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# Signal Mountain Fire Department



## Fire Department Management Study

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Municipal Technical Advisory Service  
INSTITUTE for PUBLIC SERVICE

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## Introduction and Scope of Work

The staff of the University of Tennessee Municipal Technical Advisory Service (UT MTAS) strives daily to meet its consensus mission. As an agency of the University of Tennessee and in collaboration with the Tennessee Municipal League, MTAS leverages the university's resources to improve the lives of the people of Tennessee with technical consulting, research and training for municipal governments. This study worked toward UT MTAS's mission. It was conducted at the request of Honna Rogers, University of Tennessee MTAS Management Consultant, at the town's request to study the town overall. On May 31, 2022, Interim Town Manager James Smith, Councilmember Elizabeth Baker, Fire Chief Eric Mitchell, Police Chief Mike Williams, and I met to review expectations for the study and conduct stakeholder interviews. I further met virtually with Mayor Charles Poss on June 16, 2022. Based on the outcomes of these interviews, it was concluded that the purpose of this study is to evaluate the overall management of the fire department and the adequacy and deployment of current fire station locations, fire apparatus staffing, and fire apparatus deployment.

The University of Tennessee Municipal Technical Advisory Service (UT MTAS) will provide the final version of this report to the Town of Signal Mountain, Tennessee, in an electronic format.

## Background

The Town of Signal Mountain, Tennessee, is geographically located in southwestern Hamilton County, Tennessee, atop the south end of Walden Ridge, which is part of the Appalachian Mountains. Signal Mountain geographically encompasses approximately 8.5-square miles, all located in the Chattanooga Metropolitan Statistical Area. Signal Mountain is situated directly adjacent to Chattanooga, Tennessee, to the south, and 108 miles from the capital of Tennessee. Signal Mountain has convenient access to almost unlimited travel and shipping options to support residents' work and play. The waterways and mountains provide ample opportunities for water activities, hiking, camping, and other recreational activities.

A Mayor-Council form of government governs the town. The five-member town council includes a Mayor, Vice-Mayor, and three council members. Councilmembers are elected at large, representing the town, and serving a designated term.

The town's elected officials and leadership team have made good decisions in providing public safety fire services in the community. The extensive growth and development in the community will require continued resolve, future thinking, and bold leadership to provide for the safety of the public and their property.

## Stakeholder Interviews

Stakeholder interviews were conducted to learn not only the tangible but some intangible qualities and attributes of the Signal Mountain Fire Department. Interviews were conducted with Town Councilmember Elizabeth Baker, then Interim Town Manager James Smith, Police Chief Mike Williams, Signal Mountain Fire Department Captain/Training Officer Sam Guin, and Fire Chief Eric Mitchell on May 31, 2022, and Mayor Charles Poss virtually via Zoom on June 16, 2022.

One common theme of the stakeholder interviews is that the fire department members serve the town's residents and visitors well. The questions posed to the stakeholders were:

1. What are your expectations of the Signal Mountain Fire Department study?
  - a. Analyze staffing numbers for a town our size.
  - b. Analyze the rank structure of the department.
  - c. Analyze the number of fire stations needed.
  - d. Review fire apparatus needs.
  - e. Analyze fire staff credentials.
  - f. Review fire department strategic plan.
  - g. Results validate the current administration and operations.
2. What is your overall perception of the Signal Mountain Fire Department?
  - The overarching theme of the responses was that the town has a very dedicated staff of firefighters but there is a concern that there may be too many high-ranking officials and a larger number of firefighters than compared to other towns.
3. What is the organizational environment like at the Signal Mountain Fire Department?
  - The overarching theme of the responses was that the town has very team-oriented fire department members that stick together but there may be some trust issues between the fire staff and elected officials and vice versa.
4. Do you feel the Signal Mountain Fire Department is led well?
  - The overarching theme of the responses was that yes, the department is led well but that the leadership should proactively work on internal and external relationships.
5. Does the leadership of the Signal Mountain Fire Department demonstrate a culture of collaboration?
  - The overarching theme of the responses was yes, that the members of the department work with and collaborates well with other town departments.

6. Does the leadership of the Signal Mountain Fire Department demonstrate a culture that welcomes diversity and inclusion?
  - The overarching theme of the responses was yes, that the department does demonstrate an inclusive culture but that the town itself does not have a very diverse population.
7. Do you feel the staff is equipped with the knowledge, skills, and abilities required to provide excellent performance and service to the community's residents?
  - The overarching theme of the responses was that the members of the fire department are well trained and have excellent abilities.
8. In your opinion, what are the strengths of the Signal Mountain Fire Department?
  - The overarching theme of the responses was that the department's strength lies with its dedicated staff.
9. In your opinion, what are some opportunities for improvement at the Signal Mountain Fire Department?
  - The overarching theme of the responses was that the department should focus on leadership develop and soft skills training.
10. Closing comments not covered otherwise communicated:
  - The overarching theme of the responses was that everyone we interviewed said they appreciated UT MTAS for doing the study and looked forward to the outcomes.

Summarizing, especially the expectations of the study, we will attempt to analyze at minimum the areas of focus outlined and make any needed recommendations for each. The answers to questions 2-10 are designed to get specific information but, none of the input is measured quantitatively.

## Town Governance

The Town of Signal Mountain is governed by its elected officials. The elected officials set the strategic direction and priorities of the town. The professional staff is charged with the implementation and outcomes of the priorities established. Since public entities officially communicate with their team and residents through the codes, ordinances, resolutions, laws, and policies adopted and passed, a review of the Signal Mountain municipal code was conducted focusing primarily on Title 7: Fire Protection and Fireworks. The Signal Mountain municipal code posted on the municipality's site appears to have been updated in June 2021.

Title 7 of the municipal code focuses on the town's fire protection and fireworks. Chapter 1 establishes the fire code adopted by the town as the International Code Council International Fire Code, 2018 Edition as the fire code enforced throughout the town. Chapter 2 outlines the

open burning requirements of the town. Chapter 3 establishes the National Fire Protection Association Life Safety Code, 1985 Edition, as a second code to regulate and govern conditions in the town. The municipal code does not address many aspects of the fire department in the town.

## Governance Recommendations

1. The town currently has adopted the National Fire Protection Association Life Safety Code, 1985 Edition. The town should consider the adoption at a minimum of the National Fire Protection Life Safety Code, 2018 or 2021 Edition, to more closely match the International Code Council International Fire Code adopted.
2. The town should consider a review and revision of the town's municipal code, specifically Title 7 relating to the fire service. Title 7 should address several items missing that would give the fire department leadership a clear direction of the goals and strategies of the town. *(The town is in the process of code updates as of this study)*
  - a. Establishment of the Fire Department
  - b. Establish the fire code adopted
  - c. Communicate whom the fire chief answers to, who appoints, who terminates, etc.
  - d. Establish who hires, appoints, and can terminate the fire chief
    - i. Town manager?
    - ii. Mayor?
    - iii. City Council?
  - e. Duties of the fire chief
    - i. Organize and lead the fire department.
    - ii. Plan and administer the annual budget.
    - iii. Identify risks in the community and provide mitigation strategies for the elected officials to consider.
    - iv. Maintain discipline-set expectations and maintain accountability.
    - v. Set the training priorities for the department.
    - vi. Recommend fire code to be adopted and degree of code enforcement.
    - vii. Investigate the cause and origin of all fires in the community and complete appropriate reports to the local, state, and federal levels.
    - viii. Other requirements as approved in the fire chief's job description.
  - f. Objectives of the Fire Department
    - i. To prevent uncontrolled fire from starting.
    - ii. To prevent the loss of life and property because of fires.
    - iii. To confine fires to the place of origin.
    - iv. To extinguish uncontrolled fires.
    - v. To provide emergency medical care at the highest level that the equipment and training of the personnel make practical.
    - vi. To perform such rescue work as the department equipment and the training of the personnel makes practical.



- vii. To provide code enforcement and building inspections as directed by the city within adopted codes and ordinances.
- viii. To serve as the emergency management agency of the town.
  - ix. To protect the health and safety of the residents from transportation, storage, and manufacture of hazardous materials to the extent possible that the level of equipment and training will allow.
  - x. To work with the water purveyor(s) to ensure adequate water supplies for fire protection is available.
  - xi. To provide public fire and life safety education materials and information to the residents so that they may protect themselves from harm, and o reduce the risk of fire and other hazards in the community.
- g. Other department provisions
  - i. Automatic aid provided and received.
  - ii. Mutual aid provided and received.
  - iii. Emergency Management Association Compact (EMAC) Mission Ready Packages (MRP).
  - iv. Contracts.

## Public Safety-Fire Department

The public safety services the fire department provides through fire staffing, the specialized equipment used, and government facilities are all local policy issues. The town's elected officials balance available local resources against what they determine to be acceptable community risks. The Town of Signal Mountain provides all-hazards public safety fire services to approximately 8,852 people, based on the 2020 United States Census, through a municipal fire department that is led by the fire chief and operate under Title 7 of the town's municipal code. The Town of Signal Mountain has an array of employment opportunities. The most common occupations are in education services, healthcare and social assistance, professional/scientific/technical services, finance and insurance, and manufacturing.

The Signal Mountain Fire Department has a rich history of community service. The department was established in 1919 and continues to protect the town's residents, visitors and their property from emergencies and disasters through fire suppression, emergency medical services, hazardous materials mitigation, and community risk reduction through fire prevention and public education programing.

Under the leadership of Chief Eric Mitchell and the department's senior staff, the Signal Mountain Fire Department has evolved into a 29-member career all-hazards fire department with a 100% paid professional staff recognized by the State of Tennessee. The fire department is funded by general fund allocations of the Town of Signal Mountain. The town maintains an Insurance Service Office Public Protection Rating of 2. The 29 members are assigned with twenty-seven members in operations and two members in command/support roles. In addition to professional staff, the department maintains a fleet of front-line and reserve fire apparatus/vehicles. These apparatus/vehicles are deployed from the town's two fire stations.

Station 1 includes a fire and police headquarters facility, and station 2 is a traditional fire station, located strategically within the town's approximately 8.5-square mile corporate limits. Figure 1 is a graphic depiction of the geographic limits town boundaries with fire stations plotted on the map. The Signal Mountain Fire Department responded to 942 emergency calls for service in 2021 based on the Tennessee Fire Incident Reporting System (TFIRS). The department has a fire company staffing policy that specifies that an officer, engineer, and firefighter are routinely assigned to staffing each apparatus on each date. The department also has a minimum staffing policy that allows one apparatus to be staffed with only two firefighters.

In the present and future, the town's and fire department's leaders are committed to relying on their history of forward thinking and strategically planning to reduce community risks. Providing public safety fire services through an all-hazards fire department is very complex. As the department continues to evolve, leaders must continue to be open-minded and use their resources wisely to provide these services.



*Figure 1-Signal Mountain Fire Station Locations 2022*

## **Fire Department Governance**

The fire department is like other professional, progressive organizations; there must be good governance. The department should have a modern up-to-date strategic plan, policy manual, job descriptions, medical treatment protocols, etc. As a part of the department's strategic plan created its organizational values. These values are the guiding principles of the team. Members must be accountable to self and others and be self-disciplined to live up to the expectations outlined. The following are the organizational values of the department.

### **PERSONAL INTEGRITY**

- We are loyal to the town
- We act in the best interest of citizens
- We behave in an ethical and legal manner
- We are open and honest
- We are reliable, dependable, and follow through on commitments

### **RESPONSIBILITY**

- We anticipate issues, problems, and opportunities
- We take initiative
- We act to prevent and solve problems
- We take responsibility for the outcome of our actions and decisions
- We hold ourselves and others accountable

### **RESPECT**

- We treat others in a fair, courteous, compassionate, and equitable manner
- We actively listen and seek understanding
- We provide a direct response
- We are open-minded, predictable, positive, and cooperative.

### **TEAMWORK**

- We know and respect our roles and responsibilities
- We define and agree upon goals
- We collaborate to achieve organizational goals
- We help others accomplish their goals
- We share authority, commitment, and credit

### **RESULTS**

- We take pride in our work.
- We complete assignments and projects on time and within budget
- We evaluate outcomes and seek feedback on our performance
- We are progressive
- We are innovative

## Fire Department Governance Recommendations

The department reports that it has up-to-date documents such as its strategic plan, job descriptions, emergency medical protocols, and departmental policies. This is all very good. The department must ensure that these documents are reviewed and revised annually. I would even recommend that members are tested on their recollection and understanding of each of these documents annually, with these scores documented in their training files. When the department operates under a values-based system following the department's organizational values as their compass, it is essential that everyone understand the values and the supervisors must ensure everyone is engaging and meeting expectations from the top down.

## Fire Department Staffing

The Signal Mountain Fire Department has a fire apparatus staffing policy that appears to be routinely followed, making it also the department's practice. The staffing policy assigns three trained and equipped fire members, consisting of an officer, an engineer, and a firefighter, to staff each apparatus. However, Signal Mountain also has a minimum shift staffing policy and practice of running with 8-firefighters each shift which allows one fire crew to be drawn down to a staffing level of 2. Career fire departments should use the latest edition of the National Fire Protection Association (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 consensus standard as a model planning tool for fire apparatus staffing needs. Figure 2 and Figure 3 identify the staffing standard for engine, ladder, and quint companies.

**5.2.3 Operating Units.** Fire company staffing requirements shall be based on minimum levels necessary for safe, effective, and efficient emergency operations.

**5.2.3.1** Fire companies whose primary functions are to pump and deliver water and perform basic fire fighting at fires, including search and rescue, shall be known as engine companies.

**5.2.3.1.1** These companies shall be staffed with a minimum of four on-duty members.

**5.2.3.1.2** In jurisdictions with a high number of incidents or geographical restrictions, as identified by the AHJ, these companies shall be staffed with a minimum of five on-duty members.

**5.2.3.1.2.1** In jurisdictions with tactical hazards, high-hazard occupancies, or dense urban areas, as identified by the AHJ, these fire companies shall be staffed with a minimum of six on-duty members.

