January 2018

Community Risk Assessment and Standards of Coverage Study

Frederick County Life at the Top VIRGINIA

Frederick County Fire and Rescue, Virginia

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CONSULTANT REPORT

COMMUNITY RISK ASSESSMENT AND STANDARDS OF COVER
FREDERICK COUNTY, VIRGINIA

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EXECUTIVE SUMMARY

Frederick County contracted with Fitch & Associates to objectively evaluate the fire rescue department's operations, deployment, and staffing. The Frederick County Fire Rescue Department is largely motivated to evaluate the current response model and the desire to develop a long range, risk-based, data driven staffing and deployment plan based upon the specific and unique profile of Frederick County.

Comprehensive data based quantitative and geospatial analyses were utilized to objectively evaluate the historical county demand for services by type and severity. Occupancy level data were obtained from the Insurance Services Office (ISO) and Frederick County's databases and was utilized to assess occupancy level risk within the community. Ultimately, occupancies were categorized as low, moderate, and high risks and geocoded to the respective existing district boundaries to establish an efficient and objective risk-based strategy for resource allocation.

Additionally, the Fitch team made several visits to the organization through which it engaged internal and external stakeholders. A series of structured interviews were conducted on several occasions with members representing all levels and functions within the organization. Through these efforts, the Fitch team was able to provide this document as the culmination of their observations supported by comprehensive GIS and data reports.

The current fire response time average, county wide, is 11 minutes 2 seconds. The current EMS response time, county wide, is 11 minutes 1 second. The rural average fire response times are meeting the nationwide best practice expectations in the rural areas of thirteen minutes or less. The developed areas will need some modifications to the current fire rescue response system to meet the best practices response standard.

However, a more conservative and reliable measure of performance is the fractile or percentile. This measure is more robust, or less influenced by outliers, than measures of central tendency such as the mean. Best practice is to measure at the 90th percentile. In other words, 90% of all performance is captured expecting that 10% of the time the department may experience abnormal conditions that would typically be considered an outlier. For example, if the department were to report an average response time of six minutes, then in a normally distributed set of data, half of the responses would be longer than six minutes and half of the responses would be less than six minutes. The 90th percentile communicates that 9 out of 10 times the department performance is predictable and thus more clearly articulated to policy makers and the community. The countywide performance at the 90th percentile for fire response was 17.6 minutes, and EMS response was 16.1 minutes. Of the 10,250 responses in 2016, 79.3% were EMS calls.

The distribution of risk and demand within Frederick County is primarily focused in and around the identified development areas of the county. The density of the development areas is higher than the

rural areas creating challenges for FCFRD to provide uniform service levels with the current model and allocation of resources.

The FCFRD continues to be challenged by increasing call volume and faces some workload challenges for its personnel. Specific fire companies handle a disproportionate number of calls on a routine basis. With the current paid staffing it is becoming increasingly more difficult for the stations to effectively handle concurrent calls, and the entire county is compromised due to the number of units necessary to assemble an effective fire force. Strategies are presented in this report to further support the agency's efforts to provide workload balance for their workforce.

Several alternative staffing and deployment models were evaluated and presented. Additionally, several variations of deployment and response times were evaluated that include differentiated performance and service levels based on the identified development and rural areas.

The continued success of FCFRD, and the effective planning for future growth in human resources, fixed stations, apparatus acquisition and deployment, operating efficiencies, economic control, and the dynamic changes required by an evolving community, is best served by the appointment of a single Fire Chief who has the ultimate authority and is directly responsible for all activities and decisions of the FCFRD. From a historical perspective this has been an outcome for many fire organizations across the country. It is an evolutionary process necessitated by the ever changing, time sensitive, internal and external influences faced by fire departments everywhere, every day.

DESCRIPTION OF COMMUNITY SERVED

Introduction

The Frederick County Fire and Rescue Department (FCFR) is a full-service fire agency providing fire suppression, Emergency Medical Services (EMS) Basic and Advanced Life Support (ALS), ambulance transport, fire prevention, hazardous materials, and specialized services for the unincorporated portions of the county.

Frederick County is 416 square miles at the northern-most point in Virginia, a mid-point of the East Coast. The County sits at the mouth of the Shenandoah Valley, which stretches 200 miles between two mountain ranges - The Blue Ridge Mountains to the East and The Allegheny Mountains (part of the Appalachian Mountain Range) to the West. The Valley is bound by two rivers, the Potomac River to the North and the James River to the South. Frederick County was established in 1743 from parts of Orange County and encompassed all or part of four counties in present-day Virginia — Shenandoah, Clarke, Warren, and Frederick — and five in present-day West Virginia — Hardy, Hampshire, Berkeley, Jefferson and Morgan.

The County has 11 fire service areas that provide emergency response service from 11 stations in areas of the county not serviced by a municipal fire department including the communities of Stephens City, Middletown, Clear Brook, Gore, Round Hill, Gainesboro, Star Tannery, Greenwood, North Mountain, Reynolds Store, and Millwood Station. Collectively these organizations maintain twenty-three ambulances, twenty engines, three aerial devices, and various pieces of specialty apparatus and provide services to approximately 85,000 people. The budgeted paid minimum staffing strength is 26 personnel on each shift plus one battalion chief, supplemented by volunteer personnel. Administrative command of each fire company is determined by the individual hierarchy established within the framework of their enabling authority.

LEGAL BASIS

Frederick County is governed by an elected Board of Supervisors composed of seven members, one from each magisterial district - Shawnee, Opequon, Gainesboro, Stonewall, Back Creek and Red Bud, and one chairman-at-large. Supervisors are elected for four-year terms, which are staggered at two-year intervals.

The Board of Supervisors is the policy-making body of the county and is officially known as the Frederick County Board of Supervisors. It is vested with all policy-making powers and responsibilities conferred by general law on county governing bodies. Functions of the Board of Supervisors include making land use decisions, establishing growth and development policies, setting operational policies, and reviewing and adopting the County's operational and capital budgets which set spending priorities.

2014 Virginia Code
Title 27 - Fire Protection
§ 27-23.6. Provision of fire-fighting or emergency medical services

A. Any county, city or town may contract with or provide for any volunteer fire-fighting or emergency medical services companies or associations in the county, city or town for the fighting of fire or provision of emergency medical services in any county, city or town. If such provisions are made by the county, city or town, the fire-fighting or emergency medical services company shall be deemed to be an instrumentality of the county, city or town and as such exempt from suit for damages done incident to fighting fires or providing emergency medical services therein. The county, city or town may elect to provide for the matters authorized in §§ 27-4 and 27-39.

B. Any county, city or town may provide fire-fighting and emergency medical services to its citizens by using both government-employed and volunteer company or association firefighters and emergency medical services personnel. If such a system is utilized, the volunteer fire-fighting and emergency medical services companies and associations shall be deemed an instrumentality of the county, city or town, and as such exempt from suit for damages done incident to providing fire-fighting and emergency medical services to the county, city or town. The county, city or town may also elect to provide for matters authorized in §§ 27-4 and 27-39.

"Providing fire-fighting or emergency medical services" includes travel while performing fire, rescue or other emergency operations in fire-fighting apparatus or other emergency vehicles as described in §§ 46.2-1023 and 46.2-920, respectively.

1970, c. 187; 1982, c. 239; 1991, c. 54; 2001, c. 142; 2002, c. 286.

Frederick County Code
Chapter 89 Fire and Rescue Services

§ 89-2 **Department established.**
There is hereby established the Frederick County Department of Fire and Rescue. The Department shall consist of the Department Chief and any such career officers and employees approved by the Board and appointed by the Department Chief. The Department shall work in conjunction with the volunteer fire and rescue companies as defined above, as well as the Association and its members, to achieve the mission of fire and rescue services.

§ 893 **Department Chief.**
The County Administrator shall appoint the head of the Department, who shall be known as the "Department Chief." The Department Chief shall have general supervision and control over the Department. The Department Chief shall, after consultation with the Association, establish rules and regulations for the operation of the Department. Such rules shall be consistent with the

provisions of this article. The Department Chief shall have no jurisdiction over the internal affairs of the companies. The Department Chief shall develop and administer a program for the career personnel of the Department.

§ 89-4 **Creation; purpose; bylaws.**
The Association is hereby recognized by the County for the following purposes: to work in conjunction with the Department on matters regarding the operations of the Department, including, but not limited to, reviewing operating procedures, rules and regulations, budget matters, as noted in the current service agreement; to create enthusiasm among the member companies; to coordinate the work of its membership; to disseminate knowledge of fire-fighting methods and techniques; to promote goodwill and devoted service to the people of Frederick County; and to promote a general interest and knowledge of fire prevention. The Association shall be dedicated to the service of volunteer fire and rescue members and the volunteer companies of Frederick County; and to promote and encourage cooperation among the member companies. The Committee is empowered to promulgate bylaws to effectuate the purposes set out herein.

§ 89-5 **Membership.**
Membership in the Association is governed by the current bylaws.

§ 89-6 **List of companies.**
Each individual fire and rescue organization that is located in Frederick County shall be defined as a "fire and rescue company" as provided in § 27-8.1 of the Code of Virginia, 1950, as amended. These presently include: Stephens City Volunteer Fire & Rescue Company, Inc.; Middletown Volunteer Fire & Rescue Company, Inc.; Clear Brook Volunteer Fire & Rescue, Inc.; Gore Volunteer Fire Company; Round Hill Community Fire & Rescue Company, Inc.; Gainesboro Fire Company, Inc.; Star Tannery Volunteer Fire Department; Greenwood Volunteer Fire & Rescue Company, Inc.; North Mountain Volunteer Fire Company, Inc.; Reynolds Store Volunteer Fire & Rescue Company, Inc.; Millwood Station Volunteer Fire & Rescue Company 21, Inc.

§ 89-7 **Approval of names and numbers.**
Newly established fire and rescue company names and numbers shall be recommended by the Association and are subject to final approval by the Board.

§ 89-8 **Establishment.**
Pursuant to § 27-8 of the Code of Virginia, any number of persons, not less than 20, may form themselves into a company for emergency response, subject to approval by the Board.

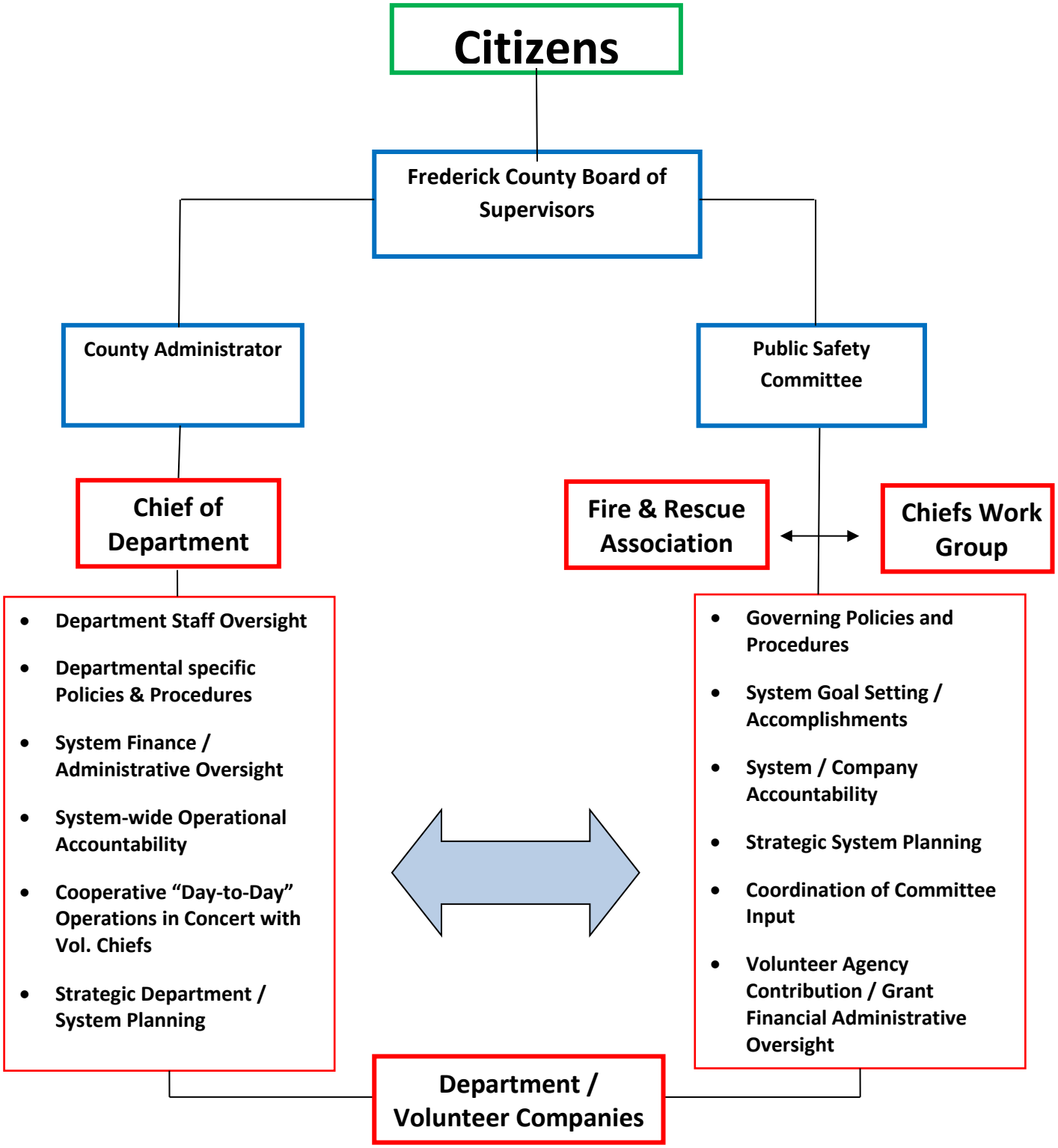
§ 89-9 **Organization.**
A writing stating such formation of a company, with names of its members, shall be presented to the Board and recorded in the Circuit Court pursuant to § 27-9 of the Code of Virginia.

§ 89-10 **Dissolution.**
Pursuant to § 27-10 of the Code of Virginia, whenever the Department shall ascertain that a company has failed, for three consecutive months, to consist of 20 active and effective members, or ascertains that it has failed for the same period of time to keep in good and serviceable condition its fire and rescue apparatus (an engine), hose, emergency medical services vehicle, equipment and other proper implements, or whenever the Board for any reason deems it advisable, the Board may act to dissolve a company.

§ 89-11 **Rules and regulations.**
The members of each company may make their own rules and regulations consistent with the laws of the Commonwealth of Virginia, this chapter, and other ordinances of the County.

Department Governance

Figure 1: Governance Model of Frederick County Fire and Rescue



HISTORY OF FREDERICK COUNTY FIRE AND RESCUE

The Fire and Rescue System consists of eleven (11) volunteer fire and rescue companies, independently operated by volunteer personnel and supported by 113 uniformed career staff and seven (7) civilian staff. The agency is an all-hazards system, coordinating with our volunteer companies to deliver emergency medical services, firefighting, hazardous materials and environmental responses within Frederick County.

The Career Department has grown considerably since its 1990 inception to address staffing requests by volunteer fire and rescue companies. These requests are the direct result of an increased demand for services from volunteer companies due to an ever-expanding county population. Over the course of the Department's lifespan, the county population has increased by 71%. Currently the Career Department is divided into three primary divisions: Operations, Life Safety (Fire Marshal), and Training. Secondary divisions include Emergency Management, Volunteer Recruitment and Retention, and EMS Billing.

The Department was created to provide supplemental operational staffing and administrative support to the County's volunteer fire and rescue companies and the Volunteer Fire and Rescue Association. In addition, the Department maintains the County's Fire and Rescue Emergency Operations Center; coordinates Emergency Management functions and related disaster services, special events planning, strategic planning and GIS/mapping services; public education and risk reduction; conducts all code-related fire inspections, and investigates the causes and origins for fires, explosions and hazardous materials incidents. The Chief is responsible for Department personnel, programs and components, and the day-to-day operational activities of the system.

CHRONOLOGY OF FREDERICK COUNTY FIRE AND RESCUE COMPANIES

Company	Founded
Stephens City Volunteer Fire Company:	**1939**
Middletown Volunteer Fire Company:	**1942**
Clear Brook Volunteer Fire Company:	**1946**
Gore Volunteer Fire Company:	**1950**
Round Hill Community Fire Company:	**1953**
Gainesboro Volunteer Fire Company:	**1958**
Star Tannery Volunteer Fire Company:	**1971**
Greenwood Volunteer Fire Company:	**1971**
North Mountain Volunteer Fire Company:	**1973**
Reynolds Store Volunteer Fire Company:	**1978**
Millwood Station Volunteer Fire Company:	**1998**

FINANCIAL BASIS

Overview

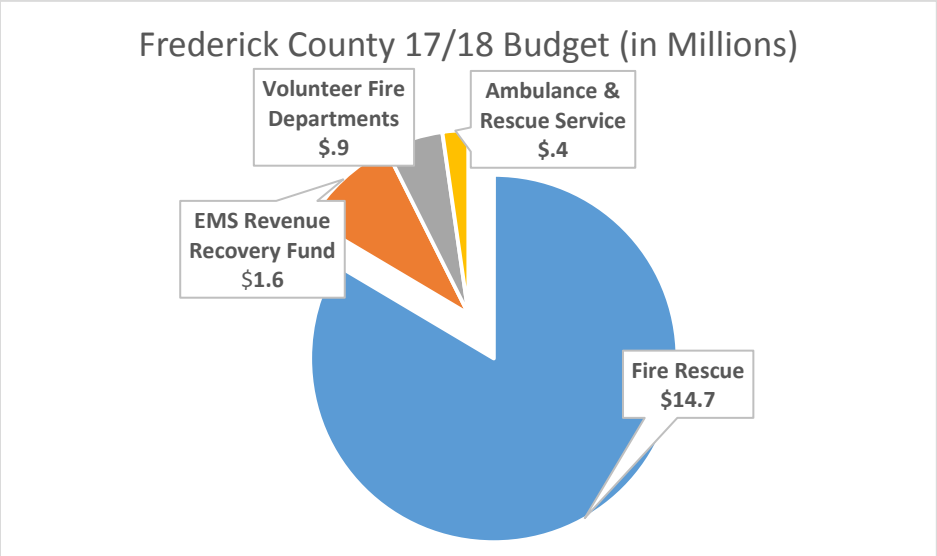
Frederick County budgets expenditures in four program areas for fire rescue services. The Table below lists those areas along with the FY17/18 budget and full-time equivalent (FTE) positions:[1]

Table 1: Fire Rescue's Program Areas - FY17/18 Expenditure Budget

Program Area	FY17/18 Budget	FTEs
Fire Rescue	$14.7 million	117.5
EMS Revenue Recovery Fund	$1.6 million	2
Volunteer Fire Departments	$.9 million	0
Ambulance & Rescue Service	$.4million	0
Total	**$17.6 million**	**119.5**

The figure that follows is a graphic representation of the funding distribution for Fire Rescue services.

Figure 2: Frederick Fire Rescue FY17/18 Expenditure Budget



In addition to the General Fund, the county has a primary revenue source to support fire rescue services, as described below.

EMS Expense Recovery. These are charges to patients who are transported by Frederick County ambulances. This is a significant revenue source for the County's General Fund and is budgeted at $1.6 million for FY17/18. The General Fund budgeted revenue for fee recovery is $491,776. The

[1] http://www.fcva.us. Frederick County FY 2017 - 2018 Annual Budget, p. 108,110,117,174

remaining expected revenue goes directly to the eleven volunteer stations based on their calls during the quarter.

Expenditure Controls and Restrictions

Management of the County is responsible for establishing and maintaining an internal control structure designed to ensure that the assets of the County are protected from loss, theft, or misuse and to ensure that adequate accounting data is compiled to allow for the preparation of financial statements in conformity with generally accepted accounting principles. The internal control structure is designed to provide reasonable, but not absolute, assurance that these objectives are met. The concept of reliable assurance recognizes that (1) the cost of a control should not exceed the benefits likely to be derived and (2) the valuation of costs and benefits requires estimates and judgments by management.

The county's Comprehensive Annual Financial Report (CAFR) for the year ending June 30, 2017, notes that the county maintains budgetary controls. The objective of these budgetary controls is to ensure compliance with legal provisions embodied in the annual appropriated budget approved by the County's governing body. Activities of the general fund, special revenue funds, and the funds of the component unit School Board are included in the annual appropriated budget. The level of budgetary control (that is, the level at which expenditures cannot legally exceed the appropriated amount) is established by function and activity within an individual fund. Open encumbrance amounts, as of June 30, 2017, have been determined and the amount of these encumbrances is reported as reservations of fund balances since they do not constitute expenditures or liabilities. Encumbrances generally are re-appropriated as part of the following year's budget.

The 2017 CAFR also provided the Independent Auditor Report which states "In our opinion, the financial statements referred to above present fairly, in all material respects, the respective financial position of the governmental activities, the business-type activities, the discretely presented component units, each major fund, and the aggregate remaining fund information of the County of Frederick, Virginia, as of June 30, 2017, and the respective changes in financial position, and, where applicable, cash flows thereof for the year then ended in accordance with accounting principles generally accepted in the United States of America."

"We did not identify any deficiencies in internal control over compliance that we consider to be material weaknesses." The controls that are in place in Frederick County, along with the Board's long-term focus and ongoing strategic planning process, indicate that the County is operating within a framework of governmental best practices.

Area Description

Geography

Frederick County is the northernmost county in the Commonwealth of Virginia and is included in the Winchester, VA-WV Metropolitan Statistical Area, which is also included in the Washington-Baltimore-Northern Virginia, DC-MD-VA-WV-PA Combined Statistical Area. Located at the North end of the Shenandoah Valley, the Blue Ridge Mountains to the East and the Allegheny Mountains (part of the Appalachian Mountain Range) to the West. The Valley is bound by two rivers, the Potomac River to the North and the James River to the South. Frederick County is 72 miles West of Washington, DC and 135 miles Northwest of Richmond, the state capitol. Winchester Regional Airport provides general aviation services for the region. Commercial options are accessible in less than an hour. IAD is only 50 minutes away and BWI & DCA provide extra destination flexibility in 90 minutes.

Longitude: -78.260102, Latitude: 39.2096441, Elevation: 268m / 879feet, Barometric Pressure: 98KPa. According to the U.S. Census Bureau, the county has a total area of 416 square miles (1,080 km^2), of which 414 square miles (1,070 km^2) is land and 2 square miles (5.2 km^2) (0.5%) is water. Frederick County has an extensive transportation infrastructure which includes major arterial roads including: Interstate 81 (North-South), Interstate 66 (East-West), US 50 (East-West), US 11 (North-South), US 522 (Northwest-Southeast), VA Primary 7 (East), VA Primary 37 (Western Bypass) and is home to Lord Fairfax Community College.

Topography

Generally, the topography of Frederick County is characterized by the rolling Shenandoah Valley, 8 to 10 miles wide. The average altitude of the broad valley is 700 feet and the mountaintops are about 1950 feet. Great North Mountain is the most prominent landmark in the Western and Southwestern parts of the county. As Great North Mountain trends southwestward from a distinct ridge along U.S Route 50, midway between Gore and Hayfield, it increases in prominence. Its altitude ranges from 800 feet in the Northeast to 2844 feet at Pinnacle Knob, the highest point in the county. Frederick County is underlain mainly by the sedimentary rocks shale, sandstone, and limestone.

Climate[2]

The average temperature of Frederick County is 52.62°F
Average high/low in July = 86/63
Average high/low in January = 40/22
Average Rainfall: 38.5 inches. The US average is 39.
Average Snowfall: 21.7 inches. The average US city gets 26 inches of snow per year

[2] Retrieved from http://www.fcva.us/services/about-us

Population and Demographic Features[3]

Frederick County population estimate of July 1, 2016: 84,421
Median household income (in 2015 dollars), 2011-2015: $69,098 ($59,209 in 2000)
Mar. 2016 cost of living index in Frederick County: 90.5 (less than average, U.S. average is 100)
Per capita income in past 12 months (in 2015 dollars), 2011-2015: $30,769
Population per square mile, 2010: 189.4 (55% urban, 45% rural)

White Non-Hispanic Alone (86.3%), Hispanic or Latino (6.6%), Black Non-Hispanic Alone (3.9%), Two or more races (1.5%), Asian alone (1.2%)

Median resident age: 39.0 years
Virginia median age: 37.0 years
Males: 40,939 (49.7%)
Females: 41,438 (50.3%)

Land area: 414 sq. mi. Water area: 2.0 sq. mi.

Industries providing employment: Professional, scientific, management, administrative, and waste management services (20.7%), Educational, health and social services (14.7%), Finance, insurance, real estate, and rental and leasing (12.4%). Private wage or salary: 66%; Government: 9%; Self-employed, not incorporated: 25%.

Disaster Potentials and Community Characteristics of Risk[4]

That assessment of risk within the community, using the Virginia Department of Emergency Management *Hazard Mitigation Plan*, was intended to reduce inconsistency and promote a rational basis for defining risk among disparate hazards. Four criteria were used in this process, and include:

- History - past record of occurrences for a specific hazard.
- Vulnerability - assesses citizens that might be killed, injured or contaminated. Also, the likelihood the property might be destroyed, damaged due to the occurrences of a specific hazard.
- Maximum Threat - considers the impact from a "worst case" scenario for a specific hazard.
- Probability - determines the likelihood of a specific hazard occurring.

For each major area of risk, the overall hazard rating is provided. The following table highlights specific hazard samples and breaks them into one of three categories: natural hazards, technological hazards, and societal hazards.

[3] Retrieved from http://www.city-data.com/county/Frederick_County-VA.html#ixzz45Ahx5nYL
[4] Virginia Department of Emergency Management-Hazard Mitigation Plan.

Table 2: Hazard Risk Categories

Natural Hazards	Technological Hazards	Societal Hazards
Tornado	Infrastructure Failure	Terrorist Attack
Winter/Ice Storm	Hazardous Materials – Fixed Site	Enemy Attack
Thunderstorm	Nuclear Power Plant Accident	Public Health
Flood	Pipelines	Civil Disturbance
Earthquake	Hazardous Materials –	
Drought	Transportation Accident	
Flash Flood	Non-Hazardous Materials	
High Temperatures	Transportation Accident	
	Fire	
	Dam Failure	
	Subsidence	

Natural Risk

Located in northern Virginia, Frederick County is most prone to winter/ice storms, tornadoes, floods and severe thunderstorms. Each of these natural risks is likely to cause a significant increase in demand on the fire department. These risks mostly would manifest themselves in disperse geographic areas, thereby stretching normal staffing and resources beyond their existing capacity.

A summary of the natural risks rated above as "negligible," and their overall hazard ratings are shown in Table below.

Table 3: Natural Risk Hazard Summary

Hazard	Overall Rating
Winter/Ice Storms	High
Flood	Med-High
Tornado	Med-High
Drought	Med-High
Wildfire	Medium
Landslide	Medium
Karst	Medium
Non-Rotational Wind	Medium
Earthquake	Med-Low

Technological Risks

From a technological hazard assessment, infrastructure failure, hazardous materials release from a fixed site, and a nuclear power plant accident were ranked with the highest potential impact on the community.

A summary of the technological risks, and their overall hazard ratings are shown in table below.

Table 4: Technological Risk Hazard Summary

Hazard	Overall Rating
Transportation: Non-Haz Mat Released	High
Hazardous Materials Release: Fixed Site	Med-High
Fire	Med-High
Transportation: Hazardous Materials Release	Med-High
Infrastructure failure	Medium
Pipeline	Medium
Dam Failure	Med-Low
Land Subsidence	Med-Low

Societal Risks

From a societal risk perspective, terrorist attacks are seen as creating the greatest potential impact on the community. While there have been no specific threats made on critical infrastructure within the area, infrastructure such as chemical, nuclear, and energy are potential targets where federal officials have issued warnings.

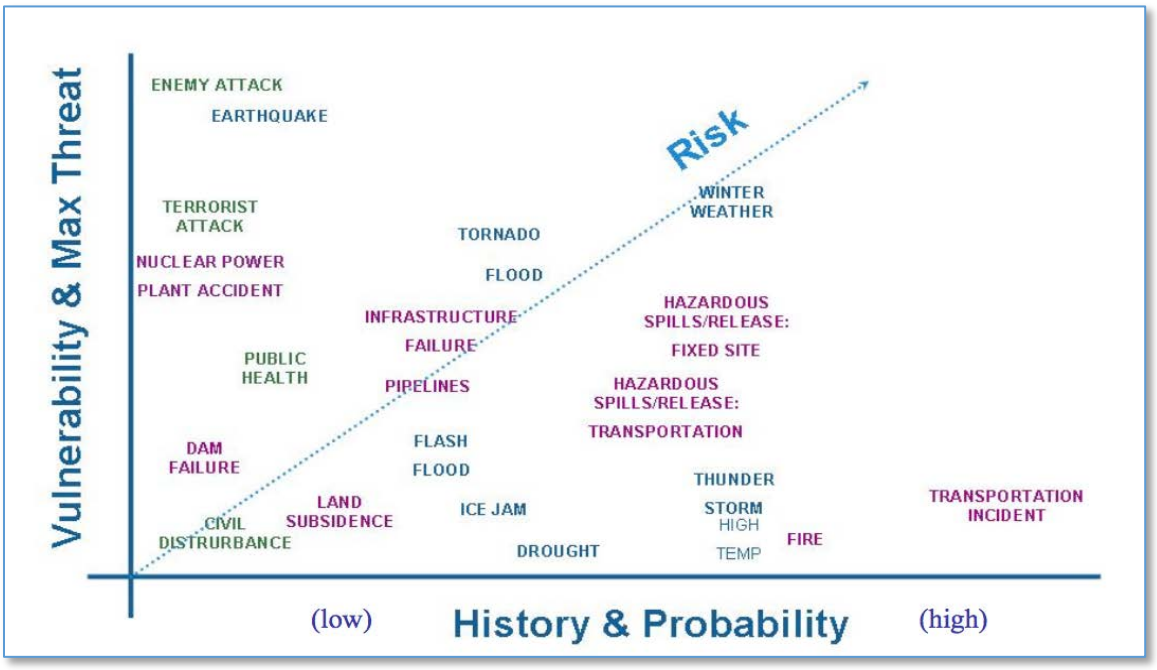
A summary of the societal risks, and their overall hazard ratings are shown in table below.

Table 5: Societal Risk Hazard Summary

Hazard	Overall Rating
Public Health	Medium
Terrorist Attack	Med-Low
Enemy Attack	Low
Civil Disturbance	Low

The following figure summarizes each hazard and plots its risk along two axes: history and probability against vulnerability and maximum threat. Caution should be used when examining only the overall ratings above. For example, while infrastructure failure has the highest overall rating, the figure below reflects the reality that winter weather has a greater probability and vulnerability along the overall risk scale. Of most importance, is the need for Frederick County Fire and Rescue to understand, and be prepared to address, disaster potentials within the community.

Figure 3: Hazard Risk Plot



SERVICES PROVIDED

Fire Suppression

The FCFR provides fire suppression services within the various jurisdictions as well as responses to requests for service from adjacent agencies. Fire suppression services are provided from 11 fixed facility fire stations distributed throughout the county. All career members of the Department are fully trained at a minimum of EMT-B and receive Firefighter I and II, Virginia HazMat Ops, EVOC I, II, III, MayDay!, vehicle extrication, and Introduction to Heavy Technical Rescue I and II during recruit school. Volunteer members may or may not have certifications.

In total, FCFR maintains the following operational units: 20 engine companies, 2 ladder companies, 1 Quint, 6 Tankers, 4 squad companies, 11 Brush units, 1 Battalion Chief Command unit, 11 Volunteer Chief vehicles, various specialty units. Minimum paid staffing of 27 per day, supported by over 160 active volunteer firefighters.

Rescue

FCFR provides Technical Rescue services, to the level of personnel training and capabilities, in conjunction with the assistance of the regional response team which can provide advanced rescue capabilities for risks such as urban search & rescue, confined space rescue, swift water rescue, dive water rescue, high and low angle rope rescue, trench rescue, helicopter rescue, and large animal rescue.

Emergency Medical Services

The FCFR provides emergency Basic Life Support (BLS) first responder level care for the sick and injured throughout the County. This is accomplished using engine, ladder and squad companies utilized as first responders. FCFR also provides Advanced Life Support (ALS) for advanced care, treatment, and transport to the hospital using 23 ambulances and 3 ALS "Chase Vehicles". All of the Department's fire suppression apparatus provides first response for BLS and ALS level incidents.

Hazardous Materials

The FCFR provides Hazardous Materials response from various fixed facility locations to provide detection and mitigation of risks within the limits of personnel training and capabilities. Additional assistance is provided by the regional response team that provides technician level trained personnel and advanced equipment.

CURRENT DEPLOYMENT STRATEGY

Fire Stations

The Frederick County Fire and Rescue utilizes 11 fixed fire station facilities to effect fire suppression, emergency medical, and special operation responses. Below is the brief overview, listed sequentially by station number, of the fire station locations, capabilities, and staffing.

Station 11: Stephens City is located at 5436 Mulberry Street, Stephens City, VA 22655

Table 6: Station 11 Resources

Apparatus Type	Quantity
Engines	2
Tower	1
Rescue Engine	1
Mini Pumper	1
Brush Unit	1
ALS Ambulances	3
HazMat Trailer	1
Boats	3
Support Unit	1
Command Vehicles	3
Total Staffing	**4 Career FCFR Personnel** **Volunteer Staff**

Station 12: Middletown is located at 7855 Main Street, Middletown, VA 22645

Table 7: Station 12 Resources

Apparatus Type	Quantity
Engines	1
Rescue Engine	1
ALS Unit	1
Mobile	1
Mini Pumper	1
Ambulances	2
Total Staffing	**2 Career FCFR Personnel** **Volunteer Staff**

Station 13: Clear Brook is located at 1256 Brucetown Road, Clear Brook, VA 22624

Table 8: Station 13 Resources

Apparatus Type	Quantity
Engines	1
Wagon	1
Tanker	1
Brush Unit	1
ALS Ambulances	2
Utility Vehicles	2
Command Vehicles	1
Total Staffing	**2 Career FCFR Personnel** **Volunteer Staff**

Station 14: Gore is located at 7184 Northwestern Pike, Gore, VA 22637

Table 9: Station 14 Resources

Apparatus Type	Quantity
Engines	1
Tanker	1
Brush Unit	1
Attack Vehicle	1
Utility Vehicles	1
Ambulances	2
Total Staffing	**2 Career FCFR Personnel** **Volunteer Staff**

Station 15: Round Hill is located at 150 Corporate Place, Winchester, VA 22602

Table 10: Station 15 Resources

Apparatus Type	Quantity
Engines	1
Rescue Engine	1
Brush Unit	1
ALS Ambulances	2
Utility Vehicle	1
Command Vehicles	1
Total Staffing	**2 Career FCFR Personnel** **Volunteer Staff**

Station 16: Gainesboro is located at 221 Gainesboro Road, Winchester, VA 22603

Table 11: Station 16 Resources

Apparatus Type	Quantity
Engines	2
Tanker	1
Mini Attack Pumper	1
Tower	1
Brush Unit	1
ALS Ambulances	2
ALS Chase Vehicle	1
Command/Support Vehicles	2
Total Staffing	**2 Career FCFR Personnel** **Volunteer Staff**

Station 17: Star Tannery is located at 950 Brill Road, Star Tannery, VA 22654

Table 12: Station 17 Resources

Apparatus Type	Quantity
Engines	2
Tanker	1
Brush Unit	1
Ambulance	1
Support Vehicle	1
Total Staffing	**2 Career FCFR Personnel** **Volunteer Staff**

Station 18: Greenwood is located at 809 Greenwood Road, Winchester, VA 22602

Table 13: Station 18 Resources

Apparatus Type	Quantity
Engines	1
Quint	1
Brush Unit	1
Utility Vehicles	1
Ambulances	3
Total Staffing	**4 Career FCFR Personnel** **Volunteer Staff**

Station 19: North Mountain is located at 186 Rosenberger Lane, Winchester, VA 22602

Table 14: Station 19 Resources

Apparatus Type	Quantity
Engines/Tanker	1
Mini Pumper	1
Tanker	1
Brush Unit	2
Ambulances	2
Utility Vehicles	1
Command Vehicles	1
Total Staffing	**2 Career FCFR Personnel** **Volunteer Staff**

Station 20: Reynolds Store is located at 9381 North Frederick Pike, Cross Junction, VA 22625

Table 15: Station 20 Resources

Apparatus Type	Quantity
Engines	1
Rescue Engine	1
Tanker	1
Brush Units	2
Off-Road Suppression Unit	1
ALS Ambulances	2
Utility Vehicles	1
Command Vehicles	1
Total Staffing	**2 Career FCFR Personnel** **Volunteer Staff**

Station 21: Millwood Station is located at 250 Costello Drive, Winchester, VA 22602

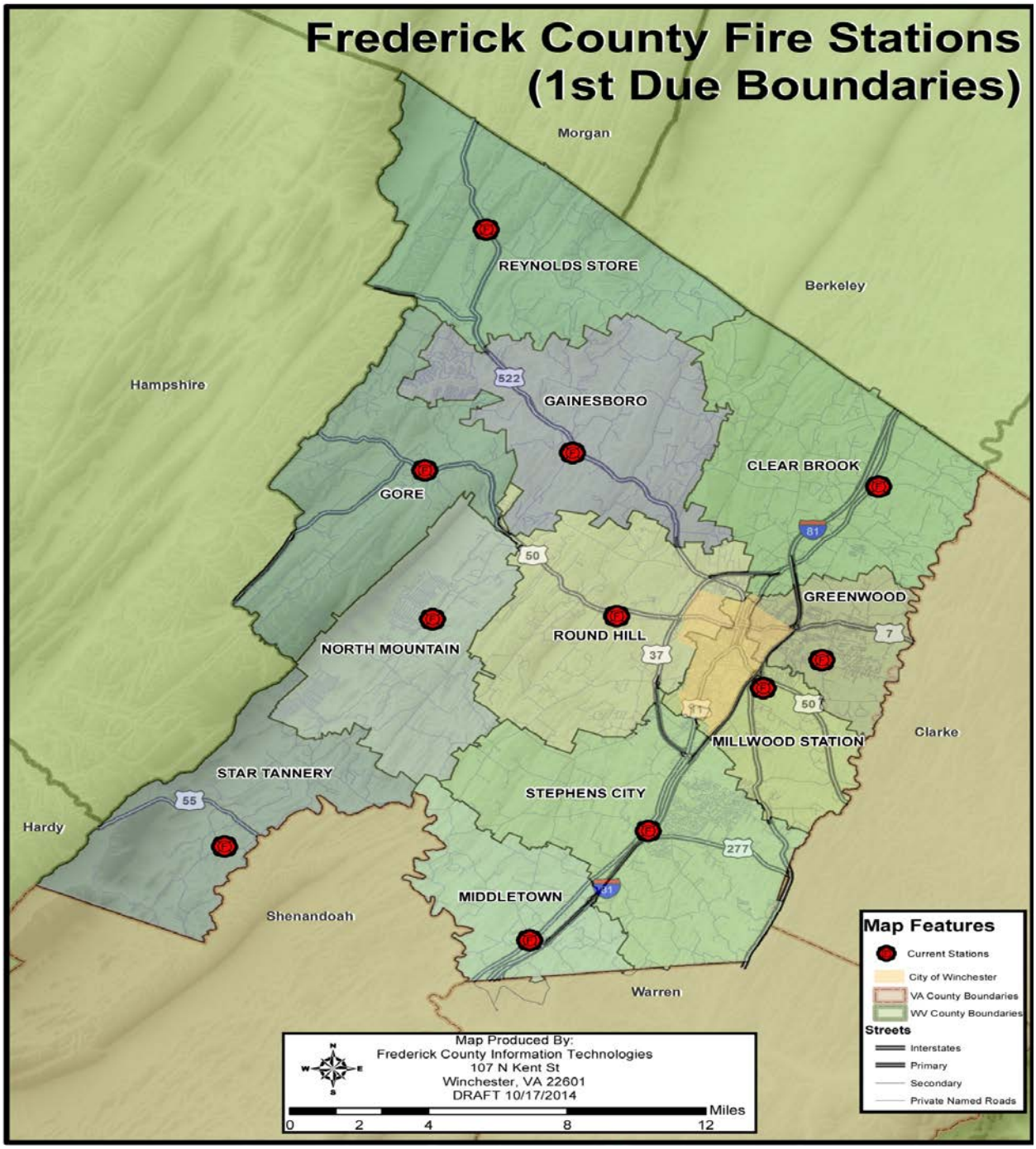
Table 16: Station 21 Resources

Apparatus Type	Quantity
Engines	1
Rescue Squad	1
Rescue Engine (reserve)	1
ALS Ambulances	2
Utility Vehicle	1
Total Staffing	**2 Career FCFR Personnel** **Volunteer Staff**

Response Areas

Consistent with the station distribution model currently utilized by FCFR there are 11 distinct station service areas. The fire station service areas have been utilized for all planning aspects for managing risk, demand, and performance. A map of the fire department service areas is provided in the following Figure.

Figure 4: Frederick County Fire Station 1st Due Boundaries[5]



[5] Frederick County Information Technologies. (2014).

Current Staffing Strategy

Evaluation of staffing levels was conducted for the Frederick County system, as a whole and each fire company separately. A survey was sent to FCFR requesting information on career personnel, broken down by either shift assignment or a daytime assignment; and to each fire company for volunteer personnel, capturing those capable of interior activities versus those non-interior qualified or limited to support/non-fire roles. Information was also gathered from this survey on those classified as officers, driver operators, medical first responder, EMT or paramedic. The requested information was received by all agencies.

Dual Rostered Personnel

Utilizing available company rosters, a limitation of this analysis is that it was not possible to identify those career personnel who may also volunteer in their local communities. To effectively evaluate the true number of total personnel in the FCFR system it would be necessary to cross-reference each company roster against the FCFR career roster. The total number of personnel available for any incident would be reduced by the number of individuals appearing on more than one roster.

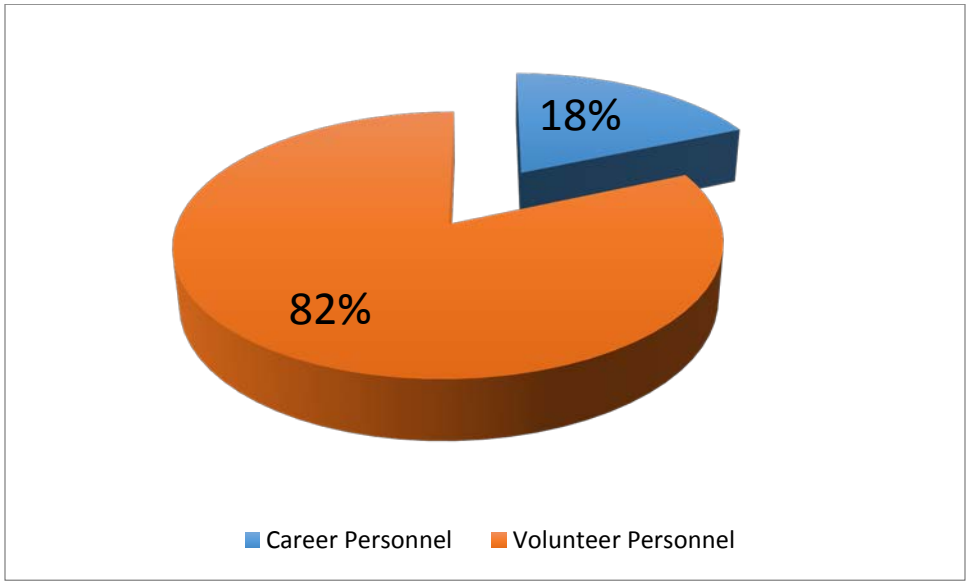
Career and Volunteer Demographics

When examining all fire companies within Frederick County, the distribution between career and volunteer personnel is reflected in the following figures. With 613 total personnel, approximately 82% are volunteers. *However, the total number of volunteer personnel reported may include non-active members as well as limited capability members as identified in Table 19.*

Table 17: Career & Volunteer Personnel by Agency Listed alphabetically after Frederick County Fire Rescue

Department	Career Personnel	Volunteer Personnel	Total Staff
Frederick County Fire and Rescue	113	0	113
Clear Brook	n/a	34	34
Gainesboro	n/a	110	110
Gore	n/a	25	25
Greenwood	n/a	48	48
Middletown	n/a	68	68
Millwood	n/a	36	36
North Mountain	n/a	24	24
Reynolds Store	n/a	43	43
Round Hill	n/a	34	34
Star Tannery	n/a	27	27
Stephens City	n/a	51	51
TOTALS	113	500	613

Figure 5: Fire Personnel Composition – All Agencies



Of the 500 members reported on company rosters, excluding FCFR, approximately 164, or roughly 33%, are certified as interior structural firefighters.

Administration, Emergency Services and Support Staff

Table 18: Summary of Administration, Emergency Services, and Support Staff Listed Alphabetically after Frederick County Fire Rescue

	Fire Chief	Vol Fire Chief	Dep Chief	Vol. Dep Chief	Asst. Chief	Vol. Asst Chief	Batt. Chief	Vol. Batt. Chief	Trng Officer	Vol. Safety Officer	Clerical[6]	Mech/ Other	FM Invest/ Inspect
Frederick County FR[7]	1	0	3	0	0	0	3	0	2	0	7	1	3
Clear Brook	0	1	0	0	0	1	0	0	0	0	4	0	0
Gainesboro	0	1	0	1	0	1	0	0	0	0	4	0	0
Gore	0	1	0	0	0	0	0	0	0	0	6	0	0
Greenwood	0	1	0	0	0	1	0	0	0	0	6	0	0
Middletown	0	1	0	0	0	1	0	0	0	1	4	0	0
Millwood Station	0	1	0	1	0	0	0	0	0	0	4	0	0
North Mountain	0	1	0	0	0	1	0	0	0	1	6	0	0
Reynolds Store	0	1	0	1	0	0	0	0	0	0	6	0	0
Round Hill	0	1	0	0	0	1	0	0	0	0	6	0	0
Star Tannery	0	1	0	0	0	1	0	0	0	0	5	0	0
Stephens City	0	1	0	2	0	1	0	0	0	4	5	0	1[8]

[6] Several of the Volunteer Companies have Officers and Operational Staff who also serve in Board/Administrative positions. For example, the Assistant Chief at Round Hill is also the Vice President of the Board.

[7] See below for more detailed staff listing for the Departments.

[8] Stephens City F&R's Assistant Chief also serves as the Fire Marshal only within the Stephens City town limits.

Table 19: Summary of Personnel by Type, Work Schedule, and Qualifications listed in Alphabetical Order after Frederick County Fire Rescue

Department	Career Full-Time (state certified)		Career Part-Time (state certified)		Volunteer Interior Firefighter	Volunteer Non-Interior Firefighter	Volunteer Support/ auxiliary (non-firefighter)	EMS Only	Total Staff
	Full-Time - 24 Hour Shift	Full-Time - 8 to 5	Part-Time - Shift	Part-Time – 8 to 5					
FCFR	103	10	0	0	0	0	0	0	113
Clear Brook	0	0	0	0	14	5	10	0	29
Gainesboro	0	0	0	0	37	4	32	6	79
Gore	0	0	0	0	9	2	11	3	25
Greenwood	0	0	0	0	24	9	9	5	47
Middletown	0	0	0	0	13	3	10	0	26
Millwood	0	0	0	0	18	6	11	1	36
North mountain	0	0	0	0	9	4	11	0	24
Reynolds Store	0	0	0	0	8	8	14	0	30
Round Hill	0	0	0	0	8	5	9	0	22
Star Tannery	0	0	0	0	2	3	8	4	17
Stephens City	0	0	0	0	22	11	8	0	41
TOTALS	103	10	0	0	164	60	133	19	489

Of the 500 members reported on company rosters, excluding FCFR, approximately 164, or roughly 33%, are certified as interior structural firefighters.

Certifications and qualifications of personnel, by agency, are reflected in the table below. As noted, the number of personnel qualified to serve in an officer's role, as well as those qualified to serve as a driver operator- as determined by the fire company – is significant. Of interest is the high percentage of personnel certified at the emergency medical technician (EMT) and Paramedic level. This represents approximately 43% of the entire FCFR system or 30% when excluding FCFR.

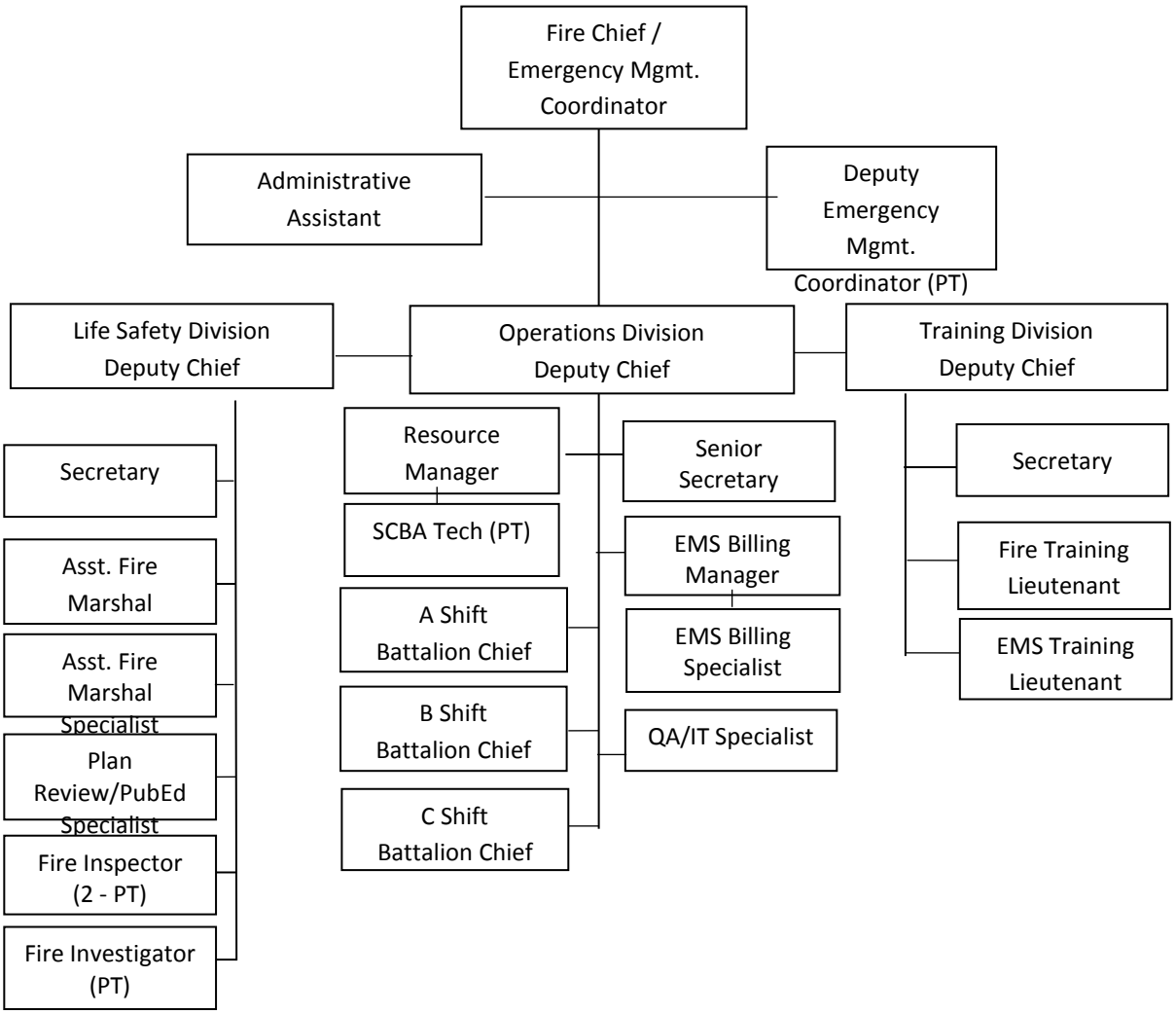
Table 20: Qualifications & Certifications by Fire Company Listed sequentially by station number

Department	Officers	Driver **Operator	Medical First Responder	EMT*	Paramedic
Frederick Co Fire Rescue	31	113	0	90	23
Clear Brook	1	14	0	11	1
Gainesboro	9	40	0	22	6
Gore	1	5	3	7	2
Greenwood	7	25	0	21	1
Middletown	8	19	11	9	1
Millwood	7	8	0	13	3
North Mountain	4	10	0	12	0
Reynolds Store	6	14	0	10	0
Round Hill	4	2	0	10	1
Star Tannery	6	15	0	6	0
Stephens City	7	21	0	15	1
TOTALS	91	286	14	226	39

Notes: *EMT includes B, E, I; ** Driver Operator includes EVOC and DPO, total not verifiable due to incomplete information reported. Each Volunteer Company maintains their own requirements for officers and drivers.

Figure 6: Frederick County Fire Rescue Organizational Chart

FREDERICK COUNTY FIRE AND RESCUE CAREER STAFF



COMMUNITY RESPONSE HISTORY

Methodology

Although FITCH collected three years (2014-2016) of CAD data, in this section of the report, the primary focus of our analysis was on the 2016 calendar year. The most recent year is utilized for measures of workload, call volume, and response time performance, because utilizing the entire three-year data set would artificially lower all measures as growth is moderated. We discuss the three years' baseline workload and response time performances as appropriate. Here we focus on responses from the following 11 Fire Companies:

Table 21: List of Fire Companies Evaluated in Alphabetical Order

Fire Company
Clear Brook
Gainesboro
Gore
Greenwood
Middletown
Millwood
North Mountain
Reynolds Store
Round Hill
Star Tannery
Stephens City

Two distinct measures were utilized: call volume and workload. First, is the number of requests for service that are defined as either "dispatches" or "calls". Dispatches/calls are the number of times a specific incident was created involving any of the 11 agencies. Conversely, "responses" are the number of times that an individual unit (or units) responded to a call. Responses will be utilized on all Agency, Station and Unit level analyses, which account for all elements of workload and performance. Calls have been categorized as EMS, Fire, Rescue, Hazard, and Mutual aid calls respectively. Transport calls are identified if any responding ambulance has recorded a unit transport time or unit arriving at hospital time.

Overview of Community Response Performance

In the year of 2016, Frederick County Fire and Rescue responded to a total of 10,250 incidents[9], which represented a 2.8% growth from 2015. EMS service requests totaled 8,133, accounting for 79.3% of the total number of incidents. The number of fire related calls were 1,379, which accounted for 13.5% of the dispatched incidents. Rescue and hazmat calls totaled 323, which accounted for 3.2% of the total incidents. A total of 382 incidents were mutual aid requests.

The number of individual unit responses will be more reflective of total workload since 54 percent of the calls resulted in multiple units responding. As summarized in Table 24, all units from the Frederick County Fire and Rescue combined made 20,609 responses and were busy on emergency calls 18,103 hours. On average, each response lasted 52.7 minutes from dispatched to clear.

Table 22: 2014 – 2016: Number of Incidents Dispatched by Category

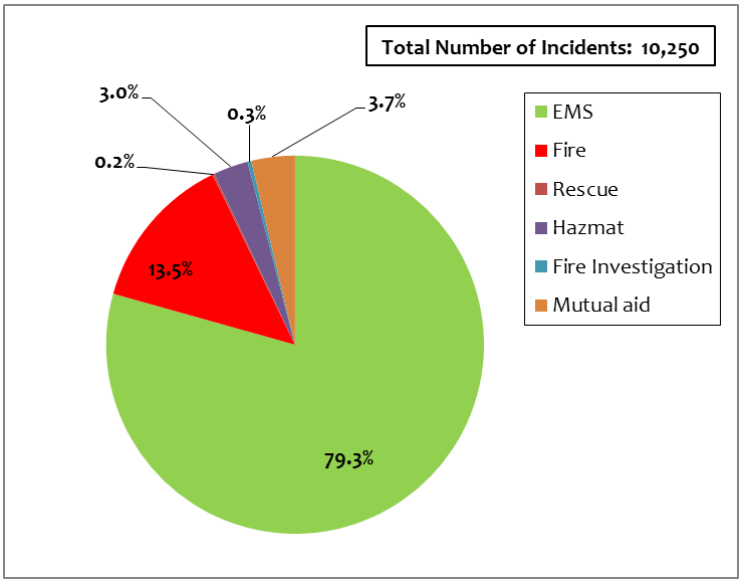
Call Category	Number of Calls		
	2014	2015	2016
Cardiac and stroke	1,013	1,010	1,138
Seizure and unconsciousness	687	673	731
Breathing difficulty	787	871	729
Overdose and psychiatric	144	125	152
MVC	505	578	582
Fall and injury	1,510	1,622	1,741
Illness and other	2,791	3,043	3,060
EMS Total	**7,437**	**7,922**	**8,133**
Structure fire	130	123	113
Outside fire	142	102	117
Vehicle fire	93	85	84
Alarm	493	437	476
Public service	282	354	424
Move-up	51	56	47
Fire other	96	120	118
Fire Total	**1,287**	**1,277**	**1,379**
Rescue	14	11	18
Hazmat	327	333	305
Fire Investigation	39	44	33
Mutual aid	383	380	382
Total	**9,487**	**9,967**	**10,250**
Calls per Day	**26.0**	**27.3**	**28.1**
YoY Growth	**NA**	**5.1%**	**2.8%**

[9] 296 Incidents were in CAD that did not have any Frederick County units assigned and were excluded. Therefore, if these incidents were included, the total count in 2016 would be 10,546.

Table 23: Number of Incidents Dispatched by Category in 2016

Call Category	Number of Calls	Calls per Day	Call Percentage
Cardiac and stroke	1,138	3.1	11.1%
Seizure and unconsciousness	731	2.0	7.1%
Breathing difficulty	729	2.0	7.1%
Overdose and psychiatric	152	0.4	1.5%
MVC	582	1.6	5.7%
Fall and injury	1,741	4.8	17.0%
Illness and other	3,060	8.4	29.9%
EMS Total	**8,133**	**22.3**	**79.3%**
Structure fire	113	0.3	1.1%
Outside fire	117	0.3	1.1%
Vehicle fire	84	0.2	0.8%
Alarm	476	1.3	4.6%
Public service[10]	424	1.2	4.1%*
Move-up	47	0.1	0.5%
Fire other	118	0.3	1.2%
Fire Total	**1,379**	**3.8**	**13.5%**
Rescue	**18**	**0.0**	**0.2%**
Hazmat	**305**	**0.8**	**3.0%**
Fire Investigation	**33**	**0.1**	**0.3%**
Mutual aid	**382**	**1.0**	**3.7%**
Total	**10,250**	**28.1**	**100.0%**

Figure 7: Percentage of Total Incidents Dispatched by Program in 2016



[10] Public Service requests are for assistance requiring a response but are found to be something other than an active fire.

