Fire Station Location Evaluation

Lebanon, Maine

October 2023

DYNAMIX CONSULTING GROUP

Contents

Acknowledgments

Dynamix Consulting Group recognizes this report contains a large amount of information and would like to thank the Board of Selectmen, staff members, and members of the fire department for their hospitality and tireless efforts in bringing this project to fruition.

Town of Lebanon

Paul Philbrick, Select Board Chair
Michael Walsworth, Select Board Vice-Chair
Shelli Boucher, Select Board Member
Richard Harlow, III, Select Board Member
Kevin Edwards, Select Board Member

Joseph Stefano, Fire Chief, Health Officer & EMA Director

Dynamix Consulting Group

The Dynamix Consulting Group Project Team for the Lebanon Fire-EMS Department Evaluation was:

Mary-Ellen Harper
Stuart McCutcheon
Bradd Clark
Matthew Krok
David Schmidt
Michael Tucker

Executive Summary

Background

On July 7, 2023, the Town of Lebanon, Maine, contracted Dynamix Consulting Group to conduct a Fire Station Location Evaluation, which included:

- A baseline assessment of the current conditions and service delivery performance. The purpose of this evaluation was to create a benchmark to measure against for future service delivery options.
- An evaluation of the future community conditions, service demand, and fire protection risks the client can expect to serve.
- Development of strategies intended to place the Lebanon Fire-Emergency Medical Services (EMS) Department in a position to successfully serve its future demand and risk. Dynamix Consulting Group developed and analyzed various facility location models for emergency services to identify options to deliver the desired service levels at the most efficient cost.

Summary Findings

In recent years, population growth and development have begun to change the character of the Town of Lebanon. These changes have resulted in an increasing demand for fire, rescue, and emergency medical services (EMS) at a time when volunteer and combination fire departments across the country, Lebanon Fire-EMS included, are seeing decreased activity from volunteer and per diem fire and EMS personnel. The combination of these factors makes this the perfect time for the Town of Lebanon to commence a community conversation to identify the level of service its residents and business owners desire - and are willing to pay for.

Dynamix Consulting Group recommends the Town of Lebanon adopt fire department performance standards and associated trigger points for when to add additional resources to achieve the desired fire department performance standards. Through the adoption of performance standards, the Town can provide a consistent level of performance, justify future additions as required by demand for services, and plan to fund the necessary resources to achieve the desired performance.

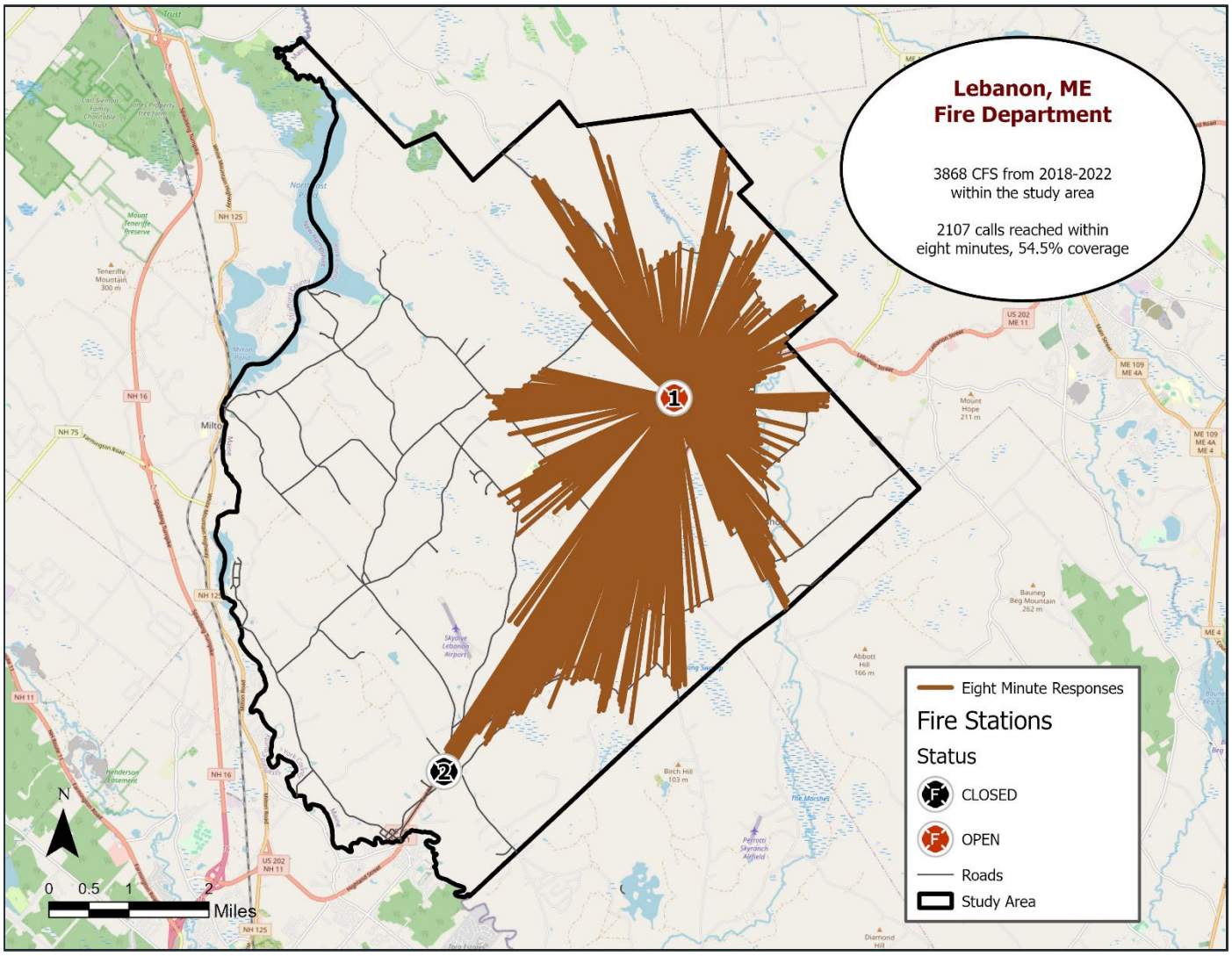
A fire station can only be effective if adequately staffed and equipped; the Town must be prepared to fund staffing and equipment for every station it places into service. Once established, the performance objectives should be regularly monitored and evaluated at least every three years to ensure they continue to meet the changing needs of the Town.

This report's Future Delivery System Models section includes a full explanation of the development of performance objectives. Dynamix Consulting Group offers the following three options for the foundation of the initial Lebanon Fire-EMS Department Performance Objectives.

Option 1: Remain status quo.

As part of this process, Dynamix analyzed Lebanon's existing single-station delivery model, which appears in the following figure. This allows for stakeholders to understand potential changes relative to the base model.

Performance from the Current Fire Station Location

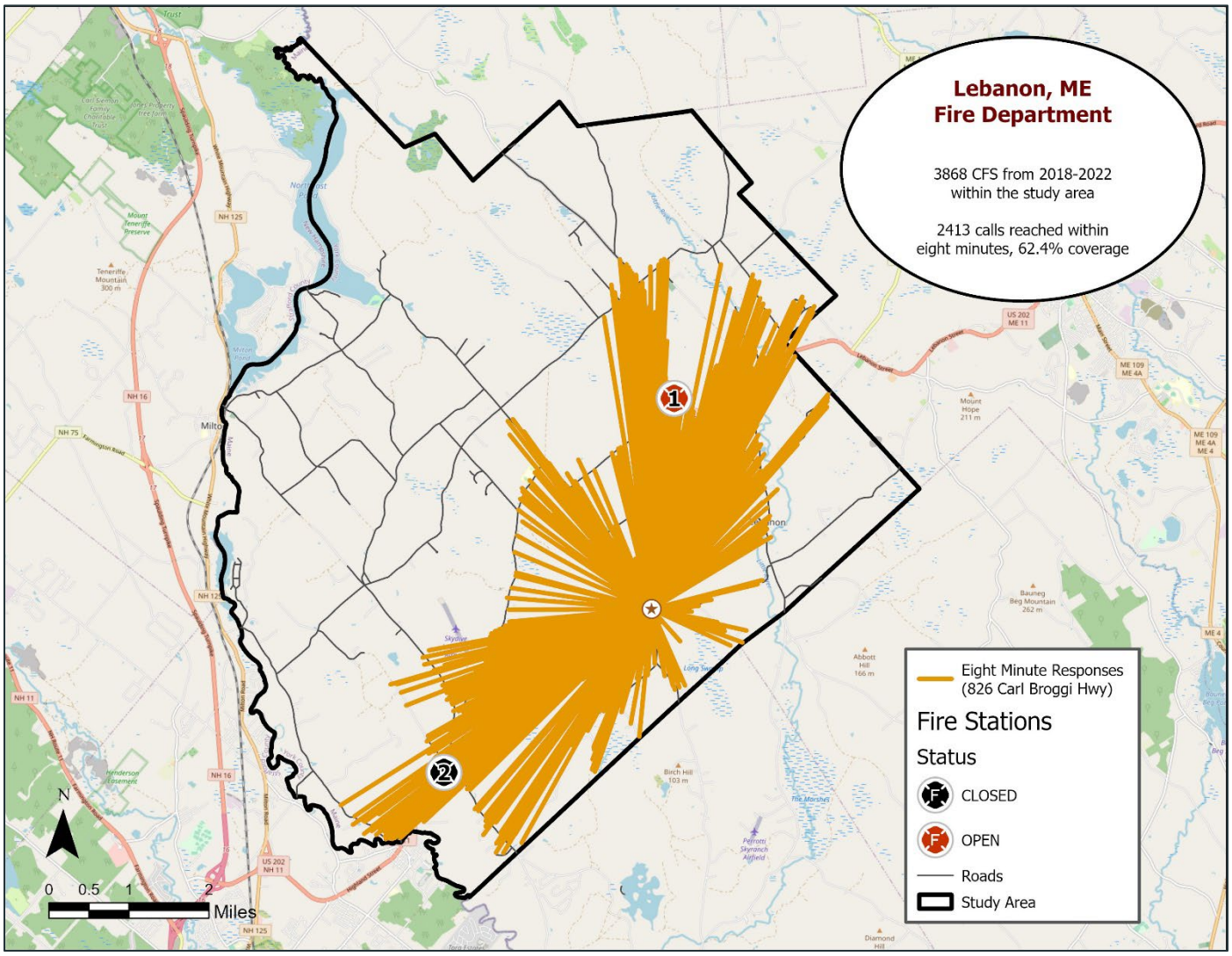


Using incident response data from 2018 through 2022, Dynamix identified the number and percentage of incidents the Department could have reached within an eight-minute travel time from the existing Station 1. Lebanon Fire-EMS Department could reach 54.5% of incidents within an eight-minute travel time from its current location.

Option 2: Relocate Station 1 to 826 Carl Broggi Highway.

The following analysis considers the Lebanon Fire-EMS Department continuing to operate from a single location in serving the Town and provides an understanding of the potential improvement in coverage using an eight-minute travel time.

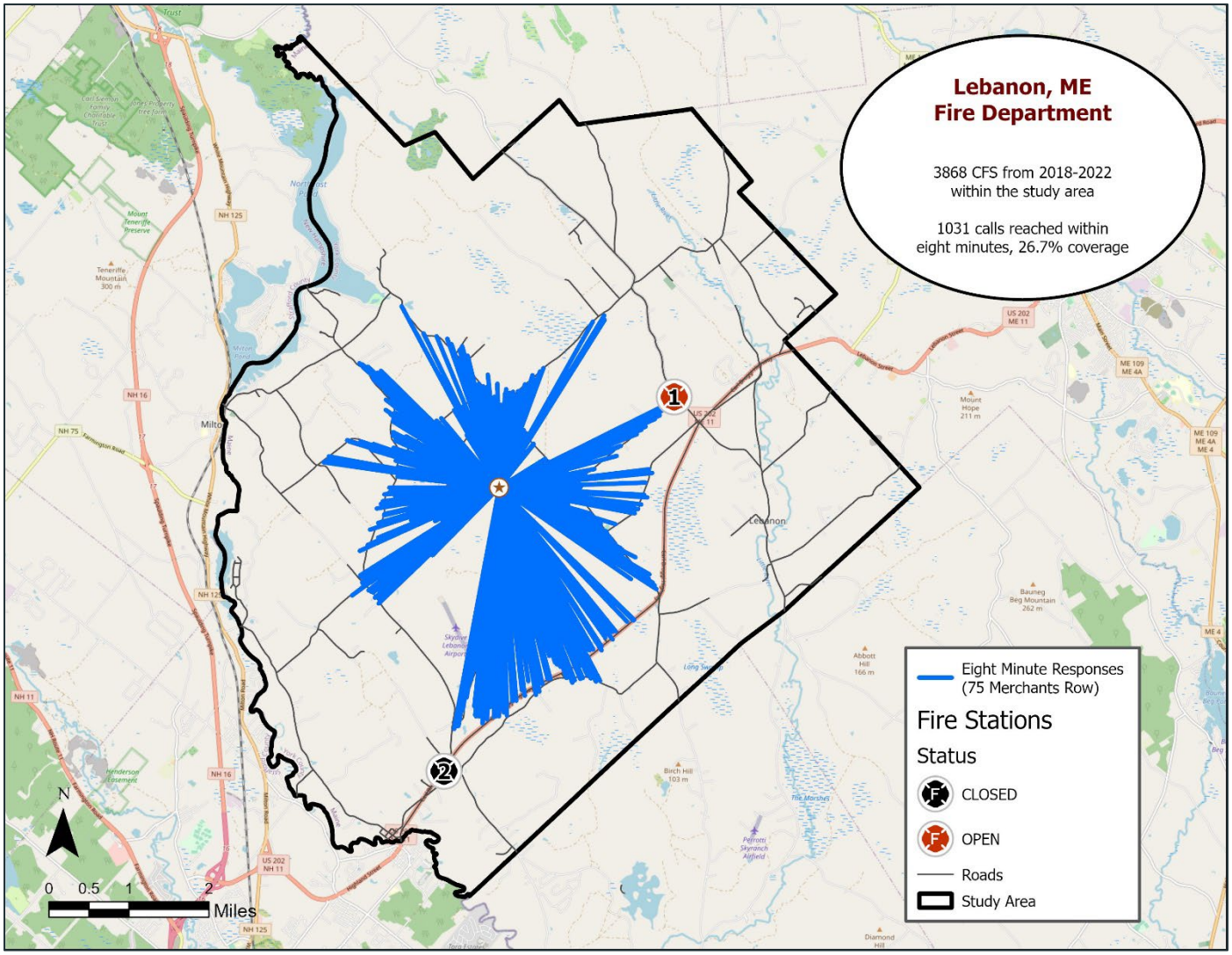
Single Fire Station Relocated to 826 Carl Broggi Highway



Should stakeholders decide to remain with a single-station service delivery model, a relocated Station 1 will allow the Department to improve the eight-minute travel time coverage to 62.4%.

Option 3: Relocate Station 1 to 75 Merchants Row.

Single Fire Station Relocated to 75 Merchants Row



This location provided by the Town decreases performance significantly; Dynamix Consulting Group does not recommend this option.

Introduction

Evaluation Process

Using organizational, operational, staffing, and geographic information system (GIS) models, this evaluation comprehensively appraises the fire and emergency medical services provided in Lebanon, Maine, upon Dynamix Consulting Group's completion of fieldwork and data collection in September 2023.