*Figure 2-NFPA 1710 Engine Company Staffing Standard*

**5.2.3.2** Fire companies whose primary functions are to perform the variety of services associated with truck work, such as forcible entry, ventilation, search and rescue, aerial operations for water delivery and rescue, utility control, illumination, overhaul, and salvage work, shall be known as ladder or truck companies.

**5.2.3.2.1** These fire companies shall be staffed with a minimum of four on-duty members.

**5.2.3.2.2** In jurisdictions with a high number of incidents or geographical restrictions, as identified by the AHJ, these fire companies shall be staffed with a minimum of five on-duty members.

**5.2.3.2.2.1** In jurisdictions with tactical hazards, high-hazard occupancies, or dense urban areas, as identified by the AHJ, these fire companies shall be staffed with a minimum of six on-duty members.

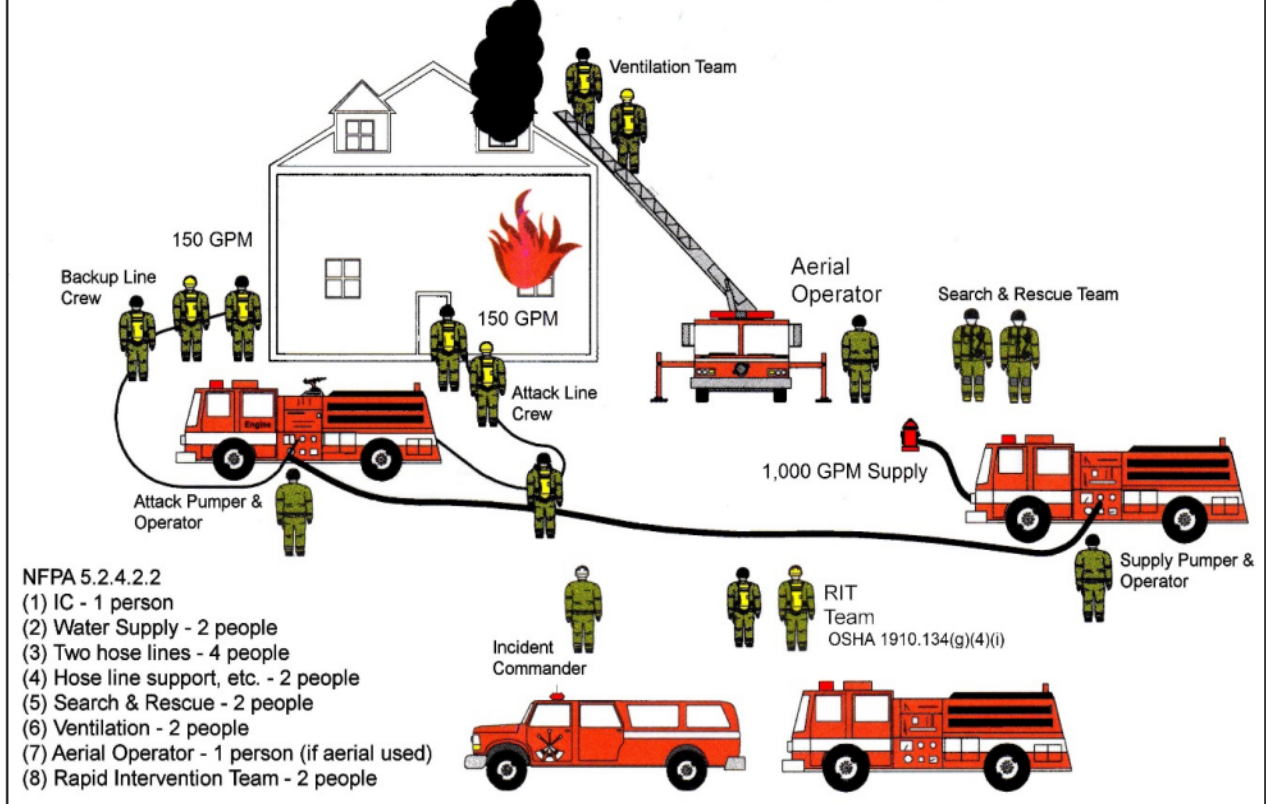
**5.2.3.4.1** A fire company that deploys with quint apparatus, designed to operate as either an engine company or a ladder company, shall be staffed as specified in 5.2.3.

**5.2.3.4.2** If the company is expected to perform multiple roles simultaneously, additional staffing, above the levels specified in 5.2.3, shall be provided to ensure that those operations can be performed as required.

*Figure 3-NFPA 1710 Ladder and Quint Company Staffing Standard*

NFPA clearly identifies a minimum staffing of 4-6 or even more fire crew staffing based on the level and complexity of the hazards identified in the community. If the town considered moving its staffing model from three per apparatus to four per apparatus, the department would need to increase staffing from nine firefighters per shift to twelve firefighters per shift.

# Initial Alarm Deployment of Firefighting Personnel



*Figure 4-NFPA1710 First Alarm Assignment to Residential Structure Fire*

Figure 4 is a visual representation of a first alarm assignment to a 2,000 square foot residential structure fire that has been critically tasked by National Fire Protection Association (NFPA) that demonstrates a need for 16-firefighters responding on the first alarm. For every person less than sixteen assigned to the incident, the firefighters assigned must be responsible for multiple roles. This can be problematic due to safety concerns associated with complex incidents.

• Incident Commander	1
• Apparatus Water Supply	2
• Rapid Intervention Crew	2
• Primary Hose Line-Attack	2
• Secondary Hose Line-Safety	2
• Hose Line Support	2
• Search and Rescue	2
• Ventilation Crew	2
• <u>Aerial Apparatus Operator</u>	<u>1</u>
<b>Total</b>	<b>16-firefighters assigned</b>

## Organizational Structure

The fire chief reports that the current organizational structure is working for the department. Figure 5, a section of NFPA 1710 does not address the number of chiefs, chief officers, captains, lieutenants, etc., that are required. It does address that each apparatus has a trained and competent supervisor.

**5.2.2.2.1 \***  
The fire department shall identify minimum company staffing levels as necessary to meet the deployment criteria required in 5.2.4 to ensure that a sufficient number of members are assigned, on duty, and available to safely and effectively respond with each company.

**5.2.2.2.2**  
Each company shall be led by an officer who shall be considered a part of the company.

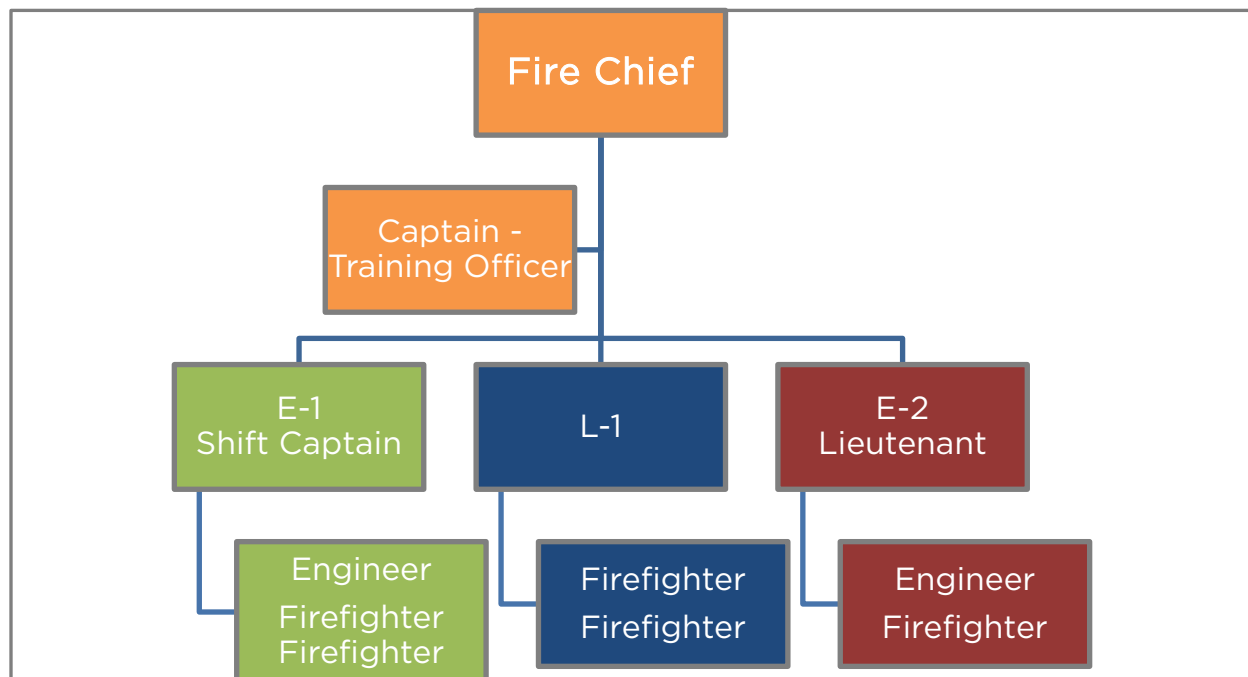
**5.2.2.2.3 \***  
Supervisory chief officers shall be dispatched or notified to respond to all full alarm assignments.

**5.2.2.2.4**  
The supervisory chief officer shall ensure that the incident management system is established as required in Section 6.2.

**5.2.2.2.5 \***  
Supervisory chief officers shall have staff aides deployed to them for purposes of incident management and accountability at emergency incidents.

*Figure 5-NFPA 1710 Requirement for Fire Company Officer*

Figure 6 is a graphic of the current organizational chart as understood by the MTAS consultant. The staff consists of one fire chief, one captain-training officer, 3-shift captains, 3-lieutenants, 12-firefighters, and an administrative professional.



*Figure 6-Signal Mountain Fire Department Organizational Chart 9-Per Shift*

## Staffing Comparison

The town requested MTAS to compare Signal Mountain Fire Department staffing to other municipal fire departments serving municipalities of similar size in population and land mass as Signal Mountain. The municipalities noted in Table 1 is not an exhaustive list of municipalities across the state but does serve as a good cross section of municipalities for comparison. The one thing that could not be replicated is Signal Mountain’s unique geographic layout whereas most of the town is located along the top of a ridge of mountains. This alone creates some unique challenges for the Signal Mountain Fire Department to overcome while serving.

As stated earlier in this report, the elected officials must balance the revenue available to the municipality and balance that with what is defined as the acceptable risk in the community. The property owners of Signal Mountain enjoy an ISO Class 2 so insurance premiums would be expected to be lower than communities with a higher ISO classification. Of the departments listed in the comparison with an ISO 2 or better classification, there is only one department with less employees.

City	TN Grand Division	Population	Type Fire Department	Fire Stations	Full-Time Employees	ISO Classification
Alcoa	East	10,978	Combination	3	30	1
Fairview	Middle	9,357	Combination	2	14	5
Jefferson City	East	8,419	Combination	1	35	2
Lexington	West	7,957	Combination	2	16	2
Milan	West	8,171	Combination		22	5
Rockwood	East	5,444	Combination	1	15	4
Signal Mountain	East	8,852	Career	2	29	2

*Table 1-Signal Mountain Compared to other Municipalities*

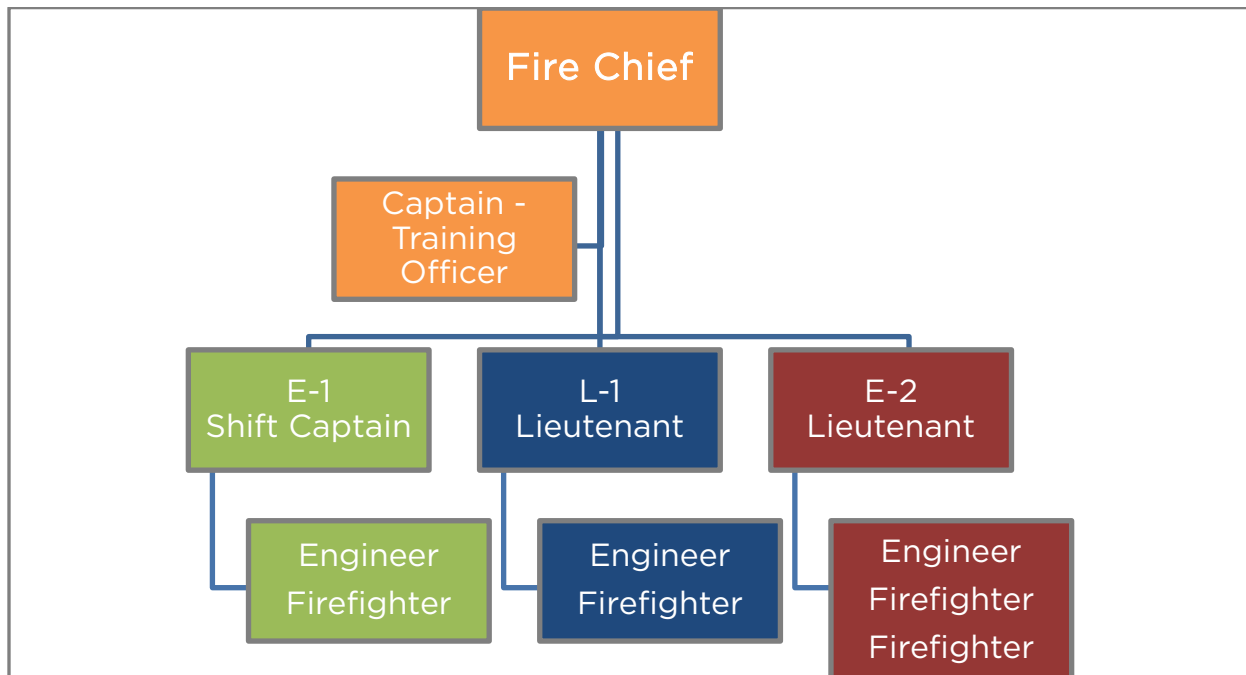
## Staffing Recommendations

NFPA 1710 identifies the need for a minimum of 4-firefighters including an officer, an engineer, and two firefighters assigned to each pumper apparatus and a minimum of 4 or more firefighters assigned to a quint apparatus due to its dual role of engine and ladder duties. NFPA 1710 has critically tasked and further identifies the need for sixteen firefighters to respond to a residential structure fire. The town currently has 3-firefighters, including an officer, engineer, and a firefighter, assigned to each engine apparatus but will allow one apparatus to fall below this assignment to 2-firefighters. This can bring the shift staffing on any given day down to 8-firefighters; half of what the NFPA standard identifies is needed.

