideal locations for three stations compared to the current locations. It is evident that travel times would improve, but approximately 30% of the TRA is not reachable no matter where fire stations are placed.

Figure 47: Three Ideal Station Locations Travel Time Heat Map



Based on the four years of historical response time data, the analysis determined that the ideal three-station configuration may reduce the current NFD travel time of 7 minutes and 42 seconds at the 90th percentile, NFD's baseline, to 5 minutes and 14 seconds at the 90th percentile. This would be an improvement of 2 minutes and 28 seconds. However, even with the three ideal locations, the NFD can only reach 70% of the entire response area within a 4-minute travel time.

Additional Station Location with Existing Station Locations

PolarisPSS analyzed the impact of adding a fourth fire station to the overall response area while keeping the existing three stations. The analysis identified the best location for a fourth fire station, Proposed #13, with the objective of increasing the NFD's 4-minute travel time percentages.

Utilizing GIS technology and the ArcGIS9 Fire Analysis Tool Software™, PolarisPSS determined the most advantageous location for a fourth fire station, Proposed #13, as it appears on the map in Figure 48.

Figure 48: Location of Proposed #13

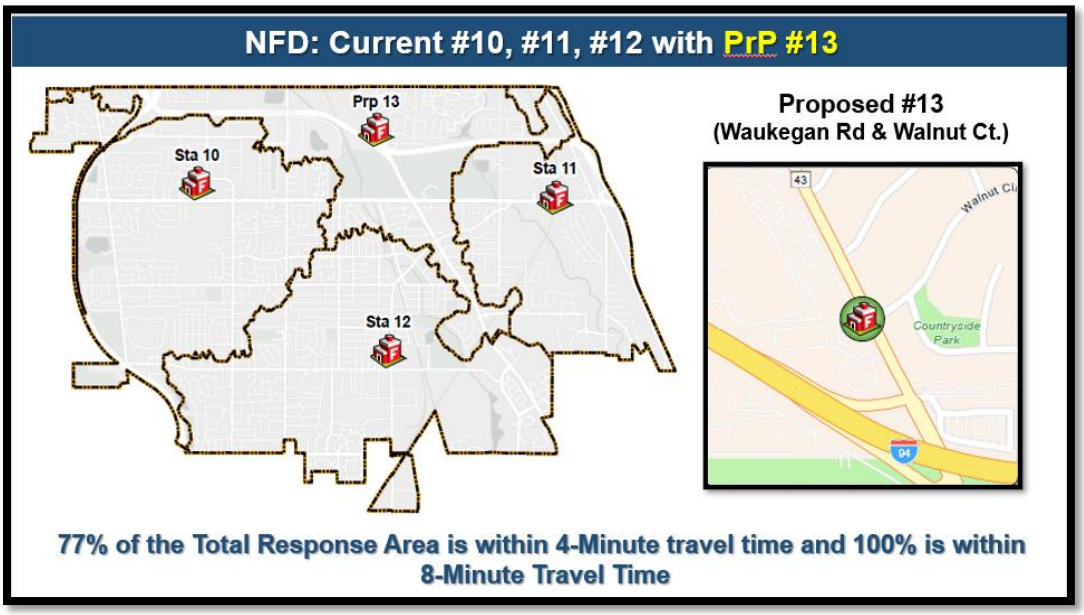
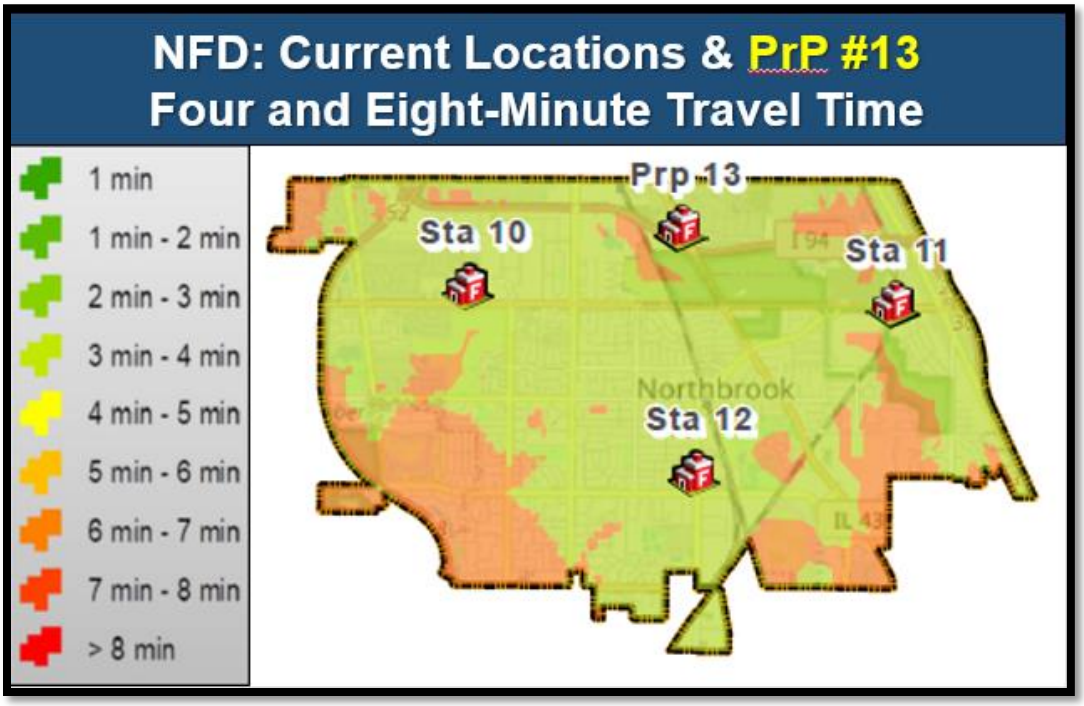


Figure 49 shows NFD travel times from current fire stations #10, #11, and #12 and Proposed #13 locations in 4-minute through 8-minute intervals. These time intervals are based on current NFPA response performance criteria, fire growth dynamics, and EMS patient outcomes. The analysis indicates that if constructed within a reasonable distance from Waukegan Road and Walnut Court., Proposed #13 would improve the 4-minute travel time percentages. Based upon the results of this GIS and spatial analysis, it appears that the Village could benefit from the addition of Proposed #13.

Figure 49: Current Locations and Proposed #13 4- and 8-Minute Travel Time Heat Map

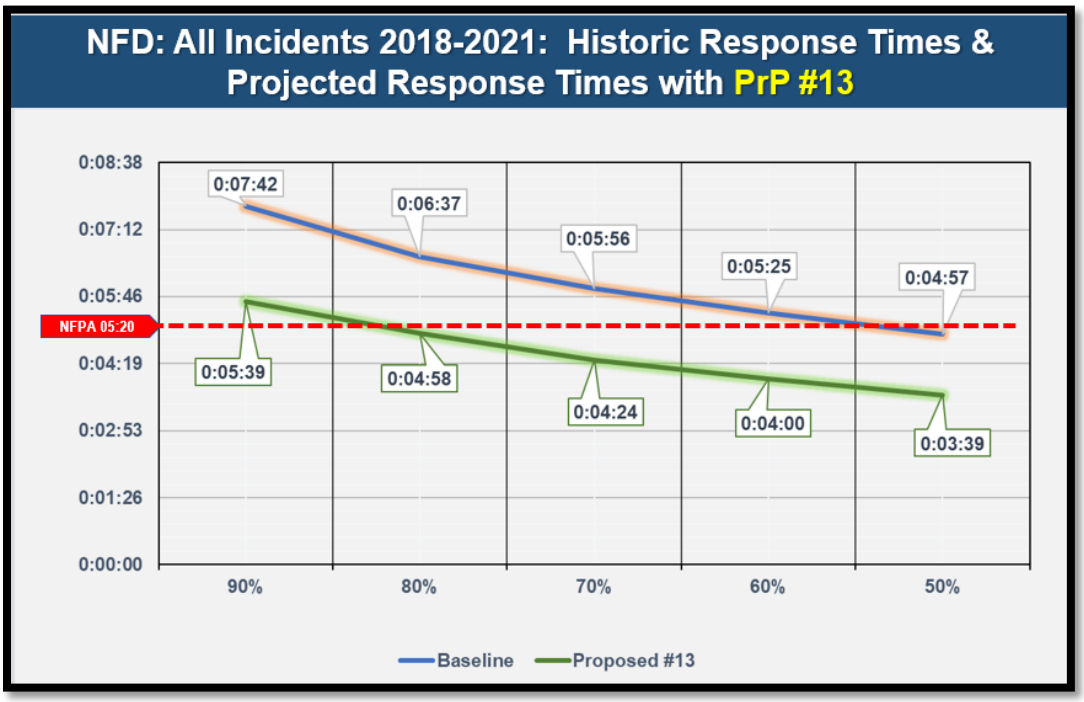


Proposed #13 Response Time Assessment

Using Proposed #13, a 4-minute travel time assessment was conducted using the historical incidents from 2018-2021. From this analysis, PolarisPSS compared the current three-station configuration travel time performance to the four-station configuration with the new location of Proposed #13.