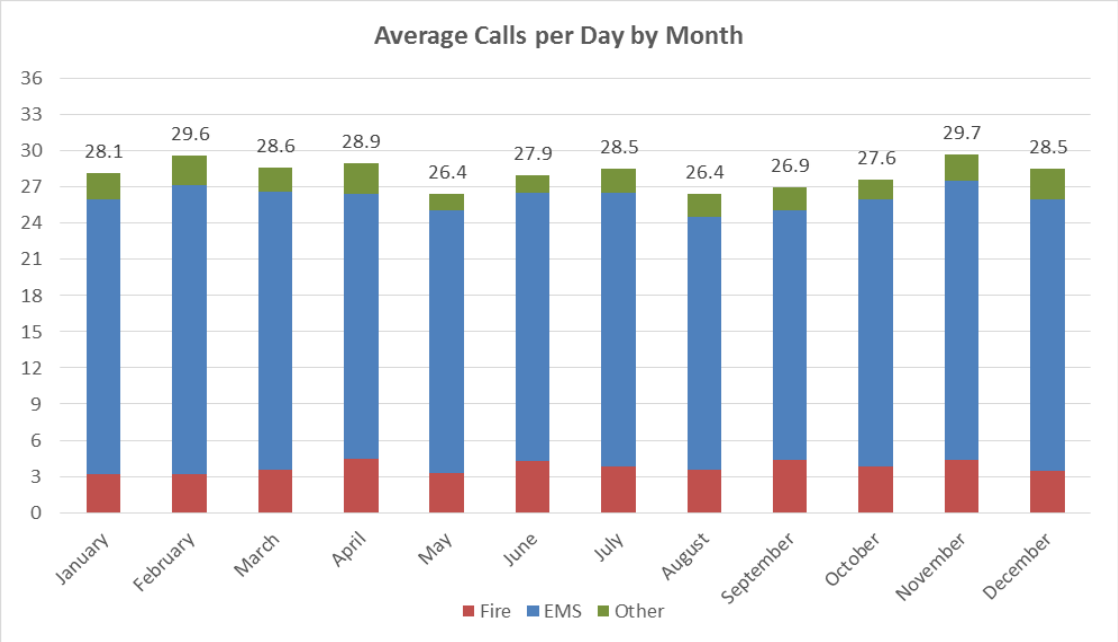
Table 24: Number of Calls, Number of Responses, and Total Busy Time by Program in 2016

Program	Number of Calls	Number of Responses	Average Responses per Call	Total Busy Hours	Average Busy Minutes per Response	Percentage of Total Busy Hours[11]
EMS	8,133	15,408	1.9	13,971	54.4	77.2%
Fire	1,379	3,488	2.5	2,703	46.5	14.9%
Rescue	305	804	2.6	488	36.4	2.7%
Hazmat	18	70	3.9	40	34.1	0.2%
Fire Investigation	33	43	1.3	158	220.2	0.9%
Mutual aid	382	796	2.1	744	56.0	4.1%
Total	**10,250**	**20,609**	**2.0**	**18,103**	**52.7**	**100.0%**

Temporal analyses were conducted to evaluate patterns in community demands. These measures examined the frequency of requests for service by month, day of week, and hour of day. In the following temporal analysis, rescue, hazmat, fire investigation and mutual aid calls were grouped into the other category for presentation purpose.

Overall, average requests per month ranged from a low of 26.4 per day in May to a high of 29.7 per day in November. The top three months with the most demands in the descending order are: November (29.7 per day), February (29.6 per day) and April (28.9 per day).

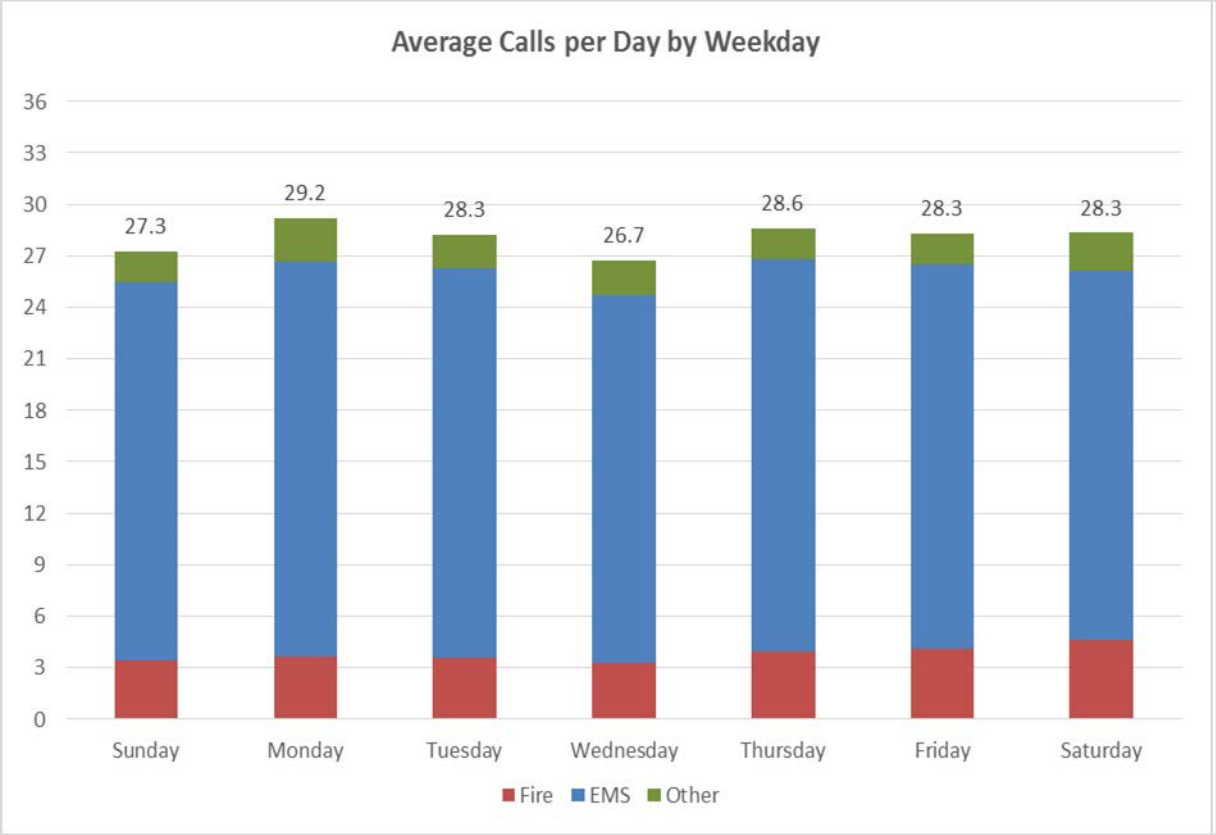
Figure 8: Overall: Average Calls per Day by Month in 2016



[11] Hours are for apparatus or unit hours and not specifically personnel hours. The total personnel hourly commitment would be calculated as the product of the total busy hours and the number of personnel assigned to each unit.

Similar analyses were conducted for requests by day of week. The data revealed that there is little variability in the demand for services by day of week. Wednesday was the lowest for the week at 26.7 calls per day. Monday has the highest frequency of requests for services at 29.2 calls per day.

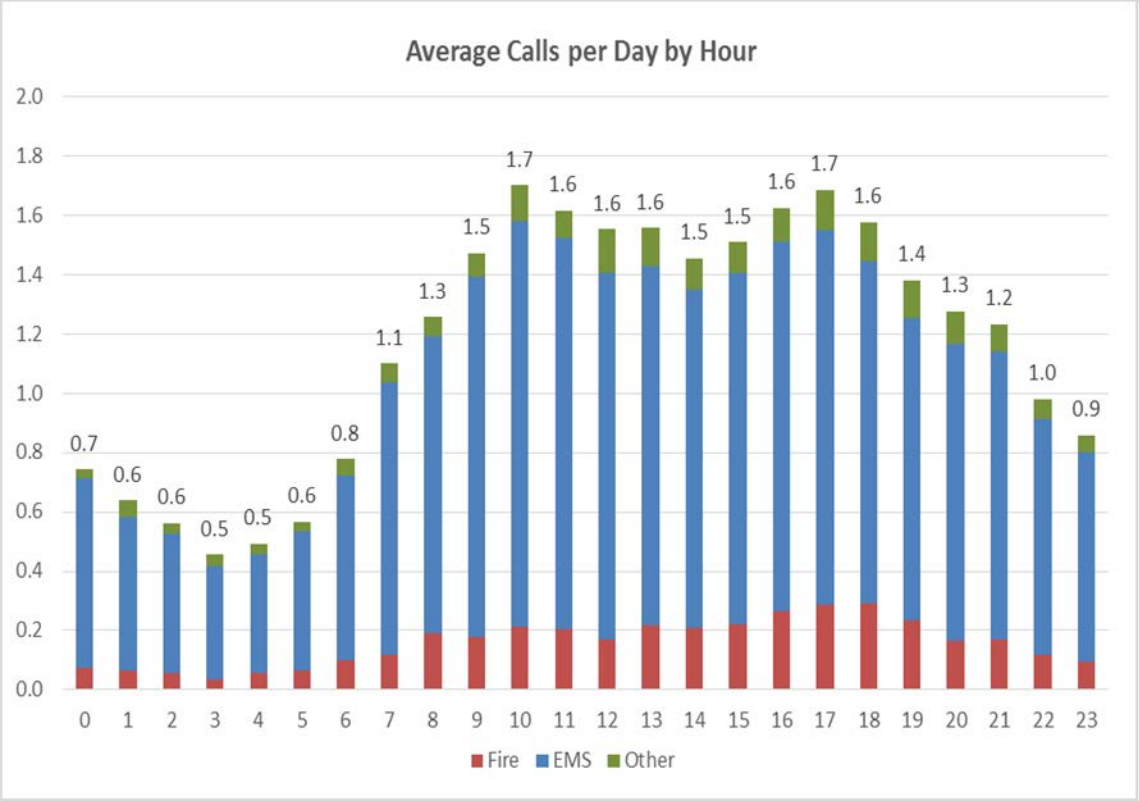
Figure 9: Overall: Average Calls per Day by Weekday in 2016



Overall demands were evaluated by the hour of the day. Considerable variability exists in the time of day that requests for emergency services are received. The average number of calls per hour is 427 or 1.2 per hour. The data illustrates that the busiest times of the day are between 1000 and 1700. The hour with the peak demand is at 1000.

To provide a more granular understanding of the community's demand for emergency services, this temporal analysis included the average number of calls per hour. In other words, when referring to the figure below, the busiest hour is at 1000 with 621 calls during that hour. The average number of calls per hour is a daily average for those 621 calls if they were equally distributed. Therefore, the busiest hour per day would be at 1000 with an average hourly call volume at 1.70 calls per day. The second busiest hour is at 1700 with 616 calls during the hour, and averaged 1.69 calls per hour.

Figure 10: Overall: Average Calls per Day by Hour in 2016



Overall, all units made 20,609-unit responses, and the total busy hours were 18,103 hours. On average, a Frederick County Fire and Rescue unit spent 52.7 minutes from dispatch to clear. Units in the Greenwood station was dispatched most, totaling 4,453 runs a year, averaging 12.2-unit responses, and 11.3 hours a day.

Table 25: Overall Workload by Station Listed alphabetically

Station	Number of Calls	Annual Total Responses	Annual Busy Hours	Average Responses per Call	Avg. Busy Minutes per Response	Busy Hours per Day	Unit Responses per Day
Clear Brook	1,123	1,316	1,235	1.2	56.3	3.4	3.6
Gainesboro	1,334	1,390	1,250	1.0	54.0	3.4	3.8
Gore	400	580	579	1.5	59.9	1.6	1.6
Greenwood	2,498	2,560	2,351	1.0	55.1	6.4	7.0
Middletown	1,184	1,673	1,608	1.4	57.7	4.4	4.6
Millwood	1,893	2,172	1,579	1.1	43.6	4.3	6.0
North Mountain	465	754	638	1.6	50.7	1.7	2.1
Public Safety Building	1,512	1,649	1,104	1.1	40.2	3.0	4.5
Reynolds Store	393	552	546	1.4	59.4	1.5	1.5
Round Hill	1,822	2,273	1,806	1.2	47.7	4.9	6.2
Star Tannery	219	249	334	1.1	80.5	0.9	0.7
Stephens City	2,207	2,674	2,466	1.2	55.3	6.8	7.3
Total	**10,250**	**17,842**	**15,495**	**1.7**	**52.1**	**42.5**	**48.9**

Table 26: Overall Workload by Unit Volunteer Companies listed alphabetically

Station	Unit	Unit Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
Clear Brook	A132	Medic Unit	65.0	527.3	487
	A131	Medic Unit	66.8	387.5	348
	E13	Engine	33.7	123.5	220
	W13	Wagon	38.5	76.5	119
	B13	Brush	39.7	44.4	67
	T13	Tanker	54.3	57.0	63
	CH13	Chief Officer	89.2	13.4	9
	MO13	Mobile	139.3	4.6	2
	SV13	Serve	46.6	0.8	1
	Clear Brook Total		**56.3**	**1,234.9**	**1,316**
Gainesboro	ALS1	ALS Chase Unit	58.1	846.1	874
	CH16	Chief Officer	40.5	227.2	337
	A162	Medic Unit	66.5	344.8	311
	A161	Medic Unit	59.1	232.3	236
	W16	Wagon	37.8	90.1	143
	E16	Engine	44.9	66.5	89

Station	Unit	Unit Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
	T16	Tanker	53.8	69.0	77
	MO16	Mobile	71.7	82.5	69
	AT16	Attack	54.2	55.1	61
	TW16	Aerial	59.8	37.8	38
	ALS16	ALS Chase Unit	106.7	26.7	15
	B16	Brush	82.6	17.9	13
	BT16	Boat	2.5	0.0	1
	Gainesboro Total		**55.5**	**2,096.0**	**2,264**
Gore	A142	Medic Unit	70.4	195.9	167
	A141	Medic Unit	69.6	141.6	122
	E14	Engine	43.8	62.8	86
	SV14	Serve	35.4	50.7	86
	AT14	Attack	66.5	45.4	41
	CH14	Chief Officer	65.3	33.7	31
	T14	Tanker	61.2	27.6	27
	B14	Brush	84.8	17.0	12
	W14	Wagon	29.1	2.9	6
	MO14	Mobile	40.0	1.3	2
	Gore Total		**59.9**	**578.9**	**580**
Greenwood	ALS2	ALS Chase Unit	55.8	1,761.9	1,893
	A183	Medic Unit	65.0	1,132.8	1,046
	A181	Medic Unit	60.3	764.2	760
	E18	Engine	31.6	145.2	276
	Q18	Aerial	26.9	103.9	232
	CH18	Chief Officer	22.5	62.5	167
	A184	Medic Unit	132.3	130.1	59
	B18	Brush	41.2	10.3	15
	SV18	Serve	36.5	1.8	3
	MO18	Mobile	8.3	0.3	2
	Greenwood Total		**55.4**	**4,112.9**	**4,453**
Middletown	A121	Medic Unit	66.2	453.3	411
	A122	Medic Unit	68.9	434.9	379
	ALS12	ALS Chase Unit	63.1	317.4	302
	RE12	Rescue Engine	30.2	146.6	291
	ET12	Engine	36.6	60.4	99
	CH12	Chief Officer	58.7	78.3	80
	AT12	Attack	44.0	38.9	53
	MO12	Mobile	47.6	41.2	52
	ATV12	ATV	363.7	36.4	6
	Middletown Total		**57.7**	**1,607.5**	**1,673**

Station	Unit	Unit Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
Millwood Station	A211	Medic Unit	57.9	764.2	792
	RE21	Rescue Engine	26.5	206.5	467
	E21	Engine	27.0	207.4	460
	A212	Medic Unit	56.3	314.4	335
	A101	Medic Unit	48.7	62.5	77
	SV21	Serve	34.7	22.6	39
	CH21	Chief Officer	42.2	1.4	2
	Millwood Station Total		**43.6**	**1,578.9**	**2,172**
North Mountain	A192	Medic Unit	62.8	174.9	167
	A191	Medic Unit	69.4	173.4	150
	CH19	Chief Officer	40.5	91.7	136
	W19	Pumper	41.9	59.3	85
	SV19	Serve	26.5	37.1	84
	AT19	Attack	33.4	36.7	66
	T19	Tanker	54.9	43.9	48
	B19	Brush	72.3	20.5	17
	E19	Engine	0.1	0.0	1
	North Mountain Total		**50.7**	**637.6**	**754**
Public Safety Building	BTL10	Duty Officer Vehicle	32.0	743.2	1,394
	FM102	Fire Marshal	68.6	61.7	54
	FM1	Fire Marshal	82.4	70.0	51
	FM2	Fire Marshal	152.7	119.6	47
	CH10	Chief Officer	34.1	17.6	31
	OPS1	Chief Officer	26.4	11.0	25
	FM103	Fire Marshal	176.5	50.0	17
	BTX10	Duty Officer Vehicle	27.6	4.6	10
	TN102	Support Vehicle	20.6	1.7	5
	HZM10	HazMat Truck	144.6	7.2	3
	TN10	Chief Officer	84.5	4.2	3
	E10	Engine	21.5	1.1	3
	EM10	Support Vehicle	178.2	8.9	3
	FM106	Fire Marshal	88.8	3.0	2
	TN101	Support Vehicle	8.5	0.1	1
	Public Safety Building Total		**40.2**	**1,104.0**	**1,649**
Reynolds Store	A202	Medic Unit	80.1	215.1	161
	E20	Engine	49.8	102.2	123
	T20	Tanker	62.6	55.3	53
	A201	Medic Unit	71.7	60.9	51
	AT20	Attack	50.4	38.7	46
	MO20	Mobile	40.8	26.5	39

Station	Unit	Unit Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
	RE20	Rescue Engine	31.3	16.2	31
	CH20	Chief Officer	40.4	20.2	30
	B201	Brush	18.4	3.4	11
	B202	Brush	114.2	7.6	4
	B203	Brush	3.5	0.2	3
	Reynolds Store Total		**59.4**	**546.2**	**552**
Round Hill	A152	Medic Unit	60.9	988.4	974
	RE15	Rescue Engine	30.9	182.1	354
	A151	Medic Unit	60.9	345.2	340
	E15	Engine	26.0	107.2	247
	SV15	Serve	29.1	84.7	175
	CH15	Chief Officer	33.4	58.4	105
	B15	Brush	30.9	39.6	77
	AT15	Attack	1.2	0.0	1
	Round Hill Total		**47.7**	**1,805.6**	**2,273**
Star Tannery	A171	Medic Unit	94.2	260.7	166
	B17	Brush	52.7	24.6	28
	W17	Pumper	50.8	16.9	20
	T17	Tanker	64.4	21.5	20
	E17	Engine	46.9	9.4	12
	SV17	Serve	16.3	0.8	3
	Star Tannery Total		**80.5**	**333.9**	**249**
Stephens City	A113	Medic Unit	61.8	974.8	947
	A112	Medic Unit	65.3	592.3	544
	A111	Medic Unit	64.1	401.4	376
	CH11	Chief Officer	31.5	124.8	238
	W11	Engine	35.8	118.7	199
	E11	Engine	35.2	113.2	193
	AT11	Attack	28.2	27.8	59
	MO11	Mobile	23.8	20.2	51
	TW11	Aerial	39.4	29.5	45
	TRS11	Tech Rescue	259.2	21.6	5
	BT11	Boat	244.9	20.4	5
	SV11	Serve	12.3	0.8	4
	ALS11	Mobile	54.5	2.7	3
	BT111	Boat	387.8	6.5	1
	HZM11	Support Trailer	26.5	0.4	1
	BT112	Boat	603.3	10.1	1
	UT11	Utility	28.8	0.5	1
	B11	Brush	38.3	0.6	1

Station	Unit	Unit Type	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses
	Stephens City Total		55.3	2,466.2	2,674
Frederick County Total			52.7	18,102.8	20,609

This analysis utilized the first arriving units of all distinct incidents. CAD data does not differentiate dispatch and turnout times reliably, so dispatch and turnout time are reported together. The mean (average) dispatch and turnout time was 312 seconds (5 minutes and 12 seconds). The mean (average) travel time was 354 seconds (5 minutes 54 seconds), and response time was 672 seconds (11 minutes and 12 seconds). The average response time is the same as the sum of the average dispatch time and turnout and travel time.

However, a more conservative and reliable measure of performance is the fractile or percentile. This measure is more robust, or less influenced by outliers, than measures of central tendency such as the mean. Best practice is to measure at the 90th percentile. In other words, 90% of all performance is captured expecting that 10% of the time the department may experience abnormal conditions that would typically be considered an outlier. For example, if the department were to report an average response time of six minutes, then in a normally distributed set of data, half of the responses would be longer than six minutes and half of the responses would be less than six minutes. The 90th percentile communicates that 9 out of 10 times the department performance is predictable and thus more clearly articulated to policy makers and the community.

The performance for dispatch and turnout time at the 90th percentile was 437 seconds (7 minutes and 17 seconds), travel time was 623 seconds (10-minutes and 23 seconds), and response time was 16.4 minutes. Please note that the summation of 90th percentile dispatch and turnout time, and 90th percentile travel time is not the same as 90th percentile response time.

Table 27: Average Dispatch, Turnout and Travel Time of First Arriving Units by Program in 2016

Program	Dispatch and Turnout Time	Travel Time	Response Time	Sample Size[12]
EMS	5.3	5.9	11.1	7,519
Fire	4.8	6.4	11.2	1,088
Rescue	5.4	6.0	11.4	15
Hazmat	5.5	5.9	11.3	274
Total	**5.2**	**5.9**	**11.2**	**8,896**

[12] The sample size is different from the totals reported in Tables 1 and 2 due to missing data elements such as missing time elements. Therefore, 87% of the total incidents are represented and are statistically robust to make inferences about the total population.

Figure 11: Average Turnout and Travel Time by Call Category in 2016

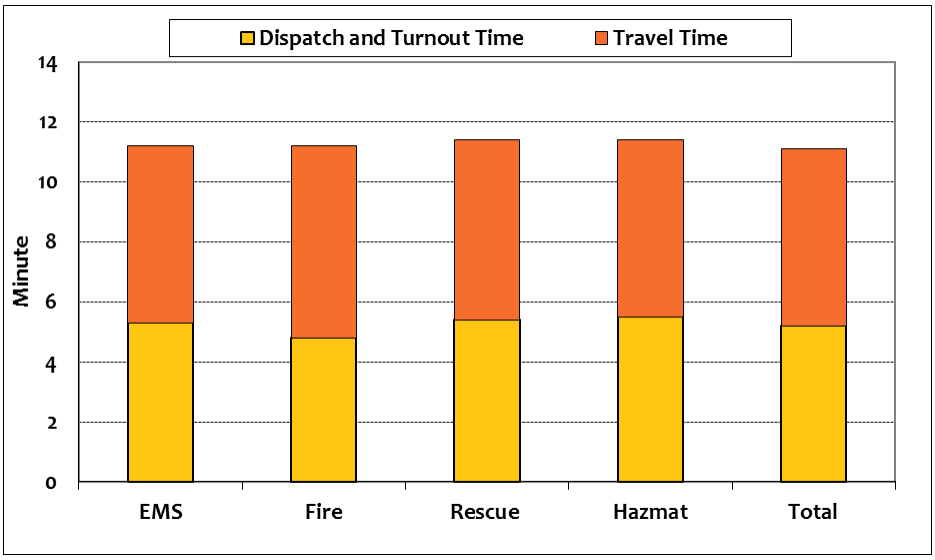


Table 28: 90th Percentile Turnout and Travel Time of First Arriving Units by Program in 2016

Program	Dispatch and Turnout Time	Travel Time	Response Time	Sample Size
EMS	7.3	10.1	16.1	7,519
Fire	7.5	11.7	17.6	1,088
Rescue	8.6	9.6	17.6	15
Hazmat	8.0	10.7	17.1	274
Total	**7.3**	**10.4**	**16.4**	**8,896**

The 911-communication center utilizes a system called the Medical Priority Dispatching System (MPDS) that triages emergency medical service calls by clinical acuity or severity. This system is used internationally and is very successful tool utilized to ensure that the right resource is sent to the right call. When reviewing the tables below, in general, the Alpha calls are the least severity incidents and could largely be responded to non-emergency and progresses to the most severe incidents as an Echo call. While it is not a straight linear pattern as the clinical severity escalates, alpha calls are the least severe and echo calls are the most severe.

The average travel time varied by EMD code from 4.8 minutes for Echo calls to 8.3 minutes for Omega calls. The 90th percentile response times were consistently more than 14 minutes and the aggregate total response time was 16.1 minutes. Echo type of EMS calls has the shortest average and 90th percentile response time.

Table 29: EMS Calls: Average Dispatch, Turnout and Travel Time of First Arriving Units by EMD Code in 2016

Program	Dispatch and Turnout Time	Travel Time	Response Time	Sample Size
Alpha	5.5	6.0	11.6	1,911
Bravo	5.5	5.7	11.2	882
Charlie	5.6	6.0	11.6	1,407
Delta	5.3	5.8	11.1	1,931
Echo	4.2	4.8	9.0	109
Omega*	5.5	8.3	13.8	29
Missing	4.4	5.6	10.0	1,250
EMS Total	**5.3**	**5.9**	**11.1**	**7,519**

**Omega indicates obvious fatality*

Figure 12: EMS Calls: Average Turnout and Travel Time by EMD Code in 2016

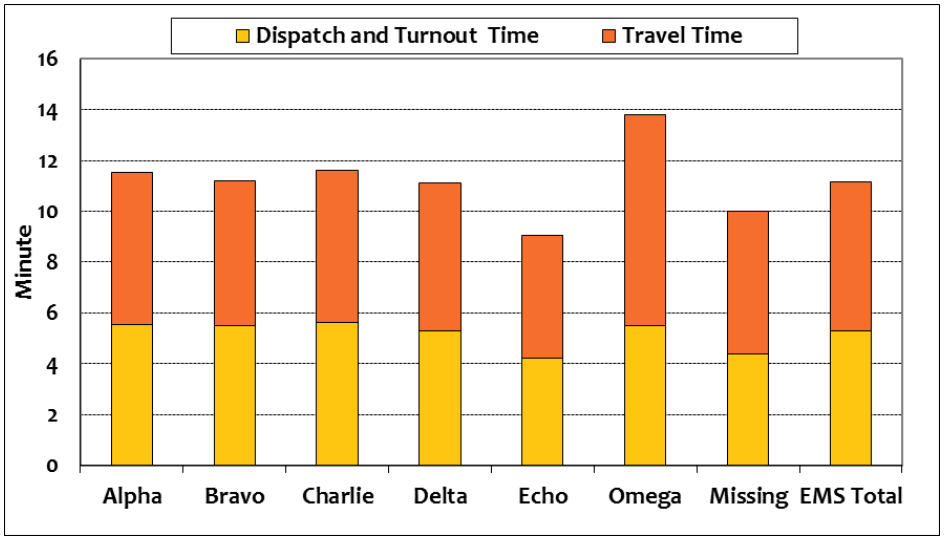


Table 30: EMS Calls: 90th Percentile Dispatch, Turnout and Travel Time of First Arriving Units by EMD Code in 2016

Program	Dispatch and Turnout Time	Travel Time	Response Time	Sample Size
Alpha	7.4	10.3	16.5	1,911
Bravo	7.4	9.8	15.9	882
Charlie	7.5	10.0	16.4	1,407
Delta	7.2	9.9	15.9	1,931
Echo	6.1	8.2	14.1	109
Omega	7.0	12.9	18.7	29
Missing	6.8	10.6	15.6	1,250
EMS Total	**7.3**	**10.1**	**16.1**	**7,519**

The distributions of dispatch and turnout time and travel time were also analyzed. A total of 53% of calls had dispatch and turnout time of five minutes or less. A total of 47% of calls had travel time of five minutes or less, and 78% of calls had travel time of eight minutes or less.

Figure 13: All Calls: Distribution of Dispatch and Turnout Time of First Arriving Unit in 2016

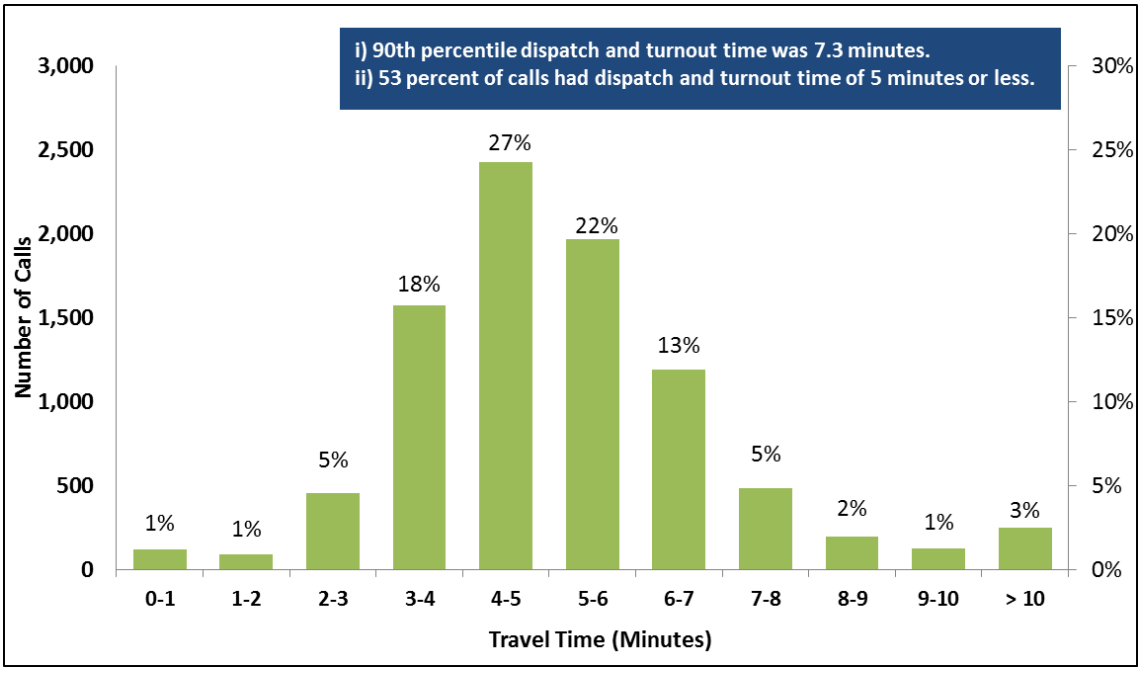
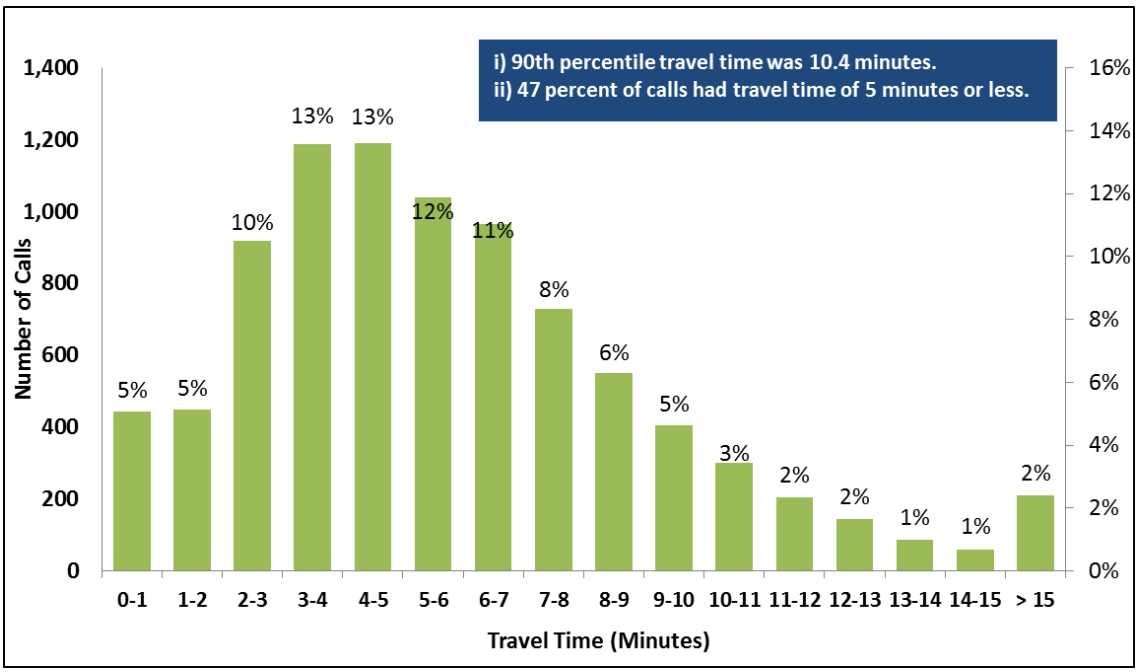


Figure 14: All Calls: Distribution of Travel Time of First Arriving Unit in 2016



COMMUNITY EXPECTATIONS

Stakeholder Input Process

The process utilized to evaluate community expectations was through structured interviews, many conducted very early in the process, and interaction with elected officials; County Administrator's office; civilian members of the Fire Study committee, career and volunteer fire chiefs and chief officers, Volunteer Firefighter's Association, career staff, and line personnel and volunteers.

There is a degree of assumed representativeness of community expectations through stakeholder input. However, for clarity, this study did not include a specific community engagement campaign.

Guiding Principles

Mission

The Frederick County Fire and Rescue Department is dedicated to providing quality and cost-effective services that protect our citizens, their property, and our environment from the effects of fire, medical emergencies, technological hazards, and man-made or natural disasters which pose a threat to our community.

The volunteer and career members of our Department shall uphold high personal and professional standards and always act with a sense of cooperation, respect and compassion for every member of the public and each member of the organization.

Above all else, our department shall hold as sacred the obligation to be responsible custodians of the public trust and in every circumstance, shall always act in the public's best interest.

Core Values

PROFESSIONAL EXCELLENCE
We believe the pursuit of excellence and demonstrating high professional standards are critical to our work. To ensure the best possible service for our community, the Fire and Rescue Department supports continuous training and encourages professional development.

HEALTH and SAFETY
We believe our health and safety are essential to fulfilling the Fire and Rescue Department's mission. We are committed to providing the best health and safety programs for our members' well-being and operational readiness.

DIVERSITY

We know Frederick County is a diverse community, and we commit to meeting its ever-changing needs. We are dedicated to reflecting and respecting that diversity throughout our organization. We will respect the diversity of our community by providing compassionate and quality service to all.

TEAMWORK AND SHARED LEADERSHIP

We believe the pursuit of excellence and demonstrating high professional standards are critical to our work. To ensure the best possible service for our community, the Fire and Rescue Department supports continuous training and encourages professional development.

EFFECTIVE COMMUNICATION

We believe communication is essential to the cohesiveness and performance of our organization. We are committed to providing effective and responsive means of communication throughout the organization and the community

INTEGRITY

We understand the trust placed in us by the public and our colleagues is integral to the performance of our duties. We are committed to honest and ethical behavior, and we will hold ourselves accountable to these values.

COMMUNITY SERVICE and INVOLVEMENT

We believe we have a duty to be involved in the communities where we work. Our responsibility is to protect life, property, and the environment. We are committed to fulfilling our responsibility and to deepening our involvement in the community we serve. No request or inquiry will go unanswered.

INNOVATION

We recognize and understand that the constancy of change in our community and industry impacts our business daily. We are committed to seeking out and implementing innovative and progressive thinking to address change effectively to benefit those we serve.

COMMUNITY RISK ASSESSMENT AND RISK LEVELS

Risk Assessment Methodology

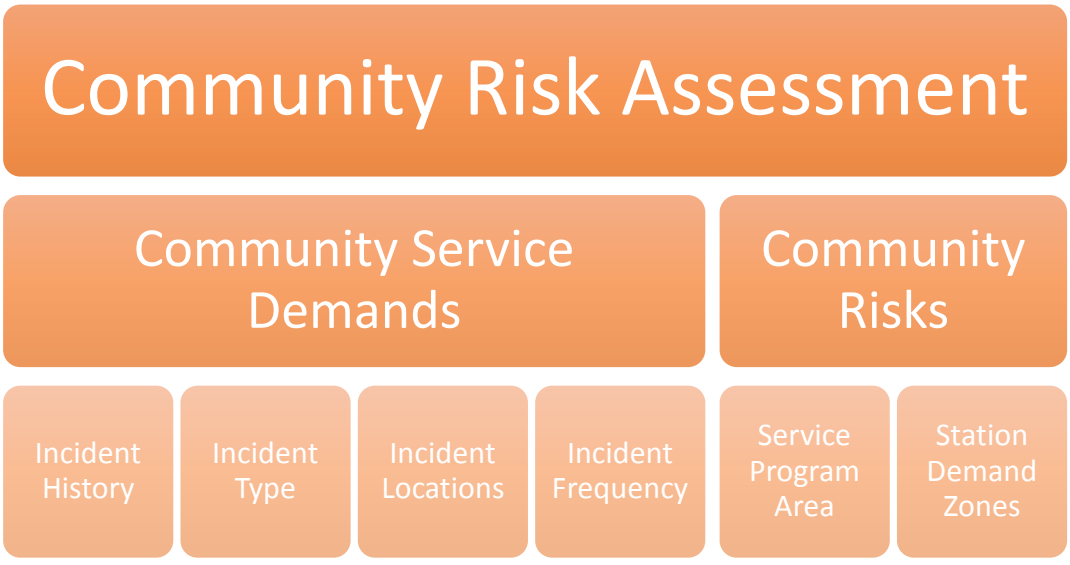
Methodology

The risk assessment process utilized a systematic methodology to evaluate the unique risks that are specific to the unincorporated county areas. This process evaluated risk from two broad perspectives. First, risk is identified through retrospective analyses of historical data. Second, risk is evaluated prospectively providing the necessary structure to appropriately allocate personnel, apparatus, and fire stations that afford sufficient distribution and concentration of resources to mitigate those risks. This methodology also provides information for the County to consider alternative solutions to assist in the mitigation of risks.

Service areas that either had little quantitative data (limited historical service demands),or did not require that level of analysis (very low level of service demands), were evaluated through both retrospective analysis as well as structured interviews with Department staff members. To improve clarity, the following terminology is used for the remainder of the risk assessment description and analyses: retrospective risk (historical demand data) will use the term Community Service Demands and prospective risk (potential service demands) will use the term Community Risks.

The overall community risk assessment process and methods utilized by the Department is presented below as Figure 15.[13]

Figure 15: Community Risk Assessment Process

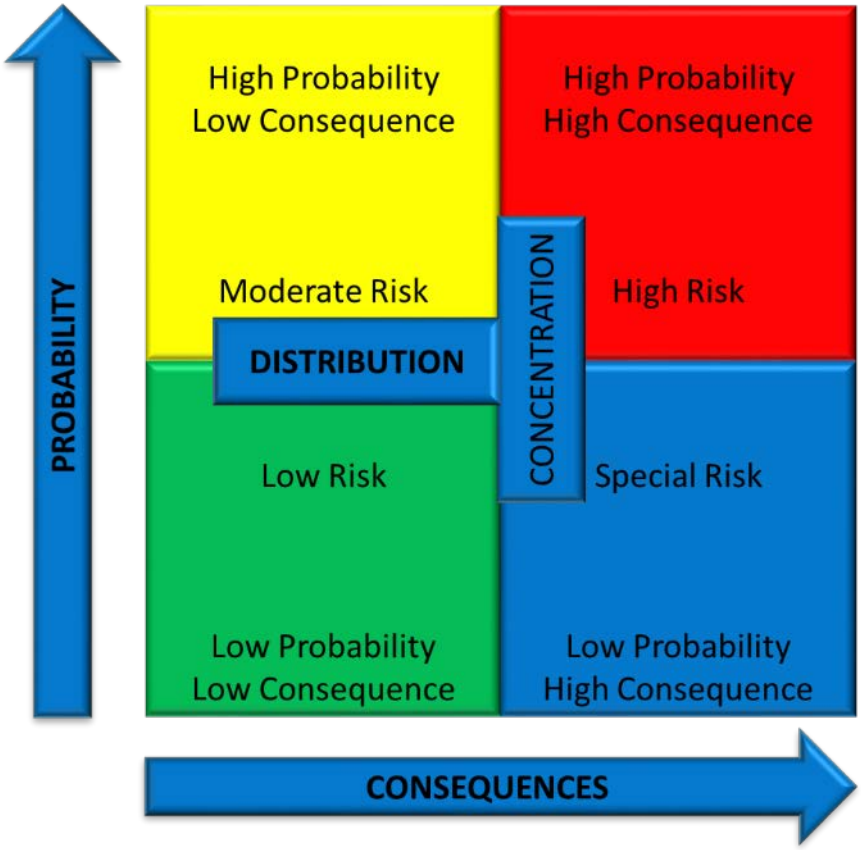


[13] Olathe Fire Department. (2012). Adapted from Community Risk and Emergency Services Analysis: Standard of Cover. Olathe, Kansas: Author.

As indicated in Figure 15, community service demands (request for assistance) were analyzed by the incident history, type, locations, and incident frequencies. Within this process a temporal analysis was completed for each major service program area (fire, EMS, Haz Mat, etc.) and evaluated by station demand zone (response area) and the frequency of incidents.

This methodology not only provides for sufficient allocation of resources to manage the readiness or preparedness aspects of the deployment strategy, but also balances the costs of readiness with an in-depth understanding of the probability of events through historical analyses. The combined results of this process were utilized to classify risk by severity utilizing a probability and consequence matrix for each program/risk area. Finally, the critical tasks required for each level of risk were identified. An example of the overall probability and consequence matrix is provided as Figure 16 below.[14]

Figure 16: Probability and Consequence Matrix



Planning Areas/Service Areas

Frederick County Fire and Rescue utilizes the existing station service areas for their planning efforts. For example, the company officers from each fire station service area are responsible for fire

[14] CFAI. (2009). Fire & Emergency Service Self-Assessment Manual, 8th (ed.). Chantilly, Virginia: Author. (p. 49)

prevention efforts, building familiarity, etcetera within the service area. Therefore, the planning areas remained consistent throughout the risk assessment process. The service areas have served the department well in this process as risk has been evaluated for both the distribution of resources and the necessary concentration of resources to meet each service area's specific and unique risks.

Population Density, Development, and Growth

Overall, the density for the unincorporated County is predominantly of rural density as defined by the Commission on Fire Accreditation International (CFAI).[15] The Commission has traditionally recognized that rural designations are populations less than 1,000 per square mile and suburban is for populations between 1,000 and 2,000 per square mile. The County has an aggregated population density of approximately 189.4 per square mile.[16] Traditionally recommended service levels for suburban populations is that the first due unit is capable of arriving within 6 minutes and 30 seconds travel time with a goal of 5 minutes.[17] However, the CFAI has combined urban and suburban densities for first arriving apparatus at a baseline of 5:12 in the most recently released 9th Edition Interpretation Guide that accompanies the 9th Edition Self-Assessment Manual.[18] The time to assemble the effective response force has remained at a baseline of 13-minutes for suburban densities.[19]

Utilizing the CFAI's traditional recommendations as a guide, rural population densities are afforded 13-minutes or less to 90% of the incidents.[20] The time to assemble the effective response force for rural populations is 18-minutes travel time.[21]

United States Census data is utilized to approximate the distribution of population throughout the County. The population density in the County is differentiated with some urban/suburban densities but is largely rural with less than 1,000 population per square mile.

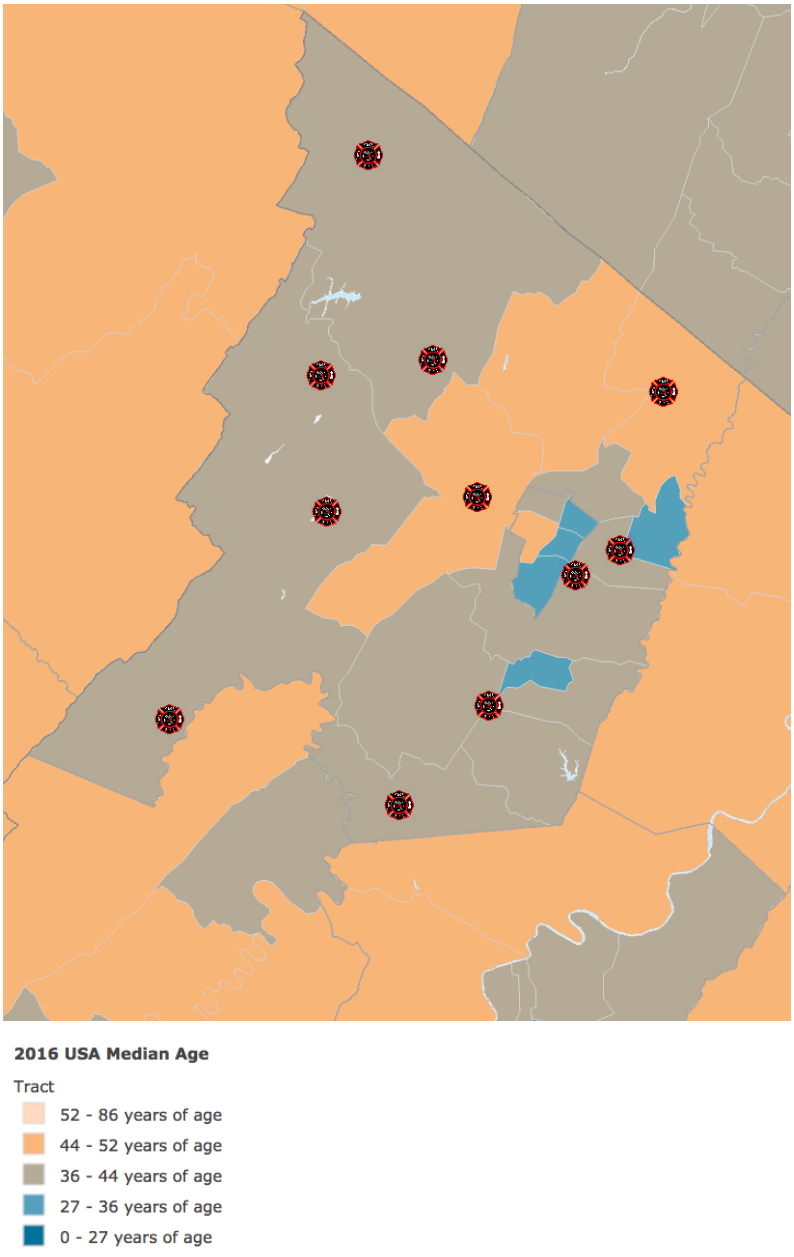
Population Characteristics

Generally, older populations and very young populations are considered to be most vulnerable to the frequency and incidents of fire. In addition, older populations historically utilize EMS services with greater frequency. It is important to understand, what field crews often recognize intuitively, that the distribution of population risks are not uniform across the jurisdiction. According to these data, overall the median age is less than 52. Age, population density, and socio-economic issues are drivers

[15] CFAI. (2009). Fire & Emergency Service Self-Assessment Manual, 9th (ed.). Chantilly, Virginia: Author. (p. 71)
[16] US Census. (2017). Retrieved on January 6, 2018 from https://www.census.gov/quickfacts/fact/table/frederickcountyvirginia/PST045217.
[17] Ibid.
[18] CFAI. (2016). Fire & Emergency Service Self-Assessment Manual: Interpretation Guide, 9th (ed.). Chantilly, Virginia: Author. (p. 99)
[19] Ibid.
[20] Ibid.
[21] Ibid.

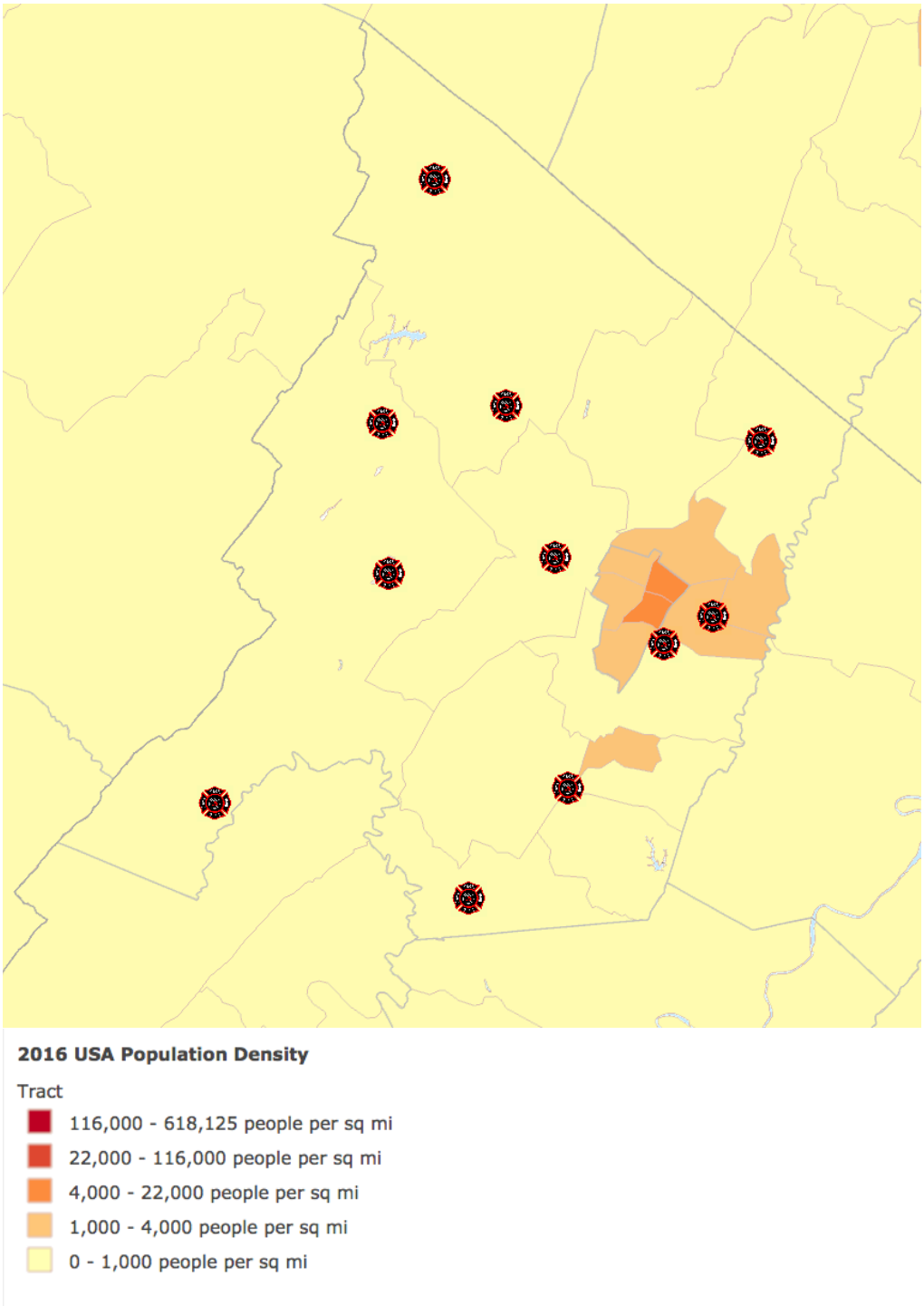
of service demands. These factors are shown in Figures 17-21 and are planning indicators for preparing for growth in service demand.

Figure 17: Median Age - 2016



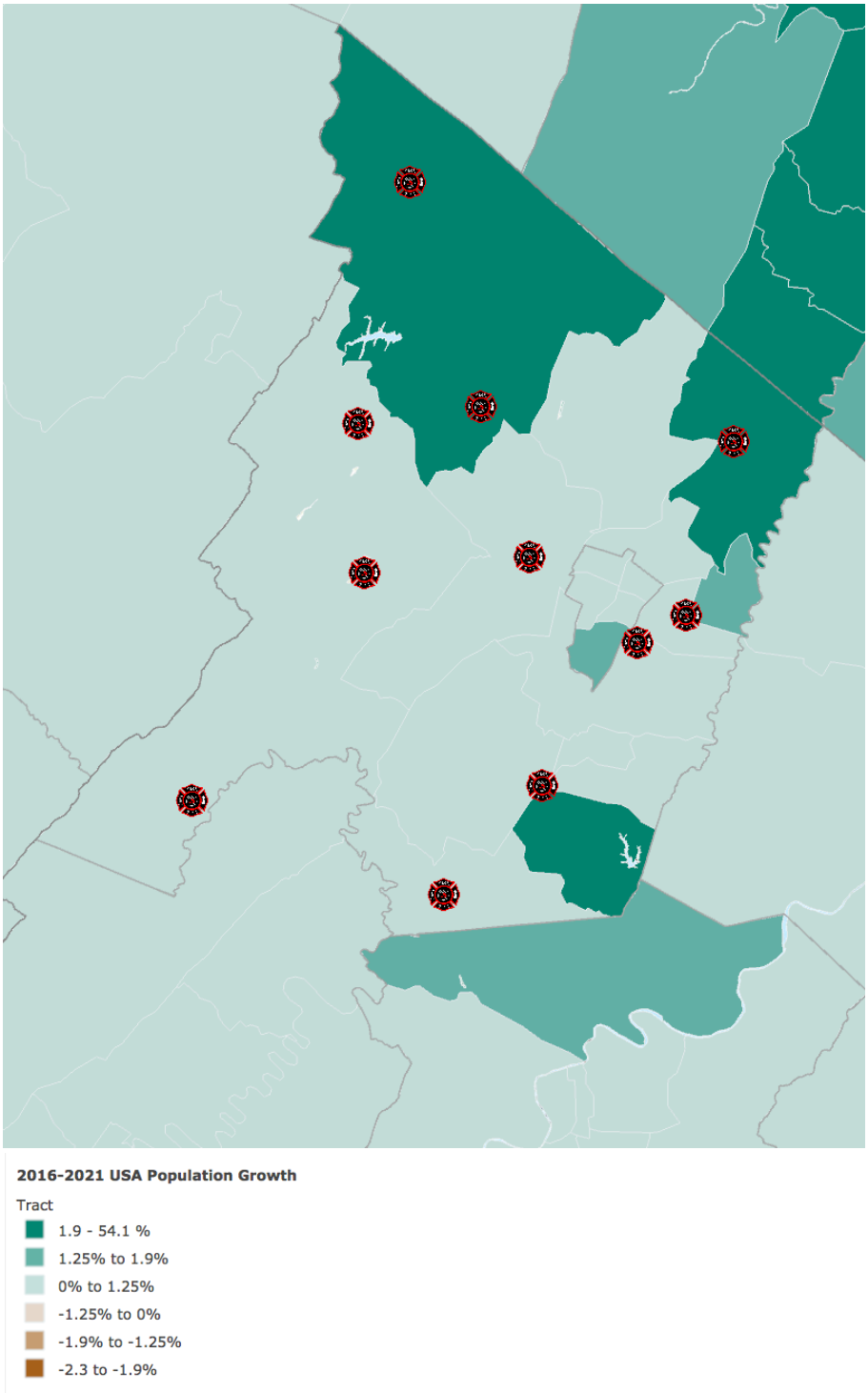
The population density in the County is largely of a rural density with some urban/suburban areas near the municipal boundaries.

Figure 18: Population Density by Census Block - 2016



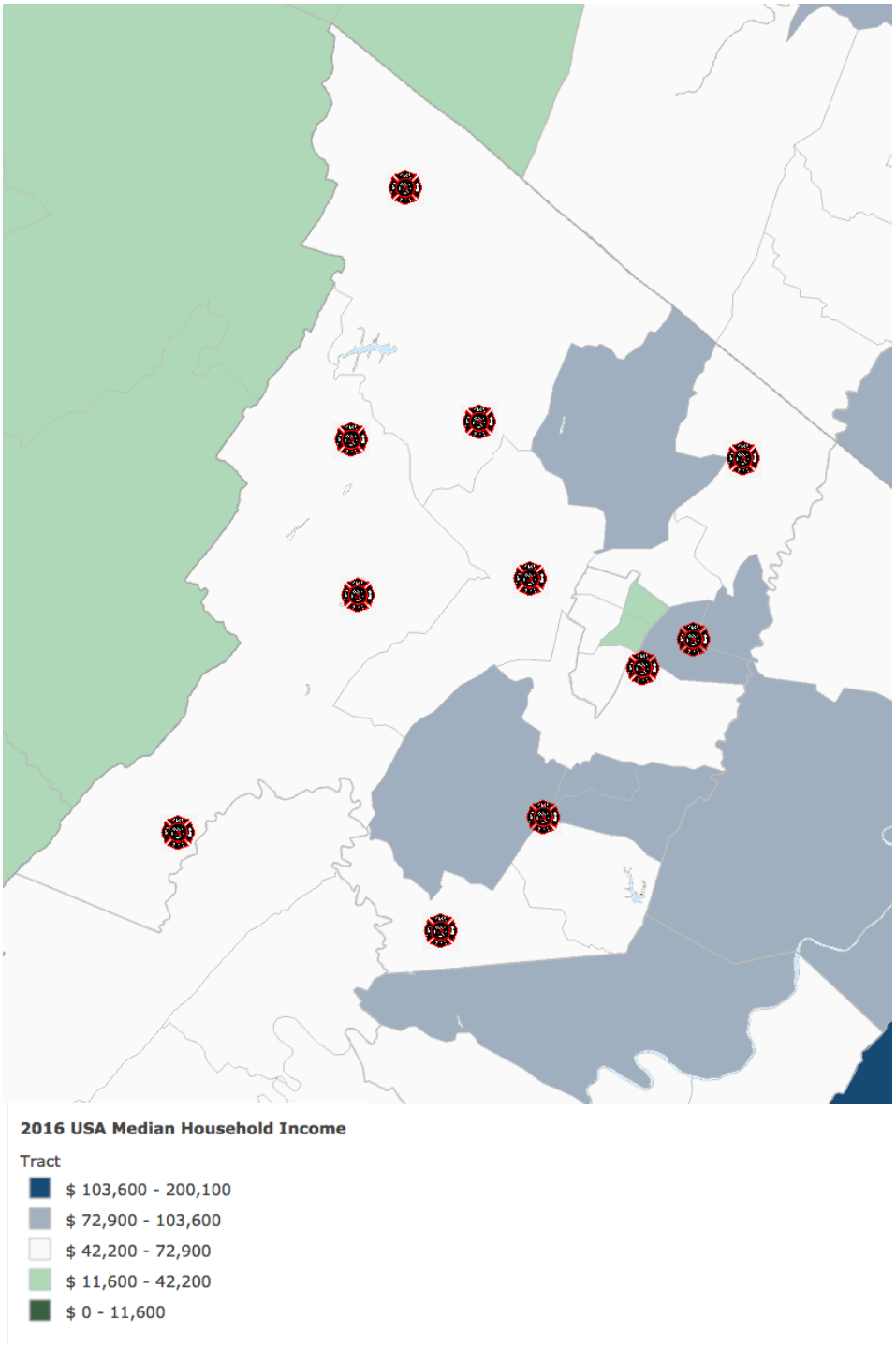
However, as a growing community, the population change is increasing at a moderate rate. The greatest growth areas are to the northwest, northeast, and southeast portions of the county. There are no reductions in population projected.