- The town should consider additional fire suppression staff to work toward having a minimum of 3-4 fire staff consisting of an officer, engineer, and firefighter assigned to each apparatus.



- Figure 7 is an example of an incremental improvement due to adding an officer to L1 and with E1 and L1 responding together, they can meet two-in/two-out 29CFR1910.134 regulations. E2 working as a single company cannot meet 2-in/2-out until E1 or L1 can arrive to back them up.
- As the town continues to grow, the town should consider incrementally raising the minimum staffing of each apparatus up to at least 4-firefighters per apparatus per shift.
- Build relationships and automatic aid agreements to augment the town’s first alarm assignment with the intent of having a minimum of 16-firefighters on scene.
- Continue to ensure each staff member is qualified and competent in the role they serve.



*Figure 7-SMFD Organizational Chart 10-Per Shift*

## Staff Training

The National Fire Protection Association and the Insurance Service Office both outline training standards for initial firefighter training as well as annual refresher training for members of the fire service. Some of the basic training standards associated with firefighter preparedness and competency are:

- Recruit Firefighter: 240-Hour Program
- Firefighter: 204-Hours (196-hours company/ 18-hours drills -training facility)
- New Driver/Engineer: 60-Hour Program
- Existing Driver: 12-Hour Program Annually
- New Officer: 40-Hours and Fire Officer I Certification
- Existing Officer: 12-Hour Program Annually with current certification

A part of firefighter training firefighters should preplan facilities in the community. Firefighters should conduct pre-planning surveys at all industrial, commercial, and residential (more than 4-residences) annually. Firefighters that do not physically visit the site should review and train on the plans conducted by others.

A review of the department’s training and certifications data for each fire staff member indicates that the members of the department are mostly meeting or in many cases exceeding the required training and certification required by these consensus standards.

Refer to Table 2 to reference the number of staff that has earned each certification level listed:

Firefighter II	29
Driver/Engineer	16
Aerial Apparatus Operator	16
Fire Instructor I	14
Fire Officer I	11
Fire Officer II	9
Fire Officer III	1
Fire Officer IV	0
Incident Safety Officer (IFSAC/ProBoard)	4
Fire Inspector	2
Fire Investigator	2

*Table 2-Tabulation of Certifications Earned*

### **Staff Training Recommendations**

The training needs of firefighters must be of paramount concern for every fire chief. Ultimately, the training strategy and priorities must reflect the fire chief’s expectations for the staff. If the fire chief is satisfied with low training standards, then the firefighters will only be very minimally trained. If the fire chief has high standards and expectations, then the firefighters will be trained to a higher standard. Higher training standards have positive effects on both internal and external customer safety.

It appears that Signal Mountain firefighters are somewhat trained, and state certified to serve in their roles. However, they do not meet all the benchmark requirements of NFPA/ISO in the areas of annual firefighter company training, annual firefighter company drills at a training facility, and new engineer training. The department did not report number of hours of training for officers, but each has earned at minimum a fire officer level I certification by the State of Tennessee. These categories were self-reported at much lower rates than the NFPA/ISO requirements.

Refer to Table 3 for a comparison of training and certifications required by ISO versus those training hours self-reported as being completed. The items in red are deficiencies that should be corrected.

Status	Required Training	Training Completed	Certified at Level	Meets Standards
Recruit Firefighter	240-Hours	400-Hours	Firefighter II	Yes
Firefighter	204-Hours (196-company/18-drills)	39.11-Company/12.59-Drill	Yes	No
New Engineer	60-Hours	9.25-Hours	Yes	No
Engineer	12-Hours	23.22-Hours	Yes	Yes
New Officer	40-Hours/Certification	Not Reported	Officer I	Yes
Officer	12-Hours/Certification	16.36-Hours	Officer I	Yes

*Table 3-Training/Certification Requirements Versus Completed*

- The department must consider setting higher standards for company training completed at each fire station. Reported completing 39.11-hours in 2021 of the required 196.0-hours indicates only approximately 20.0% completion rate.
- The department must consider setting higher standards for company drills completed at the training facility. Reported completing 12.59-hours in 2021 of the required 18.0-hours indicates only approximately 70.0% completion rate.
- The department must consider setting higher standards for new engineer training. Reported completing 9.25-hours in 2021 of the required 60.0-hours indicates only approximately 15.4% completion rate.
- Pre-Incident planning benchmark requirements has changed to 1-pre-planning inspection annually for required occupancies. The department more than met the required inspections on commercial by doing 151-commercial occupancies twice annually with 21-religious and educational being inspected once annually, and 12 or 24-multi-family being completed.
  - Recommend completing the additional 12 multi-family pre-plan inspections annually.
  - Recommend all staff train on pre-plans documents that they were not present for the inspection.

## Staff Medical / Behavioral Health Monitoring

Firefighters have responsibilities to the community that place them many times in complex, and dangerous roles to meet the needs of our residents and visitors. Our municipal firefighters are tasked with providing a vast array of public safety services to those in our community.

As such, the NFPA standard 1582 defines recommended physical medical examination components that should be checked annually by a healthcare provider. There are two additional Tennessee Code Annotated sections that require annual Behavioral Health programming and physical medical examination and cancer screenings for the six covered cancers. The department reports that each firefighter is required to complete a NFPA 1582 compliant physical medical examination annually. The town also provides an Employee Assistance Program for those employees and dependents that need these types of services.

## Medical / Behavioral Health Recommendations

Signal Mountain did not specifically call out any specific behavioral health training provided to firefighters, or the number of visits provided for free to the EAP. Tennessee Code Annotated 8-50-119 specifies the following in section C:

- Provide no less than 10 visits or sessions with a mental health provider for the purpose of treating PTSD.
- Promote the use of mental health service providers and other behavioral health professionals to public safety employees.
- Establish support programs in an effort to mitigate behavioral health issues within public safety employee community.
- Maintain and provide public safety employees at minimum once annually a list of mental health service providers who are qualified to provide trauma therapy under this section.
- Employers shall not engage in retaliatory treatment of public safety employees.
- At minimum, once annually a mental health service provider providing services to the public safety employees shall participate in training that familiarizes the provider with the unique problems associated with each public safety profession lifestyle, including, but not limited to, critical incident response training, critical incident stress management, field exercises such as crew ride-along and visits to fire stations, and similarly appropriate training.

## Fire Stations

The Town of Signal Mountain Fire Department responds to emergency and non-emergency calls for service from its two fire stations located within the geographic limits of the town. These facilities are considered critical infrastructure due to the services that are and can be provided to the residents and visitors to the community from each. It is imperative to

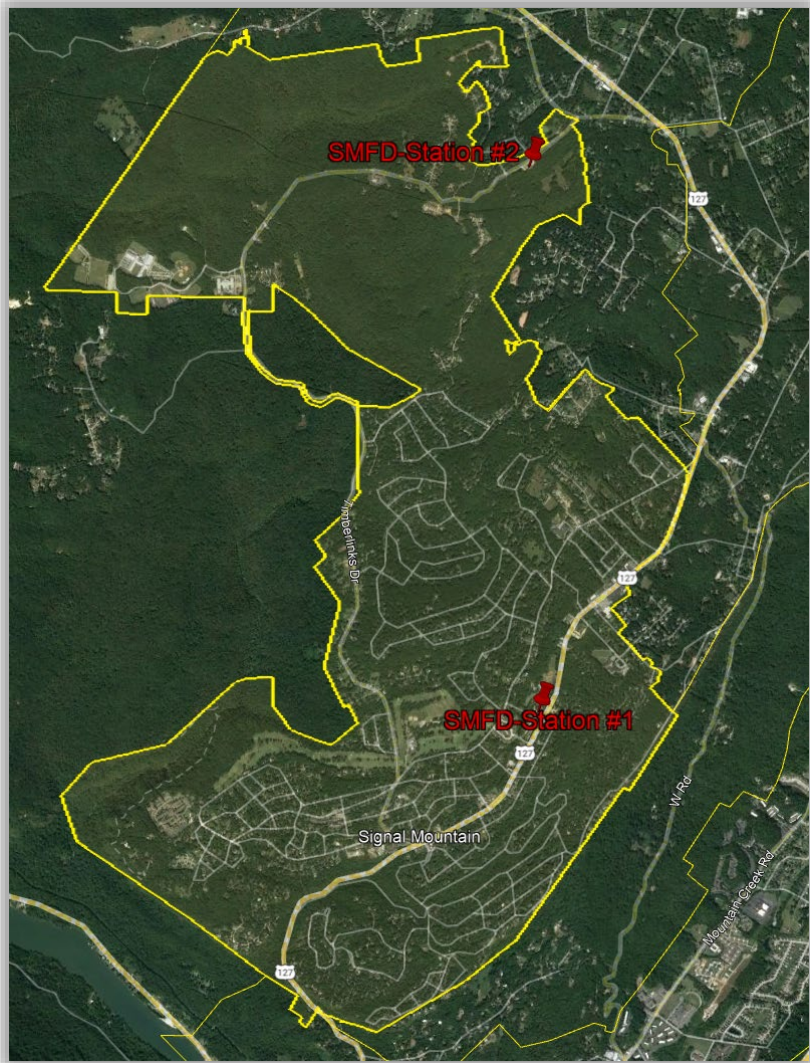
proactively plan fire station locations, fire apparatus deployment, and staffing strategies based on the needs of the specific areas of the town. One focus of this study is to evaluate the need for the town’s current fire stations in their current locations as well as identify if there are any current and/or anticipated future needs for additional fire facilities. Table 4 lists the current fire station locations with the current apparatus deployment strategy.

Signal Mountain Fire Department Stations and Apparatus		
Station	Equipment	Address
1	Chief; Captain-Training Officer; Engine 1; Ladder 1	1111 Ridgeway Avenue, Signal Mountain, Tennessee
2	Engine 2	5240 Shackelford Ridge Road, Signal Mountain, Tennessee

*Table 4-Signal Mountain Fire Department Stations and Apparatus August 2022*

A review of the location of both Signal Mountain fire stations indicated that the facilities appear to meet the needs of the firefighters and town. Station 1 is well maintained and was in the process of an exterior renovation upgrade when I visited for stake holder interviews. Station 2 is a newer facility and is well maintained. Please refer to Figure 8 for a visual reference of the fire station locations relevant to the geographic town limits. We will address the location of fire stations in a subsequent heading.

*Figure 8-Signal Mountain Current Fire Station Locations*



A fire facility cannot be considered a fire station unless there is a fire apparatus assigned to it that can be credited as a pumper apparatus. In the case of station 1 and station 2 both have a pumper apparatus assigned meeting the definition and intent of a fire station.

## Fire Apparatus

Currently, Signal Mountain Fire Department maintains a fleet of three front line fire apparatus; two-engines, one-ladder (quint), and a squad with additional support vehicles including command vehicles and rescue vehicles. The scope of this study did not comprehensively analyze the adequacy of each apparatus but only took into consideration the years since manufactured or refurbishment and deployment by type apparatus. A more comprehensive fire apparatus study can be completed as a separate UT MTAS project. This type of project would study apparatus equipment inventory, equipment maintenance and testing, hose and pump testing, ladder testing, and vehicle inspection records. A cursory review of apparatus inventory forms indicates that each of the fire apparatus are well-equipped and well-maintained. Any apparatus identified as needing additional testing or maintenance should be completed per a schedule and if an apparatus is identified to be replaced, the investment should be added to a capital equipment replacement plan.

When analyzing fire apparatus for its useable lifespan, one must look to consensus standards with which to base our findings. The National Fire Protection Association (NFPA) 1901: Standard for Automotive Fire Apparatus, 2016 Edition, is the model consensus standard used for fire apparatus. NFPA 1901, in Appendix D, identifies 15-years as the useable lifespan for a frontline fire apparatus, 10- additional years (25-years) for reserve service, and when an apparatus reaches more than 25-years of age, it should be retired. Figure 6 is an excerpt from NFPA 1901 Appendix D. This standard should be used as a guide with the understanding that if the safety or adequacy of a fire apparatus comes into question, this standard will most likely be used as the guide.

NFPA 1901 Annex D states: It is recommended that apparatus more than 15 years old that have been properly maintained and that are still in serviceable condition be placed in reserve status, be upgraded in accordance with NFPA 1912, and incorporate as many features as possible of the current fire apparatus standard (see Section D.3). This will ensure that, while the apparatus might not totally comply with the current editions of the automotive fire apparatus standards, many of the improvements and upgrades required by the current editions of the standards are available for the firefighters who use the apparatus.

Apparatus that was not manufactured to the applicable NFPA fire apparatus standards or that are over 25 years old should be replaced

*Figure 9-NFPA 1710 Annex D-Fire Apparatus Lifespan*

When we analyze Signal Mountain Fire Department’s fire apparatus fleet against the NFPA 1910 standard, apparatus should be categorized as frontline, reserve, or retired. Signal Mountain’s fleet of fire apparatus are within the NFPA 1901 standard. In Table 5, apparatus highlighted in green meet the standard, apparatus highlighted in yellow are approaching their lifespan at their current status, and red have exceeded their lifespan in their current status. Apparatus that has exceeded their lifespan in their current status should progress to the next status in the following order: frontline service, reserve service, retired-out of service.

