June 2018 Update

Community Risk Assessment and Standards of Response Coverage Study

SOC Report

ALBEMARLE COUNTY | VIRGINIA

Albemarle County Fire Rescue
Albemarle County, Virginia

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CONSULTANT REPORT

COMMUNITY RISK ASSESSMENT AND STANDARDS OF COVER
ALBEMARLE COUNTY FIRE RESCUE, VA

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EXECUTIVE SUMMARY

In 2016, Albemarle County contracted with Fitch & Associates to objectively evaluate the fire department's operations, deployment, and staffing. The Albemarle County Fire Rescue Department is largely motivated to evaluate the current response model and the desire to develop a risk-based data driven staffing and deployment plan based upon the specific and unique profile of Albemarle County. These analyses culminated in a comprehensive deployment and staffing plan referred to as a Standards of Response Coverage (SOC).

Comprehensive data based quantitative and geospatial analyses were utilized to objectively evaluate the historical count demand for services by type and severity. Occupancy level data were obtained from the Insurance Services Office (ISO) and Albemarle County's databases and was utilized to assess occupancy level risk within the community. Ultimately, over 600 occupancies were categorized as low, moderate, and high risks and geocoded to the respective existing district boundaries in an effort to establish an efficient and objective risk based strategy for resource allocation.

The current fire response time average is 10 minutes 36 seconds in the rural areas and 6 minutes 18 seconds in the developed areas. The current EMS response times are 11minutes 36 seconds in the rural areas and 6 minutes 12 seconds in the developed areas. The current rural response times are meeting or exceeding the county's comp plan expectations in the rural areas of thirteen minutes or less. The developed areas will need some modifications to the current fire rescue response system in order to meet the expectations developed for an average response time of five minutes for fires and four minutes for rescue calls.

The distribution of risk and demand within Albemarle County is primarily focused in and around the identified development areas of the county. The density of the development areas is not as high as the City of Charlottesville creating challenges for ACFR to meet the same service level with the current model and allocation of resources.

Several alternative staffing and deployment models were evaluated and presented. Additionally, a number of variations of deployment and response times were evaluated that include differentiated performance and service levels based on the Comprehensive Plan's identified *Development* and *Rural* areas. Additionally, several variations of collaboration with the City of Charlottesville were evaluated to determine the best service delivery models that balance the competing demands of each of the agencies.

Priority recommendations were posited for the following:

1. Add a second 24-hour Medic unit at Rescue Station 8
2. Add a 24-hour Engine at the Pantops station with the qualifications to cross-staff R16 during non-peak hours
3. Develop and adopt system performance measures that should provide accountable service levels regardless of employment status

4. Adopt a service level objective of a 6-minute travel time in the *Development* areas at the 90th percentile
5. Adopt a service level objective of a 15-minute travel time in the *Rural* areas at the 90th percentile

DESCRIPTION OF COMMUNITY SERVED

Department Overview

Albemarle County Fire Rescue (ACFR) is a system of numerous agencies that provide a full-portfolio of services including fire suppression, fire prevention, technical rescue, hazardous materials mitigation, as well as emergency medical services (EMS) which includes transportation of patients to the hospital at both first responder basic life support (BLS) and advanced life support services (ALS). The fire and rescue services are provided by an administrative facility, four county owned stations, leased space from Sentara Martha Jefferson Hospital, seven non-profit fire company facilities, and three non-profit rescue squad facilities. From these facilities, the provision of fire and rescue services is provided excluding fire response within the City of Charlottesville. The Albemarle County Fire Rescue Department has achieved an Insurance Service Office (ISO) rating of 3 on a scale of 1 to 10 with 1 being the highest rating. The ISO rating of 3 in the most recent evaluation is a significant increase from the previous split rating of 6/10.

Albemarle County is located in the Piedmont region, just north of central Virginia, and spans nearly 726 square miles. Charlottesville, an independent city, is located centrally within the limits of the county. The county spans a small part of the Shenandoah National Park on the Northwest border. The County is a mix of urban, suburban and rural communities. Albemarle County has a total population of approximately 105,703. The City of Charlottesville is located within Albemarle County and is the County Seat. Charlottesville is 10.4 square miles with approximately 45,593 residents[1]. The City of Charlottesville also has its own fire department (CFD) which is accredited by the Commission on Fire Accreditation International (CFAI) and has the highest fire rating of a class 1 from the Insurance Service Office (ISO)[2]. The City of Charlottesville relies on Charlottesville Albemarle Rescue Squad (CARS) to provide EMS transport to patients within the city. The City of Charlottesville has three fire stations.

Albemarle County and the City of Charlottesville host the historic and distinguished University of Virginia that has over 21,000 students enrolled and employ over 28,000 staff and faculty[3]. Within the County there are two hospitals. The University of Virginia has its own health care system and has a hospital located within Charlottesville, which includes a children's hospital. Sentara Health System also has the Martha Jefferson Hospital located in the Pantops area of the county.

The fire and rescue services are provided from eighteen stations throughout the county with a force of over 988 personnel between ACFR, Charlottesville and the ten non-profit organizations.

[1] Accessed online at http://www.charlottesville.org/about-charlottesville
[2] Accessed online at http://www.charlottesville.org/home/showdocument?id=44250
[3] Accessed online at http://www.virginia.edu/facts

The ACFR administrative staff consists of one (1) fire chief, two (2) deputy chiefs, three (3) division chiefs, five (5) battalion chiefs, 16 captains, four (4) administrative professionals, two (2) assistant fire marshals, and a fleet manager. The Fire Chief of ACFR is the Chief Executive Officer of the Department and reports to the Deputy County Executive – Community Services. The County Board of Supervisors is comprised of six (6) elected officials; one is elected from each magisterial district. The Board of Supervisors appoints the County Executive who is responsible to guide the daily operations of the County.

Each of the ten independent non-profit fire companies and rescue squads have their own board of directors that is established within the bylaws of each organization. The bylaws of each organization also establish the rule and regulations that members of each organization must follow to maintain membership. The ACFR system also has a Fire and EMS (FEMS) Board that has representation of each of the non-profit organizations. The FEMS Board meets with ACFR Fire Chief regularly to coordinate the countywide fire rescue response system and to set countywide fire rescue policy.

Legal Basis and Governance

Albemarle County was established in 1744 by the state General Assembly. The current boundaries were reduced in 1777 to its current boundaries. The county seat is Charlottesville since 1761, prior to that the county seat was in Scottsville.

The county has established a Board of Supervisors under the Commonwealth of Virginia Code. The Board of Supervisors is comprised of six elected officials. The County Executive is appointed by the Board of Supervisors and is responsible for supporting the county's mission, vision and values into operationalization. There are two Assistant County Executives; one is responsible for fiscal and management services while the other is responsible for community service. The Assistant County Executive is responsible for five departments within the county, one of which is the Fire Rescue Department.

The state of Virginia code Title 27 empowers local units of government to establish a fire department as a department within that government and appoint a fire chief to carry out the duties of a fire department. The scope of title 27 is very broad allowing the local unit of government such as a county, city or town to adopt local ordinances or rules that govern their fire department as well as determine their powers and authorities. The Virginia code also enables the establishment of Fire Companies that must have at least 20 members to engage in fire suppression activities from a single fire station. These Fire Companies must follow state and local statutes, rules and regulations. In 2011 the County Board of Supervisors passed an ordinance that went into effect in 2012 establishing a County Fire Chief. The enactment of a County Fire Chief was needed to increase the coordination amongst all the fire rescue organizations in the county; it has also allowed a more systematic approach to the provision of fire and rescue services. With the exception of the City of Charlottesville, the County Fire Chief is responsible for ensuring fire and rescue services are provided within the county.

Title 32.1, Chapter 4 of the Virginia state code, in particular Article 2.1 enable a local unit of government to provide emergency medical services to their community. This provision also allows the local unit of government to restrict the provision of emergency medical services to the community and franchise areas within the local unit of government to ensure that adequate services are provided to the community. Albemarle County is part of and located within the Thomas Jefferson Health District, which oversees the public health services in Albemarle, Fluvanna, Greene, Louisa and Nelson counties.

Albemarle County has adopted chapter six within its ordinances related to the Fire Rescue Department. Chapter six of the county's ordinances addresses the coordinated fire rescue system and responsibilities of the county and each individual volunteer fire company or rescue squad. A Fire and EMS Board (FEMS) has been established within the county to coordinate and communicate between the County Fire Rescue Department and the volunteer fire companies and rescue squads. The county's ordinance also empowers the department to enforce the outlined regulations such as the fire code and recover costs associated with providing Emergency Medical Services (EMS) within the county. While the FEMS Board advises the County Fire Rescue Chief, the County Fire Rescue Chief is the Chief Executive Officer of the Fire Rescue Department and reports to the Assistant County Executive.

History of the Agency

The Albemarle County Fire Rescue Department was established in 1993. Prior to 1993 Albemarle County had a Fire Marshal who was responsible for fire investigations and fire inspections. In 1997, the first operational staff was added to ACFR. Those first operational staff members were used to provide daylight staffing at the Seminole Trail fire station. In 1998 daylight staff was added to Stony Point and Earlysville and in 2003 the Monticello fire station added 24/7 staffing. The Hollymead station was built and staffed 24/7 in 2007. The most recent addition was the Ivy station in 2013, which included 24/7 staffing, and a renegotiation of the fire services agreement between the county and the city of Charlottesville.

In 2011, the County Board enacted a County Fire Chief system by ordinance, which was needed to increase the coordination amongst all the fire rescue organizations in the county. Except for the City of Charlottesville, the County Fire Chief is responsible for ensuring fire and rescue services are provided within the county. The County Fire Chief ordinance also outlines a grievance process for the non-profit organizations that may not agree with a decision that the County Fire Chief may make. Since the ordinance enactment ACFR has increased the funding to the individual non-profit organizations to provide some relief from fundraising to support their operations. ACFR has also started providing logistical support such as centralized purchasing of firefighting personal protective equipment, ladder testing and in the next fiscal year vehicle maintenance. There also has been an adopted countywide fleet replacement policy that has established a replacement program for vehicles and has served the department well in ensuring they have modern and reliable emergency response

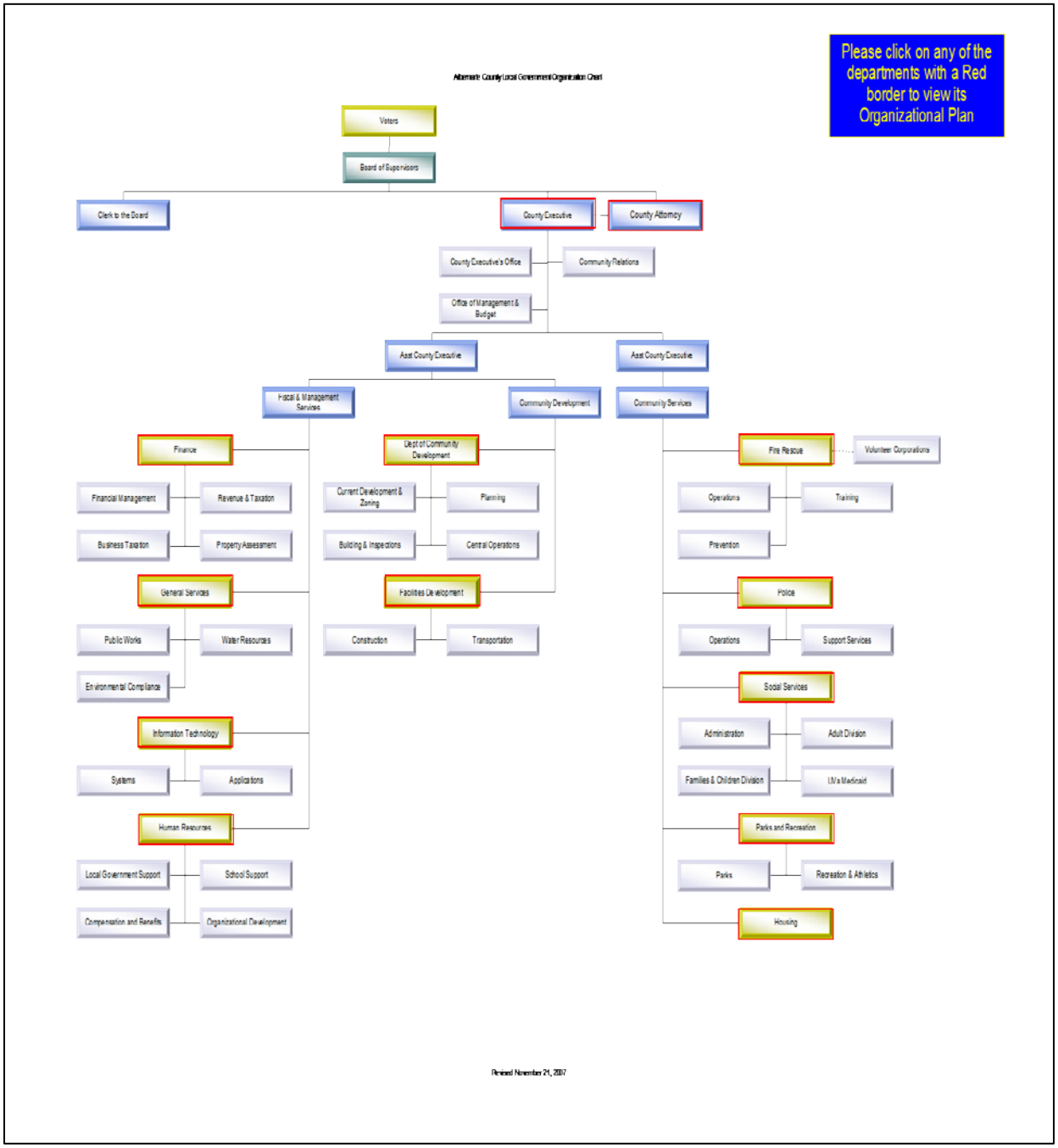
equipment. Initial training for ACFR and non-profit organization staff is coordinated at the county level providing a level of efficiency and consistency throughout the county.

The ACFR Department has met the many challenges they have been faced with including a growing development area, the transformation from a traditional volunteer department to a combination volunteer-career department, coordination of numerous fire rescue organizations within the county, increasing training requirements, as well as many other challenges. Despite all of the changes, the department has continued to fulfill its mission and look to address the future challenges within the system.

Organizational Design

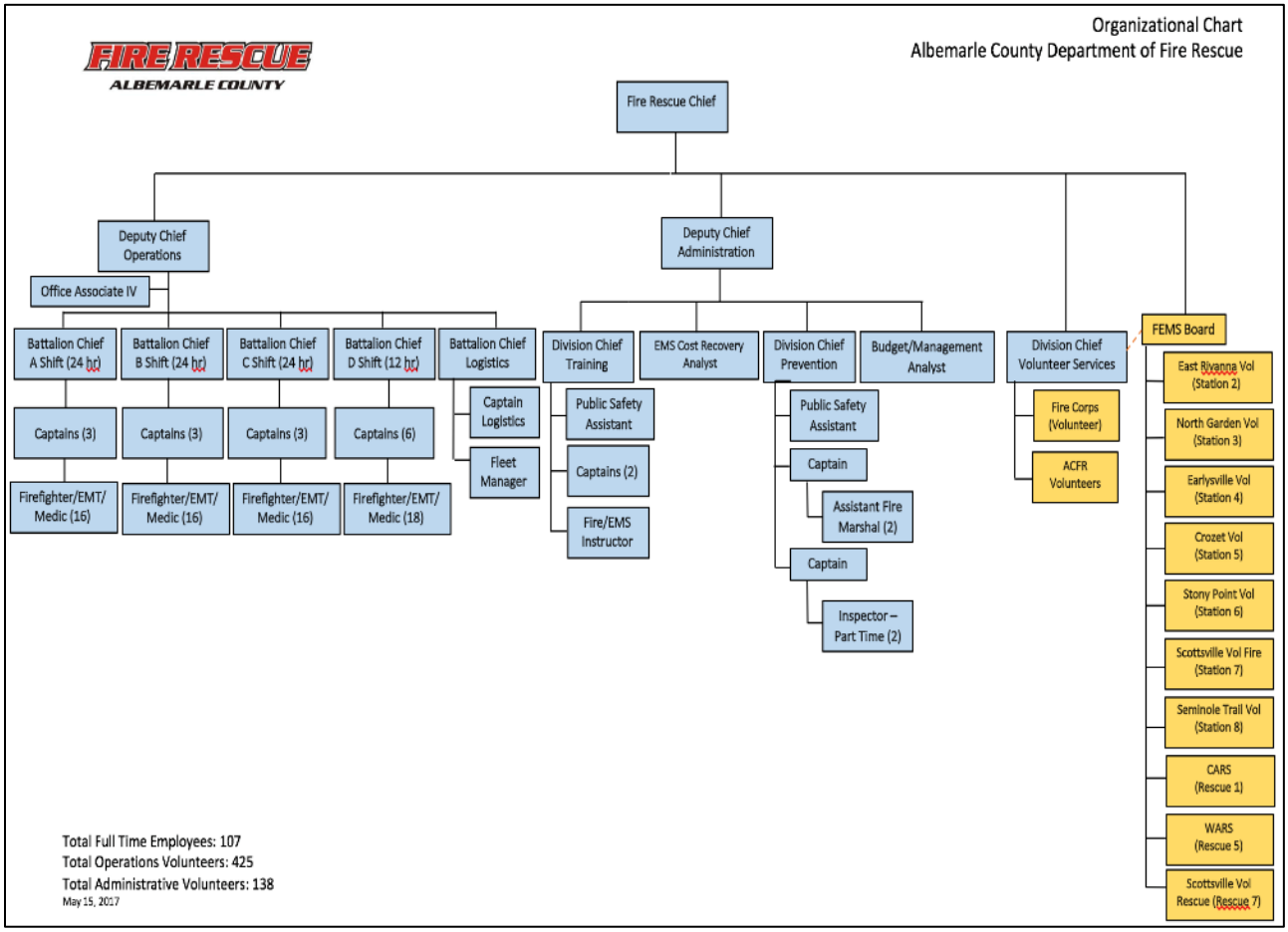
Albemarle County Fire Rescue is one of many departments within the local government of Albemarle County. Below is an organizational chart that shows the breadth of departments within the Albemarle County government and the reporting structure within the entire county organization.

Figure 1: Albemarle County Local Government Organizational Chart



The Fire Rescue Department is considered to be part of the community services branch of the county and is overseen by an Assistant County Executive. The Fire Rescue Department's organizational structure is depicted below. It is important to note that each volunteer fire and rescue department has their own organizational structure and is a non-profit organization with their own bylaws.

Figure 2: Albemarle County Fire Rescue County Organizational Chart



Each of the volunteer stations is organized as a non-profit organization with their own set of bylaws, budget and board of directors. Below is a list of the non-profit fire rescue organizations within Albemarle County and the year they were organized.