Figure 19: Annual Population Change 2016-2021



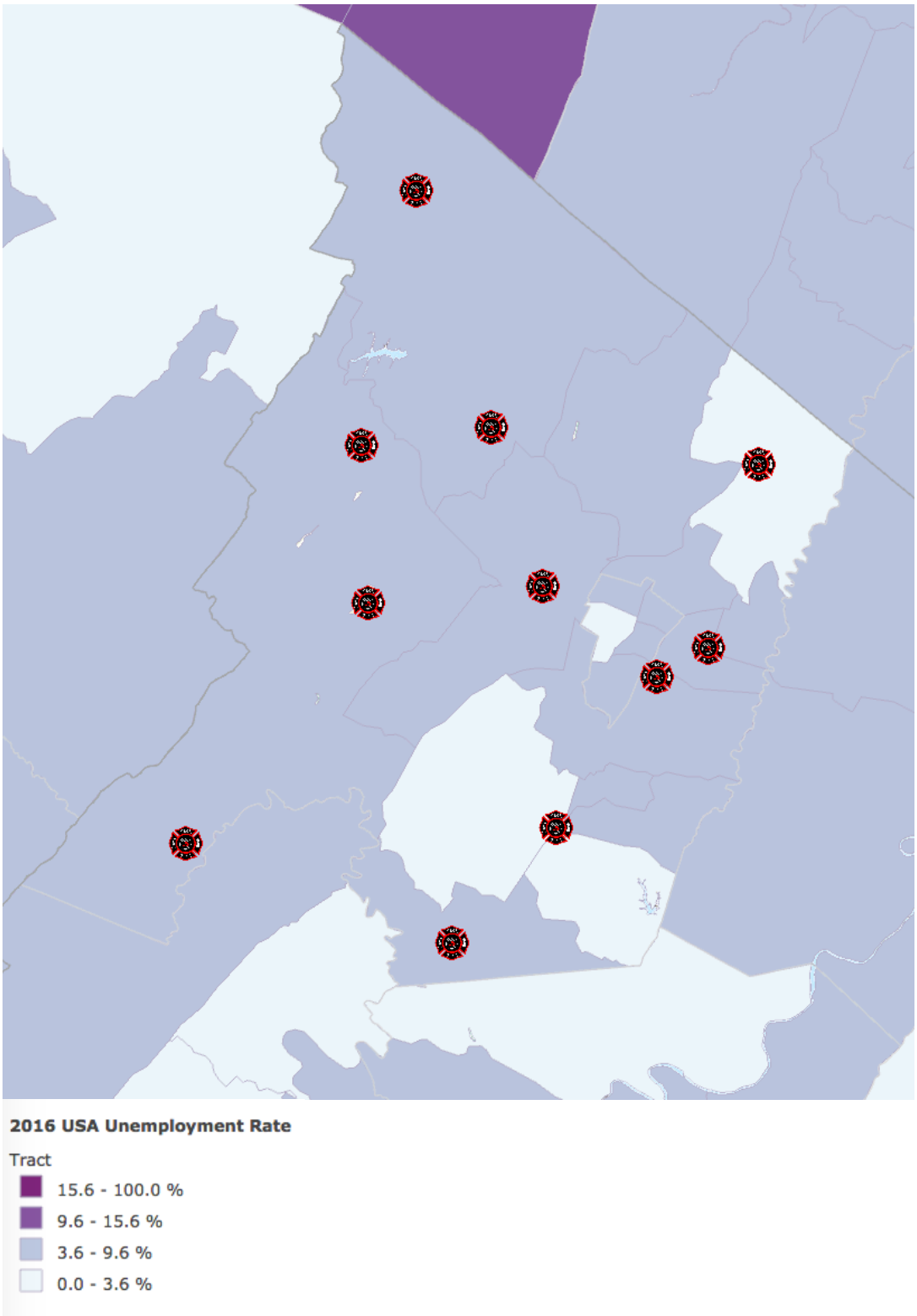
Population alone is not the sole variable that influences the demand for services as socioeconomic and demographic factors have greater influence over demand. The median household income was evaluated to determine the degree to which the community had underprivileged populations.

Figure 20: Median Household Income -2016



Finally, unemployment rates were evaluated across the county.

Figure 21: Unemployment Rates -2016



The County's governance should retain the flexibility to establish policy related to meeting or exceeding the community's expectations for service. Overall, the aggregate current performance for the County does not meet the traditionally accepted baseline recommendations for Urban and Suburban densities from the Commission on Fire Accreditation International (CFAI). An individual analysis of each fire station's performance is provided as Tables 33 and 34 in the Data Report. A comparison table of the current performance and national recommendations is provided below.

Table 31: Comparison of Response Times by Agency to Best Practices and National Experience

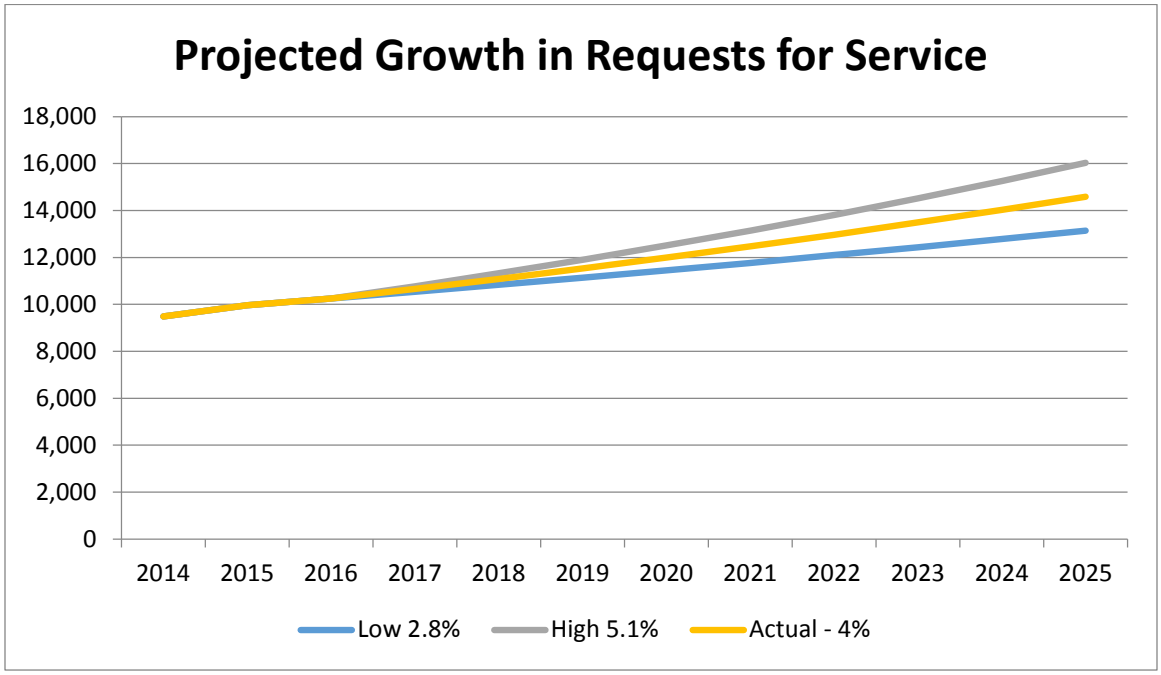
Call Category	Average Travel Time	90th Percentile Travel Time	CFAI[22] 90th Percentile Urban/Suburban Travel Time	CFAI[23] 90th Percentile Rural Travel Time	NFPA 1710[24] 90th Percentile Travel Time	USFA[25] 90th Percentile Turnout and Travel
Fire	6:24	11:42	5:12	13:00	4:00	10:59
EMS	5:54	10:06	5:12	13:00	4:00	10:59

Projected Growth in Requests for Service

The annualized growth was approximately 4% between 2014 and 2016. The following straight-line projection in the figure below should be used with caution due to the variability across years. Therefore, data must be reviewed annually to ensure timely updates to projections with the goal of utilizing at least 5-years of continuous data.

[22] CFAI. (2009). Fire & *emergency service self-assessment manual*, (8th ed.). Chantilly, Virginia: Author.
[23] Ibid.
[24] National Fire Protection Association. (2016). 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*. Boston, MA: National Fire Protection Association.
[25] USFA. (August 2006). Structure fire response times: Topical fire research series, 5(7). Emmitsburg, Maryland: Author.

Figure 22: Projected Service Demand Growth of 4.02%



Assuming that future demands may not be reasonably distributed across the various stations in the system, the system will require a redistribution of workload and ultimately reinvestment in resources to meet the growing demand. While the system should be evaluated continuously for performance and desired outcomes, the department should specifically re-evaluate workload and performance indicators for every 1,000-call increase to ensure system stability.

Risk Assessment

Fire Suppression Services

The County has 11 fire companies, each of which has a geographically identified geographic response area, that provide emergency response services in areas of the county not serviced by a municipal fire department including the communities of Stephens City, Middletown, Clear Brook, Gore, Round Hill, Gainesboro, Star Tannery, Greenwood, North Mountain, Reynolds Store, and Millwood Station. Collectively these organizations maintain twenty-three ambulances, twenty engines, three aerial devices, and various pieces of specialty apparatus and provide services to approximately 85,000 people. The budgeted paid minimum staffing strength is 27 personnel on each shift, supplemented by volunteer personnel. The individual hierarchy established within the framework of their enabling authority determines administrative command of each fire company.

Community Service Demands – Fire

Overall, there are 1,379 total fire incidents, averaging 3.8 per day. Structure, outside and vehicle fires totaled 314. The largest fire category was alarm and public service calls, averaging 1.3 and 1.2 per day.

Table 32: Number of Fire Incidents Dispatched by Category in 2016

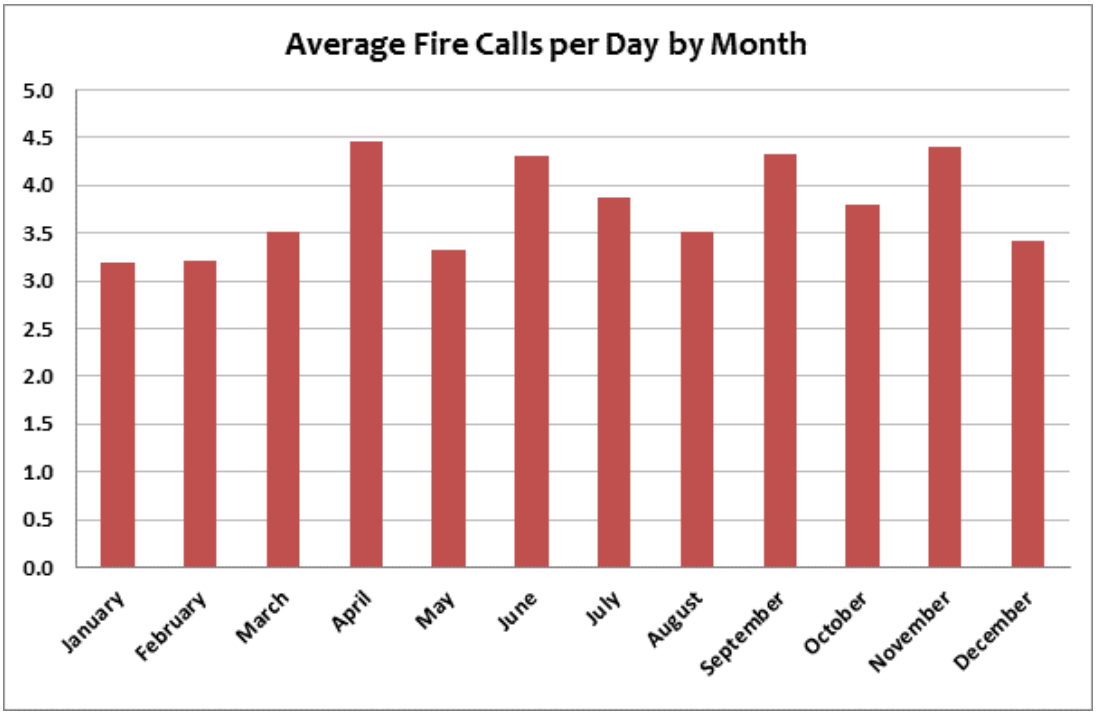
Call Category	Number of Calls	Calls per Day
Structure fire	113	0.3
Outside fire	117	0.3
Vehicle fire	84	0.2
Alarm	476	1.3
Public service	424	1.2
Move up	47	0.1
Fire other	118	0.3
Fire Total	**1,379**	**3.8**

Temporal analyses were conducted to evaluate patterns in community demands for fire related services. These measures examined the frequency of requests for service in 2016 by month, day of week, and hour of day. Results found that there was variability by month. The three months with most fire calls in order were: April (4.5 per day), November (4.4 per day) and September (4.3 per day). The three months with least fire calls in order were: January and February (3.2 per day) and May (3.3 per day). Results are presented in the following tables.

Table 33: Total Fire Related Calls per Month in 2016

Month	Number of Calls	Calls per Day	Call Percentage
January	99	3.2	7.2
February	90	3.2	6.5
March	109	3.5	7.9
April	134	4.5	9.7
May	103	3.3	7.5
June	129	4.3	9.4
July	120	3.9	8.7
August	109	3.5	7.9
September	130	4.3	9.4
October	118	3.8	8.6
November	132	4.4	9.6
December	106	3.4	7.7
Total	**1,379**	**3.78**	**100.0**

Figure 23: Average Fire Related Calls per Month in 2016

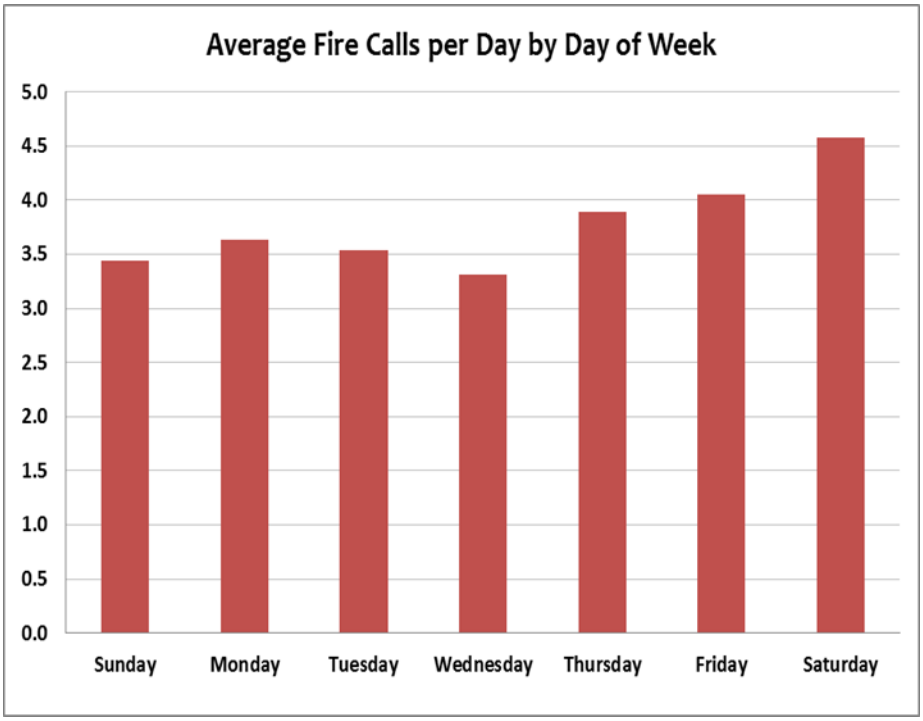


Similar analyses were conducted for fire related calls per day of week. The data revealed that there is some variability in the demand for services by day of week. Wednesday was the lowest for the week, averaging 3.3 per day or 12.5 percent of the fire related calls for the week. Saturday has the highest frequency of requests for fire related services averaging 4.6 calls per day and 17.3%. Results for this analysis are presented in the following tables.

Table 34: Total Fire Related Calls by Day of Week in 2016

Day of Week	Number of Calls	Calls per Day	Call Percentage
Sunday	179	3.4	13.0
Monday	189	3.6	13.7
Tuesday	184	3.5	13.3
Wednesday	172	3.3	12.5
Thursday	206	3.9	14.9
Friday	211	4.1	15.3
Saturday	238	4.6	17.3
Total	**1,379**	**3.78**	**100.0**

Figure 24: Average Fire Related Calls by Day of Week in 2016



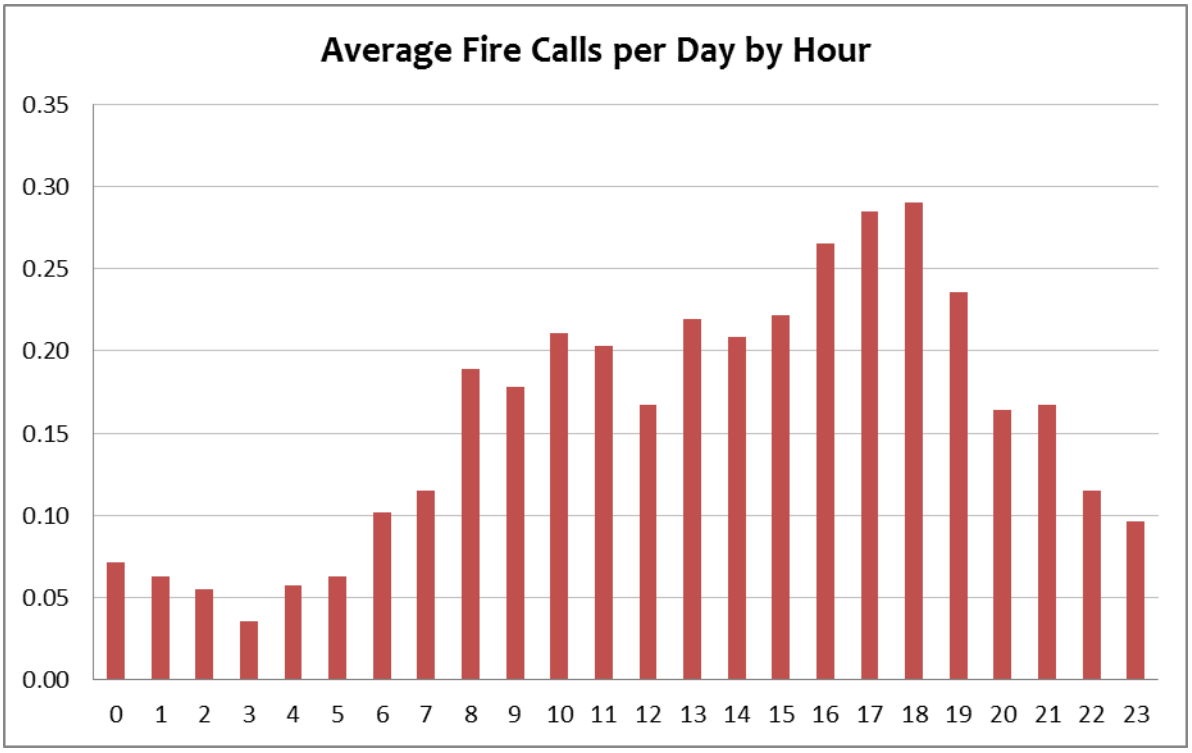
Fire related calls were evaluated by hour of the day. Considerable variability exists in the time of day that requests for fire related services are received. The hours that include 0100 to 0500 have the lowest demands. The middle of the day has the greatest frequency of calls, specifically from 1600 to 1800. The average number of calls per hour in a year is 57. Finally, in an effort to provide a more granular understanding of the community's demand for fire related services, this temporal analysis included the average number of calls per hour. In other words, when referring to the Table below, the busiest hour is at 1800 with 106 calls during that hour in 2016. The average number of calls per hour is a daily average for those 106 calls if they were equally distributed. Therefore, the busiest hour per day would be at 1800 with an average hourly call volume of 0.29 calls per hour.

Table 35: Total and Average Fire Related Calls by Hour of Day in 2016

Hour of Day	Number of Calls	Calls per Day	Call Percentage
0	26	0.07	1.9
1	23	0.06	1.7
2	20	0.05	1.5
3	13	0.04	0.9
4	21	0.06	1.5
5	23	0.06	1.7
6	37	0.10	2.7
7	42	0.12	3.0
8	69	0.19	5.0
9	65	0.18	4.7

Hour of Day	Number of Calls	Calls per Day	Call Percentage
10	77	0.21	5.6
11	74	0.20	5.4
12	61	0.17	4.4
13	80	0.22	5.8
14	76	0.21	5.5
15	81	0.22	5.9
16	97	0.27	7.0
17	104	0.28	7.5
18	106	0.29	7.7
19	86	0.24	6.2
20	60	0.16	4.4
21	61	0.17	4.4
22	42	0.12	3.0
23	35	0.10	2.5
Total	**1,379**	**3.78**	**100.0**

Figure 25: Average Fire Related Calls per Day by Hour of Day in 2016



Frederick County Fire and Rescue units made a total of 3,488 responses to fire related calls. The total time on task was 2,703 hours, and the average time on task was 46.5 minutes.

Table 36: Workload by Station for Fire Calls in 2016

Station	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses	Busy Hours per Day	Unit Responses per Day
Clear Brook	43.6	204	281	0.6	0.8
Gainesboro	63.6	427	403	1.2	1.1
Gore	55.9	116	124	0.3	0.3
Greenwood	41.5	357	516	1.0	1.4
Middletown	68.3	297	261	0.8	0.7
Millwood	28.1	183	391	0.5	1.1
North Mountain	42.0	132	189	0.4	0.5
Public Safety Building	48.6	367	453	1.0	1.2
Reynolds Store	48.3	77	96	0.2	0.3
Round Hill	31.1	185	358	0.5	1.0
Star Tannery	50.7	34	40	0.1	0.1
Stephens City	51.7	324	376	0.9	1.0
Total	**46.5**	**2,703**	**3,488**	**7.4**	**9.6**

We analyzed number of responding units by call type. Overall, 42% of fire calls were responded to by one unit; 23% were responded to by two units; 15% were responded to by three units, and 19% were responded to by four or more units. However, for structure fire calls, five or more units responded to 85% of calls. Ten or more units responded to a total of 24% of the structure fires.

Table 37: Number of Responding Units by Fire Call Type in 2016

Call Category	Number of Frederick Units							Total
	1	2	3	4	5	6	7 or more	
Structure fire	2	3	6	7	16	13	66	113
Outside fire	19	21	29	14	11	10	13	117
Vehicle fire	15	22	15	21	7	2	2	84
Alarm	161	142	109	54	8	2	0	476
Public service	288	88	34	4	5	3	2	424
Move-up	33	12	2	0	0	0	0	47
Fire other	67	30	14	3	3	1	0	118
Total	**585**	**318**	**209**	**103**	**50**	**31**	**83**	**1,379**
Percentage	**42.4%**	**23.1%**	**15.2%**	**7.5%**	**3.6%**	**2.2%**	**6.0%**	**100.0%**

Figure 26: Percentage of Structure Fire Calls by Number of Responding Units in 2016

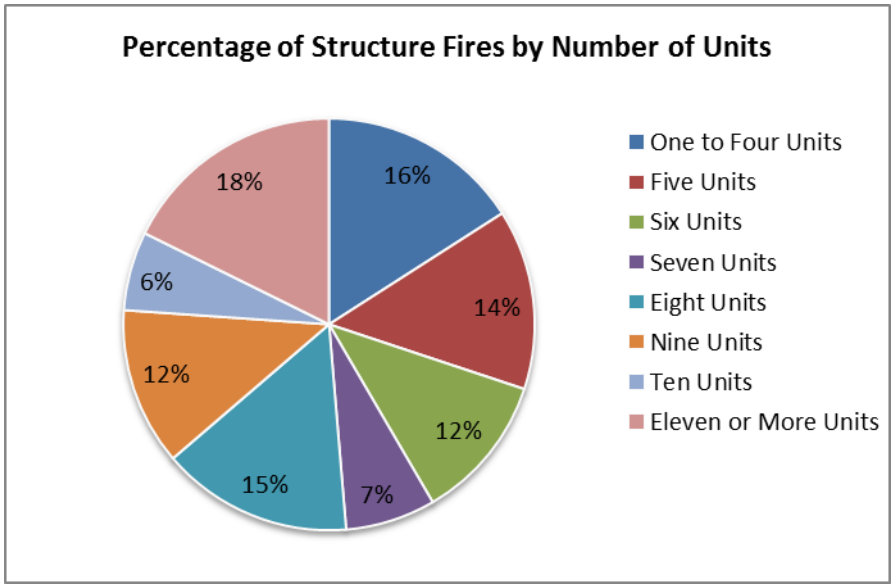
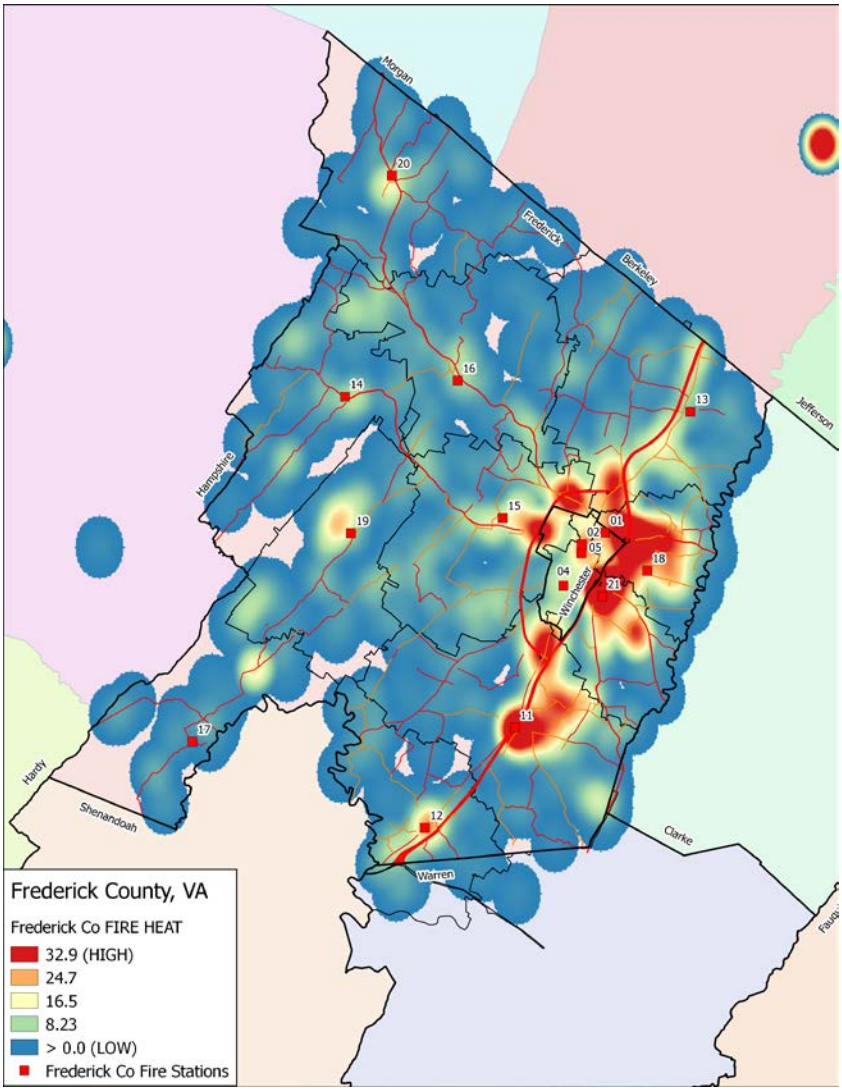


Figure 27: Heat Map for Fire Related Incidents



Community Risks – Fire

Frederick County Fire and Rescue elected to utilize the available occupancy level data provided by ISO in order to establish the most robust risk assessment for this first edition Standards of Cover document. As the department continues to refine their internal inspection and occupancy level data, it is intended that the department will transition to their internal data.

The Insurance Services Office, Inc. (ISO) is a subsidiary of Verisk Analytics, a provider of statistical, actuarial, underwriting and claims information. ISO in particular serves insurers, agents, brokers, insurance regulators, risk managers and other participants in the property/casualty insurance marketplace.

ISO provides agencies with a Fire Suppression Rating Schedule (FSRS) that assigns credit points to recognize a community's performance on measures related to fire suppression. The schedule objectively evaluates each item and uses the evaluations in a mathematical calculation to determine

the accurate amount of credit for each category. Using the FSRS, ISO develops an overall Public Protection Classification (PPC) number for each community. The PPC number represents the average class of fire protection for the jurisdiction. The PPC assigns each community a rating of 1 through 10, where 1 indicates exemplary fire protection capabilities, and 10 indicates the capabilities, if any, are insufficient for insurance credit.

Occupancy level risks identified by the Insurance Services Organization (ISO) within the County jurisdiction were quantitatively rated and categorized by high, moderate, and low risks. A total of 924 occupancies were categorized into 109 low risk occupancies, 801 moderate risk occupancies, and 14 high-risk occupancies.

The occupancy level risk matrix utilized follows in Figure 28. The occupancies identified exclude one and two-family residences. While there are multiple occupancies defined in various codes they are typically referred to as "commercial" buildings.

Figure 28: Occupancy Level Risk Matrix

Risk Class	Fire Flow		Number of Stories		Square Footage		Construction Class		Building Combustion Class		Full Credit Sprinkler System (Yes/No)	Total Risk Score
	Value	Scale	Value	Scale	Value	Scale	Value	Scale	Value	Scale	Value	Scale
High	3	≥ 1500 gpm	5	≥ 4	5	>=100k Sq. Ft.	5	Combustible or Frame	5	Quick Free and Rapid Burning	-10/0	≥ 17
Moderate	2	> 499 and < 1500 gpm	3	> 1 and < 4	3	> 10k < 100k Sq. Ft.	3	Joisted Masonry	3	Combustible	-10/0	>5 and <17
Low	1	≤ 499 gpm	1	1	1	< 10k Sq. Ft.	1	Non-Combustible Masonry Non-Combustible Fire Resistive	1	Slow Non/Limited Combustible	-10/0	≤ 5

All of the categorized risks were geocoded and mapped to better understand where the occupancy level risk identified is distributed throughout the county. Mapping for low, moderate, and high risks are presented below. Figures 29, 30, 31 are useful in understanding the concentration of the various levels of risk in relation to the locations of fire stations and total overall service demands. The specific locations of risk are also a determinate for the potential requirement for apparatus and personnel resources.

Figure 29: Low Risk Occupancies

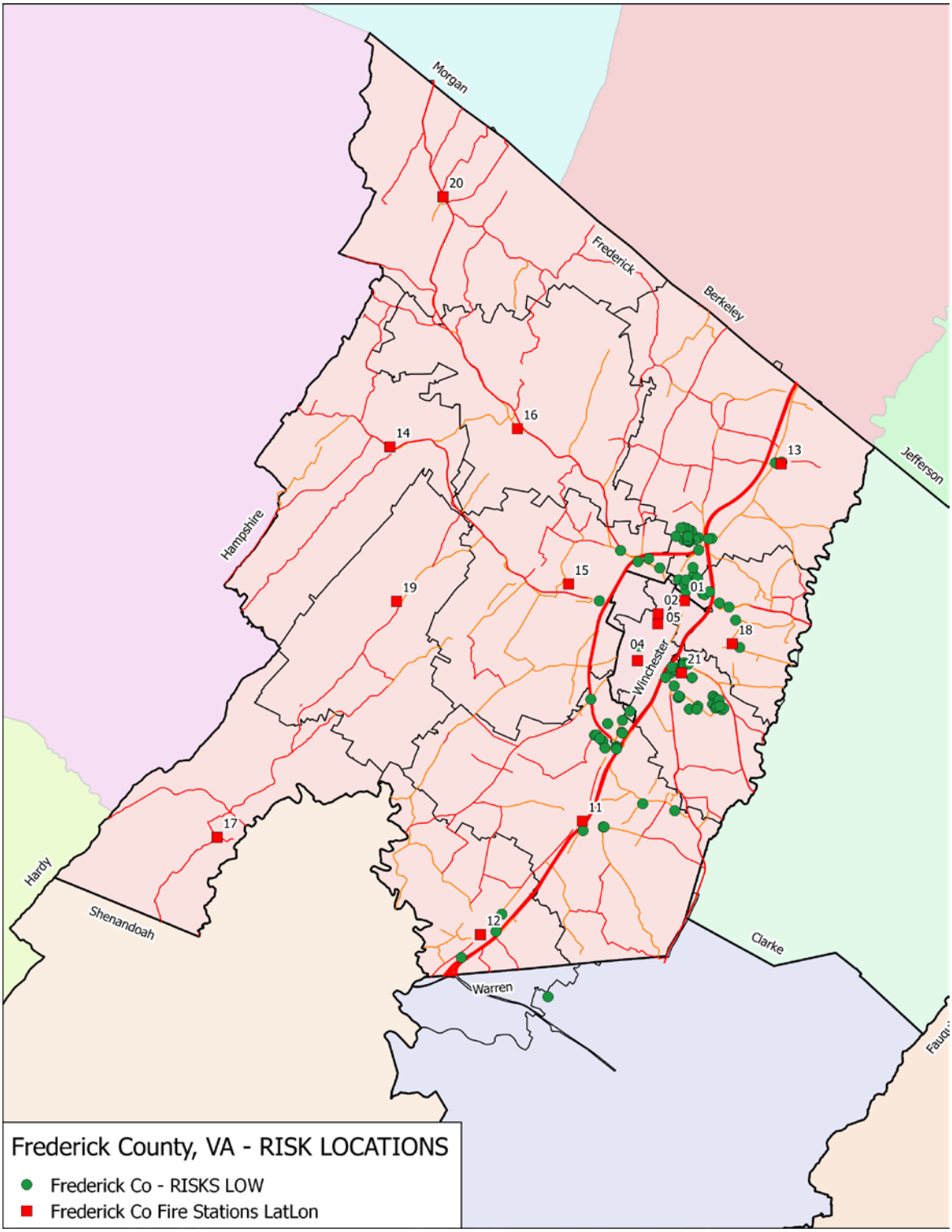


Figure 30: Moderate Risk Occupancies

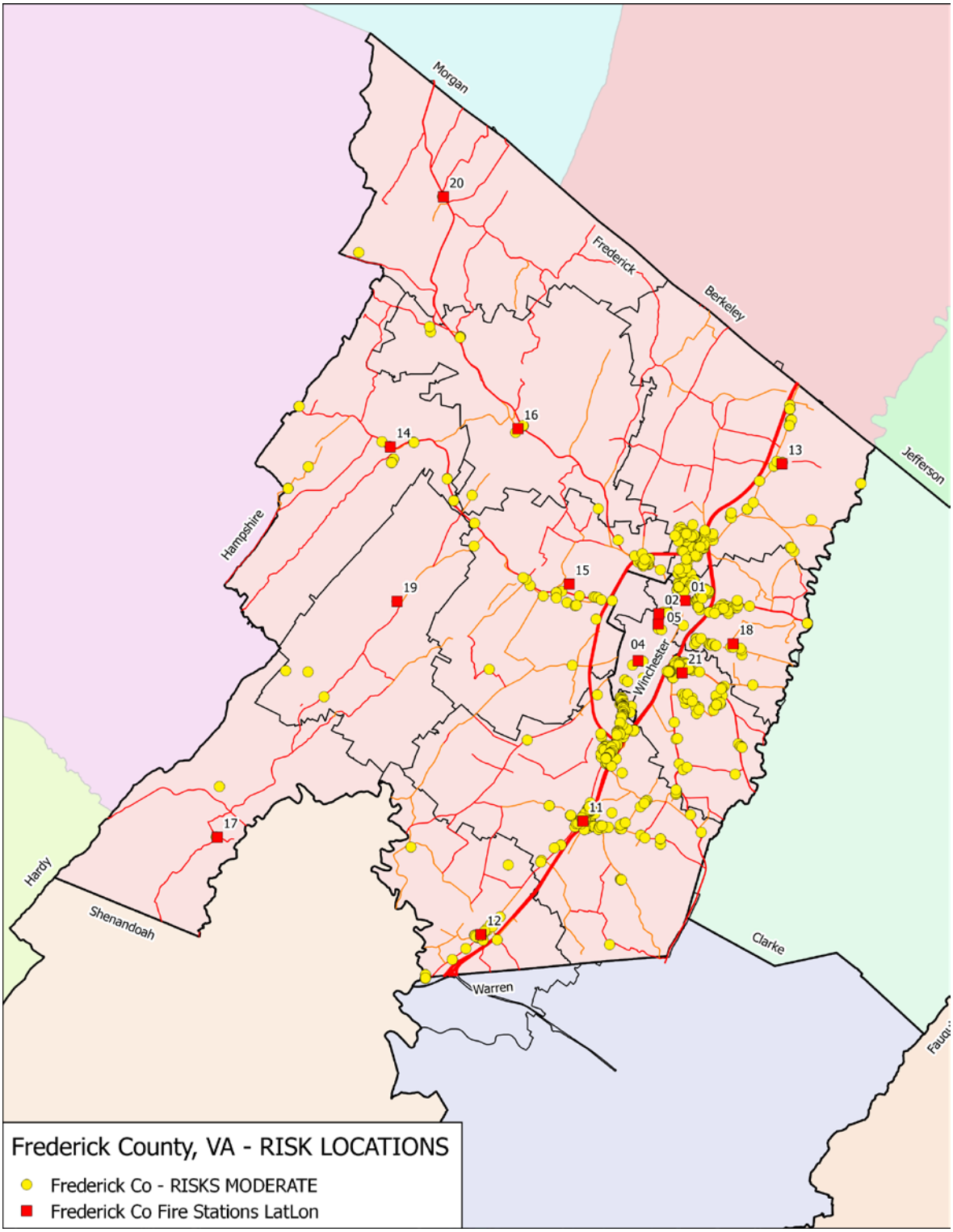
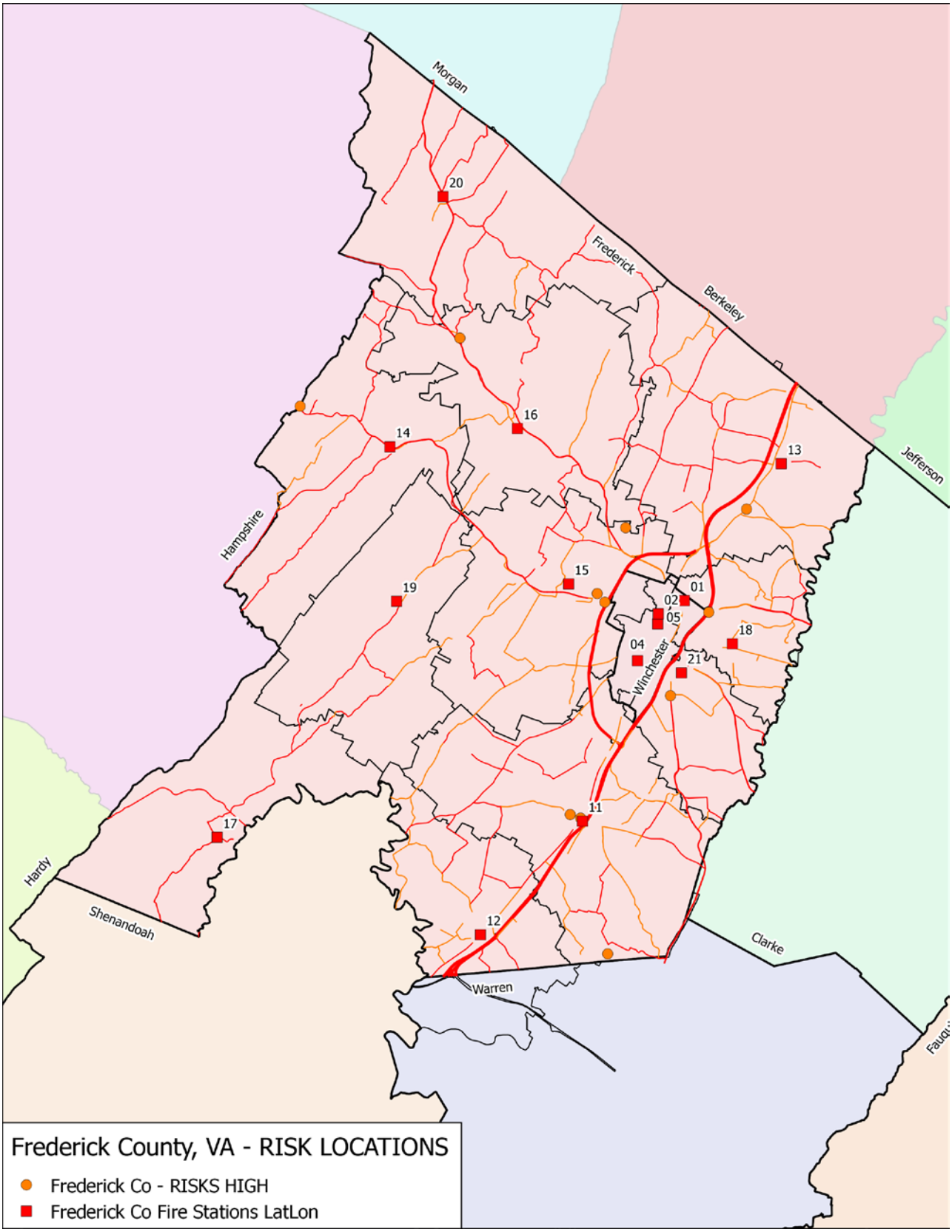


Figure 31: High Risk Occupancies



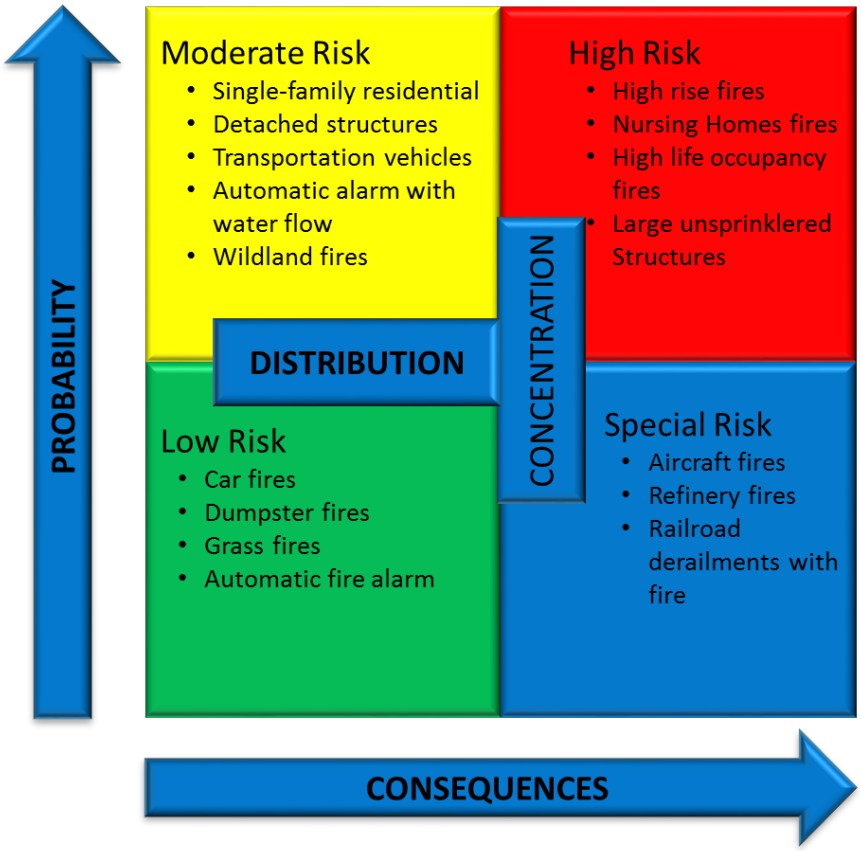
Probability/Consequence of Fire Event Risk

The relatively low frequency of fire related events required the Department to rely more heavily on the consequences of the events than the probability of the event occurring. For example, according to the Department's CAD final incident typing, the department responded to 113 structure fire incidents accounting for 1.1% of the total call volume.

Therefore, the example is intended to describe in broad terms the general types of calls that would fall into each level of risk for the public, understanding that many risks could be categorized into several risk levels depending on the information provided or conditions found. Detailed response matrices are updated as necessary and available from the department.

The resulting probability and consequence matrix is presented below.

Figure 32: Probability and Consequence Matrix for Fire Risk



Critical Task Analysis

The FCFR staff officers and Volunteer Chiefs analyzed the critical tasks required for the mitigation of typical fire related incidents in the community. Critical tasks for low, moderate, and high-risk events are presented as well as the resources allocated, as determined by the group, to each event follows in Tables 38 through 43. The findings are not representative of any actual past event and the values presented are the result of the collective professional judgment of the participants.

Table 38: Structure Fire – Low / Moderate Risk - Possible

Critical Task	Needed Personnel
Command / Control	1
Investigate	4
Total	**5**

Table 39: Resource Allocation for a Structure Fire – Low / Moderate Risk - Possible

Responding Units	Minimum Staffing
Engine (4)	4
Rescue Engine	1
Truck	1
Fire Marshal	1
Ambulance	2
Chief	1
Water Tanker (3)	3
Total Response Provided	**9-12**
Personnel Required by Critical Tasks	***5***

Table 40: Confirmed Structure Fire – Moderate Risk

Critical Task	Needed Personnel
Command / Control	2
Pump Operator	2
Fire Attack	6
Water Supply	1
Primary Search	1
Ventilation	4
RIC	2
Safety	4
Medical	2
Water Shuttle	4
Total	**22-26**

Table 41: Resource Allocation for a Confirmed Structure Fire – Moderate Risk

Responding Units	Minimum Staffing
Engine (5)	5
Rescue Engine	1
Truck (2)	2
Fire Marshal	1
Ambulance	2
Chief	1
Water Tanker (3)	3
Total Response Provided	**9-15**
Personnel Required by Critical Tasks	***22-26***

Table 42: Structure Fire – High Risk

Critical Task	Needed Personnel
Command / Control	2
Pump Operator	2
Fire Attack	8
Water Supply	1
Search	6
Ventilation	4
Aerial Operations	2
RIC	4
Safety	1
Medical	2
Water Shuttle	6
Total	**32-38**

Table 43: Resource Allocation for a Structure Fire – High Risk

Responding Units	Minimum Staffing
Engine (5)	5
Rescue Engine	1
Truck (2)	2
Fire Marshal	1
Ambulance	2
Chief	1
Water Tanker (3)	3
Total Response Provided	**12-16**
Personnel Required by Critical Tasks	***32-38***

Emergency Medical Services

Emergency medial services are provided through a combination of career personnel at each of the 11 fire stations that cross staff fire suppression apparatus and ambulances. Volunteer personnel at each of the stations supplement the career personnel. Finally, there are three advanced life support chase cars that supplement BLS ambulances.

Community Service Demands

Frederick County Fire and Rescue provides patient transport services. Requests for EMS are categorized into seven call categories using the CAD call description. On average, there were 22.3 EMS requests per day, and Cardiac and Stroke requests totaled 1,138 or 3.1 per day.

Table 44: Number of EMS Incidents Dispatched by Category in 2016

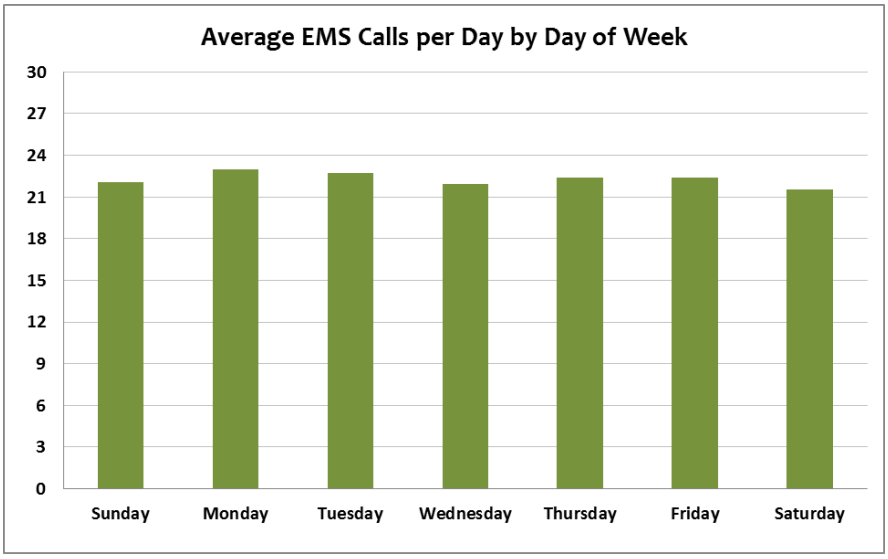
Call Category	Number of Calls	Calls per Day
Cardiac and stroke	1,138	3.1
Seizure and unconsciousness	731	2.0
Breathing difficulty	729	2.0
Overdose and psychiatric	152	0.4
MVC	582	1.6
Fall and injury	1,741	4.8
Illness and other	3,060	8.4
EMS Total	**8,133**	**22.3**

Temporal analyses were completed to describe the community's demands for emergency medical services. These analyses were completed by month of year, day of week, and hour of day. February had the most EMS demand, averaging 23.9 per day. September had the lowest EMS demand, averaging 20.7 per day.

Table 45: Annual Total and Average per Day of EMS Calls by Month of Year in 2016

Month	Number of Calls	Calls per Day	Call Percentage
January	705	22.7	8.7
February	670	23.9	8.2
March	714	23.0	8.8
April	657	21.9	8.1
May	673	21.7	8.3
June	665	22.2	8.2
July	702	22.6	8.6
August	650	21.0	8.0
September	621	20.7	7.6
October	686	22.1	8.4
November	692	23.1	8.5
December	698	22.5	8.6
Total	**8,133**	**22.3**	**100.0**

Figure 33: Average EMS Calls per Day by Month of Year in 2016

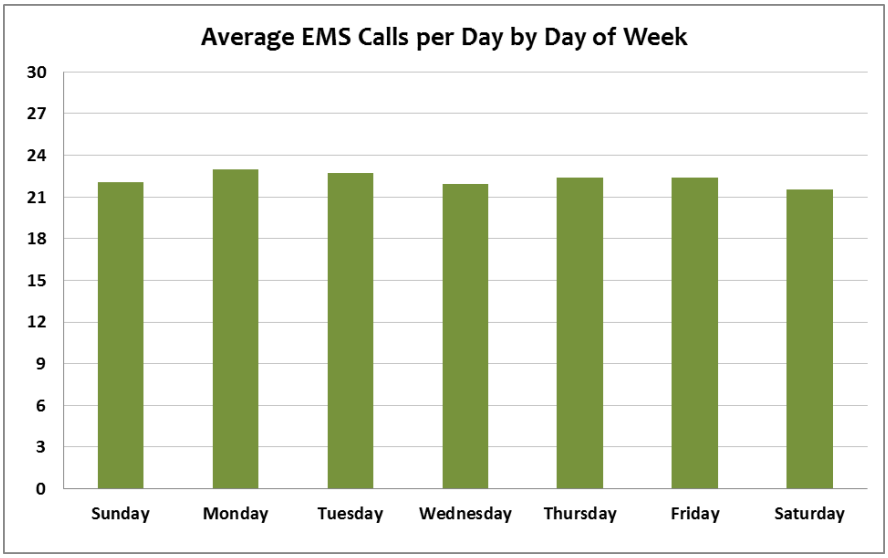


Similar analyses were conducted examining the frequency of requests for service by the day of the week. Once again, there is variability in the demand for services by the day of the week. Monday receives the most requests for service and Saturday the least. Results are provided below.

Table 46: Annual Total and Average per Day of EMS Calls by Day of Week in 2016

Day of Week	Number of Calls	Calls per Day	Call Percentage
Sunday	1,146	22.0	14.1
Monday	1,195	23.0	14.7
Tuesday	1,182	22.7	14.5
Wednesday	1,139	21.9	14.0
Thursday	1,186	22.4	14.6
Friday	1,166	22.4	14.3
Saturday	1,119	21.5	13.8
Total	**8,133**	**22.3**	**100.0**

Figure 34: Average EMS Calls per Day by Day of Week in 2016



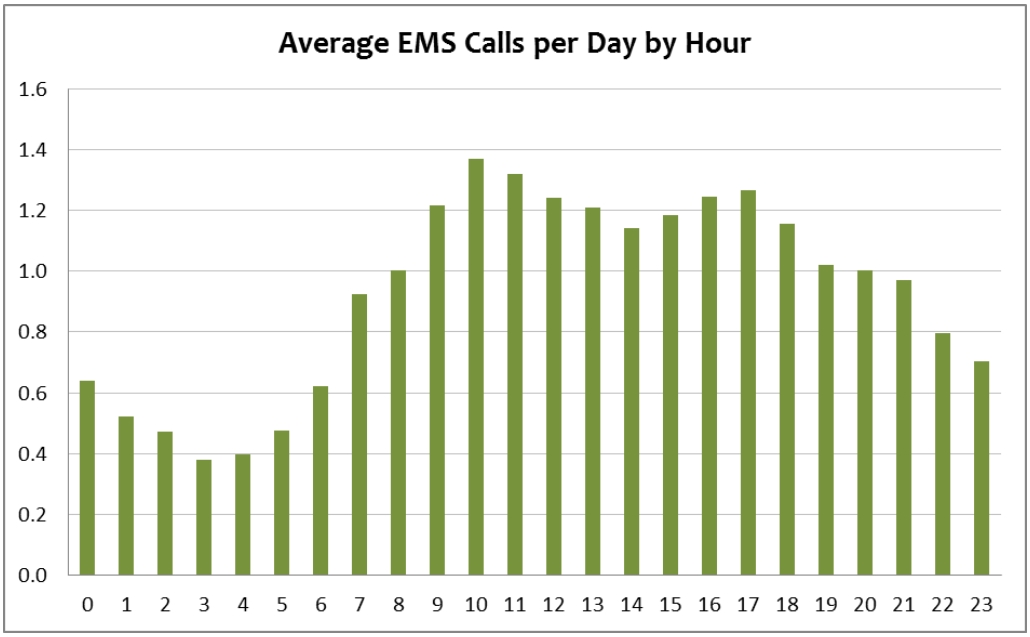
Finally, the analyses for EMS services are completed by identifying the EMS calls by hour of day and the average hourly rate of EMS calls per hour. The demand curve for requests for EMS service follows an expected pattern experienced in similar communities across the nation. The higher frequency of service calls begins from 0900 to 1800 and each hour had more than 400 calls. The demand peaked at 1000 with 500 calls in a year. Results are provided below.

Table 47: Annual Total and Average per Day of EMS Calls by Hour of Day in 2016

Hour of Day	Number of Calls	Calls per Day	Call Percentage
0	234	0.64	2.9
1	190	0.52	2.3
2	172	0.47	2.1
3	139	0.38	1.7
4	145	0.40	1.8
5	173	0.47	2.1
6	227	0.62	2.8
7	337	0.92	4.1
8	366	1.00	4.5
9	444	1.22	5.5
10	500	1.37	6.1
11	482	1.32	5.9
12	453	1.24	5.6
13	442	1.21	5.4
14	417	1.14	5.1
15	432	1.18	5.3
16	455	1.25	5.6
17	462	1.27	5.7

Hour of Day	Number of Calls	Calls per Day	Call Percentage
18	422	1.16	5.2
19	372	1.02	4.6
20	366	1.00	4.5
21	355	0.97	4.4
22	291	0.80	3.6
23	257	0.70	3.2
Total	**8,133**	**22.28**	**100.0**

Figure 35: Average EMS Calls per Day by Hour of Day in 2016



A total of 53 percent of the EMS incidents had multiple responding units. On average, 1.9 units were dispatched per EMS call. Motor Vehicle Collision (MVC) is the category that had 95% of the incidents with two or more units responding.

Frederick County Fire and Rescue units made a total of 15,408 responses to EMS calls. The total time on task was 13,971 hours, and the average time on task was 54.4 minutes. Greenwood, Stephens City, and Round Hill were the top three stations in terms of total unit responses.

Table 48: Workload by Station for EMS Incidents in 2016

Station	Avg. Busy Minutes per Response	Annual Busy Hours	Annual Total Responses	Busy Hours per Day	Unit Responses per Day
Clear Brook	62.0	939	909	2.6	2.5
Gainesboro	46.0	657	858	1.8	2.4
Gore	59.8	391	392	1.1	1.1
Greenwood	58.0	1,952	2,021	5.3	5.5
Middletown	60.5	1,213	1,203	3.3	3.3
Millwood Station	48.3	1,306	1,622	3.6	4.4
North Mountain	54.4	462	509	1.3	1.4
Public Safety Building	27.5	441	962	1.2	2.6
Reynolds Store	65.4	312	286	0.9	0.8
Round Hill	52.5	1,561	1,784	4.3	4.9
Star Tannery	91.7	249	163	0.7	0.4
Stephens City	56.1	2,029	2,171	5.6	5.9
Total	**53.6**	**11,511**	**12,880**	**31.5**	**35.3**

Transport

We analyzed outcomes for the requests for EMS services. The number of EMS transports totaled 5,996, averaging 16.4 transports per day. Approximately 74% of EMS calls resulted in a patient transport. Duration of a call is defined as the difference between the earliest dispatch time and the last unit clear time. On average, the duration of a non-transport EMS call was 27.1 minutes. The duration of a transport EMS call averaged 86.5 minutes, which was one hour or three times longer than a non-transport EMS call.