Designation	Type	Aerial	Pump Capacity	Make	Year	Age	Status
Engine 1	Engine	No	1,500	Pierce	2018	4	Frontline
Ladder 1	Ladder	75	1,500	Pierce	2015	7	Frontline
Engine 2	Engine	No	1,500	Rosenbauer	2012	10	Frontline
Squad 1	Squad	No	No	Ford	2017	5	Frontline
Engine 3	Engine	No	1,500	Quality	1993	29	Reserve
Quint 1	Quint	75	1,500	KME	1995	27	Reserve

*Table 5-Signal Mountain Apparatus Inventory-NFPA 1901 Evaluation*

It is noted, in Table 5, that Signal Mountain’s frontline apparatus are well within their NFPA 1901 15-year frontline service lifespan. The town has provided well-maintained modern apparatus for the firefighters. Newer more modern apparatuses are associated with having

many additional personnel safety characteristics as well as better technology for firefighters to use.

## **Fire Apparatus Recommendations**

Signal Mountain has done well addressing the needs of frontline fire apparatus. Having a modern fleet does somewhat take the pressure off your reserve fleet. The reserve fleet is usually routinely called into service when a frontline apparatus is out of service for maintenance or repair. Another important role that the reserve apparatus usually play is when additional firefighters are called to duty for an event that requires more than the current on-duty staff. With two fire stations and four fire apparatus, this occurs regularly to cover the town while on-duty crews are working an incident.

- Consideration should be given to replacing reserve Engine 3 with a newer apparatus to get it within the 25-year lifespan of a reserve apparatus. The town may consider utilizing the current front-line Engine 2 for this assignment.
- Acquire a new quint or at minimum an engine-service company type apparatus to meet the mission and ladder coverage that will be needed for station 2's response area.
- Consideration should be given to replacing Quint 1 with a newer ladder apparatus to get it within its 25-year reserve lifespan.
- In both cases of reserve apparatuses, the department should evaluate both reserve apparatus and develop/implement specific policies and practices to operate these older apparatuses mitigating the unique challenges presented by serving on the mountain.

## **Insurance Service Office (ISO)**

The Insurance Service Office (ISO) is an insurance advisory organization that provides statistical and actuarial information to businesses like insurance companies. ISO focuses on property/casualty insurance, including both personal and commercial lines. Insurance companies can and usually do include ISO data into their rate metrics for a jurisdiction. ISO rates jurisdictions between a 1 (best) and 10 (worst) based on their ability to prevent and suppress structure fires. Signal Mountain's Insurance Services Office (ISO) Public Protection Classification (ISO rating) is currently a Class 2. The Class 2 ISO rating places Signal Mountain well within the top percentages of cities/towns nationwide (Figure 10) as well as within the top 1% of cities in Tennessee (Figure 11). In terms of fire protection, this indicates that the leadership of Signal Mountain Fire Department and the Town of Signal Mountain has made some excellent decisions in planning for community fire protection. Figure 10 and Figure 11 graphically depict Signal Mountain's ISO rating compared to other communities across the United States and Tennessee respectively.



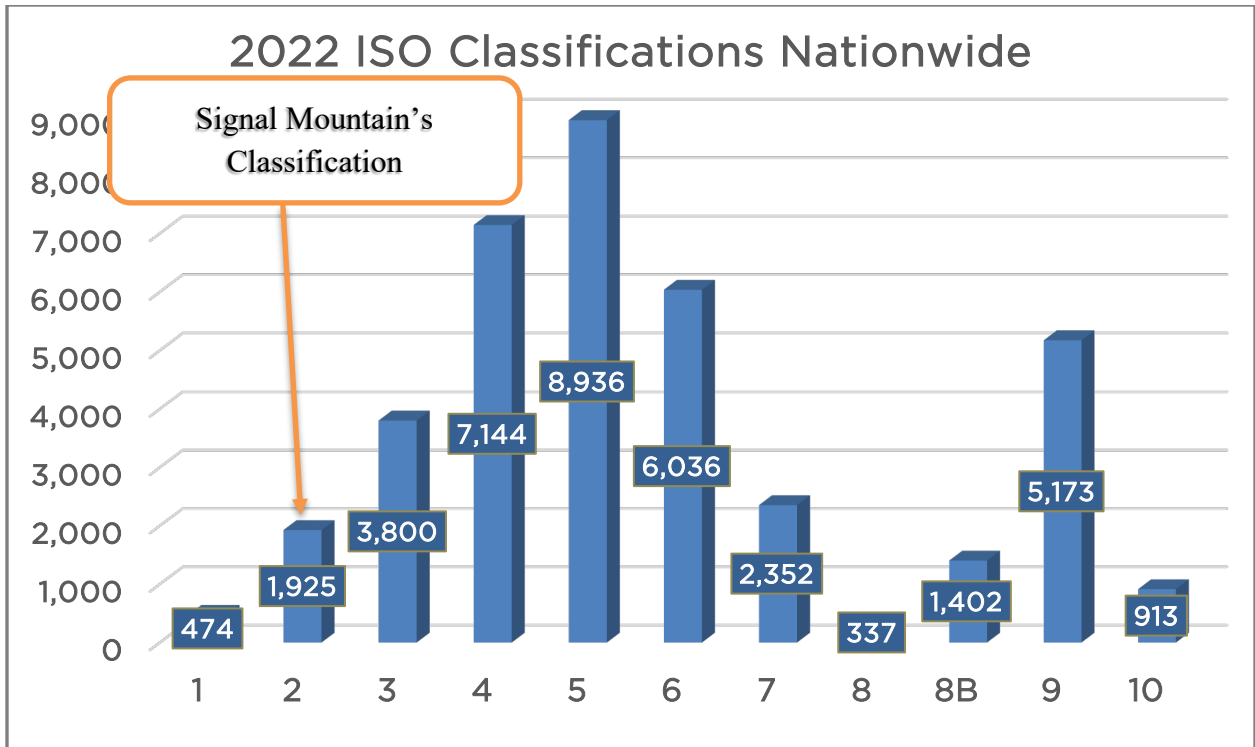


Figure 10-Public Protection Classification (ISO Rating) in the US

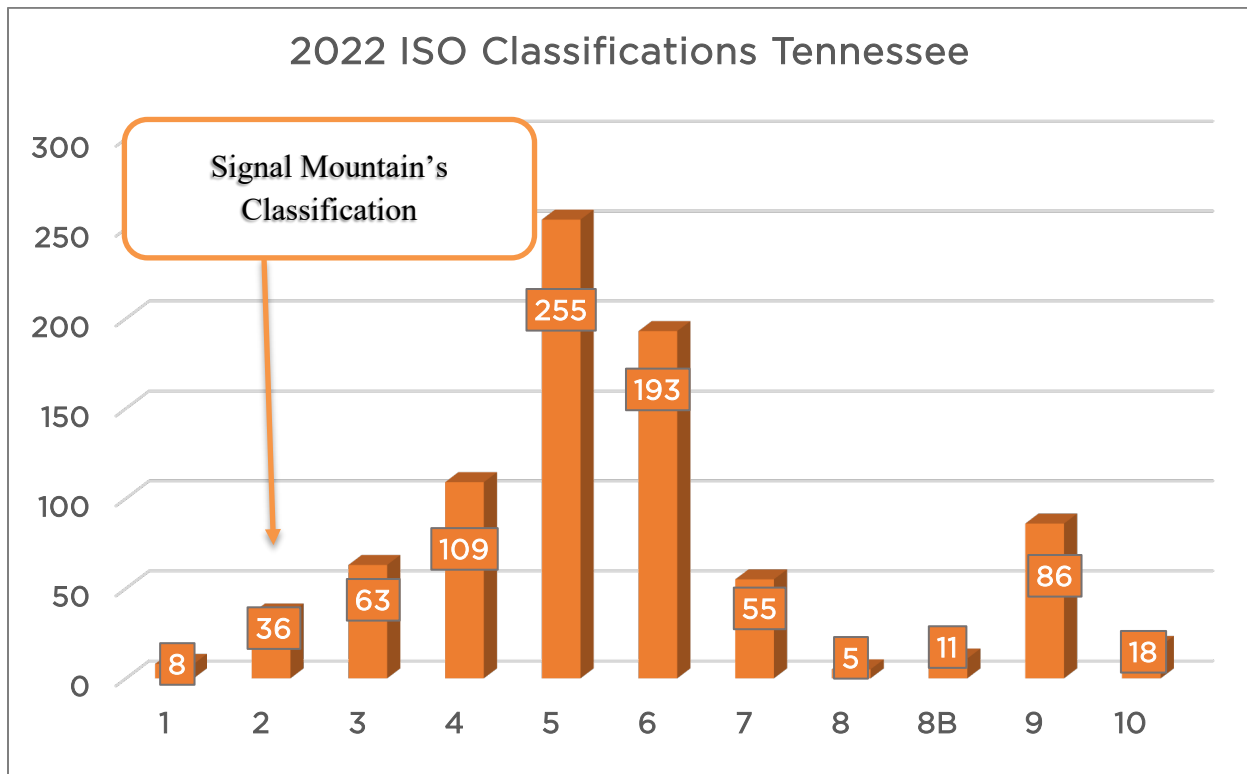


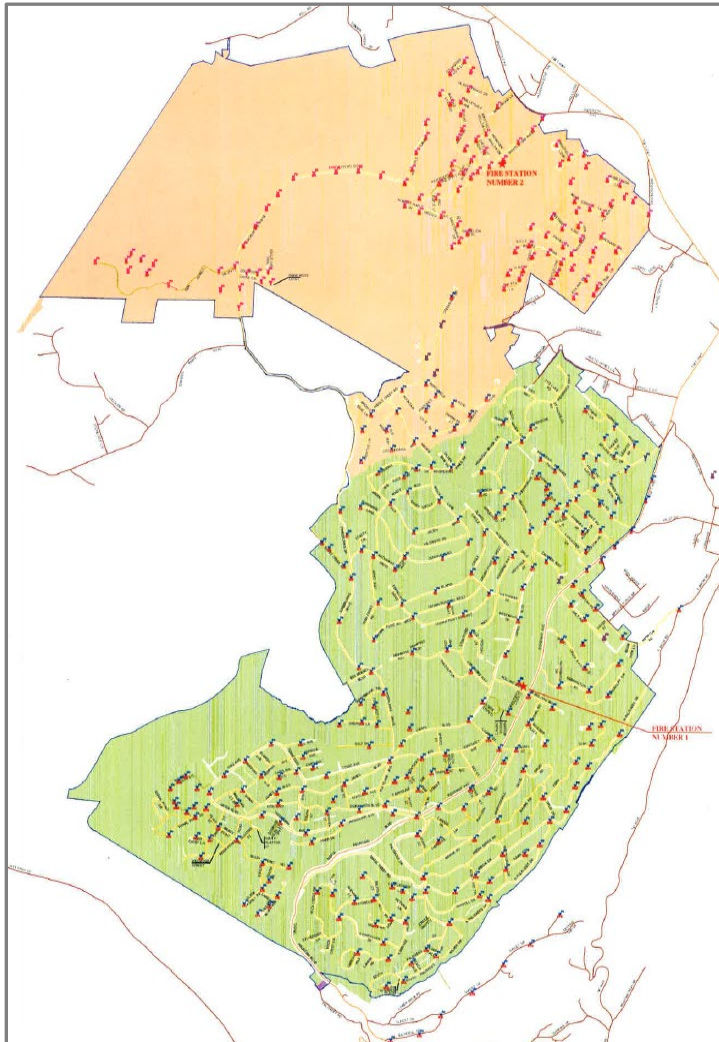
Figure 11-Public Protection Classification (ISO Rating) in Tennessee

The Signal Mountain Fire Department is an all-hazards fire department. What this means to the town is that members of the fire department are alerted and respond to all types of emergency incidents located geographically within Signal Mountain’s corporate town limits. The department also provides its services outside the corporate limits upon a request for mutual aid by another agency. What this further means to the community is that the members of the fire department are properly trained, equipped, and routinely respond to any emergency call for service the residents and visitors have. The scope and complexity of these incident responses can range from one person experiencing a medical emergency, to a plane crash on approach to the Chattanooga airport, to a mass casualty incident at one of your large retail occupancies.

## Utility Services

Utility services are provided to the residents of the town by several different providers. Water services are provided by Signal Mountain Water Department, Natural Gas services provided

by Chattanooga Gas, Sewer services provided by Hamilton County Waste Water Treatment Authority, and Broadband internet is provided by AT&T, EPB Fiber Optics, and Comcast.



Each of these utilities can play a major role in the public safety and livability of the town especially during a disaster response or recovery. The relationship between agencies and an attitude of collaboration will ensure adequate services are available to protect the residents of the community. Figure 9 is a graphic of the fire hydrant map of the town.