- East Rivanna Volunteer Fire Company (Fire Station 2) – 1969[4]
- North Garden Volunteer Fire Company (Fire Station 3) - 1970[5]
- Earlysville Volunteer Fire Company (Fire Station 4) - 1966[6]
- Crozet Volunteer Fire Department (Fire Station 5) – 1910[7]
- Stony Point Volunteer Fire Company (Fire Station 6) - 1972[8]
- Scottsville Volunteer Fire Department (Fire Station 7) – 1936[9]
- Seminole Trail Volunteer Fire Department (Fire Station 8) - 1976[10]
- Charlottesville-Albemarle Rescue Squad (Rescue Station 1) – 1960[11]

[4] http://www.ervfc.com/about/
[5] http://www.ngvfc.org/site/history.php
[6] http://www.earlysvillefire.org/
[7] http://crozetfire.org/about-us/
[8] http://www.spvfc.org/about-us.html
[9] http://www.scottsvillefire.org/index.html
[10] http://stvfd.org/history/

- Western Albemarle Rescue Squad (Rescue Station 5) - 1978[12]
- Scottsville Volunteer Rescue Squad (Rescue Station 7) - 1974[13]

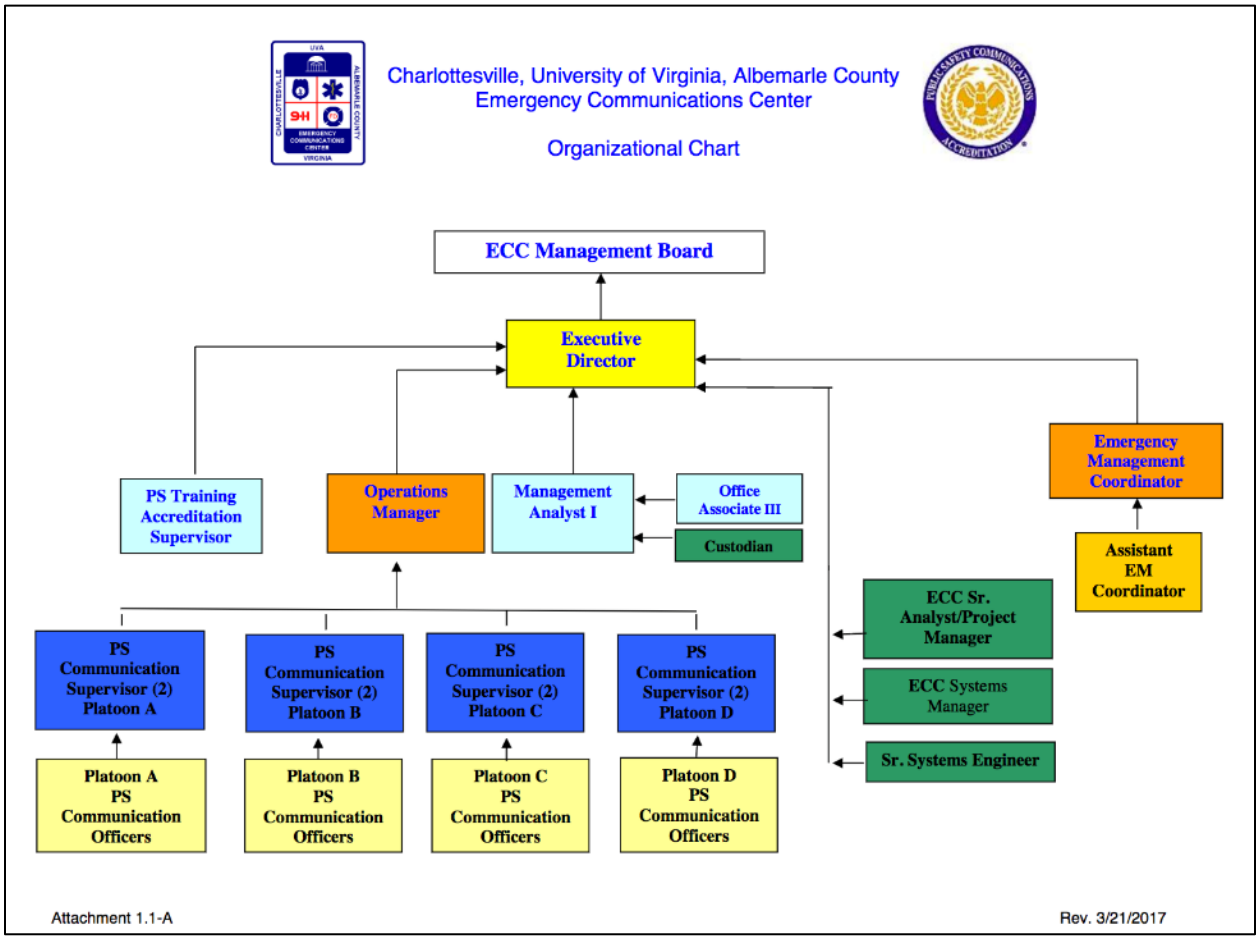
Chapter 6 of the County Code establishes a Fire and EMS Board (FEMS), which is comprised of the top official from each of the volunteer fire and rescue non-profit organizations.[14] The FEMS Board was established to coordinate amongst all the fire rescue organizations within the county and advise the County Fire Chief on issues related to the delivery of service. The FEMS Board meets regularly and has committees that report to the board on specific areas of interest such as operations and training.

Albemarle County Fire Rescue and the non-profit Rescue Squads are all members of the Thomas Jefferson EMS Council.[15] The EMS Council is a regional entity that assists in coordinating the EMS systems amongst six counties. The council also offers EMS continuing education to maintain required certifications and provides coordination amongst all the medical directors that oversee the EMS operations within the member agencies.

A joint communications center is used to provide emergency communications services to all the organizations that provide fire and rescue services in Albemarle County.[16] The Charlottesville, University of Virginia, Albemarle County Emergency Communication Center is the joint communication center who is overseen by the ECC Management Board which Albemarle County Fire Rescue has a seat on.

[11] https://carsrescue.org/about-us/
[12] http://www.westernrescue.org/newindex/orginfo.htm
[13] http://www.svrs.org/id29.htm
[14]http://www.albemarle.org/upload/images/Forms_Center/Departments/County_Attorney/Forms/Albemarle_County_Code_Ch06_Fire_Protection.pdf
[15] http://www.tjems.org/about-the-council/
[16] https://www.albemarle.org/department.asp?department=ecc

Figure 3: Charlottesville, University of Virginia, Albemarle County Emergency Communications Center Organizational Chart



Financial Basis[17]

Overview

Albemarle County in fiscal year 2017 will manage a $375 million-dollar budget overall. The lion share of the revenue is captured from property taxes that make up 44% of the overall revenue. Typically, the county property tax revenue would comprise 60% of the revenue so there is still a significant gap to recover from the pre-recession economics. The second largest share of revenue is received from the state of Virginia at 22%. This adopted FY 2017 budget includes a 2-cent rate increase to the taxpayers of the county.

The largest expense the county has is the school division that expends 58% of the budget, which is inclusive of operating, capital and debt service for the school division. Only 38% of the county's budget is spent on general government operations, capital and debt service.

[17] Albemarle County FY2017 Adopted Budget Manual http://www.albemarle.org/upload/images/forms_center/departments/Budget/forms/FY17/FY17_Adopted_Budget_S_FY17-Budget_Manual.pdf

The Albemarle County Fire Rescue Department has a separate fund from general operations called the Fire Rescue Services Operations Fund, which has a dedicated 1-cent tax to help the base funding of the fire departments operation. The FY 2017 budget includes a $93,456 increase for fire service operations, which will include a new position for the county to provide vehicle maintenance for all the fire apparatus within the county. The capital budget also includes funding to construct the Pantops public safety station.

Within the ACFR operating budget is a financial contribution to each of the volunteer fire and rescue departments that operate within Albemarle County but outside of the city of Charlottesville. The funding to the volunteer fire and rescue departments range from $91,000 to $238,000. The total contributions for fiscal year 2017 from the County to the nine volunteer agencies equals $1,405,485 total for operating. This is only the hard costs and does not account for the training and other support that the County provides to the departments. ACFR has a funding policy and requires each volunteer department to submit a budget request with justification for their request. Capital expenses such as vehicles are handled through a capital budget process. ACFR has a very detailed vehicle replacement policy that outlines the thresholds for replacing a vehicle and the number of vehicles the County will fund for each station. The volunteer departments are able to fundraise and collect other funds to operate their department as well. Many of the volunteer departments use these additional resources to purchase additional vehicles, purchase equipment or repair their facility beyond what the County is able to provide. Below is a list of the operating contributions to each of the volunteer departments:

- Crozet $145,678
- Earlysville $91,566
- East Rivanna $139,456
- North Garden $94,131
- Scottsville Fire $142,605
- Seminole Trail $195,313
- Stony Point $112,929
- Charlottesville Albemarle Rescue $116,300
- Scottsville Rescue $128,807
- Western Albemarle Rescue $238,700

Like most local governments, the recession in 2008 greatly impacted and continues to impact Albemarle County. Since the recession, the county has had six years of decreasing property tax values and three years of slow increases. While the economy may be trending upward the county has not experienced growth rates that even meet their projections. The last two years of property tax growth have been 2.64% and 1.84%. Prior to the recession, the county was experiencing double digit property value growth. This lack of growth in revenue has left the county making very difficult decisions each budget year on which services to maintain. Funding public safety and human services have been the county's priorities while the county continues to try and maintain the service levels of all the other services the county provides. The county has also been saddled with increasing mandates and

obligations that are unfunded and out of their control. An example in the FY 2017 budget is the Children's Services Act compliance for the school division that cost the county an increase of $1.7 million in expenses. Compounding the issues the county continues to experience an increasing population, which also causes an increase in the demand for many county services. The county is projected to see approximately 18,000 new residents between 2008 and 2021. This has left the county trying to maintain services while having to pause on their and the communities desire to address strategic goals and initiatives. There is no quick solution to the fiscal challenges the county is facing; the adopted budget in FY 2017 starts to set the county up to address the short term and long term challenges ahead of them.

The county has maintained compliance with the Commonwealth of Virginia budget adoption requirements found in title 15.2 of the state code. There appears to be a very concerted effort from the county to ensure there is significant transparency and public participation in their budget process. This commitment to transparency and engagement is displayed on the county's website. The county has also received the Government Finance Officers Association "Distinguished Budget Presentation Award" and the "Achievement for Excellence in Financial Reporting" each for multiple consecutive years. This award shows the county's commitment to following the best practices in government finance while also ensuring stakeholder input and common language communication. The county has also followed zero based budgeting principals and strictly follows the generally accepted accounting principal (GAAP) while ensuring compliance with the appropriate statutes and regulations. Another important validation of the financial integrity of the organization is annual third party audit that the county has completed and included in their annual comprehensive annual financial report (CAFR). Lastly the county also employs five-year financial planning and three-year trending to ensuring the county is preparing financial strategies for both the short term and long term.

While there is a significant strain on the county to establish a budget that meets the constituents' expectations with both financial contributions and service levels, the county has maintained an AAA bond rating which is the highest level of rating. This rating allows the county to secure debt at lower interest rate than those with lower ratings.

Expenditure Controls and Restrictions

The Albemarle County Fire Rescue Department is appropriated money through the annual budget process at the department level. The appropriation process allows some flexibility to the Fire Chief throughout the year to address overages and savings within the budget without the need for a budget amendment. The County purchasing policy which has an escalating process based on the total procurement cost. For example, a purchase between $5,000 and $30,000, staff are required to obtain at least three quotes and a purchase order. If there is a need for a budget amendment according to the Commonwealth of Virginia's Title 15.2 code, the County Board of Supervisors must approve the amendment.

The Albemarle County Fire Rescue Department has a central supply for many of the significant equipment and supplies that are used within the fire stations such as personal protective fire equipment, self-contained breathing apparatus, firefighting foam and fuel to name a few items. During the onsite visits, *Fitch* received positive feedback from numerous volunteer fire companies about the central supply system the department is using. This allows bulk purchasing and oversight of these important supplies and equipment.

While the Albemarle County Fire Rescue Department has a robust budget and fiscal management process, much of the county geographically is served by non-profit volunteer fire companies and rescue squads. These non-profit organizations generally own their own facility and some of their vehicles outright. The county provides funding to these volunteer fire companies and rescue squads to cover their basic operating costs, any additional funding must be provided by the volunteer fire company or rescue squad. These non-profit volunteer fire companies and rescue squads have a board of directors and bylaws that stipulate their own process for procurement. Albemarle County provides a best practice financial policy and procedures manual to all the non-profit fire rescue organizations but there is no requirement to use those best practices.

The county has a robust apparatus replacement program that allows the volunteer fire company and rescue squad significant involvement in the specifications of the replacement apparatus that will be placed in their stations. The county has a basic specification for each type of apparatus. The volunteer fire company or rescue squad is then allowed to personalize the vehicle specification beyond the basic specification. Any additional cost from the personalization above the counties budgeted amount must be covered by the non-profit corporation where the emergency vehicle is going to be housed. This has allowed these independent organizations their ability to maintain the pride and ownership in the apparatus they respond with.

Area Description

Geography

Albemarle County is geographically located in the Piedmont region, just north of central Virginia, and spans nearly 726 square miles. Charlottesville, an independent city, is located centrally within the limits of the county. The county spans a small part of the Shenandoah National Park on the Northwest border.

The Albemarle County is a mix of urban, suburban and rural communities, bisected North and South by Interstate 64 and bisected East and West by US Route 29.

Topography

Albemarle County is located 70 miles west of Richmond, Virginia and 110 miles southwest of Washington D.C.[18] Albemarle's western border with Augusta and Rockingham Counties is located within the Shenandoah National Park.

The Shenandoah National Park has the most significant topography but the county has many other topographical features.

Climate

Albemarle County, Virginia, gets 44 inches of rain per year. The US average is 39. Snowfall is 15 inches. The average US city gets 26 inches of snow per year. The number of days with any measurable precipitation is 74.

On average, there are 217 sunny days per year in Albemarle County, Virginia. The July high is around 87 degrees. The January low is 25. Sperling's comfort index for Albemarle County is a 51 out of 100, where a higher score indicates a more comfortable year-around climate. The US average for the comfort index is 54.

Population and Demographic Features

The ACFR serves a total population of approximately 105,703 within a geographic area of approximately 726 square miles.

The figure below provides various metrics of census data for Albemarle County and the State of Virginia.

Table 1: Census Data for Albemarle County and State of Virginia[19]

People Quick Facts	Albemarle County	Virginia
Population estimates, July 1, 2016, (V2016)	105,703	8,411,808
Population estimates base, April 1, 2010, (V2016)	98,998	8,001,041
Population, percent change - April 1, 2010 (estimates base) to July 1, 2016, (V2016)	6.8%	5.1%
Population, Census, April 1, 2010	98,970	8,001,024
Persons under 5 years, percent, April 1, 2010	5.7%	6.8%
Persons under 18 years, percent, April 1, 2010	19.5%	25.0%
Persons 65 years and over, percent, April 1, 2010	10.6%	11.4%
Female persons, percent, April 1, 2010	50.4%	50.3%
White alone, percent, April 1, 2010	80.8%	57.6%
Black or African American alone, percent, April 1, 2010	2.1%	6.2%
American Indian and Alaska Native alone, percent, April 1, 2010	1.4%	1.0%
Asian alone, percent, April 1, 2010	4.2%	13.0%
Native Hawaiian and Other Pacific Islander alone, percent, April 1, 2010	0.2%	0.4%

[18] Accessed online at https://www.albemarle.org/page.asp?info=demog
[6] US Census 2015 Estimates. Retrieved from https://www.census.gov/quickfacts/table/RHI305210/51,51003

People Quick Facts	Albemarle County	Virginia
Two or More Races, percent, April 1, 2010	5.0%	4.9%
Hispanic or Latino, percent, April 1, 2010	15.4%	37.6%
White alone, not Hispanic or Latino, percent, April 1, 2010	73.7%	40.1%
Living in same house 1 year ago, percent of persons age 1 year+, 2010-2014	69.2%	84.6%
Population per square mile, 2010	2617.8	239.1
Language other than English spoken at home, percent of persons age 5 years+, 2010-2014	14.2%	43.8%
High school graduate or higher, percent of persons age 25 years+, 2010-2014	91.4%	81.5%
Bachelor's degree or higher, percent of persons age 25 years+, 2010-2014	34.9%	31.0%
Veterans, 2010-2014	4,691	1,840,366
Mean travel time to work (minutes), workers age 16 years+, 2010-2014	17.2	27.6
Housing units, April 1, 2010	37,050	13,680,081
Owner-occupied housing unit rate, 2010-2014	43.8%	54.8%
Median value of owner-occupied housing units, 2010-2014	$263,100	$371,400
Households, 2010-2014	34,314	12,617,280
Persons per household, 2010-2014	2.45	2.95
Per capita income in past 12 months (in 2014 dollars), 2010-2014	$24,775	$29,906
Median household income (in 2014 dollars), 2010-2014	$42,334	$61,489
Persons in poverty, percent	24.5%	16.4%

Disaster Potentials

Based on the 2012 Hazard Mitigation Plan, the County is most vulnerable to the natural hazards of flooding, winter storms, hurricanes, high winds, wildfire, lightning, tornadoes, drought and extreme heat.

The County is also vulnerable to technological (human-caused) hazards associated with transportation accidents via rail and highway, urban fire, hazardous materials spills, Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) terrorism, civil disturbances, multi-casualty incidents, and risk associated with dam failure and inundation. Additionally, in this era, no community is immune to the potential for active shooter incidents.

SERVICES PROVIDED

Service Delivery Programs

Albemarle County Fire Rescue operates a dynamic staffing system based on the availability of volunteer staff throughout the county. Given that most volunteer fire companies and rescue squads have difficulty ensuring they have adequate staff available during the weekday daytime hours, there are two different deployment systems. Throughout the report the different deployment systems will be referred to as:

Daylight which refers to the response Monday through Friday 6am-6pm excluding major holidays

Evening and weekends, which refers to Monday through Thursday 6pm-6am and Friday 6pm though Monday at 6am.

Fire Suppression

Albemarle County provides fire suppression services within the county as well as response requests to assist other adjacent agencies from 13 fixed facilities. Fire suppression services are provided from 13 fixed facility fire stations distributed throughout the county. Of those 13 fixed facilities, three are owned and operated by the city of Charlottesville, seven are owned by non-profit volunteer fire departments and three are county owned and operated. Of those seven non-profit volunteer fire department stations, four of them have daylight staff from Albemarle County Fire Rescue from 6am until 6pm Monday through Friday excluding major holidays (daylight staffing). Throughout the county there are many different models used to provide fire suppression services to the county from fully staffed fire stations to fully volunteer on-call staff that respond to the fire station when an emergency response is needed.

All fire department personnel within the county are minimally trained to the Firefighter I level. Many of the firefighters also have EMS training but some volunteer fire companies do not require any additional training beyond Firefighter I. ACFR requires its entire staff to complete Emergency Medical Technician (EMT) and Emergency Vehicle Operations training.