The GIS analysis indicates that by adding Proposed #13 near Waukegan Road and Walnut Court, the *projected response times* would drop from the historic response time of 7 minutes 42 seconds to the projected response time of 5 minutes 39 seconds, a ***difference of 2 minutes 3 seconds.***

Figure 50: Historic Response Times and Projected Response Times with Proposed #13[102]



From the 80th percentile to the 50th percentile, the NFD would experience a 1 minute 39 second to 1 minute 18 second improvement in the 4-minute travel time performance standard. Table 26 provides a summary of this analysis. Additionally, Proposed #13 would improve the 4-minute travel time coverage for the TRA from the current baseline of 70% to 77%.[103]

Table 26: Response Times with Proposed #13

NFD: Response Times with Proposed Station #13			
Four Minute Standard	Current Three Stations	Current with Proposed #13	Travel Time Improvements
90%	0:07:42	0:05:39	0:02:03
80%	0:06:37	0:04:58	0:01:39
70%	0:05:56	0:04:24	0:01:32
60%	0:05:25	0:04:00	0:01:25
50%	0:04:57	0:03:39	0:01:18

[102] All historic incidents from 2018-2021 were used for this analysis.
[103] Proposed #13's location is outside of the Village's corporate boundaries and annexation of the area is precluded pursuant to the Lake Cook Corridor Agreement between the Villages of Northbrook and Deerfield.

Relocation of Existing Stations with Addition of Proposed #13

PolarisPSS analyzed the impact of adding Proposed #13 and relocating Stations #11 and #12 for the purpose of improving upon the 4-minute travel time, as well as assessing any improvements to the total area of coverage.

Relocation of Station #12 Alone

Figure 51 shows the NFD travel times from current Stations #10 and #11 and Proposed #13 with the relocation of Station #12 to the ideal location titled Proposed #12W. The analysis indicates that if constructed within a reasonable distance from Techny Road and Pfingston Road, Proposed #12W would result in an improvement to the overall response plan for both travel times and total area of coverage.

Figure 51: Location of Proposed #13 with Relocation of Proposed #12W:

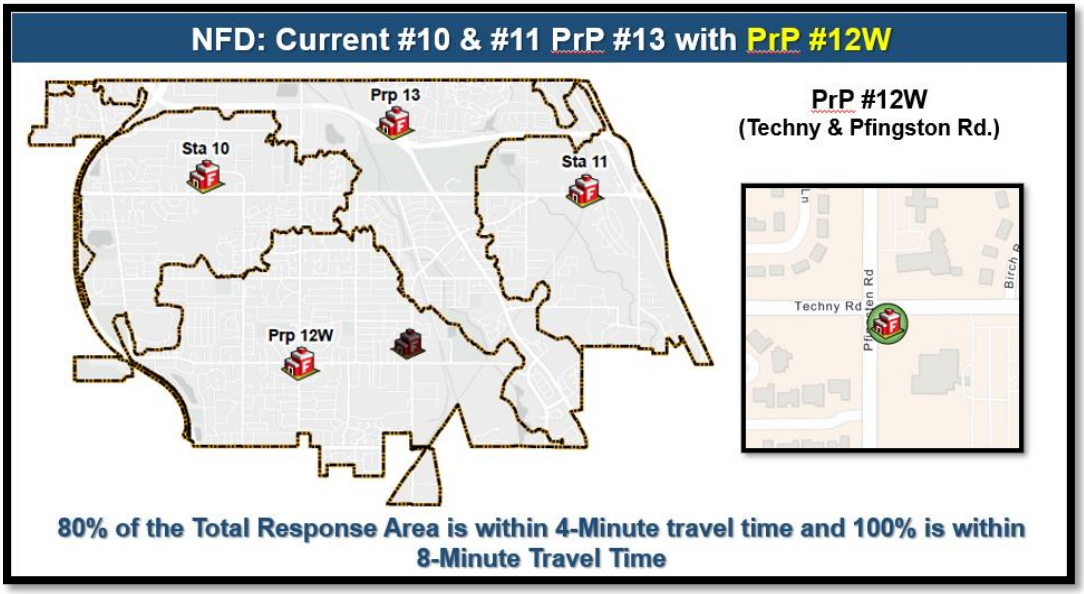
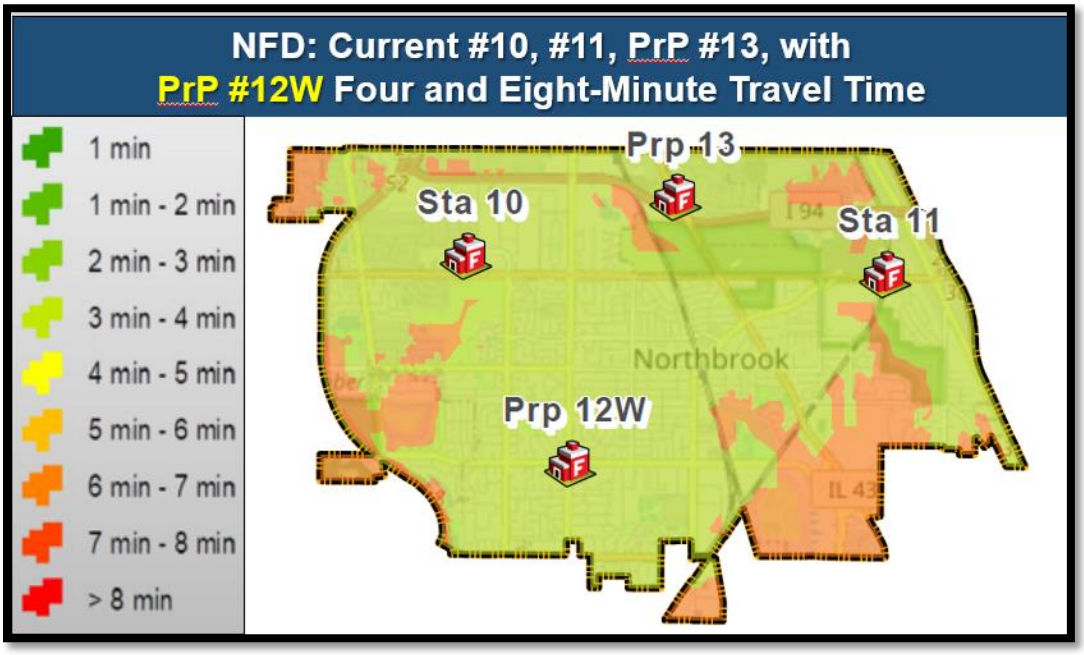


Figure 52 shows NFD's 4-minute through 8-minute travel time intervals from the current Stations #10 and #11, Proposed #13, and Proposed #12W locations. Again, the time intervals used are based on current NFPA response performance criteria, fire growth dynamics, and EMS patient outcomes.