Dynamix Consulting Group based this evaluation on data provided by the Town of Lebanon and data collected during the consultants' fieldwork. The information was then compared to a combination of Maine Laws, Insurance Services Office (ISO) requirements, National Fire Protection Association Standards (NFPA), accepted best practices within the emergency services community, and the experience of the Dynamix Consulting Group Consultants.

Referenced Laws and Industry Standards

Maine Occupational Safety and Health Administration

State Plans are Occupational Safety and Health Administration (OSHA) approved workplace safety and health programs operated by individual states or U.S. territories. In the U.S., 22 State Plans cover the private sector, state, and local government workers, and seven State Plans cover only state and local government workers. OSHA monitors state plans to ensure they are at least as effective as OSHA in protecting workers and preventing work-related injuries, illnesses, and deaths.

The Maine State Plan has adopted OSHA's occupational safety and health standards. They generally follow but are not necessarily identical to OSHA standards. Maine has a unique respiratory protection standard and a Video Display Terminal standard. The Maine Occupational Safety and Health (MEOSH) Program is part of the Maine Department of Labor Bureau of Labor Standards.

Insurance Services Office

The Insurance Services Office (ISO) is a data analytics organization that provides insurance carriers with a classification rating of a local community's fire protection. The Property Protection Class (PPC®) score or rating classifies communities based upon an overall scale of 1 (best protection) to 10 (no protection) and assesses all areas related to fire protection. These areas are divided into four major categories, which include emergency dispatch and communications (10% of the rating), water supply system and distribution capabilities (40%), the fire department (50%), and Community Risk Reduction efforts (an additional 5.5% credit is available above 100%). ISO requirements are not law, but compliance (or lack thereof) with ISO requirements will directly impact a community's fire protection rating.

National Fire Protection Association Standards

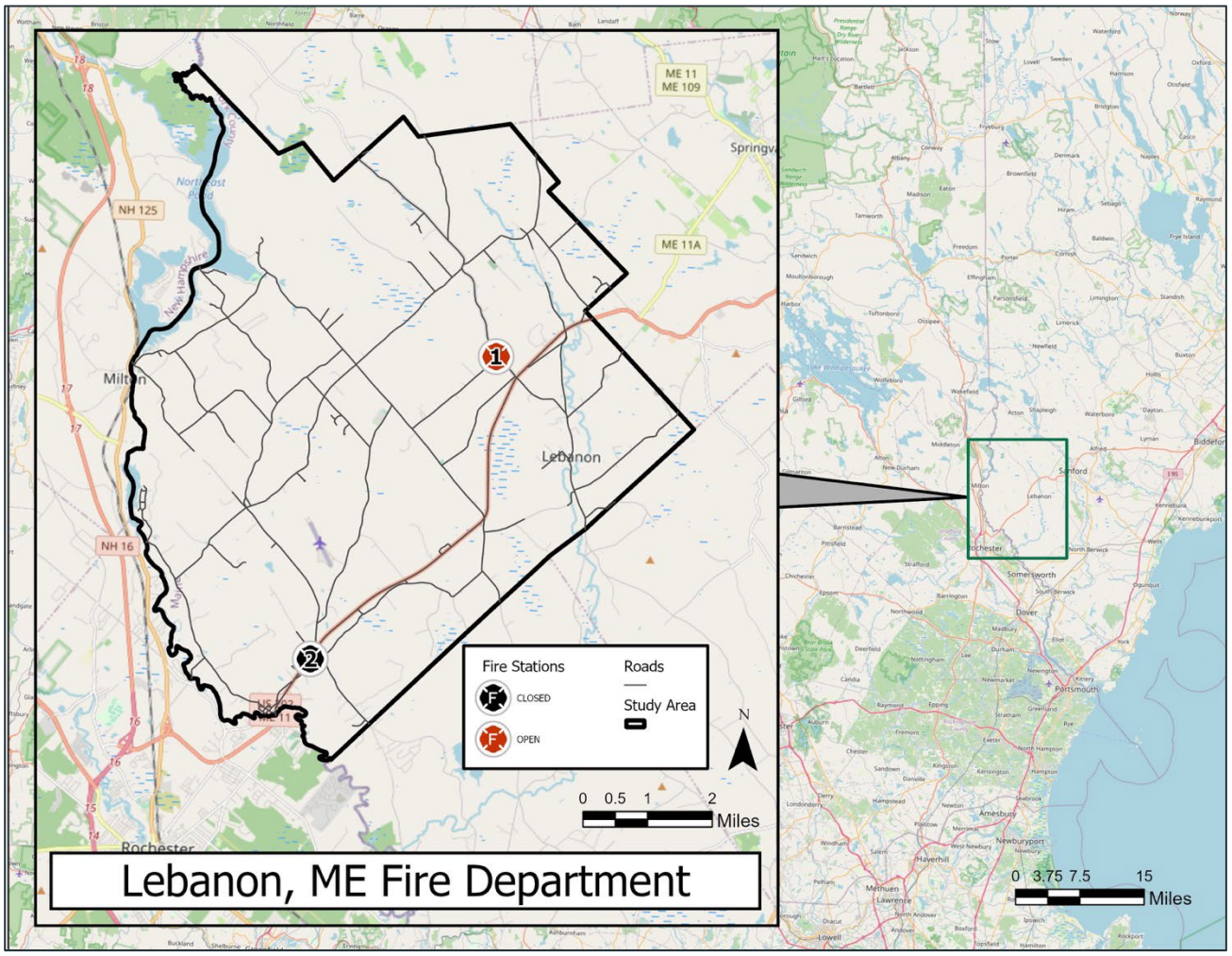
The National Fire Protection Association (NFPA) is an industry trade association that develops and provides standards and codes for fire departments and emergency medical services for local governments.

Community Profile

Service Area

The Town of Lebanon, Maine, became Maine's 23rd Town when it settled in 1743 and was incorporated on June 17, 1767, from Lebanon Plantation. Located in York County, Lebanon spans 55.83 square miles and is the westernmost Town in Maine.

Lebanon, Maine



Population and Demographics

Current Demographics

Unless otherwise noted, all population and demographic information is from the Environmental Systems Research Institute (ESRI).

Various factors can influence the need for fire and EMS within Lebanon.

- **Age**: Generally, as populations age, their need for emergency services increases. Older adults are more likely than younger populations to have chronic illnesses, functional limitations, and physical, sensory, and cognitive disabilities.
- **People with Disabilities:** People with disabilities often struggle to identify or escape hazardous situations. Disabilities can relate to physical mobility, sensory, intellectual, developmental, cognitive, or mental challenges. The Federal Emergency Management Agency (FEMA) has expanded the term "disability" to include "people with disabilities and others with access and functional needs." This expanded definition of disability includes people who may or may not fall within the definitions of civil rights laws and encompasses cross-disability issues.
- **Lack of Access to a Personal Vehicle:** These individuals rely on public transportation daily for work, school, worship, and leisure. These individuals will likely need transportation assistance in an emergency requiring evacuation.
- **Poverty**: People living in poverty experience increased risk from fire and medical emergencies due to the age and condition of their housing, inability to pay for routine medical care, lack of medical insurance, and general health conditions.

1,150	Population 65+
758	Households with Disability
91	Households without a Vehicle
129	Households Below Poverty Level

Total Population: 6,639
Median Age: 42.7
Population

Number of Households: 2,544
Average Household Size: 2.61
Households

No High School Diploma: 8%
High School Graduate: 27%
Some College: 52%
Bachelor's/Graduate/Professional Degree: 13%
Education

129 Businesses
596 Employees
Economy

White Collar: 45.8%
Blue Collar: 38.3.1%
Service Industry: 15.9%
Unemployed: 1.6%
Employment

Lebanon Fire-EMS Department

Following a fire that destroyed nine towns in the area, the East Lebanon Volunteer Fire Department was established in 1947. The Lebanon Rescue Department was established in 1981 to fulfill the need for ambulance services. These volunteer groups operated separately until 2015, when the two departments merged to form the current Lebanon Fire-EMS Department.

Staffing and Deployment

The Lebanon Fire-EMS Department operates two paramedic ambulances, one fire engine, one brush truck, an all-terrain vehicle, and a command car. The Department's staff includes 22 personnel, including two full-time employees and 20 per diem employees.

On-duty staffing changes from day to day based on the activities and needs of the Lebanon Fire Department. The Fire Chief endeavors to staff three people during the day and two at night but struggles to maintain that staffing level consistently. Training requirements and the ability to operate fire apparatus impact the staffing because when it is not possible to hire someone to work a shift who is dual-certified as both a firefighter and EMS provider and can also operate fire apparatus, it is sometimes necessary to hire two or more people who each possess some the required training to ensure that the on-duty crew can provide both fire and EMS response.

Facilities

The Town of Lebanon owns two facilities from which it has historically operated as fire stations. Both facilities are over 50 years old and need extensive renovations to comply with current codes. As demand for fire and EMS within the Town has increased, the Fire-EMS department now requires facilities that support 24 hours-a-day operations.

Previous Assessments

In March 2020, the Town of Lebanon employed HEB Engineers to conduct a structural assessment of the two fire stations. While both facilities were rated as being in fair condition, each facility has significant structural concerns relative to their ability to meet the Maine State Building Code requirements for future renovations.

Also, in March 2020, the York County Emergency Management Agency's Office of Fire and EMS Assistance provided a written report to the Lebanon Board of Selectman following an assessment of the Fire-EMS department's operation. While this report focused on administrative and operational aspects of the Fire-EMS department, the evaluator noted that neither of the facilities was in a condition that would support the growing operations of the Department.

Current Assessment

Dynamix Consulting Group visited both Lebanon fire stations in September 2023, examined past reports addressing building conditions and space needs, and conducted a gap analysis using industry best practices and recommendations from the National Fire Protection Association (NFPA)[1], the United States Fire Administration (USFA)[2], and the International Association of Firefighters (IAFF)[3]. The Lebanon fire stations were then categorized according to the following criteria:

Fire Station Condition Classifications

Excellent	Like new conditions. No visible structural defects. The facility is clean and well-maintained. The interior layout is conducive to function with no unnecessary impediments to the apparatus bays or offices. No significant defect history. Building design and construction match the building's purposes. Age is typically less than ten years.
Good	The exterior has a good appearance with minor or no defects. Clean lines, good workflow design, and only minor wear on the building interior. The roof and apparatus apron are in good working order, absent any significant full-thickness cracks, crumbling of the apron surface, or visible roof patches or leaks. Building design and construction match the building's purposes. Age is typically less than 20 years.
Fair	The building appears structurally sound with a weathered appearance and minor to moderate non-structural defects. The interior condition shows normal wear and tear but flows effectively to the apparatus bay or offices. Mechanical systems are in working order. Building design and construction may not match the building's purposes well. Shows increasing age-related maintenance but with no critical defects. Age is typically 30 years or more.
Poor	The building appears cosmetically weathered and worn with potential structural defects, although not imminently dangerous or unsafe. Large, multiple full-thickness cracks and crumbling concrete on the apron may exist. The roof has evidence of leaking or multiple repairs. The interior is poorly maintained or shows signs of advanced deterioration with moderate to significant non-structural defects. Problematic age-related maintenance or major defects are evident. It may not be well suited to its intended purpose. Age is typically greater than 40 years.

[1]https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1500

[2] https://www.usfa.fema.gov/downloads/pdf/publications/design_of_fire_ems_stations.pdf

[3] https://www.iaff.org/wp-content/uploads/FFCancer_FireStationDesign.pdf

Lebanon Fire Stations

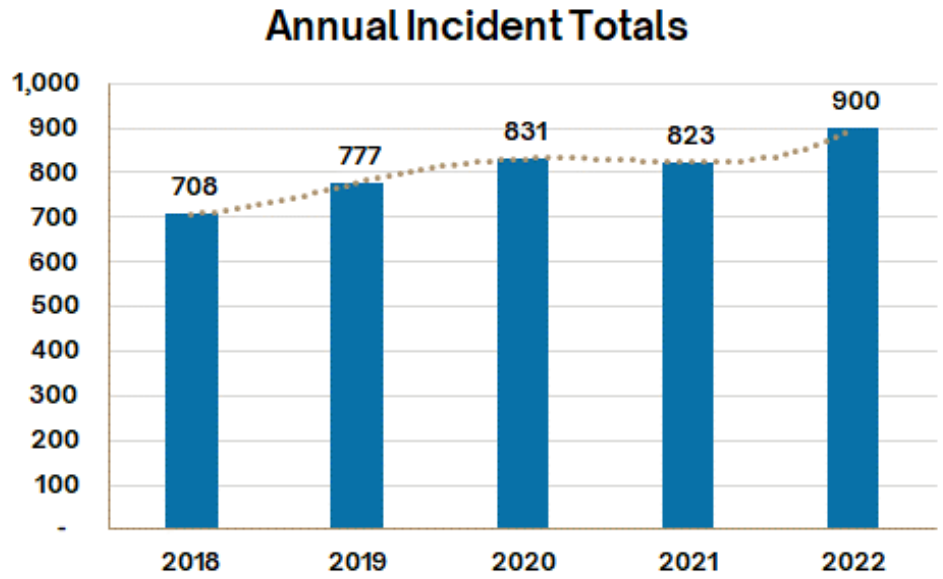
Station	Condition	Notes
Station 1, 3 Upper Cross Road 	Poor	• This Fire Station suffered a catastrophic septic system backup in June of 2023, rendering the building temporarily uninhabitable during cleanup. At the time of the Dynamix Consulting Group visit in September 2023, fire department personnel were permitted to enter the building to access apparatus or equipment; however, the temporary living quarters were in a trailer onsite with no running water on the property. • No fire sprinkler system • No electronic access • No cancer prevention engineering • Back-in bays • Inadequate bay space – units parked outside, little clearance • Inadequate office space • Inadequate storage space • Inadequate training room • Inadequate bunkrooms • No operational showers, sinks, or toilets • Inadequate parking

Station	Condition	Notes
Station 2, 1524 Carl Broggi Highway 	Poor	• Effective January 26, 2023: By order of the Select Board, Town of Lebanon, Maine: Due to liability and other risks, the Fire Station located at 1524 Carl Broggi Highway, known as Station 2, is closed to the public. Only Municipal Officers and Lebanon Fire-EMS employees on official business may enter the building. Any exception must be approved by a majority vote of the Slectboard and accompanied by a Municipal Officer or Lebanon Fire-EMS Official. • No fire sprinkler system • No electronic access • No cancer prevention engineering • Back-in bays • Inadequate bay space – units parked outside, little clearance • Inadequate office space • Inadequate storage space • Inadequate training room • Inadequate bunkrooms

Service Delivery and Performance

The demand for services drives the Lebanon Fire-EMS Department's mission to provide the Town with superior customer service and integrated emergency response to any situation threatening the life, safety, or well-being of people and property. The methods used to deploy department resources and how members accomplish training should reflect the types of incidents to which the Department responds, the level of risk associated with those incidents, and the relative frequency of occurrence of these incident types.

Reviewing trends in the incident response data can provide insights into how service demand may change year to year and the major categories of incident types. Knowing when high-demand periods occur will assist the Lebanon Fire-EMS Department in determining whether staffing levels are sufficient for that demand and in scheduling additional duties such as training, fire safety inspections, and vehicle maintenance.