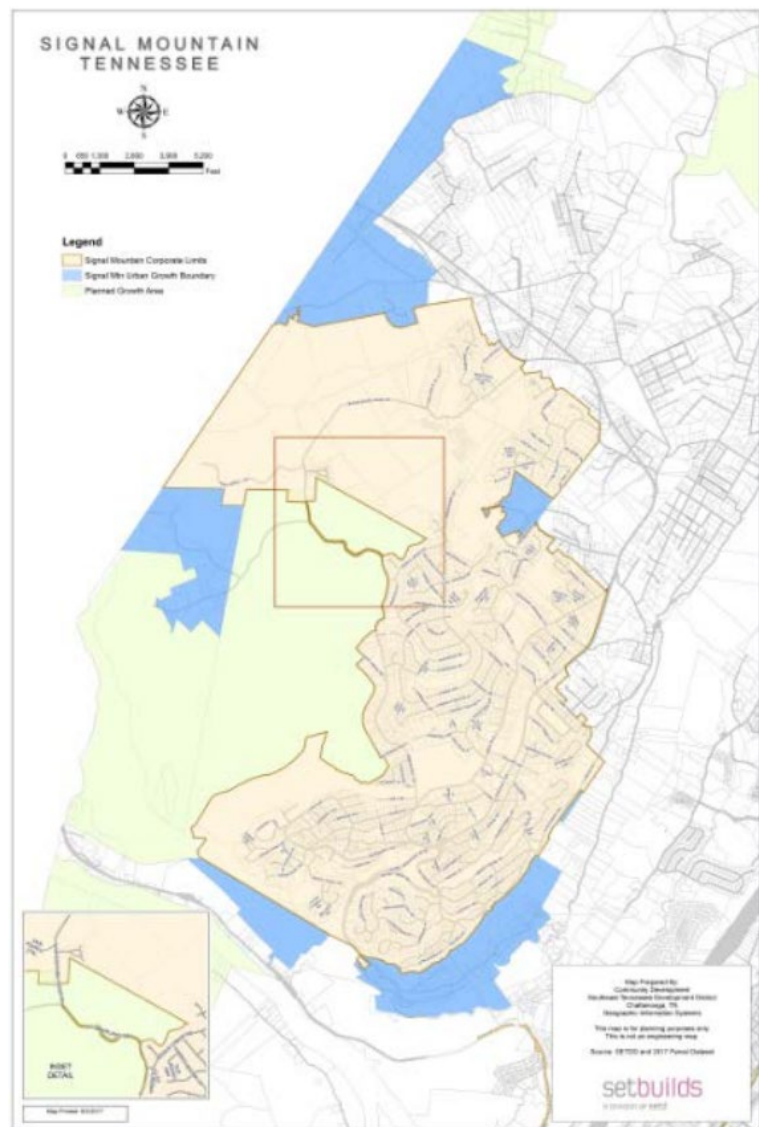
*Figure 12-Signal Mountain Fire Hydrant Map*

## Utility Services Recommendations

First responders that serve the residents of Signal Mountain rely heavily on technology to respond quickly, efficiently, and professionally to their calls for service. To this means, the fire department must cultivate positive proactive relationships with each of the utility and infrastructure providers as possible. These providers must be invited to local emergency planning sessions, tabletop drills, and full-scale drills to develop relationships and response capabilities. Figure 12 displays fire hydrant locations across the town.

## Community Risk – General Overview

Signal Mountain’s corporate boundary geographically encompasses approximately 8.5 square miles and has a population of approximately 8,852, based on the 2020 US census provided by the US Census Bureau. The town’s urban growth boundary (UGB) is larger than the current town limits, so additional growth is likely to occur. This prediction is based on the geographic location, livability, and the economic vitality of the region. Signal Mountain is experiencing growth due to its many positive attributes. Residents and/or commerce can be in two other states (Georgia and South Carolina) within one and one-half hours of leaving Signal Mountain by roadway due to the interstate and state highway system. Signal Mountain has quick access to air travel and shipping by means of nearby airports, Chattanooga Airport, and a major Norfolk Southern rail line. Figure 13 is a graphic of Signal Mountain’s UGB.



*Figure 13-Signal Mountain Urban Growth Area*

The tan area in the middle depicts Signal Mountain's current general town limits, and the blue depicts Signal Mountain's UGB. Based on the area of the UGB, Signal Mountain will not get much larger in total square miles, but it is predicted that development and population will become denser.

From 2000 to 2020 Signal Mountain's population increased about 16.1% ranking Signal Mountain as the 73<sup>rd</sup> largest town in Tennessee. Signal Mountain's population median age is 43.1-years which is older than the state average of 39.0-years, but Signal Mountain does have 22.6% of its population over the age of 65. Statistically, older population segments tend to use emergency medical services more than other population segments. Approximately 44.4 % of Signal Mountain Fire Department's responses for 2021 were due to rescue/emergency medical incidents.

## Future Needs

Extensive review of the Signal Mountain Fire Department's fire response areas, fire facility locations, fire apparatus, fire staffing, and department response practices, the existing public safety fire services response resources appear to be adequate to provide the expected level of service delivery for the size and scope of a town such as the Town of Signal Mountain. There are areas of the town that are located outside the NFPA 1710 primary service areas so as the town grows, the addition of fire department resources must be considered.

We can predict estimated response times to areas of the town using the Rand formula of Travel ( $\text{Travel Time} = 1.7(D) + 0.65$ ) + (Ring Time 0.25) + (Call Processing Time 1.00) + (Fire Department Turnout Time 1.00) as our guide. Using this formula, it is predicted that with fire apparatus and staffing in the two current fire stations the Signal Mountain Fire Department can respond to most areas of the town within 6.0-7.0-minutes of an emergency being reported.

Using the Home Fire Timeline (Figure 14), we can ascertain that response time is one of the fire department's most critical factors when responding to fire and emergency medical incidents that happen. One of the goals at a structure fire incident is to prevent flashover; giving fire suppression crews time to rescue occupants. Flashover can be prevented through the use of automatic fire sprinkler systems or a quick-fire response with proper suppression techniques or preferably a combination of both. As the town continues to grow, town leaders must proactively plan to provide adequate public safety fire services and other town services in the annexed areas.

Leaders must look to national consensus standards for guidance and benchmarking. No one standard outlines what is an acceptable response time. We must refer to the National Fire Protection Association (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 and NFPA 1221, Standard for the Installation, Maintenance and Use of Emergency Services Emergency Communications Systems. Both

are consensus standards that outline maximum response times. In the case of Signal Mountain, referring to NFPA 1710 and NFPA 1221, it can be surmised that a response time standard of six-minutes and thirty-five seconds (6:35) to 90% of incidents is a realistic goal to attain.

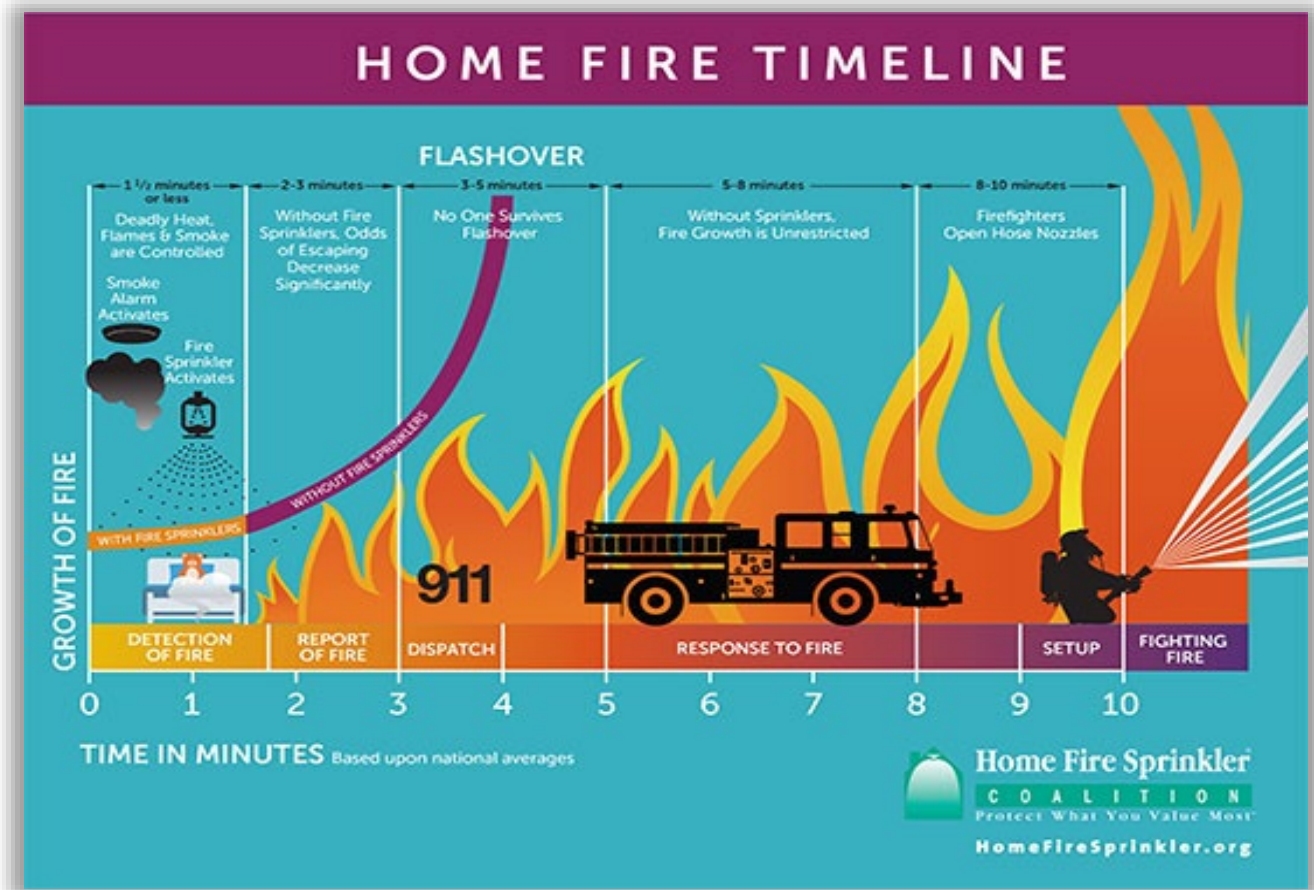


Figure 14-NFPA Home Fire Timeline

## How Many Fire Stations Does Signal Mountain Need?

To answer the question of how many fire stations does Signal Mountain need now, we can look at several sources for guidance. The first is the Insurance Services Office (ISO) Fire Suppression Rating Schedule. Section 561 of the schedule covers distribution of companies and states: “The built-upon area of the City should have a first-due engine company within 1.5-miles and a ladder-service company within 2.5-miles.” For a facility to be considered a fire station, there must be a fire apparatus credited as an engine apparatus housed there.

Using an “as the crow flies” radius of 1.5-miles to draw a circle does not adequately represent the geographical area that a single fire station can cover. Studies have shown that a polygon better represents the ISO required response area, and that the average size of the 1.5-mile polygon encompasses approximately 4.5-square miles. Two caveats: the polygon model assumes the even distribution of resources throughout the area, which is generally not the case, and the formula does not allow for geographical barriers, such as rivers, interstates, large

factories, and railroads, but the formula is useful as a reference. Based upon a 8.5 square mile service area, a travel distance of 1.5-miles, and assuming all engine companies are evenly distributed (which they are not) Signal Mountain would need 1.90 fire stations right now for adequate coverage.

The ISO standard for distribution is 1.5-miles for an engine and 2.5-miles for a ladder company, but ISO will extend a community's fire protection rating as far as five miles from a fire station provided there is adequate water available for fire protection. There is a caveat for basing fire protection on this five-mile distance, and that is the risks associated with extended response times. Travel time, measured as the time from when the fire department resource starts to roll until it arrives on the scene, is just one component of response time (see Appendix G). At 1.5-miles, the travel time for a fire engine is approximately 3:12 (time expressed as minutes: seconds). At five miles, the travel time is approximately 9:09. The response time, which includes ring time, call answering, call processing, turnout, and travel time, is much longer. Thus, a total response time of six or seven minutes for stations based on 1.5-mile distribution increases to twelve or thirteen minutes (or longer if call processing and turnout times exceed NFPA recommendations) based on 5.0-mile distribution. As stated earlier in this report, the level of fire protection provided in a community is a local decision, but due to the risk to the public, MTAS recommends basing community fire protection more toward the 1.5-mile travel distance than on the maximum 5.0-mile distance.

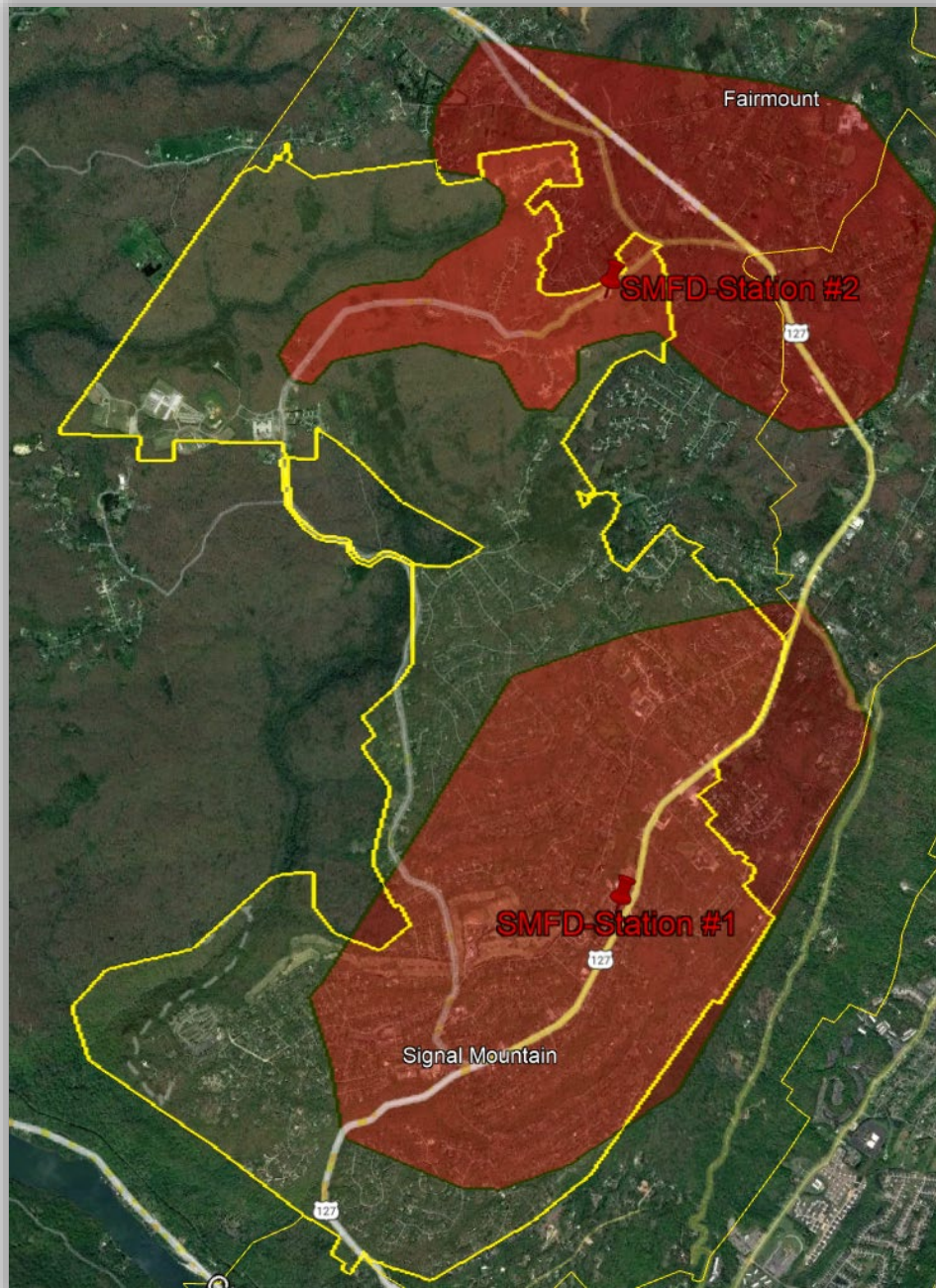
The second resource is the National Fire Protection Association (NFPA). NFPA addresses the number of fire stations needed in an indirect way based on minimum response times. NFPA Standard 1710 Section 5.2.4.1.1 allows a 240 second (4-minute) travel time for the first arriving engine company. Using an empirical model called the piecewise linear travel time function, based upon studies done by the Rand Institute estimating the average response speed of fire apparatus at 35 mph, one can determine that the distance a fire engine can travel in 4 minutes is approximately 1.97 miles. A polygon based on a 1.97-mile travel distance covers on average 7.3 square miles. Based upon an 8.5-square mile service area, a travel-time-calculated travel distance of 1.97 miles, and assuming all engine companies are evenly distributed (which they are not) Signal Mountain would need 1.20 fire stations right now. However, the town is not evenly distributed, has many large buildings, has geographic barrier issues that fire apparatus must navigate around, and strip annexations have extended the corporate limits far beyond what the existing fire stations can cover adequately. Based on the scope and complexity of the risks to the public, Signal Mountain must plan more toward the 1.5-mile model previously discussed.