Table 49: EMS Transports by Call Category in 2016

Call Category	Non-Transport		Transport		Transport Rate
	Duration	Number of Calls	Duration	Number of Calls	
Cardiac and stroke	31.7	177	91.3	961	84.4%
Seizure and unconsciousness	26.9	152	91.7	579	79.2%
Breathing difficulty	22.9	75	90.7	654	89.7%
Overdose and psychiatric	24.2	46	87.7	106	69.7%
MVC	43.7	280	98.7	302	51.9%
Fall and injury	17.9	582	82.7	1,159	66.6%
Illness and other	27.4	825	82.1	2,235	73.0%
Total	**27.1**	**2,137**	**86.5**	**5,996**	**73.7%**

We analyzed variation of total EMS requests and transport requests by the hour of the day and the average hourly rate of requests. The variation of total EMS requests and EMS transport reports followed a similar pattern. The busiest period for EMS and EMS transport requests was

between 0900 and 1800. From 0900 to 1300, on average one EMS transport occurred per hour per day.

Requests by hour of the day are represented below.

Table 50: Total EMS Calls and EMS Transports and Average per Day by Hour of Day in 2016

Hour	Number of EMS Transports	Number of EMS Calls	EMS Transports per Day	EMS Calls per Day	Transport Rate
0	161	234	0.4	0.6	68.8
1	133	190	0.4	0.5	70.0
2	122	172	0.3	0.5	70.9
3	103	139	0.3	0.4	74.1
4	103	145	0.3	0.4	71.0
5	130	173	0.4	0.5	75.1
6	158	227	0.4	0.6	69.6
7	259	337	0.7	0.9	76.9
8	267	366	0.7	1.0	73.0
9	348	444	1.0	1.2	78.4
10	376	500	1.0	1.4	75.2
11	361	482	1.0	1.3	74.9
12	347	453	1.0	1.2	76.6
13	348	442	1.0	1.2	78.7
14	309	417	0.8	1.1	74.1
15	324	432	0.9	1.2	75.0
16	334	455	0.9	1.2	73.4
17	310	462	0.8	1.3	67.1
18	313	422	0.9	1.2	74.2
19	266	372	0.7	1.0	71.5
20	274	366	0.8	1.0	74.9
21	259	355	0.7	1.0	73.0
22	208	291	0.6	0.8	71.5
23	183	257	0.5	0.7	71.2

Figure 36: Average EMS Calls and EMS Transports per Day by Hour of Day in 2016

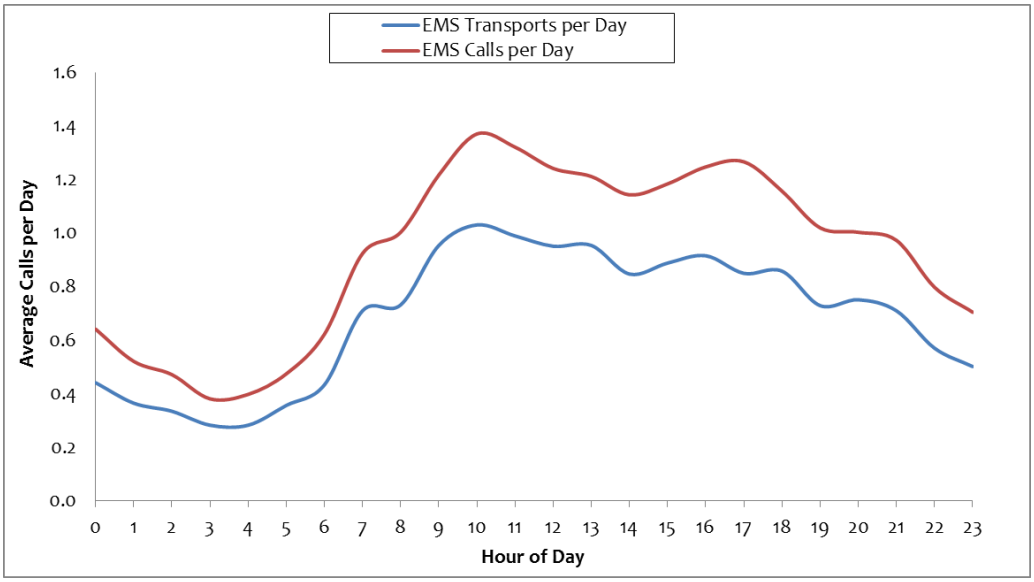
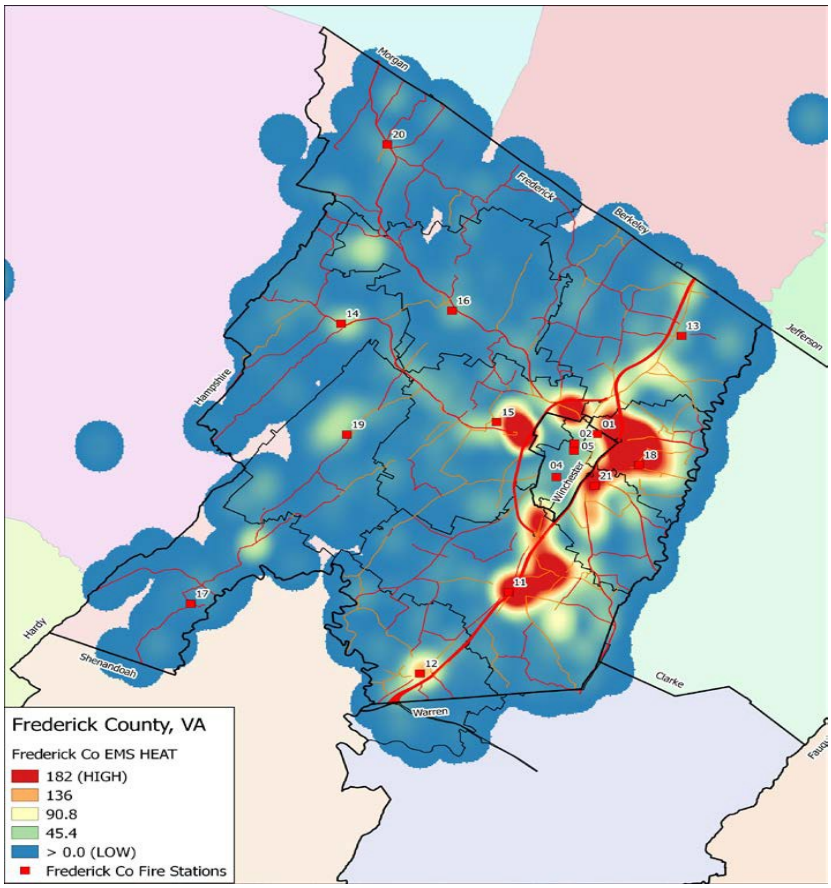


Figure 37: Heat Map for EMS Related Incidents



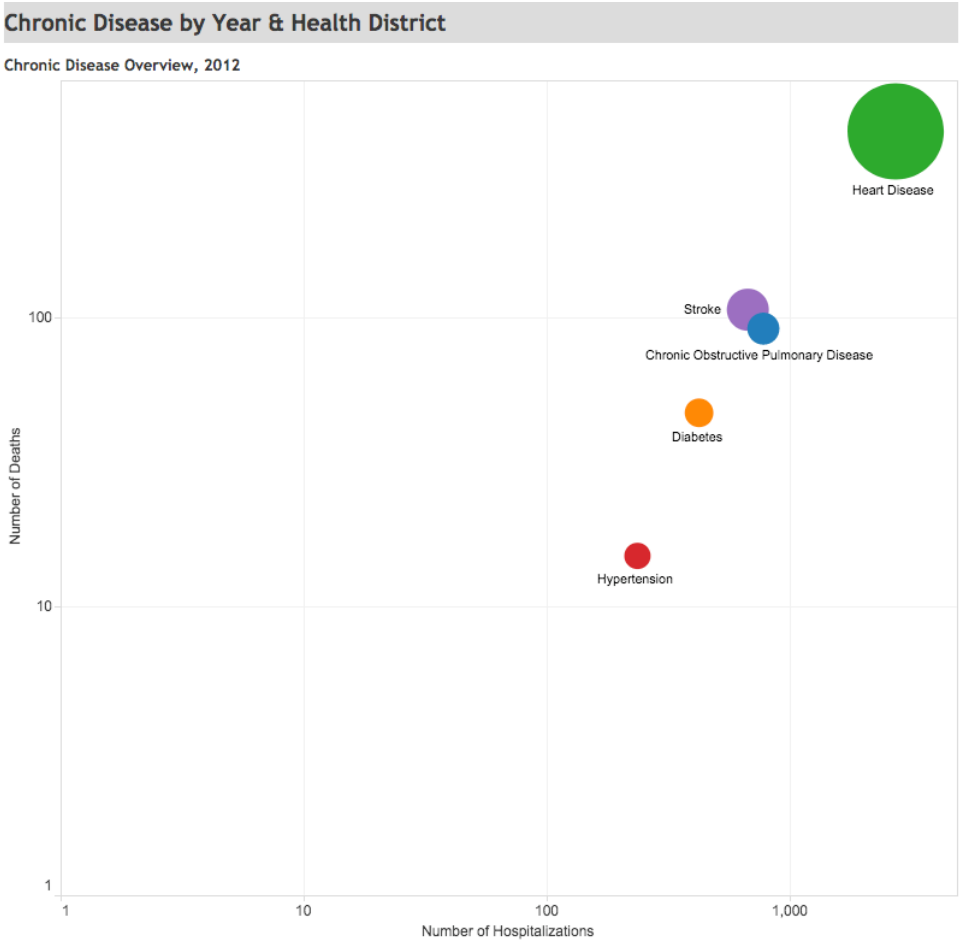
Community Risks

In addition to the community response history for EMS incidents and types, the Commonwealth of Virginia's Department of Health's health data was utilized to describe community health risks.[26] All reported statistics are for the Lord Fairfax Health District.

The five major chronic diseases in 2012 were reported in order of severity based on number of deaths and hospitalizations:[27]

- Heart disease
- Stroke
- Chronic Obstructive Pulmonary Disease (COPD)
- Diabetes
- Hypertension

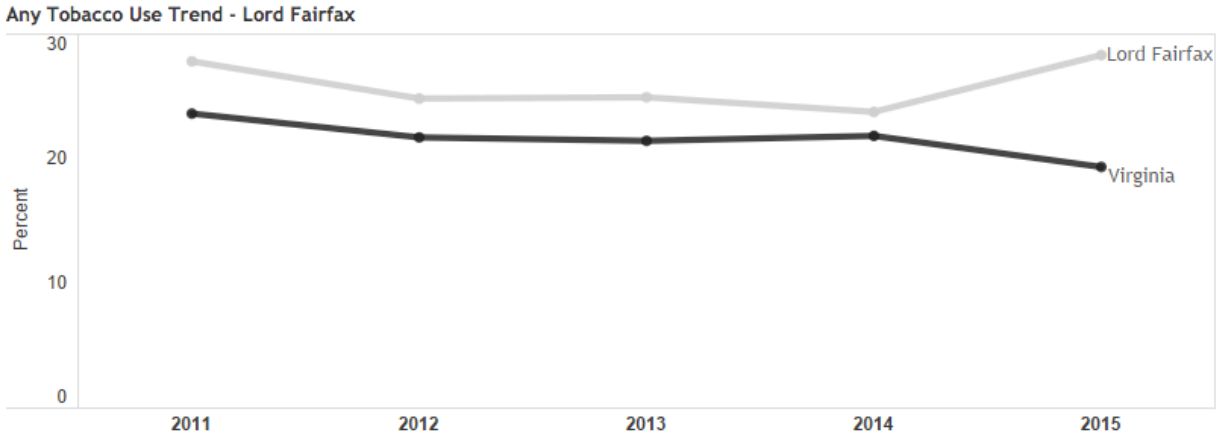
Figure 38: Major Causes of Death in Lord Fairfax Health District, VA[28]



[26] http://www.vdh.virginia.gov/data/social-determinants-of-health/
[27] ibid.
[28] Ibid.

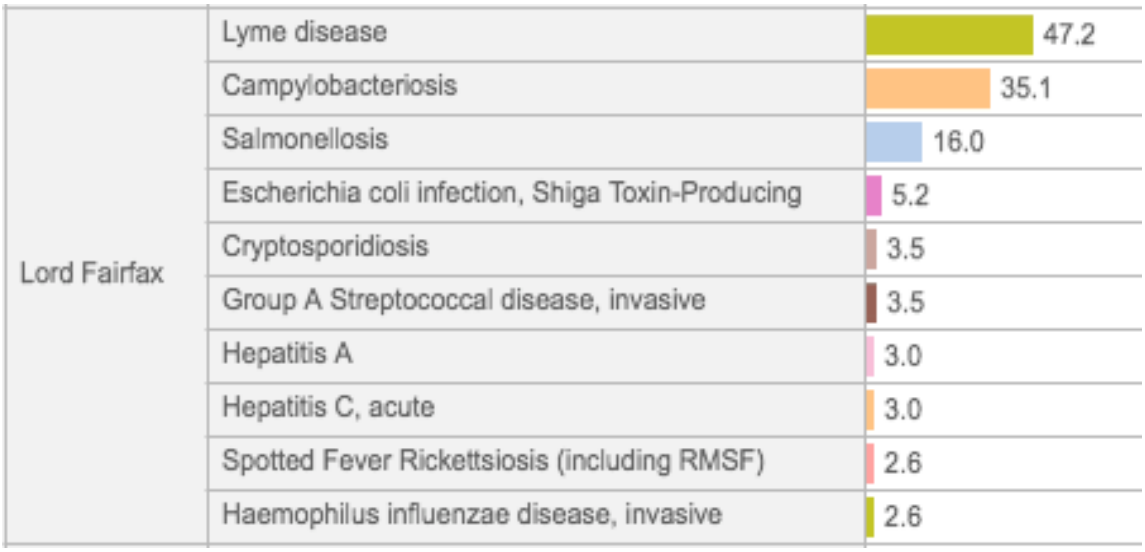
With respect to COPD, the rate of tobacco use in Lord Fairfax Health District is higher than the commonwealth.

Figure 39: Any Tobacco Use Trend - Lord Fairfax Health District[29]



The most commonly reported communicable diseases in the Lord Fairfax Health District are Lyme disease, Campylobacteriosis, and Salmonellosis in 2016.

Figure 40: 2016 Communicable Diseases in Lord Fairfax Health District[30]



Finally, the death rates for overdose, poisoning, motor vehicle crashes, and unintentional falls are all higher than the state rate within Lord Fairfax's Health District.[31] Data are presented in the figures below.

[29] Ibid.
[30] Ibid.
[31] Ibid.

Figure 41: Drug Overdose Death Rate Trend - Lord Fairfax Health District

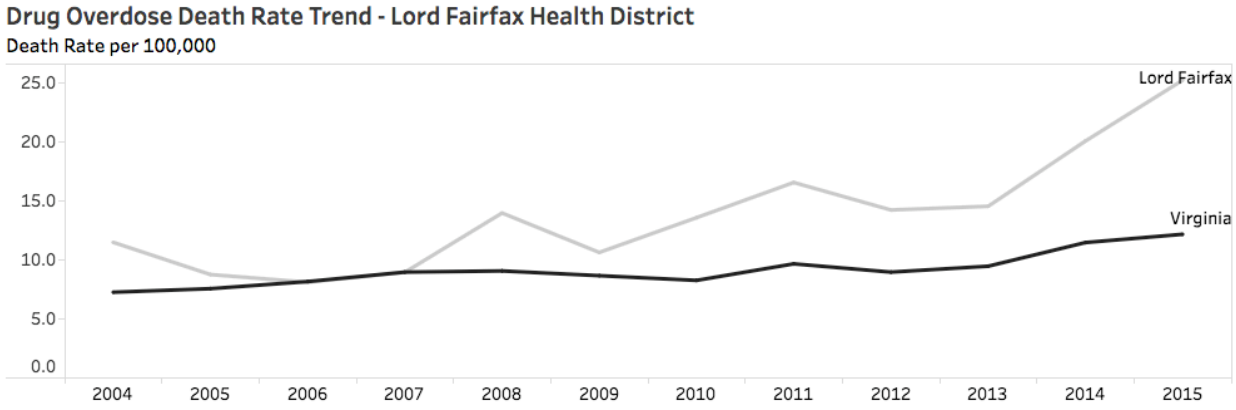


Figure 42: Motor Vehicle Traffic Death Rate Trend - Lord Fairfax Health District

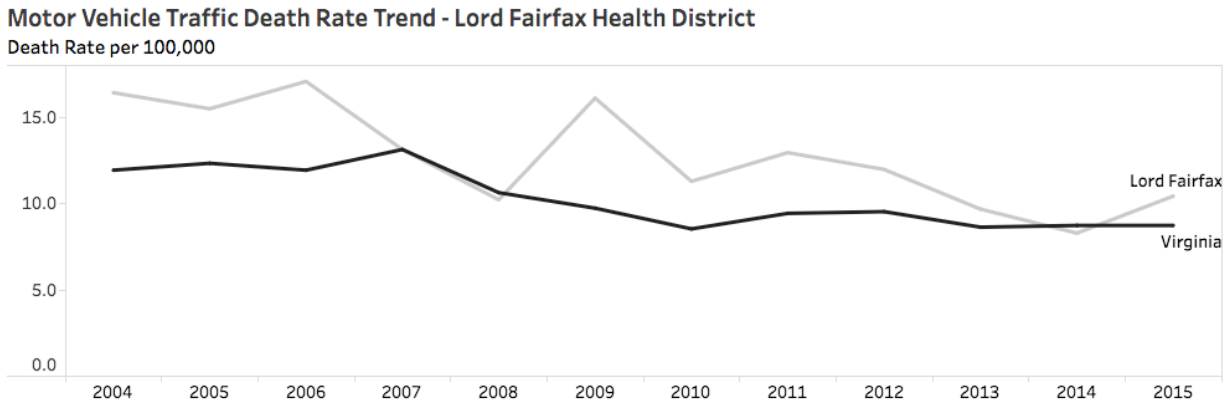


Figure 43: Poisoning Death Rate Trend - Lord Fairfax Health District

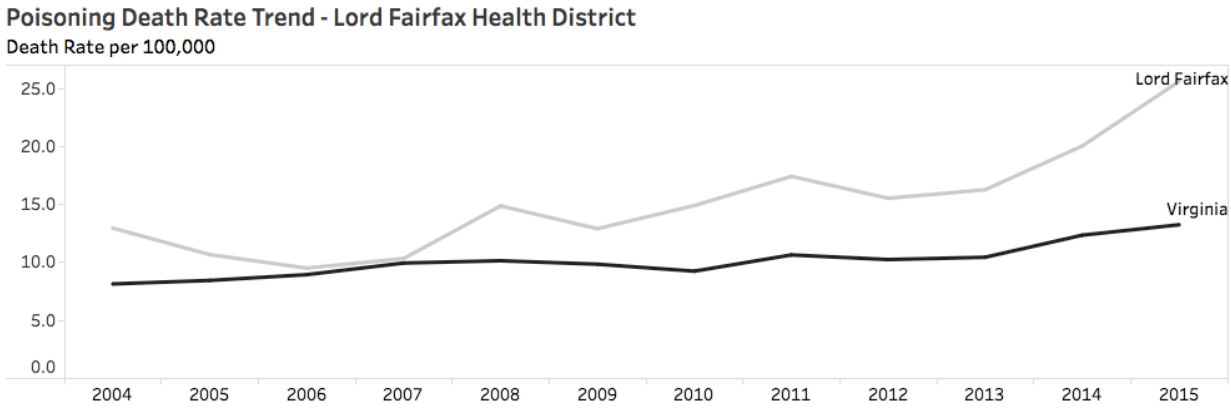
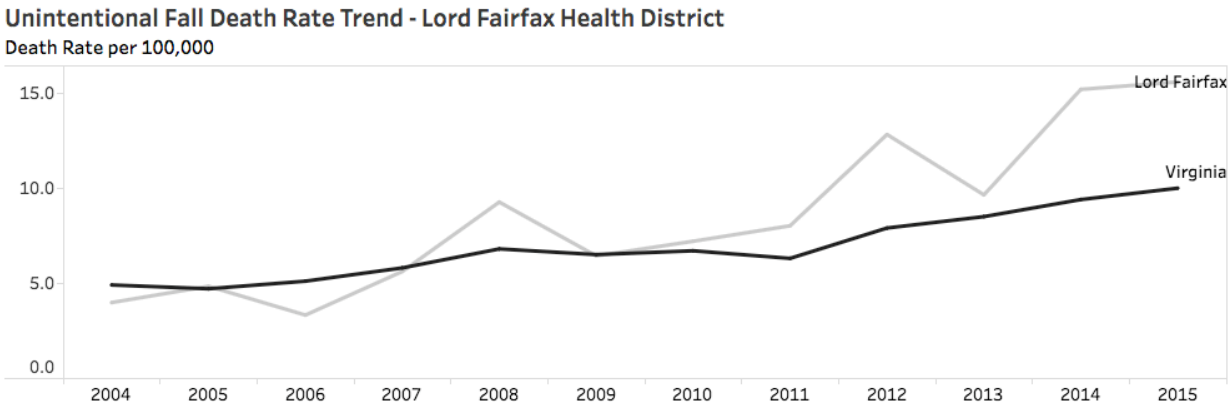


Figure 44: Unintentional Fall Death Rate Trend - Lord Fairfax Health District



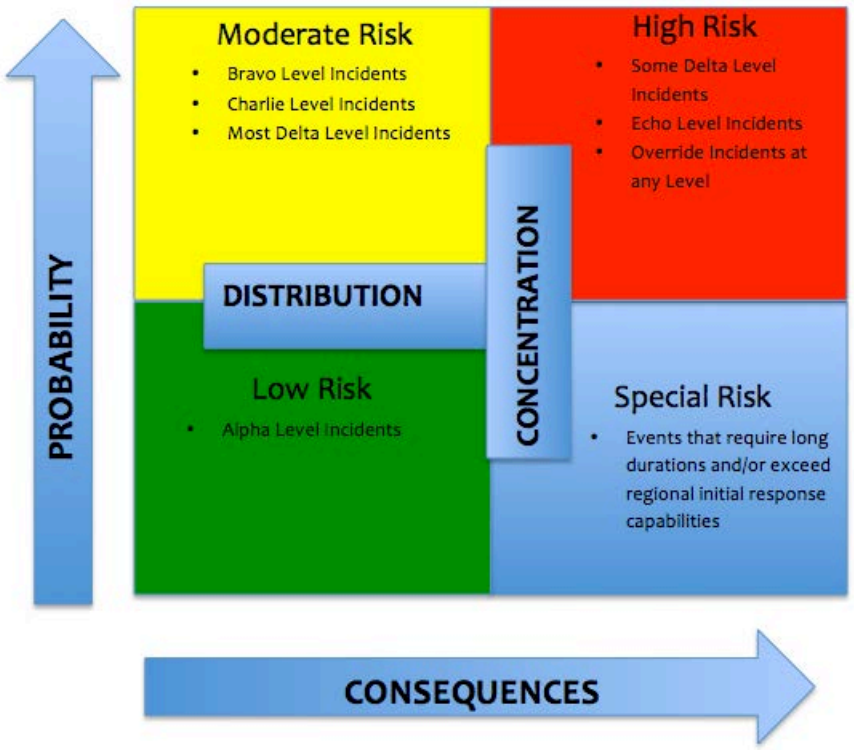
In a broad sense, FCFR is in an excellent position to contribute to the reduction and mitigation of community health risks. Community risk reduction programs that target risks such as falls prevention, poisoning, drug overdose, and driving behaviors could prove beneficial.

Probability/Consequence of EMS Risk

FCFR utilizes Emergency Medical Dispatching (EMD) and a Medical Priority Dispatching System (MPDS) to triage or prioritize medical risks at the 911-center prior to dispatching units. EMS incidents are categorized into Alpha, Bravo, Charlie, Delta, and Echo incidents with Alpha being the least emergent and Echo being the most emergent. In this manner, the department is able to send an appropriate number of resources for each level of reported risk. The CAD call type or dispatch category may fall into multiple levels of Alpha through Echo. In other words, a "fall" could be prioritized as an Alpha call as well as a Delta call depending on the severity. The detailed response matrices are updated as necessary and available from the department.

The resulting probability and consequence matrix is presented in Figure 45

Figure 45: Probability and Consequence Matrix for EMS Risk



Critical Task Analysis

The FCFR staff officers and Volunteer Chiefs analyzed the critical tasks required for the mitigation of the various EMS related incidents in the community. Critical tasks for low, moderate, and high-risk events are presented as well as the resources allocated, as determined by the group, to each event follow in tables 51 through 56 . The findings are not representative of any actual past event and the values presented are the result of the collective professional judgment of the participants.

Table 51: Emergency Medical Response – Low/Moderate Risk

Critical Task	Needed Personnel
Pt Care and Assessment	2
Total	**2**

Table 52: Resource Allocation for Emergency Medical Response – Low/Moderate Risk

Responding Units	Minimum Staffing
Ambulance	2
Total Response Provided	**2**
Personnel Required by Critical Tasks	***2***

Table 53: Emergency Medical Response - High Risk

Critical Task	Needed Personnel
Pt Care and Assessment	4
Total	**4**

Table 54: Resource Allocation for Emergency Medical Response - High Risk

Responding Units	Minimum Staffing
Engine	1
Ambulance	2
Chief	1
Total Response Provided	**4**
Personnel Required by Critical Tasks	***4***

Table 55: Emergency Medical Response - Motor Vehicle Crash with Extrication

Critical Task	Needed Personnel
Pt Care and Assessment	2
Command and Control	1
Stabilization/Extrication	4
Charged Hose Line	1
Total	**8**

Table 56: Resource Allocation for Emergency Medical Response - Motor Vehicle Crash with Extrication

Responding Units	Minimum Staffing
Engine	1
Ambulance (2)	4
ALS Chase	1
Rescue Engine	1
Chief	1
Total Response Provided	**8**
Personnel Required by Critical Tasks	***8***

Hazardous Materials Services

The FCFR provides Hazardous Materials (Haz Mat) response within the department that has capabilities for detection of and mitigation of risks. A staffed fire suppression apparatus responds for early size-up and initial mitigation so that the incident stabilization process begins immediately. More severe events can be responded to with a regional response with technician level training and more specialized equipment.

Weapons of Mass Destruction (WMD)

The National Fire Protection Association (NFPA) defines WMD as "(1) Any destructive device, such as any explosive, incendiary, or poison gas bomb, grenade, rocket having a propellant charge of more than 4 oz (113 grams), missile having an explosive or incendiary charge of more than 0.25 oz (7 grams), mine or similar device; (2) any weapon involving toxic or poisonous chemicals; (3) any weapon containing a disease organism; or (4) any weapon that is designed to release radiation or radioactivity in a level dangerous to human life."

Given the broad definition of WMD, and Frederick County's potential exposure, the risk cannot be negated. Facilities such as medical complexes, institutions of higher learning, government buildings, major shopping hubs, airports, utility, and other infrastructure locations have been targeted across the country. Incidents of this nature are complex, dynamic, and require specialized training, response, and mitigation.

Community Service Demands

Fortunately for Frederick County the demand for hazardous materials and WMD services is limited. While there is considerable exposure to hazardous materials risk, the demand for responses is low. In 2016 Frederick County 911 dispatched 18 Haz Mat calls, which equals 0.2% of all county dispatched calls. The relative low call volume renders temporal analyses unreliable since the events will be much more random than in larger data sets. In other words, the results would not be intuitive for decision-making and no further analytical analyses were conducted. The distribution of calls is relatively equally distributed throughout the County. Due to the relatively low frequency of hazardous materials incidents, the data does not suggest a more appropriate location to deploy resources for hazardous materials. There were no calls dispatched by Frederick County 911 in 2016 specifically related to WMD.

Table 57: Number of Calls, Number of Responses, and Total Busy Time by Program in 2016

Program	Number of Calls	Number of Responses	Average Responses per Call	Total Busy Hours	Average Busy Minutes per Response	Percentage of Total Busy Hours[32]
EMS	8,133	15,408	1.9	13,971	54.4	77.2%
Fire	1,379	3,488	2.5	2,703	46.5	14.9%
Rescue	305	804	2.6	488	36.4	2.7%
Hazmat	18	70	3.9	40	34.1	0.2%
Fire Investigation	33	43	1.3	158	220.2	0.9%
Mutual aid	382	796	2.1	744	56.0	4.1%
Total	**10,250**	**20,609**	**2.0**	**18,103**	**52.7**	**100.0%**

[32] Hours are for apparatus or unit hours and not specifically personnel hours. The total personnel hourly commitment would be calculated as the product of the total busy hours and the number of personnel assigned to each unit.

Community Risks

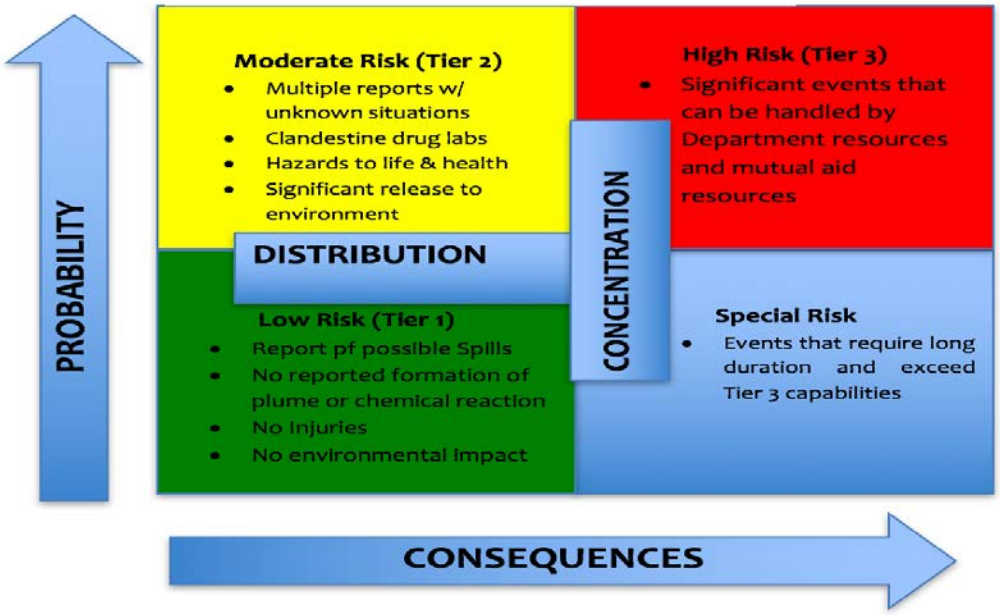
Frederick County Fire and Rescue has existing hazardous materials risks between the fixed facilities, and the transportation routes to move materials. From 2014 to 2016 Frederick County responded to diverse types of Haz Mat incidents and it is reasonable to assume that these incidents will increase with growth and development.

Probability/Consequence of Hazardous Materials Risk

The FCFR staff and Volunteer Chiefs completed analyses for the probability and consequence of hazardous materials events. In this case, the risks for hazardous materials are greater than the historical experience. Therefore, the consequence portion of the matrix had greater influence on the risk classification than the probability. All hazardous materials events are relatively low frequency as compared to other community service demands but the consequence of events can be significant.

A probability and consequences risk matrix was developed and is presented below.

Figure 46: Probability and Consequence Matrix for Hazardous Materials



Critical Task Analysis

The FCFR staff officers and Volunteer Chiefs analyzed the critical tasks required for the mitigation of typical hazardous materials risks in the community. Critical tasks for low, moderate, and high-risk events are presented as well as the resources allocated, as determined by the group, to each event in the following tables 58 through 61. The findings are not representative of any actual past event and the values presented are the result of the collective professional judgment of the participants.

Table 58: Level 1 Hazardous Materials Event - Low Risk

Critical Task	Needed Personnel
Command / Control/Investigate	2
Total	**2**

Table 59: Resource Allocation for Level 1 Hazardous Materials Incidents - Low Risk

Responding Units	Minimum Staffing
Engine	1
Total Response Provided	**2**
Personnel Required by Critical Tasks	**2**

Table 60: Level 2 Hazardous Materials Event - Moderate Risk

Critical Task	Needed Personnel
Command / Control	1
Assistant Safety Officer	1
Entry Team	4
Decon	1
Isolate and Deny Entry / Evacuation	1
Ambulance	2
Total	**10**

Table 61: Resource Allocation for Level 2 Hazardous Materials Incident - Moderate Risk / High Risk Possible

Responding Units	Minimum Staffing
Engine	1
Engine	1
Rescue Engine or Rescue Squad	1
ALS Chase	1
Ambulance	2
Chief	1
Total Response Provided	**7**
Personnel Required by Critical Tasks	**10**

Rescue Services

Technical Rescue

The FCFR has the capacity to perform technical rescue related activities. Technical rescue is a relatively broad term and includes responses to a wide variety of incidents such as water rescue, ice rescue, confined space rescue, high angle rescues, and structural collapse. Due to the critical tasking elements necessary for technical rescue events the FCFR utilizes fire response units and personnel supplemented by volunteer personnel. In large, more complex, incidents FCFR can obtain mutual aid assistance from surrounding agencies.

Community Service Demands

Like the analyses for hazardous materials, the demand for technical rescue services is low in relation to the primary areas. Frederick County 911 dispatched 305 "Rescue" related calls in 2016. This equates to .08 calls per day and 2.7% of all dispatched calls. The county is experiencing an upswing in building, so there is potential risk for high angle rescues, trench emergencies, and a consistent motor vehicle collision with entrapment potential. Due to the relatively low community demand for services temporal analyses would not produce intuitive results for decision-making.

Table 62: Number of Calls, Number of Responses, and Total Busy Time by Program in 2016

Program	Number of Calls	Number of Responses	Average Responses per Call	Total Busy Hours	Average Busy Minutes per Response	Percentage of Total Busy Hours[33]
EMS	8,133	15,408	1.9	13,971	54.4	77.2%
Fire	1,379	3,488	2.5	2,703	46.5	14.9%
Rescue	305	804	2.6	488	36.4	2.7%
Hazmat	18	70	3.9	40	34.1	0.2%
Fire Investigation	33	43	1.3	158	220.2	0.9%
Mutual aid	382	796	2.1	744	56.0	4.1%
Total	**10,250**	**20,609**	**2.0**	**18,103**	**52.7**	**100.0%**

Community Risks

The area around the City of Winchester is the population center for Frederick County, VA. As an urban/rural jurisdiction the County has a growing risk potential for technical rescue incidents due to the growing construction demands, ongoing repair to infrastructure, manufacturing industry, transportation industry, active railways, and access to bodies of water.

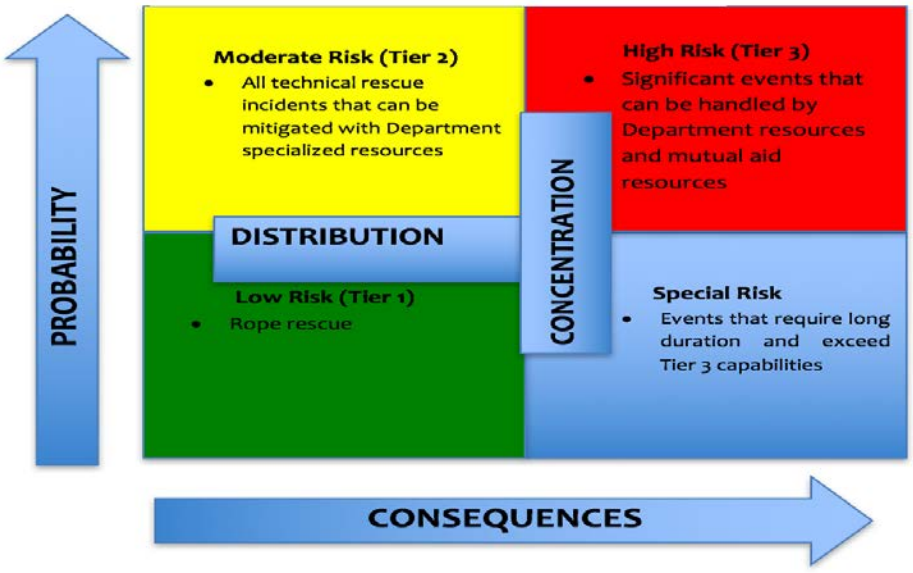
Probability/Consequence of Technical Rescue Risk

The FCFR staff and Volunteer Chiefs completed analyses for the probability and consequence of technical rescue events. In this case, the risks for technical rescue, and the FCFR technicians, are greater than the historical experience. Therefore, the consequence portion of the matrix had greater influence on the risk classification than the probability. All technical rescue events are relatively low frequency as compared to other community service demands.

A probability and consequences risk matrix was developed and follows in Figure 47.

[33] Hours are for apparatus or unit hours and not specifically personnel hours. The total personnel hourly commitment would be calculated as the product of the total busy hours and the number of personnel assigned to each unit.

Figure 47: Probability and Consequences Technical Rescue Risk Matrix



Critical Task Analysis

The FCFR staff officers and Volunteer Chiefs analyzed the critical tasks required for the mitigation of typical technical rescue risks in the community. Critical tasks for moderate and high-risk events are presented as well as the resources allocated to each event as determined by the group. The FCFR determined that the resource requirements for this program area did not have a low-risk category. Critical tasks are provided in the following tables 63 through 65. The findings are not representative of any actual past event and the values presented are the result of the collective professional judgment of the participants.

Table 63: Technical Rescue Incident - Moderate Risk/High Risk

Critical Task	Needed Personnel
Command / Control	1
Locate / Access	4
Stabilize / Patient Care / Transport	2
Total	**7**

Table 64: Resource Allocation for Technical Rescue Incident - Moderate/High Risk

Responding Units	Minimum Staffing
Engine	1
Engine	1
Rescue Engine	1
Aerial	1
Ambulance	2
ALS Chase	1
Chief Officer	1
Total Response Provided	**8**
Personnel Required by Critical Tasks	***7***

Table 65: Resource Allocation for a Water Rescue Incident

Responding Units	Minimum Staffing
Engine	1
Rescue Engine	1
Ambulance	2
Ambulance	2
Chief Officer	1
Total Response Provided	**7**
Personnel Required by Critical Tasks	*5*

REVIEW OF SYSTEM PERFORMANCE

The first step in determining the current state of the system's deployment model is to establish baseline measures of performance. This analysis is crucial to the ability to discuss alternatives to the status quo and in identifying opportunities for improvement. This portion of the analysis will focus efforts on elements of response time and the cascade of events that lead to timely response with the appropriate apparatus and personnel to mitigate the event. Response time goals should be looked at in terms of total reflex time, or total response time, which includes the dispatch or call processing time, turnout time, and travel time, respectively.

Cascade of Events

The cascade of events is the sum of the individual elements of time beginning with a state of normalcy and continuing until normalcy is once again returned through the mitigation of the event. The elements of time that are important to the ultimate outcome of a structure fire or critical medical emergency begin with the initiation of the event. For example, the first on-set of chest pain begins the biological and scientific time clock for heart damage irrespective of when 911 is notified. Similarly, a fire may begin and burn undetected for a period of time before the fire department is notified. The emergency response system does not have control over the time interval for recognition or the choice to request assistance.

Therefore, Frederick County Fire and Rescue utilizes quantifiable "hard" data points to measure and manage system performance. These elements include alarm processing (with updated CAD), turnout time, travel time, and the time spent on-scene. An example of the cascade of events and the elements of performance utilized is provided in Figure 48.[34]

Detection

Is the element of time between the time an event occurs, and someone detects it and the emergency response system has been notified. This is typically accomplished by calling the 911 Public Safety Answering Point (PSAP).

Call Processing

This is the element of time measured between when 911 answers the 911 call, processes the information, and subsequently dispatches emergency responders.

[34] Olathe Fire Department. (2012). Adapted from Community Risk and Emergency Services Analysis: Standard of Cover. Olathe, Kansas: Author.

Turnout Time

This is the element of time that is measured between the time the fire department is dispatched or alerted of the emergency incident and the time when the fire apparatus or ambulance is enroute to the call.

It is understood that for Frederick County, the Call Processing (Dispatch) time and Turnout times are combined, as they are not currently differentiated in the data captured by the CAD

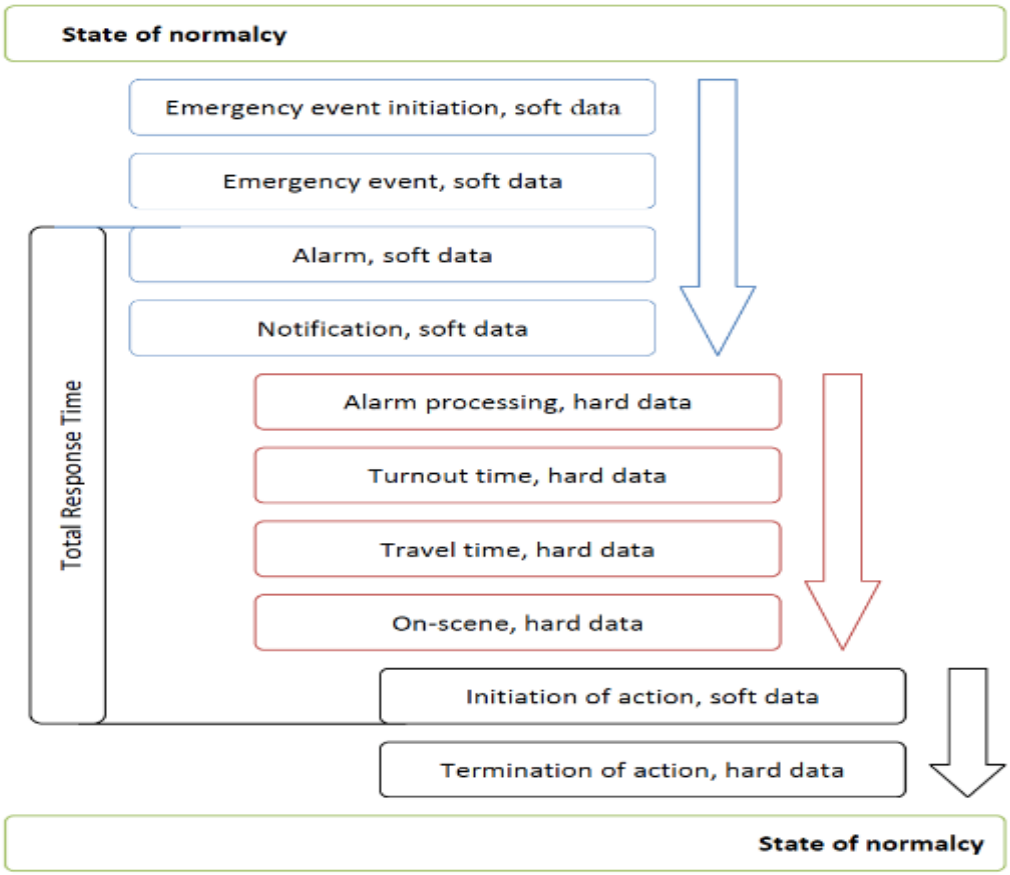
Travel Time

The travel time is the element of time between when the unit went enroute, or began to travel to the incident, and their arrival on-scene.

Total Response Time

The total response time, or total reflex time, is the total time required to arrive on-scene beginning with 911 answering the phone request for service and the time that the units arrive on-scene.

Figure 48: Cascade of Events



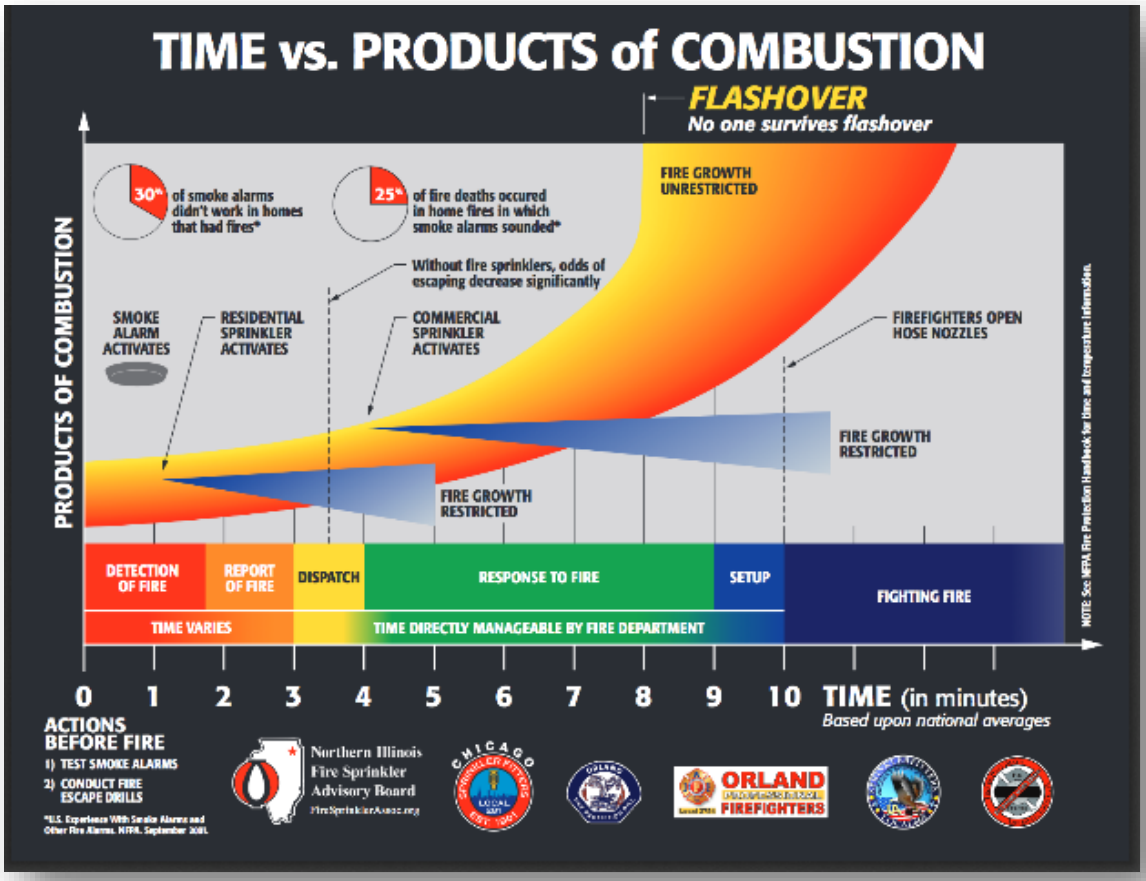
Response Time Continuum

Fire

The number one priority with structural fire incidents is to save lives followed by the minimization of property damage. A direct relationship exists between the timeliness of the response and the survivability of unprotected occupants and property damage. The most identifiable point of fire behavior is Flashover.

Flashover is the point in fire growth where the contents of an entire area, including the smoke, reach their ignition temperature, resulting in a rapid-fire growth rendering the area un-survivable by civilians and untenable for firefighters. Best practices would result in the fire department arriving and attacking the fire prior to the point of flashover. A representation of the traditional time temperature curve and the cascade of events is provided in Figure 49. [35]

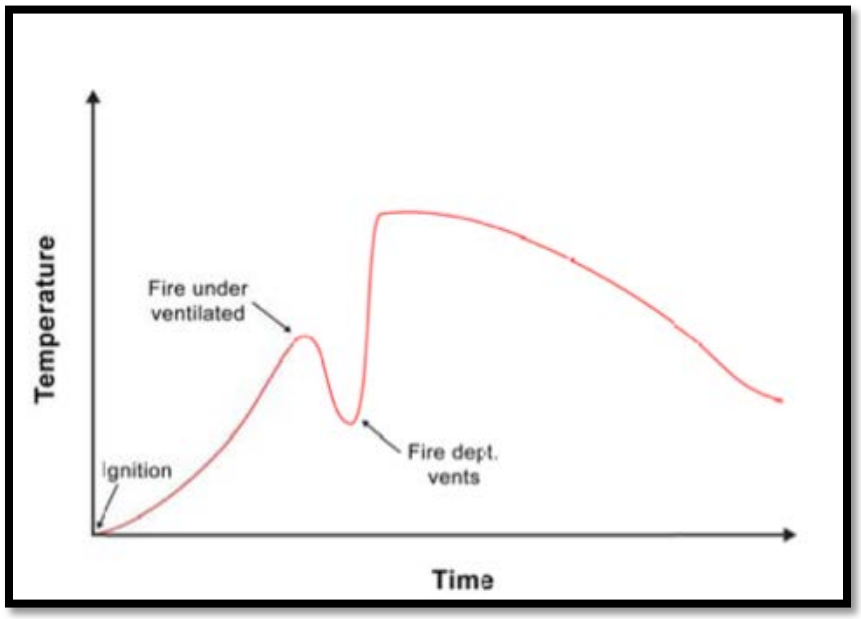
Figure 49: Example of Traditional Time Temperature Curve



[35] Example of Traditional Time Temperature Curve. Retrieved at http://www.usfa.fema.gov/downloads/pdf/coffee-break/time-vs-products-of-combustion.pdf

Recent studies by Underwriter's Laboratories (UL) have found that in compartment fires such as structure fires, flashover occurs within 4 minutes in modern fire environment. Modern home environments differ from traditional home environments with the addition of consumer furnishings made from petroleum-based products such as foam cushions and plastics. A compounding effect is also due to the advances in energy efficiency such as found in modern windows, insulation, etc. In addition, the UL research has identified an updated time temperature curve due to fires being ventilation controlled rather than fuel controlled as represented in the traditional time temperature curve. While this ventilation-controlled environment continues to provide a high risk to unprotected occupants to smoke and high heat, it does provide some advantage to property conservation efforts as water may be applied to the fire prior to ventilation and the subsequent flashover. An example of UL's ventilation-controlled time temperature curve is provided in Figure 50 below.[36]

Figure 50: Ventilation Controlled Time Temperature Curve



EMS

The effective response to Emergency Medical Service (EMS) incidents also has a direct correlation to the ability to respond within a specified period. However, unlike structure fires, responding to EMS incidents introduces considerable variability in the level of clinical acuity. From this perspective, the association of response time and clinical outcome varies depending on the severity of the injury or the illness. Research has demonstrated that the overwhelming majority of requests for EMS services are not time sensitive between 5 minutes and 11 minutes for emergency and 13 minutes for non-emergency responses.[37] The 12-minute upper threshold is only the upper limit of the available

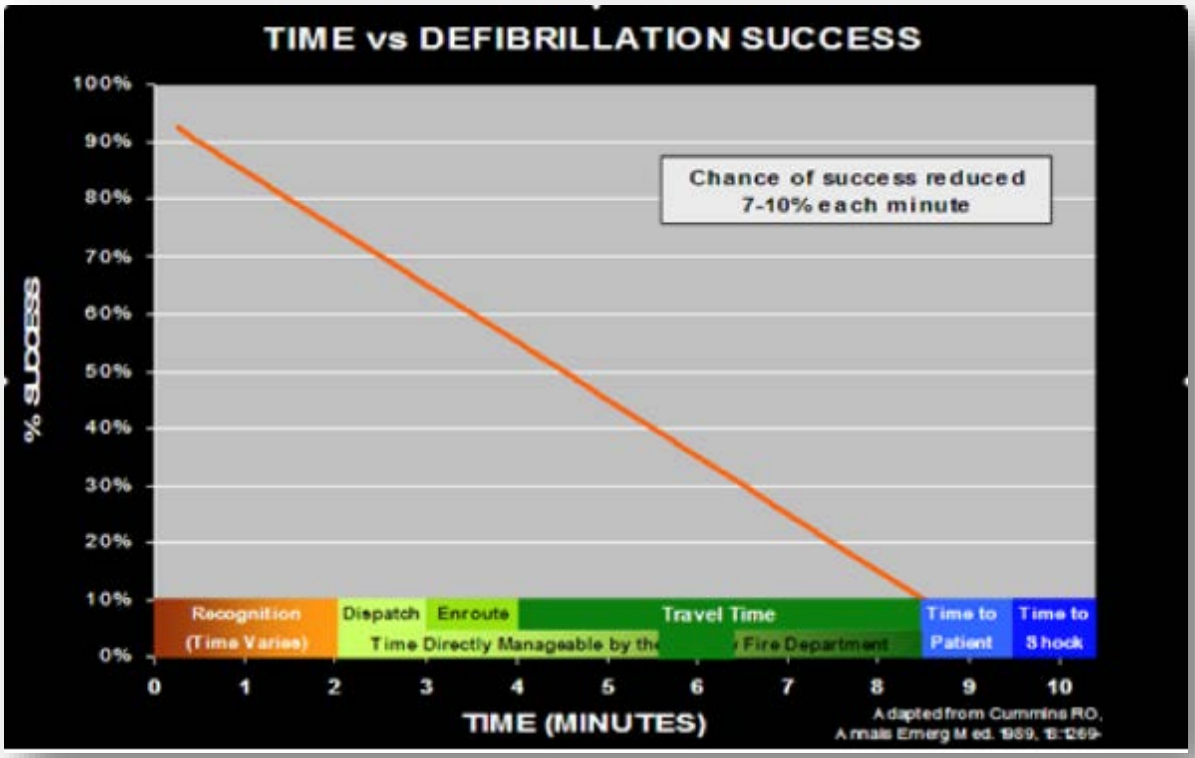
[36] UL/NIST Ventilation Controlled Time Temperature Curve. Retrieved from http://www.nist.gov/fire/fire_behavior.cfm
[37] Blackwell, T.H., & Kaufman, J.S. (April 2002). Response time effectiveness: Comparison of response time and survival in an urban emergency medical services system. *Academic Emergency Medicine,* 9(4): 289-295.

research and is not a clinically significant time measure, as patients were not found to have a significantly different clinical outcome when the 12-minute threshold was exceeded.[38]

Out of hospital sudden cardiac arrest is the most identifiable and measured incident type for EMS. In an effort to demonstrate the relationship between response time and clinical outcome, a representation of the cascade of events and the time to defibrillation (shock) is presented in Table 51. The American Heart Association (AHA) has determined that brain damage will begin to occur between four and six minutes and become irreversible after 10 minutes without intervention.

Modern sudden cardiac arrest protocols recognize that high quality Cardio-Pulmonary Resuscitation (CPR) at the Basic Life Support (BLS) level is a quality intervention until defibrillation can be delivered in shockable rhythms. The figure below is representative of a sudden cardiac arrest that is presenting in a shockable heart rhythm such as Ventricular Fibrillation (V-Fib) or Ventricular Tachycardia (V-Tach).

Figure 51: Cascade of Events for Sudden Cardiac Arrest with Shockable Rhythm[39]



[38] Blackwell, T.H., et al. (Oct-Dec 2009). Lack of association between prehospital response times and patient outcomes. *Prehospital Emergency Care,* 13(4): 444-450.
[39] Olathe Fire Department. (2012). Adapted from Community Risk and Emergency Services Analysis: Standard of Cover. Olathe, Kansas: Author.

It is important to note that many confounding variables are present in any of the broad response time to outcome relationships. For example, the recognition and detection phase previously discussed could have the greatest impact on the efficacy of the response system.

Distribution Factors

Comparison of Service Areas

Geospatial analyses were completed regarding drive times that incorporated FCFR's current performance and nationally recommended best practices. Drive times from each of the current fixed facility fire stations were created utilizing existing road miles and impedance for eight and ten minute increments. This analysis suggest that the majority of the county should be able to be responded to within 8 minutes to 10 minutes for where the majority of the risk is located. The (green) shading indicates the estimated travel time capabilities from the existing road networks. The darker the (green) shading, the more overlap exists between response capabilities within the current configuration. Finally, the number in parenthesis "(1)" indicates the order of contribution to system performance at the specific travel time goal 90% of the time or less. For example, referring to Table 66 and Figure 52, Station 18 contributes the most to the overall success of the system. As illustrated, is capable of delivering an eight (8) minute response time to 79.84% of the incidents.

Similarly, the planning analysis suggests that 90% of the incidents could be captured in 10-minutes or less. Station 21 would provide the greatest contribution to overall success. Results of this analysis are presented below.

8-Minute Urban/Suburban and 13-Minute Rural Travel - Frederick County Only

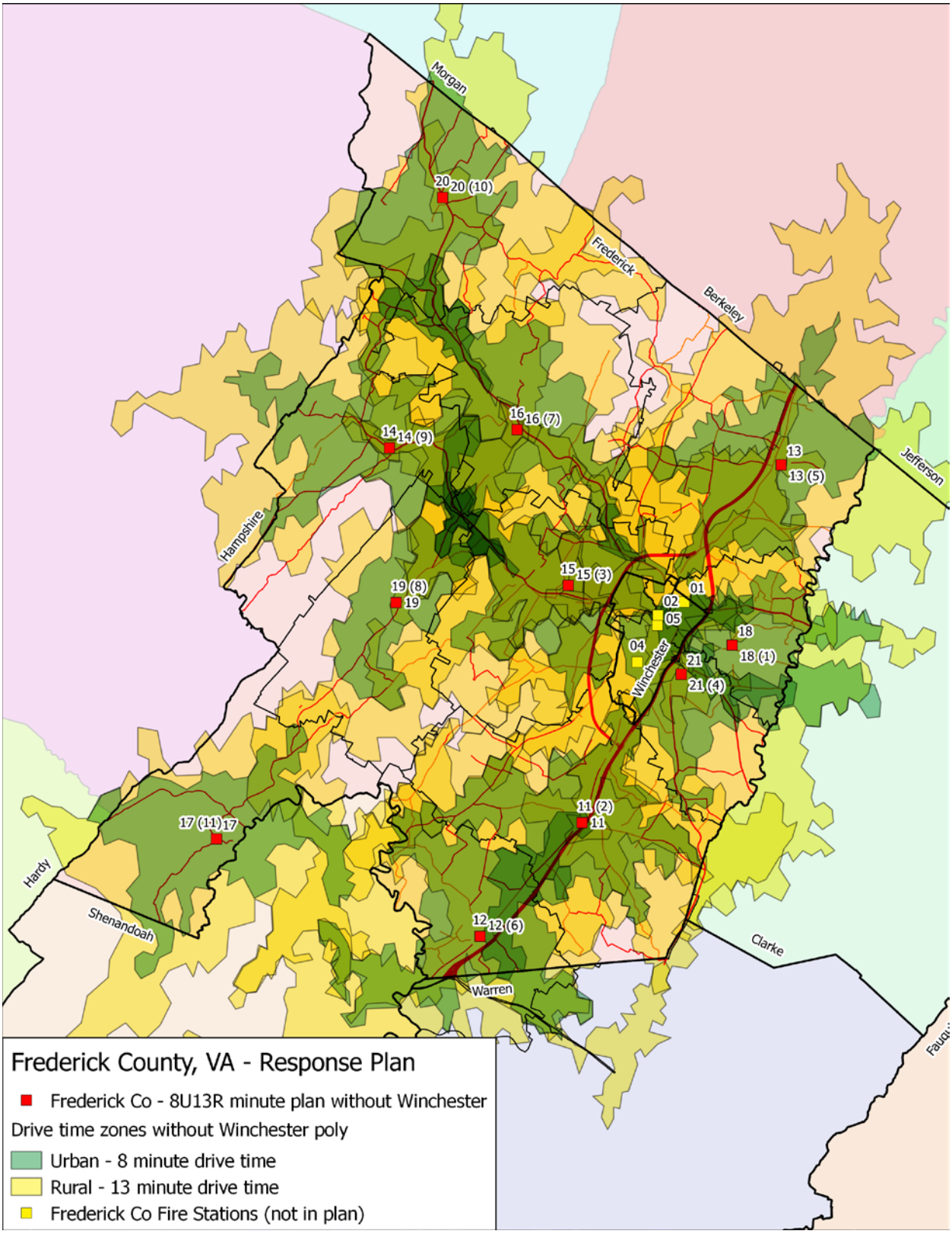
The 8-minute travel time modeling suggests that an 11-station configuration would achieve a travel time of 8-minutes or less to approximately 80% of the incidents in the urban/suburban areas without utilizing the City of Winchester. While it is less efficient than with utilizing Winchester stations, it only accounts for approximately 4% loss of coverage.