Many of the volunteer fire companies have varying levels of membership, examples include:

- Full/Active Member (has firefighter I training)
- Associate Member (has firefighter I training but less time commitment than a full member)
- Lifetime Member (after 15 years of service always have access to fire station but may or may not be certified to respond to calls)
- Driver (not allowed to perform interior firefighting but may drive apparatus and work on the exterior of a structure fire)

- Junior Firefighter (under 18 but interested in firefighter, may not enter burning structures but may respond and assist, also trains with department)
- Auxiliary Member (provide support to the department)

The Albemarle County Fire Rescue system operates the following response units amongst the ten fire stations within the county system:

- 20 fire engines (three are reserve engines)
- 3 ladder trucks
- 11 water tanker trucks
- 9 brush trucks
- 1 battalion chief command vehicle
- Numerous staff and support vehicles

The staffing of the ten fire stations has a high degree of variability. During the daylight hours there are a minimum of 35 ACFR personnel staffing fire and EMS vehicles. During the evening and weekend hours there is a minimum of 16 personnel staffing the three county owned fire stations. The volunteer fire departments within the county have very different models and strategies for responding to emergency calls. Some departments staff their fire stations when there is not ACFR staff there, while others rely solely on staff to respond in an on-call basis to the fire station when an emergency call is dispatched.

Agency	Daylight Response	Evening/Weekend Response
East Rivanna Fire	ACFR Staff – Minimum 3 Personnel	Volunteers staff station
North Garden Fire	None, On-call via pager	On-call via pager, staff onsite 6pm-midnight Friday/Saturday (November through March)
Earlysville Fire	ACFR Staff – Minimum 3 Personnel	Try to staff station, if not on-call via pager.
Crozet Fire	None, On-call via pager	On-call via pager, staff onsite Su-Fri 6p-6a,
Stony Point	ACFR Staff – Minimum 3 Personnel	Volunteers staff station 4 of 5 nights, 5th night on-call via pager
Scottsville Fire	None, On-call via pager	On-call via pager, staff station Mon-Thurs 6p-10p
Seminole Trail Fire	ACFR Staff – Minimum 3 Personnel	Volunteers staff station
Monticello	ACFR Staff – Minimum 5 Personnel	ACFR Staff – Minimum 5 Personnel
Hollymead	ACFR Staff – Minimum 5 Personnel	ACFR Staff – Minimum 5 Personnel
Ivy	ACFR Staff – Minimum 5 Personnel	ACFR Staff – Minimum 3 Personnel

Rescue

Technical Rescue services are provided in a very collaborative manner. ACFR has a rescue squad at Monticello station 11, which is cross-staffed with the engine 111 personnel. Western

Albemarle Rescue Squad (WARS) has a rescue truck and personnel and CARS provides a squad. The county is also currently working towards an automatic aid agreement with the city of Charlottesville to respond to any technical rescue calls anywhere in the county. Between ACFR, WARS, CARS, and potentially Charlottesville, there is equipment and trained personnel to respond to the low frequency but high-risk technical rescue calls. The technical rescue response includes high angle, low angle, collapse, trench and confined space incidents.

Water rescue in Albemarle County is provided between ACFR, Charlottesville Albemarle Rescue Squad (CARS), Scottsville Fire and WARS. All of the previously mentioned agencies have staff trained in water rescue and will respond to any water rescue incident within the county. The physical resources for water rescue are also distributed throughout the county to ensure a rapid response to time critical water rescue incidents.

Emergency Medical Services (EMS)

The Albemarle County Fire Rescue system provides both Basic Life Support (BLS) and Advanced Life Support (ALS) level of care for the sick and injured throughout the county. This is accomplished using a variety of emergency response units including ambulances and trained staff. Critical emergency medicals many times have fire companies utilized as first responders to provide care until an ambulance arrived on the scene. Advanced care, treatment, and transport to the hospital are provided by ACFR, Charlottesville Albemarle Rescue Service (CARS), Earlysville Fire, Scottsville Rescue and Western Albemarle Rescue Service (WARS). All of the ACFR staffed apparatus are able to provide advanced life support first response with paramedics, while many of the other fire companies provide first response services at the basic life support level with EMT trained staff. CARS receive two firefighter/paramedics from Charlottesville Fire Department during the daylight hours to assist with staffing ambulances.

The county system utilizes several different EMS training levels to provide EMS to Albemarle County. Paramedic is the highest level of training and ACFR sends a few of its personnel to paramedic school every year. EMT intermediate is also a training level used that is considered an ALS level providers along with paramedics. The EMT basic level providers are considered BLS level providers. In accordance with the Commonwealth of Virginia codes 12VAC5-31-1230 through 12VAC5-31-1250, the BLS ambulances are staffed with at least one EMT basic and a qualified driver while the ALS ambulances are staffed with at least one ALS level provider and one EMT basic (if the EMT basic is also a qualified driver otherwise a separate driver is used). ACFR also participates in the Thomas Jefferson EMS Council, which is established and required under the Commonwealth of Virginia code[20].

The Albemarle County Fire Rescue system operates 17 ambulances amongst nine facilities within the county system. However, typically only 8 are staffed at any given time. Some of

[20] http://www.vdh.virginia.gov/content/uploads/sites/23/2016/05/2012EMSRegulations-AirMedical.pdf

the EMS system is based out of fire stations while other facilities provide EMS services. One notable station is Rescue 16, which is based out of Jefferson Hospital during the daylight hours. These staff members work out of a small room within the hospital while the ambulance is parked outside next to a parking ramp. Like the fire service there is a wide variation in how the EMS units are staffed within the county. It is also important to note that there is change in primary responders based on time of day and day of week. During the daylight hours ACFR covers much more of the county for EMS than during the evening and weekend hours.

Agency	Daylight Response	Evening/Weekend Response	State EMS License
ACFR	Transport EMS - ACFR Staff	Transport EMS ALS - ACFR Staff	ALS Transport
CARS	Transport EMS - Smaller response area (limited county response), additional staff provided by Charlottesville Fire	Transport EMS ALS- CARS Staff	ALS Transport
Scottsville Rescue	Transport EMS - ACFR Staff	Transport EMS ALS- Scottsville Rescue	ALS Transport
WARS	Transport EMS - WARS Staff	Transport EMS ALS- WARS Staff	ALS Transport
East Rivanna Fire	ALS First Response - ACFR Staff	BLS First Response to all medicals - East Rivanna Staff	Under ACFR License
North Garden Fire	None, On-call via pager	None, On-call via pager	BLS First Response
Earlysville Fire	ALS First Response - ACFR Staff	Transport EMS BLS – Earlysville Fire Staff	Under ACFR License
Crozet Fire	No response unless requested	No response unless requested	N/A
Stony Point	ALS First Response – ACFR Staff	Four of five nights, Fifth night On-Call via pager	BLS First Response
Scottsville Fire	BLS First Response to 2nd medical – Scottsville Fire Staff – On Call Pager At All Times	BLS First Response to 2nd medical – Scottsville Fire Staff	BLS First Response
Seminole Trail Fire	ALS First Response – ACFR Staff	BLS First Response for ALS calls – Seminole Trail Staff	BLS First Response

Figure 4: Albemarle County Daylight EMS Coverage Map

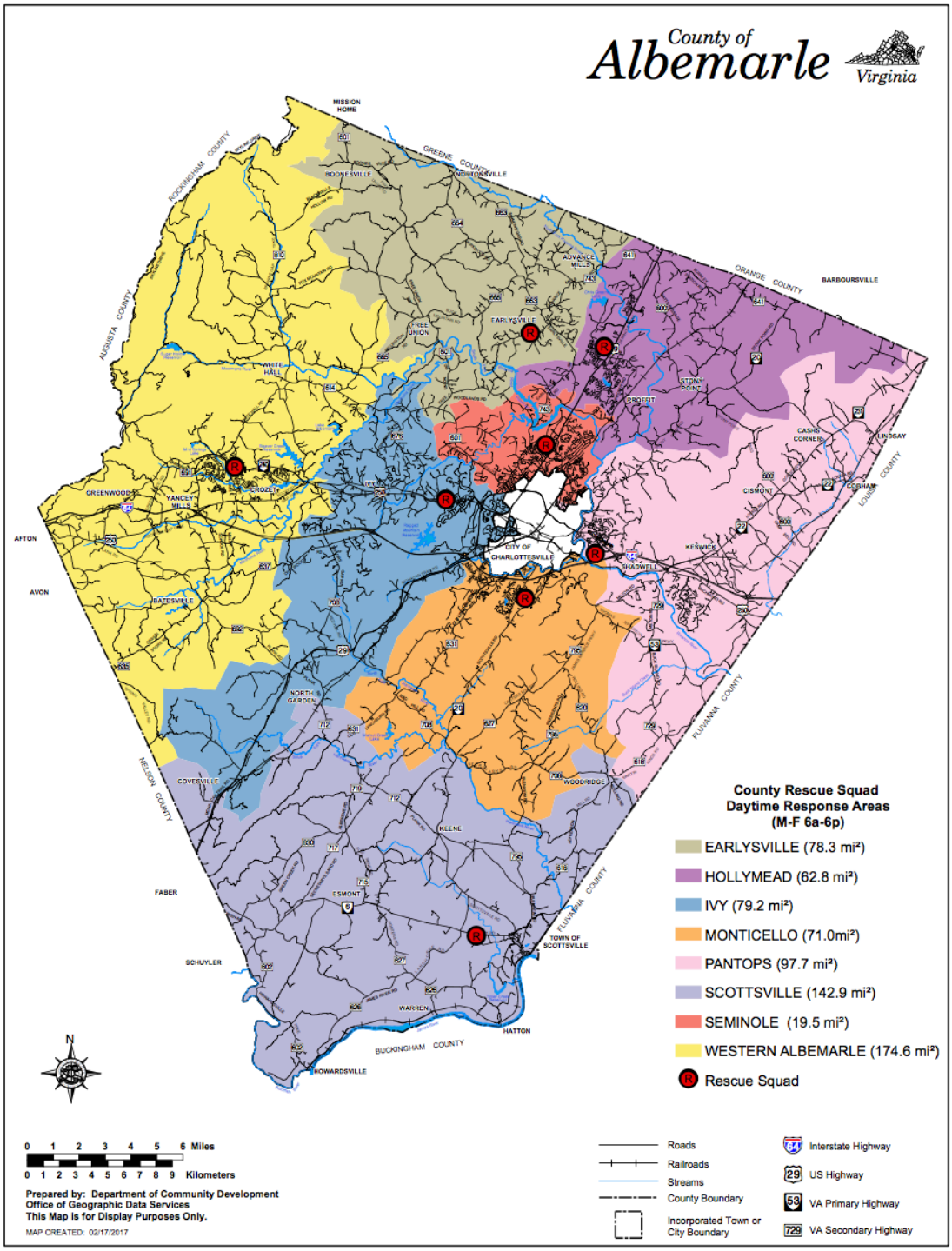
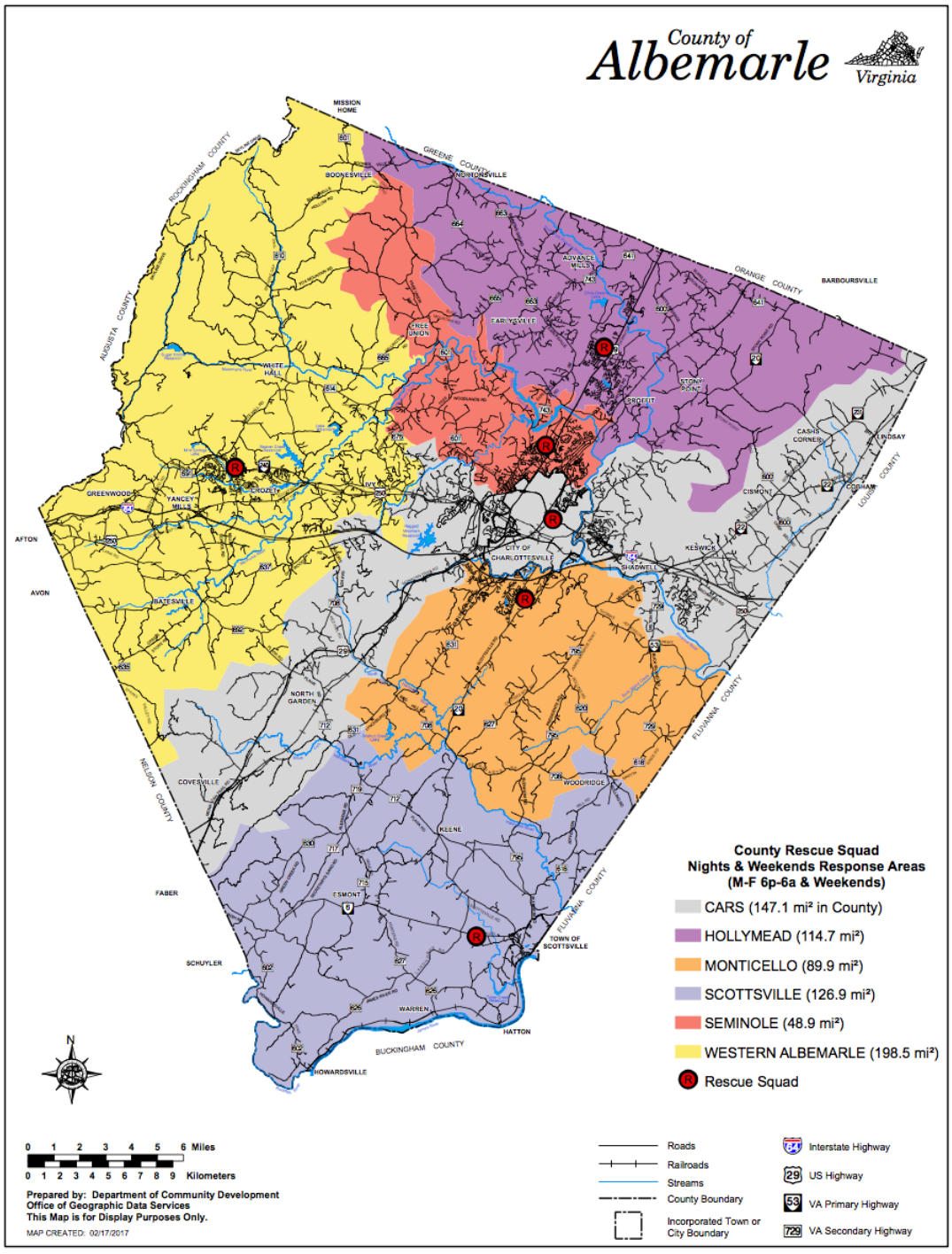


Figure 5: Albemarle County Weekend/Evening EMS Coverage Map



Hazardous Materials

Hazardous materials are handled in a collaborative approach between the City of Charlottesville and the ACFR system. The hazardous materials response is like other low frequency but high-risk incidents where the city and county both have resources committed to ensure there will be the appropriate resources dispatched. The City of Charlottesville

received a regional grant to develop the hazardous materials response. The ACFR system has previously been limited to mitigating spills through basic containment procedures, while the City of Charlottesville provided the more technical response from their station 10. ACFR has now committed more resources and has 25 personnel trained to the hazardous materials technician level that can provide the higher level of mitigation. The City of Charlottesville has well-established hazardous materials response while the ACFR system is still developing. The future response for hazardous materials incidents within Albemarle County appears to be more integrated like the technical rescue responses.

Fire Prevention

Albemarle County Fire Rescue has a Prevention Division and Office of the Fire Marshal that provides a full line of prevention services within Albemarle County. The services include fire investigation, hazardous materials investigation, public education, building plan review, issuing permits, juvenile fire setting intervention and emergency preparedness. Along with the services provided by the prevention division there is an adopted fee schedule for many of the services provided, some of the fees are set at the state level while others are developed locally.

The prevention division provides regular inspections of public buildings, schools, skilled nursing facilities, day care centers and public assemblies. Public education is provided to the public whether that is within the local schools or assistance to residents with their smoke alarm installation.

Dispatch

Dispatch services are provided by Charlottesville-University of Virginia-Albemarle County Emergency Communications Center. The emergency communications center is a consolidated dispatch center that provides service to all public safety services within Albemarle County. A management board within the organizational structure has been established containing relevant stakeholders of the emergency communication center and that management board is whom the Executive Director of the emergency communication center reports to. The emergency communications center uses locally developed call taking procedures to screen 911 callers with fire, rescue and emergency medical service needs. A commercially developed product for emergency medical call screening has been approved and is in the process of being purchased. The emergency communications center is a "Virginia Accredited Emergency Medical Dispatch Communications Center." A computer aided dispatch system is used to manage the standard processes of taking, dispatching and ensuring the appropriate response when services are requested. The emergency communications center also uses a digital 800 MHZ radio system to communicate with public safety professionals that are responding to calls for service.

Current Deployment Strategy

Fixed Facilities

Within Albemarle County there 19 fixed facilities that are used to provide the fire suppression, emergency medical, and special operation services. Below is the brief overview of the fire station locations, capabilities, and staffing.

Albemarle County Fire Rescue Headquarters: 460 Stagecoach Road, Charlottesville, VA 22902.

The Fire Rescue Headquarters houses the Fire Administration, Prevention Division/Office of the Fire Marshal, Operations Division and Training Division leadership.

Station 2: East Rivanna Volunteer Fire Company – 3501 Steamer Drive, Keswick, VA 22947.

Station 2's allocated capital and human resources are provided below.

Table 2: Station 2 – Capital Resources

Number of Apparatus	Apparatus Type
2	Engine
2	Tanker
1	Brush
1	UTV (set up for EMS)
4	Staff Vehicles
1	Ladder (due to get old Seminole Trail Ladder Truck)

Table 3: Station 2 – Human Resources*

*Weekday/Daytime Staffing is Monday-Friday 6am-6pm, excluding major holidays. Weekend/Nighttime Staffing is Monday-Thursday 6pm-6am and Friday 6pm-Monday 6am and all major holidays.

Daylight Staffing	Weekend/Nighttime Staffing
ACFR – 3 Minimum/4 Assigned	Volunteers to staff station

- Fire station built in 1993
- Volunteer Roster = 25-30 Active Personnel
- Men's/Women's bunk rooms (4 each), single officers bunk room
- Shelter site for mass evacuations and can house animals in apparatus bays
- Banquet room

Station 3: North Garden Volunteer Fire Department – 4907 Plan Road, North Garden, VA 22959.

Station 3's allocated capital and human resources are provided below.

Table 4: Station 3 – Capital Resources

# of Apparatus	Apparatus Type
2	Engine
2	Tanker
1	Brush
1	SUV for EMS
2	Staff Vehicles (second on order)
1	Mini-pumper

Table 5: Station 3 – Human Resources*

Daylight Staffing	Weekend/Nighttime Staffing
None, On-call via pager	On-Call, staff onsite 6pm-midnight Friday/Saturday (November through March)

- Volunteer Roster = 24 Active Personnel
- Established in 1970, addition in 1974 and 2000.
- Lack storage
- Banquet room, also serves as an emergency shelter
- Bunk room with two bunk beds

Station 4: Earlysville Volunteer Fire Company – 283 Reas Ford Road, Earlysville, VA 22936

Station 4's allocated capital and human resources are provided below.