The previous two examples are based upon time and distance to be covered. A third resource is the ISO Fire Suppression Rating Schedule's determination of needed engine companies based upon the community's basic (needed) fire flow. Section 513 of the schedule requires one engine company for a basic fire flow of 500 to 1,000 gallons per minute (gpm), two engine companies for a basic fire flow of 1,250 to 2,500 gpm, and three engine companies for a basic fire flow of 3,000 to 3,500 gpm. Basic fire flow is calculated by determining the needed fire flow for all non-sprinkled properties in the community, and then the fifth highest is

considered the basic fire flow for the community. A strong fire sprinkler ordinance can reduce community risk significantly, as ISO does not consider properties protected by automatic sprinkler systems when determining the basic fire flow, and properties equipped with fire sprinkler systems reduce the fire risk in the community. Signal Mountain has adopted model codes that require fire sprinklers in certain types of buildings but should consider adopting a more restrictive sprinkler ordinance to additionally require fire sprinklers in all one- and two-family residential occupancies to reduce risk to the community.

Finally, town leaders must consider the phenomenon known as flashover. As a fire grows larger, it gives off heat that heats other objects in the vicinity of the fire. At some point in the time-temperature curve, all the objects in the fire room reach their ignition temperature and ignite. The entire room bursts into flames, and the temperature rises to a point where no person can survive, including firefighters. This is called Flashover. The NFPA Fire Protection Handbook states: “During flashover, however, the temperature rises very sharply to such a level that survival of persons still in the room at that stage becomes unlikely. Thus, the time interval between the start of the fire and the occurrence of flashover is a major factor in the time that is available for safe evacuation of the fire area.” The development of fire conditions to reach the point of flashover is a function of temperature rise over time. Therefore, a sufficient number of fire stations strategically located to provide quick response times can potentially reduce the incidence of flashover, thus saving lives and property. As shown in the graph in Figure 14, flashover can occur within 3 to 5 minutes of the start of a fire. Locating fire stations to provide a total response time of three to four minutes is advantageous, as firefighters need time after arrival to setup, lay fire hose, and gain access to the seat of the fire before they can begin to search for trapped occupants or extinguish the fire. Your study recommendations are based upon 1.5-mile fire station/engine company response. Under ideal conditions and taking into consideration the roles of 911 call-takers, emergency dispatchers, traffic travel time, and fire staff/equipment limitations, this would give Signal Mountain Fire Department an estimated 5.78-minute total response time at 1.5 miles from each fire station. In the more densely populated areas and/or areas of town where there are geographic barriers, fire companies communicating that they are on scene at the street address does not necessarily mean that firefighters are in a position to effect a positive change in the incident. Members usually must pack up equipment and tools and gain access to large buildings or steep terrain to begin effective operations.

Figure15 graphically depicts the coverage area provided by the current two fire stations. The red polygon areas represent 1.5-mile travel distances, or approximately 3:12 minutes/seconds travel time. Looking at this map, it is obvious that there are large areas of the town located outside the 1.5-mile response area of an engine apparatus.



*Figure 15-Signal Mountain Fire Stations with 1.5-Mile Engine Response Area*

Taking into consideration the accepted methods to determine the proper number and distribution of fire stations across a town, Signal Mountain appears to have a sufficient number of fire stations. An important note, fire station 2 is built on the edge of the corporate geographic limits of the town, therefore much of station 2’s 1.5-mile response zone is outside the town’s limits.



Fire stations should be designed with the future needs of the department and community in mind. This means we must take into consideration anticipated apparatus deployment, staffing, response volume, population growth, applicable National Fire Protection standards, life safety codes, and building codes.

## Fire Companies Defined

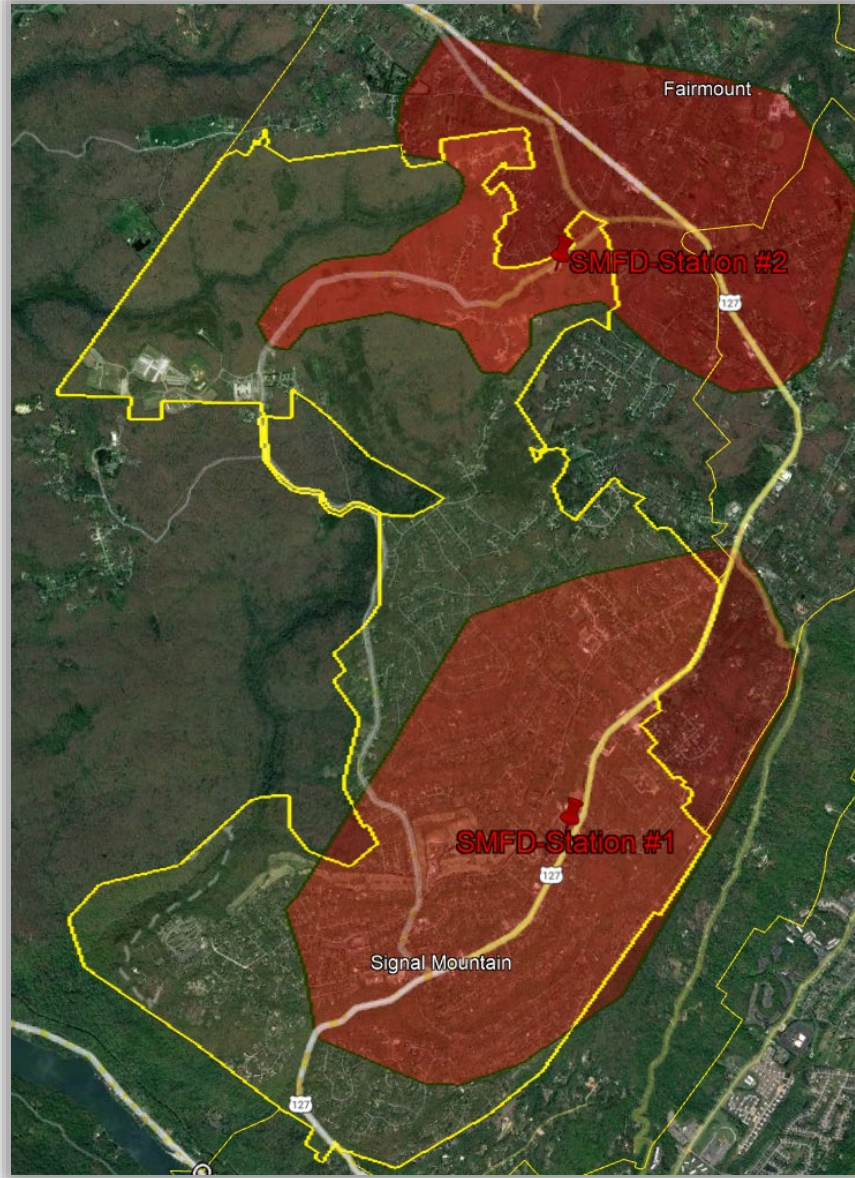
Fire departments utilize fire apparatus as tools to combat and extinguish unwanted fires. For the purposes of this study, we will define five categories of fire apparatus: engine, quint, ladder, and tender/tanker.

- Engine apparatus: fire apparatus with a permanently mounted fire pump of at least 750 gallons per minute (gpm) pump capacity, minimum 500-gallon water tank, and hose bed whose primary purpose is to combat structural and associated fires. An engine apparatus can earn full credit as an engine.
- Quint apparatus: fire apparatus that performs five different firefighting functions. Must have permanently mounted fire pump of at least 750 gpm pump capacity, minimum 300-gallon water tank, hose bed, ground ladders, and aerial ladder. A quint apparatus housed by itself can earn full credit as an engine and 0.50% credit as a ladder. A quint apparatus housed with an engine can earn 100% ladder credit.
- Ladder apparatus: fire apparatus equipped with an aerial ladder, elevating platform, or water tower that is designed and equipped to support firefighting and rescue operations by positioning personnel, handling materials, providing continuous egress, or discharging water at positions elevated from the ground. A ladder apparatus must be housed with an engine apparatus.
- Service apparatus: fire apparatus that is designed and equipped to support firefighting and rescue operations by positioning personnel, handling materials, and providing continuous egress. This apparatus is similar to a ladder apparatus without being equipped with an aerial ladder or elevated master stream device. A service apparatus must be housed with an engine apparatus.
- Tender/Tanker apparatus: is a specialized firefighting apparatus designed for transporting water from a water source to the scene of an emergency. Typically, water tenders support engine and/or ladder companies during fires and hazardous material incidents.

## How Many Engine Companies Does Signal Mountain Need?

A community needs an apparatus credited as an engine apparatus assigned to respond from each fire station. Fire stations should be planned with 1.5-mile polygon primary service areas to ensure quick efficient emergency response and earn maximum ISO credit. This can be accomplished by deployment of an engine apparatus in each station. Figure 16 illustrates the current engine company deployment and each engine company's corresponding 1.5-mile

coverage areas. It is obvious that there is a significant geographic area of the town not covered in one of these response areas. Signal Mountain needs 2.0-apparatus categorized as an engine apparatus strategically located across the town now.



*Figure 16-Signal Mountain's Two-Station Primary Engine Coverage*

### **How Many Ladder Companies Does Signal Mountain Need?**

A community needs a ladder company when it has at least five buildings that are three stories or more tall, five buildings more than thirty-two feet in height, a basic fire flow of 3,500 gallons per minute, or any combination of these conditions. Signal Mountain has several buildings that meet these multiple criteria throughout the town.

One can use the polygon model to determine the number of needed ladder trucks or service companies based upon ISO's maximum travel distance of 2.5-miles for a ladder or service company. The average size of a polygon for a ladder or service company is 12.5 square miles. Based upon an 8.5 square mile service area, a travel distance of 2.5-miles, and assuming all ladder companies are evenly distributed (which they are not) Signal Mountain needs a minimum of 1.0 ladder company right now. With the long travel distances associated with the current fire station locations taken into consideration, Signal Mountain needs to consider adding an additional quint apparatus or service apparatus assigned to fire station 2.

Figure 17 is a visual of the Town's 2.5-mile ladder apparatus response area. It is evident that the town has a significant geographic area that are not located within the 2.5-mile response area for a ladder apparatus.

**Fire Apparatus Recommendation:**

Refer to Fire Apparatus Recommendations on page 23 for specific apparatus redeployment recommendations.

*Figure 17-Existing Ladder Company Deployment*



## Recommendation Implementation

To provide for firefighter safety, excellence in internal/external customer service, while helping to maintain or improve Signal Mountain's Class 2 ISO Public Protection Classification, Signal Mountain should consider the recommendations outlined in this study report and develop plans to implement each recommendation as soon as practical. The recommendations made, in this report, will require open mindedness at all levels of the organization and considerable resources so each must be planned for accordingly. Recommendations should be considered and planned for systematically to be achieved and sustained over time. It is almost always a good idea to develop plans with the objective to phase capital improvements and staffing strategies over multiple steps and fiscal budget years.

## Summary

It is an honor and privilege to conduct this study for the Town of Signal Mountain. I am impressed with the caliber of men and women that serve every day, to plan for and protect the citizens and visitors of the town. The Town of Signal Mountain enjoys a Class 2 ISO Public Protection Classification rating due to the leadership and decisions that have been made to date. The Class 2 rating currently places the town in the top percentage of communities nationwide and in the top 1% in Tennessee in terms of fire protection. Because of the Class 2 rating, residents and business owners enjoy living in a potentially safer community while enjoying lower property insurance rates. Annexation and growth have occurred, but the town addressed that with the addition of Station 2. Signal Mountain's existing fire stations are strategically located to provide good coverage with no service area overlap to meet ISO's fire station distribution requirements over the town. However, there are areas of Signal Mountain that are geographically located outside the optimal response zone for any of the existing fire stations resulting in long response times. The town and department's leadership has demonstrated some priority on firefighter safety by implementing a minimum apparatus staffing policy and practice. Two of the three front-line companies are being led by a company officer, Captain on Engine 1 and a Lieutenant on E2. Ladder 1 has very minimal staff and does not have a supervisor assigned. It appears, with limited study, that Signal Mountain has a good handle on its division-of-labor and span-of-control. The two current fire stations and apparatus deployment do appear adequate to provide the levels of fire services as defined in both NFPA 1710 and ISO for the citizens and visitors of Signal Mountain. As Signal Mountain continues to grow, the department should continue to grow to meet the needs of the town. This may bring on consideration of an organizational restructure to keep the department's division of labor and span of control within recognized standards. The National Incident Management System recommends a span-of-control of between 3 and 7 subordinates, with 5 subordinates being optimal.