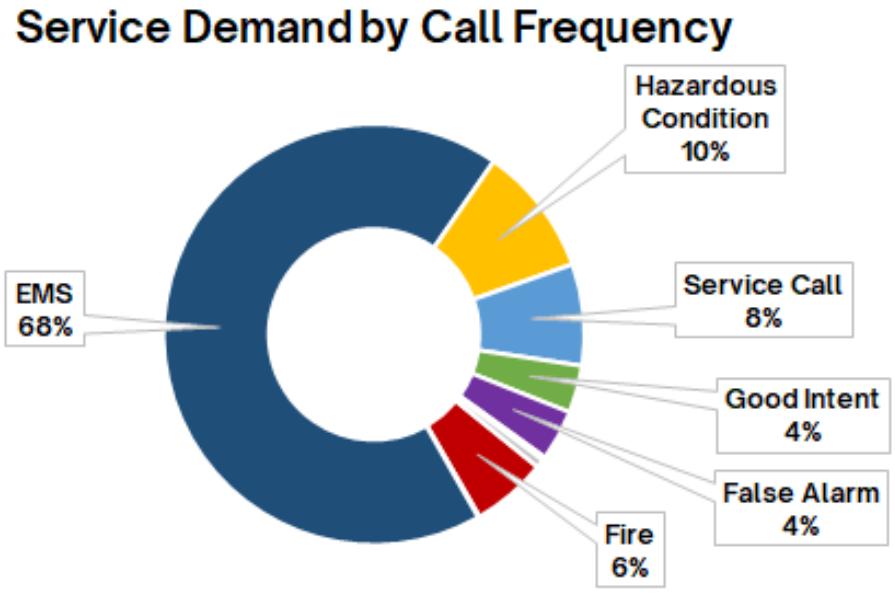


From 2018 through 2022, the total increase in call volume was 192 incidents (27.19%). Annualized over this period, the Department experienced an increase of 6.78% from year to year. The volume increase from 2018 to 2019 was 9.7%, 6.9% from 2019 to 2020. The years 2020 to 2021 saw a slight decrease of 1% and rose moderately, with a 9.4% increase from 2021 to 2022. The overall increase from 2018 to 2022 was 27.19%.

While annual incident totals can provide perspective on how community dependence upon the fire and emergency medical services fluctuates year over year, understanding the types of incidents and their relative frequency is equally important to the deployment model and associated services offered by the Fire-EMS department.

Categories used in this analysis are based on the National Fire Incident Reporting System (NFIRS) guidelines for grouping incident types. Within the NFIRS classifications are subcategories to classify individual incidents, providing valuable data to identify trends and risks specific to a community served by the reporting fire department. The broad categories include the following incident types:

- 100 Fires
- 200 Overheat/Overpressure
- 300 EMS
- 400 Hazardous Conditions
- 500 Service Call
- 600 Good Intent
- 700 False Alarms
- 800 Severe Weather
- 900 Special Incident

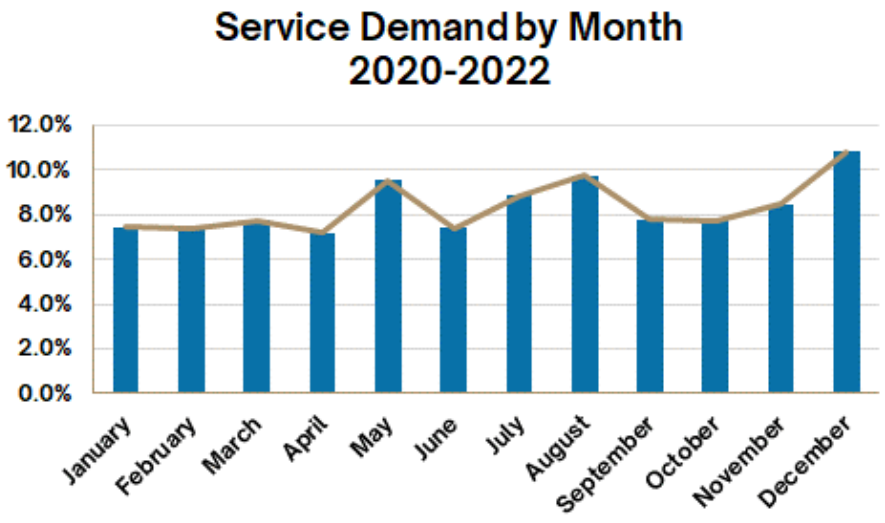


Like many other fire and rescue departments across the country, the majority of responses by the Lebanon Fire-EMS Department are medical (EMS) in nature. Hazardous Conditions at 10% (chemical spills or noxious gases) and Service calls at 7.8% (assisting a person or agency in a nonemergency capacity) make up the next highest tier in calls for service. Fires at 5.8% and False Alarms at 3.9% (alarms transmitted via the public telephone network using the local emergency reporting number), with Good Intent calls at 3.6% (a condition mistaken as an emergency) coming in next. Also included in the analysis are Overpressure/Overheated equipment, Severe Weather, and Special Incidents (such as standbys); however, they accounted for less than 0.6% each of call frequency for Lebanon.

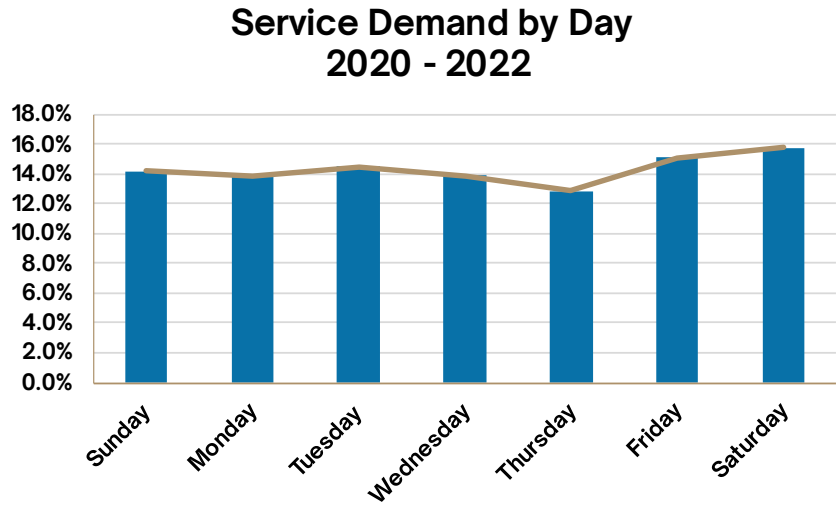
Temporal Variation

Understanding when increases or decreases in service demand are most likely to occur will provide the Lebanon Fire-EMS Department with insights into when to anticipate higher or lower service demand levels and to staff accordingly. By examining demand patterns by month, day, and hour, temporal patterns emerge as to when the greatest demand levels occur. The first illustration is temporal variation by month.

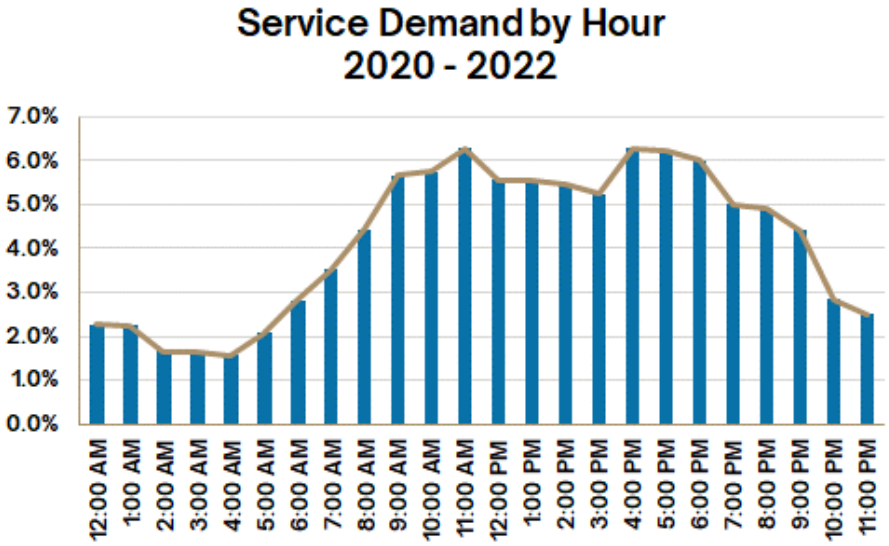
Demand for service by month illustrates a somewhat inconsistent pattern that varies by more than 3.6%. The decreases occur during late winter and early spring and yet again in the fall. In two of the three high-demand months, there is a crescendo of increases leading up to the peak-demand months.



Demand by day of the week displays a pattern of service demand increasing on weekends and decreasing on weekdays. This is most likely due to activities that bring visitors to Lebanon on the weekends.



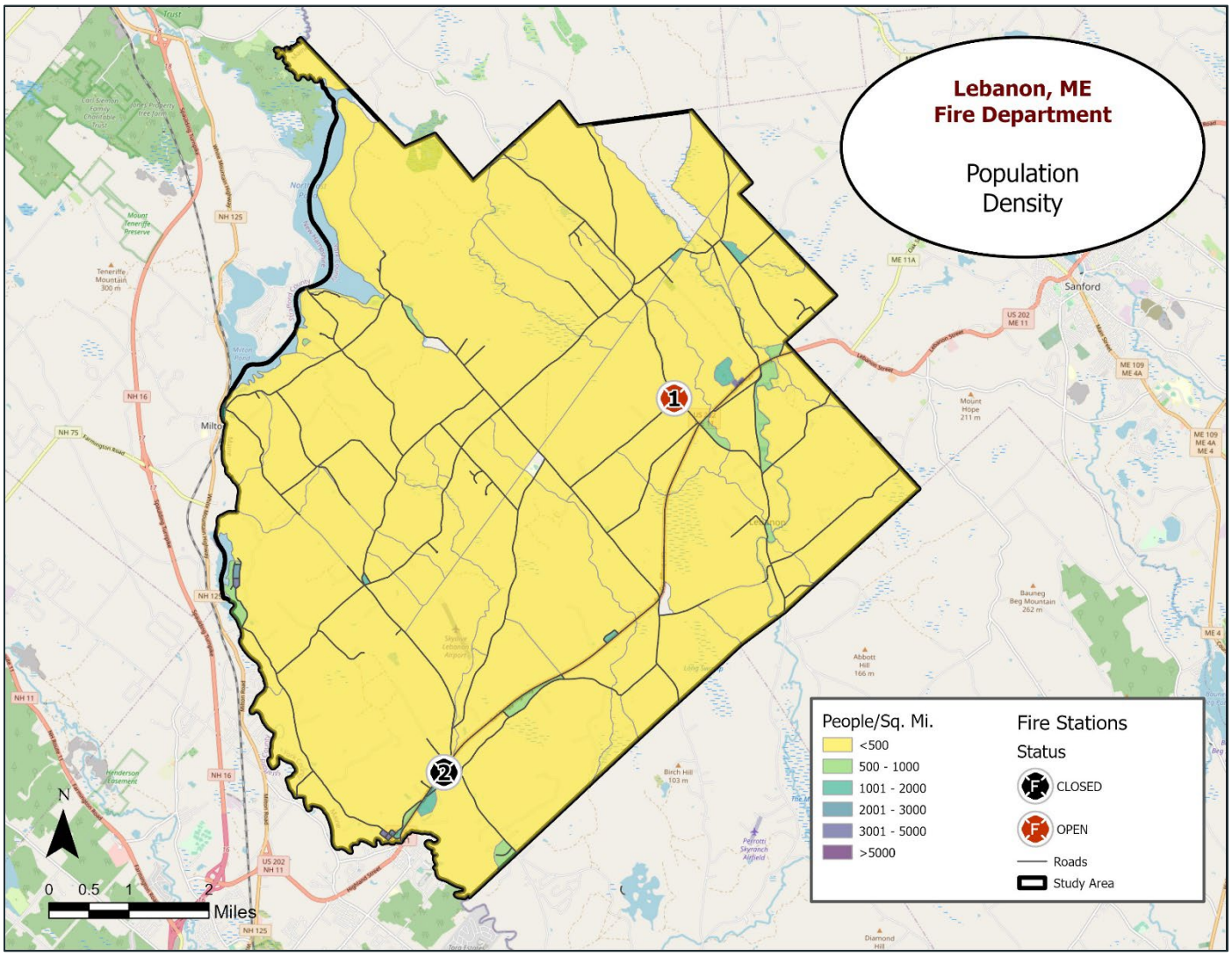
Finally, demand by the hour of day also follows a pattern of incidents increasing at the beginning of the day, reaching its peak during the late morning, a slight decrease in the afternoon, and a returning increase towards the end of the workday. The volume then decreases throughout the night, with 2 a.m. to 4 a.m. being the hours of lowest demand.



Population Density and Geographical Demand

One of the best predictors of service demand is population density. It stands to reason that more people concentrated in a given area will result in higher demand. While the specific demographics of a population can also affect the frequency of service requests, understanding the distribution of population densities is a fundamental element of developing an optimized deployment strategy. For incidents such as fires or major medical events such as cardiac arrest or severe traumatic injuries, the speed at which first-due resources can reach the incident scene will have a dramatic effect on the responder's ability to resolve the event with a positive outcome. First depicted is the population density of the Town by U.S. Census Blocks using 2023 American Community Survey (ACS) estimates.

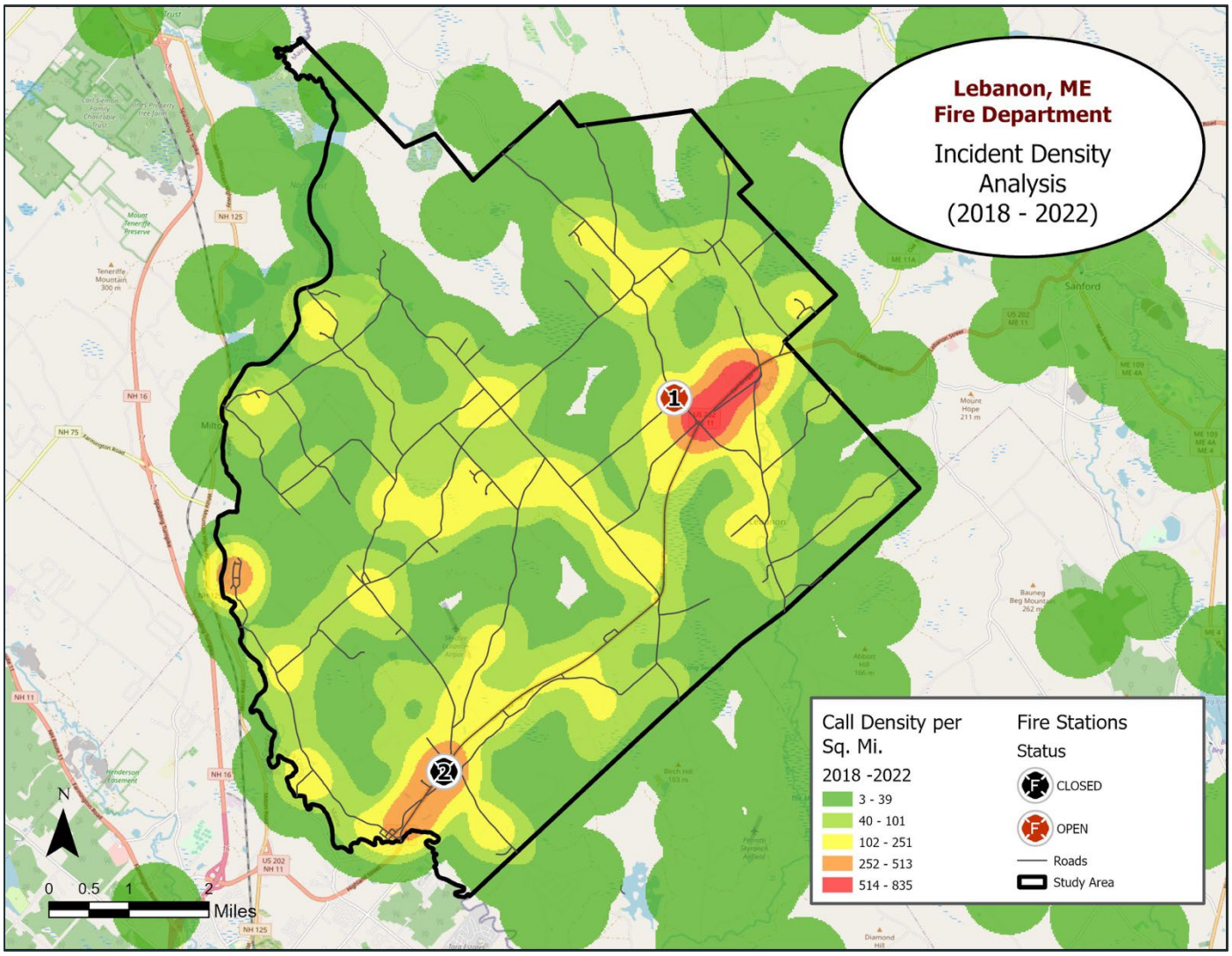
Population Density by U.S. Census Blocks 2023 ACS



The majority of the Town is rural with little commercial activity. While the Fire-EMS department is located near an area of greater population density, it would be cost-prohibitive for the community to staff multiple fire stations with career staff.