Table 6: Station 4 – Capital Resources

Number of Apparatus	Apparatus Type
1	Ambulance
2	Engines
1	Tanker
1	Hazmat (with SCBA compressor)
2	Brush Trucks

Table 7: Station 4 – Human Resources*

Daylight Staffing	Weekend/Nighttime Staffing
ACFR Staff 3 Minimum/4 Assigned	Try to staff station, if not on-call from home.

- Volunteer Roster = 12 Active Personnel
- Built in 1983
- BLS EMS transport, ALS EMS transport from ACFR
- Banquet facility
- 3 bunk rooms (single room, room with 3 beds and room with 5 beds)

Station 5: Crozet Volunteer Fire Department – 5652 Three Notch'd Road, Crozet, VA 22932

Station 5's allocated capital and human resources are provided below.

Table 8: Station 5 – Capital Resources

Number of Apparatus	Apparatus Type
3	Engines
2	Brush
1	Ladder
1	Tanker
1	Van
2	Command Vehicles
1	Utility Vehicle

Table 9: Station 5 – Human Resources*

Daylight Staffing	Weekend/Nighttime Staffing
None, On-call via pager	Su-Fri duty crew in station 6p-6a, provide food for dinner

- Volunteer Roster = 35 Active Personnel, 50 Total (full members, associate members, lifetime members and junior members). Majority of members over 50 years old
- Built in 1985, remodeled in 2009
- Single bunkroom with six beds

Station 6: Stony Point Volunteer Fire Company – 3827 Stony Point Road, Charlottesville, VA 22911

Station 6's allocated capital and human resources are provided below.

Table 10: Station 6 – Capital Resources

Number of Apparatus	Apparatus Type
2	Engines
2	Brush (One 1962 unit)
1	Tanker
2	Utility Vehicles
1	UTV

Table 11: Station 6 – Human Resources*

Daylight Staffing	Weekend/Nighttime Staffing
ACFR Staff 3 Minimum/4 Assigned	Volunteer Duty Crews 4 of 5 nights, 5th night on-call staff respond via pager

- Volunteer roster = 20
- Built in 1974
- 2 bunk rooms (one has 5 beds)
- Outdoor garage has fitness room and storage

Station 7: Scottsville Volunteer Fire Department – 141 Irish Road, Scottsville, VA 24590

Station 7's allocated capital and human resources are provided below.

Table 12: Station 7 – Capital Resources

Number of Apparatus	Apparatus Type
2	Engines
1	Brush
2	Tanker
2	Boats
4	Command Vehicles/SUV's
5	Kayaks
1	Hazmat Trailer

Table 13: Station 7 – Human Resources*

Daylight Staffing	Weekend/Nighttime Staffing
None, On-call via pager	Volunteer Duty Crews Mon-Thurs 6p-10p, other times on-call staff via pager

- Volunteer roster = 35 full members, 50 total (full and associate members)
- Built in 1980's
- Have separate garage for storage, fitness and medical SUV
- Boats and one SUV are stored under carports
- Responsible for water rescue in the southern ½ of the county
- Had sleeping rooms but turned them to offices

Station 8: Seminole Trail Volunteer Fire Department – 3055 Bermakr Drive, Charlottesville, VA 22906.

Station 8's allocated capital and human resources are provided below.

Table 14: Station 8 – Capital Resources

Number of Apparatus	Apparatus Type
3	Engines
1	Ladder
1	Brush
1	Utility Vehicles
4	Command Vehicles/SUV's

Table 15: Station 8 – Human Resources*

Daylight Staffing	Weekend/Nighttime Staffing
ACFR Staff 3 Minimum/4 Assigned	5 Volunteer Duty Crews that rotate

- Volunteer roster = 91 Active members, 40% are UVA students. 40 of the 91 are in their initial training
- Built in 1980, addition in 2012
- 4 bunk rooms with (4 beds each, adding a 5th bed to each), 1 officer's bunkroom
- First respond to ALS calls
- Container training facility onsite
- Volunteers must staff the station at least 108 hours per month

Station 11: Monticello Fire & Rescue Department – 25 Mill Creek Drive, Charlottesville, VA 22902

Station 11's allocated capital and human resources are provided below.

Table 16: Station 11 – Capital Resources

#Number of Apparatus	Apparatus Type
2	Engine (1 reserve)
2	ALS Ambulance (1 reserve)
1	Rescue Squad
1	Tanker
1	Brush

Table 17: Station 11 – Human Resources*

Weekday/Daytime Staffing	Weekend/Nighttime Staffing
ACFR Staff 5 Minimum/6 Assigned	ACFR Staff 5 Minimum/6 Assigned

- Volunteer roster = 8
- Built in 2002
- Bunk room with 8 beds, bunk room with 2 beds, third bunkroom with 1 bed, officer bunk 1 bed

Station 12: Hollymead Fire & Rescue Department – 3575 Innovation Drive, Charlottesville, VA 22902

Station 12's allocated capital and human resources are provided below.

Table 18: Station 12 – Capital Resources

Number of Apparatus	Apparatus Type
1	Engine
2	ALS Ambulances (1 reserve)
1	Ladder
1	Command Vehicle

Table 19: Station 12 – Human Resources*

Weekday/Daytime Staffing	Weekend/Nighttime Staffing
ACFR Staff 6 Minimum	ACFR Staff 6 Minimum

- Volunteer roster = 6
- Built in 2007
- Houses only Battalion Chief 24/7 for ACFR system
- 8 bunk rooms (four single rooms, one two-person, one three-person, two six-person)

Station 15: Ivy Fire Rescue – 640 Kirtley Lane, Charlottesville, VA 22901

Station 15's allocated capital and human resources are provided below.

Table 20: Station 15 – Capital Resources

Number of Apparatus	Apparatus Type
1	Engine
1	ALS Ambulances

Table 21: Station 15 – Human Resources*

Weekday/Daytime Staffing	Weekend/Nighttime Staffing
ACFR Staff 5 Minimum (ALS Ambulance)	ACFR Staff 3 Minimum (Only engine staffed)

- Volunteer roster = 11
- Built in 2013
- ALS Ambulance only staffed during daylight hours
- 3 bunk rooms with 2 bunk beds in each
- No drains in apparatus bay

Rescue Station 1: Charlottesville Albemarle Rescue Squad – 828 McIntire Road, Charlottesville, VA 22902

Rescue Station 1's allocated capital and human resources are provided below.

Table 22: Rescue Station 1 – Capital Resources

Number of Apparatus	Apparatus Type
10	ALS Ambulances
1	Heavy Rescue Truck
1	Extrication Truck
3	Command Vehicles/SUV's

Table 23: Rescue Station 1 – Human Resources*

Weekday/Daytime Staffing	Weekend/Nighttime Staffing
2 Charlottesville Firefighter/Paramedics work with a CARS volunteer to staff two ambulances	2 Charlottesville Firefighter/Paramedics work with a CARS volunteer to staff two ambulances

- Built in 1960
- Weekday/daytime two ambulances are staffed with CARS volunteers and Charlottesville Firefighter/Paramedics
- Coverage area increases weekend/nighttime staffing (i.e. Pantops, etc.)
- Total of 199 volunteers, 70 of them are probationary members. Of the total membership, 11 are able to provide Advanced Life Support (ALS) care

Rescue Station 5: Western Albemarle Rescue Squad – 1257 Crozet Avenue, Crozet, VA 22932

Rescue Station 5's allocated capital and human resources are provided below.

Table 24: Rescue Station 5 – Capital Resources

Number of Apparatus	Apparatus Type
3	Ambulances
1	Heavy Rescue Truck
2	SUV's
1	Pickup Truck
1	Water Rescue Trailer

Table 25: Rescue Station 5 – Human Resources*

Weekday/Daytime Staffing	Weekend/Nighttime Staffing
1-6 personnel	1-6 personnel

- Built in 1960
- Variable staffing based on availability of volunteers
- At least 80 volunteers
- Provide ALS and BLS transport service based on volunteer staff availability
- Have two buildings (old fire stations).
- 3 Bunk Room (two rooms can hold 3 personnel, one single bedroom)

Rescue Station 7: Scottsville Rescue Squad – 805 Irish Road, Scottsville, VA 24590

Rescue Station 7's allocated capital and human resources are provided below.

Table 26: Rescue Station 7 – Capital Resources

Number of Apparatus	Apparatus Type
4	Ambulances
1	Trailer / ATV
3	SUV's

Table 27: Rescue Station 7 – Human Resources*

Weekday/Daytime Staffing	Weekend/Nighttime Staffing
ACFR Staff 2 Minimum	Variable

- Built in 1998
- Variable staffing based on availability of volunteers
- On-call 1 EMT and 1 Driver
- Men's and women's dorm (2 bunk beds each)

Rescue Station 8: 3045 Berkmar Drive, Charlottesville, VA 22906

Rescue Station 8's allocated capital and human resources are provided below.

Table 28: Rescue Station 8 – Capital Resources

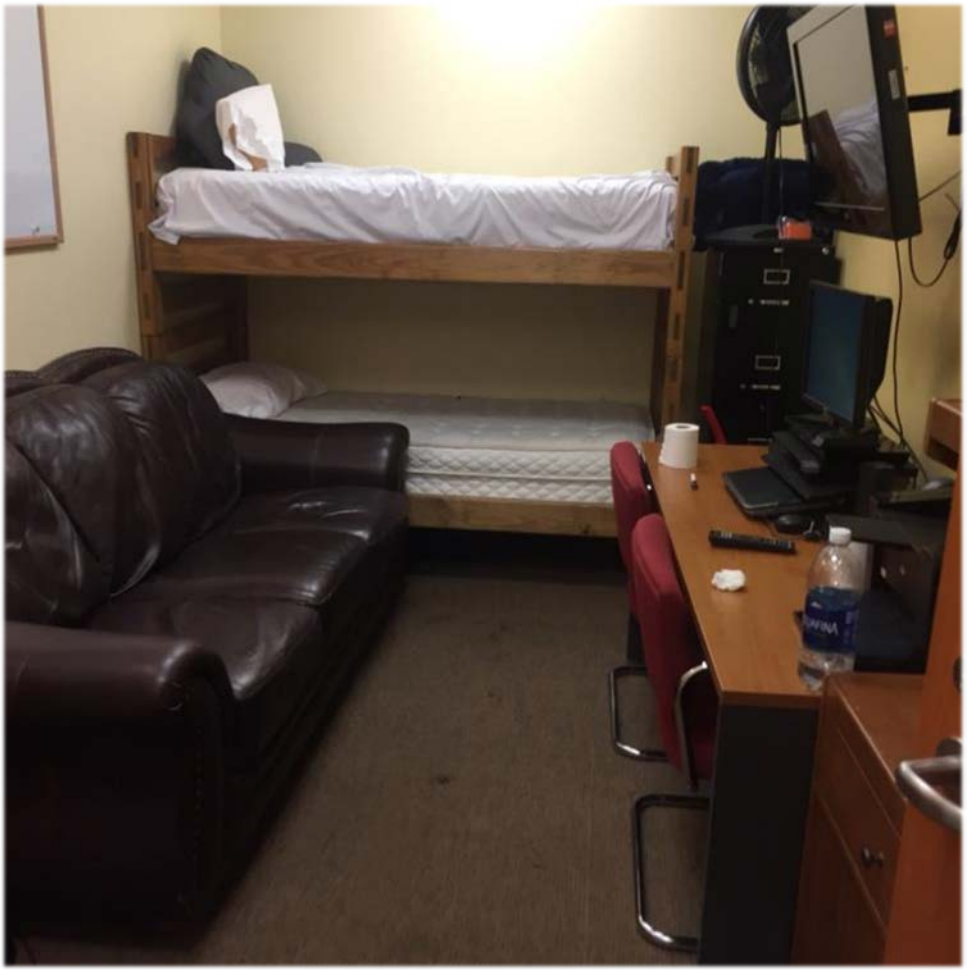
Number of Apparatus	Apparatus Type
2	2 Ambulances (1 Reserve)

Table 29: Rescue Station 8 – Human Resources*

Weekday/Daytime Staffing	Weekend/Nighttime Staffing
ACFR Staff 2 Minimum	ACFR Staff Minimum 2

- Station is currently being remodeled
- Stationed out of Fire Station #8 during remodel

Rescue Station 16: Martha Jefferson Hospital - 500 Martha Jefferson Dr, Charlottesville, VA 22911



Rescue Station 16's allocated capital and human resources are provided below.

Table 30: Rescue Station 16 – Capital Resources

Number of Apparatus	Apparatus Type
1	1 Ambulance

Table 31: Rescue Station 16 – Human Resources*

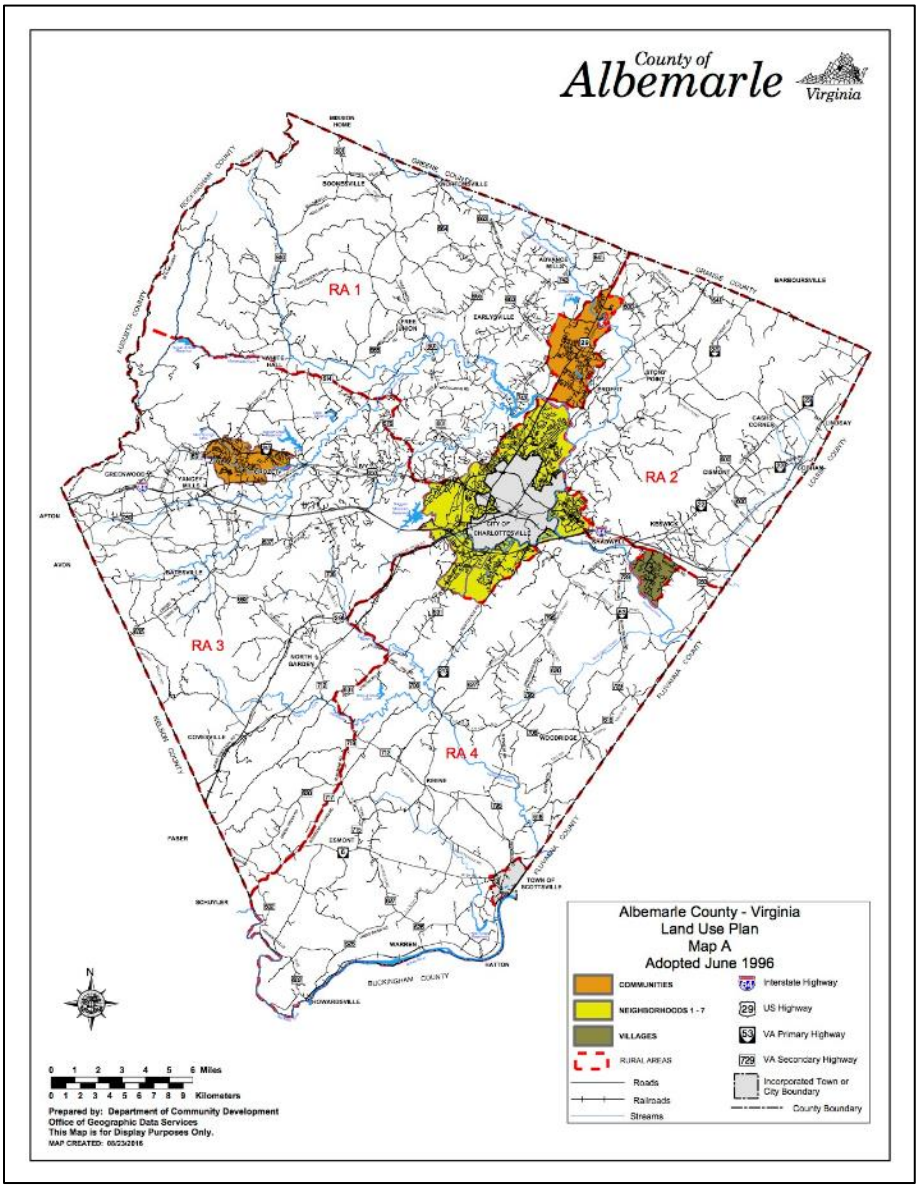
Weekday/Daytime Staffing	Weekend/Nighttime Staffing
ACFR Staff 2 Minimum	None – only staff daylight

- Ambulance is parked next to parking ramp outdoors
- 2-3 minute walk to truck from crew quarters
- Ambulance is stored at East Rivanna when not staffed
- Truck will be based from Pantops station once built
- Room has a microwave and refrigerator

Response Areas

Fire Demand Zones (FDZ) have been identified and are utilized for all planning aspects for managing risk, demand, and performance. The fire and rescue station coverage areas do not directly correlate with the FDZs. There is a distinction between the rural or undeveloped areas and the developed areas, which are encompassed of the neighborhoods, communities and villages. The rural areas and the developed areas have different response and protection expectations. A map of the FDZs is provided below.

Figure 6: Albemarle County Fire Rescue Fire Demand Zones



Apparatus

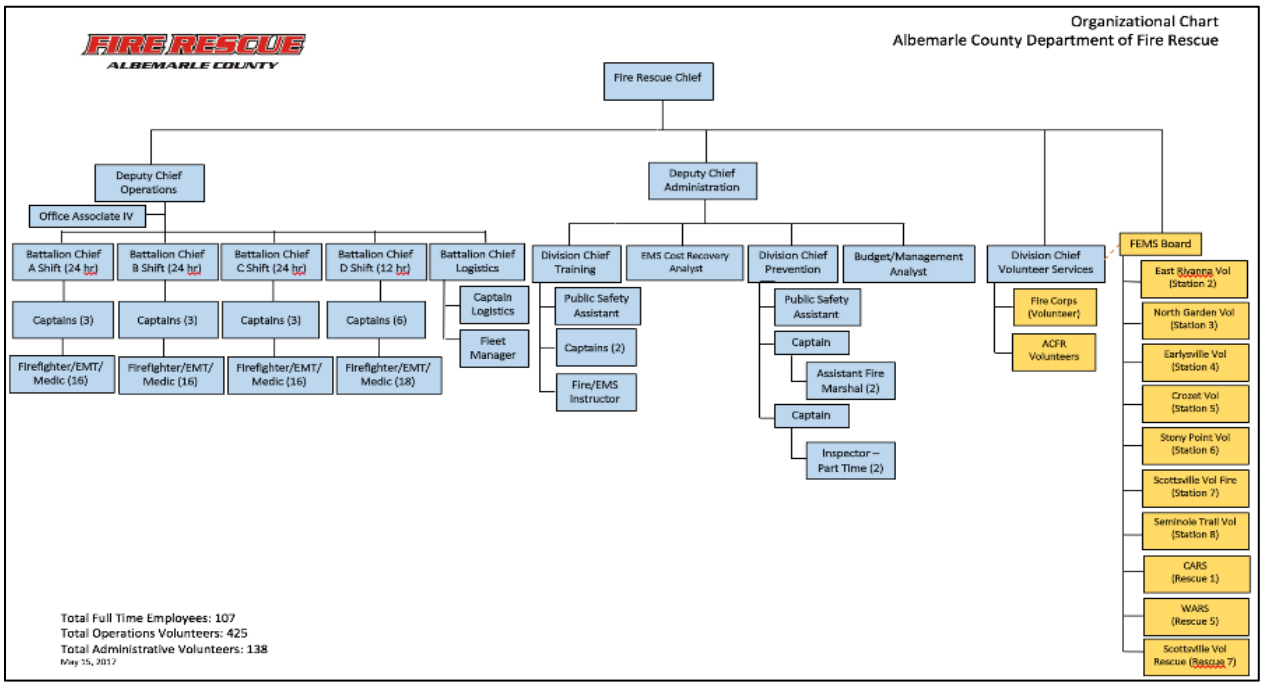
Each of the department's apparatus has been previously presented in the description of the fixed facilities. Notably Albemarle County Fire Rescue has a robust fleet replacement plan and policy that outlines three levels of support for vehicles. The first level of support is full support for a vehicle that is part of the county's replacement plan and the vehicle will be replaced with a like vehicle. Rotated replacement is the second level of support for a vehicle and that level of support allows for the vehicle to be replaced with another vehicle in the fleet when the original vehicle is at the end of its life. The last level is support only and the county provides the insurance, maintenance and fuel for the vehicles. Many of the support only vehicles were purchased by and are owned by the volunteer fire companies or rescue squads.