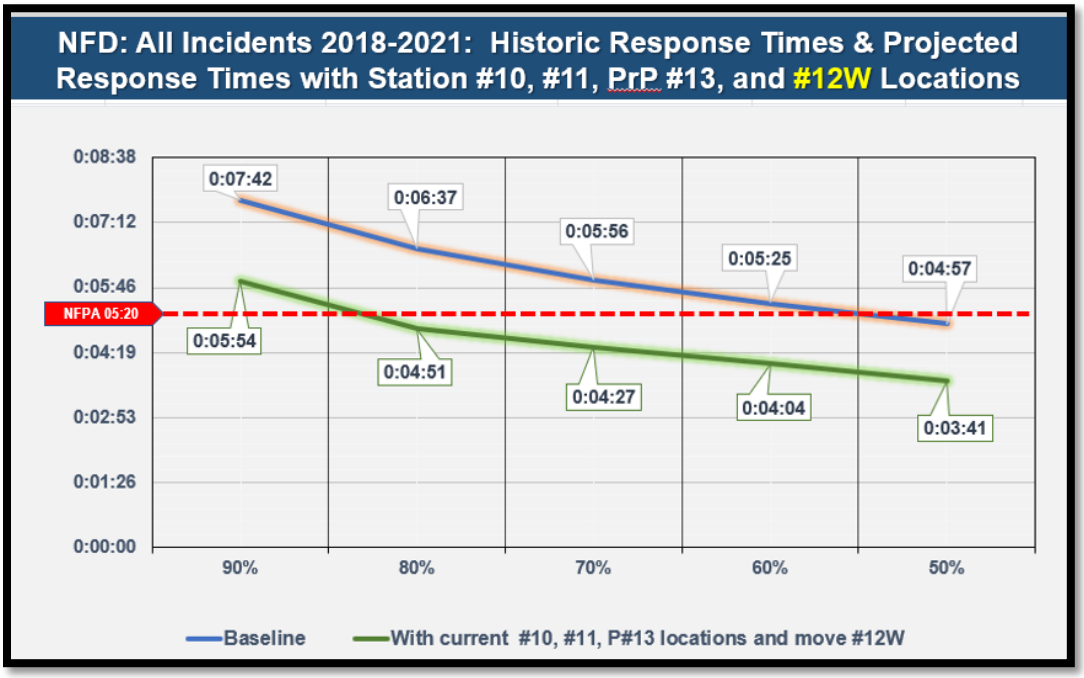
Figure 52: Current Stations #10 and #11, Proposed #13, With Relocation of Proposed #12W 4- and 8-Minute Travel Time



Findings

Based upon the results of this GIS and spatial analysis, it appears that the Village could benefit from the addition of Proposed #13 and the relocation of Station #12. Figure 53 displays the GIS analysis conducted with current Stations #10 and #11locations, Proposed #13, and Proposed #12W to assess any improvements in travel times and total area of coverage. The analysis indicates that the *projected response times* would drop from the historic response time 7 minutes 42 seconds to the projected response time of 5 minutes 54 seconds, a ***difference of 1 minute 48 seconds.*** Proposed #13 would also help to lower UHUs for Stations #10 and #11, thereby increasing their availability for response.

Figure 53: Historic Response Times and Projected Response Times with Station #10, Station #11, Proposed #13, and Proposed #12W



From the 80th percentile to the 50th percentile, the NFD would experience a 1minute 46 second to 1minute 16 second improvement in the 4-minute travel time performance standard. Table 27 provides a summary of this analysis. Additionally, the proposed relocation of Station #12 would improve the 4-minute travel time coverage for the total response area from the current baseline of 70% to 80%.

Table 27: 4-Minute Travel Time Improvements with the Relocation of Station #12

NFD: 4-min. Travel Time Improvements			
Four Minute Standard	Current #10, #11, and #12 Stations	Current with Proposed #13 & 12W	Travel Time Improvements
90%	0:07:42	0:05:54	0:01:48
80%	0:06:37	0:04:51	0:01:46
70%	0:05:56	0:04:27	0:01:29
60%	0:05:25	0:04:04	0:01:21
50%	0:04:57	0:03:41	0:01:16

Relocation of Station #11 and Station #12

PolarisPSS analyzed the best location for Station #11 with current Station #10, Proposed #13, and the relocated Station #12W. The analysis indicated that improvements could be gained by relocating Station #11 south and west of its current location.

The analysis displayed in Figure 54 indicates that within a reasonable area of Voltz Road and Woodlark Drive, the relocation of Station #11 would improve the overall response plan in both travel times and total area of coverage.

Figure 54: Current Stations #10 and #11, Proposed #13, Proposed #12W, With Relocation of Station #11SW

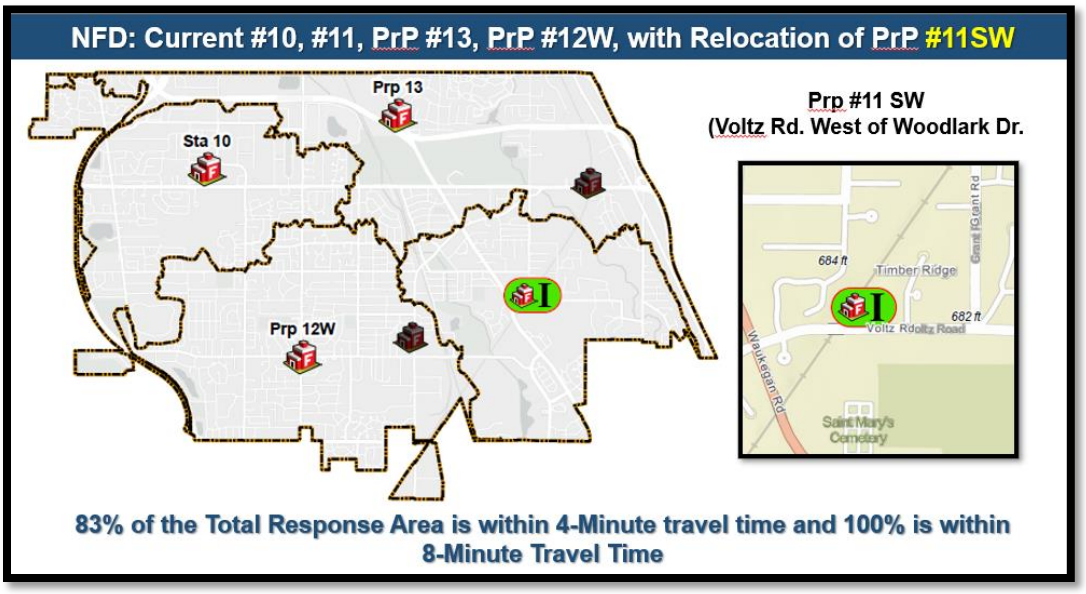
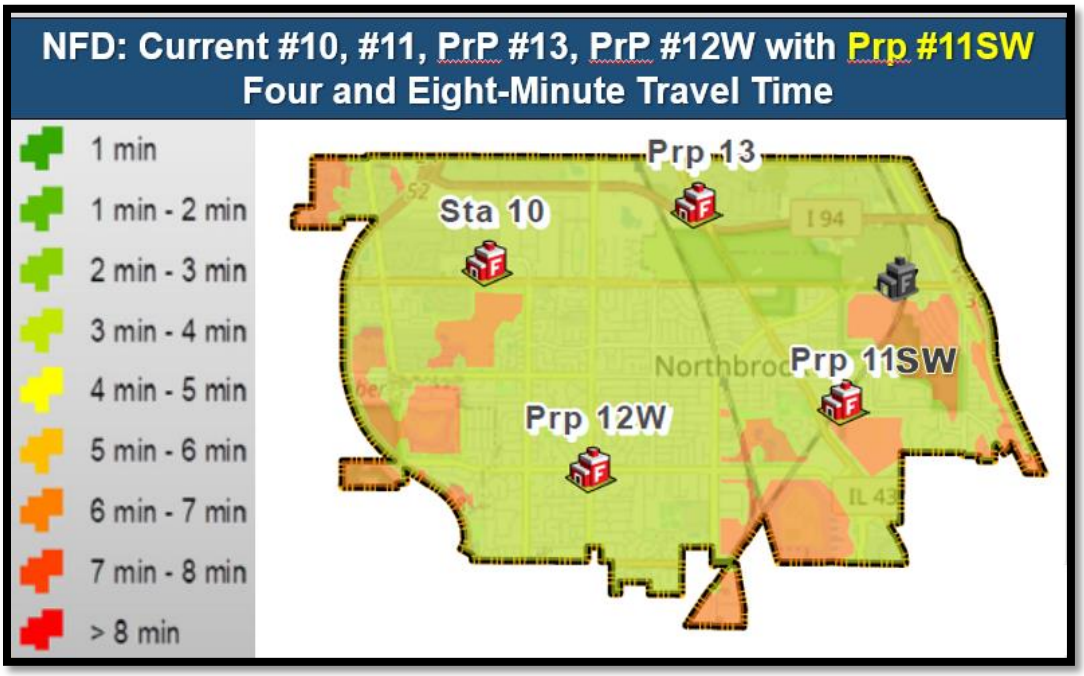


Figure 55 shows NFD's 4-minute through 8-minute travel time intervals from the current Stations #10, #11, Proposed #13, Proposed #12W, and Relocation of #11SW locations. Again, the time intervals are based on current NFPA response performance criteria, fire growth dynamics, and EMS patient outcomes.