Providing for an all-hazards fire department, especially one that provides the public safety fire services needed by a growing world-class town, is very complex. Signal Mountain has many target hazards, such as extensive facilities, railroad, and highways spread throughout

the town. There are large public events and gatherings at area venues that present very real challenges for the fire department.

It is never advisable for a town to make significant changes to the organization or operation thereof to just maintain or chase after a better ISO Public Protection Class rating. What we find is that when departments have a practice of proactively planning and operating based on national standards, the firefighting forces are safer and work more efficiently meaning a sustained or improved ISO classification usually follows.

Based on the scope and findings of this study, Signal Mountain must consider implementation of as many of the recommendations specified in this report as feasible. These actions will improve firefighter safety, provide for quick and efficient public safety fire services to the public, and could serve to sustain or improve Signal Mountain's Class 2 ISO rating. It is important to note that a worsening of the ISO by 1 classification could lead to an increase in insurance premiums for residents of one- and two-family dwellings; further, an improvement of the ISO by 1 classification could lead to a decrease in insurance premiums for residents of one- and two-family dwellings. It is estimated that a shift in ISO by 1 classification could result in a 2%-5% increase/decrease in homeowner insurance premiums.

## Recommendations-Additional

The following recommendations outline the most efficient and cost-effective ways for the Town of Signal Mountain to provide for an all-hazards fire department delivering the wide range of programs and services needed to address unique community risks and needs. Recommendations will focus on four components of the department: fire station locations, fire apparatus deployment, fire apparatus staffing, and proactive community risk reduction.

**Response Time Standard:** Adopt a response time standard for the community. Signal Mountain Fire Department is a perpetual organization that will outlast current leaders, and this study looks at current and anticipated future needs. Once adopted, the response time standard will serve as a planning guide for future leaders. This study recommends a response time standard of 6:35 (six minutes, 35 seconds) for 90% of all responses, which is based upon recommendations found in NFPA Standard 1710, Standard for the Organization and Deployment of Fire Suppression Operations. The 6:35 breaks down as follows: ring time – 15 seconds, call processing time – 60 seconds, firefighter turnout time – 80 seconds, travel time – 240 seconds. Using this standard, planners would look for fire station locations to maintain a 4-minute travel time to as much of the area to be protected as possible.

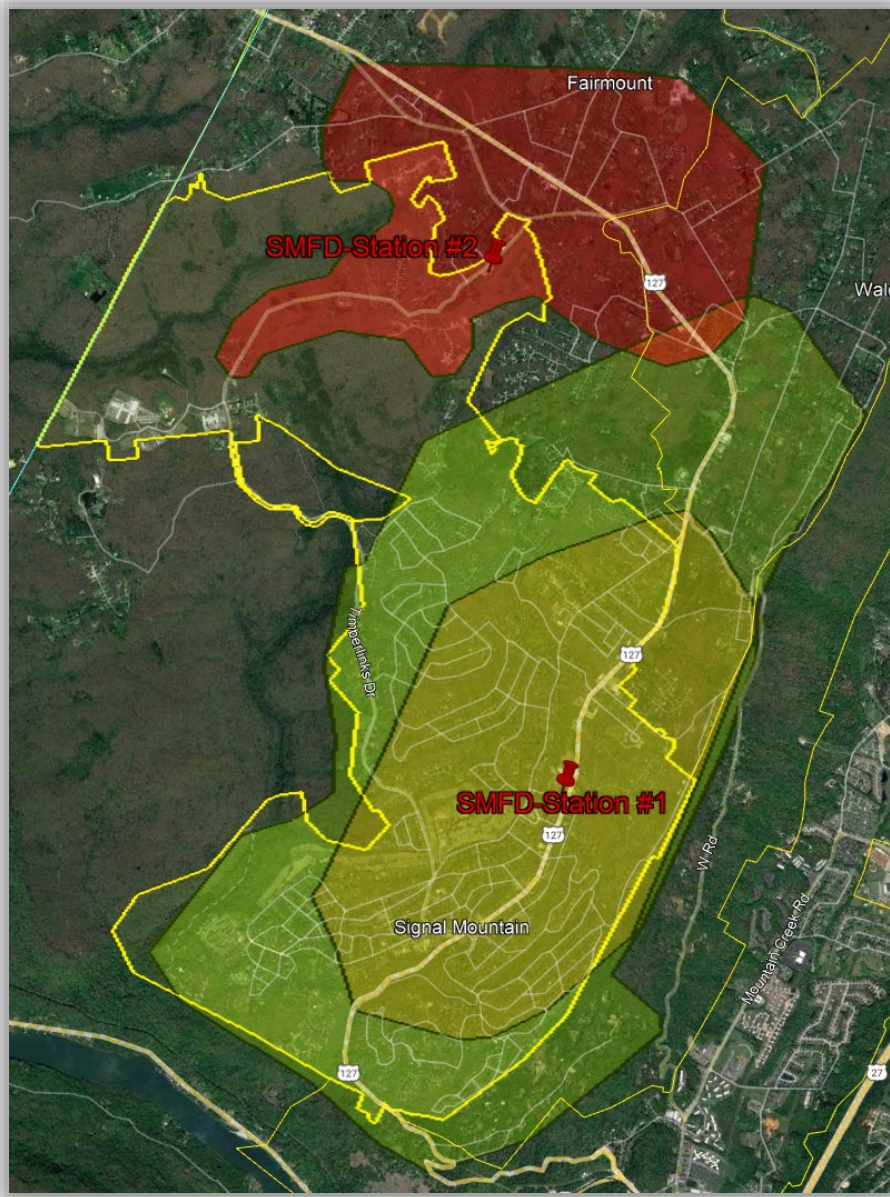
**Automatic Fire Sprinklers:** Adopt the most current fire code to include the sections that require automated fire sprinkler systems in new construction homes/businesses and consider incentives for owners that retrofit sprinkler systems in existing buildings. Utilize resources like the National Fire Sprinkler Association as a resource as you plan for this step. It is worth noting that facilities equipped with fire sprinkler systems are much safer, and occupants are more likely to survive if a fire occurs. Also, when determining the basic fire flow for a community, ISO does not consider properties protected by a code-compliant automatic fire sprinkler system. In a sprinkled building, the amount of time between the occurrence of a fire and reopening for business can be as little as a few hours or days versus months, years, or even never rebuilding for a non-sprinkled building. This will help provide excellent safety for the citizens/visitors to the community and help ensure a steady revenue stream for the town.

- Tennessee’s fire mortality rate for civilians has been among the highest in the nation. During 2002-2010, the period included in the Tennessee Fire Mortality Study, the national fire mortality rate declined, but the rate in Tennessee increased. Residential structure fires account for about three-fourths of all civilian fire deaths in the state. Residential fire sprinklers save money and lives and are a good investment in a home. Still, they are controversial in many communities, which is why this study recommends

researching residential sprinklers before considering adopting an ordinance. Adopting an ordinance would be proactive for community safety.

## Fire Stations:

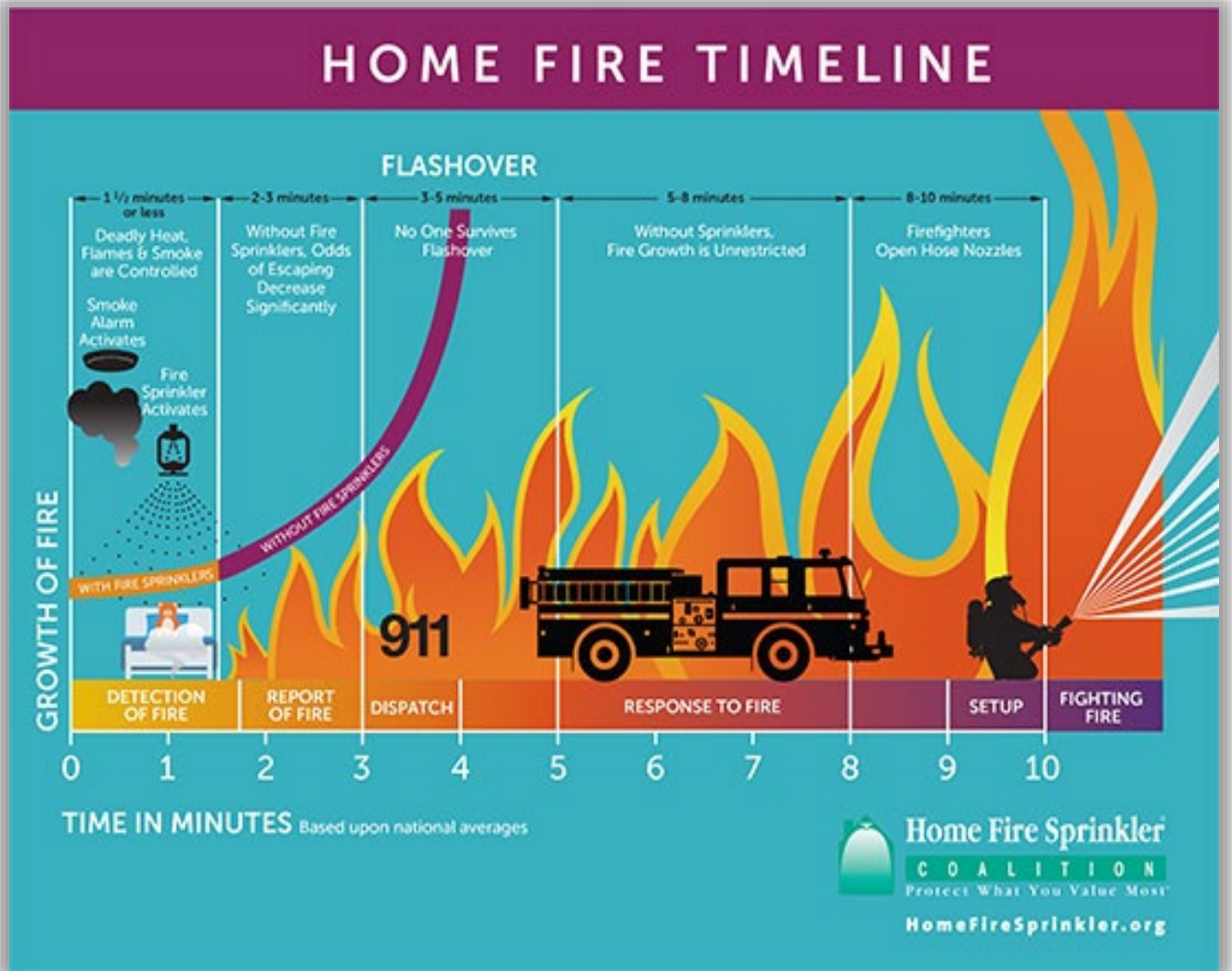
**Current Stations:** Two fire stations serve Signal Mountain currently. Each of the existing facilities is somewhat strategic in serving the town. This is a great foundation to move the department forward utilizing current fire station locations. Current and future fire stations must help ensure that firefighters have minimal exposure to carcinogens, especially at the fire station. Figure 18 graphically demonstrates engine coverage in red and ladder coverage in green.



*Figure 18-Engine Coverage in Red and Ladder Coverage in Green*

## Appendixes

### Appendix A-NFPA Home Fire Timeline

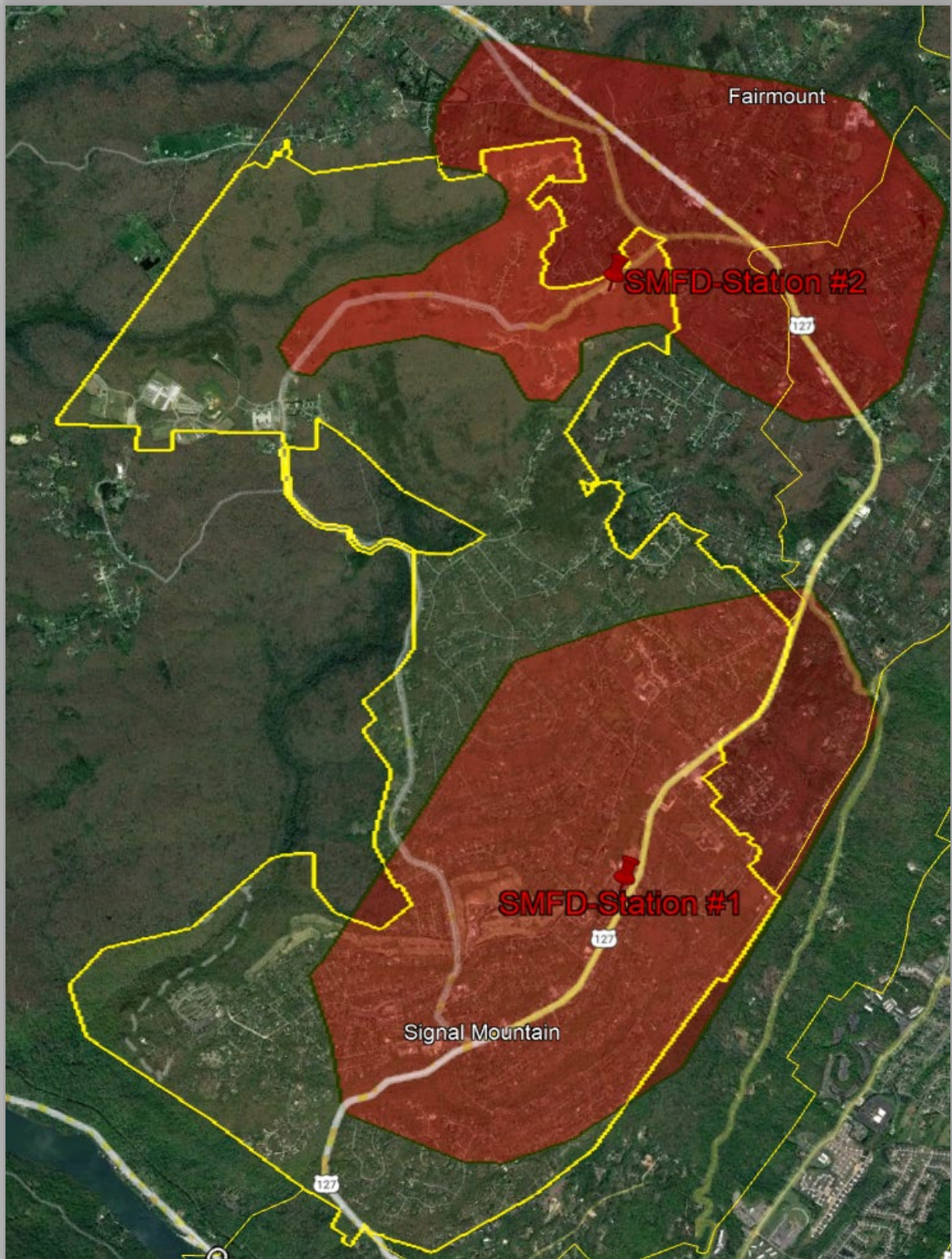


The home fire timeline indicates that a residential fire sprinkler system can control a fire within 1.5-minutes of ignition. This is long before the fire department can be alerted and respond to the address.