Current Staffing Strategy

Organizational Structure

The ACFR operates from numerous fixed facilities throughout the county, with its headquarters located on Stagecoach Road, which is a separate facility from any emergency response facility. The headquarters location houses the fire administration which includes the Fire Rescue Chief, Deputy Fire Chiefs, Division Chiefs, administrative support staff, Prevention Division, Training Division, Budget/Management staff, Logistics Battalion Chief and other operational support staff. The following organizational chart below illustrates the general organizational structure of the department.

Figure 7: Albemarle County Fire Rescue Department Organizational Chart



The Department's organizational structure reflects a typical, paramilitary organization. The Fire Administrative Team is comprised of six senior uniformed officers, including the Fire Chief, two Deputy Chiefs and three Division Chiefs. Primary responsibility for the administration and management of the department's budget rests with the Fire Chief. The Deputy Chief – Operations is responsible for delivery of emergency services, which includes most of the staff within ACFR. The Deputy Chief – Administration is responsible for the Training Division, Prevention Division and the budget management. The Division Chief – Volunteer Services is responsible for collaborating with all the fire and rescue stations that have volunteer staff to ensure they are prepared to respond to emergencies, facilitate communication amongst the numerous agencies and address any issues that may arise.

Additionally, there are five (5) Battalion Chiefs, which ensure that the county has at least one command level officer on duty within the county 24 hours per day. Three of the Battalion Chiefs work on a 24 hour rotating shift while the fourth Battalion Chief works daylight hours and the fifth Battalion Chief coordinates the department's logistics but is available to supplement the operational response as needed. Among the line/response personnel, the next level of supervision is 16 Fire Captains, where 12 perform individual station / company supervision on 24 hour shifts and four Fire Captains who work on a daylight schedule in an administrative capacity for the Training Division, Prevention Division and Operations Division.

Administration, Emergency Services and Support Staff

As noted above, the fire administrative team consists of six chief level officers. Each of the three divisions has an administrative assistant (operations, prevention and training). The Deputy Chief – Administration has two analysts that oversee the budget management and EMS cost recovery.

The Training Division is staffed with the Division Chief, Public Safety Assistant (administrative assistant), two Training Fire Captains and one Fire/EMS Instructor. The training division provides initial Firefighter I, EMT and Emergency Vehicle Operations training to all ACFR, volunteer fire company and rescue squad staff*****. The Training Division is also responsible for all of the continuing education of all of the ACFR staff to maintain the required certifications and mandates.

The Prevention Division is staffed with the Division Chief, Public Safety Assistant (administrative assistant), two Fire Captains, two Assistant Fire Marshals and two part-time Fire Inspectors. The staff within the Prevention Division is responsible for the fire investigations, permits, building plan reviews, public education, juvenile fire setter intervention and fire inspections within the county with exception of the city of Charlottesville.

*****Western Albemarle Rescue Squad provides their own initial training that is funded from ACFR and is open to other staff within the county.

This overview does not encompass each of the ten - volunteer fire companies and rescue squads within the county. Each of the volunteer fire companies and rescue squads are separate corporations with their own organizational structure and governance.

COMMUNITY RESPONSE HISTORY

Methodology

We utilized two CAD data files provided by Albemarle County Fire Rescue (ACFR) for analyses reflecting unique incidents and unit-level responses during the calendar year from January 1, 2017 to December 31, 2017. We reference two distinct measures in this report—call volume and workload. The number of requests for service are defined as "incidents" or "calls" (i.e., call volume). Call volume reflects the number of times a distinct incident was created involving one or more ACFR units, or calls received in ACFR's jurisdiction. Calls were categorized as Agency Assist, EMS, Fire, Hazmat, Police-Related, Public Service, or Rescue using the "CADCallType" field in the CAD data file. "Responses" are the number of times that an individual unit (or units) responded to a call (i.e., workload).

Audits of the data files were first conducted to identify any anomalies for attention and reconciliation prior to data analysis. Select exclusion criteria were applied prior to the identification of unique incidents to reflect call volume. Exclusion criteria were also applied prior to the identification of unique responses to reflect unit-level workload. All entries with one or more times outside of the logical temporal sequence of events (e.g., reported "AlarmDateTime" was earlier than reported "IncidentDateTime") were excluded. Duplicate entries were also excluded. The application of exclusion criteria for workload and performance time data resulted in slight reductions of call volume across analyses and related tables or figures; these adjusted sample sizes are noted in the report where applicable.

Responses were classified by ACFR based on call status and the role of the responding unit. Call status as emergency or non-emergency was assigned per call type by ACFR and was based on "CADCallType" from the CAD data file. Select units were identified by ACFR as primary front-line units. The majority of analyses related to performance (e.g., travel time) were restricted based on these classifications to include only primary front-line units responding to emergency (lights and sirens) calls and are identified in the report where applicable. Any reduced sample sizes due to missing data are noted in the report where applicable.

Overview of Community Response Performance

During the 2017 reporting period (i.e., January 1, 2017 to December 31, 2017; hereinafter referred to as 2017), ACFR responded to a total of 13,038 requests for service, or incidents (Figure 8; Table 32).

EMS related requests totaled 8,777, accounting for 67.3% of the total call volume, and fire related requests totaled 2,426, accounting for 18.6% of the total call volume. Table 33 presents call volume by community type (i.e., development, rural, or other area).

Classifications of call types from the CAD data file into program and call category are presented in the Appendix to the Data Report.

Figure 8: Percentage of Total Incidents by Program

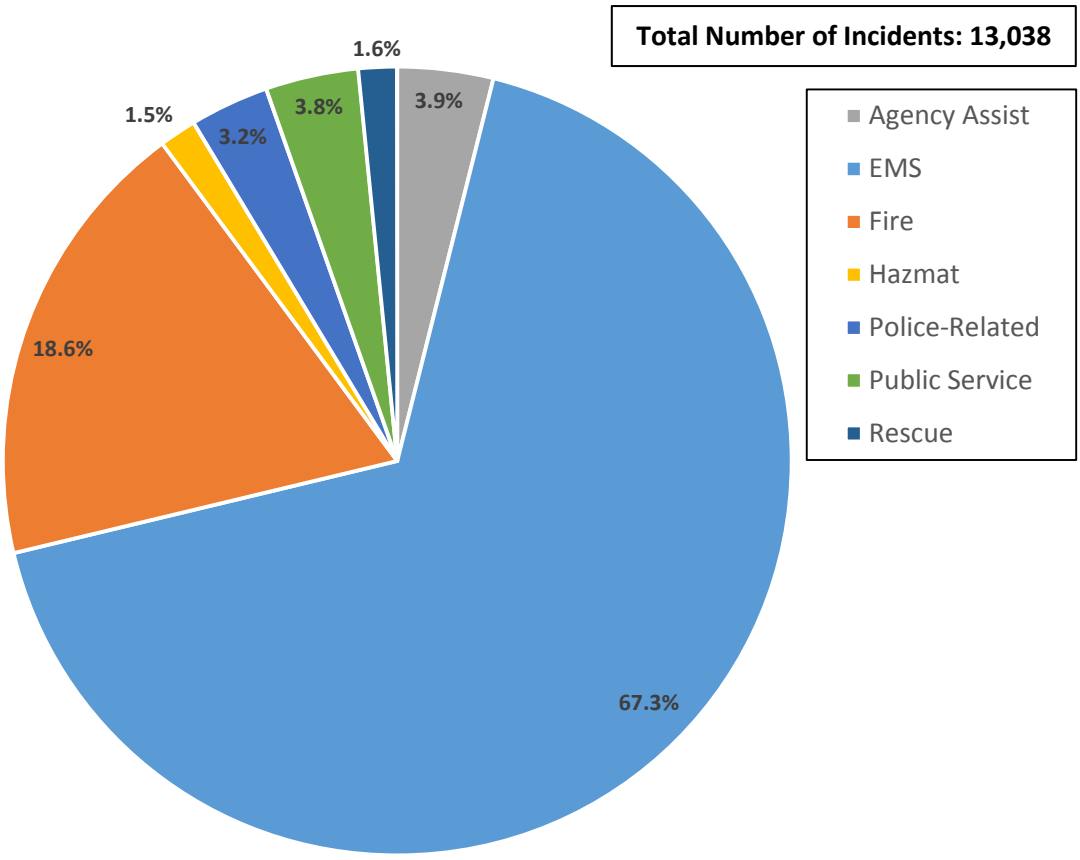


Table 32: Number of Incidents by Program and Call Category

Call Category	Number of Calls	Average Calls per Day	Call Percentage
Agency Assist	**513**	**1.4**	**3.9**
Aircraft Emergency	1	0.0	0.0
Alarm	212	0.6	1.6
Cardiac and Stroke	1,530	4.2	11.7
Difficulty Breathing	,1052	2.9	8.1
Fall and Injury	1,706	4.7	13.1
Illness and Other	2,481	6.8	19.0
MVC	878	2.4	6.7
Obvious Death	4	0.0	0.0
Overdose and Psychiatric	174	0.5	1.3
Seizure and Unconsciousness	702	1.9	5.4
Standby	37	0.1	0.3
EMS Total	**8,777**	**24.0**	**67.3**
Aircraft Emergency	3	0.0	0.0
Alarm	890	2.4	6.8
Elevator Emergency	11	0.0	0.1
Fire Other	404	1.1	3.1
Mutual Aid	40	0.1	0.3
MVC - Fluids Down	315	0.9	2.4
Outside Fire	389	1.1	3.0
Structure Fire	130	0.4	1.0
Structure Fire - Reduced Response	138	0.4	1.1
Vehicle Fire	106	0.3	0.8
Fire Total	**2,426**	**6.6**	**18.6**
Hazmat	**197**	**0.5**	**1.5**
Police-Related	**423**	**1.2**	**3.2**
Public Service	**495**	**1.4**	**3.8**
Mutual Aid	23	0.1	0.2
Rescue	175	0.5	1.3
Water Rescue	9	0.0	0.1
Rescue Total	**207**	**0.6**	**1.6**
Total	**13,038**	**35.7**	**100.0**

Table 33: Number of Incidents by Program, Call Category, and Community Type

	Number of Calls by Community Type[1]			
Call Category	**Development**	**Rural**	**Other**	**Total**
Agency Assist	**296**	**197**	**20**	**513**
Aircraft Emergency	1	0	0	1
Alarm	157	51	4	212
Cardiac and Stroke	1,006	494	30	1,530
Difficulty Breathing	708	328	16	1,052
Fall and Injury	1,189	488	29	1,706
Illness and Other	1,632	797	52	2,481
MVC	398	451	29	878
Obvious Death	3	1	0	4
Overdose and Psychiatric	115	54	5	174
Seizure and Unconsciousness	491	202	9	702
Standby	13	20	4	37
EMS Total	**5,713**	**2,886**	**178**	**8,777**
Aircraft Emergency	3	0	0	3
Alarm	513	369	8	890
Elevator Emergency	9	1	1	11
Fire Other	90	308	6	404
Mutual Aid	6	26	8	40
MVC - Fluids Down	144	154	17	315
Outside Fire	143	238	8	389
Structure Fire	75	42	13	130
Structure Fire - Reduced Response	95	38	5	138
Vehicle Fire	37	64	5	106
Fire Total	**1,115**	**1,240**	**71**	**2,426**
Hazmat	**124**	**61**	**12**	**197**
Police-Related	**221**	**191**	**11**	**423**
Public Service	**362**	**125**	**8**	**495**
Mutual Aid	9	7	7	23
Rescue	44	125	6	175
Water Rescue	1	7	1	9
Rescue Total	**54**	**139**	**14**	**207**
Total	**7,885**	**4,839**	**314**	**13,038**

[1]"CompPlanArea" values in the CAD data file identified as "Development" areas include CROZ, HOLL, N-1, N-2, N-3, N-4, N-5, N-6, N-7, PINE, RIVA, and SVIL; "CompPlanArea" values in the CAD data file identified as "Rural" areas include RA-1, RA-2, RA-3, RA-4; and "CompPlanArea" values in the CAD data file identified as "Other" were noted to be different localities and include Augusta, Buckingham, Charlottesville, CITY, Fluvanna, Greene, Nelson, and Orange.

Combined, all ACFR units made 25,551 responses, and were busy on calls for a total of 15,635.2 hours in 2017 (Table 34). The number of individual unit responses will contribute to understanding total department workload, as 6,808 of 13,012 calls (52.3%) resulted in multiple ACFR units responding.

Table 34: Number of Calls, Number of Responses, and Total Busy Time by Program

Program	Number of Calls[1]	Number of Responses[2]	Average Responses per Call	Responses with Time Data[3]	Total Busy Hours	Average Busy Minutes per Response	Percentage of Total Busy Hours
Agency Assist	513	1,275	2.5	1,266	816.4	38.7	5.2
EMS	8,764	15,550	1.8	15,395	10,827.0	42.2	69.2
Fire	2,416	5,467	2.3	5431	2,379.8	26.3	15.2
Hazmat	197	597	3.0	592	251.3	25.5	1.6
Police-Related	420	914	2.2	906	499.2	33.1	3.2
Public Service	495	698	1.4	693	225.2	19.5	1.4
Rescue	207	1,050	5.1	1036	636.2	36.8	4.1
Total	**13,012**	**25,551**	**2.0**	**25,319**	**15,635.2**	**37.1**	**100.0**

[1]"Number of Calls" reflects an adjusted number of unique incidents to correspond with number of responses following the application of exclusion criteria, as noted in the Appendix, regardless of calculated busy time.
[2]"Number of Responses" reflects the total number of entries in the CAD data file following the application of exclusion criteria, as noted in the Appendix, regardless of calculated busy time.
[3]"Responses with Time Data" reflects the number of responses in the CAD data file with available "AlarmDateTime" values and "InServiceDateTime" values.

This analysis focused on response times and utilized the first arriving units of all distinct incidents from time of unit notification until arrival at the scene, thus excluding the dispatch processing time. Table 35 shows the response time broken out by comp plan area rural or development and the response category of fire or EMS. Both the fire and EMS categories had reasonably similar times for the given comp plan area, an example is the mean (average) response to the rural areas was 10:36 for fire and 11:36 for EMS. This response time consistency between the two response categories demonstrates that the system is relatively balanced. The comp plan goal of 13:00 is being reached by both fire and EMS in the rural areas. While there is a room for modifications to the system in order to meet the development average response time goal of 5:00 for Fire and 4:00 for EMS, defined in the comp plan. The current development area performance is 6:18 for fire and 6:12 for EMS.

Table 35: Average Dispatch, Turnout, Travel, and Response Times by Program and Community Type[1] – First Arriving Units

Program and Community Type	Dispatch Time (Minutes)	Turnout Time (Minutes)	Travel Time (Minutes)	Response Time (Minutes)	Sample Size[2]
Agency Assist	**4.4**	**1.3**	**7.1**	**12.8**	**459**
Development	4.6	1.3	5.1	11.0	268
Rural	4.2	1.3	10.4	15.8	174
Other	3.3	1.2	6.9	11.4	17
EMS	**2.6**	**1.3**	**6.8**	**10.5**	**8,055**
Development	2.5	1.2	5.0	8.7	5,295
Rural	2.6	1.4	10.2	14.0	2,640
Other	3.8	1.4	10.8	15.7	120
Fire	**2.6**	**1.6**	**6.6**	**10.7**	**1,390**
Development	2.3	1.4	4.9	8.5	763
Rural	2.7	1.9	8.7	13.3	597
Other	6.0	1.4	9.0	15.7	30
Hazmat	**4.8**	**1.9**	**6.8**	**13.4**	**162**
Development	4.1	1.6	5.6	11.2	104
Rural	6.5	2.1	8.9	17.6	52
Other	2.5	4.4	9.4	16.3	6
Police-Related	**5.5**	**1.6**	**7.2**	**14.0**	**338**
Development	5.8	1.2	6.3	12.9	175
Rural	5.3	2.1	8.3	15.2	159
Other	3.6	0.4	6.3	9.1	4
Rescue	**3.1**	**1.6**	**8.1**	**12.8**	**185**
Development	3.9	1.3	5.5	10.7	50
Rural	2.7	1.7	9.1	13.4	127
Other	5.6	1.0	9.2	15.8	8
Total	**2.8**	**1.4**	**6.8**	**10.8**	**10,589**
Development	2.7	1.3	5.0	8.9	6,655
Rural	2.9	1.5	9.8	14.1	3,749
Other	4.2	1.5	10.0	15.2	185

[1]"CompPlanArea" values in the CAD data file identified as "Development" areas include CROZ, HOLL, N-1, N-2, N-3, N-4, N-5, N-6, N-7, PINE, RIVA, and SVIL; "CompPlanArea" values in the CAD data file identified as "Rural" areas include RA-1, RA-2, RA-3, RA-4; and "CompPlanArea" values in the CAD data file identified as "Other" were noted to be different localities and include Augusta, Buckingham, Charlottesville, CITY, Fluvanna, Greene, Nelson, and Orange.

[2]Sample sizes depicted represent the total number of first arrivals made by ACFR primary front-line units during 2017 per program following all exclusions as noted in the Appendix; sample sizes corresponding to individual table values may be slightly lower due to missing time data such that the sum of average dispatch, turnout, and travel times may not equal average response time.

There is a significant difference between the mean (average) measure and the 90th percentile measure not only from the times displayed in Table 36 but in the system performance the community experiences. The mean or average measure shows at what interval the department would arrive at 50% of the time. The 90th percentile measure is an industry best practice and 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.