Next, using GIS software to conduct an incident density analysis, or Hot Spot analysis, determines how commercial areas impact service demand within the Town. Law enforcement uses this type of analysis to identify areas of densest activity relative to other areas. While other areas may have a greater overall call volume, hot spots appear when multiple incidents occur near each other. This analysis does not suggest a certain number of calls occurred in each area but instead provides a way to compare incident density in different areas across the Town.

Incident Density Analysis



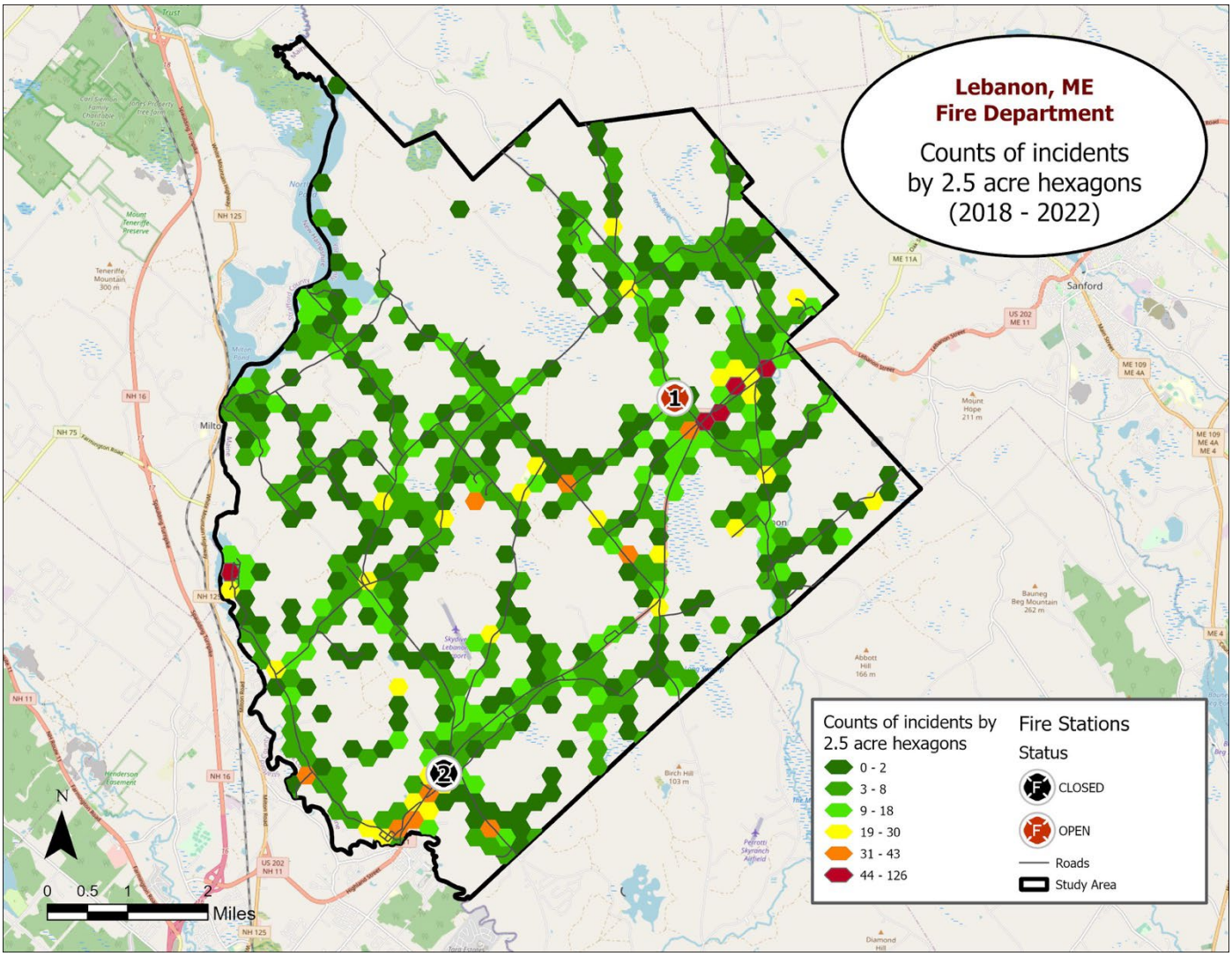
The figure above shows that the highest density of incidents is occurring in the general area of the current Station 1. It is worth noting that the figure indicates an increasing incident occurrence directly surrounding the area of Station 2, which is currently closed.

The figure also indicates a higher ratio of incidents occurring in the southwest area of Lebanon (Wittum Way and Comanche Lane). The presence of these two specific "hot spots" does not necessarily correlate to these two locations being located within the best sites to provide services to the residents and visitors of Lebanon.

Later in this report, an "optimization" analysis will be provided to facilitate the decision-making as to the best location of future fire stations that allows for the highest percentage of calls to be reached within a four and eight-minute travel time.

The following figure utilizes Lebanon's historical incident data to understand incident locations relative to a 2.5-acre area. Within this five-year period, areas identified by a dark green coloration have experienced two calls or less per 2.5 acre, while dark red areas have realized in 44 to 126 incidents per acre. It is important to note this representation does not indicate the severity of calls but only the frequency of incidents.

Incident Count by 2.5-Acre Hexagons 2018-2022



While the frequency of incidents surrounding Station 1 and the currently closed Station 2 are expected, it is worth noting that a high frequency of incidents has occurred in the western portion of the Town (I.e., Wittum Way and Comanche Lane). Additionally, the figure includes "orange" areas where a higher frequency of calls has occurred. This is something that Lebanon's leadership must account for when evaluating the need for and location of a second fire station.

Resource Distribution Study

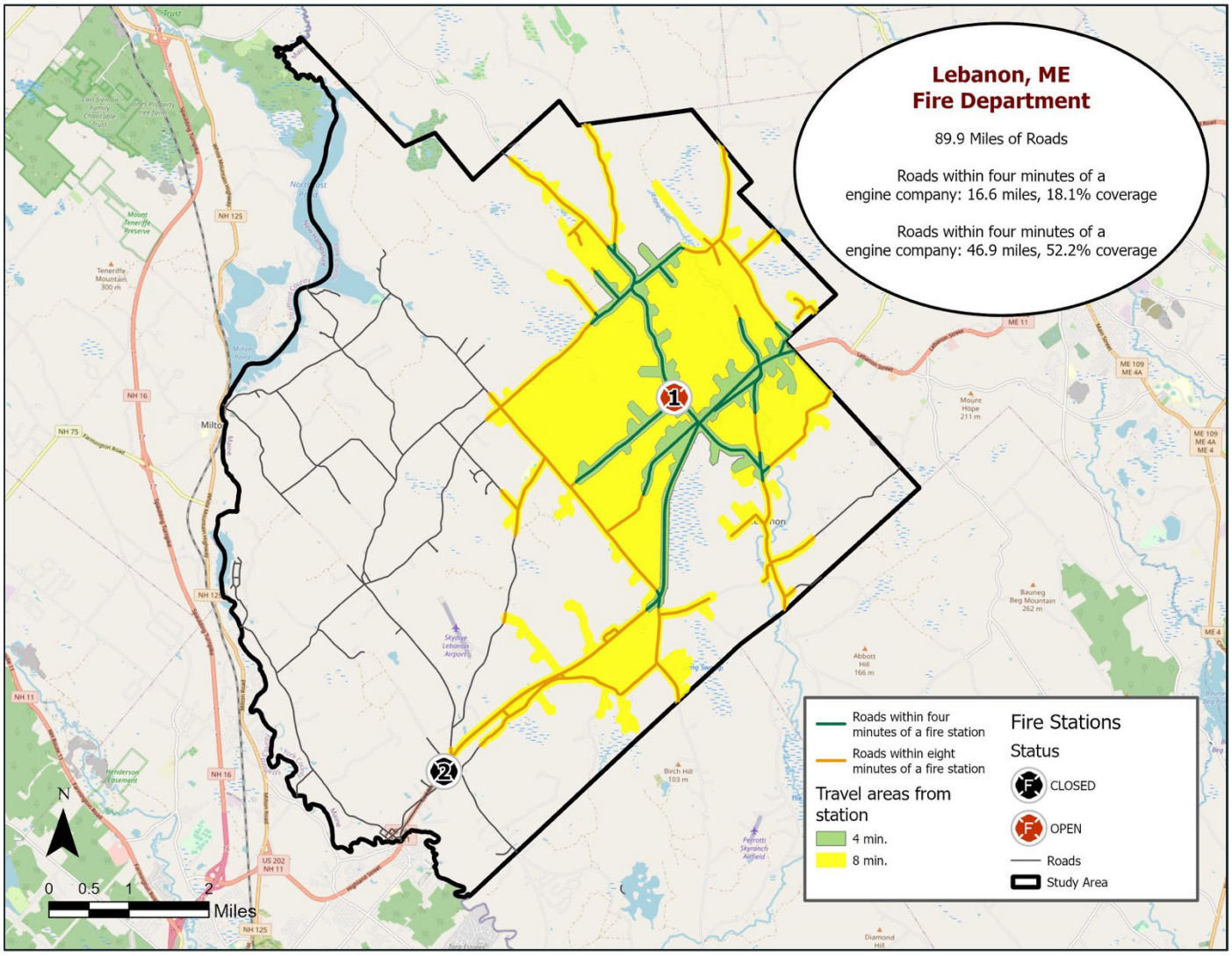
The first step is to evaluate the Department's current performance to determine how the Fire-EMS department's deployment model affects coverage throughout the Town of Lebanon. Evaluating the current deployment model and performance involves using fire service industry standards, including National Fire Protection Association (NFPA) standards and Insurance Services Office (ISO) criteria. The first section involves applying NFPA criteria specific to fire department performance, to the Lebanon Fire-EMS Department's capabilities.

NFPA 1710 Criteria

The National Fire Protection Association (NFPA) is an industry trade association that develops and provides standards and codes for fire department and emergency medical services for use by local governments. One of these standards, NFPA 1710: Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments (2020 ed.), serves as a national consensus standard for career fire department performance, operations, and safety. Within this standard, a travel time of 240 seconds, or four minutes, is the benchmark for career departments to reach emergency calls within their jurisdiction with the first arriving unit. Additionally, the balance of the response (called the effective response force) must arrive at the incident within 480 seconds, or eight minutes.

The following figure provides a synopsis of the Department's ability to meet these standards based on predicted travel times using historical traffic data from Esri for traffic patterns at 8 a.m. on Monday mornings. Unshaded pockets indicate that the area falls outside the model's maximum extension from the road network.

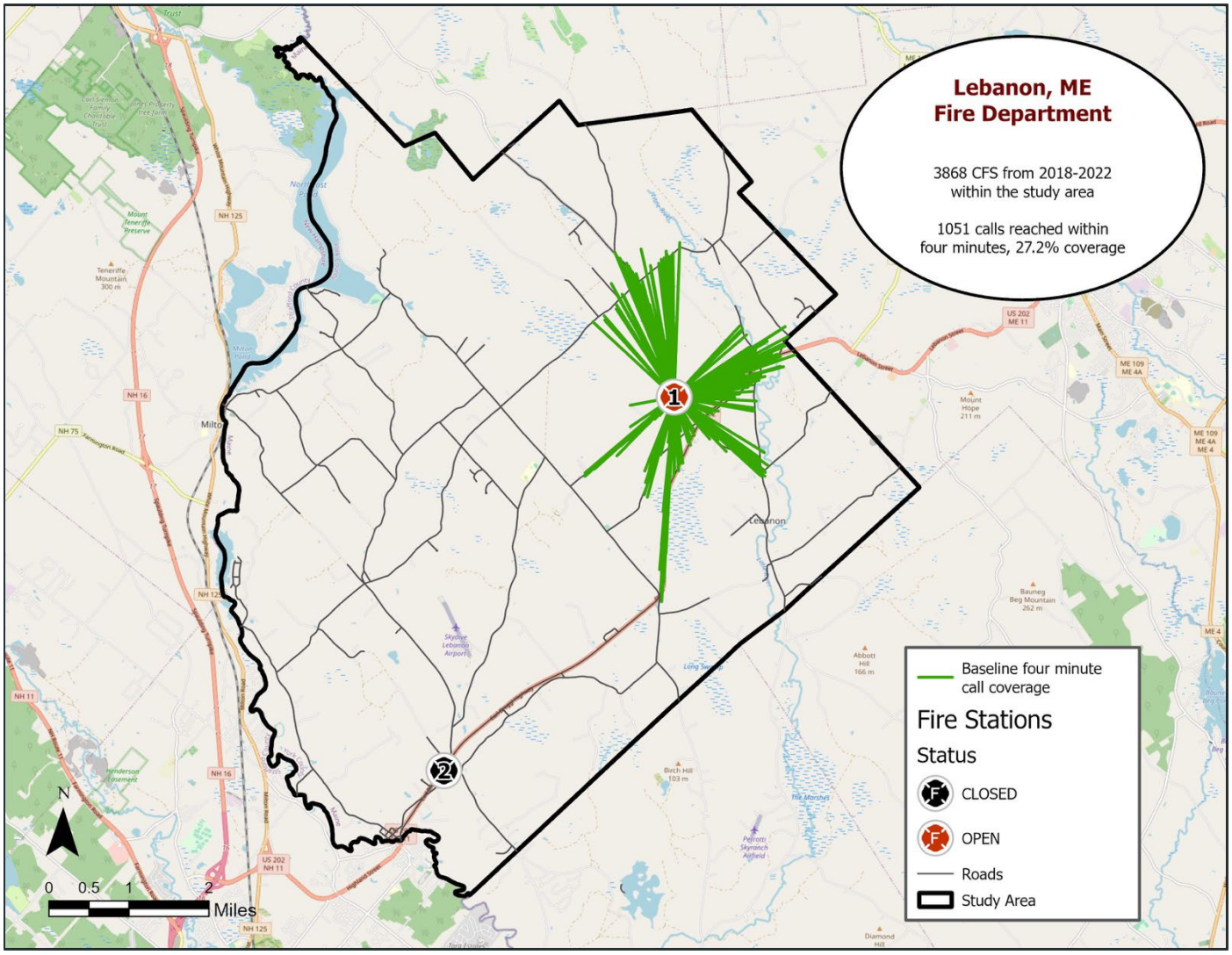
NFPA 1710 Predicted 4-Minute Travel Coverage



Of the Town's nearly 90 miles of roadway, 18.1% are within four minutes, and 52.2% are within a predicted eight-minute travel time.