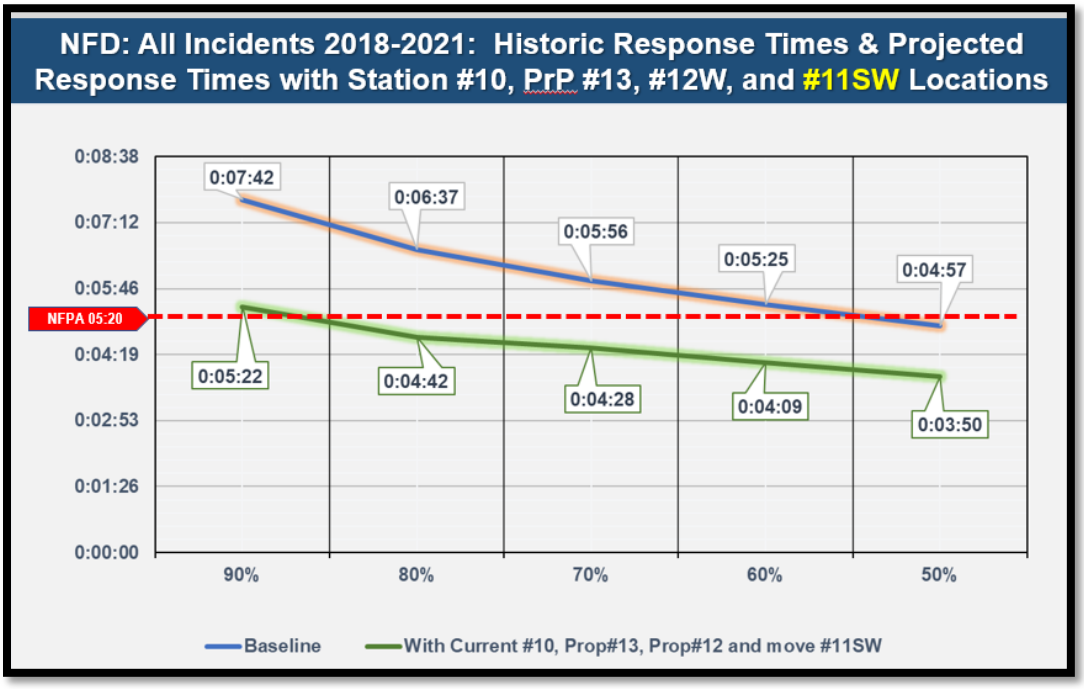
Figure 55: Current Stations #10 and #11, Proposed #13, Relocation of #12W, With Relocation of #11SW 4- and 8- Minute Travel Times



Findings

Based upon the results of this GIS and spatial analysis, it appears that the Village could benefit from the proposed relocation of Stations #11 and #12W. Figure 56 shows the results of the GIS analysis conducted with current locations of Station #10, Proposed #13, Proposed #12W, and the proposed relocation of Station #11 to assess any improvements in travel times and total area of coverage. The analysis indicates that the *projected response times* would drop from the historic response time 7 minutes 42 seconds to the projected response time of 5 minutes 22 seconds, a ***difference of 2 minutes 22 seconds.***

Figure 56: Historic Response Times and Projected Response Times with Station #10, Proposed #13, Proposed #12W, and Proposed #11SW Locations



From the 80th percentile to the 50th percentile, the NFD would experience a 1minute 55 seconds to 1minute 7seconds improvement in the 4-minute travel time performance standard. Table 28 provides a summary of this analysis. Additionally, the proposed relocation of Station #11 would improve the 4-minute travel time coverage for the total response area from the current baseline of 70% to 83%.

Table 28: 4-Minute Travel Time Improvements

NFD: 4-min. Travel Time Improvements			
Four Minute Standard	Current #10, #11, and #12 Stations	Current #10, Proposed #13, #12W, and #11SW	4-Min Travel Time Improvements
90%	0:07:42	0:05:22	0:02:20
80%	0:06:37	0:04:42	0:01:55
70%	0:05:56	0:04:28	0:01:28
60%	0:05:25	0:04:09	0:01:16
50%	0:04:57	0:03:50	0:01:07

Recommendations:
PolarisPSS recommends a three step plan that in the end will significantly improve travel times and the percentage of the TRA that would be covered within the 4-minute travel time.

Step #1: *The analysis identified that the three current fire station locations can only cover 70% of the entire Village within a 4-minute travel time and indicates that a fourth fire station is needed. The Village should consider building Proposed #13 in the recommended area of Waukegan Road and Walnut Court to increase the coverage area from 70% to 77%.*

Step #2: *If Proposed #13 is built, the next step toward achieving the goal of improving the 4-minute travel time and increasing the area of coverage from a 77% to 80%, is to relocate Station #12 to the location of Proposed #12W.*

Step #3: *If Proposed #13 is built and Station #12 is relocated to Proposed #12W, the next step toward achieving the goal of improving the 4-minute travel time and increasing the area of coverage from a 80% to 83%, is to relocate Station #11 to the location of Proposed #11SW.*

Modify the IGA with the NBRFPD to reflect the investment required to add a fourth fire station.

Appendix

A. Acronym List
B. Tables of Figures
C. Table of Tables
D. Emergency Management Authorities Review
E. Apparatus Replacement Plan
F. 7G Side Letter Agreement
G. Summary of Recommendations

Appendix A: Acronym List

AED	Automatic External Defibrillator
A-EMT	Advanced- Emergency Medical Technician
ALS	Advanced Life Support
AOR	Area of Response
ARP	Apparatus Replacement Plan
AVL	Automatic Vehicle Location
BLS	Basic Life Support
CERT	Community Emergency Response Team
CFAI	Commission on Fire Accreditation International
CFR	Code of Federal Regulations
CPR	Cardio Pulmonary Resuscitation
CPSE	Center for Public Safety Excellence
CRRP	Community Risk Reduction Plan
DEMRS	(Cook County) Department of Emergency Management and Regional Security
DICO	Designated Infection Control Officer
DPSE	Division of Personnel Standards and Education
ECG	Electrocardiogram
EMA	Emergency Management Agency
EFD	Emergency Fire Dispatch
EMD	Emergency Medical Dispatch
EMI	Emergency Management Institute
EMS	Emergency Medical Services

EMT-B	Emergency Medical Technician- Basic
EMT-P	Emergency Medical Technician- Paramedic
EMS	Emergency Medical Services
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
EPCRA	Emergency Planning and Community Right-to-Know Act
ERF	Effective Response Force
ERU	Emergency Response Units
ESDA	Emergency Services and Disaster Agency
EVT	Emergency Vehicle Technician
FF/PM	Firefighter/Paramedic
FLSA	Fair Labor Standards Act
FOIA	Freedom of Information Act
FPB	Fire Prevention Bureau
FSRS	Fire Suppression Rating Schedule
GEMT	Ground Emergency Medical Transport
GIS	Geographical Information System
HIPAA	Health Insurance Portability and Accountability Act
HPH	Health Promoting Hospital
Hrs.	Hours
HSEEP	Homeland Security Exercise and Evaluation Program
IAFC	International Association of Fire Chiefs
IAFF	International Association of Firefighters
ICMA	International City/County Management Association
ICS	Incident Command System

IDPH	Illinois Department of Public Health
IEMA	Illinois Emergency Management Agency
IGA	Intergovernmental Agreement
IL OSHA	Illinois Division of Occupational Safety and Health
ISO	Insurance Services Office
IV	Intravenous
LEPC	Local Emergency Planning Committee
LOS	Level of Service
MABAS	Mutual Aid Box Alarm System
MMNL	Metra Milwaukee North Line
MW	MegaWatt
NBRFPD	Northbrook Rural Fire Protection District
NDCP	National Domestic Preparedness Consortium
NFD	Northbrook Fire Department
NFIRS	National Fire Incident Reporting System
NFPA	National Fire Protection Association
NIMS	National Incident Management System
NIPSTA	Northern Illinois Public Safety Training Academy
NIST	National Institute of Standards and Technology
OSFM	Office of the State Fire Marshal
OSHA	Occupational Safety and Health Administration
PM	Preventive Maintenance
PO	Purchase Order
PPC	Public Protection Classification
PPE	Personal Protective Equipment