This scenario falls short of the urban/suburban response of 8-minutes at 90% and continues to require all 11 current fire station locations. This model would provide for greater than 97% coverage of rural incidents within 13-minutes or less. Therefore, approximately 2.7% of the incidents in the rural areas would receive service longer than 13-minutes.

Table 66: Marginal Fire Station Contribution for 8-Minute Urban/Suburban and 13-Minute Rural Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	18	1,953	1,953	20.12%
2	11	1,764	3,717	38.30%
3	15	1,315	5,032	51.84%
4	21	725	5,757	59.31%
5	13	720	6,477	66.73%
6	12	254	6,731	69.35%
7	16	250	6,981	71.92%
8	19	227	7,208	74.26%
9	14	199	7,407	76.31%
10	20	186	7,593	78.23%
11	17	156	7,749	79.84%
12	21	942	8,691	89.54%
13	11	235	8,926	91.96%
14	16	210	9,136	94.13%
15	19	91	9,227	95.06%
16	13	86	9,313	95.95%
17	14	69	9,382	96.66%
18	20	25	9,407	96.92%
19	12	16	9,423	97.08%
20	15	14	9,437	97.23%
21	17	9	9,446	97.32%

Figure 52: Travel Time Bleed Maps for 8-Minute Urban/Suburban and 13-Minute Rural Travel Times



10-Minute Urban/Suburban and 13-Minute Rural Travel – Frederick Stations Only

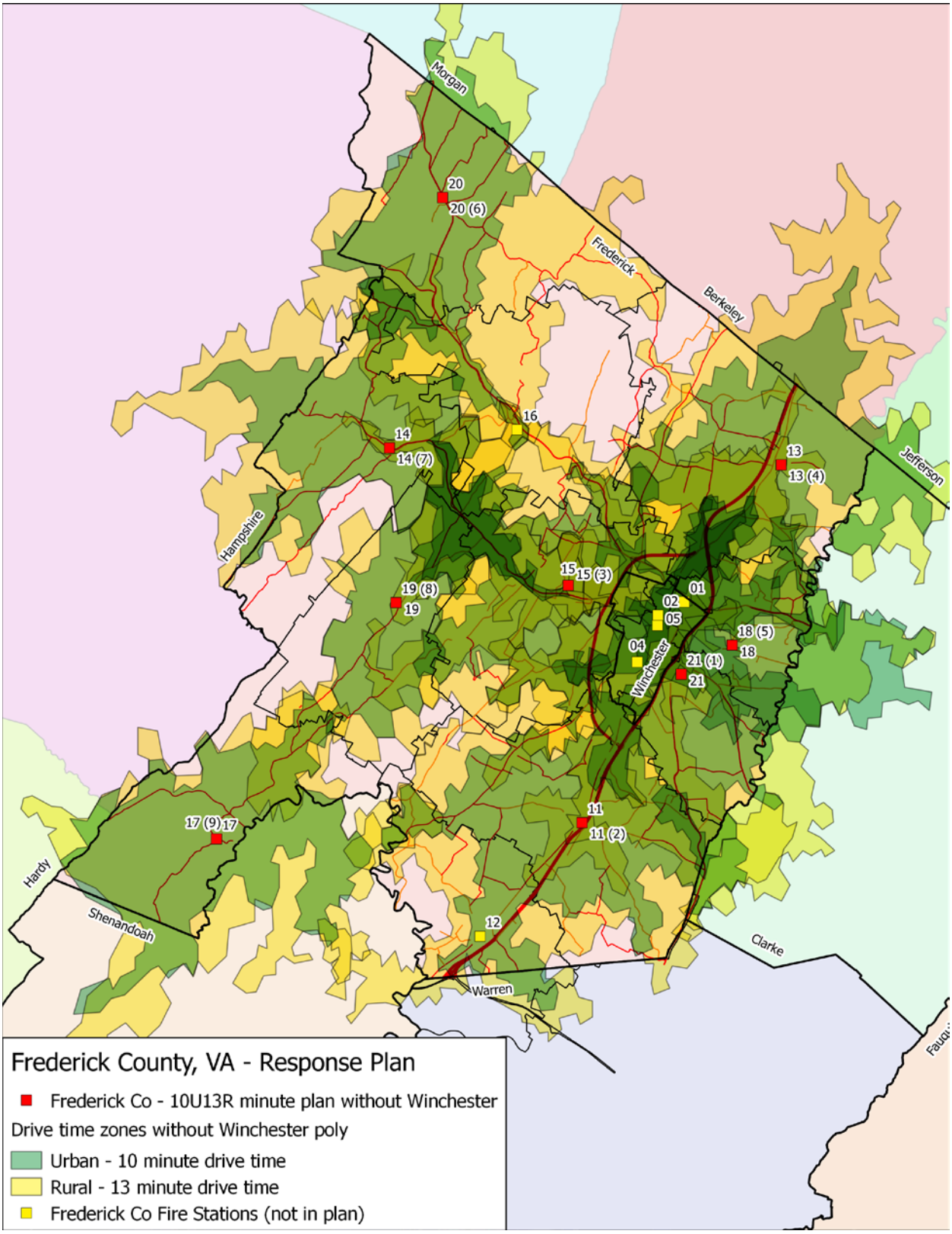
The 10-minute travel time modeling suggests that a 9-station configuration would achieve a travel time of 10-minutes or less to 90.87% of the incidents in the Urban/Suburban areas and approximately 97% of the rural incidents in 13-minutes or less. Similar to the previous analysis, Station 18 would be the only station that does not provide any rural coverage and no additional stations are needed for rural coverage that were not already included in the requisite stations for the urban and suburban areas.

Therefore, this configuration would require a 9-station deployment model to continue to meet 10-minutes urban/suburban and 13-minutes rural responses for greater than 90% of the incidents. *This model requires one less station than if the City of Winchester provided coverage.* In this model, 3.4% of the rural incidents would have a response time greater than 13 minutes.

Table 67: Marginal Fire Station Contribution for 10-Minute Urban/Suburban and 13-Minute Rural Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	21	3,658	3,658	37.69%
2	11	1,694	5,352	55.14%
3	15	1,535	6,887	70.96%
4	13	560	7,447	76.73%
5	18	404	7,851	80.89%
6	20	318	8,169	84.16%
7	14	251	8,420	86.75%
8	19	231	8,651	89.13%
9	17	169	8,820	90.87%
10	11	223	9,043	93.17%
11	20	163	9,206	94.85%
12	15	85	9,291	95.72%
13	13	56	9,347	96.30%
14	17	15	9,362	96.46%
15	14	11	9,373	96.57%
16	19	6	9,379	96.63%
17	21	2	9,381	96.65%

Figure 53: Travel Time Bleed Maps for 10-Minute Urban/Suburban and 13-Minute Rural Travel Times

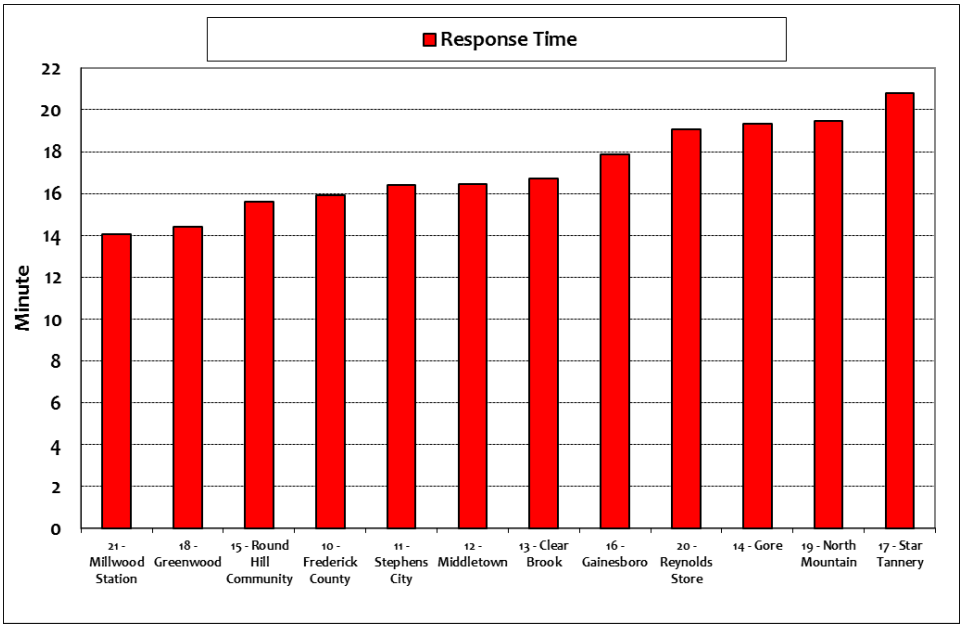


Finally, the geospatial analyses were validated through a review of annual historical performance across each of the service areas. In general, the actual performance validates the planning assessments on potential performance. The data were further analyzed to compare the individual station service area's performance. With respect to travel time performance, performances for calls in stations 21, 18, and 15 were less than 10 minutes and stations 10, 11, 12, and 13 were 11 minutes or less. The historical travel time performance for each fire station service area is provided below.

Table 68: 90th Percentile First Arrival Performance by Fire Service Area in Ascending Order of Response Time

First Due Station Service Area	Dispatch and Turnout Time	Travel Time	Response Time	Sample Size
21 - Millwood Station	7.1	8.5	14.1	840
18 - Greenwood	7.1	8.5	14.4	1,862
15 - Round Hill	7.0	9.7	15.6	1,291
11 - Stephens City	7.2	10.5	16.4	2,095
12 - Middletown	7.1	11.0	16.4	519
13 - Clear Brook	7.2	10.7	16.7	867
16 - Gainesboro	7.4	11.5	17.9	382
20 - Reynolds Store	8.1	12.7	19.1	221
14 - Gore	8.6	13.2	19.4	248
19 - North Mountain	9.8	12.6	19.5	331
17 - Star Tannery	7.9	15.7	20.8	151
Total	**7.7**	**11.3**	**17.3**	**8,807**

Figure 54: 90th Percentile Response time by Fire Station Service Area



Comparison of Workloads by Station Service Area

Another method of assessing the effectiveness of the distribution model is to analyze the demand for services across the distribution model. Workload is assessed at the first due station service area level and at the individual unit level.

Of requests in the jurisdiction of Frederick County Fire and Rescue, analyses illustrate that the Station Service Area for Greenwood accounted for 21.7% of the total demand, station demand within Stephens City accounted for 18.0%, and station Round Hill Community accounted for 12.2% of the total. The workload of the top three station service areas accounted for 52% of the department total.

Table 69: Number of Calls and Responses by First Due Station Service Area[40]

First Due Station Service Area	Number of Calls	Number of Unit Responses	Responses per Day	Percent of Department Workload
10 - Frederick County	100	160	0.4	0.8
11 - Stephens City	2,216	3,714	10.2	18.0
12 - Middletown	744	1,279	3.5	6.2
13 - Clear Brook	981	2,053	5.6	10.0
14 - Gore	290	740	2.0	3.6
15 - Round Hill Community	1,402	2,522	6.9	12.2
16 - Gainesboro	422	1,149	3.1	5.6
17 - Star Tannery	178	362	1.0	1.8
18 - Greenwood	1,990	4,470	12.2	21.7
19 - North Mountain	356	979	2.7	4.8
20 - Reynolds Store	316	762	2.1	3.7
21 - Millwood Station	979	1,893	5.2	9.2
Berkeley County	28	35	0.1	0.2
Clarke County	27	58	0.2	0.3
Hampshire County	42	88	0.2	0.4
Hardy County	8	11	0.0	0.1
Jefferson County	5	10	0.0	0.0
Morgan County	42	101	0.3	0.5
Out of County	3	4	0.0	0.0
Warren County	4	8	0.0	0.0
Winchester	117	211	0.6	1.0
Total	**10,250**	**20,609**	**56.5**	**100.0**

[40] The CAD data provided did not have a method to determine calls involving Shenandoah County.

Figure 55: Number of Incidents by Station Service Area

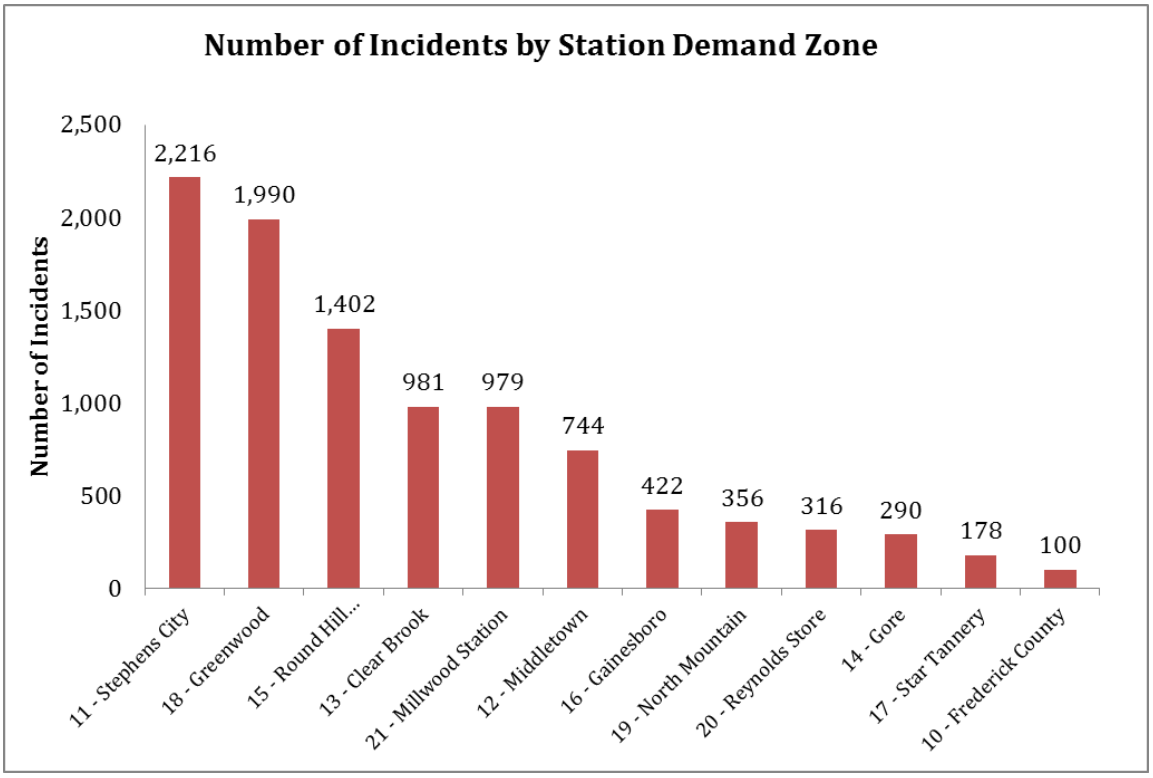
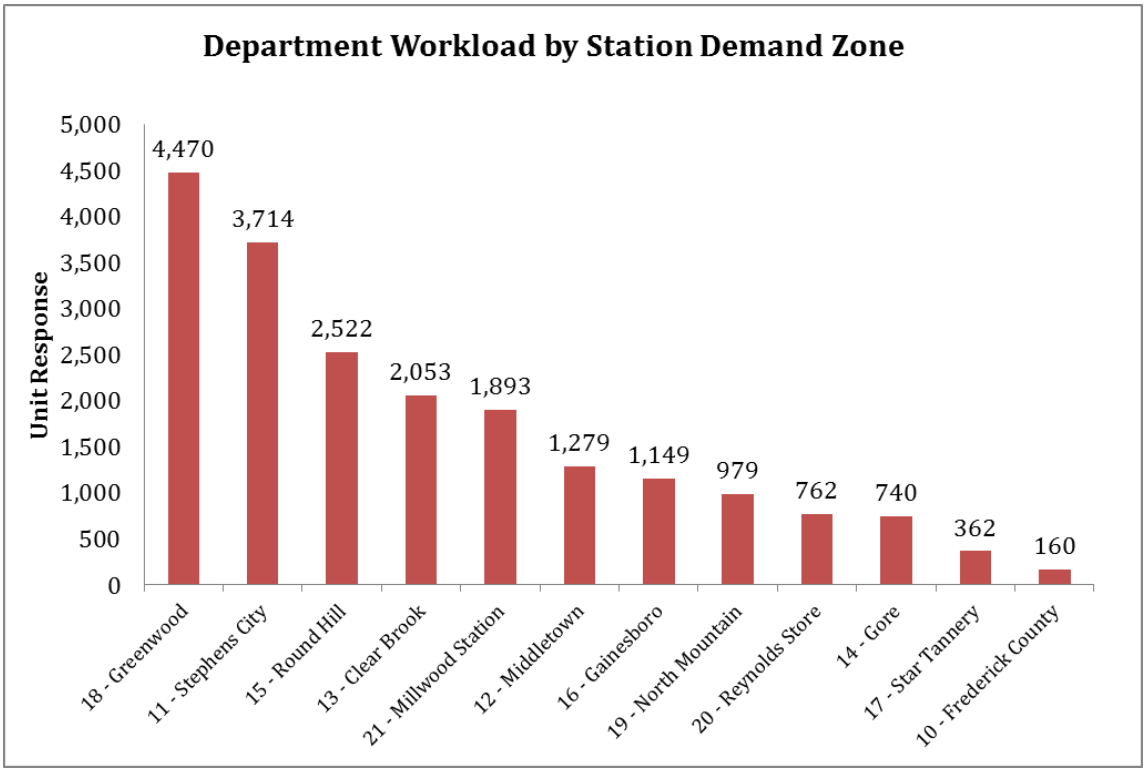


Figure 56: Workload by Station Service Area



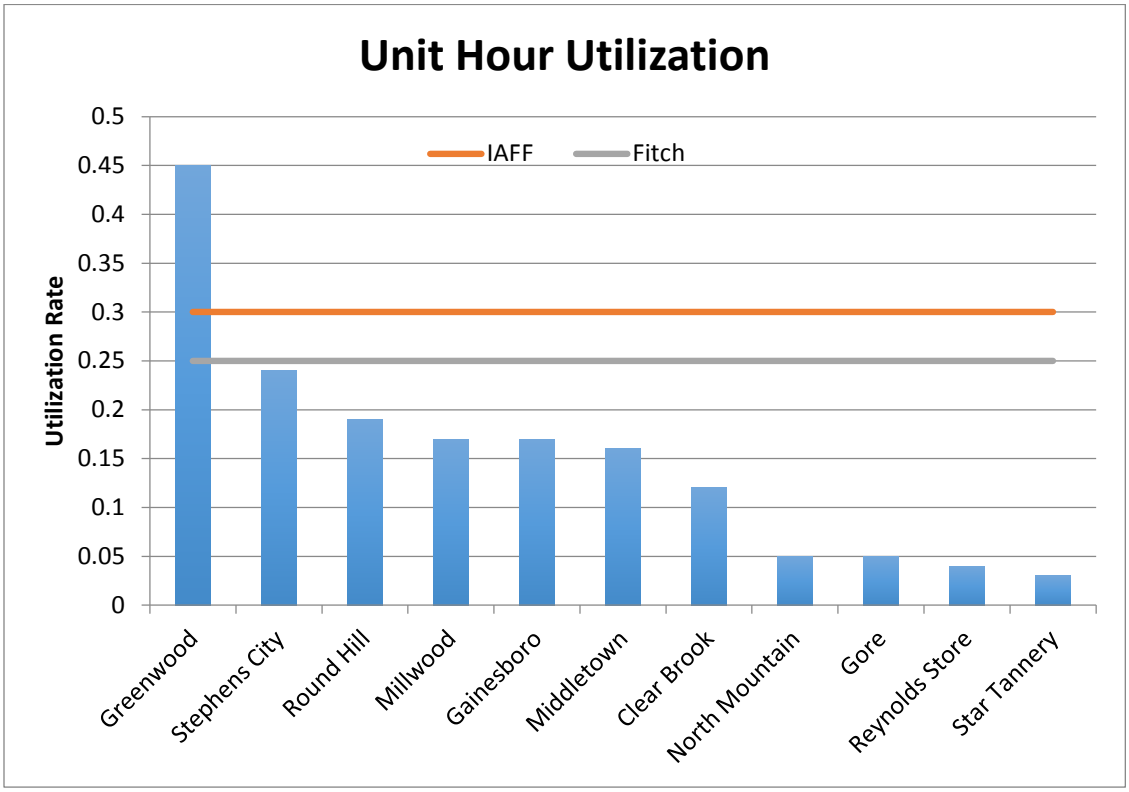
Comparison of Workloads by Unit Hour Utilization (UHU)

Another measure, time on task, is necessary to evaluate best practices in efficient system delivery and consider the impact workload has on personnel. Unit Hour Utilization (UHU) determinants were developed by mathematical model. This model includes both the proportion of calls handled in each major service area (Fire, EMS, Rescue, and Hazmat) and total unit time on task for these service categories in 2016. The resulting UHU's represent the percentage of the work period (24 hours) that is utilized responding to requests for service. Historically, the International Association of Fire Fighters (IAFF) has recommended that 24-hour units utilize 0.30, or 30% workload as an upper threshold.[41] In other words this recommendation would have personnel spend no more than eight (8) hours per day on emergency incidents. These thresholds take into consideration the necessity to accomplish non-emergency activities such as training, health and wellness, public education, and fire inspections. The 4th edition of the IAFF EMS Guidebook no longer specifically identifies an upper threshold. However, *FITCH* recommends that an upper unit utilization threshold of approximately .30, or 30%, would be considered best practice. In other words, units and personnel should not exceed 30%, or eight (8) hours, of their workday responding to calls. These recommendations are also validated in the literature. For example, in their review of the City of Rolling Meadows, the Illinois Fire Chiefs Association utilized a UHU threshold of .30 as an indication to add additional resources.[42] Similarly, in a standards of cover study facilitated by the Center for Public Safety Excellence, the Castle Rock Fire and Rescue Department utilizes a UHU of .30 as the upper limit in their standards of cover due to the necessity to accomplish other non-emergency activities.[43]

We grouped cross-staffed units together and conduct UHU analysis at station level. Greenwood Station has the highest workload at 0.45, followed by the next four highest: Stephens City station at 0.24, Round Hill at 0.19, and Millwood and Gainesboro at 0.17.

[41] International Association of Firefighters. (1995). Emergency *Medical Services: A Guidebook for Fire-Based Systems.* Washington, DC: Author. (p. 11)
[42] Illinois Fire Chiefs Association. (2012). An *Assessment of Deployment and Station Location: Rolling Meadows Fire Department.* Rolling Meadows, Illinois: Author. (pp. 54-55)
[43] Castle Rock Fire and Rescue Department. (2011). Community *Risk Analysis and Standards of Cover.* Castle Rock, Colorado: Author. (p. 58)

Figure 57: Station Level Unit Hour Utilization



Note: Greenwood station assumed one unit was staffed by full-time firefighters 24/7.

Table 70: Station Level Unit Hour Utilization

Station	Unit	Busy Hours	UHU	IAFF	Fitch
Greenwood	A181/A183/A814/E18/ALS2	3,934	0.45	0.30	0.25
Stephens City	A111/A112/A113/E11	2,082	0.24	0.30	0.25
Round Hill	A151/A152/RE15/E15	1,623	0.19	0.30	0.25
Millwood	A211/A212/RE21/E21	1,493	0.17	0.30	0.25
Gainesboro	A161/A162/E16/ALS1	1,490	0.17	0.30	0.25
Middletown	A121/A122/ALS12/RE12/ET12	1,413	0.16	0.30	0.25
Clear Brook	A131/A132/E13	1,038	0.12	0.30	0.25
North Mountain	A191/A192/W19	408	0.05	0.30	0.25
Gore	A141/A142/E14	400	0.05	0.30	0.25
Reynolds Store	A201/A202/E20	378	0.04	0.30	0.25
Star Tannery	A171/E17	270	0.03	0.30	0.25

DESCRIPTION OF FIRST ARRIVING UNIT PERFORMANCE

Analyses of the response characteristics of the first arriving units were conducted. Overall the system had a mean dispatch and turnout time of 312 seconds, and 437 seconds at the 90th percentile. The travel time for all first arriving unit responses were calculated irrespective of their assigned station service area. In other words, this analysis describes the first arriving unit to the scene. The mean travel time was 354 seconds, or 5 minutes and 54 seconds. Performance at the 90th percentile was 623 seconds, or 10 minutes and 23 seconds.

The "total response time" is defined as from call entry through unit arriving on scene. The mean response time is 672 seconds, or 11 minutes and 12 seconds. Performance at the 90th percentile is 981 seconds, or 16 minutes and 21 seconds. Results of first arriving unit performance are provided below.

Table 71: Description of First Arriving Unit Emergency Response Performance

Measure	Average	90th Percentile
Dispatch and Turnout Time	5.2	7.3
Travel Time	5.9	10.4
Response Time	11.2	16.4

The 90th percentile dispatch and turnout time for EMS and fire calls were 7.3 and 7.5 minutes respectively. For EMS calls, a total of 51% of calls had dispatch and turnout time of five minutes or less. For fire calls, a total of 65% of the calls had dispatch and turnout time of five minutes or less.

The 90th percentile travel time for EMS and fire calls were 10.1 and 11.7 minutes respectively. For EMS calls, a total of 47% of the calls had travel time of five minutes or less. For fire calls, a total of 46% of calls had travel time of five minutes or less.

Figure 58: EMS Calls: Distribution of Dispatch and Turnout Time of First Arriving Unit

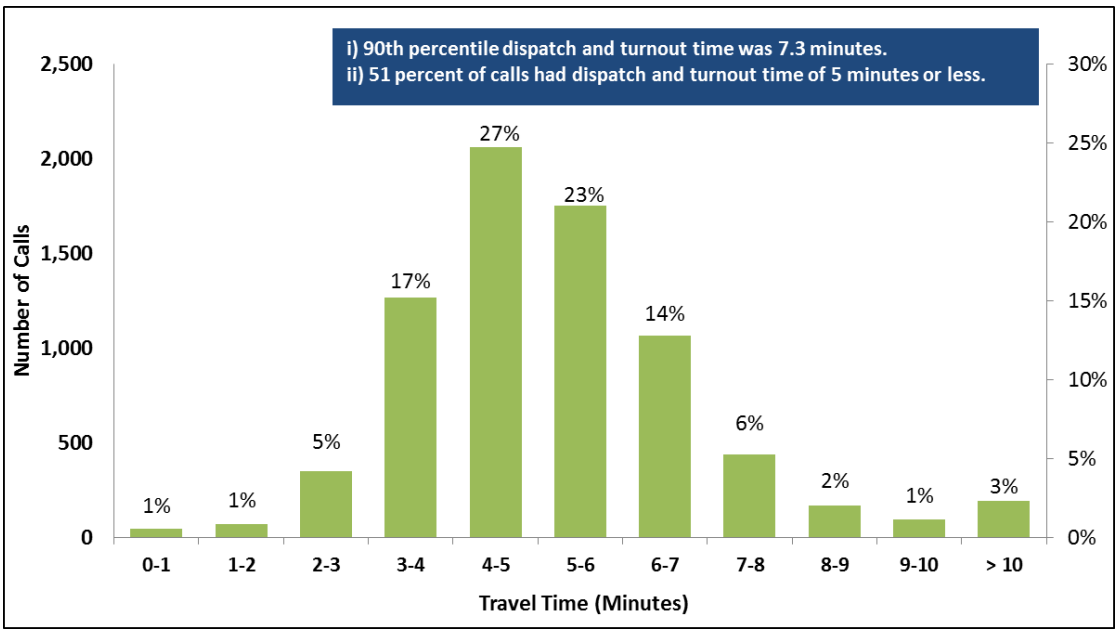


Figure 59: EMS Calls: Distribution of Travel Time of First Arriving Unit

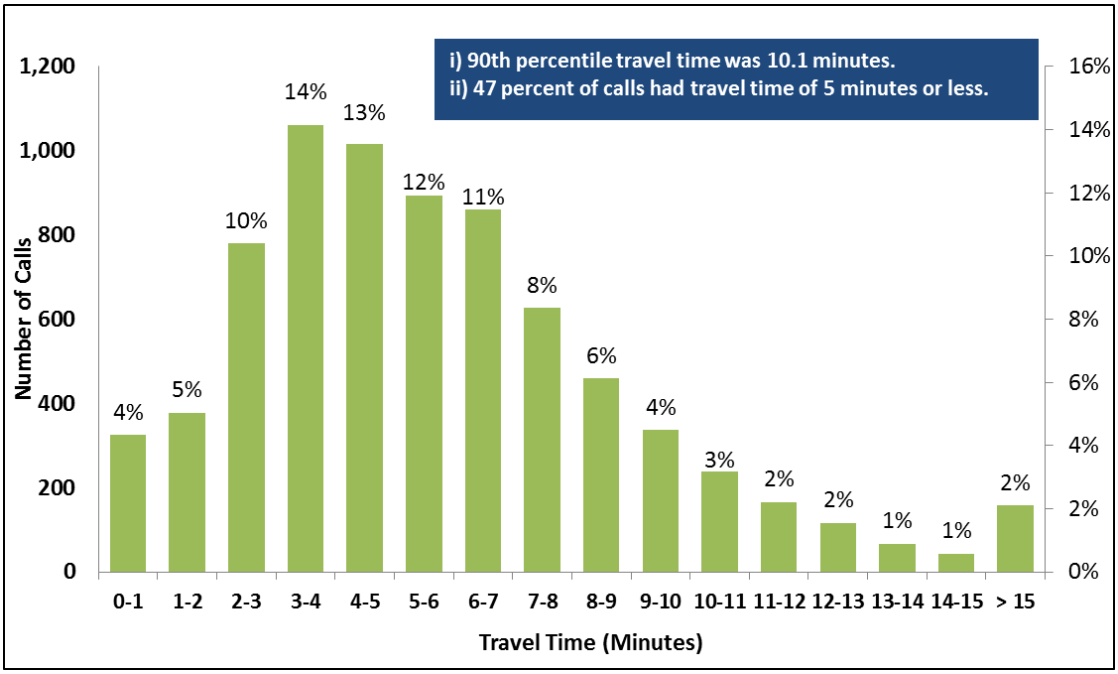


Figure 60: Fire Calls: Distribution of Dispatch and Turnout Time of First Arriving Unit

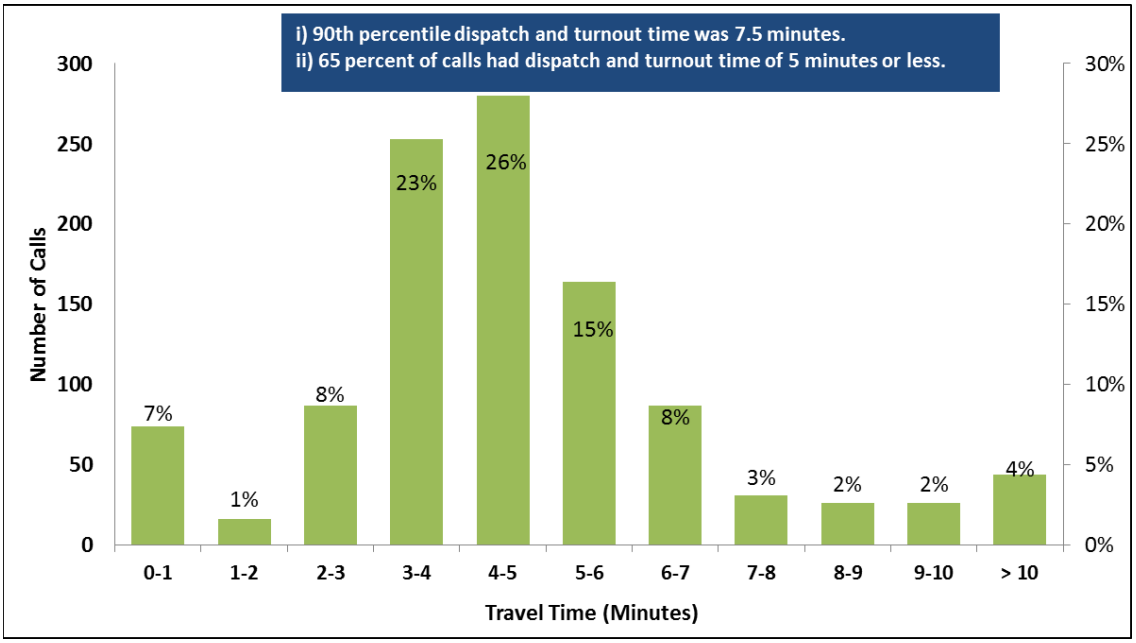
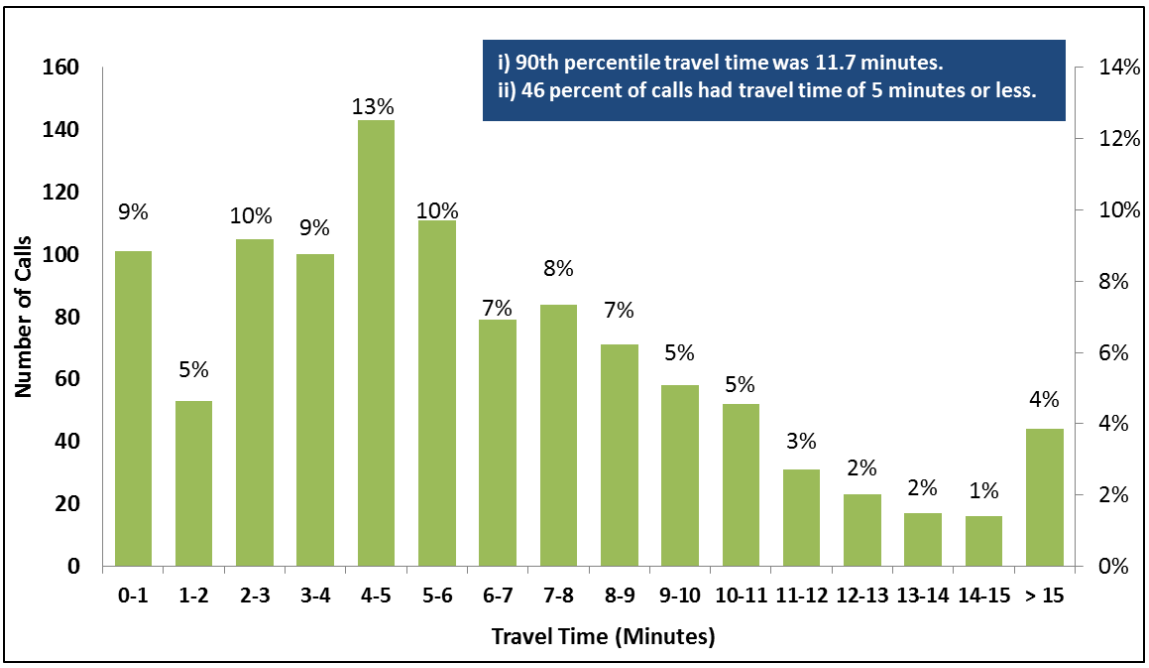


Figure 61: Fire Calls: Distribution of Travel Time of First Arriving Unit



In the following analysis, we focused on units staffed by career firefighters. Greenwood units had the fastest average and 90th percentile response time, followed by Millwood Station and Round Hill.

Table 72: Average Dispatch, Turnout and Travel Time of First Arriving Units by Station

Station	Unit	Dispatch and Turnout Time	Travel Time	Response Time	Sample Size
Clear Brook	A131/A132/E13	5.1	6.2	11.3	697
Gainesboro	A162/A161/E16	5.2	6.9	12.1	256
Gore	A141/A142/E14	5.3	6.2	11.5	207
Greenwood	A184/A183/A181/E18	5.1	5.1	10.2	1,431
Middletown	A121/A122/RE12/ET12	5.2	6.9	12.0	541
Millwood Station	A211/A212/RE21/E21	5.2	5.8	10.9	945
North Mountain	A192/A191/W19	6.5	6.4	13.0	220
Reynolds Store	A202/A201/E20	5.3	6.1	11.5	177
Round Hill	A151/A152/RE15/E15	5.1	5.9	11.0	1,109
Star Tannery	A171/E17	4.9	9.6	14.6	127
Stephens City	A111/A112/A113/E11	5.1	5.9	11.0	1,641
Total		**5.2**	**6.0**	**11.1**	**7,325**

Table 73: 90th Percentile Dispatch, Turnout and Travel Time of First Arriving Units by Station

Station	Unit	Dispatch and Turnout Time	Travel Time	Response Time	Sample Size
Clear Brook	A131/A132/E13	7.2	10.5	16.4	697
Gainesboro	A162/A161/E16	7.4	11.4	17.8	256
Gore	A141/A142/E14	7.9	13.2	19.3	207
Greenwood	A184/A183/A181/E18	7.0	8.3	14.1	1,431
Middletown	A121/A122/RE12/ET12	7.3	11.9	18.1	541
Millwood Station	A211/A212/RE21/E21	6.9	10.0	15.9	945
North Mountain	A192/A191/W19	9.9	11.2	18.4	220
Reynolds Store	A202/A201/E20	7.8	12.2	17.6	177
Round Hill	A151/A152/RE15/E15	6.9	9.8	15.4	1,109
Star Tannery	A171/E17	7.1	15.5	20.5	127
Stephens City	A111/A112/A113/E11	7.0	9.5	15.4	1,641
Total		**7.1**	**10.3**	**16.1**	**7,325**

ALS1 and ALS2 responded to countywide incidents, and they only arrived first on scene 28% of the time. Of all their responses, ALS1's average response time was 15.6 minutes, and the 90th percentile response time was 22.1 minutes. ALS2's average response time was 12.1 minutes, and the 90th percentile response time was 16.9 minutes. When they arrived first on scene, ALS1 90th percentile response time was 17.9 minutes, and ALS2 90th percentile response time was 13.2 minutes.

Table 74: ALS1/AL2: Average Dispatch, Turnout and Travel Time by Arrival Sequence

Station	Unit	Arrival Sequence	Dispatch and Turnout Time	Travel Time	Response Time	Sample Size
Gainesboro	ALS1	1	5.1	7.6	12.8	132
		2	5.9	10.4	16.3	281
		3 or later	5.3	11.7	17.0	129
		Total	**5.6**	**10.0**	**15.6**	**542**
Greenwood	ALS2	1	5.0	4.5	9.5	143
		2	5.5	7.2	12.7	219
		3 or later	8.5	8.3	16.9	51
		Total	**5.7**	**6.4**	**12.1**	**413**

Table 75: ALS1/AL2: 90th Percentile Dispatch, Turnout and Travel Time by Arrival Sequence

Station	Unit	Arrival Sequence	Dispatch and Turnout Time	Travel Time	Response Time	Sample Size
Gainesboro	ALS1	1	7.0	11.9	17.9	132
		2	7.7	15.6	22.8	281
		3 or later	7.6	17.3	23.1	129
		Total	**7.6**	**15.6**	**22.1**	**542**
Greenwood	ALS2	1	7.0	8.1	13.2	143
		2	7.5	11.4	18.0	219
		3 or later	13.4	11.1	22.7	51
		Total	**7.8**	**10.4**	**16.9**	**413**

ALS1 and ALS2 respond to countywide incidents that require them to travel more distance than units that are responding within their respective service area. This results in ALS1 and ALS2 having longer response times, and 90th Percentile response times, than units responding within their demand zone from the same station. This difference is identified by comparing Tables 72 and 73 to the data in Tables 74 and 75.

First Arriving Unit Response Time by Station Service Area

Further analyses were conducted to measure the performance of the first arriving unit in each service area. Response times are reported below at both the mean and 90th percentile respectively. The Millwood Station had the best response time performance, and the average response time was 10.0 minutes, and the 90th percentile response time was 14.1 minutes. The second fastest station service area is Greenwood.

Table 76: Mean First Arrival Performance by First Due Station Service Area. Listed by response time

Station Service Area	Dispatch and Turnout Time	Travel Time	Response Time	Sample Size
21 - Millwood Station	5.1	4.9	10.0	840
18 - Greenwood	5.2	5.2	10.3	1,862
10 - Frederick County	5.0	5.6	10.6	89
12 - Middletown	5.0	6.0	11.0	519
15 - Round Hill	5.2	5.8	11.0	1,291
11 - Stephens City	5.2	6.2	11.4	2,095
13 - Clear Brook	5.1	6.3	11.5	867
14 - Gore	5.4	6.8	12.1	248
16 - Gainesboro	5.2	6.9	12.2	382
20 - Reynolds Store	5.6	6.7	12.3	221
19 - North Mountain	6.2	6.6	12.8	331
17 - Star Tannery	5.6	9.9	15.5	151
Total	**5.2**	**5.9**	**11.2**	**8,896**

Figure 62: Average Dispatch and Turnout and Travel Time by Station Service Area

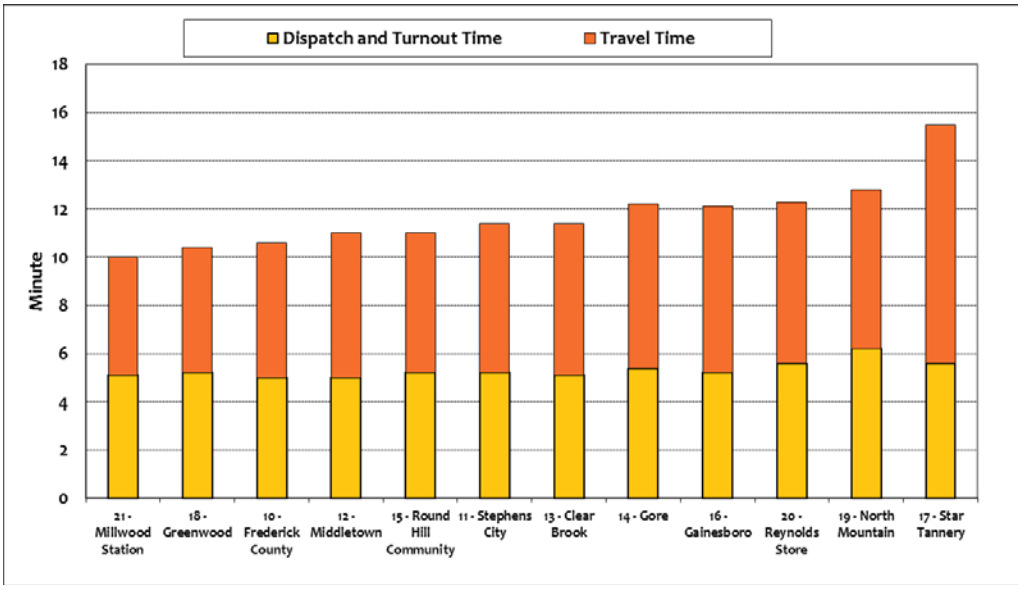
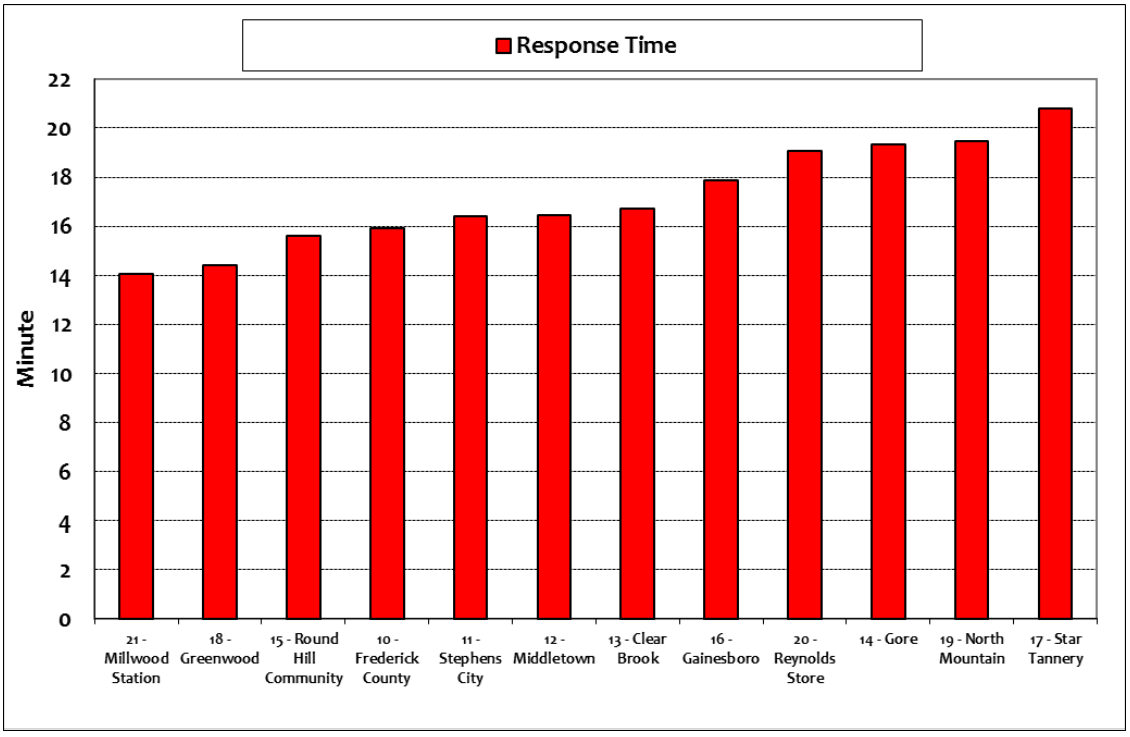


Table 77: 90th Percentile First Arrival Performance by Station Service Area. Listed by response time

Station Service Area	Dispatch and Turnout Time	Travel Time	Response Time	Sample Size
21 - Millwood Station	7.1	8.5	14.1	840
18 - Greenwood	7.1	8.5	14.4	1,862
15 - Round Hill	7.0	9.7	15.6	1,291
10 - Frederick County	7.0	10.5	15.9	89
11 - Stephens City	7.2	10.5	16.4	2,095
12 - Middletown	7.1	11.0	16.4	519
13 - Clear Brook	7.2	10.7	16.7	867
16 - Gainesboro	7.4	11.5	17.9	382
20 - Reynolds Store	8.1	12.7	19.1	221
14 - Gore	8.6	13.2	19.4	248
19 - North Mountain	9.8	12.6	19.5	331
17 - Star Tannery	7.9	15.7	20.8	151
Total	**7.3**	**10.4**	**16.4**	**8,896**

Figure 63: 90th Percentile Response time by Station Service Area



The data were further analyzed to compare the individual station service area's performance. Regarding dispatch and turnout time, performances for calls in Round Hill Community, Millwood Station, and Middletown were the fastest. With respect to travel time performance, performances for calls in Greenwood, Millwood Station, and Round Hill Community were the fastest. Calls in Reynolds Store, Gore and Star Tannery had the longest 90th percentile travel time.

Figure 64: 90th Percentile Dispatch and Turnout Time by Station Service Area

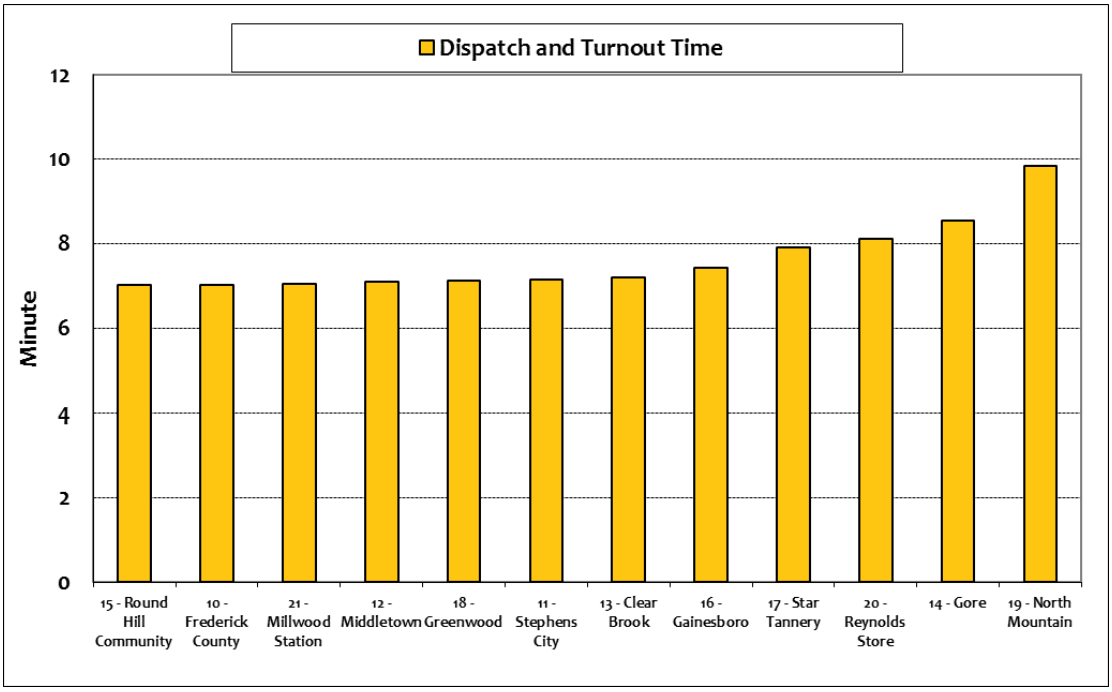
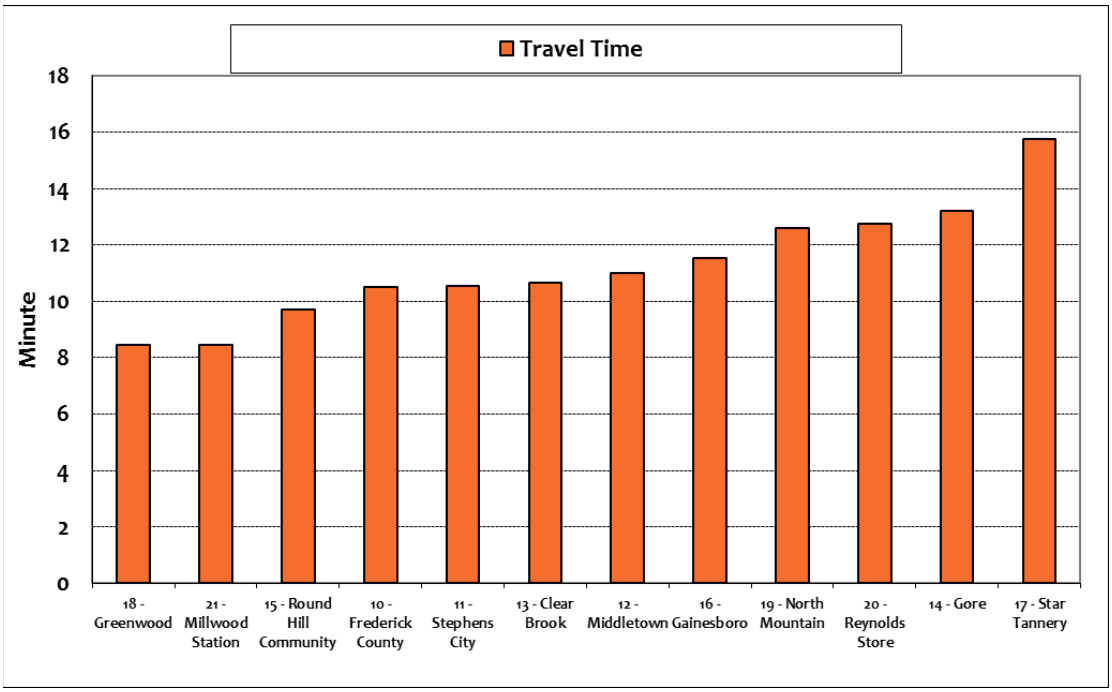


Figure 65: 90th Percentile Travel Time Performance by Station Service Area



Concentration Factors

Concentration of Risks by Service Area

Analyses were conducted to describe and measure the relative concentration of risks in each of the fire station service areas. Therefore, a station service area risk matrix was developed to quantitatively evaluate the relative risk by including measures for the frequency of moderate and high risk occupancies in each fire service area that are directly correlated to the necessity of higher concentrations of resources. In addition, several measures that both serves the distribution aspect of the risk evaluation, but also contributes to the need for higher concentrations of resources. For example, a higher call volume may serve to drive the need for additional resources to cover the community's demand.

The variables included in the risk matrix are the demand for services for each station service area, the number of high and moderate-risk occupancies, and the impact of simultaneous events in each station service area. All measures were weighted equally, however, two variables have surrogate relationships with historical community demands and one variable is dedicated to prospective occupancy risk. Community demands were rated more heavily in an effort to provide a realistic balance between the risk potential with historical experience. The risk tool and the scoring template are provided below.

Table 78: Summary of Station Fire Service Area Risk Concentration Matrix

Risk Class	Community Demand (D)		Call Concurrency (C)		High/Moderate Risk Occupancies (R)		Total Risk Score
	Value	Scale (Calls)	Value	Scale (%)	Value	Scale (Occupancies)	$\sqrt{\frac{(CD)^2+(CR)^2+(RD)^2}{2}}$
Maximum	≥10	≥4,050	≥10	≥ 27	≥10	≥500	≥72
High	7 – 9	≥ 2,700 and < 4,049	7	≥ 18 and < 27	7 to 9	≥ 300 and <449	≥ 39.35 and < 72
Moderate	4 to 6	≥ 1,350 and < 2,700	5	≥ 9 and < 18	4 to 6	≥ 150 and < 300	≥ 16.49 and < 39.35
Low	1 to 3	< 1,350	1	<9	1 to 3	< 150	< 16.49

**Explanation of Occupancy Risk Types were provided previously as part of the full risk assessment in Figure 28.*

Results categorized stations 18 and 11 as high-risk locations. Stations 21, 13, and 15 were classified as moderate risk stations. All other stations were categorized as low risk station areas. Three-dimensional models are presented for each of the station demand zones. All other stations are either moderate or low risk areas.