Secondly flashover over usually occurs with the 3–4-minute timeframe from ignition. This is an important benchmark due to when flashover occurs there is little chance of residents or firefighters surviving.



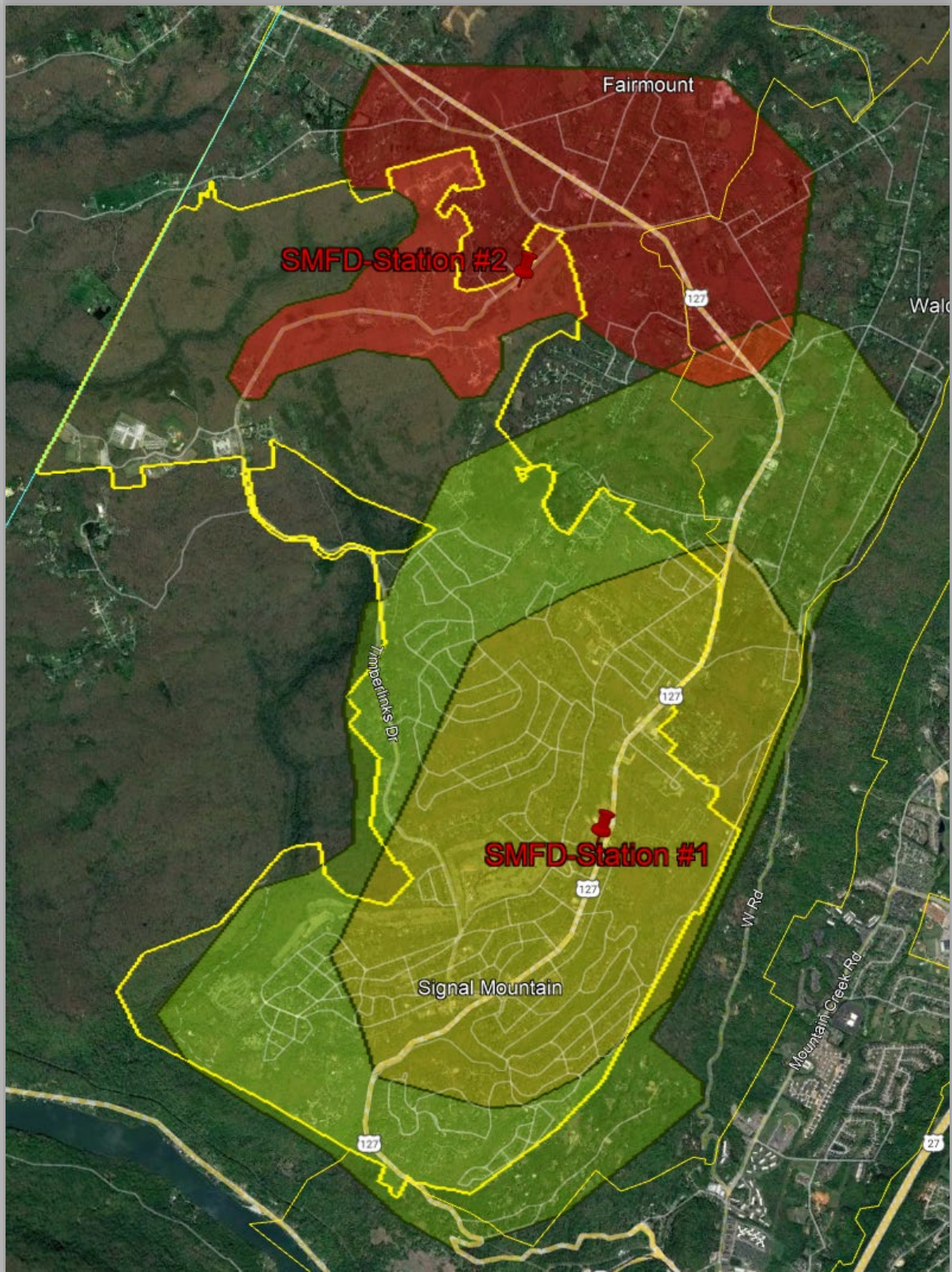
Appendix B-Signal Mountain 2-Fire Station 1.5-mile Coverage



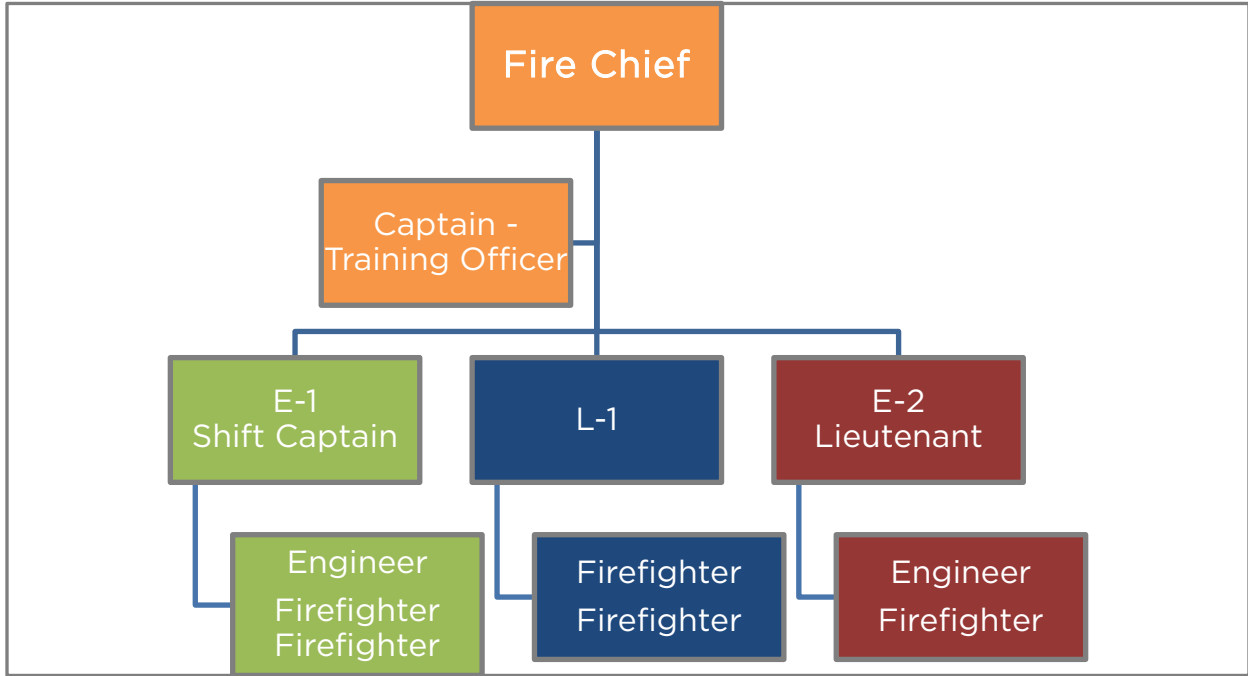
Appendix C-Signal Mountain Current Ladder Company Coverage



Appendix D-Both Engine and Ladder Coverage-Engine Red, Ladder Green

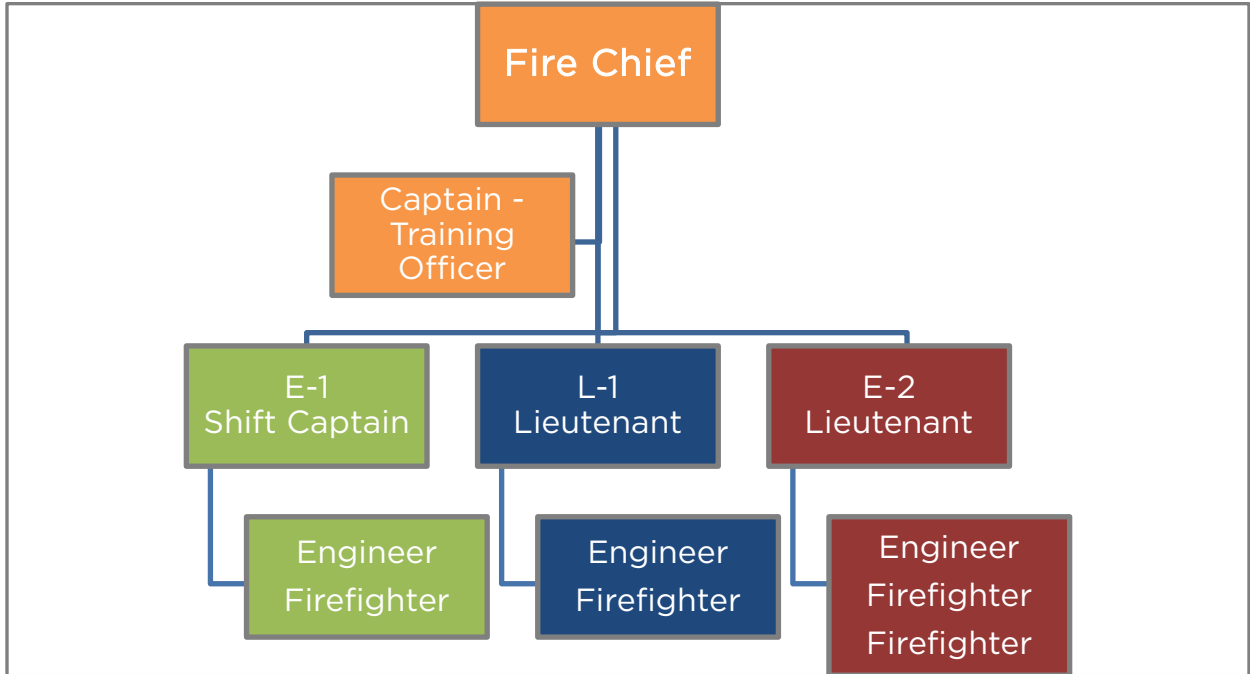


## Appendix E- SMFD Current Organizational Chart



\*It was noted that Ladder 1 does not have an officer/supervisor assigned. It was further noted that Engine 2 is regularly staffed with only three firefighters.

Appendix F- SMFD Recommended Organizational Chart-Incremental Improvement



Recommended organizational chart change would assign a Lieutenant to Ladder 1 and implement a 4-person minimum staffing practice at Station 2.

## Appendix G-Estimated Response Time Chart

Distance To Travel in Miles	Estimated Travel Time	Ring Time	Call Processing Time	Fire Dept. Turnout Time	Total Response Time
0.25	1.08	0.25	1.00	1.33	3.66
0.38	1.30	0.25	1.00	1.33	3.88
0.50	1.50	0.25	1.00	1.33	4.08
0.75	1.93	0.25	1.00	1.33	4.51
1.00	2.35	0.25	1.00	1.33	4.93
1.25	2.78	0.25	1.00	1.33	5.36
1.50	3.20	0.25	1.00	1.33	5.78
1.75	3.63	0.25	1.00	1.33	6.21
2.00	4.05	0.25	1.00	1.33	6.63
2.25	4.48	0.25	1.00	1.33	7.06
2.50	4.90	0.25	1.00	1.33	7.48
2.75	5.33	0.25	1.00	1.33	7.91
3.00	5.75	0.25	1.00	1.33	8.33
3.25	6.18	0.25	1.00	1.33	8.76
3.50	6.60	0.25	1.00	1.33	9.18
3.75	7.03	0.25	1.00	1.33	9.61
4.00	7.45	0.25	1.00	1.33	10.03
4.25	7.88	0.25	1.00	1.33	10.46
4.50	8.30	0.25	1.00	1.33	10.88
4.75	8.73	0.25	1.00	1.33	11.31
5.00	9.15	0.25	1.00	1.33	11.73
5.25	9.58	0.25	1.00	1.33	12.16
5.50	10.00	0.25	1.00	1.33	12.58
5.75	10.43	0.25	1.00	1.33	13.01
6.00	10.85	0.25	1.00	1.33	13.43
6.25	11.28	0.25	1.00	1.33	13.86
6.50	11.70	0.25	1.00	1.33	14.28
6.75	12.13	0.25	1.00	1.33	14.71
7.00	12.55	0.25	1.00	1.33	15.13

### Notes:

- Travel time was calculated using the Rand formula of  $T = 1.7(D) + 0.65$  to estimate travel time, where “T” is time and “D” is the distance to be covered expressed in miles.
- The 15-second ring time, 60-second call processing time, and 80-second turnout time are based on recommendations found in NFPA Standard 1710.
- Minutes expressed as decimal minutes: to compute seconds, multiply the number to the right of the decimal number by 0.60. For example, 3.66 decimal minutes equals 3:40 (3-minutes, 40-seconds).

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