The following map utilizes the department incident data from 2018 through 2022 to provide an understanding of the incident locations within a four-minute travel time of Station 1.

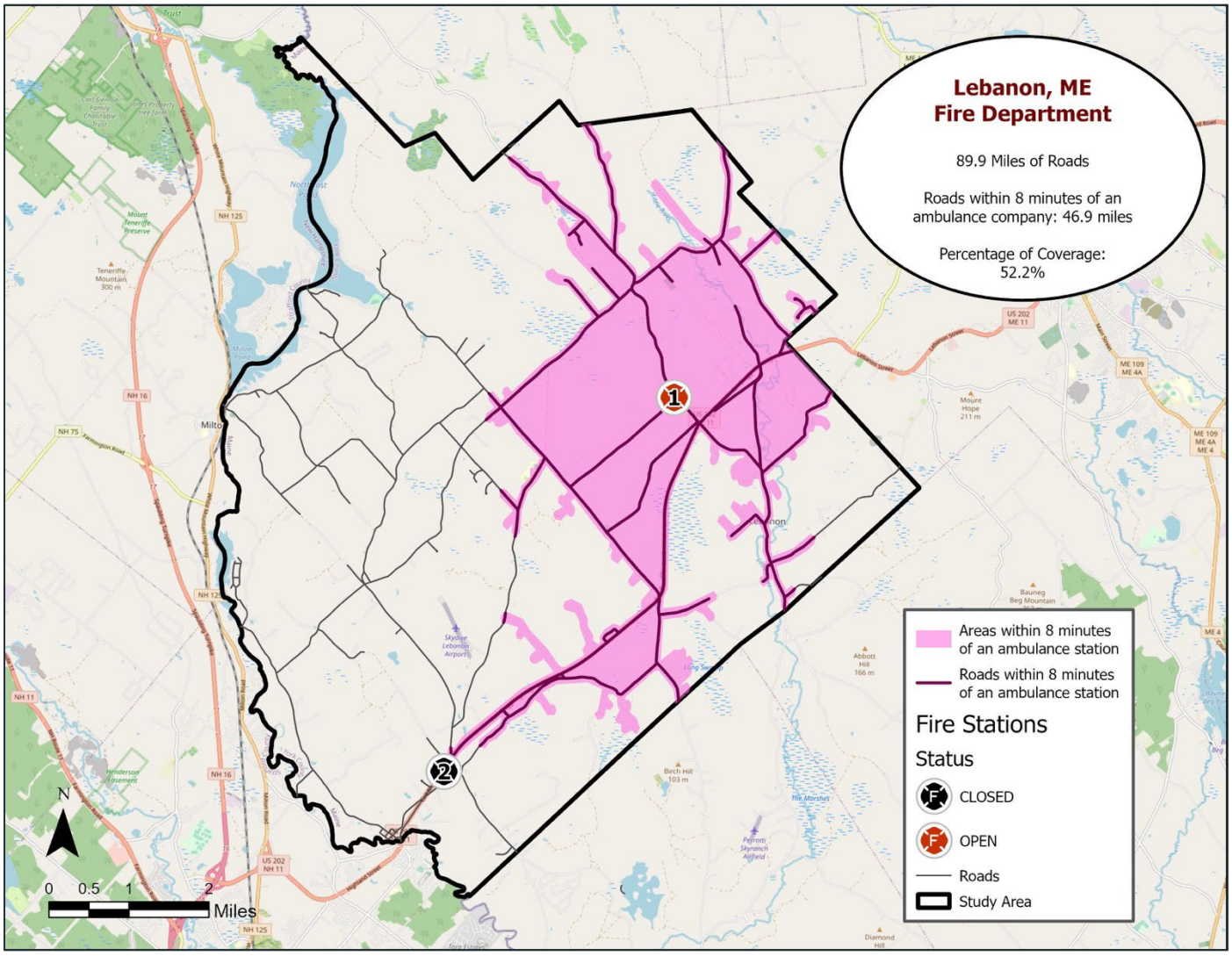
Predicted 4-Minute Travel Coverage to Incidents 2018-2022



Of the 3,868 incidents the Lebanon Fire-EMS Department responded to during this reporting period, 1,051 were located within a four-minute travel of Station 1, resulting in a 27.2% coverage area for those incidents.

For emergency medical calls, NFPA 1710 calls for an Advanced Life Support (ALS) transport unit to arrive within an eight-minute travel. The following map provides an understanding of Lebanon's roads within eight minutes of the ambulance located at Station 1.

NFPA 1710 Predicted 8-Minute Travel Coverage



Similar to the percentage of roads within eight minutes of a fire engine, 52.2% of the Town's roads are within eight minutes of Station 1. Understanding this performance capability is critical when considering the survivability of individuals experiencing cardiac arrest or respiratory arrest incidents.

ISO Response Performance

The Insurance Service Office, commonly known as ISO, is a subsidiary of Verisk Analytics. ISO was created in 1971 to provide data and information to the insurance industry to assist in developing various insurance products.

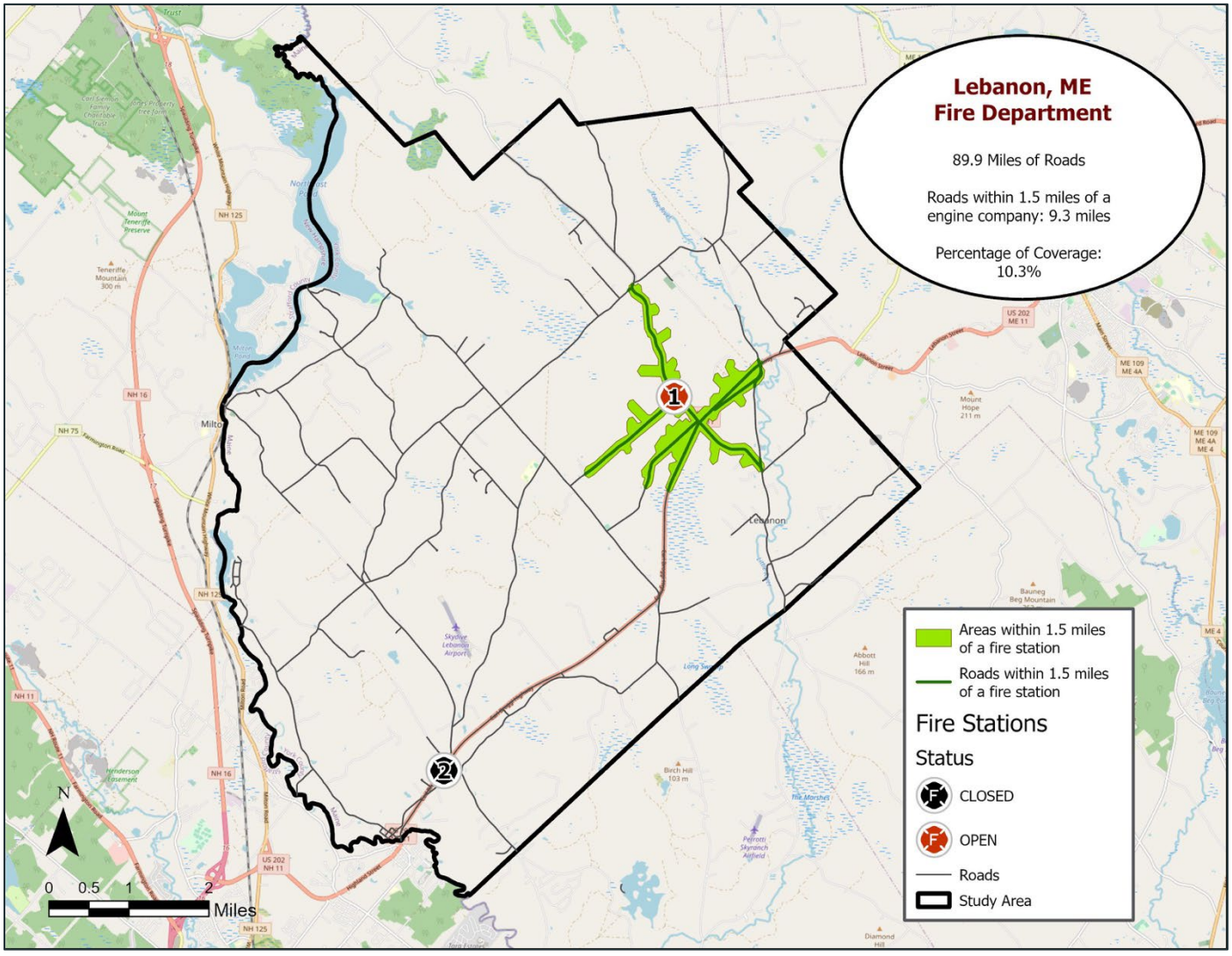
A key component of the ISO is grading fire departments relative to fire department operations, water supply, emergency communications, and community risk reduction. ISO utilizes its Fire Suppression Rating Schedule (FSRS) to provide each fire department with a Public Protection Classification (PPC®). This allows ISO to assign each fire department a numerical score between 1 and 10. Communities assigned a PPC® of 10 effectively have no credible fire service. Fire departments earning a PPC® of 1 have earned the distinction of achieving the best rating given by ISO for creditable fire services.[4]

[4] https://www.isomitigation.com/ppc/fsrs

Engine Company Performance

A key area of credit towards a community's PPC® score is the degree to which structures protected by the fire department fall within a 1.5 road-mile service area of a fire station. ISO uses this 1.5 road-mile standard to estimate a 4-minute travel time for first responding units as required by NFPA 1710. Next, an analysis of current fire stations with areas in light green indicating those structures within a 1.5-mile drive. Based on the ISO engine company travel criteria, 10.3% of the Town lies within the 1.5-mile travel distance.

1.5-Mile Engine Coverage



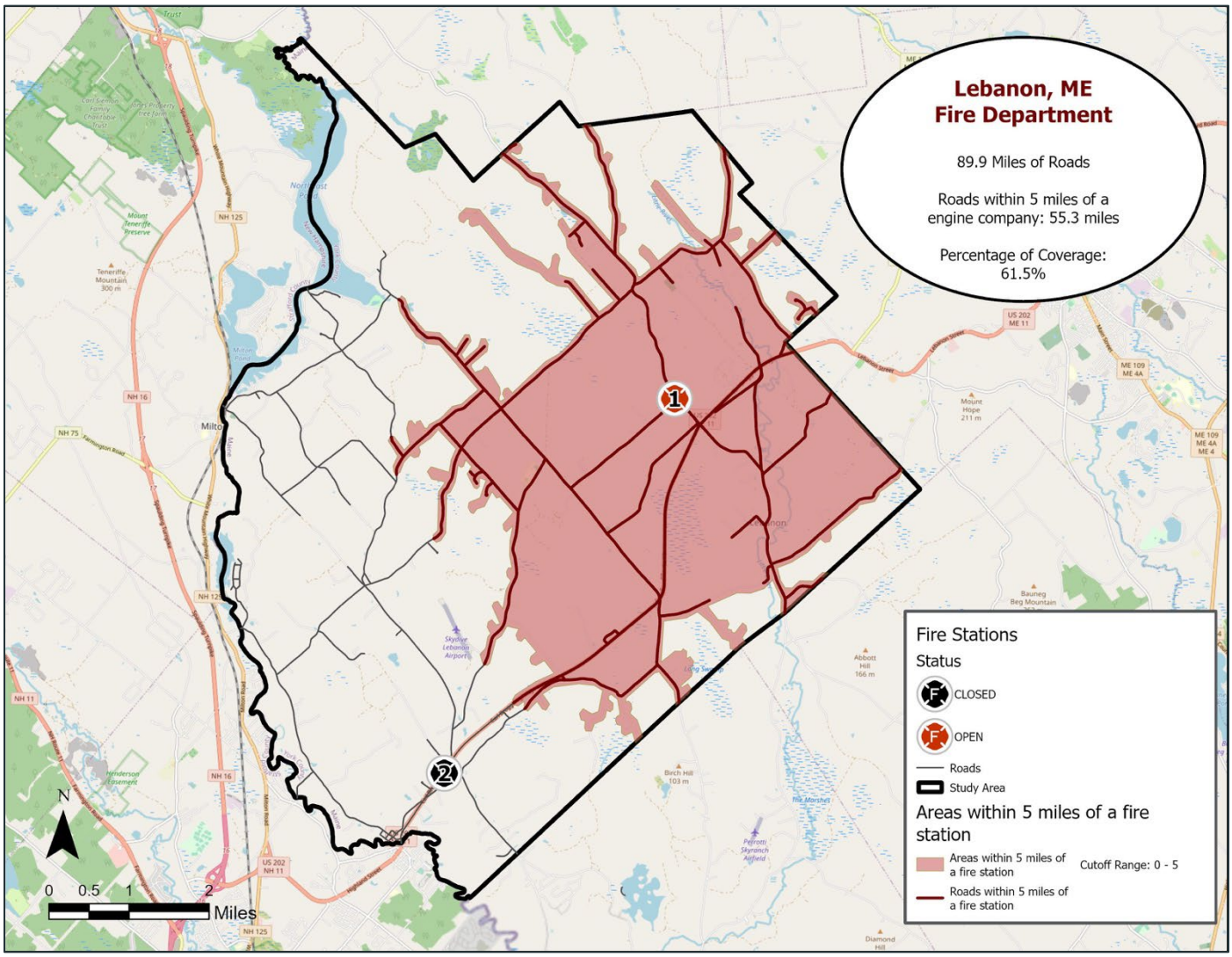
Ladder Company Performance

ISO considers a property's distance from a ladder company. In many jurisdictions, ladder companies deploy to only certain types of incidents and are not considered the first due unit for all other incident types. As such, ISO uses a 2.5 road-mile travel distance for ladder companies to estimate an 8-minute travel time in urban and suburban areas. The Town of Lebanon does not operate a ladder company; however, the Department could earn some credit if fire engines carry appropriately sized ladders for structures within the Town.

ISO Fire Station Coverage

To receive a PPC® rating from ISO that indicates fire coverage is available, structures must fall within 5 miles of a fire station. Areas outside of 5 road miles are subject to receiving a PPC® rating of 10, meaning that no fire department coverage is available. Using this criterion, 61.5% of Lebanon lies within five road miles of a fire station and is eligible to receive a rating based on the fire department's performance.

Roads Within 5 Miles of a Fire Station



Response Reliability Study

This section evaluates resource reliability using several metrics to establish a global perspective on Lebanon's ability to provide sufficient resources to meet service demand within the community. When all units are available and in quarters, supplying sufficient resources is typically not a problem; however, when multiple calls occur simultaneously, units are committed to incidents for extended periods of time, or when insufficient resources exist to safely and effectively mitigate an emergency, further preparation and planning is necessary.

Call Concurrency

Call concurrency compares how often multiple calls occur and places additional demand on resources. Below, a concurrent call includes an instance when an in-service unit responds to a separate incident before the first unit clears the scene and becomes available. When two incidents occur simultaneously, and a third separate incident occurs, three concurrent calls are present, and so on. Due to the limited staffing in Lebanon and the distance of mutual aid units, multiple calls can be problematic for the Department.