PSAP	Public Safety Answering Point
QA	Quality Assurance
QI	Quality Improvement
RED Center	Regional Emergency Dispatch Center
RMS	Records Management System
SCBA	Self-Contained Breathing Apparatus
SCUBA	Self-Contained Underwater Breathing Apparatus
SOC	Standard of Cover
SOG	Standard Operating Guidelines
SOP	Standard Operating Procedure
TIC	Thermal Imaging Camera
TRA	Total Response Area
UHU	Unit Hour Utilization
UL	Underwriters' Laboratories
USFA	United States Fire Administration
VoN	Village of Northbrook
WMD	Weapons of Mass Destruction

Appendix B: Table of Figures

Appendix C: Table of Tables

Appendix D: Emergency Management Review

Authorities:

Village of Northbrook Ordinances:

Northbrook, Illinois Code of Ordinances Chapter 3, Article IV Civil Emergencies, Emergency Services and Disaster Relief

Division 1- Emergency Management Agency

Division 2- Civil Emergencies

Cook County Ordinances

Chapter 26, Article II, Cook County, IL Code of Ordinances

State of Illinois Statutes

20 ILCS 3305/5 *et. seq.* Illinois Emergency Management Agency Act

IEMA Regulations:

29 IL Adm Code 301

Subpart B Emergency Operations Plan Requirements

Subpart C: Emergency Operations Plan Submission and Review Requirements

Issue	Authority	Analysis	Conclusion
Whether NB is required to have an Emergency Services and Disaster Agency (ESDA) or Emergency Management Agency (EMA) by Illinois law.	• Illinois Emergency Management Act (IEMAct) 20 ILCS 3305/10 • NB Ord. Ch 3, Art. IV, Div.1.	Cook County must establish an ESDA and NB is under jurisdiction of the Cook County ESDA (IEMAct §10(b)). NB is not required by statute to establish an ESDA or EMA, but NB may by ordinance establish an emergency management agency or department (IEMAct §10(c)). An EMA created by ordinance is distinct from an ESDA mandated by statute. NB has created an EMA coordinator but has delegated the duties the Fire Chief. The Fire Chief is the liaison officer for the Cook County ESDA (IEMAct §10(e) and (i)). Governor may mandate municipal corporations to have and ESDA (IEMA §10(d)).	NB is not required by statute to have an ESDA or EMA but has established an EMA through its own ordinance. NB has created an EMA Agency with a coordinator, but not established a separate department or agency. Research has not disclosed a mandate from the Office of the Governor mandating NB to establish an ESDA.

Whether NB is certified EMA by Cook County ESDA	• 29 IL Adm Code 301.520 • Cook Co Ord Ch 26 §26.31	IEMA Regulations identify requirements for certification that include training and continuing education for the coordinator and exercises. Must be recertified for 2-4 years. Cook County requires a biennial review for certification.	While NB does have a previously certified EOP, there are no documents identifying NB EMA as a Cook County-certified non-mandated ESDA/EMA. Requirements for certification include education requirements for the EMA coordinator, an EOP, and exercises. Certifications are effective for at least two years but no longer than four years.
Whether NB is required to prepare an Emergency Operations Plan (EOP).	• 20 ILCS 3305/10(g) • 29 IL Adm Code 301.320(a) • 29 IL Adm Code §301.210 et seq • Cook County Ord Ch 26 Art II §26-33(b)	Each ESDA shall biennially submit for approval an EOP to IEMA. EOPs shall comply with standards set by 29 IL Adm Code §301.210.	NB is a non-mandated and non-accredited EMA/ESDA. The IL Adm Code requires non-mandated EMA/ESDAs to submit EOPs complying with planning standards to the Cook County ESDA. NB EOP has not been recertified within the last two years.

Whether NB EOP complies with current IEMA standards	29 IL Adm Code Subpart B Subpart C §301.320	Requirements are distinguished by date as EOPs submitted before and after 01/02/2002. EOP requirements changed for EOPs due for review on or after 09/01/2020. See §301.230.	EOP is out of date and has provisions that may not comply with current requirements. EOP must be thoroughly reviewed to determine items that must be revised to comply with the post-09/01/2020 mandates.

Appendix E: RECOMMENDED FIRE DEPARTMENT VEHICLE REPLACEMENT SCHEDULE - FY20/21 - FY40/41

Type	#	Fleet	Year	Replace yrs	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34	34/35	35/36	36/37	37/38	38/39	39/40	40/41
Ambulance	12R	64	2014	11					AMB											AMB					
Ambulance	12	68	2016	11							AMB											AMB			
Ambulance	11	65	2017	11									AMB											AMB	
Ambulance	10	69	2018	11											AMB										
Ambulance	10R	66	2011	11	AMB												AMB								
Engine	10R	56	2004	20					ENG																
Engine	12	58	2008	20									ENG												
Engine	11	60	2015	20													ENG								
Engine Pumper Squad	11	57	2017	20																	P/SQD				
Engine	10	59	2021	20	ENG																				ENG
Tower Ladder	12R	61	2009	20									TWL												
Tower Ladder	12	62	2019	20																			TWL		
Rescue Squad	12	55	2018	20																			RESCUE		
Battalion	Bat 10	76	2015	10				BAT										BAT							
Battalion	Bat 11	73	2017	10							BAT										BAT				
Utility/FPB		71	2007	10				UTL																	
Pickup/Training		70	2017	12										UTL											
Staff Car - Explorer (1102)		51	2016	10						STAFF															
Staff Car - Explorer (1100)		75	2016	10						STAFF															
Staff Car - Explorer (1101)		52	2018	10								STAFF													
Staff Car - Explorer (FPB)		53	2018	10								STAFF													
Staff Car - Escape (FPB)		54	2018	10								STAFF													

Refurbish Engine and Tower when taken out of front line service.
Battalion - 10 year replacement schedule - 5 years front line + 5 years reserve service.
FY 16/17 Pumper/Squad in place of 5th Engine (57) and Squad (55) - estimated 20 yr service life for Pumper/Squad.
FY 17/18 Rescue - estimated 20 yr front line service.
FY 19/20 Five Engines at 20 years = 10 years front line + 10 years reserve service.
FY19/20 Tower Ladder 10 years front line + 10 years reserve service.
FY20/21 Ambulance replacement schedule = 7 years front line + 4 years reserve service. Due to low mileage and other mechanical reasons, extended from 10 to 11 years. Extension resulted in longer gap in replacement (FY20/21 to FY24/25).
FY23/24 #76 replacing #71
FY29/30 Utility/FPB - due to average annual mileage, extended replacement from 10 to 12 years.

AMB = Ambulance
ENG = Engine
P/SQD = Pumper Squad
TWL = Tower Ladder
RESCUE = Rescue Squad
BAT = Battalion
UTL = Utility
STAFF = Staff Car

	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34	34/35	35/36	36/37	37/38	38/39	39/40	40/41
AMB	$337,384				$387,156		$414,731		$444,270		$475,913		$509,810			$565,236		$605,495		$648,621	
ENG	$735,702				$844,235				$968,779				$1,111,696								$1,463,892
P/SQD																	$1,598,119				
TWL									$1,902,605										$2,683,812		
RESCUE																			$666,928		
BAT				$62,500			$69,295							$88,165			$97,745				
UTL										$45,000											
STAFF						$100,000		$159,000													
Totals	$1,073,086			$62,500	$1,231,391	$100,000	$484,026	$159,000	$3,315,654	$45,000	$475,913		$1,621,507	$88,165		$565,236	$1,695,864	$605,495	$3,350,740	$648,621	$1,463,892

FY20/21 Ambulance purchase price $337,384
FY16/17 Pumper Squad purchase price $776,000
FY19/20 Tower Ladder purchase price $1,386,000 plus change orders - budget sheet says spent 1,395,414
FY17/18 Rescue purchase price $327,000
FY14/15 2015 Battalion Expedition purchase price $33,042
FY16/17 2017 Battalion Expedition purchase price $38,196

Used 3.5% increase per year to calculate future estimated purchase cost

SIDE LETTER OF AGREEMENT

CODE INSPECTIONS

WHEREAS, the Village of Northbrook ("Village") seeks to engage the services of a part-time code inspector; and

WHEREAS, International Association of Firefighters Local 1894 ("Union") represents all full-time firefighters in the Village Fire Department below the rank of Captain; and

WHEREAS, the bargaining unit employees represented by the Union do not currently perform code inspection work; and

WHERAS, the Village and the Union seek to allow bargaining unit employees to perform code inspection work on a non-precedential basis.