Table 79: Summary of Station Service Area Risk Concentration Ratings

Station Service Area	Demand	Risk	Call Concurrency	Sum Score	Total Risk Score	Risk Rating
21	3	3	7	481.5	21.94	Moderate
18	5	3	10	1,812.5	42.57	High
17	1	1	2	4.5	2.12	Low
14	1	1	3	9.5	3.08	Low
13	3	3	8	616.5	24.83	Moderate
15	4	2	10	1032	32.12	Moderate
19	1	1	5	25.5	5.05	Low
20	1	1	5	25.5	5.05	Low
16	1	1	7	49.5	7.04	Low
11	5	5	10	2,812.5	53.03	High
12	2	1	6	92	9.59	Low

Figure 66: 3-D Risk Profile for Millwood Station 21

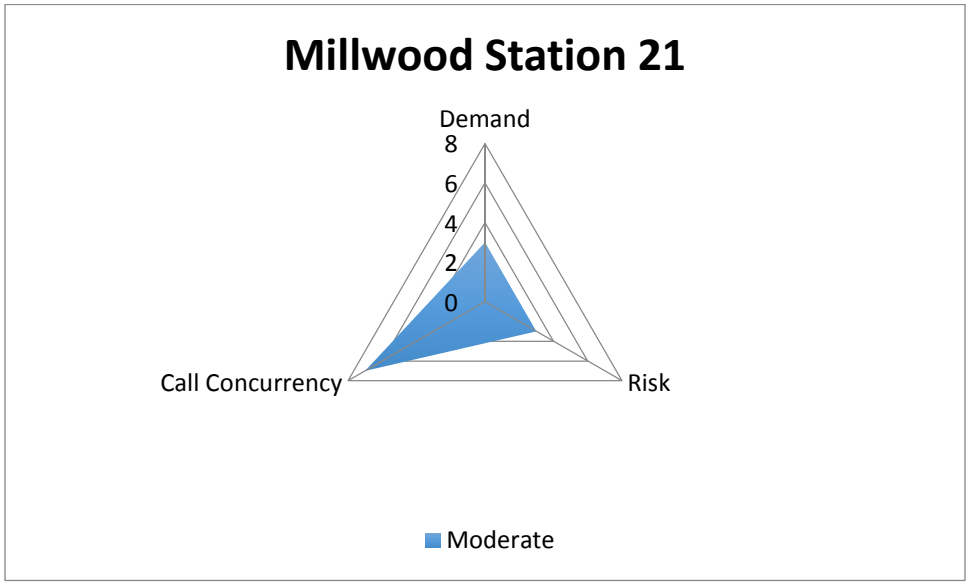


Figure 67: 3-D Station Risk Profile for Greenwood Station 18

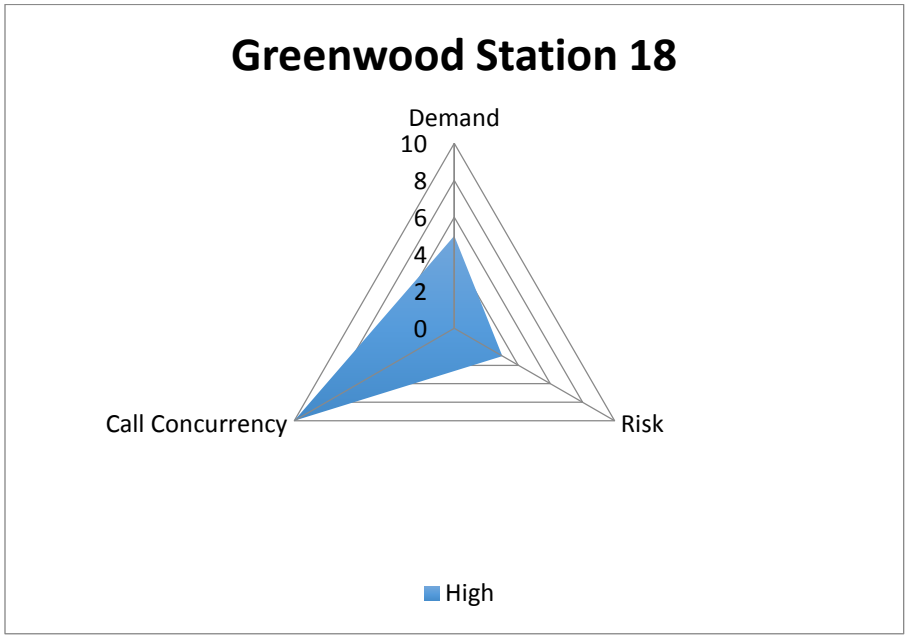


Figure 68: 3-D Station Risk Profile for Star Tannery Station 17

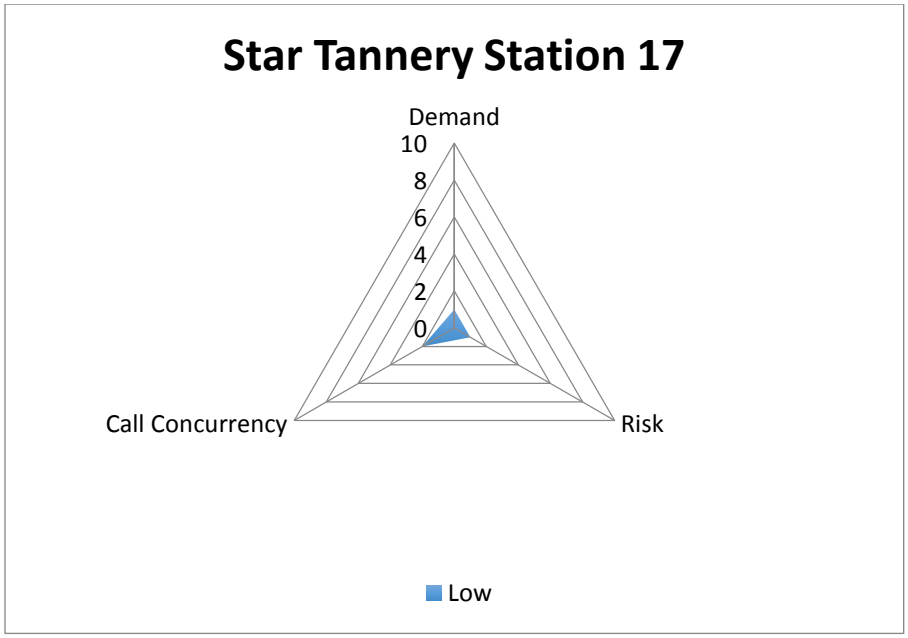


Figure 69: 3-D Station Risk Profile for Gore Station 14

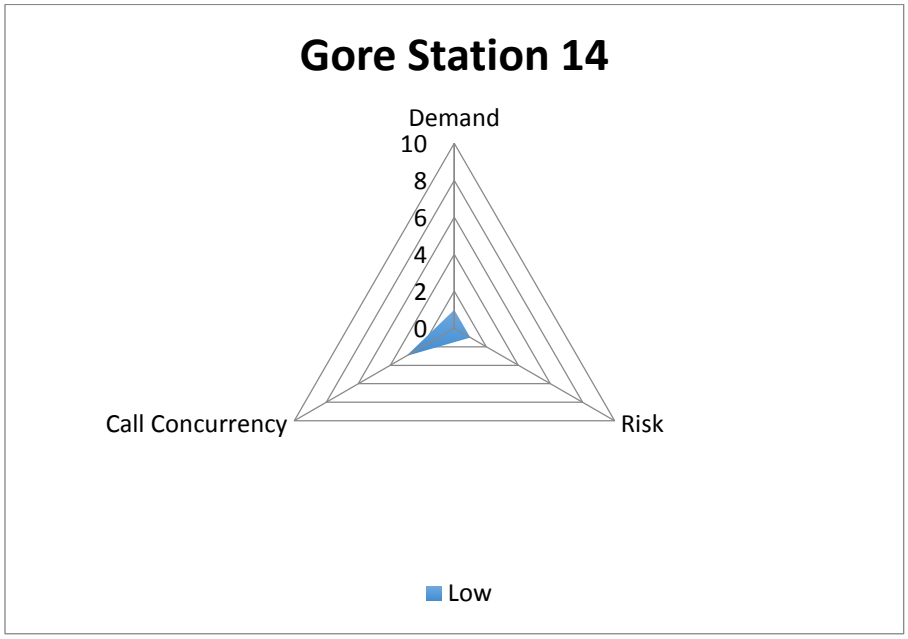


Figure 70: 3-D Station Risk Profile for Clear Brook Station 13

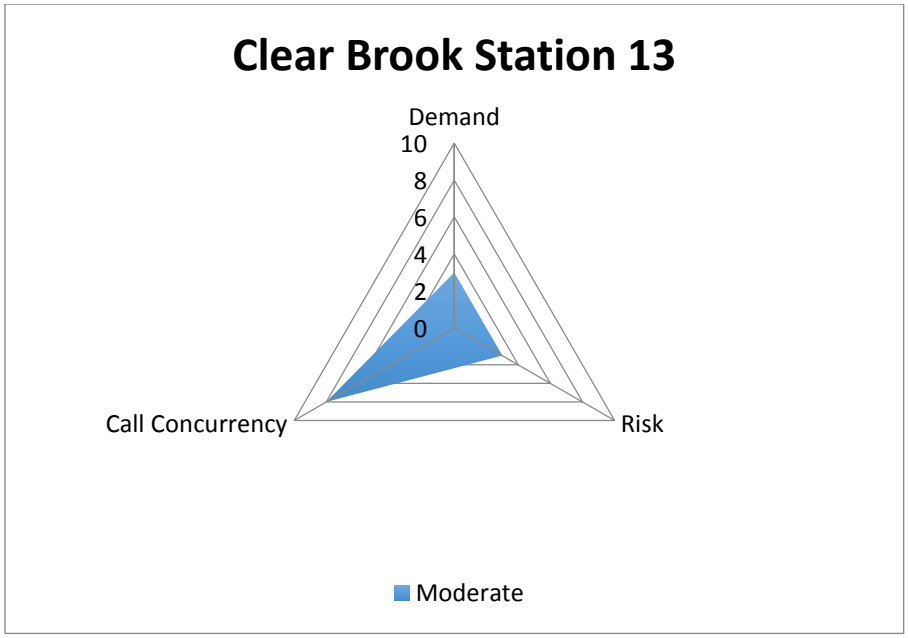


Figure 71: 3-D Station Risk Profile for Round Hill Station 15

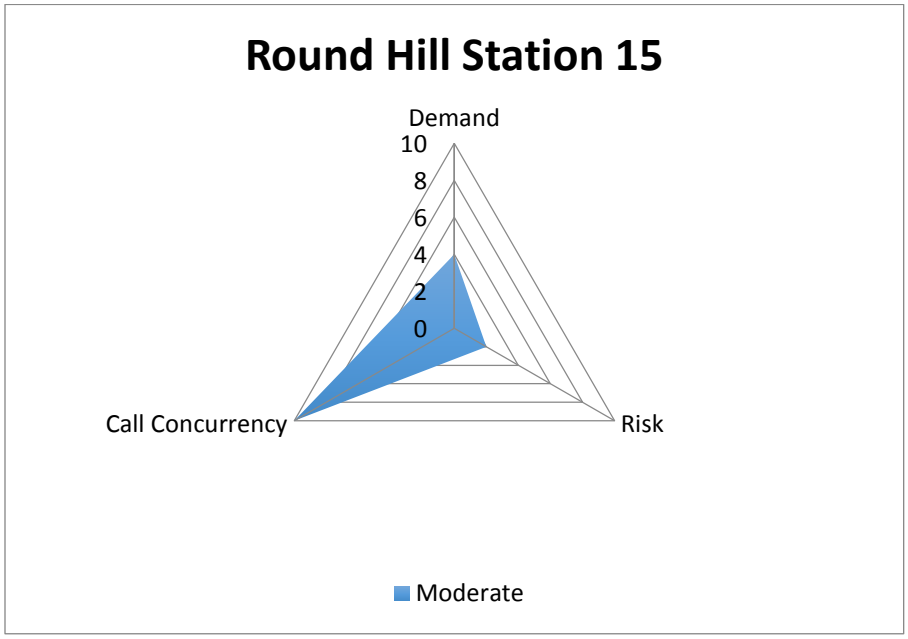


Figure 72: 3-D Station Risk Profile for North Mount Station 19

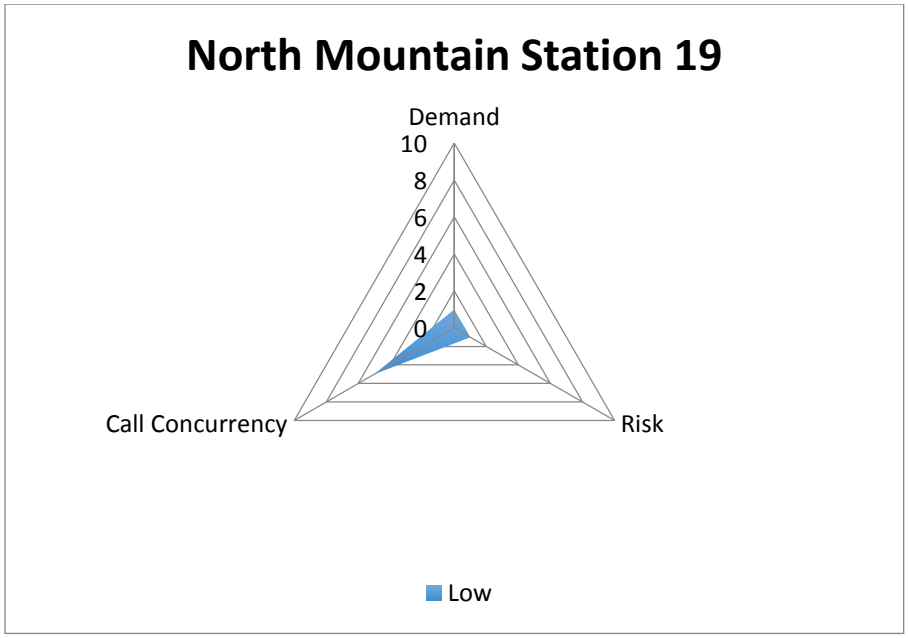


Figure 73: 3-D Station Risk Profile for Reynolds Store Station 20

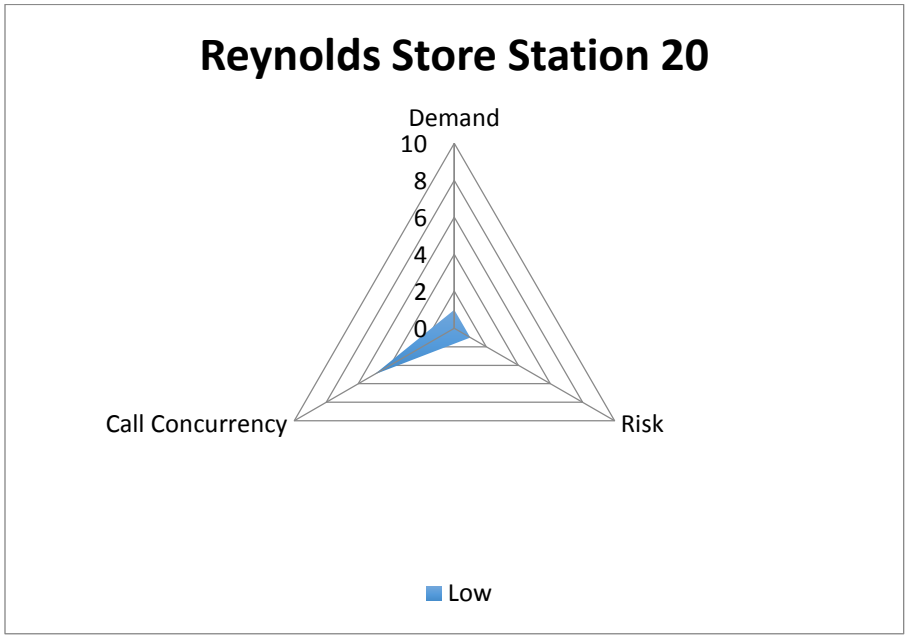


Figure 74: 3-D Station risk Profile for Gainesboro Station 16

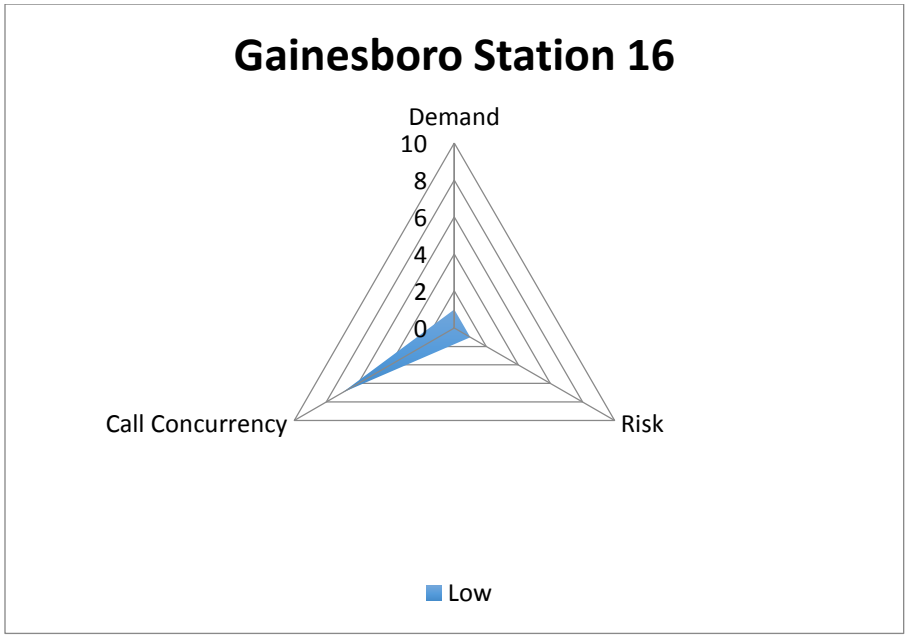


Figure 75: 3-D Station risk Profile for Stephens City Station 11

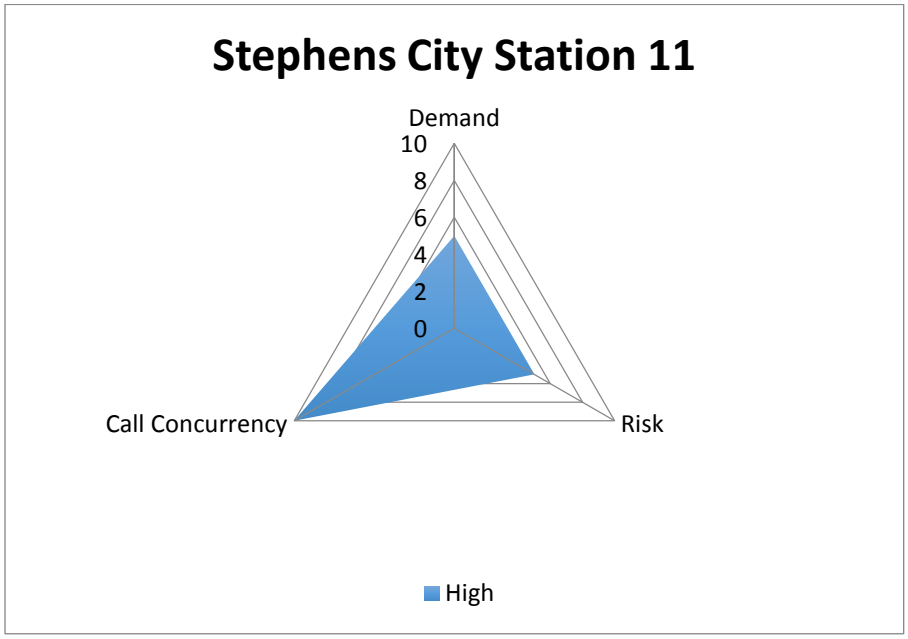
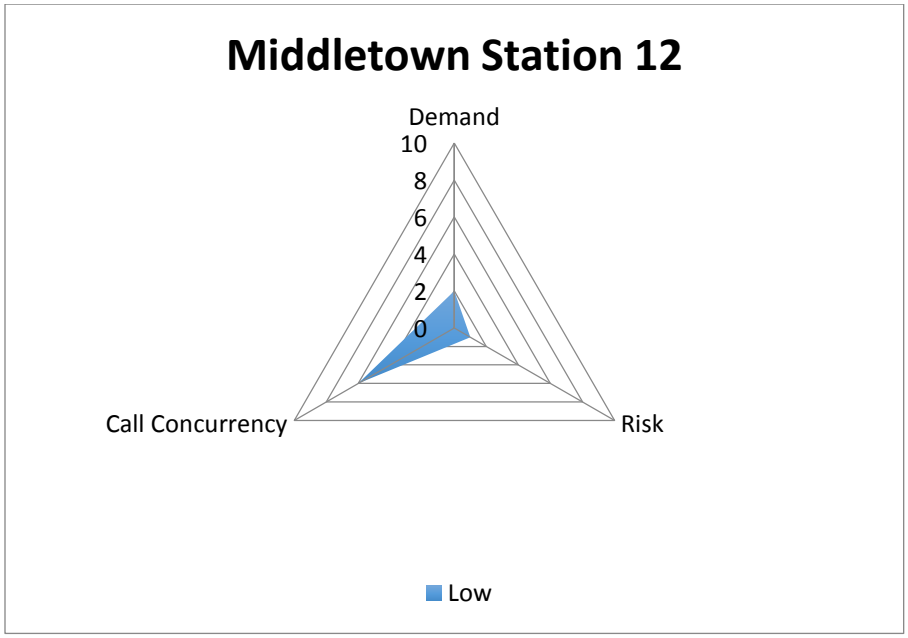


Figure 76: 3-D Station risk Profile for Middletown Station 12



Concentration of Resources

The station fire service area risk matrix demonstrates that the risk associated within the County is generally low to moderate in nature and the demand can be appropriately handled within the umbrella of the current distribution model. However, in following a risk-based design, stations of high risk may need additional resources.

Two high-risk service areas are generated from the application of the risk matrix suggesting a greater concentration of resources should be assigned to assist in covering both the inherent risk as well as the community's demand for services. Station 18's risk rating is more influenced by demand for services than unprotected risk. Station 11's risk rating is more balanced between inherent risk and the demand for services. In general, the distribution model that currently exists is capable of addressing the low and moderate concentrations of risk without increased concentrations of resources. Therefore, the competing demands for where these resources are placed are not necessarily driven by occupancy risk when the potential risk and the historical demand are not congruent. Table 77 summarizes the concentration of career resources.

In recent history, the deployment strategy did not have a strong tie between risk and resource allocation, and with respect to staffing, does not have any correlation between risk and the concentration of staffing. In other words, all staffing remained constant at 2-personnel per day that cross staff any of the units necessary to respond. Volunteer staffing is variable to the agency and time of day. However, recently the department has increased staffing from 2 to 4 at both stations 11 and 18. This risk assessment is well aligned with the department's staffing decision.

The following summary is intended to illustrate the major pieces of apparatus and is not meant to be all-inclusive. For example, it is understood that many of the stations have utility vehicles, boats, and four-wheel drive vehicles, support vehicles, etc. at their disposal.

Table 80: Summary of Concentration of Resources by Station SERVICE AREA and Risk Rating at Min. Staffing in Ascending Station Order

Station Service Area	Engine Quint Pump/Tender	Ambulance	ALS Chase	Brush	Squad	Tower	Hazmat	Tanker	Mini-Pumper	Command	Total Min. Career Staffing	Risk Rating
11	Engines - 3	ALS – 3		1	1	1	1		1	3	4	High
12	Engines – 2	BLS - 2	1						1		2	Low
13	Engine – 1	ALS - 2		1				1		1	2	Moderate
14	Engine – 1	BLS – 2		1					1		2	Low
15	Engine – 2	ALS -2	BLS	1						1	2	Moderate
16	Engines – 2	ALS – 2	1	1		1		1	1	2	2	Low
17	Engines – 2	BLS - 1		1				1			2	Low
18	Engine – 1	BLS – 3		1		Quint - 1					4	High
19	Engine/Tanker – 1	BLS – 2	BLS	1				1		1	2	Low
20	Engines – 2	ALS – 2		2				1		1	2	Low
21	Engine – 2	ALS – 2			1						2	Moderate

Note: All Units are Cross-staffed by Career Personnel or staffed by volunteer staff

Effective Response Force Capabilities

The capability of an Effective Response Force (ERF) to assemble in a timely manner with the appropriate personnel, apparatus, and equipment is important to the success of a significant structural fire event. Therefore, it is important to measure the capabilities of assembling an ERF. In most fire departments, the distribution model performs satisfactorily, but it is not uncommon to be challenged to assemble an ERF in the recommended timeframes.

Several factors affect the capabilities to assemble an ERF such as the number of fire stations, number of units, and number of personnel on each unit. Each of these policy decisions should be made in relation to community's specific risks and the willingness to assume risk.

The relatively low frequency of structure fire responses (113), and the significant number of fire stations (11), the sample size for each fire station would be statistically small limiting the acuity for decision making. Additionally, since two of the stations staff at a constant of four, and the remaining nine stations staff at a constant of two, the depth of response for career personnel is a factor of the station location. Therefore, geospatial analyses were completed to evaluate the relative capability to cover the geography with each subsequent responding unit/station.

There are two prevailing recommendations for the time to assemble an effective response force for structure fires. First, NFPA 1710 suggests that the Effective Response Force (ERF) should arrive in eight (8) minutes travel time or less in the urban areas. Second, the CFAI provides a baseline travel time performance objective of 10 minutes and 24 seconds 90% of the time or less in the urban areas. Additionally, the CFAI allows for 13-minutes in the suburban areas and 18 minutes in the rural areas. Therefore, 10, 13, and 18-minute travel times were created to demonstrate the relative coverage throughout the jurisdiction.

Similarly, NFPA 1720, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Volunteer Fire Departments*, delineates between a volunteer department or a combination department as follows: If the department is comprised of less than 85% majority of either volunteer or career membership it would be a combination department. If the department has greater than 85% volunteer then it would be categorized as a volunteer department.[44] Given the delineation described by NFPA, until the FCFR exceeds 85% career membership it will continue to be considered a Combination Department and consequently NFPA 1720 would be the appropriate prevailing document.

NFPA 1720 does not differentiate dispatch, turnout, and travel time separately. Therefore, the following recommended response times are the time from dispatch notification of the departments/units until the arrival.

[44] NFPA 1720. (2010) Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Volunteer Fire Departments. Quincy, Massachusetts: Author.

Figure 77: Description of NFPA 1720 Performance Objectives[45]

Demand Zone[a]	Demographics	Minimum Staff to Respond[b]	Response Time (minutes)[c]	Meets Objective (%)
Urban area	>1000 people/mi²	15	9	90
Suburban area	500–1000 people/mi²	10	10	80
Rural area	<500 people/mi²	6	14	80
Remote area	Travel distance ≥ 8 mi	4	Directly dependent on travel distance	90
Special risks	Determined by AHJ	Determined by AHJ based on risk	Determined by AHJ	90

[a] A jurisdiction can have more than one demand zone.
[b] Minimum staffing includes members responding from the AHJs department and automatic aid
[c] Response time begins upon completion of the dispatch notification and ends at the time interval shown in the table.

Overall, the ERF coverage is more robust near the municipal centers where the greatest historical demand exists. The rural areas of the county are more challenged since they do not benefit from concentric response zones; that is station service areas that overlap and can be effectively covered by adjacent stations.

When referring to Figures 78-80, the "purple" areas illustrate the geographic capability to travel within evaluated time frames of 10, 13, and 18-minute intervals respectively. Each successively darker shade of "purple" indicates that more than one station can cover the same area within the evaluated time frame. For example, there is considerable more coverage in the 18-minute scenario as compared to the 10-minute scenario. In all cases, with 2 person staffing, assembling an effective response force for labor-intensive calls such as structure fires will continue to be challenging.

[45] Ibid.

Figure 78: 10-Minute ERF represented by purple shading – All Current Stations

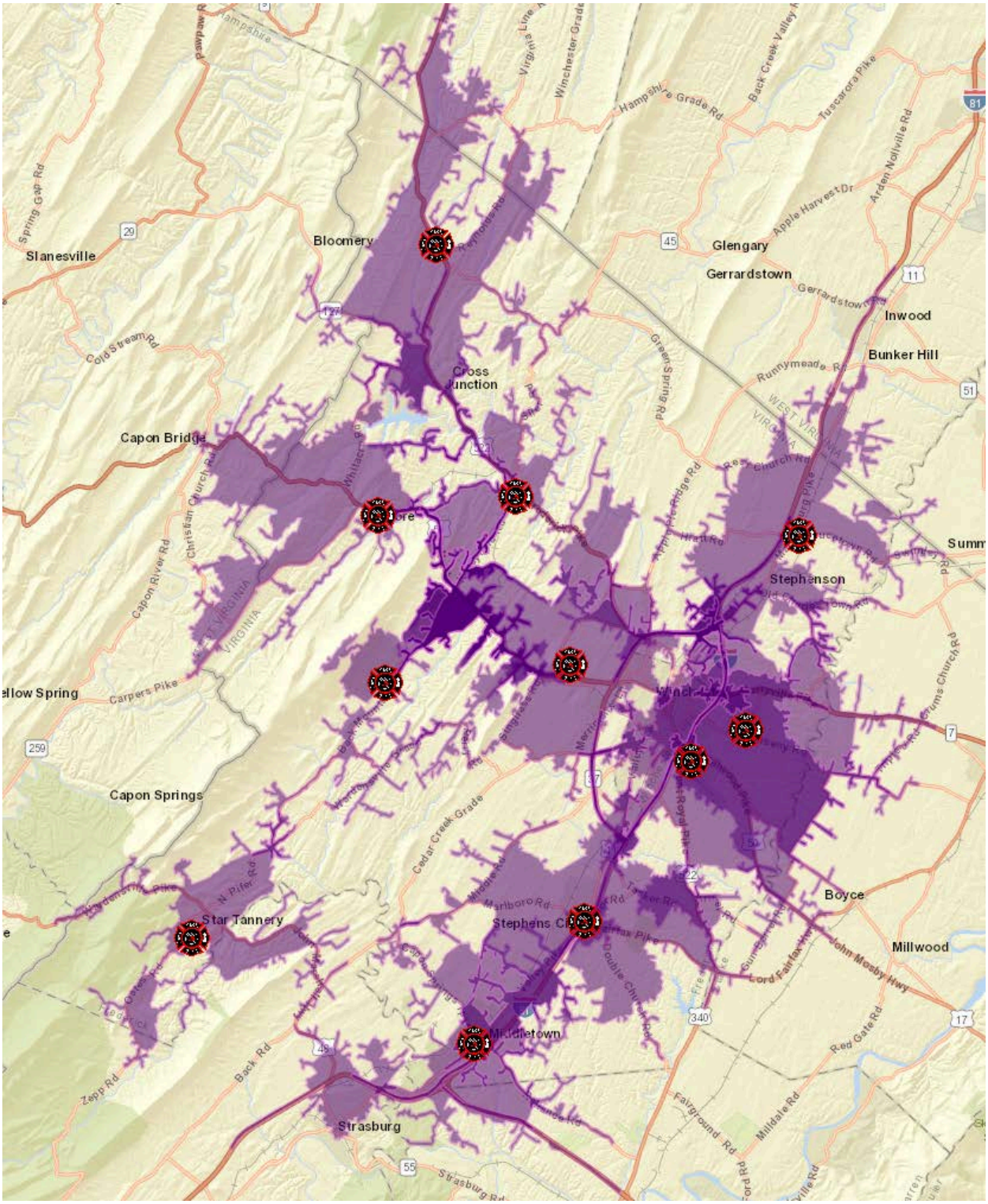


Figure 79: 13-Minute ERF represented by purple shading - All Current Stations

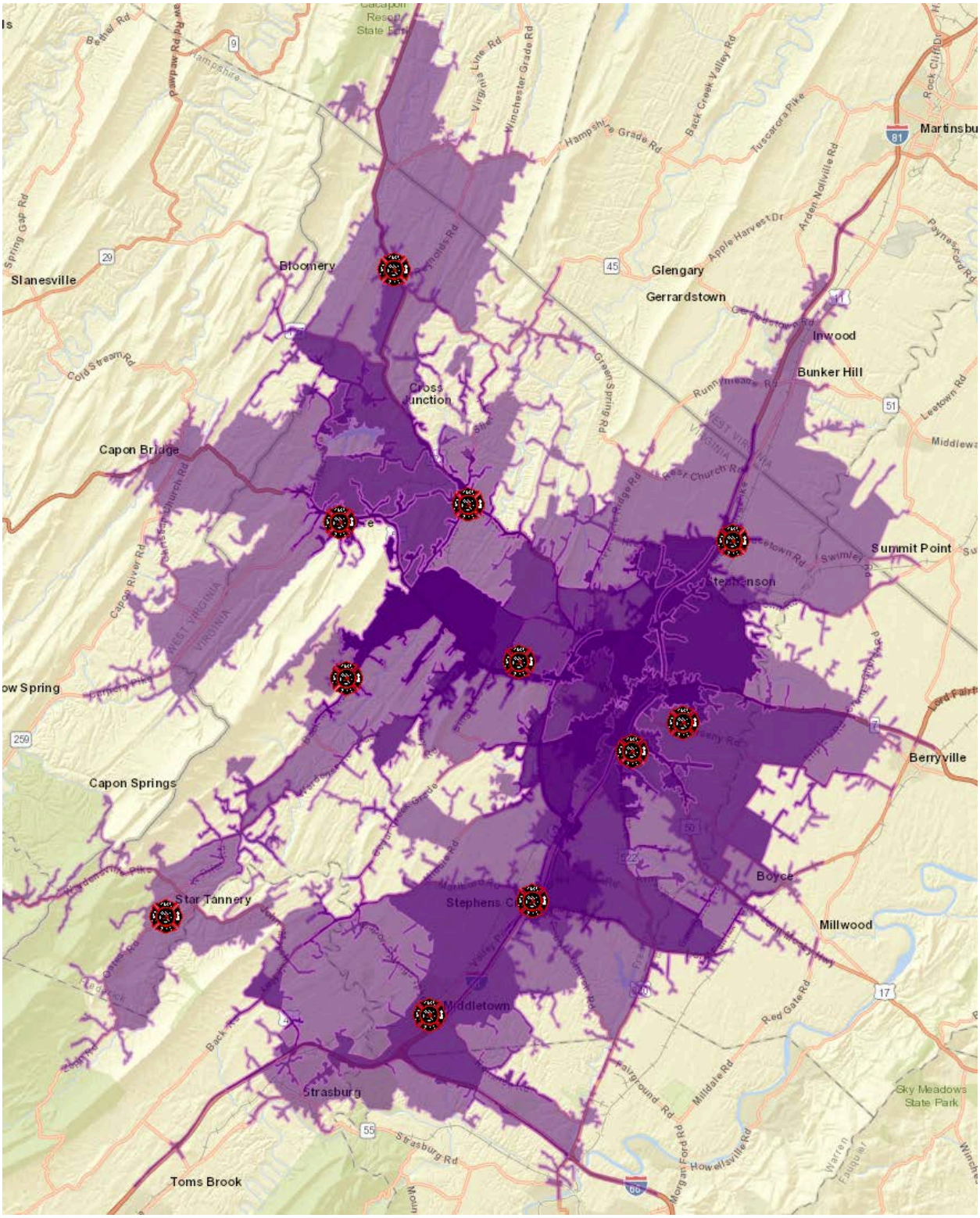
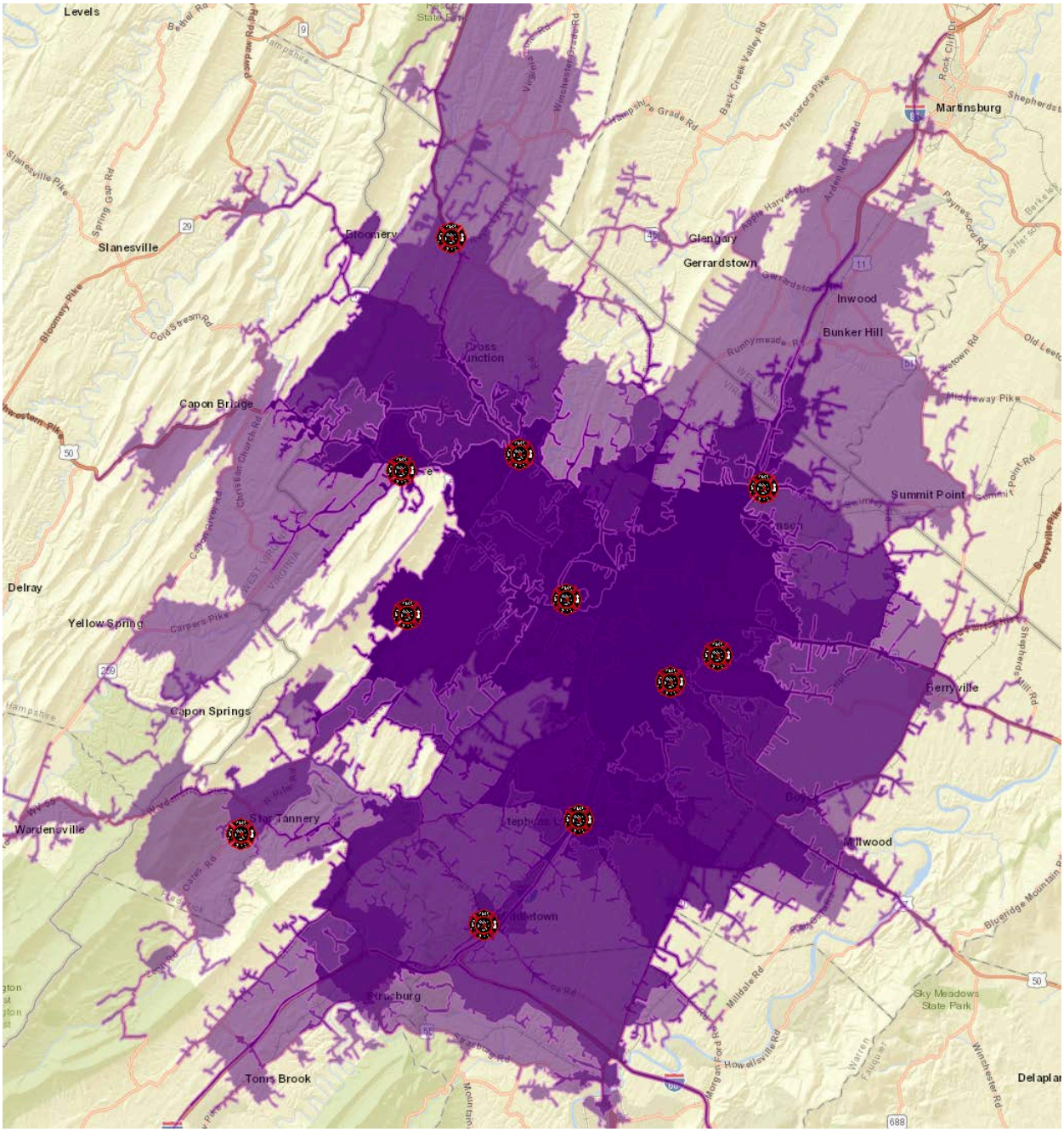


Figure 80: 18-Minute ERF represented by purple shading - All Current Stations



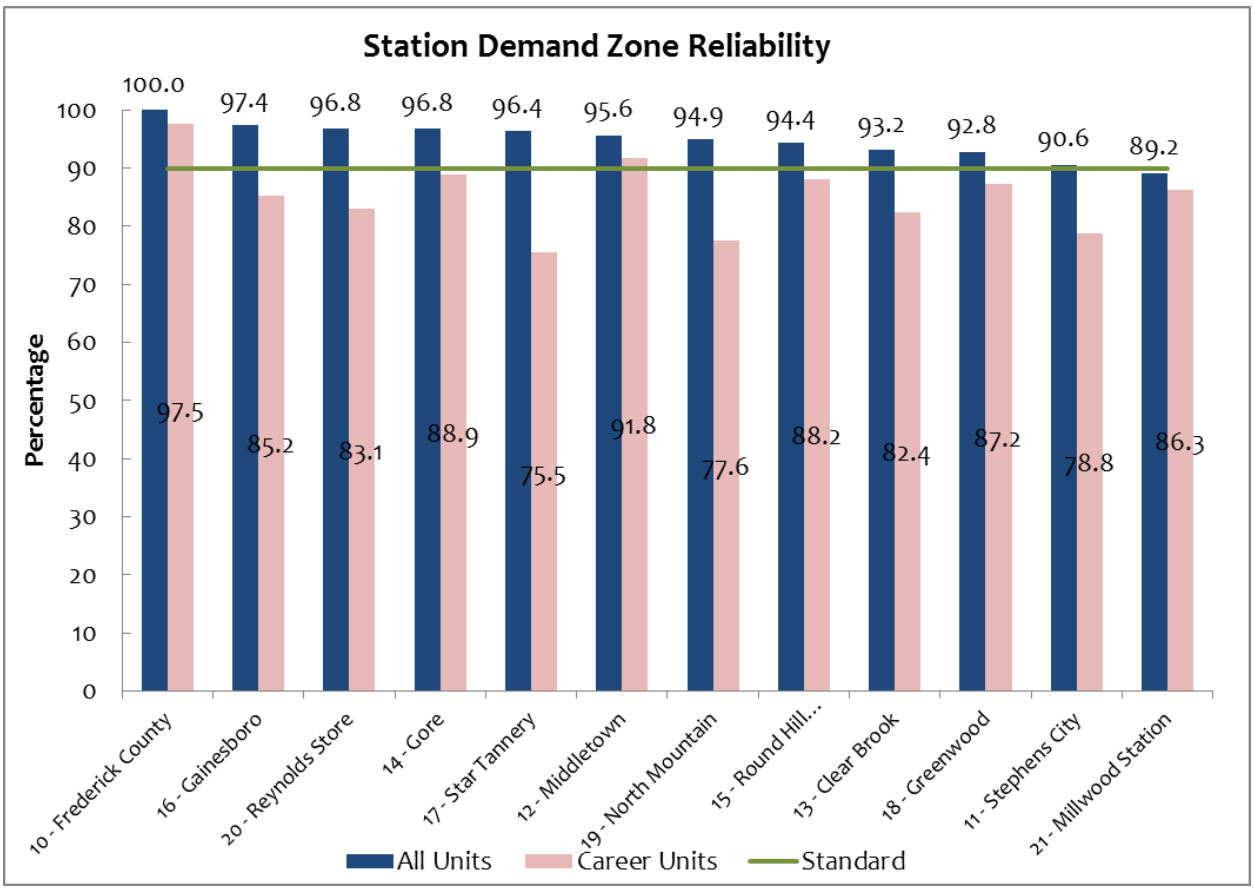
Reliability Factors

Percentage of First Due Compliance

The reliability of the distribution model is a factor of how often the response model is available and able to respond to the call within the assigned service area. If at least one unit from the first due station is able to respond to a call, we consider the station is able to respond to the call within the assigned service area. Utilizing the fire service areas, analyses reveal that all stations except Millwood Station had reliability of 90% or above.

We also only analyzed reliability of career units and only Frederick County, and Middletown had reliability of 90% or above. Star Tannery had the lowest career unit reliability at 75.5.

Figure 81: Percentage Reliability by Station Service Area Listed by % reliability

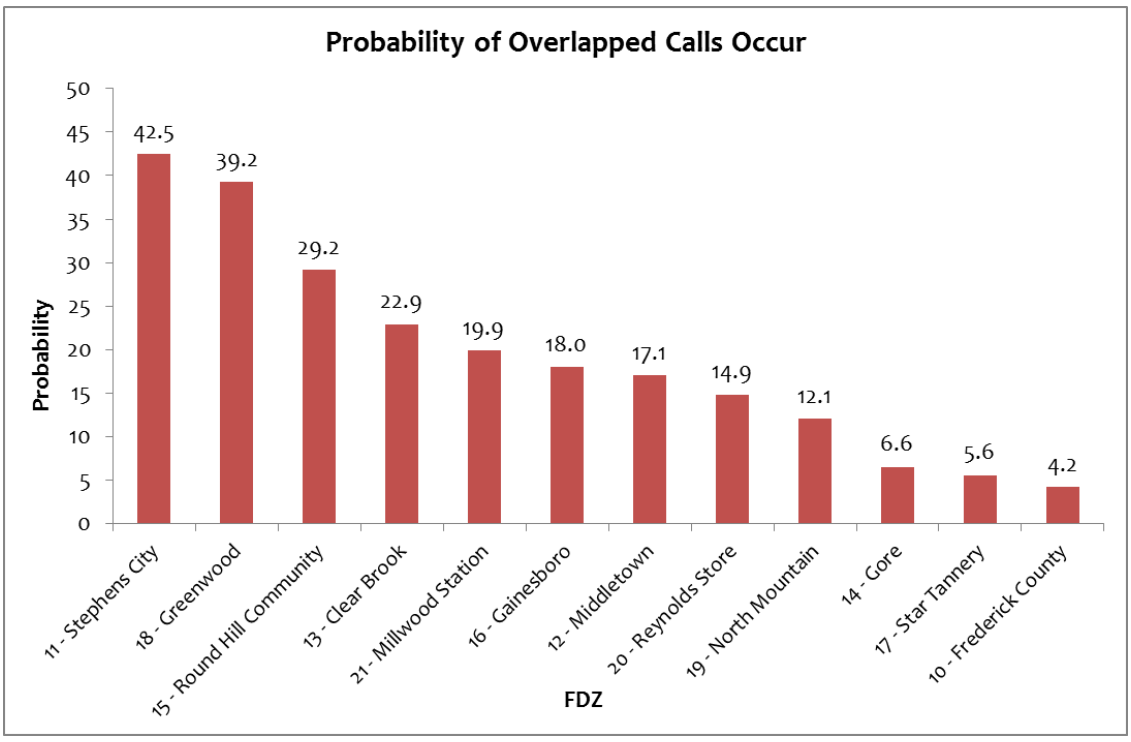


Overlapped or Simultaneous Call Analysis

Overlapped calls are defined as the rate at which another call was received for the same first due station service area while there were one or more ongoing calls in the same first due station service area. For example, if there is one call in station Stephens City's service area, before the call was cleared another request in Stephens City's service area occurred and those two calls would be captured as overlapped calls. Some studies also refer as simultaneous calls. Understanding the probability of overlapped or simultaneous calls occurs will help to determine the number of units to staff for each station. In general, the larger the call volume a first due station service area has, it is more likely to have overlapped or simultaneous calls. The distribution of the demand throughout the day will impact the chance of having overlapped or simultaneous calls. The duration of a call will also have major influences, since the longer time it takes to clear a request, the more likely to have an overlapped request.

Station Stephens City had the highest probability of having overlapped calls at 42.5% since it has the highest demand at 2,216 requests in 2016, and the average duration was 65.3 minutes. Station Greenwood had the second highest probability of overlapped calls at 39.2%. Greenwood station has the second highest demand at 1,990 requests in 2016 and the average duration was 65.9 minutes.

Figure 82: Probability of Overlapped Calls Occur by Station Service Area



PERFORMANCE OBJECTIVES AND MEASUREMENT

The Commission on Fire Accreditation International recommends that agencies considering accreditation establish both benchmarks (future oriented goals) and baseline (currently obtainable) objectives to help guide both ongoing and future oriented planning.

Therefore, the following benchmark performance objectives are offered for the Department's consideration. The Department is encouraged to evaluate and discuss internally and to update the template language as desired.

Performance Objectives – Benchmarks

Fire Suppression Services Program

For 90% of all priority structure fire incidents, the first-due unit shall arrive, with a minimum of 2 personnel, within 10 minutes and 30 seconds total response time. The first-due unit shall be capable of initiating a rescue, advancing a first attack line, or providing a minimum of basic life support for victims.

For 90% of all priority structural fire incidents, the effective response force, with a minimum of 9 personnel, shall arrive within 13 minutes total response time. The effective response force should be capable of preventing further escalation of the fire incident.

Emergency Medical Services Program

For 90% of all priority ALS emergency medical incidents, the first-due Advanced Life Support (ALS) unit shall arrive within 10 minutes and 30 seconds total response time with a minimum of 2 personnel. The first-due unit shall be capable of providing advanced life support and transport for medical incidents. If an engine or ladder company is assigned the incident, it will be capable of providing a minimum of Basic Life Support (BLS) with automated external defibrillator (AED) capability, until the ALS unit arrives on the scene. The ALS total response time is commensurate with the effective response force.

For 90% of all priority EMS incidents, the effective response force, with a minimum of 4 personnel, shall arrive within 13 minutes total response time. The effective response force should be capable of patient care and transport support.

Hazardous Materials Services Program

For 90% of all hazardous materials incidents, the first-due unit shall arrive, with a minimum of 2 personnel, in 10 minutes and 30 seconds total response time. This unit shall be capable of initiating the mitigation of a hazardous materials incident at the operations level.

For 90% of all incidents, the effective response force, consisting of a minimum of 10 personnel, shall arrive within 13 minutes total response time. The effective response force should be capable of mitigation of a hazardous materials incident that may include entry, identification, recon, decontamination, and rehabilitation. A regional response is available for major incidents.

Special Rescue Operations Program

For 90% of all incidents, the first-due unit shall arrive, with a minimum of 2 personnel, in 10 minutes and 30 seconds total response time. This unit shall be capable of initiating the mitigation of a technical rescue incident.

For 90% of all incidents, the effective response force, consisting of a minimum of 7 personnel, shall arrive within 13 minutes total response time. The effective response force should be capable of mitigation of a technical rescue incident that may include shoring, extrication, below-grade rescue, and high-angle rescue. A regional response is available for major incidents.

Summaries of FCFR's benchmark objectives are presented below.

Table 81: Summary of FCFR's Benchmark Objectives

Measured at the 90th Percentile		Suppression	BLS	ALS	HazMat	Tech Rescue
Call Processing	Pick-up to Dispatch	1:00	1:00	1:00	1:00	1:00
Turnout	Turnout Time 1st Unit	1:30	1:30	1:30	1:30	1:30
	Turnout Time for ERF	1:30	1:30	1:30	1:30	1:30
Travel	Travel Time 1st Due	8:00	8:00	8:00	8:00	8:00
	Travel Time ERF	10:30	10:30	10:30	10:30	10:30
Total Response Time	Total Response Time 1st Due	10:30	10:30	10:30	10:30	10:30
	Total Response Time ERF	13:00	13:00	13:00	13:00	13:00

Performance Objectives – Baselines

Baseline performance is designed to closely mirror current capabilities and performance in a manner to establish a minimum threshold, or baseline, for performance. It would be recommended that the department measure, evaluate, and manage the performance at least quarterly. Similar to the benchmark objectives, the department is encouraged to continuously monitor and update or change the baseline objectives as necessary.

Fire Suppression Services Program

For 90% of all priority structure fire incidents, the first-due unit shall arrive, with a minimum of 2 personnel, within 16 minutes and 30 seconds total response time. The first-due unit shall be capable of initiating a rescue, advancing a first attack line, or providing basic life support for victims.

For 90% of all priority structural fire incidents, the effective response force, with a minimum of 9 personnel, shall arrive within 21 minutes and 30 seconds total response time. The effective response force should be capable of preventing further escalation of the fire incident.

Emergency Medical Services Program

For 90% of all priority ALS emergency medical incidents, the first-due Advanced Life Support (ALS) unit, with a minimum of 2 personnel, shall arrive within 16 minutes and 30 seconds total response time. The ALS unit shall be capable of providing advanced life support and transport for medical incidents. If an engine or ladder company is assigned the incident, it will be capable of providing Basic Life Support (BLS) with automated external defibrillator (AED) capability, until the ALS unit arrives on the scene.

For 90% of all incidents, the effective response force, consisting of 4 personnel, shall arrive within 20 minutes and 30 seconds.

Hazardous Materials Services Program

For 90% of all hazardous materials incidents, the first-due unit shall arrive, with a minimum of 2 personnel, in 18 minutes total response time. This unit shall be capable of initiating the mitigation of a hazardous materials incident at the operations level.

For 90% of all incidents, the effective response force, consisting of a minimum of 10 personnel, shall arrive within 21 minutes and 30 seconds total response time. The effective response force should be capable of mitigation of a hazardous materials incident that may include entry, identification, recon, decontamination, and rehabilitation. A countywide response is available for major incidents.

Special Operations Program

For 90% of all incidents, the first-due unit shall arrive, with a minimum of 2 personnel, in 16 minutes and 30 seconds total response time. This unit shall be capable of initiating the mitigation of a technical rescue incident.

For 90% of all incidents, the effective response force, consisting of a minimum of 7 personnel, shall arrive within 21 minutes and 30 seconds total response time. The effective response force should be capable of mitigation of a technical rescue incident that may include shoring, extrication, below-grade rescue, and high-angle rescue. A countywide response is available for major incidents.

In summary, the department's baseline performance has been as follows when compared to the CFAI baseline objectives. When referring to the summary tables that follow, there are some data elements that must be understood. First, the performance listed for "Total Response Time" includes the combined dispatch, turnout, and travel time measures at the 90th percentile. Secondly, the data are presented as found in the CAD system. The first due performance for hazardous materials risks should be commensurate with the first due performance for all other fire related incidents. However, the sample size was very small and does not provide quality information to make any inferences or assumptions about performance. Third, both the hazardous materials and the special operations programs did not have sufficient data to analyze the effective response forces. Therefore, they are submitted with an n/a. Finally, as previously discussed with respect to the ERF, the frequency of incidents where sufficient vehicles arrived to assemble a minimum ERF was relatively low and measures at the 90th percentile are problematic in small data sets. The ERF performance should be considered with caution and average times may be more appropriate until a much large sample size can be obtained. The tables below provide a comparison of baseline performance to baseline objectives.

Table 82: Summary of Baseline Performance and Baseline Objectives for Fire Suppression

Suppression Fires - 90th Percentile Times		2016	CFAI BASELINE Objective	FCFR Baseline Objective
Call Processing	Pick-up to Dispatch	n/a	1:30	1:30
Dispatch and Turnout	Turnout Time 1st Unit	7:30	3:00	3:00
	Turnout Time for ERF	7:30	3:00	3:00
Travel	Travel Time 1st Due	11:42	5:12 -Urban/Suburban 13:00 - Rural	13:00
	Travel Time ERF	n/a	10:24 – Urban 13:00 – Suburban 18:12 - Rural	18:30
Total Response Time	Total Response Time 1st Due	17:42	8:12 – Urban/Suburban 16:00 – Rural	16:30
	Total Response Time ERF	n/a	13:24 – Urban 16:24 – Suburban 21:12 – Rural	21:30

Table 83: Summary of Baseline Performance and Baseline Objectives for EMS

EMS - 90th Percentile Times		2016	CFAI BASELINE Objectives	FCFR Baseline Objectives
Call Processing	Pick-up to Dispatch	n/a	1:30	1:30
Dispatch and Turnout	Turnout Time 1st Unit	7:18	3:00	3:00
	Turnout Time for ERF	7:18	3:00	3:00
Travel	Travel Time 1st Due	10:06	5:12 -Urban/Suburban 13:00 - Rural	`10:00
	Travel Time ERF	n/a	10:24 – Urban 13:00 – Suburban 18:12 - Rural	13:00
Total Response Time	Total Response Time 1st Due	16:06	8:12 – Urban/Suburban 16:00 – Rural	16:30
	Total Response Time ERF	n/a	13:24 – Urban 16:24 – Suburban 21:12 – Rural	20:30

Table 84: Summary of Baseline Performance and Baseline Objectives for Special Operations

Special Operations (Water and Technical Rescue) - 90th Percentile Times		2016	CFAI BASELINE Objective	FCFR Baseline Objective
Call Processing	Pick-up to Dispatch	n/a	1:30	1:30
Dispatch and Turnout	Turnout Time 1st Unit	8:36	3:00	3:00
	Turnout Time for ERF	8:36	3:00	3:00
Travel	Travel Time 1st Due	9:36	5:12 -Urban/Suburban 13:00 - Rural	13:00
	Travel Time ERF	n/a	10:24 – Urban 13:00 – Suburban 18:12 - Rural	18:30
Total Response Time	Total Response Time 1st Due	17:36	8:12 – Urban/Suburban 16:00 – Rural	16:30
	Total Response Time ERF	n/a	13:24 – Urban 16:24 – Suburban 21:12 – Rural	21:30

Table 85: Summary of Baseline Performance and Baseline Objectives for Hazardous Materials

Hazardous Materials - 90th Percentile Times		2016	CFAI BASELINE Objective	FCFR Baseline Objective
Call Processing	Pick-up to Dispatch	n/1	1:30	1:30
Dispatch and Turnout	Turnout Time 1st Unit	8:00	3:00	3:00
	Turnout Time for ERF	8:00	3:00	3:00
Travel	Travel Time 1st Due	10:42	5:12 -Urban/Suburban 13:00 - Rural	13:00
	Travel Time ERF	n/a	10:24 – Urban 13:00 – Suburban 18:12 - Rural	18:30
Total Response Time	Total Response Time 1st Due	17:	8:12 – Urban/Suburban 16:00 – Rural	16:30
	Total Response Time ERF	n/a	13:24 – Urban 16:24 – Suburban 21:12 – Rural	21:30

COMPLIANCE METHODOLOGY

This Standards of Response Coverage document is designed to guide the Department to continuously monitor performance, seek areas for improvement, and to clearly articulate service levels and performance to the community we have the privilege of serving. Therefore, the Fire Chief may establish a Compliance Team to continuously monitor elements of this SOC and make recommendations for system adjustments or improvement quarterly.

Compliance Team / Responsibility

The Compliance Team may consist of the following department members and will have the responsibility of continuously monitoring changes in risk, community service demands, and department performance in each program area, fire department demand zone, and/or risk category.

Chair –Operations level Chief or equivalent
Member – Data Analyst
Member – Fire Prevention Representative
Member – EMS Representative
Member – as determined by FCFR

Performance Evaluation and Compliance Strategy

FCFR will evaluate system performance by measuring first due unit performance at the 90th percentile quarterly and annually. In addition, the Department will evaluate first due performance by each individual fire station service area and by program area. Measures for the effective response force by each program area, fire station service area, and risk category will be evaluated annually. Annual reviews will be conducted in January of each year regarding the previous year. All response performance monitoring will exclusively evaluate emergency responses.

The compliance team will determine the strengths, weaknesses, opportunities, and threats of the system performance annually and make recommendations for system adjustments to the Fire Chief. Finally, the Department will annually update and evaluate the risk assessment matrices for relevancy and changes in community risk.

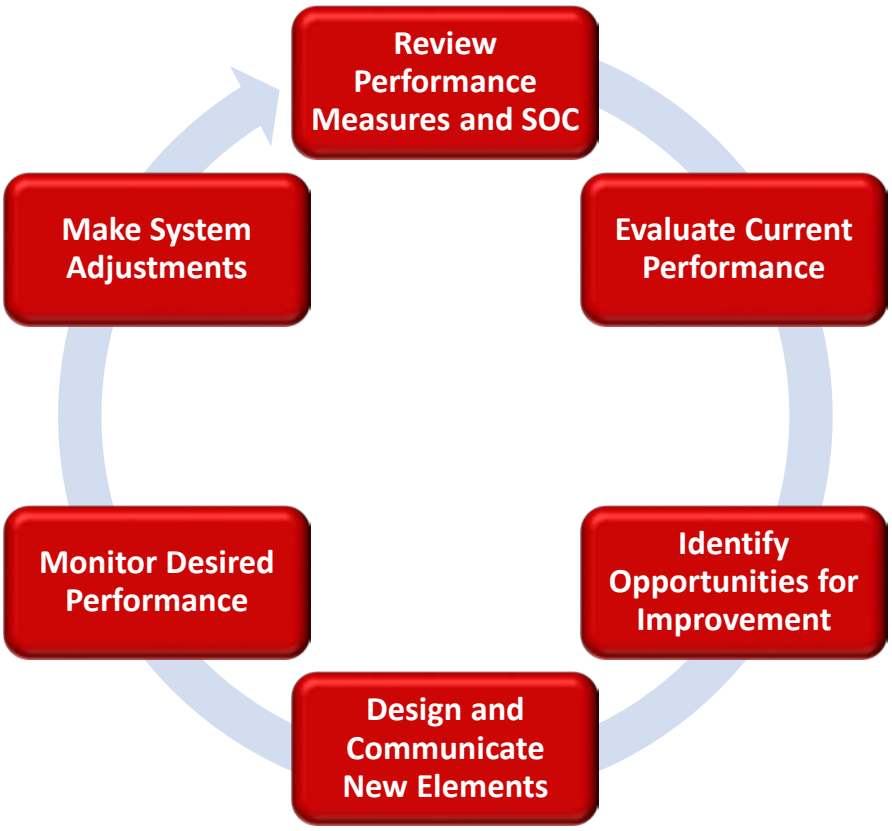
Compliance Verification Reporting

The compliance team will communicate results of the period evaluations to the Fire Chief. The Fire Chief will disseminate the quarterly and annual results and any system adjustments in a timely manner so that both performance measurement and continuous improvement becomes part of the organization's culture. All performance and risk measures will be reported to the County Administration and the Board of Supervisors and available to the community annually.

Constant Improvement Strategy

The Department would be well served by utilizing the following conceptual model to facilitate both compliance and continuous improvement.

Figure 83: Continuous Improvement and Compliance Model



OVERALL EVALUATION, CONCLUSIONS, AND RECOMMENDATIONS

Overall Evaluation

The overall evaluation is the final component of the Standards of Cover (SOC) process. As a risk-based process that incorporates risk, mitigation, and outcomes measures, the Department and the County leadership can more easily discuss service levels, outcomes, and the associated cost allocations based on community risk.