Concurrency	
Single Incident	85.4%
2	11.7%
3	1.9%
4	0.4%
5 or more	0.6%

While the majority of responses occurred one at a time, multiple incidents occurred approximately 15% of the time. Due to the limited staffing of the Department and lack of volunteers, the Fire-EMS department will be heavily reliant on mutual aid companies for major events like structure fires and those times when only two firefighters are on duty.

Unit Hour Utilization

Another component considered when evaluating resource reliability is Unit Hour Utilization (UHU). UHU provides an expression of the workload placed on the crew assigned to that unit and describes the amount of time that a unit is not available for response because it is already committed to another incident. The larger the percentage, the greater its utilization, and the less available it is for assignment to subsequent calls for service, training, and ancillary duties. Expressed as a percentage, UHU rates represent the percentage of the total hours of use in a year.

At the time of the report, incident data for each responding unit was unavailable; therefore, Unit Hour Utilization could not be calculated.

Response Performance Summary

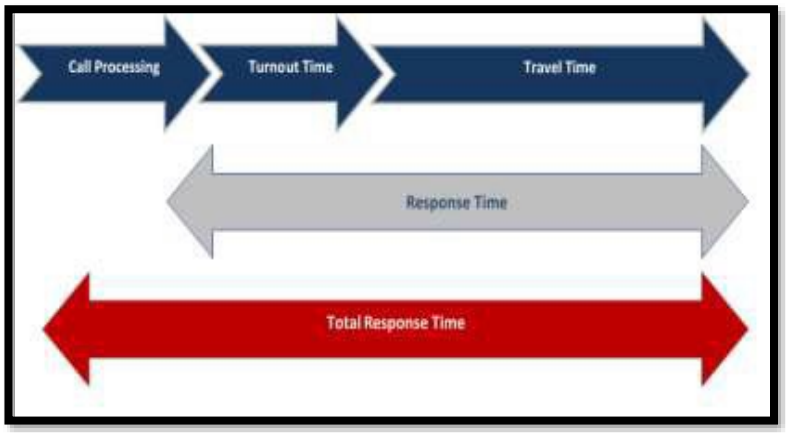
The most visible element of a fire department is its response performance. How quickly units arrive on the scene and the efficiency with which they resolve an emergency are typically the only interaction most residents will have with the fire department. NFPA 1710 is the applicable standard for career fire departments to evaluate the Department's system performance.

Response time performance is comprised of the following components:

- **Call-Processing Time:** The amount of time between answering a call by the 911 Primary Public Safety Answering Point, or dispatch center, and dispatching of resources.
- **Turnout Time:** The time interval between response unit notification of the incident and apparatus response.
- **Travel Time:** The amount of time the responding unit actually spends on the road traveling to the incident until arrival at the scene. This is a function of speed and distance.
- **Response Time:** This time calculation is from the time of dispatching the fire department to the arrival of the first apparatus. Response Time equals the sum of "Turnout Time" and "Travel Time."
- **Total Response Time:** This is the most apparent time to the caller requesting emergency services. Total response time is the amount of time that occurs from the time they place the emergency call until the units arrive. This time often includes factors both within and outside the fire department's control, particularly when another agency provides dispatch services.

Tracking the individual components of response time will enable Lebanon to identify deficiencies and areas for improvement. Once understood, the current performance for Call Processing, Turnout Time, and Travel Time, develop response goals and standards that are both relevant and achievable. Fire service best practices recommend that fire service organizations monitor and report the components of Total Response Time.

The Time Continuum is comprised of the three elements described above—Call Processing, Turnout Time, and Travel Time. Response Time is a combination of Turnout and Travel Time, and Total Response Time is the sum of all the times starting with the Call-Processing Time, Turnout Time, and Travel Time. The following section includes a more detailed discussion of the components of the Response Time Continuum, including the results of analyses where possible.



Historically, fire rescue service providers have used the performance measurement of average response time to describe the levels of performance. The average is a commonly used descriptive statistic, also called the mean of a data set. Averages may not accurately reflect the performance of the entire data set because data outliers can significantly skew averages, especially in small data sets. One extremely good or bad value can skew the "average" for the entire data set. Percentile measurements are a better measure of performance since they show that most of the data set has achieved a particular level of performance. The 90th percentile means that 90% of responses were equal to or better than the performance identified, and that the other 10% are data outliers, inaccurate data, or situations outside of normal operations that delayed performance. This compares to the desired performance objective to determine the degree of success in achieving the goal.

When evaluating fractile performance, an important consideration is that each category's results are not additive, meaning that the sum of two or more constituent metrics cannot be simply added together to find the sum. This is because each dataset is discrete and, as such, requires individual evaluation, particularly when data quality is an issue. If a metric, such as response time, possesses most of its data points, while turnout time is not accurately documented, a significant difference can exist between the response time calculated using the fractile descriptive and the sum of turnout time and travel.

Evaluating the various response time components using the fractile analysis method requires evaluation of each component separately, as the available data and the data quality may vary significantly.

Providing an analysis of performance for emergency calls within the Department required removing the following incidents:

- Nonemergency incident types
- Mutual and auto aid given
- Other aid given
- NFIRS call types within the 500, 600, 800, and 900 series
- Cells containing zeros or no value

Call Processing Time

The industry standard for call processing (or alarm handling) is NFPA 1221: Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems. This standard provides for communication centers to have processing times of not more than 60 seconds 90% of the time. For special operations, calls requiring translation, or other factors described in the standard, times should not exceed 90 seconds at the 90th percentile.

At the time of this report, call processing data was unavailable.

Turnout Time Performance

The second component of the response continuum, and one directly affected by response personnel, is turnout performance. Turnout is the time it takes personnel to receive the dispatch information, move to the appropriate apparatus, and begin responding to the incident. NFPA 1710 calls for a 90th percentile turnout performance of 80 seconds for fire and special operations calls and 60 seconds for all other emergency calls.

At the time of this report, turnout data was unavailable.

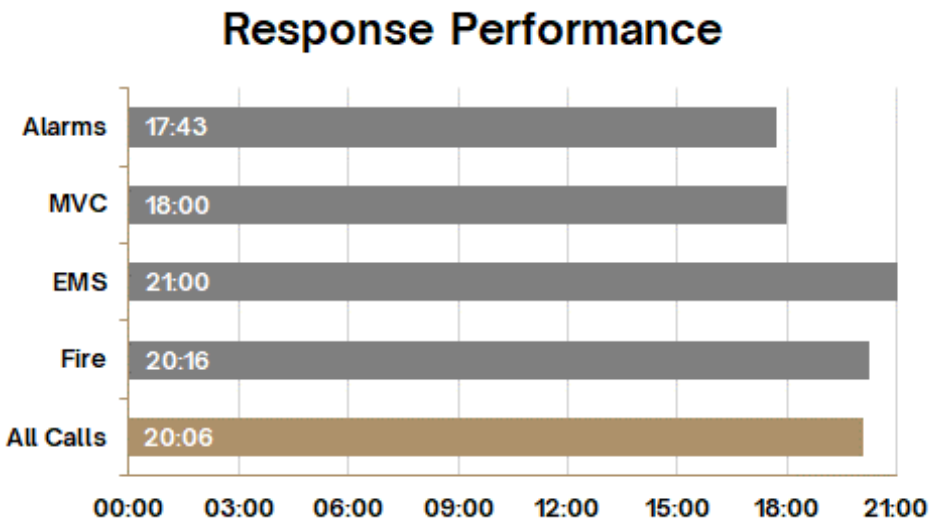
Travel Time Performance

The third component of the response continuum is travel time. It is important to understand that travel time is not specifically a factor of speed as much as it results from the proper placement of fire stations from which emergency responses begin. Travel time is the amount of time between when the apparatus departs for the call and when it arrives on the scene. The measurement is at the 90th percentile. NFPA 1710 requires that units arrive on scene to an emergency call within a 4-minute travel time, 90% of the time. Traffic congestion, construction, and the condition of the road network are all potential factors in delaying a response.

At the time of this report, travel performance data was unavailable.

Response Time Performance

Response time is the amount of time from initial notification to the fire department until the first unit arrives on the scene. Response time performance is the calculation of the difference between the initial notification time and the arrival time.



Response time performance exceeds NFPA 1710 standards. The time required for the first due unit to arrive on the scene is nearly two and a half times greater than the time allotted to assemble all required personnel and apparatus for an effective response force. A common response time goal for fire departments is 8 minutes. The Department should consider formally establishing a response time goal, or some other performance-driven goal, to provide trigger points for adding additional resources and improving the Department's response performance.

Total Response Time Performance

The culmination of the Response Time Continuum is total response time. When citizens call for emergency assistance, this metric represents what they experience as they place the call and wait for help to arrive. Total response time is the amount of time that elapsed from when the call was initiated at the communications center until the first emergency unit arrived on the scene.

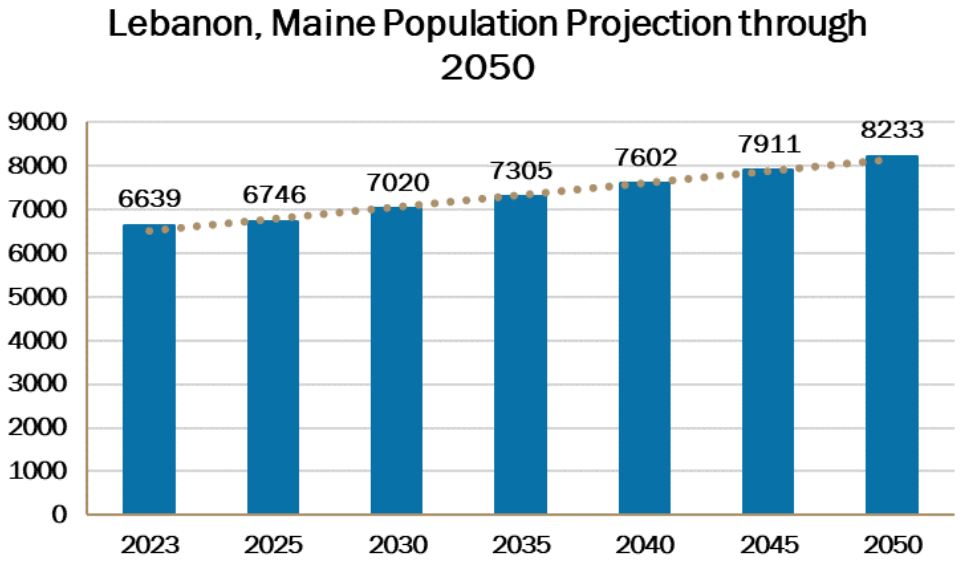
The Department has not provided data that allows for the evaluation of total response performance.

System Demand Projections

Understanding current and future demand is essential to ensuring that resources are sufficient to meet the community's needs. In this section, considerations include predicted growth in Lebanon and population and service demand projections, which assist in estimating the impact of growth over time.

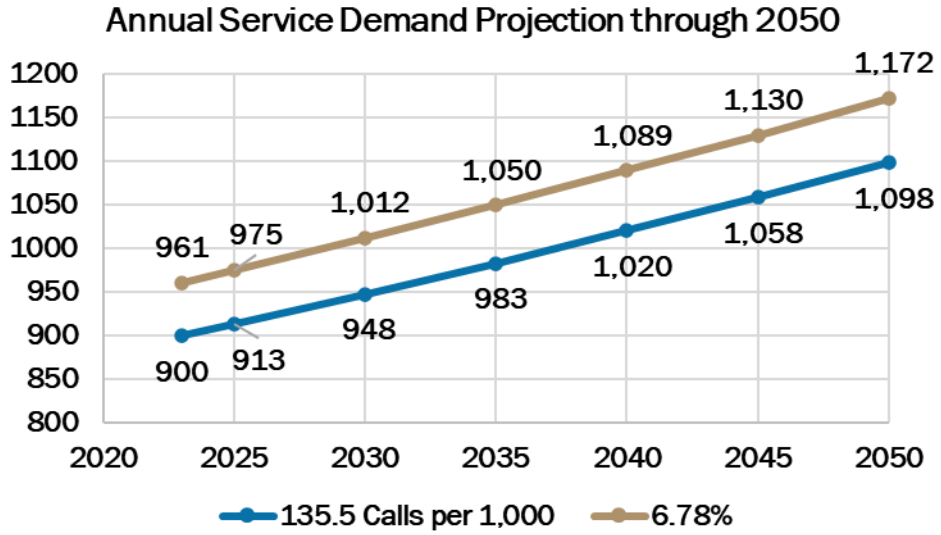
Population Growth Projections

The Town of Lebanon generally has a population density of less than 500 people per square mile. However, some areas are more active regarding demands for service than others. Below is a linear projection for the Town's population. This model used an annual increase of 0.8%, which appears consistent with census data from previous years. While some growth is likely to occur over this time, the impact of this growth on the Fire-EMS department would likely not adversely affect operations; however, the type of growth and demographic features of new residents could drive demand higher than anticipated.



Service Demand Projections

The demand for services is central to the existence of a fire department. Often, as the population rises or falls, so does the demand for services. Using the population projections from the previous section, service demand projections illustrate whether population increases would impact emergency services in the future based on historical call volume. The formula to determine projected demand included the 2022 per capita rate of 135.5 calls per 1,000 in population and the average annual increase of 6.78% calculated in the service delivery section.



Based on the results of the service demand projection, call volume in Lebanon should remain manageable for the Lebanon Fire-EMS Department.

Future Delivery System Models

Response Standards and Targets

The Town of Lebanon should establish Response Standards and Targets for its fire department based on the desired service level of the community and the community's willingness to pay for service.

Following the development of performance standards, Town leadership should monitor the fire department's performance monthly and communicate this performance to all stakeholders to allow for full transparency and a data-driven approach to any required changes to fire department staffing.

Development of Performance Objectives

Three main factors lead to the successful mitigation of emergencies: sufficient numbers of well-trained *personnel,* arriving on reliable and well-equipped *apparatus* appropriate to the task at hand, and *quickly enough* to make a positive difference in property preserved or lives saved.

The previous sections of this report have laid out the current response to fire and EMS calls in Lebanon. The following describes the consequences of failing to deliver sufficient personnel and equipment early enough to mitigate the emergency addressed.

Dynamics of Fire in Buildings

Most fires within buildings develop in a predictable manner unless influenced by highly flammable material. Ignition, or the beginning of a fire, starts the sequence of events. It may take several minutes or even hours from ignition until a flame is visible. This smoldering stage is extremely dangerous, especially when people are sleeping, since large amounts of highly toxic smoke may be generated during this phase.

Once flames appear, the sequence continues rapidly. Combustible materials adjacent to the flame heat and ignite, which in turn heats and ignites other adjacent materials if sufficient oxygen is present. As the objects burn, heated gases accumulate at the room's ceiling. Some of the gases are flammable and highly toxic.

The spread of the fire from this point continues quickly. Soon, the flammable gases at the ceiling and other combustible material in the room of origin reach ignition temperature. At that point, an event termed "flashover" occurs; the gases and other materials ignite, igniting everything in the room. Once a flashover occurs, damage caused by the fire is significant, and the environment within the room can no longer support human life. Flashover usually occurs about five to eight minutes from the appearance of flames in typically furnished and ventilated buildings. Since flashovers have such a dramatic influence on a fire event's outcome, any fire agency's goal is to apply water to a fire before a flashover occurs.