NOW, THEREFORE, THE PARTIES AGREE AS FOLLOWS:

1. Neither party will object if bargaining unit employees perform code inspection work.

2. Code inspection assignments shall be on a voluntary basis. When the Chief determines in his discretion that he needs volunteers to perform code inspection work, the Chief will seek volunteers and assign code inspection work pursuant to the method described in Section 12.06 of the collective bargaining agreement.

3. Pursuant to Section 7(g)(2) of the Fair Labor Standards Act ("FLSA), the parties agree that all code inspection work shall be paid at a regular, straight time rate of $16.66 per hour, and that all overtime code inspection work shall be paid at an overtime rate of $25.00 per hour. Once the code inspector achieves Fire Inspector 1 or Fire Investigator status, the work shall be paid at a regular, straight time rate of $17.33 per hour, and that all overtime code inspection work shall be paid at an overtime rate of $26.00 per hour. Once the code inspector achieves Fire Inspector 1 and Fire Investigator status, the work shall be paid at a regular, straight time of $18.00 per hour, and that all overtime code inspection work shall be paid at an overtime rate of $27.00 per hour.

4. Any employee who volunteers to perform code inspection work will be required to sign the attached 7(g)(2) Agreement before performing such work. Any employee who chooses not to sign the attached 7(g)(2) Agreement will be ineligible to perform code inspection work.

5. This Side Letter of Agreement shall be effective from the date it is signed until April 30, 2015. The Side Letter shall remain in effect during the period of negotiations for a successor collective bargaining agreement. The Side Letter

shall be completely void upon execution of a successor collective bargaining agreement unless it is renewed by mutual agreement of both parties.

6. This Side Letter of Agreement is a non-precedential agreement. The Agreement, the negotiations which led to the Agreement, and the parties' experiences under the Agreement, may not be introduced by either party during any impasse resolution proceeding under Section 14 of the Illinois Public Labor Relations Act.

7. The parties explicitly agree that nothing within this Agreement shall be construed to make code inspection work "bargaining unit work," nor shall the code inspection work be covered by the "Firefighter Substitutes Act," Public Act 095-0490. Upon expiration of this Side Letter of Agreement, the Village shall have all the rights to assign code inspection work to any bargaining unit employee, non-bargaining unit employee, contractor, or third party that the Village possessed as of March 1, 2014.

AGREED:

Village of Northbrook, Illinois

By: Andrew Carlson

Date: 4/11/18

IAFF Local 1894

By:

Date: 4/11/18

12.05 Overtime Distribution. Once the Department has determined that overtime is required, it shall follow existing practices regarding the manner of overtime distribution.

12.06 7 (g) Voluntary Work The VILLAGE may offer employees work opportunities that substantially differ from the employee's regular duties of emergency preparation and response related to fire suppression, rescue and/or EMS services. Work related to Public Education, Fire Inspections, Special Events and other work mutually agreed between the VILLAGE and the ASSOCIATION, when performed outside of the employee's work shift, shall be compensated at time and one half (overtime) at mutually agreed upon rates between the VILLAGE and ASSOCIATION that are less than the rates established for regular work normally performed by bargaining unit employees according to Section 7 (g) of the FLSA, 29 USC §207 (g). Work assignments under this section, 12.06, shall be offered on a voluntary basis. As appropriate, the Fire Chief will periodically post sign up-sheets for 7(g) work assignment and equalize opportunities among qualified volunteers. The VILLAGE may require employees to possess specific minimum qualifications and experience in order to work such assignments and selection of employees may be on a competitive basis. Continued work opportunities in 7 (g) positions shall be contingent upon positive performance on the employee's past 7 (g) assignments. Employees working a 7 (g) assignment who are called back to perform Firefighter/Paramedic duties shall be compensated at one and one half times their regular pay rate in accordance with Section 12.03 of the Agreement for the performance of such Firefighter/Paramedic duties.

ARTICLE 13 - HOLIDAYS

13.01 Recognized Holidays. The VILLAGE shall recognize eight (8) paid holidays each year. These holidays are New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the day after Thanksgiving Day, Christmas Eve Day and Christmas Day. If any of these holidays falls on

Appendix G: Recommendations

	Recommendations	Page
1	As outlined in the EMS Field Experiments, some EMS call types present situations that cannot be adequately addressed by a two-person ambulance crew. The current NFD practice of dispatching either an ALS fire engine or ALS tower ladder along with the ambulance is a best practice to ensure that patient care needs are met in a timely and safe manner. The same holds true 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., minimizing the need for small-sized crews to repeatedly ascend and descend stairs). This current practice should continue.	22
2	Continue to use UL for annual testing of NFD's tower ladder apparatuses and all ground ladders.	32
3	All mechanics who work on fire apparatus should obtain the Emergency Vehicle Technician (EVT) certification as recommended by the manufacturer of each apparatus so that the maintenance performed supports peak performance.	32
4	Include the provision of apparatus-specific training for EVTs in vehicle purchase contracts.	32
5	Continue to support the current ARP that includes a replacement schedule consistent with NFPA 1901 Standard for Automotive Fire Apparatus recommendations.	33
6	NFD should routinely review and adjust the ARP to ensure the anticipated service demand increases can be met with the current fleet. Expected delays between order submission and delivery of a new apparatus, as well as cost increases affecting the marketplace should continue to be considered during the plan review.	33
7	The Village of Northbrook should conduct a space needs analysis that is inclusive of a current condition assessment to determine long term facility needs and inform recommendations for refurbishment/remodeling of current facilities and/or for new facility construction.	36
8	Complete a strategic planning process to establish a shared understanding of the Department's strategic priorities, objectives, key outcomes, and action initiatives.	38
9	Conduct an in-depth analysis of job responsibilities for each position once the second Deputy Chief position is filled.	38
10	Update written job descriptions for each position, including qualification requirements of the person filling the position.	38
11	Establish a project management reporting system to track the monthly progress with project and program implementation progress.	38
12	Submit monthly and annual reports to Village management to provide updates on activities within each NFD division.	38
13	Conduct a job task analysis to provide management with objective criteria needed to identify current job responsibilities and tasks assignments. As necessary, realign tasks and/or hire additional support personnel to address workload issues.	39
14	Provide Certified Ambulance Coder training to staff members responsible for EMS billing.	40

	Recommendations	Page
15	If time spent by the Administrative Clerk processing EMS billing approaches 80% full-time equivalent, the Village should evaluate whether an outside contractor would be more cost effective for processing EMS billing.	**40**
16	Conduct one-year evaluation of GMET participation.	**40**
17	Evaluate the 7G Side Letter Agreement to include a time commitment requirement by individuals applying for the position and pay increases for time in grade.	**44**
18	Update FPB ordinances to reflect current practices (e.g., report issuance for code violations).	**44**
19	Increase the focus on education programs that target the age 65 years and older population and identified high-risk target hazards in an effort to enhance occupant safety and preparedness.	**44**
20	Establish a self-re-inspection program for minor violations that allows the occupant to submit written and photographic documentation of violation correction.	**44**
21	Establish a program to allow basic storefronts to complete and certify a checklist every “X “number of years in-lieu of an annual in-person inspection. This program will enable Fire Inspectors to prioritize the in-person inspection of more complex occupancies.	**44**
22	Continue to pursue partnerships with community groups and businesses to assist with sponsorship and participation in public events. Fire prevention and education programs can reduce the risk of fires and injuries effectively when used as part of the Department’s overall prevention strategy. However, it may take months before the prevention and education initiatives become fully effective.	**45**
23	Publish an annual report on the NFD’s activities from the preceding year to inform and educate the community about the Department’s role in community safety. Documenting the Department’s accomplishments will also help to show members the difference they have helped to make within the community.	**45**
24	Research and evaluate the costs and benefits of a Mobile Integrated Healthcare Program to mitigate the unnecessary use of Village ambulances for non-emergency transports to the hospital.	**48**
25	The Training Division should continue to provide both practical and hands-on learning opportunities and consider an on-line training provider portal for the purpose of accomplishing EMS and fire continuing education requirements.	**50**
26	Enter information contained in the hazardous materials statistical data sheets into the Department’s Firehouse Record Management System so that it is available to Department and specialty team leadership to use this information as part of the annual evaluation of hazmat program performance.	**53**
27	To enable the Village to operate a fully functioning Emergency Management Agency pursuant to Northbrook Ordinance Article IV §3-96, the Village should identify existing positions that will assume responsibility for the functions identified in Northbrook Ordinance Article IV §3-99. The Village should consider dedicating and budgeting additional positions to ensure performance of and compliance with IEMA requirements such as emergency management planning, training, and exercise functions.	**53**