Overall, the department is performing well within the current system. The community enjoys high quality services from a professional and well-trained department. Predominantly, the department's distribution and concentration delivery models are appropriately aligned with the county's unique risks. In addition, the practice of cross-staffing units provides operational and fiscal efficiencies. However, there are areas that have been identified that the Department could make incremental system adjustments to improve.

While it is recognized that FCFR has attempted to control costs and provide efficient services, such as cross staffing units and measured growth of career staffing, it is now once again time to reinvest for the future to continue to meet expectations for service.

General Observations

Measuring Total Response Time and Dispatch Center Performance

The Department has not established goals for system performance prior to the completion of this SOC. The aggregate performance is more representative of the system performance. The individual station service areas performance provides understanding of the compartmentalized performance. While it is up to the department to establish policy related to meeting or exceeding community expectations, there are opportunities to better align goals and baseline objectives.

However, it is important to clarify nuances in the data collection process for the CAD system. A distinct "dispatch time", defined from when a citizen calls 911 until the emergency crews and apparatus are dispatched, is not clearly identifiable in the data set. Turnout time, defined as the time between when the units/crews are notified until they are enroute to the incident, is not identifiable either. Therefore, the data reports an aggregated value of both dispatch and turnout time at 7.3 minutes at the 90th percentile.

Based-on national experience, it is more likely that the elongated time (7.3 minutes) is associated with the turnout time that may be most influenced by times when volunteers have to drive to the station in before responding. However, several suggestions are provided to improve data collection and performance management.

Observations and remedies:

While it is understandable that the travel time is over 10-minutes for Frederick County Fire and Rescue, it is also recognized that the total citizen experience is over 16 minutes from the time 911 is called until the first unit's arrival at the 90th percentile. This is known as the total response time.

The department could impact the total response time in most instances with the improvement of crew turnout time and/or improved dispatch time that is more closely aligned with best practices such as NFPA 1710 or NFPA 1221. Irrespective of the national recommendations and standards, it is suggested that best practice is 2 minutes or less at the 90th percentile for call processing or dispatch time.

Recommendation: #1
It is recommended that FCFRD begin dispatching at the unit level rather than at the station level. In this manner, performance between career or staffed models and volunteer or unstaffed models could be evaluated within the context of the service delivery model. This would also provide a definitive data point to measure dispatch or call processing time.

Recommendation: #2
Once the dispatch center is able to dispatch at the unit level and separate out dispatch time from turnout time. The department is encouraged to monitor turnout time to ensure the performance is best practice at 60 seconds for an EMS incident and up to 90 seconds for a fire related incident. Turnout time performance is typically within personnel and management control. Improvement of turnout times is generally a no-cost option.

Internal Performance Goals and the Distribution of Resources

The Department is evaluating policy options for both maintaining current performance at a 10-minute travel time and/or improving to an 8-minute travel time objectives. This will be a two-minute improvement in travel time performance. If the department was also able to improve turnout time to best practice, the department could improve the customer's experience by four to six minutes. Currently, the department is performing at 10.4 minutes or faster to 90% of the incidents.

Only Stations 18 and 21 are performing at less than 9-minutes at the 90th percentile.

Table 86: 90th Percentile Turnout and Travel Time of First Arriving Units by Program

Program	Dispatch and Turnout Time	Travel Time	Response Time	Sample Size
EMS	7.3	10.1	16.1	7,519
Fire	7.5	11.7	17.6	1,088
Rescue	8.6	9.6	17.6	15
Hazmat	8.0	10.7	17.1	274
Total	**7.3**	**10.4**	**16.4**	**8,896**

Table 87: 90th Percentile First Arrival Performance by Fire Station Service Area

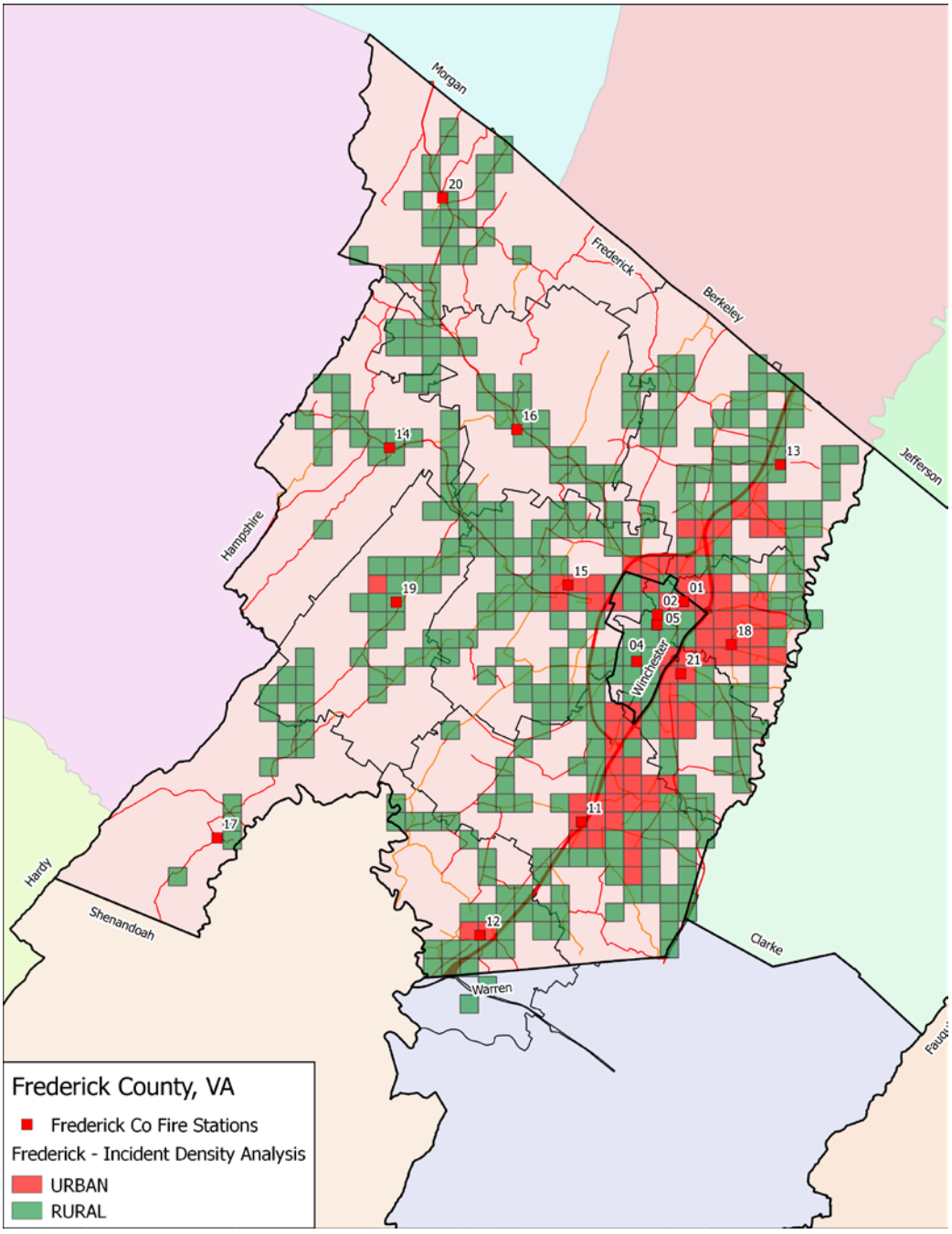
First Due Station Service Area	Dispatch and Turnout Time	Travel Time	Response Time	Sample Size
21 - Millwood Station	7.1	8.5	14.1	840
18 - Greenwood	7.1	8.5	14.4	1,862
15 - Round Hill	7.0	9.7	15.6	1,291
10 - Frederick County	7.0	10.5	15.9	89
11 - Stephens City	7.2	10.5	16.4	2,095
12 - Middletown	7.1	11.0	16.4	519
13 - Clear Brook	7.2	10.7	16.7	867
16 - Gainesboro	7.4	11.5	17.9	382
20 - Reynolds Store	8.1	12.7	19.1	221
14 - Gore	8.6	13.2	19.4	248
19 - North Mountain	9.8	12.6	19.5	331
17 - Star Tannery	7.9	15.7	20.8	151
Total	**7.3**	**10.4**	**16.4**	**8,896**

The current performance is both expected and reasonable from a system design perspective when considering the differences in demand and population levels across the district.

Urban/Rural call density is calculated based on the relative concentration of incidents based on approximately 0.5-mile geographic areas as well as the adjacent 0.5-mile areas. The results demonstrate an urban and rural designation based on call density for services and not based on population. The red areas are designated as urban service areas and the green areas are designated as rural service areas. Any area that is not colored has less than one call every six months in the 0.5-mile area and the adjacent areas.

When referring to the figure below, it is clear that in general, the majority of the County is rural by definition of this analysis. Stations 11, 15, 18, and 21 are of urban demand densities with smaller portions of 12, 13, and 19 as well.

Figure 84: Urban and Rural Call Density Map with Current Stations



In addition to the quantitative analyses provided, Geographic Information System (GIS) analyzed the station locations and associated travel time capabilities. The current capabilities were evaluated to determine if, from a planning perspective, an 8-minute or 10-minute travel time is obtainable within the current configuration.

8-Minute Urban/Suburban and 13-Minute Rural Travel - Frederick County Only

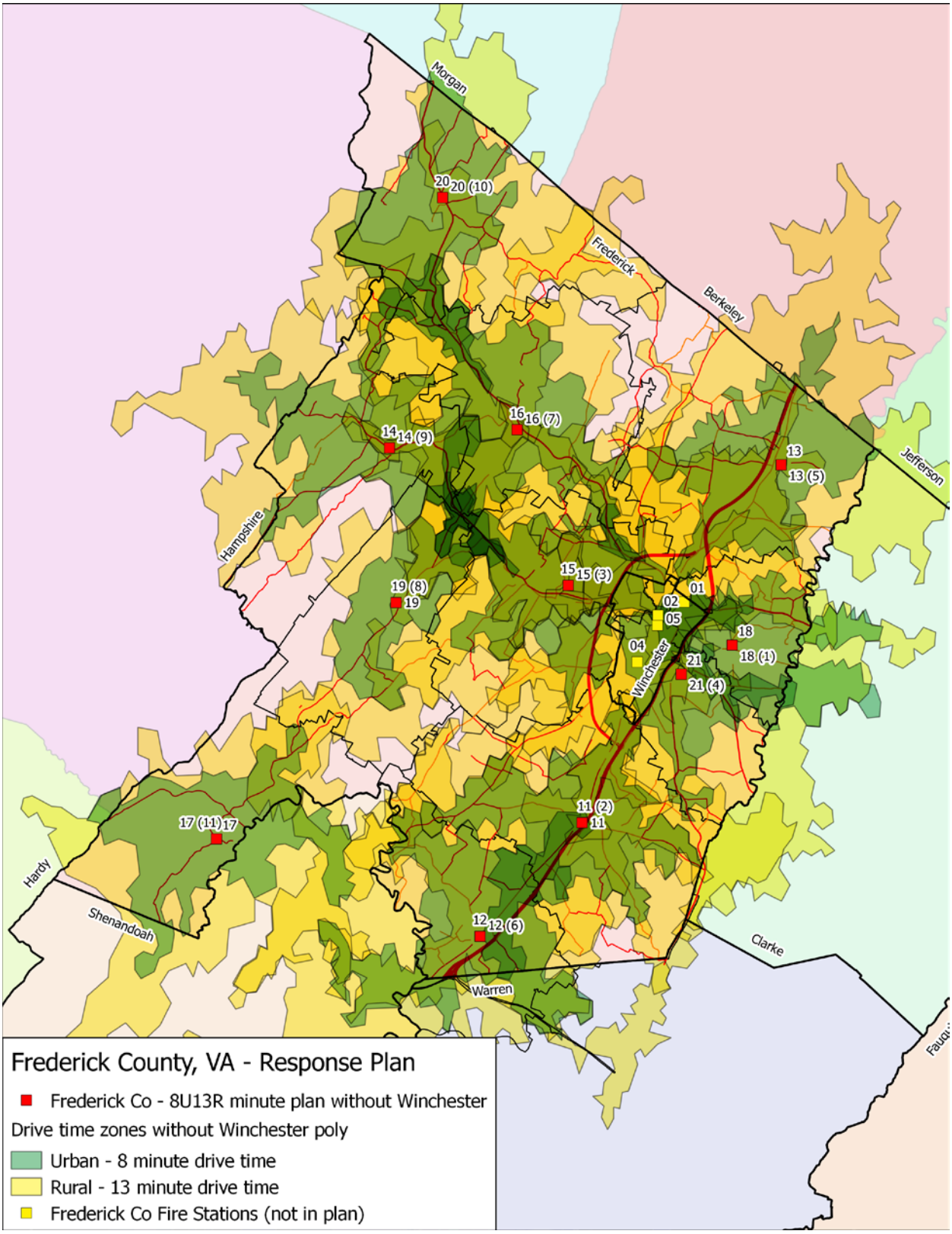
The 8-minute travel time modeling suggests that an 11-station configuration would achieve a travel time of 8-minutes or less to approximately 80% of the incidents in the urban/suburban areas without utilizing the City of Winchester. While it is less efficient than with utilizing Winchester stations, it only accounts for approximately 4% loss of coverage.

This scenario falls short of the urban/suburban response of 8-minutes at 90% and continues to require all 11 current fire station locations. This model would provide for greater than 97% coverage of rural incidents within 13-minutes or less. Therefore, approximately 2.7% of the incidents in the rural areas would receive service longer than 13-minutes.

Table 88: Marginal Fire Station Contribution for 8-Minute Urban/Suburban and 13-Minute Rural Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	18	1,953	1,953	20.12%
2	11	1,764	3,717	38.30%
3	15	1,315	5,032	51.84%
4	21	725	5,757	59.31%
5	13	720	6,477	66.73%
6	12	254	6,731	69.35%
7	16	250	6,981	71.92%
8	19	227	7,208	74.26%
9	14	199	7,407	76.31%
10	20	186	7,593	78.23%
11	17	156	7,749	79.84%
12	21	942	8,691	89.54%
13	11	235	8,926	91.96%
14	16	210	9,136	94.13%
15	19	91	9,227	95.06%
16	13	86	9,313	95.95%
17	14	69	9,382	96.66%
18	20	25	9,407	96.92%
19	12	16	9,423	97.08%
20	15	14	9,437	97.23%
21	17	9	9,446	97.32%

Figure 85: Travel Time Bleed Maps for 8-Minute Urban/Suburban and 13-Minute Rural Travel Times



10-Minute Urban/Suburban and 13-Minute Rural Travel – Frederick Stations Only

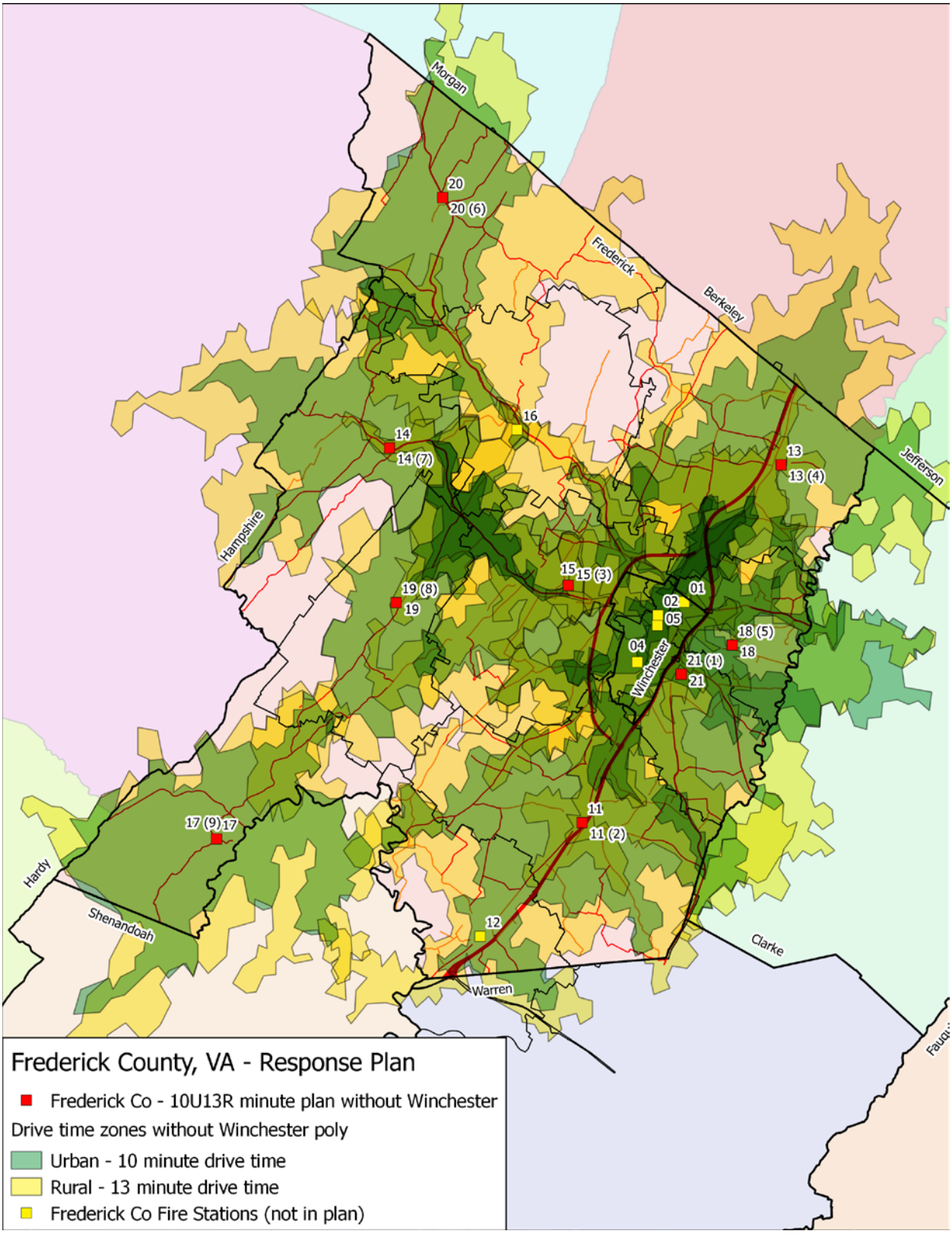
The 10-minute travel time modeling suggests that a 9-station configuration would achieve a travel time of 10-minutes or less to 90.87% of the incidents in the Urban/Suburban areas and approximately 97% of the rural incidents in 13-minutes or less. Similar to the previous analysis, Station 18 would be the only station that does not provide any rural coverage and no additional stations are needed for rural coverage that were not already included in the requisite stations for the urban and suburban areas.

Therefore, this configuration would require a 9-station deployment model to continue to meet 10-minutes urban/suburban and 13-minutes rural responses for greater than 90% of the incidents. *This model requires one less station than if the City of Winchester provided coverage.* In this model, 3.4% of the rural incidents would have a response time greater than 13 minutes.

Table 89: Marginal Fire Station Contribution for 10-Minute Urban/Suburban and 13-Minute Rural Travel Time

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	21	3,658	3,658	37.69%
2	11	1,694	5,352	55.14%
3	15	1,535	6,887	70.96%
4	13	560	7,447	76.73%
5	18	404	7,851	80.89%
6	20	318	8,169	84.16%
7	14	251	8,420	86.75%
8	19	231	8,651	89.13%
9	17	169	8,820	90.87%
10	11	223	9,043	93.17%
11	20	163	9,206	94.85%
12	15	85	9,291	95.72%
13	13	56	9,347	96.30%
14	17	15	9,362	96.46%
15	14	11	9,373	96.57%
16	19	6	9,379	96.63%
17	21	2	9,381	96.65%

Figure 86: Travel Time Bleed Maps for 10-Minute Urban/Suburban and 13-Minute Rural Travel Times



Optimized Station Distribution Plans

8-Minute Urban/Suburban and 13-Minute Rural Travel Time

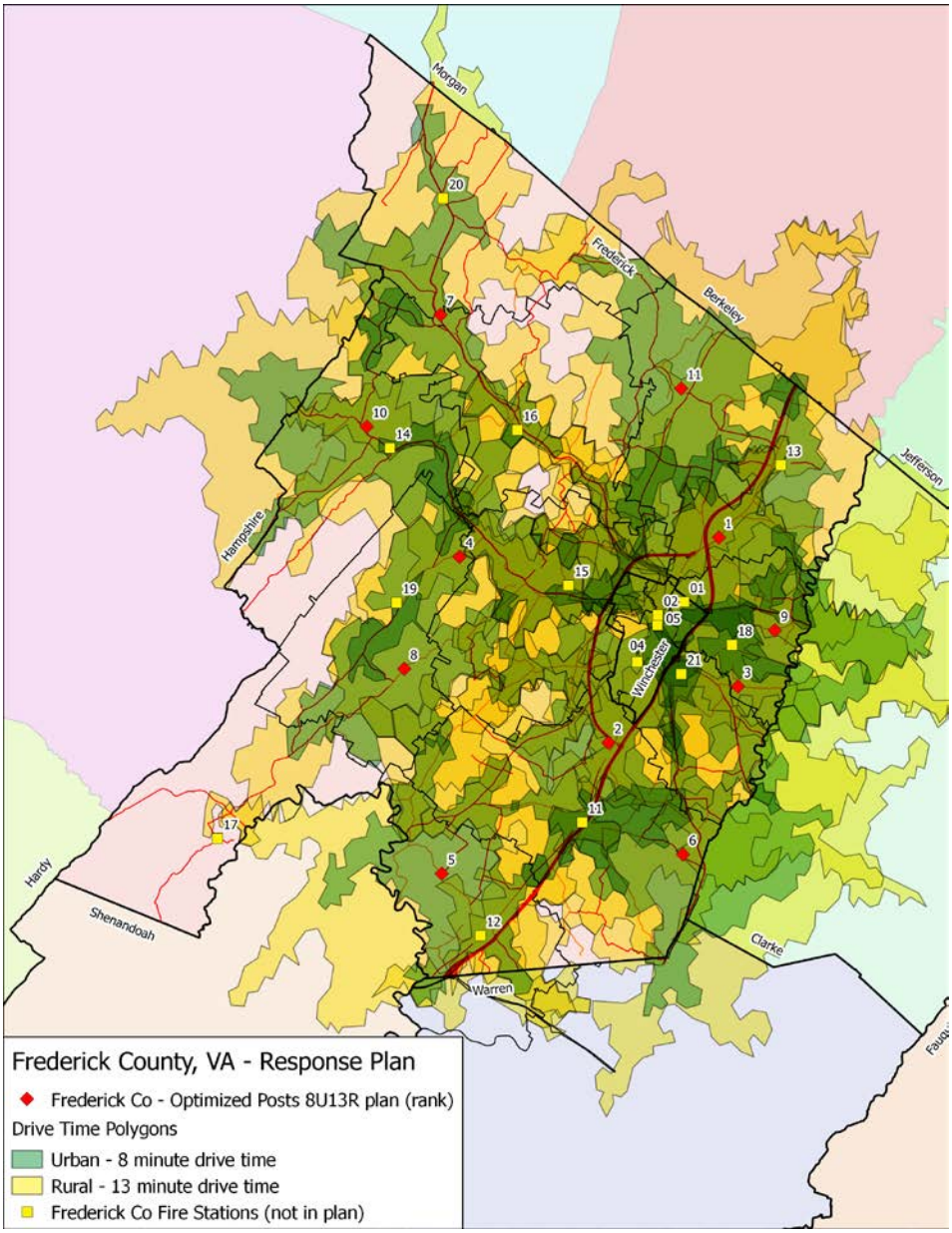
Analyses were completed to develop an optimized station distribution model for an 8-minute travel time as well. This evaluation suggests, that an optimized 11-station model can provide for 90.6% effectiveness covering all incidents within 8-minutes or less travel time in the urban/suburban areas and 96.96% in 13-minutes in the rural areas. In comparison, the current station distribution would require more than 14 stations. Alternatively, the current 11-station configuration can achieve approximately 80% at 8-minutes. A graphic illustration is presented below.

In other words, the long-term strategy of rebuilding stations in optimized locations, as they need replaced can improve performance by 2-minutes and 10% over the existing configuration. The recurring costs for personnel, apparatus, and equipment would not be impacted by the station locations.

A graphic illustration is presented below.

Recommendation: #3
If the desired service level is to improve to an 8-minute travel time, it is recommended that the County adopt a long-term strategy to relocate fire stations when they are due for a major refurbishment or replacement. Once fully implemented the county would have the same number of fire stations as today (11).

Figure 87: Optimized Station Deployment Plan - 8-Minute Urban/Suburban and 13-Minute Rural Travel Time



10-Minute Urban/Suburban and 13-Minute Rural Travel Time

Analyses were completed to develop an optimized station distribution model for a 10-minute travel time as well. This evaluation suggests, that an optimized 7-station model can provide for greater than 90% effectiveness covering all incidents within 10-minutes or less travel time for urban/suburban areas and 96.57% within 13-minutes in the rural areas. In comparison, the current station configuration would require 9 stations for commensurate service.

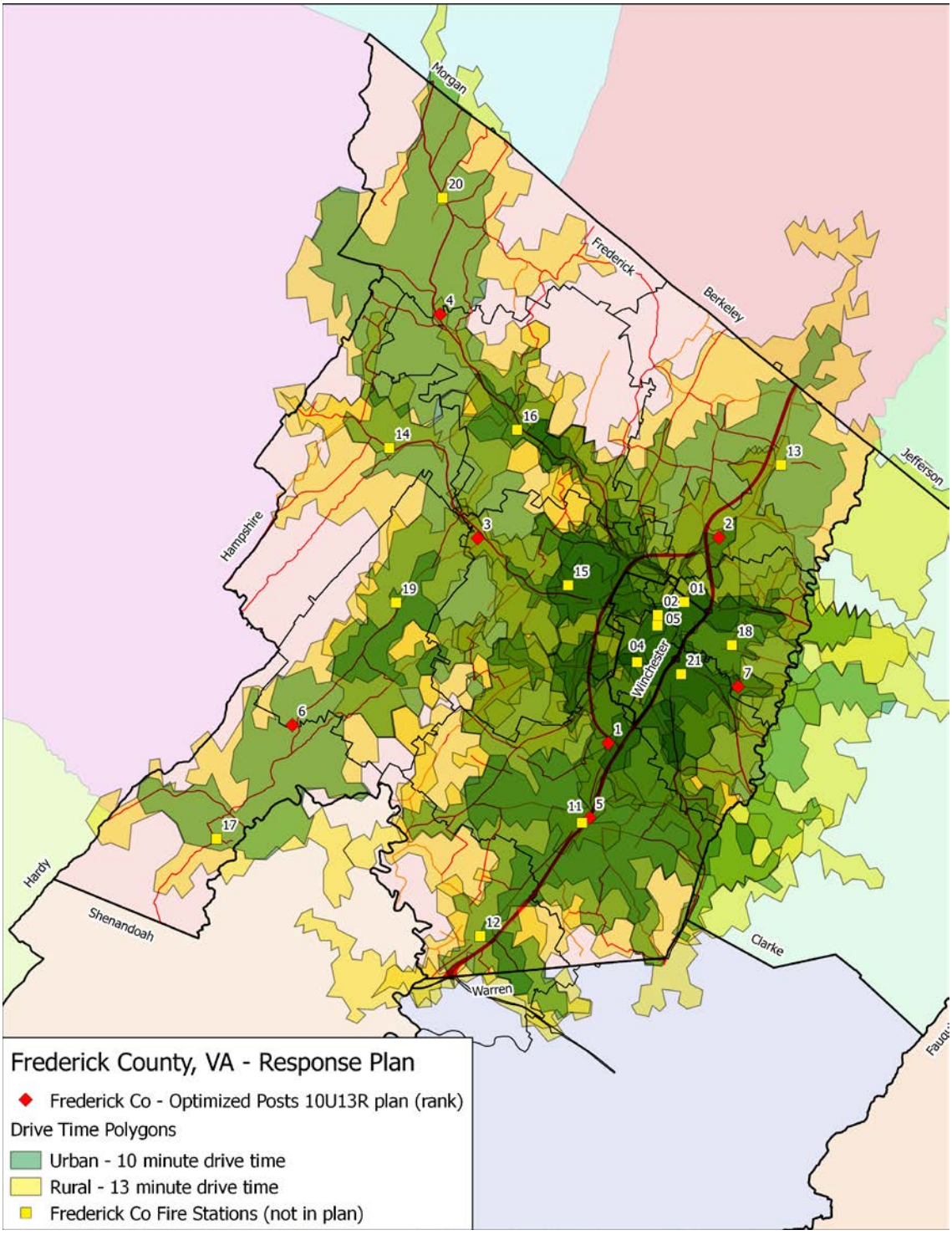
While the cost of new stations vary considerably by the clients' desires and limitations in site footprints, it is reasonable to utilize $4,000,000 as a planning placeholder for capital costs. If the

assumption holds, then this option would have a long-term net capital reduction of approximately $16,000,000 in today's dollars.

Recommendation: #4
If the desired service level is to maintain the current 10-minute travel time, it is recommended that the County develop a long-term strategy to relocate fire stations when they are due for a major refurbishment or replacement. Once fully implemented the county would have reduced capital liabilities by four stations and offset personnel requirement by redistributing existing personnel as desired. This is estimated as a long-term capital savings of approximately $16,000,000 dollars while maintaining current performance.

A graphic illustration is presented below.

Figure 88: Optimized Station Deployment Plan - 10-Min. Urban/Suburban and 13-Min. Rural Travel Time



Workload Capacity – Reinvesting or Reallocating Resources

The department is currently operating within the boundaries of nationally recommended best practices with respect to workload. Overall, the department is performing at approximately 0.15, or 15%.

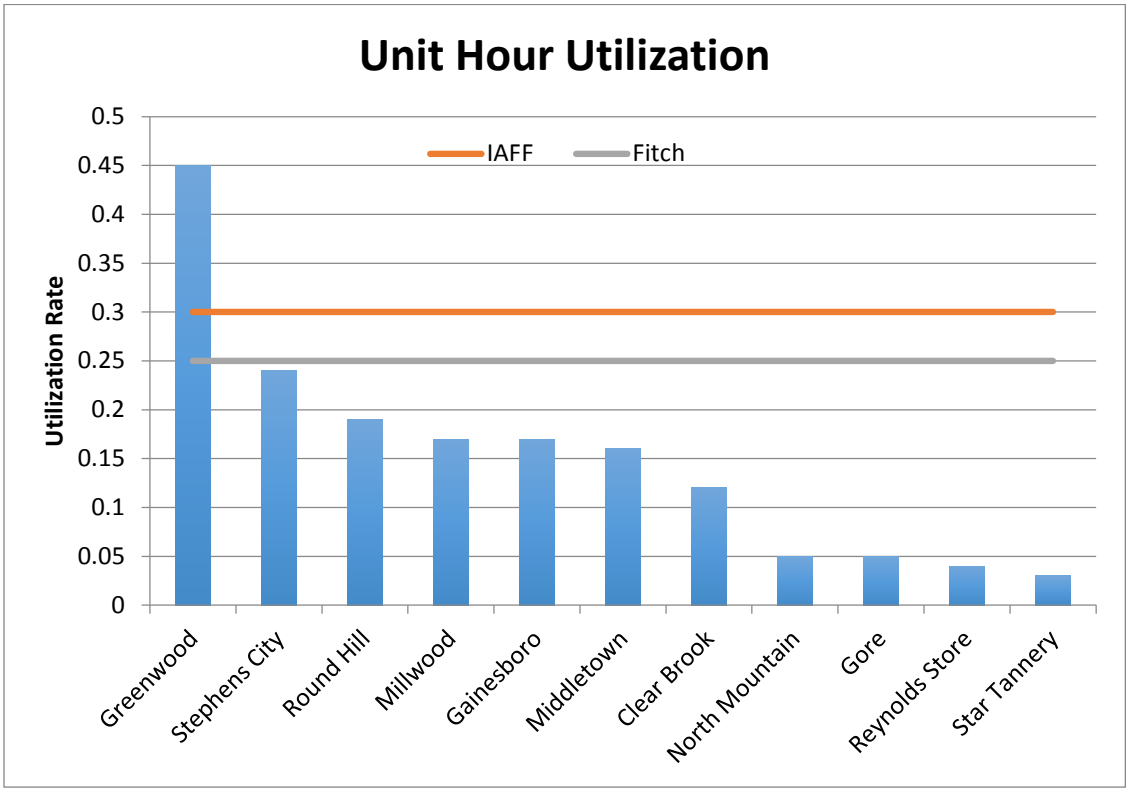
We grouped cross-staffed units together and conducted UHU analyses at the station level. Greenwood Station has the highest workload at 0.45, followed by Stephens City station at 0.24, Round Hill Community at 0.19. North Mountain, Gore, Reynolds Store, and Star Tannery stations all had UHU less than or equal to 5%.

FITCH's position is that workloads greater than 0.25 are not optimal on a 24-hour shift and should not exceed 0.30. The addition of a dedicated Medic unit at the Greenwood station would re-distribute the workload across the singular crew that cross-staffs each of the units. An additional Medic resource should be considered for the Stephens City station in the near future as the workload is nearly at our recommended threshold to begin planning for a new resource. Finally, these changes should have a moderating effect on some of the other stations, reducing the UHU for multiple units responding from surrounding stations.

Recommendation: #5
It is recommended that a dedicated Medic unit be added at the Greenwood station, and an additional Medic resource should be considered for the Stephens City station in the near future. It is also recommended that the workload, reliability, and call concurrency be evaluated in all stations, but specifically in Greenwood, Stephens City, Round Hill Community, Millwood, Gainesboro, and Middletown.

Recommendation: #6
It is recommended that the workload, reliability, and call concurrency be evaluated in all stations, but specifically in Greenwood, Stephens City, Round Hill Community, Millwood, Gainesboro, and Middletown due to their relatively higher workloads.

Figure 89: Station Level Unit Hour Utilization



Staffing, Scheduling, and Overtime

Staffing and Schedules

The fire department currently operates on a "modified Detroit" schedule that equates to an average workweek of 56 hours per week regardless of the pay cycle for each of three shifts. Analyses were completed to determine if there were any fiscal advantages to changing the schedule.

Departments around the country utilize a variety of schedules that typically result in a 42, 48, or 56-hour workweek. Schedules for 42, 48, and 56-hour workweeks were evaluated to determine the relative fiscal impact of the various schedules. In all scenarios the minimum staffing was maintained on all units and no deployment changes were necessary or contemplated. Finally, an evaluation was completed to determine the impact of establishing a Kelly Day or Relief Day to reduce overtime hours; 52-hour workweek or less. This analysis utilizes the average leave histories of the employees provided by FCFRD.

When referring to the table below, the staffing multiplier is the number of personnel needed to fill one position or seat on an apparatus 24 hours a day and 7 days a week given the average work week and annual hours. For example, for the 42-hour workweek in the first row, it would require 4.67 employees to continuously staff one position 24/7. This table assumes a minimum daily staffing of 27 personnel 24/7.

Table 90: Comparison of Various Work Schedules and Staffing Demands

Work Week (hrs.)	Annual Hours	Staffing Multiplier	Needed Employees	Additional Employees to Cover Vacation Slots	Delta from Current of 103	Delta in Personnel Costs Utilizing Average Salary
42 (Kelly Days)	2,184	4.67	126	21	44 Additional	$2,381,197.28
48 (Kelly Days)	2,496	4.0	108	15	20 Additional	$1,082,362.40
52 (Kelly Day)	2,704	3.65	99	13	9 Additional	$487,063.08
56	2,912	3.36	91	12	0	$0

The department's current staffing multiplier is 3.82 (103 shift FTE / 27 minimum staffing). Therefore, the department has elected to staff for the available vacation slots above and beyond the staffing multiplier. For example, 103 shift FTE / 3 shifts = approximately 34 personnel per shift. This would equate to a total of 7 personnel that could be off on any shift (34 personnel per shift – 27 minimum staffing = 7) prior to hiring back on overtime. However, as the department adds relief personnel, those employees need to have access to time off as well. Therefore, the number of time of slots needs to be increased to 3.6 from 3.2. Again, doubling the available slots employees can take off would be approximately 7 slots, which is in line with the department's current practices.

Results from this analysis suggest that within the current minimum staffing of 27 personnel and the average leave history of the employees; the optimized staffing could be 91 (27 x 3.36). Utilizing this approach already accounts for 3.6 vacation slots per day within the relief formula. Therefore, following the department's current practice, an additional 12 employees would need to be hired (3.6 x 3.36 = 12.1) to cover the available time off slots.

The number of available "slots" that personnel can take off each day on scheduled leave is approximately 6. There are times where this may be exceeded with Fire Chief's approval. Utilizing the total hours of 27,923 hours that include vacation, sick leave, and other miscellaneous leave accounts, it would require a minimum of 3.2 available slots for all employees to capture their average leave. This figure was calculated when the department had 91 personnel on shift. Now that there are 103 personnel, the number of required slots is 3.6. However, it is understood that not all days are as desirable as others, therefore a factor of approximately 2, or a total of 7 slots off for vacation is a reasonable solution to account for desirable days, partial vacation days, etc. It is recommended that the department continue to utilize the 7 available slots per day, but do not allow greater than 7 personnel off per shift on scheduled leave.

The current schedule that the fire department utilizes is the most efficient schedule to provide coverage 24 hours per day 7 days a week.

Recommendation: #7
It is recommended that Frederick County and FCFRD continue with the current work schedule for the foreseeable future.

Recommendation: #8
It is recommended that FCFRD continue to use no more than 7 "slots" per day for scheduled leave.

Overtime

There is a direct relationship between the available staffing and overtime liabilities. Understanding the average workweek and minimum staffing, there may be some additional capacity to reallocate resources as the system continues to grow to meet community demands. However, there are three general factors that contribute to overtime usage that deserves consideration. First, Virginia affords payment for premium overtime (1.5 X base rate) for all scheduled hours. Since the average workweek is 56 hours, there is inherent Fair Labor Standards Act (FLSA) overtime that occurs each pay period that has nothing to do with leave usage of the personnel. Virginia requires payment of all overtime at the premium regardless of the "sweat hours" (hours actually worked as opposed to hours on some type of leave) that are afforded in the federal FLSA standard. In other words, even if the employee took several days' vacation, reducing the "sweat hours" or actual time at work, the scheduled work hours would continue to be compensated at full rate and at a premium rate for hours past 212 hours in the 28-day work cycle (7 days/week x 4 weeks). At 56 hours a workweek, the average month would be approximately 224 hours (56-hour week x 4 weeks). Therefore, there would be approximately 12 hours of overtime each month for each employee due to the current schedule plus an additional 8 hours of off duty training per month for a total of 20 hours of overtime. These hours are inherent in the prescribed schedule prior to any operational overtime to cover PTO, unscheduled leave, etc.

Second, as previously described, the department has 8-hours of training scheduled each month that will always be paid at the premium rate because it is above the 56 hour work week. Third, anytime the department allows greater than 6 personnel off per shift, such as scheduled leave, or additional positions are vacated due to unscheduled leave, the department must hire back personnel to ensure minimum staffing of 27 is obtained. The unscheduled leave experience may have the greatest unpredicted impact on overtime based on the limited ability for administrative control.

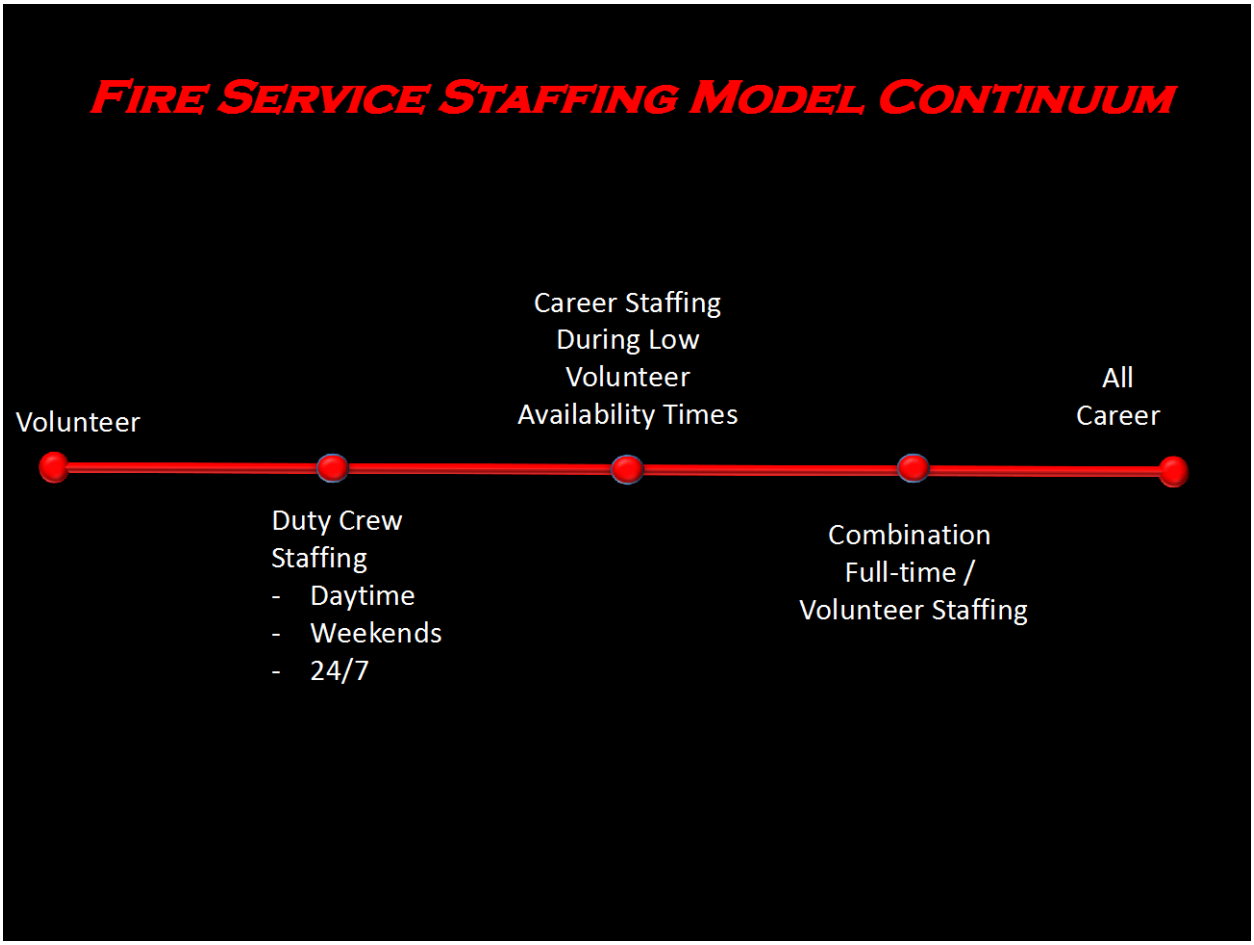
Finally, since all scheduled hours above 212 in 28 days are essentially overtime, it may be in the best interest of the County to hire FTE's rather than carry the extra burden of overtime. For example, since all overtime is at the premium 1.5 rate, it may be better to hire an FTE at the 1.0 rate. Virginia has eliminated the benefit of the FLSA "sweat hours" requirement to pay premium pay, by requiring all scheduled hours to be compensated irrespective of if they utilized vacation for example. Therefore, the traditional method of determining the break over of straight time employment versus overtime at a premium is negated.

Recommendation: #9
Since the relationship is a 1 to 1 ratio, it is recommended that Frederick County continue to hire personnel to offset the need for shift back-fill and provides for additional surge capacity in the system for extreme events. Adding additional personnel seems to be a more efficient use of limited fiscal resources.

Staffing Challenges

Frederick County Fire and Rescue has a very diverse staffing model that has served the citizens very well. The system utilizes fire and rescue staffs that include both career and volunteer personnel. Most of the volunteer stations are having challenges with recruitment and or retention which is a national issue and FCFR is no exception. The volunteer departments impacted are either running short of their optimal strength or are unable to keep staff long enough to obtain the necessary training and experience to be a long term asset to the system. FCFR has taken steps by supporting recruitment and retention as a system.

Figure 90: Fire Service Staffing Model Continuum



FCFR should provide service level expectations and benchmarks throughout the system. FCFR can use those benchmarks in both performance and reliability to determine when the current staffing model is contributing to the benchmarks set for performance. This could include turnout time expectations and or response time expectations. If the volunteer stations were unable to meet the expectations that contribute to systems benchmarks, it would allow FCFR to take steps to assist in meeting those expectations. The department may then need to determine which staffing model is needed to meet the benchmarks. As the previous image shows there are several different staffing options. As the performance and reliability decreases of a particular staffing model at a particular station, additional investment in the model to the right of the current staffing model may be necessary. As the volunteerism decreases while the demand for service increases the ability to rely on volunteers to respond also decreases. As recruitment and retention of volunteer staff continues to be challenging the addition of career staff will be necessary to provide a consistent level of service to the citizens. FCFR should ensure that regardless of staffs' employment type that there is an adequate number of trained staff able to respond in a reliable manner to the demand for service with the systems expectations.

Staffing is a balance as depicted in the following image between capital costs, operating costs, available resources, risk tolerance, community expectations and desired reliability. FCFR like many departments in the country may need to look to expand investment in career staff when volunteer staffs are no longer able to reliably respond to the community demands and expectations.

Recommendation: #10
It is recommended that the cost of frequent volunteer turnover be quantified to determine when the cost of continual recruitment, equipping, and training volunteers with short longevity exceeds the contribution that is provided to the system with the current model.

Figure 91: Finding Balance in Fire Service Staffing

Risk-based Approach to the Allocation of Resources

Following a risk-based approach to managing risk, two STATION SERVICE AREAS's were categorized as high-risk station service areas and three stations service areas were categorized as moderate. All other stations service areas were categorized as low-risk stations. Within a risk-based approach, the system is designed to have a higher concentration of resources at stations of higher risk versus lower risk.

In all developed alternatives below, it is assumed that the Battalion Chief will continue as currently deployed and that would bring the current minimum staffing to 27. In addition, in all models it is intended that every station would cross-staff an ambulance, preferably at the Advanced Life Support (ALS) level.

Alternative 1 – Risk-based Engine and Station Staffing at 8-Minutes Urban/Suburban

Alternative 1 contemplates a risk-based deployment strategy that utilizes all 11-current fire stations and seeks to achieve an 8-minute travel time for urban/suburban areas and a 13-minute travel time

for rural incidents. As previously discussed, it is understood that the 8-minute travel time may only achieve approximately 80% of the incidents within the urban/suburban timeframe. The goal would be to achieve 90% of the incidents. However, it should not be discounted that the vast majority of the incidents would be responded to within 8-minutes or less.

This alternative would increase engine staffing from 2 to 3 personnel for 24/7 coverage for all moderate and high-risk station service areas (11, 13, 15, 18, and 21). All other station service areas would continue to be staffed with 2 personnel on the primary fire apparatus. This is to accomplish the baseline services for fire suppression and first responder EMS incidents.

Staffed ambulances would be provided at stations 11, 12, 13, 15, 18, and 21. A second ambulance would be assigned to stations 11 and 18, both high-risk stations. Stations 14, 17, 19, and 20 would continue to be staffed with 2 personnel and cross-staff an ambulance consistent with current practice. This alternative would have all ALS ambulances and would eliminate the cross-staffed ALS chase vehicles.

Station 16 is allocated an ALS ambulance and the associated 2 person staffing due to an analysis the evaluated the balance between call concurrency and call volume. For this report, it is recommended that any stations that have greater than or equal to 1,800 (<5 calls per day) and greater than or equal to 15% call concurrency that each unit is staffed rather than continuing to cross-staff resources.

Therefore, all additional engine staffing was allocated due to the risk ratings of moderate or high. The recommendations for staffed ambulance placement is allocated based the geographic requirements to achieve the greatest contribution to response time performance. Station 16 is the only exception. This alternative would have all ALS ambulances and would eliminate the cross-staffed ALS chase vehicles.

Table 91: Summary of Career Staffed Resource Allocation for Alternative 1 – 8/13 All 11 Fire Stations

Station Service Area	Engine Quint Pump/Tender	Ambulance	Ambulance	Cross Staffed Ambulance	Current Minimum 24/7 Staffing	Total Recommended 24/7 Min. Career Staffing	Risk Rating
21	Engine	ALS		ALS	2	5	Moderate
18	Engine	ALS	ALS	ALS	2	7	High
17	Engine			ALS	2	2	Low
14	Engine			ALS	2	2	Low
13	Engine	ALS		ALS	2	5	Moderate
15	Engine	ALS		ALS	2	5	Moderate
19	Engine			ALS	2	2	Low
20	Engine			ALS	2	2	Low
16	Engine	ALS		ALS	2	4	Low
11	Engine	ALS	ALS	ALS	2	7	High
12	Engine	ALS		ALS	2	4	Low
Total	11	7	2	4[46]	22	45	

Note: Apparatus are restricted to the recommended primary staffed units. This summary does not address additional apparatus staffed by volunteers.

Alternative 2 – Rick-based Engine and Station Staffing at 10-Minutes Urban/Suburban

Alternative 2 contemplates a risk-based deployment strategy that utilizes all 11-current fire stations and seeks to achieve a 10-minute travel time for urban/suburban areas and a 13-minute travel time for rural incidents. As previously discussed, it is understood that the 10-minute travel time will accomplish a minimum of 90% of the incidents within the urban/suburban timeframe. However, it should not be discounted that the vast majority of the incidents would be responded to within 8-minutes or less (80%) if all 11 stations continue to be utilized.

This alternative would increase engine staffing from 2 to 3 personnel for 24/7 coverage for all moderate and high-risk station service areas (11, 13, 15, 18, and 21). All other station service areas would continue to be staffed with 2 personnel on the primary fire apparatus. This is to accomplish the baseline services for fire suppression and first responder EMS incidents.

Staffed ambulances would be provided at stations 11, 12, 13, 15, 18, and 21. A second ambulance would be assigned to stations 11 and 21, both high-risk stations. Stations 14, 17, 19, and 20 would continue to be staffed with 2 personnel and cross-staff an ambulance consistent with current practice.

[46] Only four primary ambulances that are cross-staffed. In total, could have 11 cross-staffed ambulances, but only require 4 as primary deployment.

Station 16 is allocated an ALS ambulance and the associated 2-person staffing due to an analysis the evaluated the balance between call concurrency and call volume. For this report, it is recommended that any stations that have greater than or equal to 1,800 (<5 calls per day) and greater than or equal to 15% call concurrency that each unit is staffed rather than continuing to cross-staff resources.

Therefore, all additional engine staffing was allocated due to the risk ratings of moderate or high. The recommendations for staffed ambulance placement is allocated based the geographic requirements to achieve the greatest contribution to response time performance. Station 16 is the only exception. This alternative would have all ALS ambulances and would eliminate the cross-staffed ALS chase vehicles.

Table 92: Summary of Career Staffed Resource Allocation for Alternative 2 – 10/13 All 11 Fire Stations

Station Service Area	Engine Quint Pump/Tender	1st Staffed Ambulance	2nd Staffed Ambulance	Current Minimum 24/7 Staffing	Total Recommended 24/7 Min. Career Staffing	Risk Rating
11	Engine	ALS	ALS	4	7	High
12	Engine	ALS		2	4	Low
13	Engine	ALS		2	5	Moderate
14	Engine			2	2	Low
15	Engine	ALS		2	5	Moderate
16	Engine	ALS		2	4	Low
17	Engine			2	2	Low
18	Engine	ALS		4	5	Moderate
19	Engine			2	2	Low
20	Engine			2	2	Low
21	Engine	ALS	ALS	2	7	High
Total	11	7	2	26	45	

Note: Apparatus are restricted to the recommended primary staffed units. This summary does not address additional apparatus staffed by volunteers.

Alternative 3 – Partially Autonomous EMS Layer with Risk-based Engine Staffing

Alternative 3 is an incremental variation of the Alternative 2. Analyses have demonstrated that stations 12 and 16 are not required to meet 90% of the incidents within 10-minute urban/suburban travel times for EMS. In other words, all 11-stations would be included for fire, non-EMS, and first responder EMS incidents. Only 9-stations would be resourced with staffed ambulances and stations 12 and 16 would continue current practices. All moderate and high-risk station service areas are recommended to have 3-person engine staffing.

Table 93: Summary of Career Staffed Resource Allocation for Alternative 3 – 10/13 All 11 Fire Stations

Station Service Area	Engine Quint Pump/Tender	1st Staffed Ambulance	2nd Staffed Ambulance	Current Minimum 24/7 Staffing	Total Recommended 24/7 Min. Career Staffing	Risk Rating
11	Engine	ALS	ALS	4	7	High
12	Engine			2	2	Low
13	Engine	ALS		2	5	Moderate
14	Engine	ALS		2	4	Low
15	Engine	ALS		2	5	Moderate
16	Engine			2	2	Low
17	Engine	ALS		2	4	Low
18	Engine	ALS		4	5	Moderate
19	Engine	ALS		2	4	Low
20	Engine	ALS		2	4	Low
21	Engine	ALS	ALS	2	7	High
Total	11	9	2	26	49	

Note: Apparatus are restricted to the recommended primary staffed units. This summary does not address additional apparatus staffed by volunteers.

Alternative 4 – Partially Autonomous EMS Layer and 2-Person Engine Staffing

Alternative 4 is an incremental variation of either Alternatives 1 or 2. The only difference in baseline deployment between Alternative 1 and 2, are the changes from Station 18 to 21. Analyses have demonstrated that stations 12 and 16 are not required to meet 90% of the incidents within 10-minute urban/suburban travel times for EMS. In other words, all 11-stations would be included for fire, non-EMS, and first responder EMS incidents. Only 9-stations would be resourced with staffed ambulances and all fire suppression apparatus would continue with 2-person staffing.

Table 94: Summary of Career Staffed Resource Allocation for Alternative 4 – 10/13 All 11 Fire Stations

Station Service Area	Engine Quint Pump/Tender	1st Staffed Ambulance	2nd Staffed Ambulance	Current Minimum 24/7 Staffing	Total Recommended 24/7 Min. Career Staffing	Risk Rating
11	Engine	ALS	ALS	4	6	High
12	Engine			2	2	Low
13	Engine	ALS		2	4	Moderate
14	Engine	ALS		2	4	Low
15	Engine	ALS		2	4	Moderate
16	Engine			2	2	Low
17	Engine	ALS		2	4	Low
18	Engine	ALS		4	4	Moderate
19	Engine	ALS		2	4	Low
20	Engine	ALS		2	4	Low
21	Engine	ALS	ALS	2	6	High
Total	11	9	2	26	44	

Note: Apparatus are restricted to the recommended primary staffed units. This summary does not address additional apparatus staffed by volunteers.

Alternative 5 – Partially Autonomous EMS at 12 Minutes and 2-Person Engine Staffing

Alternative 5 is an incremental variation of either Alternatives 1 or 2. The only difference in baseline deployment between Alternative 1 and 2, are the changes from Station 18 to 21. In this scenario, all 11-stations would be included for fire, non-EMS, and first responder EMS incidents and would continue to perform at 10-minutes urban/suburban and 13-minutes rural coverage. However, an additional ALS ambulance layer would be provided at a 12-minute travel time. Only 5-stations would be resourced with staffed ambulances and all fire suppression apparatus would continue with 2-person staffing.

Table 95: Summary of Career Staffed Resource Allocation for Alternative 5 – 12 Minutes All 11 Fire Stations

Station Service Area	Engine Quint Pump/Tender	1st Staffed Ambulance	2nd Staffed Ambulance	Current Minimum 24/7 Staffing	Total Recommended 24/7 Min. Career Staffing	Risk Rating
11	Engine	ALS	ALS	4	6	High
12	Engine			2	2	Low
13	Engine	ALS		2	4	Moderate
14	Engine			2	2	Low
15	Engine			2	2	Moderate
16	Engine	ALS		2	4	Low
17	Engine			2	2	Low
18	Engine			4	2	Moderate
19	Engine	ALS		2	4	Low
20	Engine			2	2	Low
21	Engine	ALS	ALS	2	6	High
Total	11	5	2	26	36	

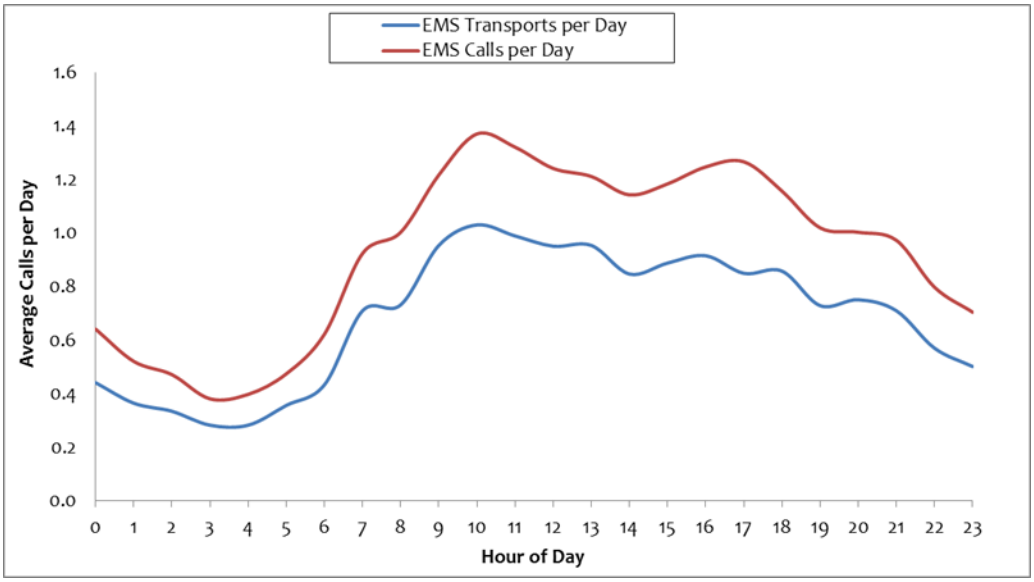
Note: Apparatus are restricted to the recommended primary staffed units. This summary does not address additional apparatus staffed by volunteers.

Alternative 6 – Peak Load Ambulance Program and 2-Person Engine Staffing

Alternative 6 is an incremental variation of either Alternatives 1 or 2. The only difference in baseline deployment between Alternative 1 and 2, is the changes from Station 18 to 21. In this scenario, all 11-stations would be included for fire, non-EMS, and first responder EMS incidents and would continue to perform at 10-minutes urban/suburban and 13-minutes rural coverage. However, any additional staffed ambulances are provided as peak-load units that work 12-hours per day. In total, 7 peak-load ambulances could be deployed plus 2 additional 24/7 ambulances. All stations not identified would continue current practices of cross-staffing ambulances.