Although modern codes tend to make fires in newer structures more infrequent, today's energy-efficient construction (designed to hold heat during the winter) also tends to confine the heat of a hostile fire. In addition, research has shown that modern furnishings ignite more quickly and burn hotter (due to synthetics). In the 1970s, scientists at the National Institute of Standards and Technology found that after a fire broke out, building occupants had about 17 minutes to escape before becoming overcome by heat and smoke. Today, that estimate is as short as three minutes.[5] The necessity of effective early warning (smoke alarms), early suppression (fire sprinklers), and firefighters arriving on the scene of a fire in the shortest period of time is more critical now than ever.

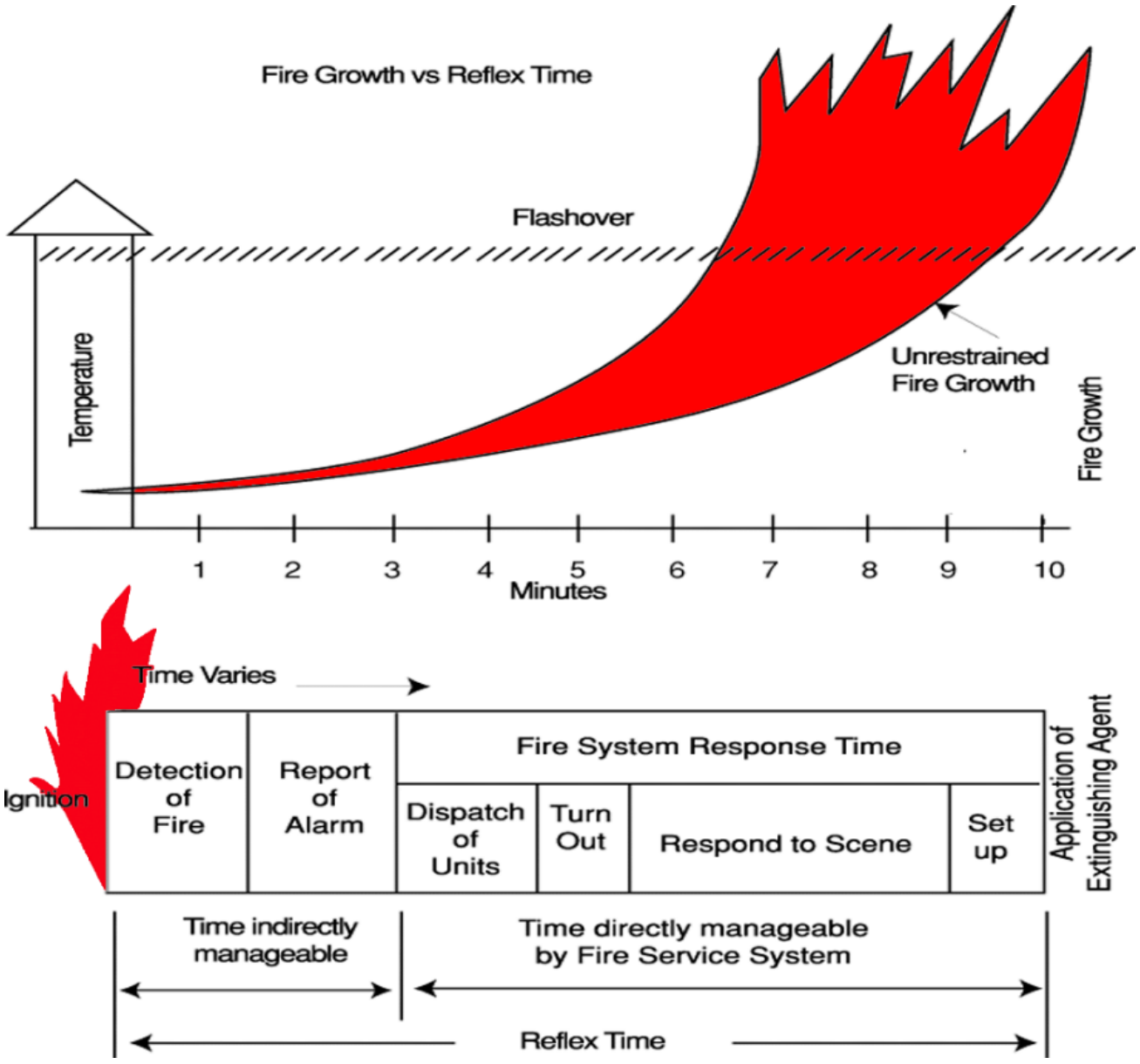
The prompt arrival of at least four personnel is critical for structure fires. Federal regulations (29 CFR 1910.134) require personnel entering a building involved in a fire to work in groups of two. Further, before personnel can enter a building to extinguish a fire, at least two personnel must be on the scene and assigned to rescue the firefighters should the fire attack crew become trapped. This is the two-in, two-out rule. However, if responders know victims are trapped inside the building, responders can perform a rescue attempt without additional personnel ready to intervene outside the structure. Further, there is no requirement that all four arrive on the same response vehicle. Many fire departments rely on more than one unit arriving to initiate an interior fire attack.

As important as preventing flashovers is the need to control a fire before it damages the structural framing of a building. Materials used to construct buildings today are often less fire-resistive than the heavy structural skeletons of older frame buildings. Today, lighter materials are used in the construction of roof trusses and floor joists, which are more easily weakened by the effects of fire. "Lightweight" roof trusses fail after five to seven minutes of direct flame impingement. Plywood I-beam joists can fail after as little as three minutes of flame contact. This creates a dangerous environment for firefighters.

In addition, the contents of buildings today have a much greater potential for heat production than in the past. The widespread use of plastics in furnishings and other building contents rapidly accelerates fire spread and increases the amount of water needed to effectively control a fire. All these factors make the need for early application of water essential to a successful fire outcome.

[5] *National Institute of Standards and Technology, Performance of Home Smoke Alarms, Analysis of the Response of Several Available Technologies in Residential Fire Settings, Bukowski, Richard, et al.*

The following figure illustrates the sequence of events during the growth of a structure fire over time.



As is apparent by this description of the sequence of events, applying water in time to prevent flashover is a serious challenge for any fire department. It is critical, though, as studies of historical fire losses can demonstrate.

The NFPA found that fires contained to the room of origin (typically extinguished before or immediately following flashover) had significantly lower rates of death, injury, and property loss compared to fires that spread beyond the room of origin (typically extinguished post-flashover). As evidenced in the following figure, fire losses, casualties, and deaths rise significantly as the extent of fire damage increases.

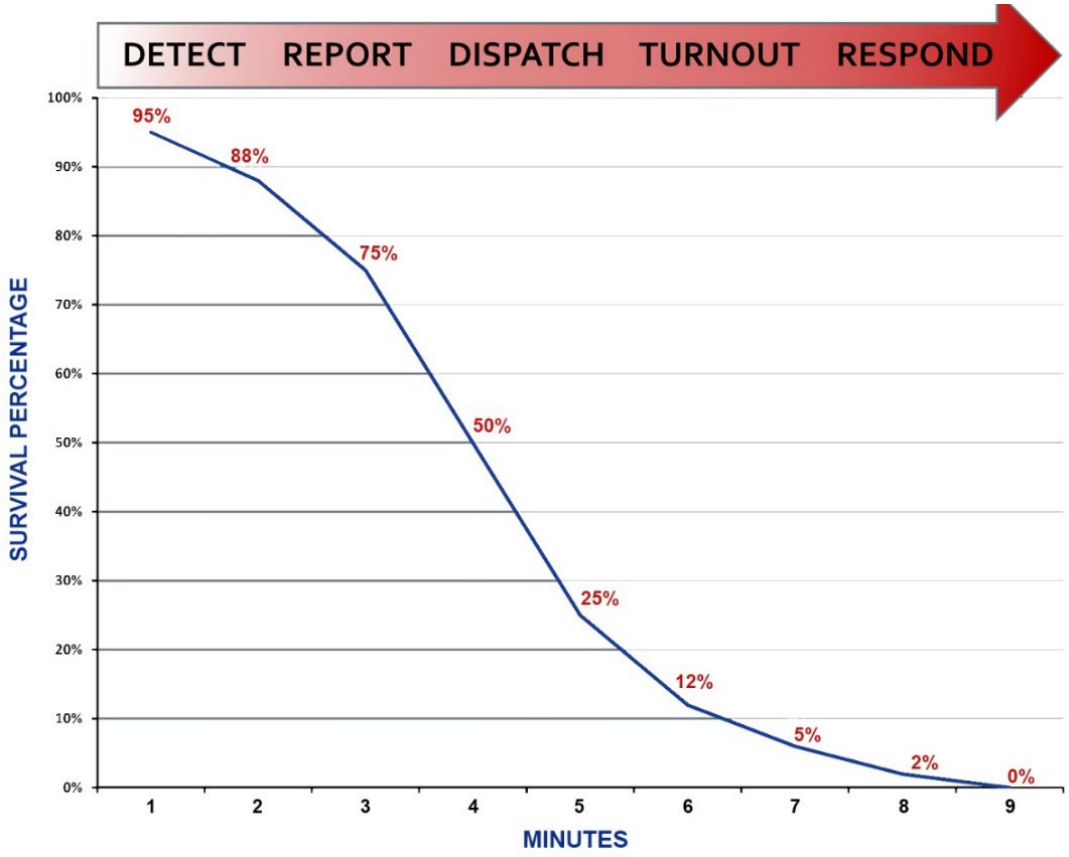
Fire Extension in Residential Structures

Fire Extension	Rates per 1,000 Fires		
	Civilian Deaths	Civilian Injuries	Average Dollar Loss Per Fire
Confined to the room of origin or smaller	1.8	24.8	$4,200
Confined to the floor of origin	15.8	81.4	$36,300
Confined to the building of origin or larger	24.0	57.6	$67,600

Emergency Medical Event Sequence

Cardiac arrest is the most significant life-threatening medical event in emergency medicine today. A victim of cardiac arrest has mere minutes to receive lifesaving care if there is to be any hope for resuscitation. The American Heart Association (AHA) issued a set of cardiopulmonary resuscitation guidelines designed to streamline emergency procedures for heart attack victims and to increase the likelihood of survival. The AHA guidelines include goals for applying cardiac defibrillation to cardiac arrest victims. Cardiac arrest survival chances fall by 7 to 10% for every minute between collapse and defibrillation. Consequently, the AHA recommends cardiac defibrillation within five minutes of cardiac arrest. As with fires, the sequence of events that lead to emergency cardiac care can be graphically illustrated, as in the following figure.

Cardiac Arrest Event Sequence



The percentage of opportunity for recovery from cardiac arrest drops quickly as time progresses. The stages of medical response are similar to the components described for fire response. Recent research stresses the importance of rapid cardiac defibrillation and the administration of certain medications to improve the opportunity for successful resuscitation and survival.

People, Tools, and Time

Time matters a great deal in achieving an effective outcome in an emergency event. Time, however, is not the only factor. Delivering sufficient numbers of properly trained and appropriately equipped personnel within the critical time period completes the equation.

For medical emergencies, this can vary based on the nature of the emergency. Many medical emergencies are not time-critical. However, a rapid response is essential for serious trauma, cardiac arrest, or conditions that may lead to cardiac arrest. Equally critical is delivering enough personnel to the scene to perform all the concurrent tasks required to provide quality emergency care. For a cardiac arrest, this can be up to six personnel: two to perform CPR, two to set up and operate advanced medical equipment, one to record the actions taken by emergency care workers, and one to direct patient care. Thus, for a medical emergency, the real test of performance is the time it takes to provide the personnel and equipment needed to deal effectively with the patient's condition, not necessarily the time it takes for the first person to arrive.

Critical Tasks, Risk, and Staffing Performance

The goal of any fire service organization is to provide adequate resources within a period of time to reasonably mitigate an emergency event. However, all emergency events inherently carry their own set of special circumstances and will require varying levels of staffing based on factors surrounding the incident. Properties with high fire risk often require greater numbers of personnel and apparatus to effectively mitigate fire emergencies. Staffing and deployment decisions should occur with consideration of the level of risk involved. Common risk categories used in the fire service are:

- **Low Risk:** Areas and properties used for agricultural purposes, open space, low-density residential, and other low-intensity uses.
- **Moderate Risk:** Areas and properties used for medium-density single-family residences, small commercial and office use, low-intensity retail sales, and equivalently sized business activities.
- **High Risk:** Higher-density businesses and structures, mixed-use areas, high-density residential, industrial, warehousing, and large mercantile structures.

Fire emergencies are even more resource-critical. Again, the true test of performance is the time it takes to deliver sufficient personnel to initiate water application to a fire. This is the only practical method to reverse the continuing internal temperature increases and ultimately prevent flashover. The arrival of one person with a portable radio does not provide fire intervention capability and should not be counted as an "arrival" by the fire department.

Performance Objective Goals

Dynamix Consulting Group emphasizes the importance of establishing and regularly monitoring performance metrics for deploying resources. These metrics serve as the foundation for determining whether or not the organization is meeting the expectations of the community it serves. Without regular and consistent performance evaluation, setting and achieving goals established to meet community expectations is impossible.

Response standards established by a fire department must originate from the community served to create a balance between what is desired and what can be afforded. Because of this, Dynamix Consulting Group cannot establish baselines and benchmark performance metrics for a given organization. However, recommendations based upon the analysis conducted throughout this report may help serve as a starting point for these discussions with the community or may serve as a reevaluation tool for the organization's current standards.

Response standards are individual to each organization. Multiple factors such as staffing, financial constraints, size of the service area, and politics will influence each fire department's ability to set achievable goals and objectives for a response.

Station Location Opportunities

Often, communities consider emergency services facilities to be "50-year" facilities. Constructing new facilities is often expensive and beyond the means of many cities and towns. It is, therefore, of utmost importance to select the most effective building locations to maximize the effectiveness of the emergency response effort. GIS technology enables stakeholders to analyze multiple deployment models to visually understand the outcomes of keeping certain facilities in place or relocating them to provide better service to the community. GIS analysis will allow Lebanon leadership to select locations serving the largest area possible, considering the Town's existing road network, and using historical incident locations to understand how the relocated facilities can perform.

Due to the current fire department site, the Town would need to make several improvements for a Certificate of Occupancy. The site requires extensive preparation of the soils and is most likely a more expensive option than others available.

GIS software was used to conduct a service area analysis to determine the viability of the proposed fire station locations selected by the Town of Lebanon. The purpose of this analysis is to select the location that will provide:

- The largest service area based on travel within the road network; and
- Capture within that service area the greatest number of incidents.