Table 36: 90th Percentile Dispatch, Turnout, Travel, and Response Times by Program and Community Type[1] – First Arriving Units

Program and Community Type	Dispatch Time (Minutes)	Turnout Time (Minutes)	Travel Time (Minutes)	Response Time (Minutes)	Sample Size[2]
Agency Assist	**6.8**	**2.4**	**14.1**	**21.3**	**459**
Development	6.3	2.4	9.1	15.0	268
Rural	7.4	2.3	18.8	25.8	174
Other	8.3	2.2	10.8	23.4	17
EMS	**3.8**	**2.3**	**13.3**	**18.2**	**8,055**
Development	3.5	2.2	8.6	12.7	5,295
Rural	4.3	2.4	17.8	22.1	2,640
Other	8.2	2.9	19.4	24.7	120
Fire	**5.6**	**3.0**	**12.2**	**18.2**	**1,390**
Development	4.4	2.3	8.6	12.7	763
Rural	6.4	5.1	14.5	20.4	597
Other	13.1	3.5	16.0	24.9	30
Hazmat	**8.4**	**4.7**	**12.3**	**20.3**	**162**
Development	8.3	3.0	9.0	15.2	104
Rural	10.3	5.8	17.0	24.4	52
Other	--	--	--	--	6
Police-Related	**9.2**	**2.5**	**12.4**	**21.4**	**338**
Development	9.0	2.2	9.2	17.7	175
Rural	12.3	5.0	15.7	24.2	159
Other	--	--	--	--	4
Rescue	**7.2**	**3.2**	**14.8**	**21.3**	**185**
Development	8.4	2.4	10.9	21.3	50
Rural	5.7	3.7	15.3	20.7	127
Other	--	--	--	--	8
Total	**4.4**	**2.4**	**13.2**	**18.6**	**10,589**
Development	3.9	2.2	8.7	13.0	6,655
Rural	4.9	2.7	17.1	22.0	3,749
Other	9.1	3.1	18.4	24.8	185

[1]"CompPlanArea" values in the CAD data file identified as "Development" areas include CROZ, HOLL, N-1, N-2, N-3, N-4, N-5, N-6, N-7, PINE, RIVA, and SVIL; "CompPlanArea" values in the CAD data file identified as "Rural" areas include RA-1, RA-2, RA-3, RA-4; and "CompPlanArea" values in the CAD data file identified as "Other" were noted to be different localities and include Augusta, Buckingham, Charlottesville, CITY, Fluvanna, Greene, Nelson, and Orange.

[2]Sample sizes depicted represent the total number of first arrivals made by ACFR primary front-line units during 2017 per program following all exclusions as noted in the Appendix; sample sizes corresponding to individual table values may be slightly lower due to missing time data such that the sum of average dispatch, turnout, and travel times may not equal average response time.

First Arriving Unit Response Time by Station Demand Zone

Further analyses were conducted by station demand zone to measure the performance of the first arriving primary front-line units to emergency calls in each demand zone by "FireFirstDue" for fire related calls, by "RescueFirstDueDay" for EMS related calls during the MFDAYLIGHT period, and by "RescueFirstDueNight" for EMS related calls during the WEEKEND/EVENING period, regardless of where the unit is assigned or originated. Performance times are reported at both the average and 90th percentile values.

With respect to turnout time for fire related calls, first arriving primary front-line units responding to calls in the demand zone for fire first due station Stony Point had the lowest average turnout time at 0.9 minutes (1.9 minutes at the 90th percentile; Table 37; Table 38; Figure 9; Figure 10). First arriving primary front-line units responding to calls in the demand zone for fire first due station North Garden had the highest average turnout time at 4.0 minutes (9.3 minutes at the 90th percentile).

With respect to travel time for fire related calls, first arriving primary front-line units responding to calls in the demand zone for fire first due station Seminole had the lowest average travel time at 4.4 minutes (7.5 minutes at the 90th percentile). First arriving primary front-line units responding to calls in the demand zone for fire first due station Scottsville had the highest average travel time at 9.5 minutes (16.3 minutes at the 90th percentile).

Table 37: Fire and Rescue Station Reference

Station Name	Station Number
East Rivanna Volunteer Fire Company	F02
North Garden Volunteer Fire Company	F03
Earlysville Volunteer Fire Company	F04
Crozet Volunteer Fire Department	F05
Stony Point Volunteer Fire Company	F06
Scottsville Volunteer Fire Department	F07
Seminole Trail Volunteer Fire Department	F08
Monticello Fire Station (ACFR)	F11
Hollymead Fire Station (ACFR)	F12
Ivy Fire Station (ACFR)	F15
Charlottesville-Albemarle Rescue Squad	R01
Western Albemarle Rescue Squad	R05
Scottsville Volunteer Rescue Squad	R07
Rescue Station 8	R08
Martha Jefferson Hospital	R16

Table 38: Average First Arrival Performance in Minutes – Fire First Due Station

First Due Station	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size[1]
City	5.8	1.7	7.4	14.3	40
Crozet	4.6	2.3	7.1	14.0	168
Earlysville	2.6	2.0	9.3	13.7	85
East Rivanna	2.6	1.3	8.4	12.2	198
Hollymead	2.1	1.5	6.0	9.5	103
Ivy	4.2	1.3	6.8	12.3	164
Monticello	2.4	1.1	6.5	9.8	196
North Garden	5.6	4.0	8.4	17.9	65
Scottsville	6.1	3.0	9.5	18.3	73
Seminole	2.7	1.3	4.4	8.2	430
Stony Point	2.6	0.9	9.1	12.7	43
Total[2]	**3.3**	**1.6**	**6.7**	**11.5**	**1,574**

[1]Sample sizes depicted represent the total number of first arrivals made by ACFR primary front-line units during 2017 per first due station noted; sample sizes corresponding to individual table values may be slightly lower due to missing time data such that the sum of average dispatch, turnout, and travel times may not equal average response time.

[2]Responses associated with station demand zones Fluvanna (n=1), Greene (n=2), Nelson (n=3), and Not Identified (n=3) are not presented individually in the table, but are included in the total values.

Table 39: 90th Percentile First Arrival Performance in Minutes - Fire First Due Station

First Due Station	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size[1]
City	16.9	2.7	12.2	24.3	40
Crozet	9.0	7.1	12.7	20.3	168
Earlysville	5.8	4.7	16.8	21.6	85
East Rivanna	4.3	2.4	13.4	17.5	198
Hollymead	4.6	2.5	11.5	16.1	103
Ivy	3.4	2.0	11.6	15.6	164
Monticello	3.6	1.8	11.2	16.8	196
North Garden	12.0	9.3	15.7	24.7	65
Scottsville	12.3	9.4	16.3	28.8	73
Seminole	4.7	2.2	7.5	11.6	430
Stony Point	4.5	1.9	17.2	21.4	43
Total[2]	**6.2**	**3.1**	**12.3**	**18.9**	**1,574**

[1]Sample sizes depicted represent the total number of first arrivals made by ACFR primary front-line units during 2017 per first due station noted; sample sizes corresponding to individual table values may be slightly lower due to missing time data.

[2]Responses associated with station demand zones Fluvanna (n=1), Greene (n=2), Nelson (n=3), and Not Identified (n=3) are not presented individually in the table, but are included in the total values.

Figure 9: Average First Arrival Performance in Minutes - Fire First Due Station

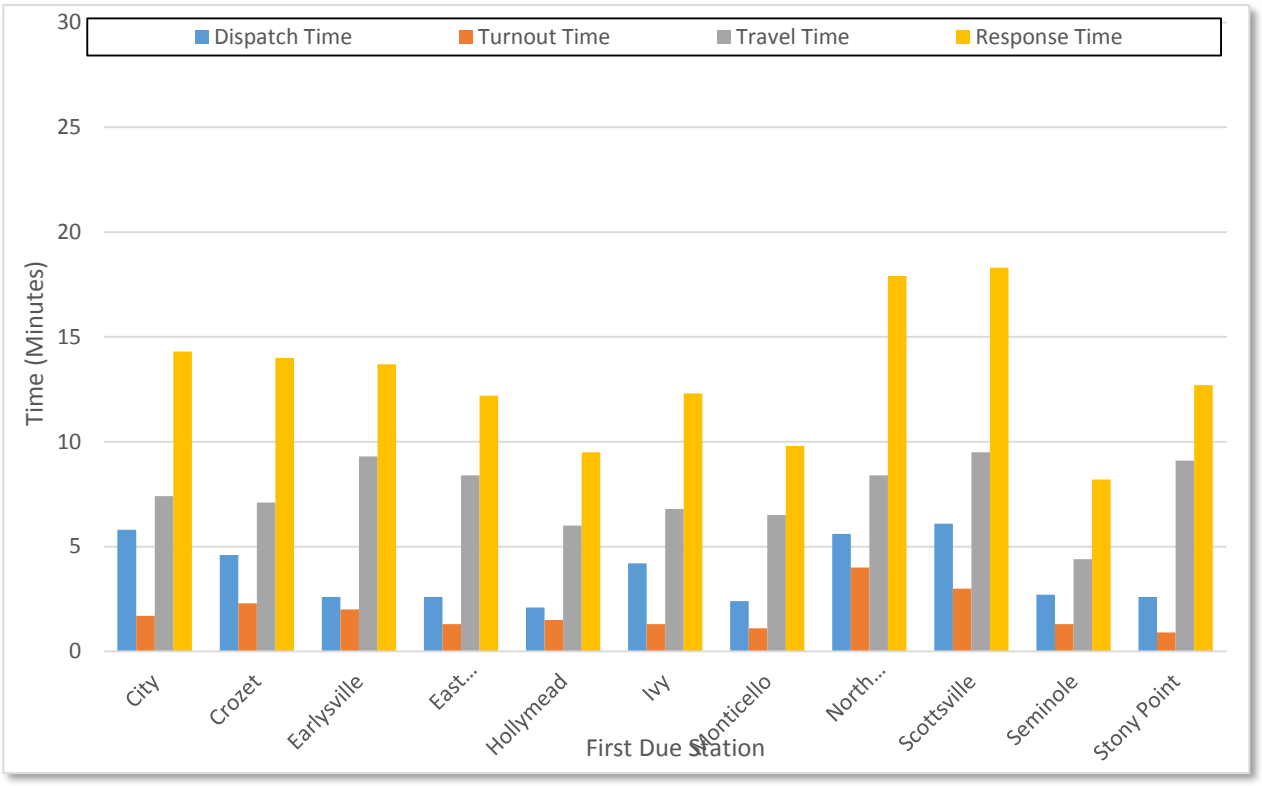
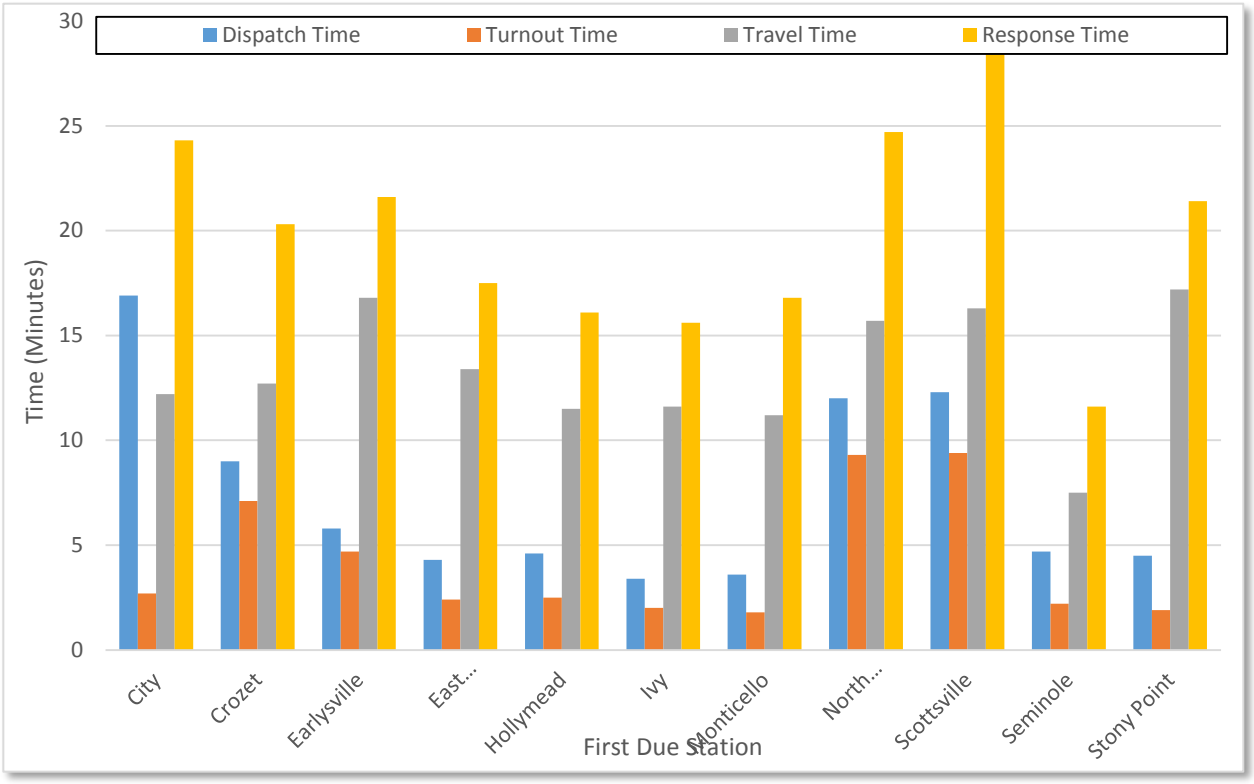


Figure 10: 90th Percentile First Arrival Performance in Minutes - Fire First Due Station



With respect to turnout time for EMS related calls during the MFDAYLIGHT period, first arriving primary front-line units responding to calls in the demand zone for rescue day first due station Monticello had the lowest average turnout time at 0.9 minutes (1.4 minutes at the 90th percentile; Table 40; Table 41; Figure 11; Figure 12). First arriving primary front-line units responding to calls in the demand zone for rescue day first due station Earlysville had the highest average turnout time at 1.4 minutes (2.0 minutes at the 90th percentile).

With respect to travel time for EMS related calls during the MFDAYLIGHT period, first arriving primary front-line units responding to calls in the demand zone for rescue day first due stations Hollymead and Seminole had the lowest average travel time at 5.0 minutes (8.0 minutes at the 90th percentile for Hollymead and 8.5 minutes at the 90th percentile for Seminole). First arriving primary front-line units responding to calls in the demand zone for rescue day first due station SVRS had the highest average travel time at 12.7 minutes (22.0 minutes at the 90th percentile).

Table 40: Average First Arrival Performance in Minutes – EMS MFDAYLIGHT First Due Station

First Due Station	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size[1]
Earlysville	3.3	1.4	11.3	15.8	131
Hollymead	3.0	1.1	5.0	9.0	443
Ivy	2.4	1.2	7.5	11.1	382
Monticello	2.5	0.9	6.3	9.7	469
Pantops	2.0	1.0	6.9	9.8	892
Seminole	2.4	1.1	5.0	8.5	1,314
SVRS	3.0	1.1	12.7	16.2	325
WARS	3.1	1.2	6.6	10.7	611
Total[2]	**2.6**	**1.1**	**6.7**	**10.2**	**4,605**

[1]Sample sizes depicted represent the total number of first arrivals made by ACFR primary front-line units during 2017 per first due station noted; sample sizes corresponding to individual table values may be slightly lower due to missing time data such that the sum of average dispatch, turnout, and travel times may not equal average response time.

[2]Responses associated with station demand zones Buckingham (n=8), CARS (n=14), Fluvanna (n=2), Greene (n=1), Nelson (n=1), and Not Identified (n=12) are not presented individually in the table, but are included in the total values.

Table 41: 90th Percentile First Arrival Performance in Minutes - EMS MFDAYLIGHT First Due Station

First Due Station	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size[1]
Earlysville	3.6	2.0	20.5	25.7	131
Hollymead	4.0	1.8	8.0	13.5	443
Ivy	3.6	1.8	14.5	17.3	382
Monticello	3.2	1.4	12.8	17.8	469
Pantops	3.0	1.9	11.9	15.5	892
Seminole	3.5	1.8	8.5	12.0	1,314
SVRS	4.6	1.8	22.0	26.2	325
WARS	5.5	2.3	13.8	19.8	611
Total[2]	**3.8**	**1.9**	**12.6**	**17.5**	**4,605**

[1]Sample sizes depicted represent the total number of first arrivals made by ACFR primary front-line units during 2017 per first due station noted; sample sizes corresponding to individual table values may be slightly lower due to missing time data.

[2]Responses associated with station demand zones Buckingham (n=8), CARS (n=14), Fluvanna (n=2), Greene (n=1), Nelson (n=1), and Not Identified (n=12) are not presented individually in the table, but are included in the total values.