	Recommendations	Page
28	The Village EOP requires a comprehensive review and update. See Appendix D for an overview of requirements that must be addressed in the EOP update. Once updated, the EOP should be submitted to the Cook County Department of Emergency Management and Regional Security for re-certification.	**55**
29	Document EOC operational procedures (e.g., process for how incident action plans are developed, briefings conducted) and assign responsibility for the performance of emergency management functions within the EOC (e.g., EOC management, routine testing to communication equipment, conduct of after action reviews).	**55**
30	Incorporate opportunities to test EOC functionality, both in terms of operational procedures and technology resources, to aid the Village in identifying areas that require additional planning, training, and/or resourcing.	**55**
31	Test all EOC resources (e.g., resources in the information boxes) for functionality on a routine basis and updated as necessary. Document the role of the Finance Section Chief and train personnel to fill this position.	**55**
32	Develop a procedure for the real-time tracking of incident expenses that can be universally implemented by all Village Departments.	**55**
33	The Illinois Emergency Management Agency (IEMA) and the federal Emergency Management Institute (EMI) offer free training on a wide range of emergency management topics. At a minimum, the Village's Emergency Management Coordinator(s) should complete IEMA's 8-hour New Coordinator's Workshop and the Illinois Professional Development Series training requirements. The workshop is designed to provide new local emergency management agency coordinators an overview of their responsibilities in relationship to their local government and the state and covers how the content of the Illinois Emergency Management Act and current requirements outlined in the Illinois Emergency Management Agency Administrative Rules affect local jurisdictions. The seven on-line and six discussion-based classroom courses that comprise the Professional Development Series are designed to provide an introduction to the wide range of responsibilities for which emergency managers must be prepared. The Village may wish to consider requiring position-specific emergency management training for certain Village positions that have a specialized role in supporting emergency management operations (e.g., public information officer, finance director).	**56**
34	Centralize the management of emergency management and NIMS-compliance training to ensure that all Village positions that have a defined emergency management role maintain the minimum training required for their position. The development of individual training plans for positions with defined emergency management functions is necessary. Dedication of personnel hours to support the scheduling and tracking of emergency management training is required.	**56**

	Recommendations	Page
35	The National Domestic Preparedness Consortium (NDPC) is a partnership of several nationally recognized organizations whose membership is based on the urgent need to address the counter-terrorism preparedness needs of the nation's emergency first responders within the context of all hazards including chemical, biological, radiological, and explosive Weapons of Mass Destruction (WMD) hazards. Acceptance into a training course is coordinated through IEMA.	**56**
36	Establish an emergency management exercise program with the intent of validating emergency response plans and identifying areas for improvement. At the onset, the Village may consider prioritizing command, control, and communications for incidents that require multi-agency/multi-disciplinary support, inclusive of multi-jurisdictional incidents and incidents that require EOC activation, as the exercise program focus. Establishing the Village's exercise program to be consistent with the Homeland Security Exercise and Evaluation Program (HSEEP) will provide the Village with an established set of guiding principles and validated approach for exercise program management, design and development, conduct, evaluation, and improvement planning.	**57**
37	Review and evaluate to determine how and whether the CERT Program should be retained or restructure.	**57**
38	The Village of Northbrook should review with RED Center the guidelines call takers and dispatchers use to classify calls by type and priority level. Call takers and dispatchers have an important role in interpreting and documenting the information that enables them to identify the incident type and set the incident's priority level. It is essential for the NFD to have input on the guidelines to ensure the accuracy of the data produced and enable the NFD to reliably analyze current trends and use the information to inform staffing and service delivery decisions.	**61**
39	The Village of Northbrook should look at the processing times in a comprehensive manner. Call transfers between the primary and secondary PSAP centers have an impact on the overall processing time standard. Given the life safety implications for critical incidents, both Village of Northbrook and RED Center PSAPs should make every effort to reduce/eliminate transfers, thereby reducing the amount of time required to answer, process, transfer, and dispatch alarms. Potential strategies to reduce transfers include consolidation, either physical or virtual, CAD to CAD integrations, improved wireless call routing, and improved compliance with call answering standards.	**61**
40	Annually assess the response time performance of all automatic aid companies to ensure that the assembly of an effective response force is occurring within the NFPA 1710 standards.	**68**
41	Develop a Community Risk Reduction Plan (CRRP) that identifies strategies and programs to mitigate the potential increase in emergency services due to an aging population.	**82**
42	Develop a CRRP that identifies strategies and programs in support of the Village's Emergency Operations Plan for the purpose of mitigating the potential requirements for increased emergency services resources in response to transportation and railroad emergencies.	**82**

	Recommendations	Page
43	Based upon the current three station configuration, NFD should establish the following performance goals: **Turnout Time Goals** **Goal 1:** NFD will achieve a turnout time goal of 1 minute (1:00) for EMS incidents 90% of the time. **Goal 2:** NFD will achieve a turnout time goal of 1 minute, 20 seconds (1:20) for fire incidents 90% of the time. **Response Time Goals** **Goal 1:** NFD will achieve a response time goal of 5 minutes (5:00) or less for the first arriving medical unit for medical emergencies 80% of the time. **Goal 2:**NFD will achieve a response time goal of 5 minutes, 20 seconds (5:20) or less for the first arriving fire suppression company for fire incidents 80% of the time. **Effective Force Response Time Goals** **Goal 1:** NFD will achieve an effective response force of 17 personnel for structure fires in 9 minutes, 20 seconds (9:20) or less, 90% of the time.	110
44	Produce a quarterly measurement report on the NFD's operational performance. Monitor performance measures to ensure the availability, capability, and efficient and effective use of resources. Performance measures should include alarm processing, turnout time, response time, and total response time for each first-due fire and EMS company.	110
45	On a quarterly basis, monitor the UHU for each first-due ambulance and fire suppression company within each AOR for the purpose of assessing any increases in both demands for services and company workload fatigue. The acceptable UHU benchmark is 0.25 or less.	118
46	In collaboration with RED Center, standardize data metrics to improve the consistency and reliability of reported data.	118
47	PolarisPSS recommends a three step plan that in the end will significantly improve travel times and the percentage of the TRA that would be covered within the 4-minute travel time. **Step #1:** The analysis identified that the three current fire station locations can only cover 70% of the entire Village within a 4-minute travel time and indicates that a fourth fire station is needed. The Village should consider building Proposed #13 in the recommended area of Waukegan Road and Walnut Court to increase the coverage area from 70% to 77%. **Step #2:** If Proposed #13 is built, the next step toward achieving the goal of improving the 4-minute travel time and increasing the area of coverage from a 77% to 80%, is to relocate Station #12 to the location of Proposed #12W. **Step #3:** If Proposed #13 is built and Station #12 is relocated to Proposed #12W, the next step toward achieving the goal of improving the 4-minute travel time and increasing the area of coverage from a 80% to 83%, is to relocate Station #11 to the location of Proposed #11SW.	135
48	Modify the IGA with the NBRFPD to reflect the investment required to add a fourth fire station.	135

POLARIS
PUBLIC SAFETY SOLUTIONS, LLC

December 13, 2022

Andy Carlson
Fire Chief
Northbrook Fire Department
740 Dundee Rd.
Northbrook, IL 60062

Chief Carlson,

Enclosed you will find Addendum 1 to the Comprehensive Fire Department Organizational Assessment dated November 2022. Polaris Public Safety Solutions, LLC is submitting this addendum to provide an analysis of the Northbrook Fire Department's fire and EMS company resource utilization during the first 12 hours of the shift. The content of the Addendum supplements the information provided in the Unit Hour Utilization section that starts on page 110 of the report.

Appendix B: Table of Figures and Appendix C: Table of Tables have also been updated to reflect the inclusion of the addendum content.

Please let me know if you have any questions.

I am looking forward to presenting the report findings to the Board on January 10, 2023.