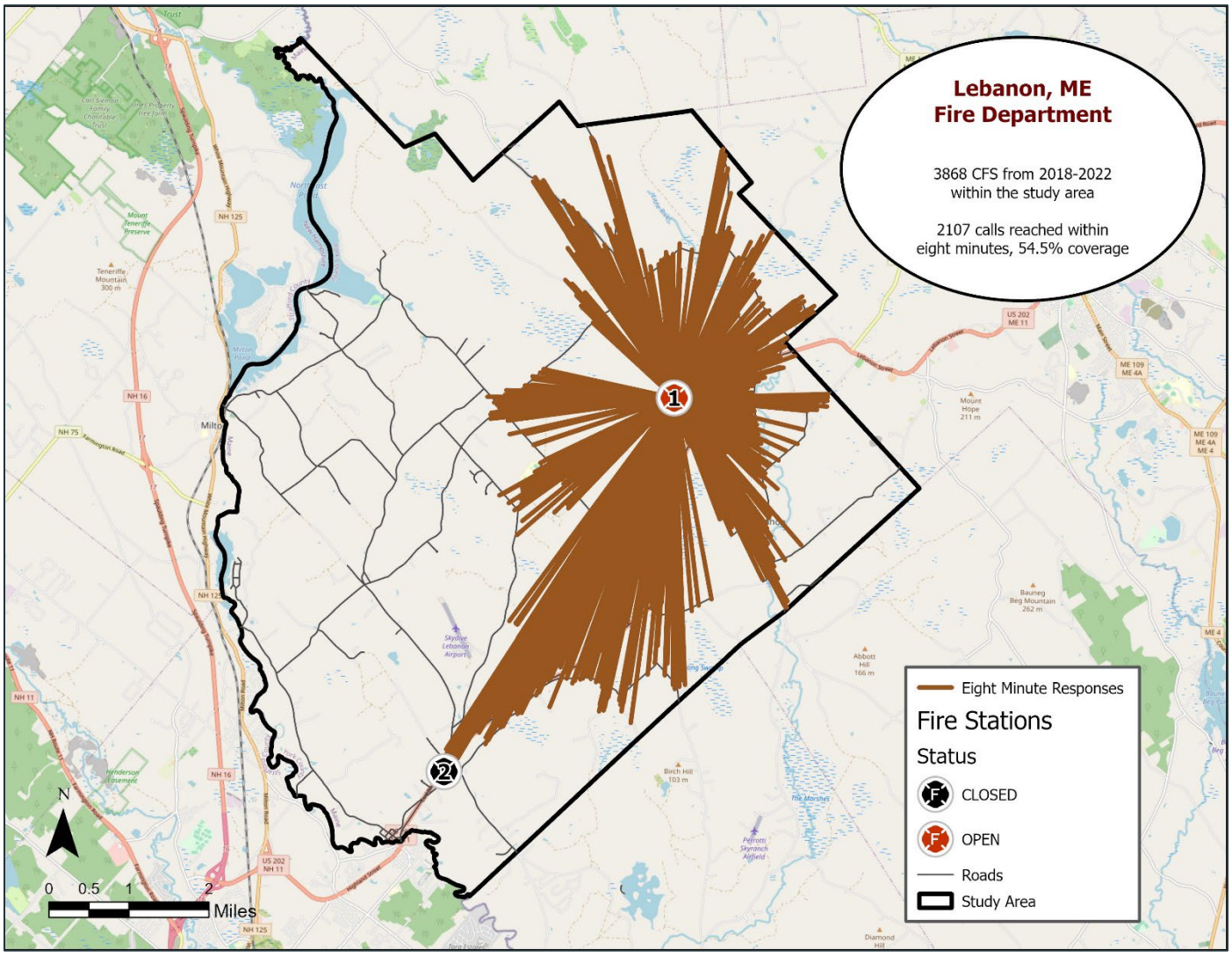
A baseline analysis of the current deployment model was developed to provide a means of comparison between models. Travel estimates were provided through Esri's proprietary database for historic traffic patterns at 8 a.m. on Monday mornings.

For the following models, an eight-minute travel time was used as Lebanon is a predominately rural community, funding is limited, and industry research has demonstrated that an eight-minute travel time for an ALS ambulance is most appropriate for rural communities.

Option 1: Remain status quo.

As part of this process, Dynamix analyzed Lebanon's existing single-station delivery model, which appears in the following figure. This allows for stakeholders to understand potential changes relative to the base model.

Performance from the Current Fire Station Location

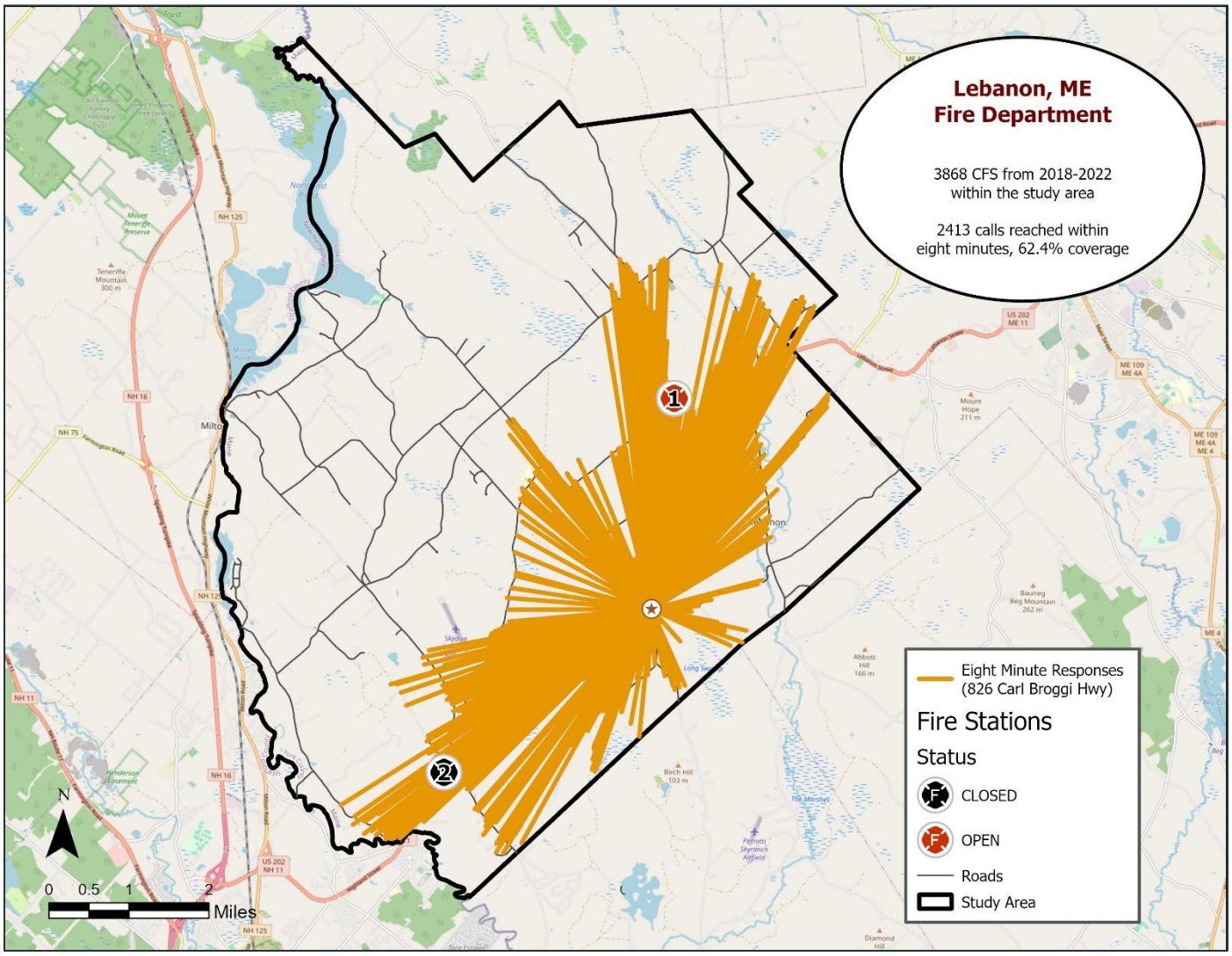


Using incident response data from 2018 through 2022, Dynamix identified the number and percentage of incidents the Department could have reached within an eight-minute travel time from the existing Station 1. Lebanon Fire-EMS Department could reach 54.5% of incidents within an eight-minute travel time from its current location.

Option 2: Relocate Station 1 to 826 Carl Broggi Highway.

The following analysis considers the Lebanon Fire-EMS Department continuing to operate from a single location in serving the Town and provides an understanding of the potential improvement in coverage using an eight-minute travel time.

Single Fire Station Relocated to 826 Carl Broggi Highway

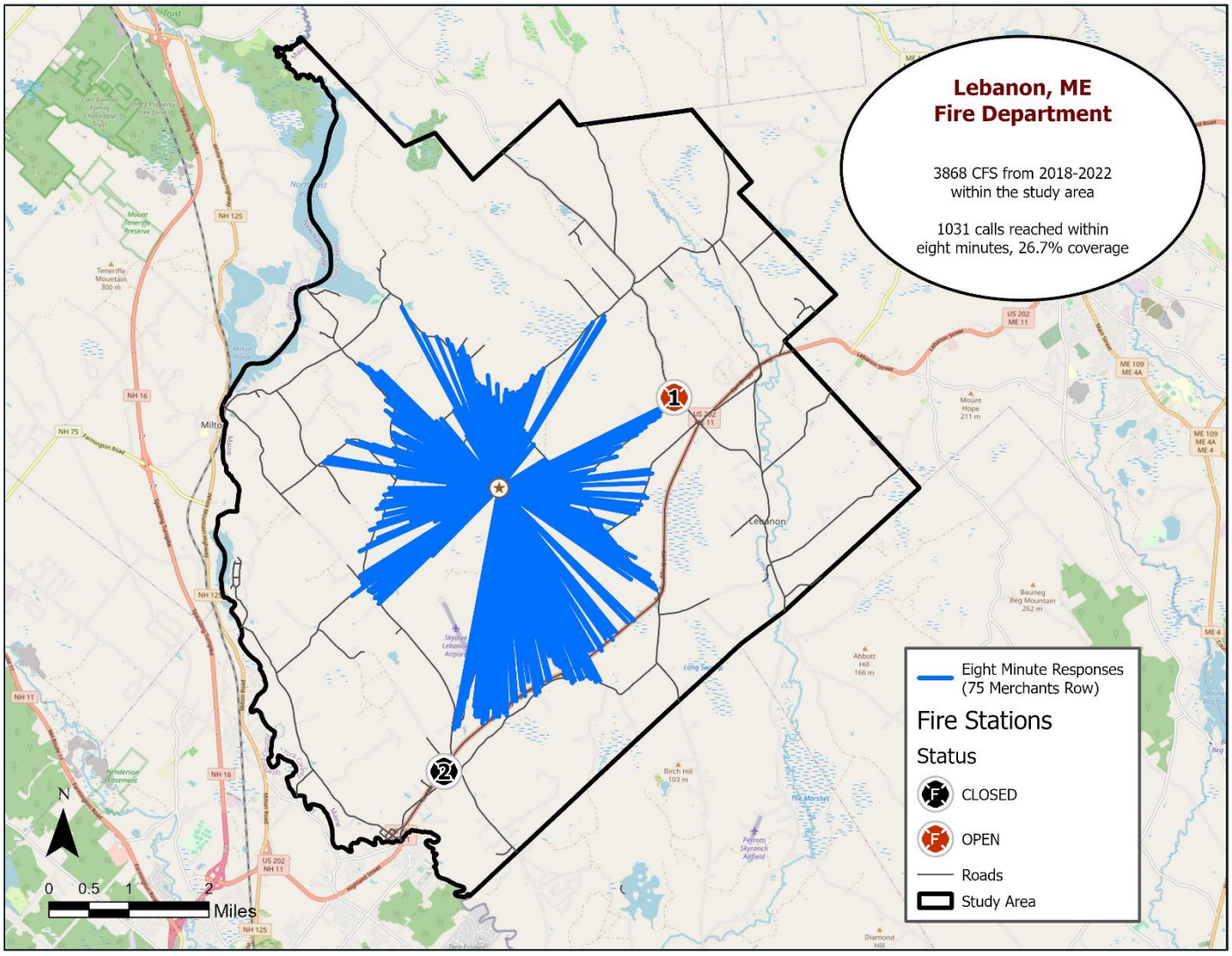


Should stakeholders decide to remain with a single-station service delivery model, a relocated Station 1 will allow the Department to improve the eight-minute travel time coverage to 62.4%.

This is Dynamix Consulting Group's preferred option; understanding that this exact property may not be available for a fire station, the Town should seek land to build a fire station in this area.

Option 3: Relocate Station 1 to 75 Merchants Row.

Single Fire Station Relocated to 75 Merchants Row



This location provided by the Town decreases performance significantly; Dynamix Consulting Group does not recommend this option.

Future Fire Station Considerations

Dynamix Consulting Group recommends including the following features in plans for a new fire station in Lebanon.

Automatic Fire Sprinkler Protection

NFPA 1: *Fire Code* requires "New buildings housing emergency fire, rescue, or ambulance services shall be protected throughout by approved supervised automatic sprinkler systems." The requirement for fire sprinkler installation protects the emergency services personnel occupying the facility and reduces the risk of disrupting the provision of emergency services to the community because of a fire. While not required by the code for existing buildings, Dynamix Consulting Group recommends the Town consider installing fire sprinkler systems in all existing fire stations for the safety of the firefighters who occupy the stations and to demonstrate to the community the importance of automatic fire sprinkler systems.

Access Control

Fire stations were historically places where residents and visitors from the community accessed any part of a fire station with very few limitations. Unfortunately, the current social environment requires emergency service providers to implement specific security measures limiting and controlling access to fire rescue facilities. The need to protect firefighters drives the control of limited access, installation of expensive equipment, and protection of sensitive data from access by individuals desiring to harm the community. Presently, fire station access in Lebanon is by keys or key codes. This is unreliable for securing buildings, as members can copy keys or share access codes. The Town should consider installing electronic access control systems that monitor who enters and exits the buildings and allow the Town to turn off access to individuals as needed in all facilities.

Cancer Prevention Engineering

Firefighting is an occupation with higher rates and varieties of cancer than many other occupations. Regrettably, exposure to cancer-causing agents (carcinogens) does not end with fire extinguishment. Exposure for firefighters continues when returning to the fire station until gear, equipment, and the firefighters themselves become "clean" of the carcinogens from the smoke and other products of the fire through decontamination efforts. Until this time, the risk of continued cross-contamination remains for the firefighters.

Within the Lebanon Fire-EMS Department, there are cancer prevention policies in place. Firefighters have received training protocols for both cancer prevention and decontamination. To limit or reduce firefighter exposure to toxic products of combustion that occur *after the fire*, firefighters must store turnout gear in well-ventilated rooms to prevent additional firefighter exposure to off-gassing chemicals absorbed into turnout gear during a fire. To that end, the Town should protect firefighters from cancer, including pressurizing corridors to help keep contaminates out of designated clean areas, private showers, and a second set of turnout gear or access to a second set for all firefighters.

Back in Bays

Both fire stations have "back-in bays." The lack of drive-throughs at these facilities constitutes a safety concern, as many firefighter injuries and accidents occur when backing emergency vehicles into the bays. Dynamix Consulting Group notes that all stations use "back in" procedures; however, drive-through bays are the recommended configuration. For all future buildings that will house apparatus, the Town should consider a design that allows for drive-through bays that are large enough to accommodate all frontline and reserve apparatus.

Conclusion

The Dynamix Consulting Group project team began collecting information for the Lebanon Fire-EMS Department Fire Station Location Evaluation in July 2023. The team members recognize this report contains a large amount of information, and Dynamix Consulting Group would like to thank the Board of Selectmen and Fire Chief for their efforts in bringing this project to fruition.

It is Dynamix Consulting Group's sincere hope the information contained in this report is used to its fullest extent and that its implementation will improve the emergency services provided to the citizens of Lebanon.

DYNAMIX
CONSULTING GROUP

Dynamix Consulting Group

PO Box 68 Lake Alfred, FL 33850

Mary-Ellen Harper

860.729.8247 | Mary-Ellen@DynamixConsultingGroup.com

Stuart McCutcheon

863.662.1474 | Stuart@DynamixConsultingGroup.com