The middle of the day, between 8:00 am and 8:00 pm, experiences the vast majority of incident call volume and workload. In addition, the overwhelming volume is for EMS related incidents as opposed to fire suppression incidents with a relatively high transport rate. Much of the non-peak overnight period has less than one call every two hours on average. Please see the figure below.

Figure 92: Average EMS Calls and EMS Transports per Day by Hour of Day



Therefore, it is recommended that the department consider a strategy of hiring 12-hour employees to meet demands above and beyond the base level services. This is the most efficient manner to address increases in demand for the future once base level services have been established for the 24-hour period.

Table 96: Summary of Career Staffed Resource Allocation for Alternative 6 – 10/13 All 11 Fire Stations

Station Service Area	Engine Quint Pump/Tender	Peak Load Ambulance	24/7 Staffed Ambulance	Current Minimum 24/7 Staffing	Total Recommended 24/7 Min. Career Staffing	Total Peak-Load Staffing (12-hour)	Risk Rating
11	Engine	ALS	ALS	4	4	2	High
12	Engine	ALS		2	2	2	Low
13	Engine	ALS		2	2	2	Moderate
14	Engine			2	2	0	Low
15	Engine	ALS		2	2	2	Moderate
16	Engine	ALS		2	2	2	Low
17	Engine			2	2	0	Low
18	Engine	ALS		4	2	2	Moderate
19	Engine			2	2	0	Low
20	Engine			2	2	0	Low
21	Engine	ALS	ALS[47]	2	4	2	High
Total	11	7	2	26	26	14	

Note: Apparatus are restricted to the recommended primary staffed units. This summary does not address additional apparatus staffed by volunteers.

A comparison of the general costs for each of the developed alternatives are provided in the table below. A baseline estimate for a minimum staffing of 26 personnel per day utilized the average salary range of $54,118.12 as provided by the department. It is understood that a Battalion Chief (BC) is assigned to each shift bringing the actual minimum staffing to 27 each day. However, to compare alternatives for the personnel assigned to primary response apparatus, the base minimum staffing utilized was 26. As stated previously, in all scenarios it is assumed that the BC will continue as currently deployed. In addition, the department's current staffing multiplier (3.82) was utilized for these comparison purposes. Under the current staffing strategy, FCFR requires 3.85 personnel for each person deployed 24/7. Finally, it is also understood that these estimates are personnel costs only utilizing the average salary as provided by FCFR and may not be representative of the total compensation. This is for comparison purposes to illustrate the relative fiscal impact of each alternative.

[47] The resource allocation and definition of high-risk station shifts between Stations 18 and 21 depending on whether an 8 or 10-minute travel time is adopted.

Table 97: Comparison Table of Alternatives Utilizing Average Salary for Personnel Costs Only

Alternative	Current Minimum Staffing (w/o BC)	Proposed Minimum Staffing (w/o BC)	Delta from Current FTE of 100 (w/o BC)	Delta from Current Staffing Utilizing Average Salary
Alternative 1	26	45	73	$3,927,893.15
Alternative 2	26	45	73	$3,927,893.15
Alternative 3	26	49	89	$4,754,818.02
Alternative 4	26	44	69	$3,721,161.93
Alternative 5	26	36	39	$2,067,312.18
Alternative 6	26	14[48]	35	$1,894,134.20

Recommendation: #11
The County is encouraged to consider one of the alternatives to meet or exceed desired service levels.

[48] Peak Load Schedule only requires 2.5 personnel to fulfill the schedule as opposed to FCFR current practice of 3.85.

NON-DEPLOYEMENT OBSERVATIONS AND CONSIDERATIONS

Division and Support Staff Needs

Admin/EMS Billing – As the organization grows additional demands are placed on the administrative staff. Additional line personnel equate to an exponential increase in the provision of routine administrative services, which in turn can negatively impact the effective output of staff. Keeping pace with the number of administrative personnel is paramount to ensure that all aspects of organizational activities can be accomplished effectively and efficiently. Consistent with this theme is the need to provide an identifiable means of horizontal and vertical communications, clearly defined job descriptions, work space and equipment compatible with required functions, succession planning, and opportunities for personal and professional growth. Deliberate and contemplative consideration should be given when determining the need for additional administrative staff, appropriate assignments, and the potential of replacing administrative FTE vacancies with line and staff fire officers.

Recommendation: #12
It is understood that FCFRD has recently filled this position. It is recommended that FCFRD continue efforts to ensure long-term sustainability of the new position.

Training Division - The personnel assigned to the FCFRD Training Division continue to perform at a high level under continually increasing demands. As the community continues to develop, and the risks and exposures become more diverse, training of personnel becomes even more imperative. Delivery of requisite training programs is directly proportionate to the personnel available to conduct the training. Currently the limited staff is providing all programs including recruit school, in-service, specialty on-demand programs, and officer development. Potential increases to training efficiencies could be realized through the development of a dedicated training facility, compiling a cadre of certified instructors, and the expanded use of Target Solutions, or similar software, by the Training Division and company officers. Current delivery methodology lends itself to increasing amounts of overtime hours, flex scheduling, and potential "burn out" of training staff. As the organization continues to grow it does not appear that the current number of training staff, and subsequent delivery systems, are sustainable over time. In addition, it would be extremely beneficial for the organization to develop a division succession plan to account for staff changes and retirements.

Recommendation: #13
It is recommended that the possibility of developing on shift training officers be explored to augment the training division and relieve excessive hours from current staff.

Life Safety/Fire Marshal - This division is impacted by county growth and development on a daily basis due to the plan review and inspection functions being performed. In addition, personnel in this division also supplement and support emergency functions as needed or directed by the organizational hierarchy. The divergence from their identified primary responsibilities has the potential to negatively impact service delivery and customer satisfaction. Timeliness is paramount when assisting customers who need approvals, certifications, or authorizations to move forward with various business endeavors. Currently division functions are being provided by a combination of full time and part time personnel. As the built inventory increases it will become necessary to evaluate the historic work metrics of both full and part time staff. Demands for the services of the Life Safety division will continue to increase and may create the need to transition part time positions to full time positions.

The department can determine the appropriate fire inspection staffing levels by evaluating the general demand for services, the frequency of service, and the average duration of each activity. As an example, if the department has 1,000 inspectable properties, that need to be inspected once each year, and the average time to complete an inspection is 1 hour; then with an estimated employee capacity to accomplish 6 full inspections (plus travel and lunch) would require 1 employee to complete (less average vacation, sick leave, etc.). This is calculated as 1,000 inspections X 1 hour per inspection = 1,000 needed hours. Next, 6 inspections per day would require 1,560 (52 weeks X 30 hours per week) / 1,000 = 0.75. This can be replicated for other activities such as plans review, public education, etc.

As fire prevention is the first line of defense in protecting the community from fire it is incumbent on the organization to constantly reassess the effectiveness of these efforts to insure an appropriate return on the investment being made. The Fire Marshal's office has a dedicated, qualified staff committed to their mission. Progress and effectiveness can be eroded should support be lacking, or activities perceived to be a low priority. Horizontal and vertical communication pathways should be well defined and contain feedback and follow up provisions.

Recommendation: #14
It is recommended that the FCFRD consider requesting an official opinion from the U.S Dept. of Labor, Wage and Hour Division, regarding the specific local conditions regarding On-Call status. While there are general guidelines relative to compensation for these hours, there are more specific benchmarks that are unique to each agency's use of on-call hours. Said opinion would be useful in developing an organizational policy that could clearly and definitively explain the counties position

Operations - Emergency response personnel continue to meet their challenge with limited resources. FCFRD is fortunate to have dedicated individuals committed to the mission and who constantly adapt to the changing environment. Limited staffing, as identified by FCFR staff officers, directly impacts the time necessary to assemble an effective fire force. Due to the uncertainties of volunteer response the limited staffing also impacts the commitment of multiple fire stations, which further exacerbates the issue of coverage of simultaneous calls for assistance. Under the current model the

continued increase of EMS related incidents further erodes the availability of full time staff for fire and other emergency activities. Given the inherent risks associated with emergency response, personnel safety is of the utmost importance. Essential to this task is the standardization of policies.

Recommendation: #15
It is recommended that a clearly defined chain of command policy be created, and directives for consistency in volunteer staffing/response. Continued analysis of projected community growth is necessary to determine short and long-term needs for appropriate staffing locations

Organizational Structure and Management

The current FCFRD organizational chart shows three distinct divisions: Operations, Life Safety, and Training. While "Administration" can loosely be identified on the org chart as those positions above the Division level, EMS Operations and Volunteer related activities do not appear in the organizational chart. While neither of the absent functional areas appear to rise to the Division level, they are nevertheless significant contributors to organizational success. It is not uncommon for certain functional tasks to be comingled within existing Divisions for ease of administration, as indicated by "Resource Manager" (Logistics), under the Operations Division as much of the logistics function is impacted by operational concerns or issues. In similar fashion, volunteer related functions seem to be aligned with Administration due, in large part, to the need to have access to the Fire Chief. Both the Chief's Working Group and the Fire & Rescue Association interact with the Fire Chief, however they have no official place on the FCFRD organizational chart.

Managing across divisional boundaries requires a concentrated effort to be successful. Horizontal communication is paramount and should include the Chief's Working Group and the Fire & Rescue Association. Administrative communications should be formalized and utilize a defined distribution pathway. The development of specific distribution lists can be helpful to insure the right people get the right messages. Each functional division should develop a vertical pathway to streamline the dissemination of information. Information intended for department wide distribution should not rely on word of mouth communication and should be accomplished through a process defined by organizational policy.

Divisional leadership should be charged with developing recommendations that can be used to incentivize personnel to pursue opportunities within the division. This would include opportunities for divisional advancement based on competencies, experience, and education. Often the best-qualified candidates in a division can be eliminated from consideration for advancement based on prerequisite requirements not available by serving in the division. Continuity of service delivery may be impacted due to divisional leaders having to learn from the ground up regarding their new responsibilities.

Effective control of emergency incidents relies heavily on span of control and a clear chain of command. Standardized operating policies are necessary to allow personnel from various districts to be effective throughout the system regardless of location. Adequate supervision of response

personnel, paid and volunteer, is essential for safe operations. The magnitude of the event is not the sole determinant of the need for supervision. Each station would be well served to have an Officer on duty at all times. This provides for the necessary accountability, adheres to chain of command, and clearly identifies the decision-making authority. Station Officers take command of incidents until relieved by a higher-ranking officer or as defined by organizational policy. Ultimately, each incident should have one Incident Commander. The delineation of this concept should be defined by organizational policy, with input from the various stakeholders, and be implemented across all districts within FCFRD.

With approximately 80% of all emergency activity being EMS related, and a substantial portion of the paid staff involved in these incidents, there seems to be a limited of identity of this function in the current organizational chart. Given the complexities of prehospital emergency care, and the transportation of the sick and injured, the need for specialized training, incident supervision, compliance, equipment standardization, protocols, and medical direction may require a dedicated EMS officer.

The continued success of FCFRD, and the effective planning for future growth in human resources, fixed stations, apparatus acquisition and deployment, operating efficiencies, and the dynamic changes required by an evolving community, is best served by the appointment of a single Fire Chief who has the ultimate authority and is directly responsible for all activities and decisions of the FCFRD. From a historical perspective this has been an outcome for many fire organizations across the country. It is an evolutionary process necessitated by the ever changing, time sensitive, internal and external influences faced by fire departments everywhere, every day. This transition should be a collaborative effort of all the stakeholders and does not signal the demise of the individual company's leadership. The opportunity exists to synthesize volunteer leadership groups into a single advisory committee for providing input to the organizations decision-making process.

The combination of a single Fire Chief, and an engaged advisory committee, will provide advantage to the oversight of funding and the distribution of assets, thus maximizing the return on investment of taxpayer dollars. It would also allow for a general standardization of service levels across the entire county.

Recommendation: #16
It is recommended that FCFRD develop a policy that clearly defines the internal communication process, both horizontally and vertically.

Recommendation: #17
It is recommended the FCFRD take the necessary action to provide an officer at each station on each shift.

Recommendation: #18
It is recommended that promotional policies be revised to permit internal divisional promotion without the encumbrance of rank requirements not achievable within the division.

Recommendation: #19
It is recommended that FCFRD develops, adopts, and publishes a policy that defines emergency operation guidelines that will be implemented on a countywide basis for career and volunteer personnel.

Recommendation: #20
It is recommended that Frederick County revisit the hierarchal makeup of the county fire service to create a single fire chief supported by an advisory committee to be defined by the county.

Recommendation: #21
It is recommended that FCFR appoint a senior officer as the Medical Officer or EMS Officer to oversee the multiple issues regarding the delivery of pre-hospital emergency medical services.

Officer Development

There are numerous programs and standards available to provide officer development. Modern technologies, operating procedures, information management strategies, and many other factors impact today's fire service leaders. Fire officers must be prepared to address multiple challenges on the fire ground, at the station, and in the community. It would be beneficial for the organization to develop base line requirements for the various levels within FCFRD. The available programs address existing officers as well as aspiring new officer candidates. Several of the available resources for officer development are shown below.

The Virginia Fire Officer Academy is an interactive, highly challenging, educational initiative of the Virginia Fire Chiefs Association. The academy provides modern, ethical leadership values while promoting best practices in fire and emergency services health and safety by providing fire and emergency service professionals a comprehensive certificate program designed to provide the key skills and techniques of exemplary leadership necessary to enhance firefighter safety and to advance a culture of leadership through ownership and safety in today's ever-changing fire and emergency services. The Virginia Fire Officer Academy is designed for those fire service professionals who are new to the officer corps and those poised to get there. This academy will help you prepare, improve, or expand your leadership skills and help you gain the professional credentials needed to reach your career goals by providing an opportunity to interact with the finest scholars, public officials, and leading practitioners who have demonstrated an expertise or exceptional achievement in the fire service.

Virginia Department of Fire Programs Incident Management (NIMS). The National Incident Management System (NIMS) has been developed to provide a common system that emergency service agencies can utilize at local, state and federal levels. NIMS consists of five major sub-systems that collectively provide a total systems approach to all risk incident management. There are fourteen such programs with the most commonly used being: ICS-100: Introduction to the Incident Command System, ICS-200: ICS for Single Resources and Initial Action Incidents, ICS-300: Intermediate ICS for Expanding Incidents, ICS-400: Advanced ICS for Command and General Staff, IS-

700: National Incident Management System, An Introduction, IS-800: National Response Framework, An Introduction.

NFPA 1021: Standard for Fire Officer Professional Qualifications identifies the up-to-date Job Performance Requirements (JPRs) necessary for the duties of a fire officer and specifically identifies four levels of progression: Fire Officer Levels I, II, III, and IV.

The National Fire Academy's (NFA) Executive Fire Officer (EFO) Program provides senior fire officers with a broad perspective on various facets of fire and emergency services administration. The courses and accompanying research examine how to exercise leadership when dealing with difficult or unique problems within communities.

EFO Program students enhance their professional development through a series of four graduate and upper-division-baccalaureate equivalent courses taken over a four-year period. Each course is two weeks in length. An Applied Research Project (ARP) that relates to your organization is required within six months after the completion of each of the four courses.

By utilizing the available programs, either whole or in part, it would be possible to develop organizational policy to govern the required course work for both paid and volunteer officers. Implementation of the requirements could include a date specific deadline for each level within the system.

Recommendation: #22
It is recommended that FCFRD develop and adopt a policy that clearly defines the educational requirements for promotional advancement, at all levels, for paid and volunteer personnel.

Wage Analysis and Recommendations

Frederick County is in the Winchester Metropolitan Statistical Area (MSA) made up of Frederick County, VA and Hampshire County, WV. Its 2016 population of 135,238 ranked 297th in the United States. Winchester MSA had a per capita personal income (PCPI) of $43,836. This PCPI ranked 150th in the United States and was 107 percent of the state average. The 2016 PCPI reflected an increase of 2.1 percent from 2015. The 2015-2016 state change was 3.1 percent.

Due to the SMA being narrow in scope, and not representative of surrounding cities and counties, it is necessary to evaluate additional criteria. Understanding the locations of the candidate pool, in conjunction with the distance residents are willing to commute to work, provides a more comprehensive overview of economic factors affecting recruitment and retention. The more common scenario is residents of Frederick County working in counties to the east closer to the DC Metro area. This creates a salary disparity that will be difficult to overcome. Today's workforce is more likely to take the first job offer while continuing to seek a more economically advantageous opportunity. Retention becomes a more complex challenge than initial recruitment.

Attracting new employees goes beyond starting salaries. At the entry level, salaries within 5% of competing employers is not typically a detractor. Ancillary benefits of employment, and their costs, are key factors in leveling the field when recruiting. Potential candidates for employment will look for ways that the perceived lost earning potential can be made up through cost control, personal and professional development, health and safety initiatives, and additional earning capabilities. Separation usually occurs at the low end of the seniority scale. Employees that have several years invested, or who have achieved promotions are less like to leave

It is important to acknowledge that the current staffing levels may be a disincentive to some potential applicants. As FCFRD continues to grow it would be helpful to have the organizations short and long-term goals as part of the employment package. Additionally, it has been recently reported that vacancies can cost as much as 60% of the annual salary in overtime cost and training time for replacements. When factored in to the overall budget considerations this cost may eliminate any savings realized by lower salaries

Recommendation: #23
It is recommended, as a mid-range solution and to incentivize new employees to stay, that the FCFRD implement a policy requiring new employees to reimburse the organization for the certification training cost if the employee leaves within a specific period of time.

Recommendation: #24
It is recommended that Frederick County conduct a study analyzing the FCFRD classification and compensation system to determine internal and external equity. This will provide the baseline for future salary considerations in response to the findings and provide the data needed to implement a phased reconciliation of identified salary discrepancies.

Capital Improvement Programs

The FREDERICK COUNTY CAPITAL IMPROVEMENTS PLAN FY 2017-2022[1] currently lists four CIP projects associated with the Fire & Rescue department. Over the five-year plan total project cost exceeds $19M. In addition, the plan identifies anticipated additional spending of $19.75M on one of the projects beyond the current five-year schedule.

Also included in the current five-year plan is the development of revolving fund for Fire & Rescue Companies capital requests. This new project consists of accumulating the amount of $1M over the five-year plan for the benefit of Fire and Rescue Services. It is the intention of this capital expenditure fund to be for purchasing additional and replacement capital equipment and fire and rescue vehicles and equipment. Individual Fire and Rescue Companies requests have been added to the CIP. The individual Fire and Rescue Companies have identified their own capital requests, which have been recognized in the CIP by way of a total project category that exceeds $13M. The individual projects are not prioritized and are not identified in the CIP. Based on county Finance Committee requirements these capital projects are assumed to meet the $100,000 guidelines.

In accordance with the 2017-2022 CIP it is noteworthy that the listed projects are considered advisory only. The identified required funding has not been allocated or encumbered, and it is possible projects may not be funded during the year indicated.

Observationally, the total identified capital in the areas of Fire & Rescue, and Fire & Rescue Companies exceeds $20M across the current five-year CIP. These Funds are also listed as 100% county contributions. Based on the published document, and the justifications contained therein, it is difficult to determine to what extent all capital requests were viewed in their totality to use current CAD and GIS data to prioritize need, develop time lines, and determine return on investment. Without a detailed list of the projects contained in the $13M Fire and Rescue Companies Capital Requests it is difficult to analyze how this funding may overlap with the $1M Revolving Fund, or the extent to which the projects are necessary versus discretionary. Additionally, it is not clear whether any of the Companies' requests include apparatus.

Some of the factors that impact the development of a comprehensive Fire & Rescue CIP are outlined in other areas of this report. Exacerbating the process is the lack of a detailed vehicle/apparatus replacement schedule and the absence of a means to approve, or disapprove, the replacement of apparatus or the acquisition of additional pieces of equipment or apparatus. While the Fire Companies continue to experience difficulty maintaining their respective fleets, requiring them to seek economic assistance from the county, it is incongruent for them to have total autonomy in purchasing.[1] http://www.fcva.us/home/showdocument?id=13882

Recommendation: #25
It is recommended that FCFRD, working with the Fire Companies, establish a long-term vehicle replacement plan, inclusive of annual funding contributions to a fund specifically designated for this purpose. This plan would also include a determination of the necessary types and numbers of various pieces of apparatus. A result of this process would provide a list of which existing units would be replaced. Projecting the remaining life of a piece of apparatus, and its replacement cost, will allow for the calculation of the annual amortized cost to be deposited to insure funds exist when needed. Applying the calculation across the identified required fleet provides for long term planning and annual budgeting. This plan would eliminate the continuation of accrued debt to purchase apparatus and expedite the replacement process when needed.

Recommendation: #26
It is recommended that FCFRD, working with the Fire Companies, develop a list of capital improvements to fixed facilities that is prioritized and has a timeline for projected completion. This list should be evaluated on need, longevity, and contribution to the overall system performance and service delivery.

Health and Safety Programs/Risk Management (loss control)

Health and Safety - NFPA 1500 Standard on Fire Department Occupational Safety, Health, and Wellness Program specifies the minimum requirements for an occupational safety and health program for fire departments or organizations that provide rescue, fire suppression, emergency medical services, hazardous materials mitigation, special operations, and other emergency services. This standard requires the appointment of a department Health and Safety Officer who meets the

qualifications defined in NFPA 1521 Standard for Fire Department Safety Officer Professional. NFPA 1500 also allows the Authority Having Jurisdiction to establish a phase-in schedule for compliance with specific requirements of the standard.

NFPA 1582 *Standard on Comprehensive Occupational Medical Program for Fire Departments* outlines an occupational medical program that will reduce risks and provide for the health, safety, and effectiveness of fire fighters operating to protect civilian life and property.

NFPA 1583 Standard on Health-Related Fitness Programs for Fire Department Members outlines a complete health-related fitness program (HRFP) for members of fire departments involved in emergency operations to enhance their ability to perform occupational activities and reduce the risk of injury, disease, and premature death. This document is intended to help fire departments develop a health-related fitness program for department members that requires mandatory participation but is not punitive. The document is not intended to establish physical performance criteria.

Risk Management – NFPA 1500 4.2 requires a Fire Department to develop and adopt a comprehensive written risk management plan. The risk management plan shall at least cover the risks associated with the following: (1) Administration (2) Facilities (3) Training (4) Vehicle operations both emergency and non-emergency (5) Protective clothing and equipment (6) Operations at emergency incidents (7) Operations at non-emergency incidents (8) Products of combustion, carcinogens, fire-ground contaminants, and other incident-related health hazards (9) Other related activities.

The risk management plan shall include at least the following components: (1) Risk identification – actual and potential hazards (2) Risk evaluation – likelihood of occurrence of a given hazard and severity of its occurrence (3) Establishment of priorities for action – the degree of a hazard based upon the frequency and risk of occurrence (4) Risk control techniques – solutions for elimination or mitigation of potential hazards; implementation of best solution (5) Risk management monitoring – evaluation of effectiveness of risk control techniques.

NFPA 1250 Recommended Practice in Fire and Emergency Service Organization Risk Management establishes criteria to develop, implement, or evaluate a fire and emergency service organization (FESO) risk management program for effective risk identification, control, and financing to minimize the impact of detrimental events on individuals, the emergency services, and the jurisdiction.

Recommendation: #27
It is recommended that the FCFRD develop a written policy statement that clearly reflects its commitment to risk management through the development, implementation, and administration of a risk management program. The program should also delineate the lines of responsibility and liability between FCFRD personnel and the fire companies with respect to apparatus and fixed facilities.

Recommendation: #28
It is recommended that FCFRD conduct comprehensive fire and life safety inspections of all county fire stations as part of the risk management program.

Alternative/Supplemental Funding Sources

Service expectations placed on EMS and fire services organizations, including the fire service's role in EMS delivery, response to natural disasters, hazardous materials incidents, technical rescue, and acts of terrorism, have steadily increased. Striking the right balance between various sources of local revenue has become an essential skill for EMS and fire administrators and chief officers. So, too, has the ability to identify and acquire grants and other alternative revenues. EMS agencies and fire departments require funding for expenses such as equipment, training, and salaries to provide necessary protection to their respective communities. However, with tighter budgets, less government subsidies, and fewer donations, it is becoming increasingly more difficult for EMS agencies and fire departments to meet greater and more complex demands for its services.

The most common source of funding for local governments is taxes. These include property taxes, sales tax, excise tax, income tax, and an assortment of regulatory and user fees. Which types of taxes available to local governments is determined by each State Constitution. Senior executives in emergency services must familiarize themselves with how their jurisdiction is funded and understand the political and legal limitations of taxes as a source of local revenue. Below are some examples of funding sources.

Local Property (Ad Valorem) Tax - An ad valorem tax (Latin for according to value) is a tax based on the value of real estate or personal property. It is perhaps the most common source of funding for municipal and county services. A property tax is typically levied at a set rate per dollar of assessed value. There are two forms of property tax: primary and secondary. The primary component of a property tax is used to fund general operating expenses, while the secondary component is used to fund special obligations, such as the repayment of bonds and budget overrides.

Fire Flow Tax - The fire flow tax is a type of property tax that is assessed to properties based on a computed fire flow requirement, typically using an Insurance Services Office (ISO) formula for fire flow. The tax can be used to cover the cost of fire protection and other emergency service functions. The fire flow tax amount is determined by calculating the risk factor of a property based on a specific formula.

Sales Taxes - Next to property tax, sales taxes are the most important revenue sources for local governments. A sales tax generates revenues by imposing a tax on retail and other sales activities. These taxes go into a community's general revenues that support a myriad of services including fire protection and EMS.

Income Tax - An income tax is typically assessed on the wages and earnings of individuals but may also be applied to the net income of unincorporated small businesses. Forty-Three States levy some level of income tax. In a few States, local governments can also levy an income tax. One of the strengths of a personal income tax is the capacity to reach nonresidents who commute to jobs in the county. These commuters use county services but do not contribute their fair share for the cost of providing these services through property or sales taxes.

Real Estate Transfer Tax - Real estate transfer taxes are special-purpose taxes assessed on the sale of property. Usually, they are a percentage of the selling price of the real estate. Real estate transfer taxes have sometimes been levied to provide an additional source of revenue for public safety and public works projects. Proceeds from such taxes are pooled with other general-fund revenues but can be earmarked for specific purposes.

Utility-User Tax - A utility tax is a charge on the use of public utilities such as telephone, cell phone, cable television, gas and electric services, municipal water, wastewater, and garbage collection. The utility tax applies to both businesses and homeowners. Taxes are collected by the utility as part of its regular billing procedure and then remitted to the county . A utility-user tax may be imposed as a special tax, earmarked for a specific purpose, or a general tax to be used for a variety of municipal needs.

Development Impact Fees - An impact fee is a direct charge levied by local governments against developers to help offset the cost of new growth. Impact fees most often take the form of a one-time permit charge assessed at the time of plat approval or an application for a building permit. These fees provide a county funding for capital projects. Counties may only impose fees on developments that will benefit from the infrastructure improvements. The fees cannot be used to fund operational expenses. Therefore, impact fees cannot be used for maintenance or to eliminate deficiencies in older neighborhoods.

Emergency-Response Service Fees - Fire and EMS agencies have experimented with charging fees to insurance companies to raise revenue to support services. Typically, automobile insurance policies provide coverage for medical expenses and ambulance transportation, but not for fire- or police-response services. These fees try to recoup the cost of providing non-compensated prehospital medical treatment and rescue activities.

Inspection Fees - Inspection fees have long been used by fire departments to provide funding for fire prevention. Fee schedules vary among jurisdictions. Inspection fees may be based upon the type of inspection conducted (initial or re-inspection), the occupancy (educational, industrial, residential, etc.), and the size of the building. Many departments charge a flat fee for initial inspections with additional fees for each subsequent re-inspection. Additional fees may be charged when special hazards are present, such as hazardous materials storage areas.

Plan Review and Permitting - Many fire departments review building plans for fire code compliance and inspect the installation of fire protection systems during construction. The fire department often receives part of the permit fees paid to the jurisdiction for these services. Fees are also charged for occupancy permits, special hazards permit, reviewing plans for building renovations, and reviewing new fire protection systems in existing buildings. Fees are also often charged for inspecting daycare centers, hotels, hospitals, nursing homes, spray-painting businesses, and other specific occupancies that require special permits to operate. Departments may also charge a fee for special event permits such as public events, the use of fireworks, large tent events (circuses, beer tents, etc.), as well as other special purposes such as open burning or movie production sets.

Hazardous Materials Fees - Maintaining the capability to respond effectively to hazardous materials incidents adds significant costs for local jurisdictions. Hazardous materials response requires hundreds of hours of training and continuing education, specialized equipment, and technical expertise to conduct inspections. Hazardous materials occupancies do not have to be large or unusual to pose a challenge, such as a microchip manufacturing plant, the local pool store and exterminator business can pose significant problems for first responders. Seemingly minor incidents involving hazardous materials can keep fire companies occupied for long periods of time and present dangers to the public, responders, and the environment. To offset the expense of providing hazardous materials response capabilities, some fire departments have adopted a hazardous materials storage and inspection fee. Revenue from this fee helps ensure steady income for training fire inspectors and covering the cost of specialized inspection services. Many fire departments also charge for hazardous materials team response, both to offset the cost of the response and to incentivize proper maintenance of hazardous materials facilities. The fee also helps replace equipment used to mitigate a spill or release. Federal law requires the owner or transporter of released hazardous materials to pay cleanup costs, including fire department and EMS costs, which helps to justify these fees.

Special Service (Standby and Fire Watch) Fees - Fees for "special" services attempt to recover or offset the costs from the users of the service. These fees may be charged for services such as EMS standby at a football game or fire watch at a concert venue. The users often pay less than they would if they contracted with a for-profit provider for the service and often receive intangible benefits such as communications links that can quickly get additional resources to an event if an emergency develops.

Fines for Nuisance Alarms - Most new commercial buildings and an increasing number of residences have fire detection systems that can trigger unwanted fire alarms requiring the response of the fire department. Each false alarm creates some danger for the public and firefighters. In 2009, fire departments responded to 16 false alarms for every 10 fires, and 45 false alarms for every 10 structure fires. From 2000 to 2009, 24 firefighters died responding to unwanted fire alarms, including malicious false alarms and alarm malfunctions. Increasingly, cities and counties are adopting nuisance and unwanted alarm ordinances that include fines to encourage better maintenance of

systems, place greater responsibility on the system owner for unnecessary or inappropriate actions triggering alarms, and recover some of the costs of responding to these types of alarms.

Seized Assets - Another source of funds, equipment, and vehicles accessed by a growing number of public safety agencies are the assets seized during drug raids. Where the fire and EMS agency can demonstrate that illegal drug activity has increased the demand for services, such as through EMS records of illegal drug overdoses, or that first responders have participated in drug-related incidents (such as hazardous materials team response to drug labs, Special Weapons and Tactics (SWAT) paramedics in support of drug raids, and treating victims of raids), they may be able to share in money and equipment seized by law enforcement in drug-related arrests and raids. They money may have to be used for the purchase of special equipment for assistance in drug-related incidents, but can include vehicles, ambulances, communications equipment, computers, and other resources. The equipment does not have to be used solely for drug-related incidents so long as it is available for such incidents.

Traditional Loans - Many fire/EMS agencies, particularly independent volunteer organizations, use traditional forms of borrowing money through banks and lending institutions. These loans are also used for capital improvements such as construction of stations, refurbishing existing stations, and vehicle and equipment purchases. Fire/EMS agencies should exercise due diligence in "shopping" for a loan, searching for the best interest rate and loan terms. Some banks and lending institutions will provide lower-interest loans or different loan options for volunteer, service-oriented organizations, particularly if the lending institution is based in the community being served.

Recommendation: #29
It is recommended that the FCFRD Department work collaboratively with county administration, county legal, and the budget and finance departments to strategize if any of the alternatives, or combination of alternatives, may be appropriate. Systemically those revenue streams that are derived from the direct delivery of services have proven successful.

Compliance with Laws, Regulations, and Standards

While inspections were not conducted by *Fitch,* site visits during the development of this report did not reveal glaring widespread noncompliance. There were isolated issues noticed that may be more systemic upon closer analysis. The innumerable laws, regulations, codes, and standards are difficult to observe on a casual basis. Some observations noted were fire and life safety code issues, diesel exhaust encroaching into living space, stored personal protective gear exposed to exhaust particulate, and lock out tag out. Records for rope, hose, SCBA, training and medical equipment, for example, would require a concentrated effort to evaluate. Assurance of compliance requires constant review and oversight and is everyone's responsibility. Ultimately there should be a single point of contact within the organization for anyone with questions

Recommendation: #30
It is recommended that the FCFRD develop and adopt a comprehensive written policy related to compliance

responsibility, employee reporting process, and line of authority for problem resolution.

Recommendation: #31
It is recommended that the FCFRD appoint a senior fire officer as the organization's compliance officer for centralizing documents, reports, and organizational oversight.

Strategies for Recruitment, Retention, and Training of career personnel and Volunteers

Many of the issues effecting paid personnel are addressed elsewhere in this report. Volunteers however are a different dynamic and must be recognized as having a separate set of values. Much research has been done on this issue.

Although the recruitment and retention challenges continue to grow, some volunteer organizations maintain good membership while others continue to function with reduced numbers. Those organizations that seek solutions and adapt to our changing personnel environment are successful. Individuals are still willing to give their time to volunteer emergency services organizations provided the following:

- The experience is rewarding and worth their time.
- The training requirements are not excessive.
- The time demands are adaptable and manageable.
- They are rewarded with a personal sense of value.
- There is good leadership minimizing conflict.
- There is ample support for the organization.

The emergency services are the most demanding of volunteer activities today. The physical and time demands associated with training; responding to incidents; maintaining facilities, apparatus, and equipment; fundraising; and administering a nonprofit corporation are grueling if not managed properly. In today's hectic world, strong leadership is required to make the emergency services the organizations that will attract and retain volunteers. As indicated by earlier research, there is no single reason for the decline in volunteers in most departments. However, there is a universal consensus that skilled department leadership is a key to resolving the problems. Retention and recruitment problems usually can be traced to several underlying factors: more demands on people's time in a hectic modern society; more stringent training requirements; population shifts from smaller towns to urban centers; changes in the nature of small town industry and farming; internal leadership problems; and a decline in the sense of civic responsibility, among other factors. Although some regions are more affected than others, and the problems and solutions vary across regions, even within States and counties, volunteer retention and recruitment is a problem nationwide. ***Specifically, it is a local issue and must be dealt with locally.***

Can the trend in declining volunteerism be reversed? Information collected reveals that departments that have taken steps to deal with the problems have seen a resurgence in volunteerism. This

indicates that many of the problems can be mitigated or eliminated if proper attention and resources are given to them. This text will attempt to identify and share the ideas and practices that are successful in recruitment and retention. Departments that have failed to address the problems and challenges of volunteering in today's world have been forced to hire career firefighters, consolidate, or even close their doors.

Several factors underlie today's retention and recruitment problem in the volunteer fire service. It is a complex and multifaceted problem. Although stringent training standards, leadership problems, and time constraints caused by increased family responsibilities--particularly in two-career families and single-parent households--seem to be the most common causes, there are many other factors contributing to the turnover that volunteer departments are currently facing. The problems most frequently cited by the Bureau of Labor Statistics for are:

Lack of time 44.7%
Health/Medical problems 14.7%
Family responsibilities ..... 9 .5%
Other 8.2%
No longer required/relevant..... 5.8%
Wasn't interested..... 4.3%
Moved, transportation, expenses..... 4.2%
No one asked..... 3.2%
Burnout..... 2.4%
No longer member of organization..... 1.7%

The following data are from the St. Joseph's University Study in 2004
What makes your members leave your organization? *

No time to volunteer..... 93.3%
Conflicts in organization..... 47.8%
Organizational leadership created adverse atmosphere..... 46.7%
Too much training..... 45.6%
Attitude of existing personnel to newcomers..... 39.1%
Criticism received from officers/older members..... 38.0%
Lack of camaraderie..... 9.5%
* Many respondents indicated more than one reason for leaving the organization
https://www.usfa.fema.gov/downloads/pdf/publications/fa-310.pdf

The causes of the problems are similar in all 50 States. No single region of the country is dealing with problems that are significantly different than those found in other regions. There are some differences, however, in problems faced by urban versus rural communities. These differences stem from the sociological differences in the urban versus rural communities.

Increased training requirements have had a major effect on retention and recruitment. On-the-job training is no longer permitted as a substitute for formal training and certification. The time when a volunteer can start to go on calls and do other "exciting" duties is delayed, and their initial enthusiasm may be lost. Also, some volunteers are not good at taking written tests and may quit rather than face one, fail, and have to leave. Formal training, however, has made both the volunteer and career fire service more professional and effective. Increased training requirements have been particularly traumatic for older members who have no certifications and are no longer allowed to run certain calls. Some who once volunteered to simply join in and pull hose or drive the apparatus are no longer allowed to do so.

During the same time in which the number of volunteers has declined, the volunteer fire service has had to contend with an increase in the volume of emergency calls due to the lack of education on when to call 9-1-1. The NFPA reports that fire department call volumes increase at varying rates depending on the community. This means that volunteer fire departments have to do more with fewer people, and that the overall demands on individual volunteers have increased.

Increasing Emergency Medical Call Volume --Emergency medical calls have created the greatest increase in call volumes for fire departments. Years ago, most fire departments did not respond to EMS calls. Currently, more departments are becoming involved with providing medical service. This may only be at a first responder level; but regardless of the level, increases the response load considerably.

Increase in the Number of Automatic Alarms --As previously noted, the volume of automatic alarms has grown steadily, particularly in areas with commercial buildings that often have alarm systems. Fire departments have also experienced a sharp increase in call volume due to alarm system malfunctions. Many volunteers are growing tired of the time demands associated with responding to these malfunction false alarms. Some departments enact polices that, after a set number of malfunctions in each time period, the occupants are charged the response costs and/or fined to reduce the unnecessary use of volunteer resources. In addition, medical alert alarms are adding to unnecessary emergency responses.

Less Emphasis on Social Aspects of Volunteering--The loss of the social aspects associated with volunteering has hurt recruitment and retention. Many volunteers join fire departments and stay involved not only to serve their community and help others in need, but also to develop social relationships. Some volunteers report that the time demands of volunteering coupled with the time constraints of everyday life have left no time to develop social ties or spend time outside of the station with other firefighters. Likewise, many fire departments have closed their firehouse clubs and poolrooms that historically have been social centers for many volunteers. **M**any retention and recruitment problems can be traced back directly or indirectly to leadership problems. Effective leadership helps retain members as well as reduce dissatisfaction. Ineffective leadership is the most common reason for a decline in membership. **I**nternal conflicts and other stresses drive members out

of fire departments. The two greatest problems with internal conflict in the volunteer fire service originate among leaders or between volunteer and career members in combination departments.

The erosion of the volunteer fire service in the United States has economic and social effects. The economic ramifications are obvious, as towns are forced to hire career firefighters in place of volunteers. The 75 percent of the country served by volunteer firefighters relies on them to be the first line of defense in almost any type of emergency from fires and medical emergencies to technical rescues and hazardous materials spills. Volunteers are the initial mitigators before the arrival of county, State, or Federal backup emergency response teams for all types of natural disasters. Of the over 30,000 fire departments in the United States, 88 percent are volunteer, protecting 40 percent of the population.

Fire Chiefs Jack Snook and Dan Olsen are national experts on retention of volunteer firefighters. In their book, *Recruiting, Training, and Maintaining Volunteer Firefighters*, they identify four characteristics of a volunteer department that are essential to retaining members:

- The program must meet individual needs.
- The program must provide its membership with reward and recognition.
- The program must provide adequate supervision and leadership.
- The program must challenge members.

The research by St. Joseph's University confirmed these as core elements to recruitment and retention coupled with the issue that all recruitment and retention is local. Additionally, the needs, leadership, and challenges are all local.

"Volunteer Viewpoint"

If you want my loyalty, interests, and best efforts, remember that:

1. I need a sense of belonging, a feeling that I am honestly needed for my total self, not just for my hands, nor because I take orders well.

2. I need to have a sense of sharing in planning our objectives. My need will be satisfied only when I feel that my ideas have had a fair hearing.

3. I need to feel that the goals and objectives of the organization are within reach and that they make sense to me.

4. I need to feel that what I'm doing has a real purpose that contributes to human welfare--that its value extends beyond my personal gain, or hours.

5. I need to share in making the rules by which, together, we shall live and work toward our goals.

6. I need to know with some clear detail just what is expected of me--not only my detailed task but where I have opportunity to make personal and final decisions.

7. I need to have some responsibilities that challenge, that are within range of my abilities and interest, that contribute toward reaching my assigned goal, and that cover all goals.

8. I need to see that progress is being made toward the goals we have set.

9. I need to be kept informed. What I'm not up on, I may be down on. (Keeping me informed is one way to give me status as an individual.)

10. I need to have confidence in my superiors--confidence based upon assurance of consistent fair treatment, or recognition when it is due, and trust that loyalty will bring increased security.

The Effective Management of Volunteer Programs. J. Donald Philips, Hillsdale College, Hillsdale, Michigan.

As volunteers quit or are unable to respond in the daytime, more and more communities are forced to hire career firefighters. This may further diminish volunteers' interest and cause more to drop out, or it may lighten the volunteers' workload, thereby increasing their willingness to volunteer. Much depends on how the concept is sold to the department and how both the career and volunteers are managed. The greatest factor influencing the success of a combination department is good leadership that encourages the career and volunteer members to work together as a team recognizing the need for and importance of each other.

When career members are hired, fire departments must establish the roles and responsibilities of career and volunteer members in a clear, written format. These should include responsibilities with station duties and emergency calls. In the long run, written, defined roles will help to avoid conflict over who is supposed to do what.

Some departments that have hired career members have found that volunteers quit because they feel like they are being replaced and no longer have a purpose in the organization. To avoid this feeling, departments can give volunteers their own special role such as technical rescue response, staffing the second engine, staffing a ladder truck (if career personnel staff only an engine), or other fire ground support duties.

INCENTIVES

Incentive programs are used throughout the volunteer fire service as a retention tool. They are necessary to help recruit and retain volunteers. Localities benefit financially from having experienced volunteers who are willing to stay active for years. Due to the demanding and risky nature of firefighting, many departments find that members consider leaving the service after only 5 to 10

years. Long-term (10 to 20 years) retention of members is important to ensure that there is a solid base of experienced members.

There are many ways to set up an incentive system in a fire department. The most successful incentive programs today are diverse and appeal to volunteers of all ages, experience, and ranks. Any of the incentives listed previously could be offered, but fire departments should not limit themselves to one type of incentive program for all volunteers because one program may not appeal to all members. Instead, they should offer a menu of several different programs from which volunteers could select to receive. Certain incentives are more appealing to individual volunteers--such as older volunteers--than others. Since membership in the volunteer fire service has become more diverse, fire departments must strive to find the right types of recognition and incentives that appeal to all or a majority of the members. However, it must be remembered that these incentives can vary extensively for the different age groups within the department.

The incentive system must be equitable. In other words, each item on the menu should provide similar benefits so that volunteers who choose different items receive similar benefits. Volunteers should be allowed to choose the incentive (or combination of incentives) they want to receive on an annual basis.

Civic leaders are sometimes hesitant to provide financial incentives to volunteers. However, the benefits of retaining members by providing small financial incentives far outweigh the costs of excessive turnover or hiring full-time firefighters.

While monetary benefits are becoming a higher priority in what attracts personnel to the volunteer fire department, this should not be the primary purpose for joining. The time demands are very high, making the hourly return very low. Those who join strictly for the material benefits will soon become disheartened and leave. They need to be mentored and learn the concept that the real goal of volunteering is the desire to help others who are in need. Financial awards, besides their obvious reward, have the psychological aspect of helping volunteers rationalize to themselves and their families that they are getting some tangible benefit from the extra hours.

Types of Direct Financial Incentives

- retirement/pension or length-of-service award programs (LOSAP);
- individual retirement accounts;
- pay per call or per hour, or though “monthly pots”;
- annual reimbursements;
- tax exemptions and tax deductions;
- health insurance (for volunteers and their families) including dental and vision;
- tuition assistance;
- housing assistance;
- low-interest housing loans;
- in-season bonuses;

- scholarships;
- emergency funds (loans); and
- death benefits

Other Incentives

There are many incentives that have little or no cost but can be highly motivational nonetheless. These go a long way because they acknowledge dedication and hard work while allowing all members an equal opportunity to achieve them.

- Select a member of the year or month, for both operational and administrative positions.
- Ask local merchants for discounts or gift certificates for volunteers at local businesses.
- Recognize volunteers who complete training courses with certificates, plaques, or by featuring them in the local newspaper.
- Award outstanding volunteers with subscriptions to fire or EMS magazines.
- Cover the reasonable expenses associated with sending a volunteer to a special out-of-town training class.
- Award outstanding members with all-expense paid trips to State Firefighter Association meetings or training conferences.
- Award a top responder with a family get-away trip to a local hotel or resort.
- Occasionally excuse members who have given certain numbers of years of service from work details or mandatory duty nights.
- Excuse the "member of the month" from housework.
- Exempt volunteers from local utility bills (water, trash, etc.).
- Issue officers fire department vehicles that they can take home.
- Give the top responder of the department a reserved parking spot.
- Give flowers to spouses on special occasions.
- Permit members to use the station washer and dryer for personal use.
- Provide an area and tools for car maintenance at the station.
- Provide free videos, cable television, and movie channels at the station.
- Create departmental trading cards with pictures of the volunteers (good for the kids).
- Provide physical fitness facilities at the station.
- Provide free meals to members on duty or at training.
- Give volunteers passes to local sporting events. (Local sporting teams often will donate to the department to give away.)

Qualifying for benefits and incentives

Fire departments must establish a base level of performance that a volunteer must meet to qualify for a particular level of awards. Many departments measure this by creating a point system for participating in activities. Volunteers accrue points by running calls, attending training, attending meetings, and providing administrative or support service. Members who attain a sufficient number

of points in a year qualify for either a basic, mid-, or high-level award. They then are eligible to receive the incentive benefits they choose.

The awards should be given only to members who meet all of the departmental requirements, in addition to meeting point requirements. In other words, members should be required to maintain a certain level of training, attend a certain number of meetings, perform a certain amount of administrative work, or a certain amount of prevention duties to remain qualified for incentives. The incentive system can be structured so that all members are eligible to receive benefits (active firefighters and EMTs, administrative members, public educators), or that only certain members receive them (firefighters, or only those participating on duty crews).

The system allows members, both operational and administrative, to earn points through a wide range of activities. Certain categories have restrictions about the number of points that can be earned. Others have no maximums so that volunteers are encouraged to spend more time in these activities. It is recommended that the points for the Public Education and Administrative Duties categories be increased to encourage participation. Volunteers who earn points above the minimum requirements for a basic-level award can qualify for higher-level awards. A department may require volunteers to earn a certain minimum number of points in an area to qualify for any award (e.g., a volunteer must accrue at least 4 points in meetings, 8 points in training, 1 point in public education).

Recommendation: #32
It is recommended that FCFRD create a standing committee, comprised of representation from FCFRD and the fire companies, to review, research, and develop a comprehensive system wide recruitment and retention policy that not only provides incentives but also addresses the fundamental characteristics required for success.

Recommendation: #33
It is recommended that FCFRD conduct a personnel file review of former employees and volunteers to evaluate the time frame in which most personnel leave the organization.

Recommendation: #34
It is recommended that FCFRD create, conduct, and document, formal exit interviews to allow the standing committee to have updated data reflecting the causes of separation.

Future Vision and Goals and Objectives for Future Growth

Developing a System of Standards to Guide Performance Management

The Frederick County Fire and Rescue system utilizes a variety of staffing and performance levels to bring the "system" together to respond to requests for service. There is evidence that the current FCFR leadership has lead with inclusion and transparency and the collective system is collegial while working together to provide services. However, performance and capabilities vary across the county due to the segmented approach to service delivery. Specifically, the performance varies anytime the first due (career) staff are unavailable or require a multi-unit response within the first due territory as the volunteer performance may vary by time of day and organizational requirements. It is both reasonable and a best practice to recognize that differentiate deployment plans may exist between rural areas and urban or suburban areas.

Therefore, a system of measures and thresholds that serve as triggers are offered to assist the Department and system in maintaining a commensurate manner in or to respond and mitigate like risks. In addition, these measures should establish baseline service levels to be provided irrespective of service or employment status. In other words, baseline service objectives should be established to provide a highly credible and reliable service to the citizens of Frederick County that utilizes performance as the measure rather than whether the personnel are career or volunteer.

The following table summarizes initial recommendations to the County. However, FCFR should review and modify as necessary to best meet their needs. When referring to the table below, it is intended to be read as the desired performance is either less than or greater than what is stated. When the reciprocal is true on any of the individual measures, it would be important for FCFR to review other like measures to determine if action must be taken. Two examples are provided to compare and contrast. First, if the "unit hour utilization" is exceeding the threshold of 0.25 on a 24-hour staffed unit then action must be taken based on only the individual factor. However, the immediacy of the change may have some flexibility if other performance measures such as response time and concurrency are within limits. Similarly, if the "reliability begins to fall below the threshold, but the response time and workload is still acceptable, then a longer reaction time may be acceptable.

Figure 93: Summary of Recommended Baseline Service Objectives

Type of Measure	Performance Metric	Career	Volunteer[49]	Review Period
Station/Unit Performance	Dispatch	≤2 Min at 90%	≤2 Min at 90%	Quarterly
	Turnout Time	≤1.5 Min at 90%	≤6 Min at 90%	Quarterly
	Travel Time	≤6 Min at 90%	≤15 Min at 90%	Quarterly
	Minimum Engine Staffing	≥2 Firefighters	≥2 Firefighters	Daily
	Minimum Ambulance Staffing	≥1 FF/PM ≥1 FF/EMT	≥1 PM and ≥1 EMT *If cross staffed must be FF Certified	Daily
	Percentage of Calls with "no response"	≤1%	≤9.9%	Quarterly
System Design and Performance	Station Service Area Risk Rating Changing	Increases in Risk to Moderate or High	Increases in Risk to Moderate or High	Annually
	Reliability	≥90%	≥90%	Quarterly
	Call Concurrency	≤15%	≤15%	Quarterly
	Call Volume	3,000 – Initial 500 – Ongoing	1,800 – Initial 300 - Ongoing	Annually
	Unit Hour Utilization	≤0.25 on 24-hour units ≤0.50 on 12-hour units	≤0.25 on 24-hour units ≤0.50 on 12-hour units	Quarterly
	Cross-Staffing	<1,800 annual calls and <15% Call Concurrency	<1,800 annual calls and <15% Call Concurrency	Annually

Recommendation: #35

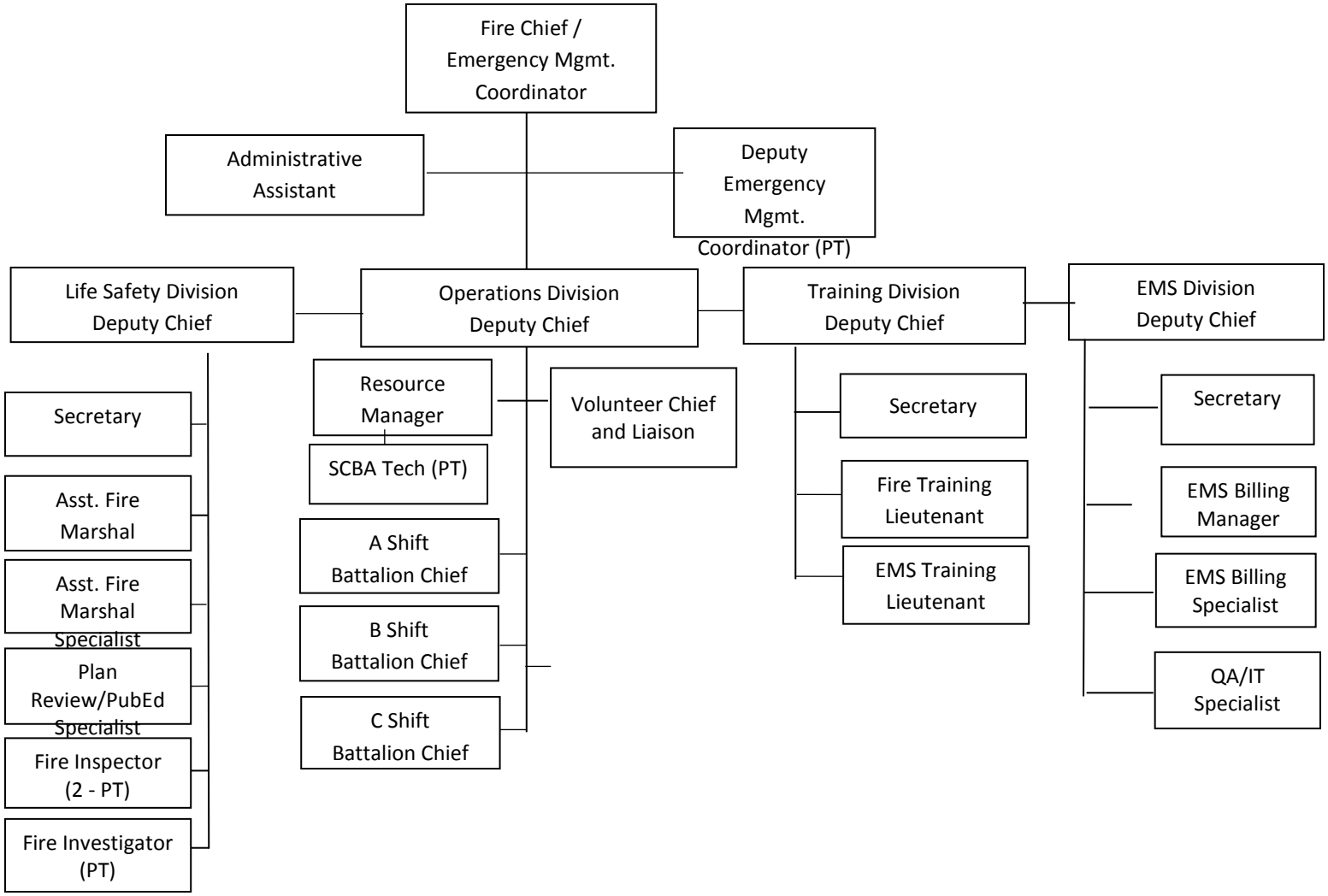
It is recommended that FCFRD implement a Compliance Team to systematically review the performance of the organization and make recommendations regarding needed or necessary improvements.

Recommendation: #36

It is recommended that FCFRD revise the existing Organizational Chart to include the functional areas of EMS and Volunteers.

[49] If Rural Stations are staffed 24-7 career personnel the Turnout Time should be equal to the career performance.

PROPOSED FREDERICK COUNTY FIRE AND RESCUE ORGANIZATIONAL CHART



DEFINITION OF TERMS

1. Standards of Cover – is a risk-based assessment to measure and establish standards of response activity to include response times, staffing, and risk mitigation strategies. This is a tenant document to be considered for accreditation by the Commission on Fire Accreditation International (CFAI) and is considered a best practice for ensuring resource decisions are transparent and uniformly evaluated and articulated.
2. Total Response Time – is the time from when 911 was called and the time of the first arriving unit on scene.
3. Travel Time – is the time from when the units are enroute the call and the time of the first arriving unit onscene. In other words, driving time.
4. Turnout Time – is defined as the time from when the crews/stations are notified of an incident and the time it takes to assemble and begin driving to the call.
5. Risk – has many meanings in different contexts. For example, consider "risk management" the context or area of consideration can have considerable variability. This study utilizes both prospective and retrospective risk defined as follows:
    a. Prospective Risk – is defined for these purposes as the inherent or potential risk associated with commercial occupancies.
    b. Retrospective Risk – is defined as the historical evidence of call demand/volume associated with community risks.
6. Occupancy Level Data – is the risk based data available to measure occupancies as defined as prospective risk. Occupancy level data is at the individual building level rather than more regional geographic data such as station response area or station service areas.
7. Risk-based – is defined as a systematic measure of both prospective and retrospective risk to guide decisions for response time, resource allocation, station placement, and staffing considerations. A risk-based approach is a preferred best practice as opposed to less structure or objective processes.
8. Station Service Area – is defined as the assigned or responsible response area for each station. This is the unit of measure for response time, call volumes, reliability, call concurrency, and prospective risks for planning and performance measurement. This term is synonymous with the following terms:
    a. First due station area
    b. Response area
    c. Fire Demand Zone (FDZ)
9. Community Service Demands – are defined as the requests for service received from the community. In other words, the fire/ems services generally do not generate their own work. The requests for service are driven by the community needs.
10. Probability and Consequence Matrix – is a two-dimensional matrix designed to assist in identify how to best determine resource and staffing configurations in order to appropriately mitigate categorized risks.
11. Critical Tasks – are defined as the critical and necessary tasks that must be accomplished to successfully mitigate the different kinds of calls that occur and at the varying risk levels. For example, the department may require considerable more tasks to put out a structure fire then is needed for a trash can fire.
12. Concentric Station Areas – is defined as stations that are surrounded by other stations that can respond into their districts or station demand zones. This typically occurs for central stations, but stations that are near the borders of communities may only be able to receive

aid from one direction causing a longer duration response time when additional assistance is needed.

13. Reliability – is defined as the rate at which a call in a particular station's area is able to be responded to by a unit assigned to that station area. In other words, when a call comes in Station 11's area, was a unit assigned to Station 11 able to respond to the call.
14. Overlapping Calls – is defined as the rate of simultaneous or concurrent calls that occur in each station area. In other words, what percentage of the time did a call come in for Station 11's area, and a 2nd or greater request for service occurred at the same time prior to the original request being mitigated and the unit returning back to available status for another call.
15. Distribution of Resources – is defined as the geographic distribution of fire/ems stations and resources. Generally considered a single base-layer of services.
16. Concentration of Resources – is defined as the need for multiple resources or increased staffing concentrations at existing stations to meet the demands and or risks associated with the first due response/demand zones.
17. Unit Hour Utilization (UHU) – a measure of time on task. UHU's are measured by all time on task, from dispatch to available for all call types and durations, divided by number of available hours in the schedule.

Attachment A

Data Report

FITCH
& ASSOCIATES

Attachment B

GIS Report

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