Figure 11: Average First Arrival Performance in Minutes - EMS MFDAYLIGHT First Due Station

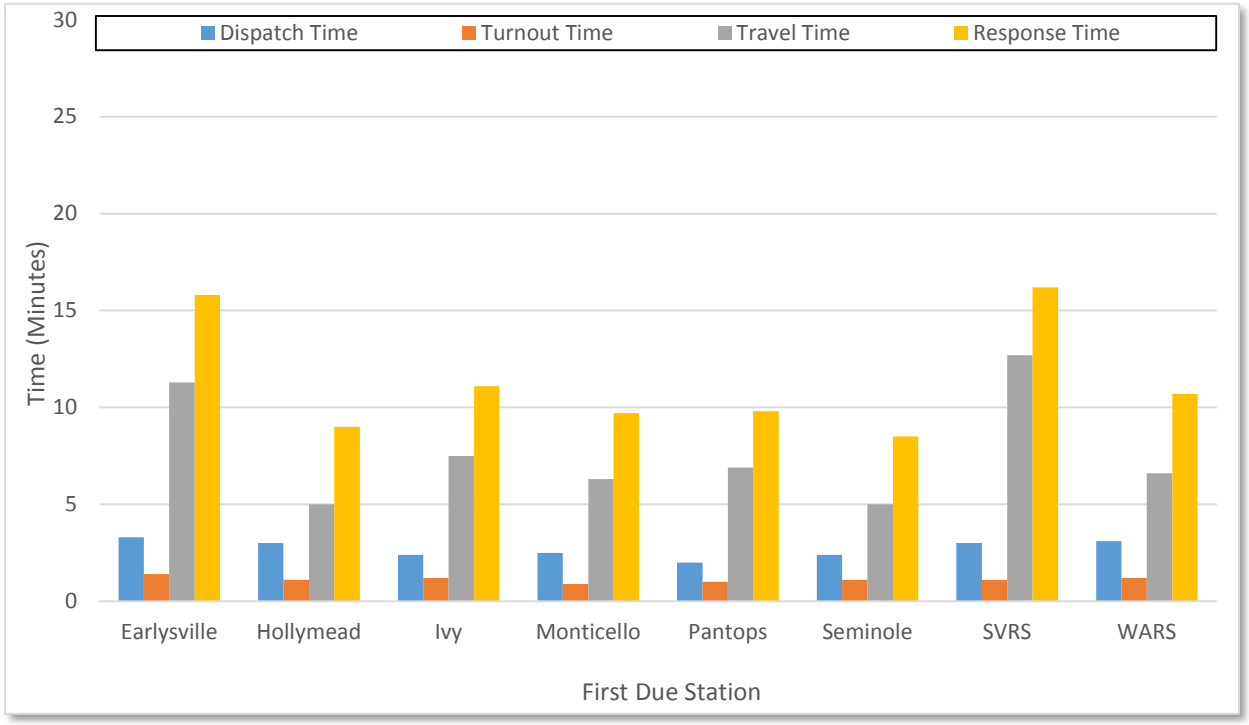
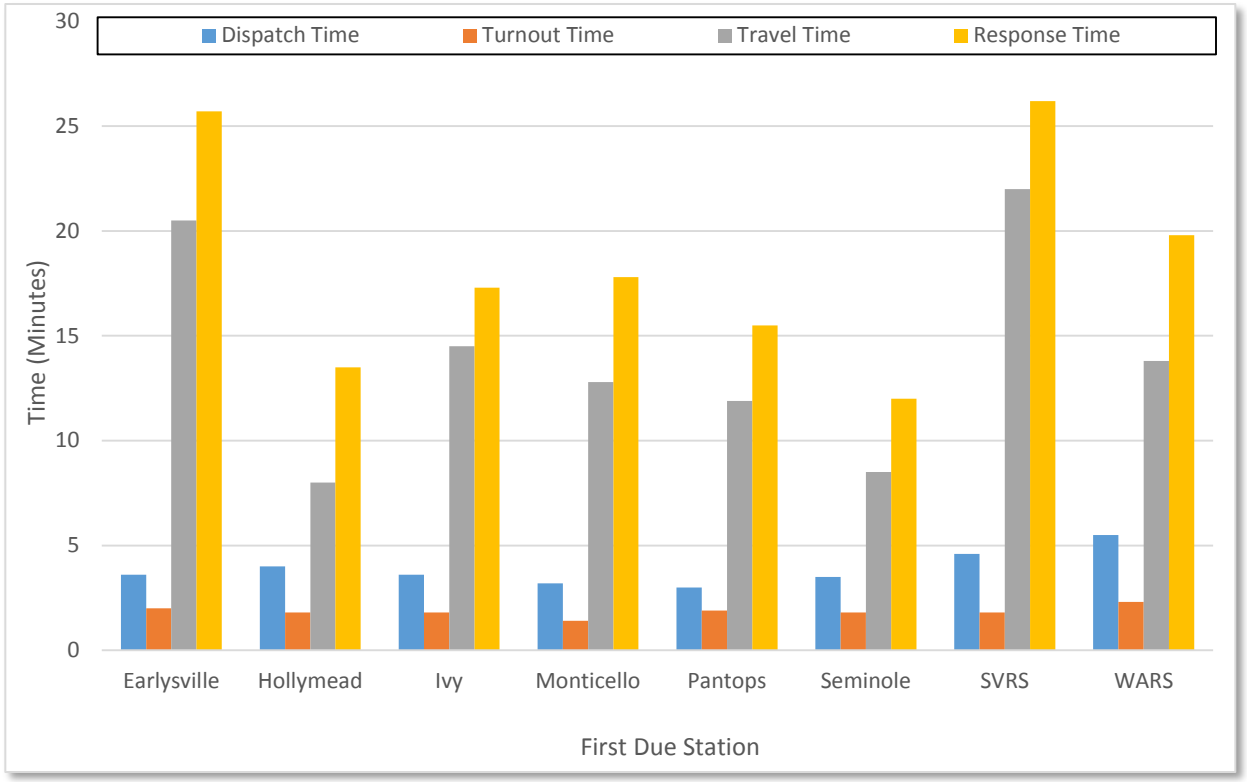


Figure 12: 90th Percentile First Arrival Performance in Minutes - EMS MFDAYLIGHT First Due Station



With respect to turnout time for EMS related calls during the WEEKEND/EVENING period, first arriving primary front-line units responding to calls in the demand zone for rescue night first due station Monticello had the lowest average turnout time at 1.1 minutes (1.9 minutes at the 90th percentile; Table 42 Table 43; Figure 13; Figure 14). First arriving primary front-line units responding to calls in the demand zone for rescue night first due station SVRS had the highest average turnout time at 2.0 minutes (3.6 minutes at the 90th percentile).

With respect to travel time for EMS related calls during the WEEKEND/EVENING period, first arriving primary front-line units responding to calls in the demand zone for rescue night first due station Seminole had the lowest average travel time at 4.9 minutes (7.9 minutes at the 90th percentile). First arriving primary front-line units responding to calls in the demand zone for rescue night first due station SVRS had the highest average travel time at 11.9 minutes (21.9 minutes at the 90th percentile).

Table 42: Average First Arrival Performance in Minutes – EMS WEEKEND/EVENING First Due Station

First Due Station	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size[1]
CARS	3.4	1.6	7.8	12.7	670
Hollymead	2.8	1.4	7.2	11.4	586
Monticello	2.5	1.1	7.3	10.9	573
Seminole	2.5	1.5	4.9	8.8	1,272
SVRS	3.5	2.0	11.9	16.9	460
WARS	2.7	1.5	6.7	10.7	814
Total[2]	**2.8**	**1.5**	**7.0**	**11.2**	**4,410**

[1]Sample sizes depicted represent the total number of first arrivals made by ACFR primary front-line units during 2017 per first due station noted; sample sizes corresponding to individual table values may be slightly lower due to missing time data such that the sum of average dispatch, turnout, and travel times may not equal average response time.
[2]Responses associated with station demand zones Buckingham (n=14), Fluvanna (n=2), Greene (n=1), and Not Identified (n=17) are not presented individually in the table, but are included in the total values.

Table 43: 90th Percentile First Arrival Performance in Minutes - EMS WEEKEND/EVENING First Due Station

First Due Station	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size[1]
CARS	5.0	2.7	13.9	20.1	670
Hollymead	4.0	2.3	13.7	19.2	586
Monticello	3.6	1.9	14.5	18.6	573
Seminole	3.7	2.6	7.9	13.0	1,272
SVRS	7.7	3.6	21.9	27.5	460
WARS	4.8	2.6	13.3	18.4	814
Total[2]	**4.4**	**2.6**	**13.9**	**19.5**	**4,410**

[1]Sample sizes depicted represent the total number of first arrivals made by ACFR primary front-line units during 2017 per first due station noted; sample sizes corresponding to individual table values may be slightly lower due to missing time data.
[2]Responses associated with station demand zones Buckingham (n=14), Fluvanna (n=2), Greene (n=1), and Not Identified (n=17) are not presented individually in the table, but are included in the total values.

Figure 13: Average First Arrival Performance in Minutes - EMS WEEKEND/EVENING First Due Station

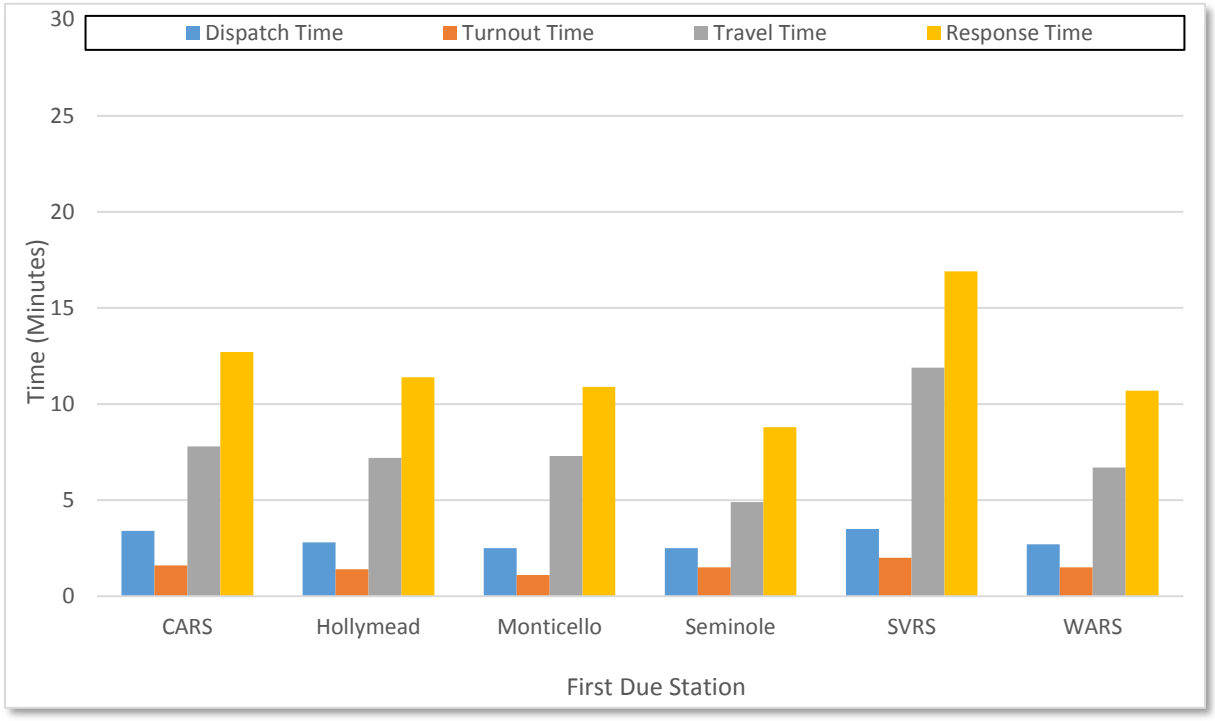
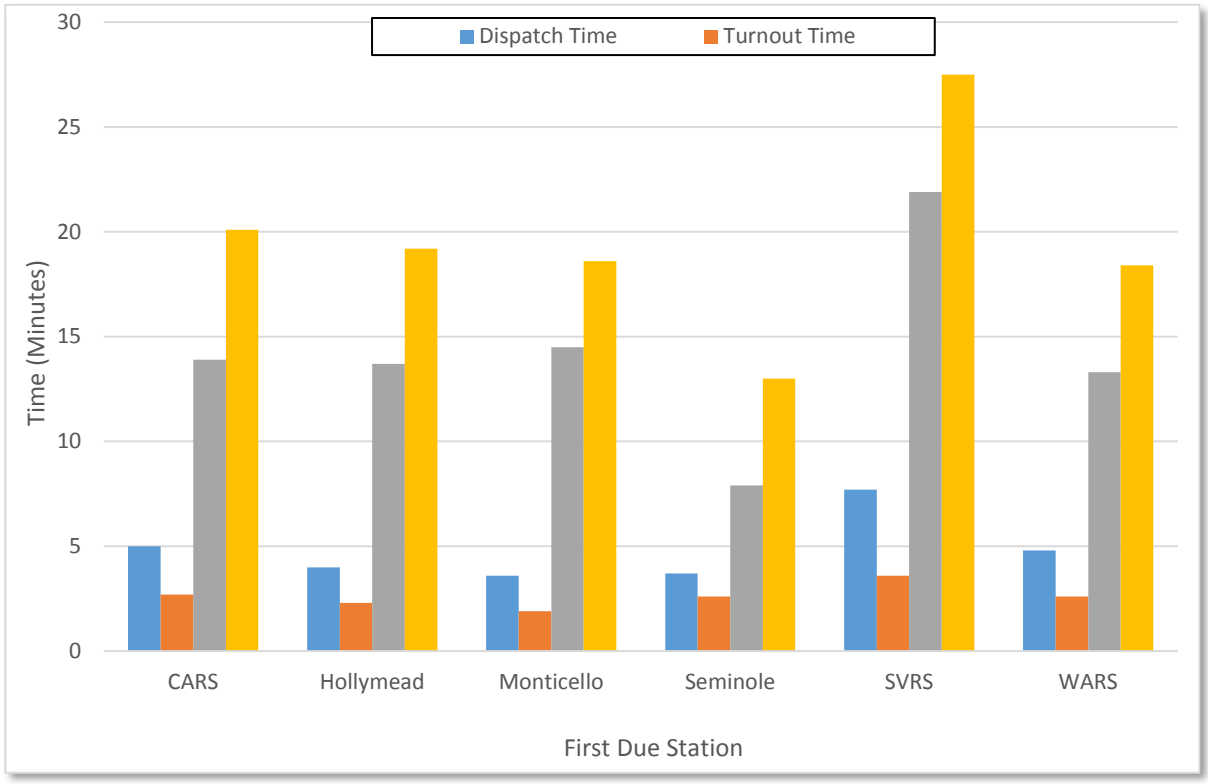


Figure 14: 90th Percentile First Arrival Performance in Minutes - EMS WEEKEND/EVENING First Due Station



COMMUNITY EXPECTATIONS & PERFORMANCE GOALS

Stakeholder Input Process

ACFR has not yet held community focus groups or outreach meetings to determine community expectations of the department. While expectations may vary between the highly dense response areas and less dense rural areas, the community forums can assist with public education of the services currently being provided and provide citizens to express the level of services desired and/or needed in their communities. This would be especially important in the more highly populated development areas. While stakeholder focus group meetings have not been held, the elected officials have weighed in through the comprehensive plan that outlines rural and developed response time expectations both fire and EMS responses.

Community Expectations

A recommended process that could be utilized by the department to evaluate community expectations would be through structured interviews and interaction with chief officers, county staff, key community stakeholders and line personnel. The representativeness of the organizational structure and continuous community interactions will be helpful in contributing to the assessment of community expectations. Currently the community expectations are set through the county's comprehensive plan based and the two sets of expectations based on two classifications of area rural and developed. Meeting with stakeholders may ensure the ACFR system is meeting the community's expectations as outlined or whether the department's performance needs to be adjusted.

Guiding Principles and Internal Performance Expectations and Goals20F[21]

Mission

We will provide the highest quality services to protect and preserve the lives, property, and environment of our community.

Vision

Albemarle County will be home to the model volunteer-career fire and emergency medical services system.

Values

- Integrity
- Innovation

[21] Retrieved from ACFR Vision Document at http://www.albemarle.org/upload/images/forms_center/departments/Fire_and_Rescue/forms/Organizational_Direction.pdf

- Stewardship
- Learning

Strategic Direction

- Develop a unified combination emergency service system at the operations level.
- Deliver services that are consistent with our customer's expectations.
- Further develop and support our volunteer and career personnel.
- Recruit and retain quality volunteer and career personnel.

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 Albemarle County. 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 Department to consider alternative solutions to assist in the mitigation of risks.

Service areas that either had little quantitative data, or did not require that level of analysis, were evaluated through both retrospective analysis as well as structured interviews with Department staff members. In an effort to improve clarity, the following terminology is used for the remainder of the risk assessment description and analyses: retrospective risk will use the term Community Service Demands and prospective risk will use the term Community Risks.

The overall community risk assessment process and methods utilized by ACFR is presented below.[22]

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

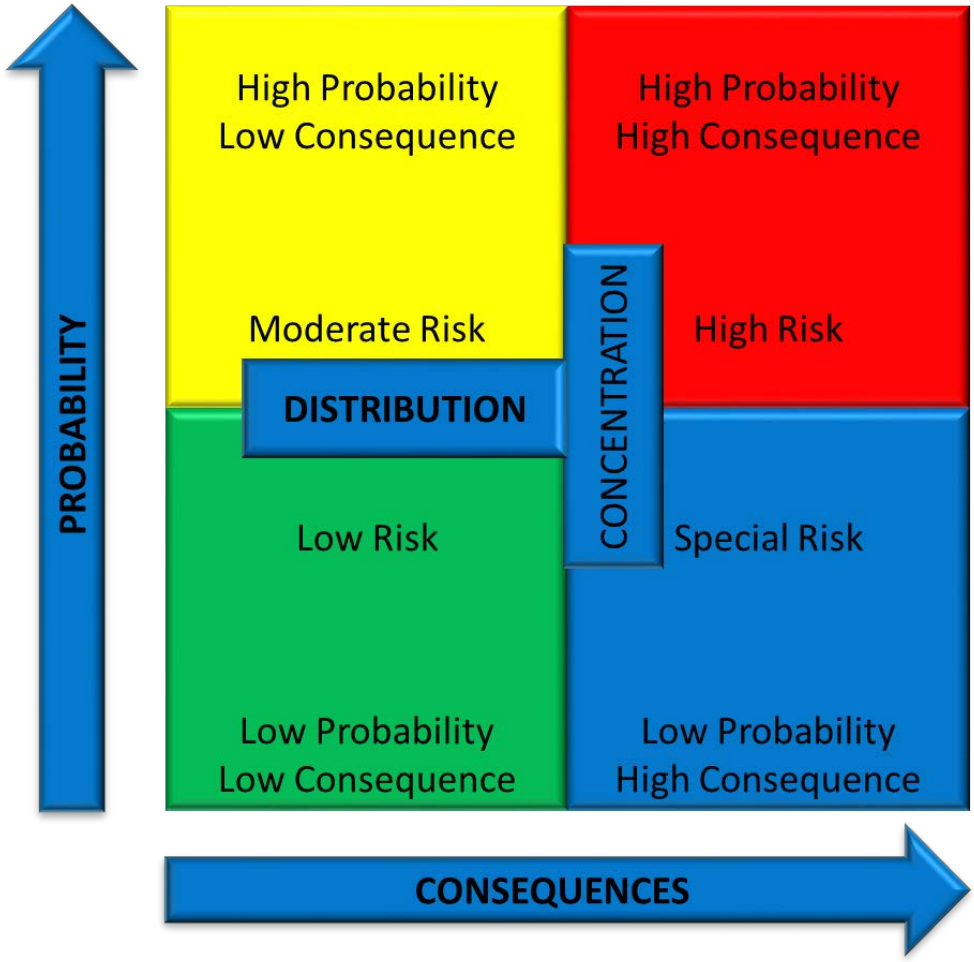
Figure 15: Community Risk Assessment Process

Community service demands were analyzed by the incident history, type, locations, and incident frequencies. Within this process a temporal analysis was completed for each major program area and evaluated by station demand zone and the frequency of incidents. Community risks were evaluated by each program area and risks are identified in each demand zone.

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 below.[23]

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

Figure 16: Probability and Consequence Matrix



Planning Areas/Zones

The Department utilizes the existing station demand zones and/or Districts for their planning efforts. The station demand zones are based on the response geography for each station and do not necessarily align with the County's comprehensive plan that calls for a distinction in the baseline response between the developed and rural areas. An example of this is in Crozet where both the volunteer fire and rescue departments respond to the developed area within Crozet as well as out to the very rural areas outside of Crozet. The available information from the Computer Aided Dispatch system (CAD) was organized by station demand zone. Therefore, the station demand zones have been primarily used to analyze their performance within this report except where specifically noted. The station demand zones 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 demand zone's specific and unique risks.

Additional analyses per fire demand zone are presented under the heading "Comparison of Demand Zones."