Respectfully,

Robert M. Buhs
Managing Member
Polaris Public Safety Solutions, LLC

Comprehensive Fire Department Organizational Assessment Study

Northbrook Fire Department

Village of Northbrook, Illinois

Addendum One

December 2022

Polaris Public Safety Solutions, LLC

Addendum 1 to the Comprehensive Fire Department Organizational Study, November 2022

NFD Station Unit Hour Utilization between 0700 to 1900 Hours

Again, using the most recent response data from 2021 rather than the cumulative or average data from 2018-2021, the data will provide a better current demand analysis since it excludes the COVID-19 variance that occurred in 2020. This analysis provides an overview of the workload that was experienced during the ***12-hour peak load period*** from 7:00 AM through 7:00 PM (12-hour peak workload). This analysis will provide the greatest evidence of any system stress as well as workforce fatigue that may occur during peak hours especially when other routine non-emergency shift responsibilities must be accomplished. The recommended 12-hour benchmark is between .20 (4 hours, 48 minutes) and .25 (6 hours).

Figure 57: Station #10: 12-Hour UHU for Calendar Year 2021

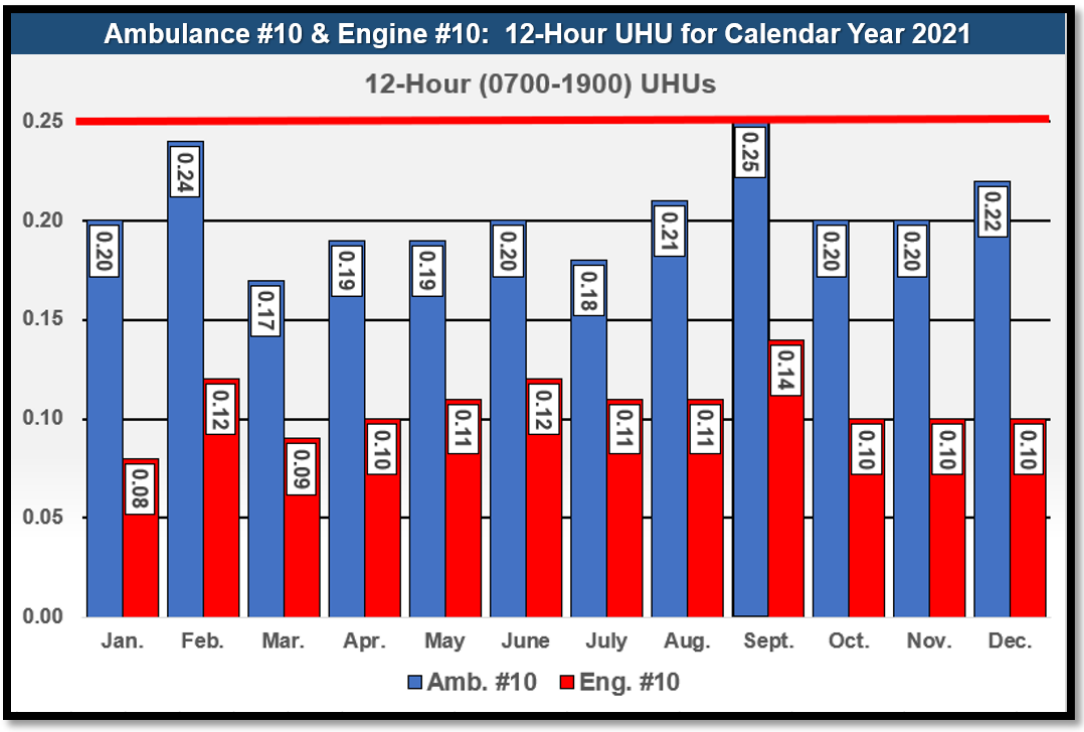


Figure 58: Station #11: 12-Hour UHU for Calendar Year 2021

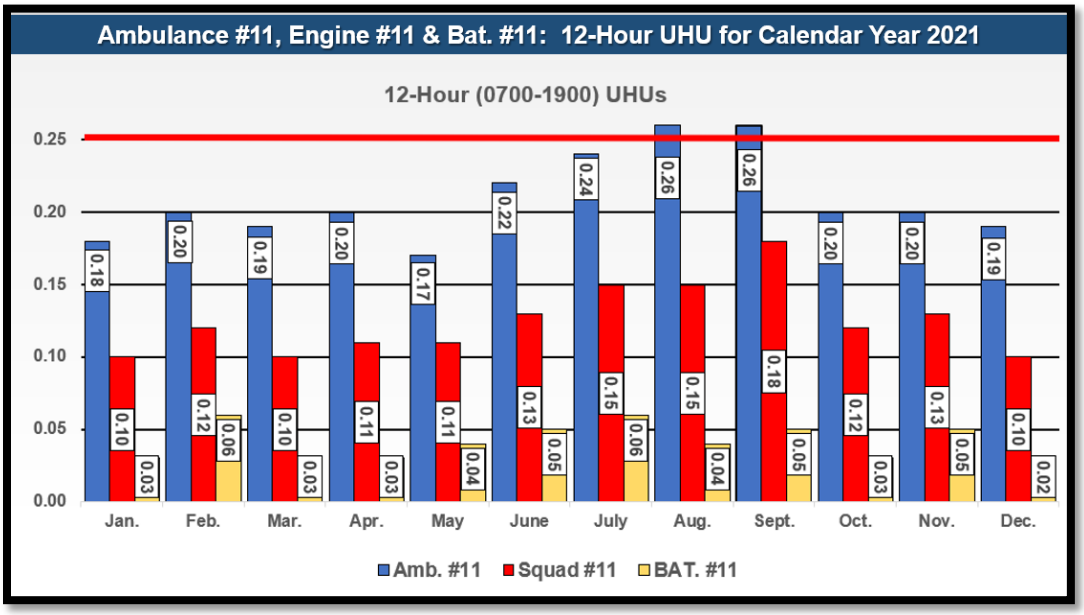
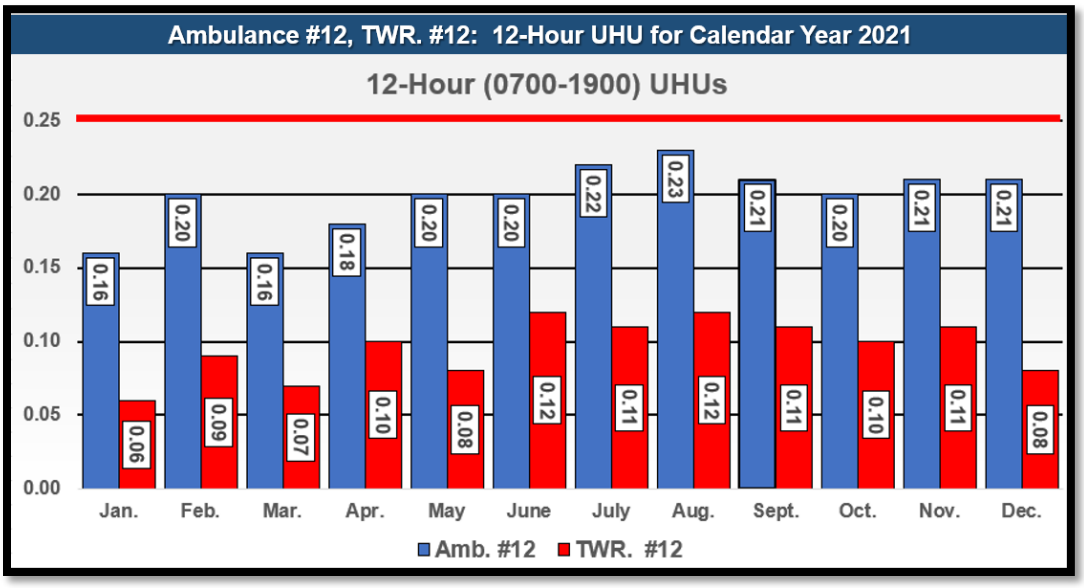


Figure 59: Station #12 Companies' 12-Hour UHU for Calendar Year 2021



Findings

Our findings indicate that *Ambulance #11* is experiencing four months at .20 percent, two months between .20 and .25, and ***two months that exceed .25 percent***. In total, four months out of 12 exhibits indicates system stress causing a lack of availability or a delay in system response.

Ambulance #10 is experiencing the second highest percentages with four months of activity between .20 and .25 percent and an additional four months at .20 percent. Though still within the ideal benchmark, the trend would indicate future system stress.

Ambulance #12 is experiencing a moderate level of activity with five months between .21 and .23 percent. Ambulance #12 highest percentage was .23 percent in the month of August but it's important to note the trend would indicate future system stress.

Appendix B: Table of Figures

Appendix C: Table of Tables