Community Characteristics of Risk23F[24]

Geographic and Weather-Related Risks

1. Flooding
   - *Highest relative risk and impact for Albemarle County.*
   - *Usually caused by excessive precipitation, which can create flash flooding situations.*
   - *James River corridors and the western edges of the county along the Blue Ridge Mountains are at the greatest risk.*
   - *"Scottsville, Howardsville and Sugar Hollow have experienced frequent flooding." Scottsville has a levee that protects the city from the frequent flooding it once experienced.*
   - *These events are usually long-term and most last several days.*
2. Winter Storms
   - *Highly likely to occur in Albemarle County.*
   - *Marked by any combination of snow, ice and extremely cold temperatures.*
   - *"Nor'easters" cause the most significant impact.*
   - *Exact track of storm can be unpredictable and grow rapidly.*
   - *Albemarle County has experienced 49 days between 2010-2016 with winter weather, 14 of those days are considered winter storms by NOAA[25].*
3. Hurricanes
   - *Not as frequent of occurrence as winter storms or flooding.*
   - *Can create hazards such as tornados, high winds, flooding, and landslides.*
   - *Can be "Nor'easters" storm creating inland effects.*

4. High Wind/Windstorms
   - *Can be accompanied by thunderstorms, hurricanes, tornadoes and microburst.*
   - *Microbursts are a significant aviation concern.*
   - *Usually cause property and infrastructure damage.*
5. Wildfire
   - *"80 percent of forest fires are started by negligent human behavior"[26]*
   - *Probability is primarily based on weather conditions and human behaviors.*
   - *Albemarle County has wildland-urban interface where development meets unoccupied or natural land.*

[24] Thomas Jefferson Planning District Commission. (2012). *Region Hazard Mitigation Plan*. Retrieved from http://www.albemarle.org/upload/images/Forms_Center/Departments/Community_Development/Forms/Comp_Plan_Round_4/ComprehensivePlanLinks/HazardMitigationPlan2012Final.pdf
[25] NOAA National Center for Environmental Information. Retrieved from https://www.ncdc.noaa.gov/stormevents/
[26] IBID

- *Most of these fires are contained and extinguished quickly creating little property loss or human impact. The largest impact is timber or crop damage.*

6. Lightning
   - Likely to occur in Albemarle County
   - Can start wildfires in under certain conditions
   - Produced through thunderstorms
   - "Lightning continues to be one of the top three storm-related killers in the United States"[27]
7. Tornadoes
   - *Unlikely to occur in Albemarle County but if a tornado occurs it has the potential to impact life, property and business.*
   - *"Natures most violent storms" and winds that can get upwards of 300MPH.*[28]
   - *The path of damage can be more than one mile wide and 50 miles long*[29]
   - *The state averages seven tornados per year.*
   - *Albemarle has recorded 11 tornados, 11 deaths, 4 injuries and $750,000 of documented property loss attributed to tornados since 1959.*
8. Drought
   - *Moderately likely to occur in Albemarle County.*
   - *Largest effect is on property and businesses.*
   - *Characterized by long periods of time with little rainfall. Can be exacerbated by high temperatures, high winds and low humidity.*
   - *Increases probability of wildfire.*
9. Extreme Heat
   - *Moderately likely to occur in Albemarle County.*
   - *Illustrated by high temperatures and high humidity.*
   - *Greatest impact is on humans as the heat and humidity impact the ability to maintain a normal temperature within the body.*
   - *High-risk populations include elderly, young and those with respiratory difficulties.*[30]
10. Dam Failure
    - *Unlikely to occur but has significant human impact and moderate property and business impact if it were to occur.*
    - *Albemarle County has seven high-risk dams according to the Hazard Mitigation Plan, which is more than any other county in the Thomas Jefferson Planning District.*[31]
    - *Sugar Hollow and South Fork Rivanna Dams would also fail into either developed or developing areas of the County.*
11. Landslides
    - *Most likely to occur on the western portion of the County.*[32]

[27] Department of Homeland Security https://www.ready.gov/thunderstorms-lightning
[28] IBID
[29] IBID
[30] IBID
[31] IBID

- *Can occur quickly with little to no notice.*
- *Can be produced by both natural and human causes.*
- *Landslides and mudslides are caused by one or a combination of changes in slope of the terrain, increased load on the land, shocks and vibrations, changes in water content, groundwater movement, frost action, weathering, and changes in vegetation.*

12. Earthquake
    - *Low to moderate likelihood in Albemarle County.*
    - *"Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking."*[33]
    - *Last earthquake in the region was in Louisa County in 2011. The state has had over 160 earthquakes documented since 1977; most of these are not felt.*
13. Extreme Cold
    - *Low probability in Albemarle County.*
    - *Characterized by very low temperatures which can be exacerbated by high wind and low wind chills.*
    - *High-risk populations include elderly, young, chronically ill and those without shelter.*
14. Fire
    - *The principal structural fire threats for the County stems from the built environment, both commercial and residential occupancies.*
15. Hazardous Materials
    - *The County faces potential risks of hazardous materials incidents, both fixed site and transportation related.*
    - *However, low frequency of historical events.*
    - *Ground transportation via highway and railway network*
16. Pandemics
    - *The nature and extent of this threat contains no significant documentation.*

The overall hazard risk assessment for the Thomas Jefferson Planning District which Albemarle County is part of is provided below.

[32] IBID
[33] IBID

Figure 17: Hazard Identification and Analysis/Vulnerability Assessment[34]

	PROBABILITY 2011	HUMAN IMPACT 2011	PROPERTY IMPACT 2011	BUSINESS IMPACT 2011	RISK 2011
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interruption of services*	*Relative threat (increases with Percentage)*
EVENT	0 = N/A 1 = Low 2 = Low-Moderate 3 = Moderate 4= Hi-Moderate 5=High	0 = N/A 1 = Low 2 = Moderate 3 = High			0 - 100%
Flooding	5	3	3	2	89%
Winter Storms	5	2	2	2	67%
Hurricanes	3	2	2	2	40%
High Wind / Windstorms	3	2	2	1	33%
Wildfire	3	1	2	1	27%
Lightning	4	1	1	1	27%
Tornadoes	2	2	2	2	27%
Drought	3	0	2	2	27%
Extreme Heat	3	2	0	1	20%
Dam Failure	1	3	3	2	18%
Landslides	2	1	1	1	13%
Earthquake	2	1	1	1	13%
Extreme Cold	1	2	1	1	9%
AVERAGE SCORE	2.64	1.57	1.57	1.36	26%

Risk = Probability * Severity

Risk	Probability	Severity
.26	.53	.50

Prospective Fire Risk Analysis

Insurance Services Office, Inc.

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.

[34] Ibid.

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.

ISO provides services throughout the United States and a number of other nations; however, domestically Hawaii, Idaho, Louisiana, Mississippi, and Washington have rating agencies in their respective states and do not formally participate with the ISO system of rating risk.

Transportation Risks

Aviation

The Charlottesville Albemarle Airport is located 8 miles north of the City of Charlottesville and 1 mile west of Route 29. In 1984, amended in 2003, under law in the Commonwealth of Virginia, the airport was created as an independent political subdivision.[35] The airport has a 60,000 square foot terminal, general aviation facilities, and air charter firms occupy the airport. Military aircraft also use the airport. A single 6,801 foot runway serves the airport.[36] The airport recorded 67,005 flights in 2016 according to the FAA.[37] The largest category of flights are considered general aviation accounting for 24,510 flights. The commercial airline service is provided by three commercial carriers to six airports ranging from Chicago to Atlanta.

The airport public safety officers also provide the Federal Aviation Administration (FAA) Aircraft Rescue and Fire Fighting (ARFF) staffing and equipment for air carrier commercial passenger operations identified in the FAA – Part 139 regulations. ACFR works collaboratively with the Charlottesville Albemarle Airport Public Safety Officers, as ACFR would be called for mutual aid if there were a significant incident at the airport.

Railroad

There are three rail lines within Albemarle County. Two of the lines are owned by CSX and the third is owned by Norfolk Southern.[38] Two of the lines also are used by Amtrak with a stop in Charlottesville. Amtrak operates three passenger trains daily. [39] One of the CSX lines is leased to a regional rail operator, Buckingham Branch Short Line rail services.

[35] Accessed online at http://www.gocho.com/content/uploads/2014/05/Charlottesville-Albemarle-Airport-CAFR-2016-1.pdf
[36] Accessed online at http://www.gocho.com/about-cho/overview/
[37] Accessed online at https://aspm.faa.gov/opsnet/sys/opsnet-server-x.asp
[38] Accessed online at http://www.drpt.virginia.gov/media/1133/final_rail-map-aug2012afor_wall_prints.pdf
[39] Accessed online at http://www.albemarle.org/navpages.asp?info=business16

The freight cargos are diverse, many originating from or destined to seaports and beyond. The exact volume of hazardous materials rail shipments is elusive because of railroad security concerns. ACFR staff can receive a confidential analysis of hazards by rail that includes the type and volume of hazardous materials transported through Albemarle County by requesting the report from the railroads.

Highway

Significant road infrastructure, including highways and interstates, provide access for the population of Albemarle County and Charlottesville. Therefore, the inherent risk of motor vehicle accidents, vehicle fires, and hazardous materials releases exist.

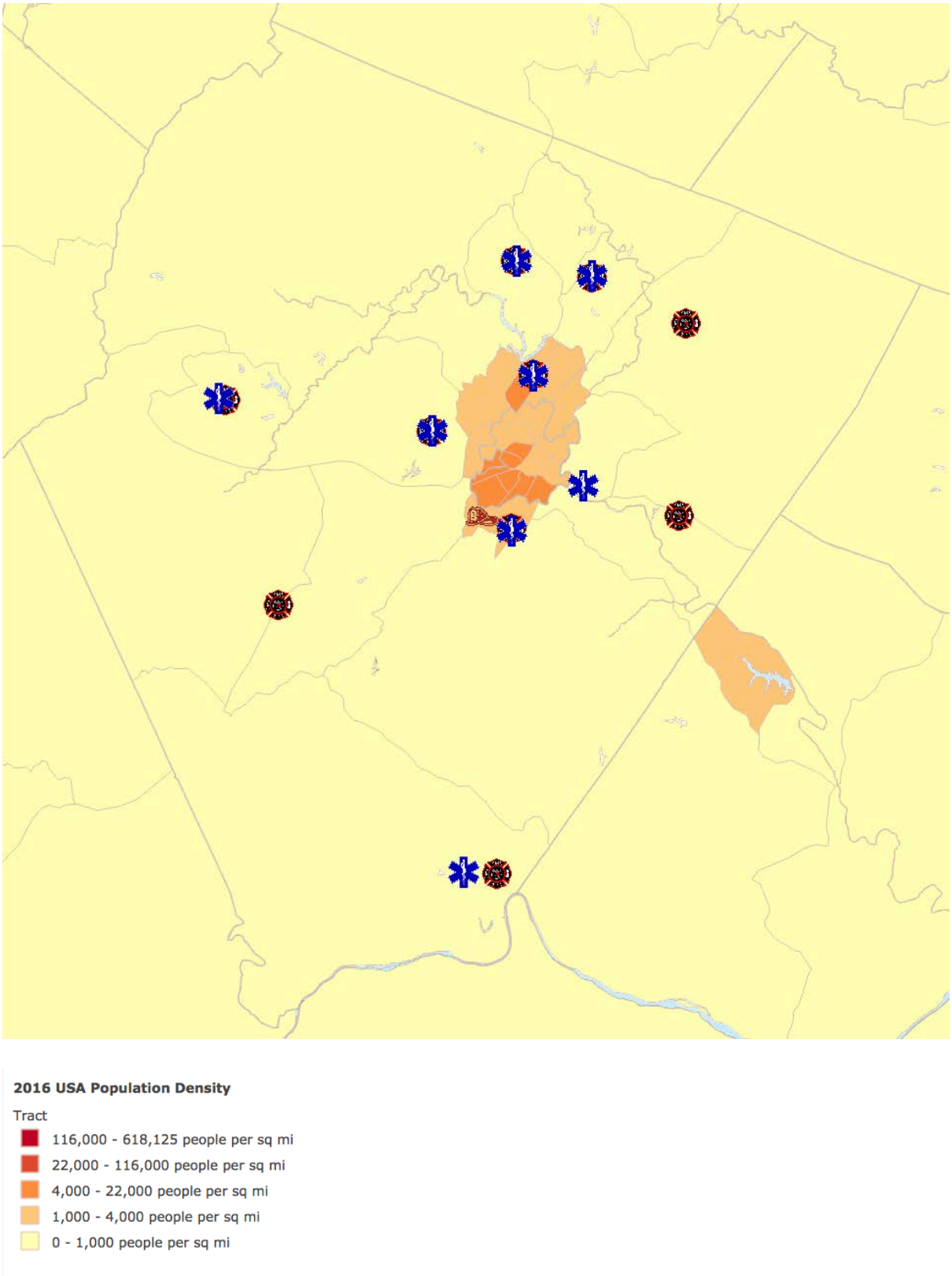
Population Density, Development, and Growth

Overall, the density for the Albemarle County Fire Rescue response area is split between rural and suburban density as defined by the Commission on Fire Accreditation International (CFAI).[40] The Commission's definition is that rural is for populations less than 1,000 per square mile. The suburban definition from CFAI's is for populations between 1,000 and 2,000 per square mile. The CFAI's definition for an urban density is an incorporated area with over 30,000 people and a population density over 2,000 people per square mile. The metropolitan threshold is over 3,000 people per square mile.[41] The Department has a population density of approximately 140 per square mile overall while the City of Charlottesville has a population density of 4,260 per square mile.[42]

United States Census data is utilized to approximate the distribution of population throughout the District. The population density in the District is differentiated with urban/suburban densities in and around the City of Charlottesville and the adjacent Albemarle County Development Area. The remainder of the County is largely rural with less than 1,000 population per square mile.

[40] CFAI. (2009). Fire & Emergency Service Self-Assessment Manual, (8th ed.). Chantilly, Virginia: Author. (p. 71)
[41] Ibid.
[42] Accessed online at http://statisticalatlas.com/county/Virginia/Albemarle-County/Population

Figure 18: Population Density by Census Block - 2016



There are a few different agencies that can be referenced when looking at service levels. CFAI's recommended service levels are determined based on the population density from rural to metropolitan. CFAI recommends a baseline performance of 90-second turnout times at the 90th percentile regardless of the population density. The travel time for the first unit in the rural area is 13 minutes at the 90th percentile and the suburban travel time is 5 minutes 12 seconds at the 90th percentile.[43] These are the two population densities that are applicable to ACFR. CFAI then outlines benchmarks as a goal for each population density. The benchmark goal for turnout time would be 80 seconds for fire responses and 60 seconds for EMS responses at the 90th percentile. The travel time benchmark goals are 10 minutes for rural and 4 minutes for suburban. Fitch believes the CFAI model provides relaxed and attainable baseline performance standards that departments can design a system to. Once the system is designed, the department can then work to continuously improve the system to meet the benchmark goals identified by CFAI.

A second agency that provides response time standards is the National Fire Protection Association (NFPA). There are two standards that identify response times, the differentiator is whether the department is staffed or relies on volunteer/on-call responders. The staffed standard is the NFPA 1710 standard which identifies a 4 minute travel time at the 90th percentile and turnout times 60 seconds for EMS and 80 seconds for fire at the 90th percentile.[44] NFPA 1710 does not differentiate between population densities. The second NFPA standard is 1720 which applies to volunteer/on-call responses. This 1720 standard does differentiate between population densities for the response time standard. One noticeable difference between NFPA and CFAI is that NFPA's densities are more stringent than CFAI's. The 1720 standard does not differentiate between the turnout time and travel time, it identifies an overall response time from unit notification until arrival at the scene. The NFPA 1720 standard calls for an urban response time of 9 minutes or less 90 percent of the time with a population density of 1,000 per square mile or greater. The suburban population density is defined as 500 to 1,000 per square mile with a response time of 10 minutes or less 80 percent of the time. The rural response time standard is 14 minutes or less 80 percent of the time with a population density less than 500 per square mile.[45]

[43] Ibid.

[44] 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.

[45] National Fire Protection Association. (2014). 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*. Boston, MA: National Fire Protection Association.

Table 44: Comparison of Population Density Categories between CFAI and NFPA 1720

Category	CFAI[46] Population Per Square Mile	NFPA 1720[47] Population Per Square Mile
Metropolitan	3,000 +	N/A
Urban	2,000-3,000	1,000 +
Suburban	1,000-2,000	500-1,000
Rural	Less than 1,000	Less than 500
Wilderness	No Maintained Roads	Travel Distance > 8 Miles

Table 45: Comparison of Population Density Categories between CFAI and NFPA 1720

Place	Population Per Square Mile[48]	CFAI Category	NFPA 1720 Category
Crozet	1,360	Suburban	Urban
Pantops	1,340	Suburban	Urban
Hollymead	1,300	Suburban	Urban
Piney Mountain	1,270	Suburban	Urban
Rivanna	620	Rural	Suburban
Ivy	450	Rural	Rural
Scottsville	320	Rural	Rural
Cismont	210	Rural	Rural
Free Union	120	Rural	Rural

The last agency that provides response time information is the United State Fire Administration (USFA). The USFA collects data from fire departments across the country using the National Fire Incident Reporting System (NFIRS). The data analyzed by the USFA shows that over 90 percent of the fire department response times are 10:59 seconds or less based on the departments that report to NFIRS.[49] The USFA information does not set a response time best practice or break down the response times by population density but rather analyzes the information as a reference point.

The Albemarle County Board has adopted a Comprehensive Plan that identifies a desired performance level for the Fire Rescue Department. The comprehensive plan states fire and EMS response to the rural area should average 13 minutes or less. The comprehensive plan identifies the developed area average response times as 4 minutes for EMS and 5 minutes for fire. The goal in the developed areas is to create parity with the City of Charlottesville.[50]

[46] Ibid.
[47] Ibid.
[48] Accessed online at http://statisticalatlas.com/county/Virginia/Albemarle-County/Population
[49] USFA. (August 2006). Structure fire response times: Topical fire research series, 5(7). Emmitsburg, Maryland: Author.
[50] 2015 Albemarle County Comprehensive Plan accessed online at https://www.albemarle.org/upload/images/Forms_Center/Departments/Community_Development/Forms/Comp_Plan_Round_4/Table_of_Contents_final_6-10-15_LINKED.pdf

Overall, the aggregate current performance for the Department meets rural response time average identified in the County's Comprehensive Plan while the Department is struggling to meet the developed response time standard in the Comprehensive Plan as well as the industry best practice. This report will help identify the challenges in meeting the Comprehensive Plan's expectations. An individual analysis of each station's performance is provided within the report. A comparison table of the current performance and national recommendations is provided below.

Table 46: Comparison of Response Times by Agency to Best Practices and National Experience

Category	Average Turnout / Travel Time	90th Percentile Turnout / Travel Time	Comp Plan Standard Turnout / Travel	CFAI Turnout Time Baseline 90%	CFAI [51] Baseline 1st Unit Travel 90%	NFPA 1710 Turnout Time 90%	NFPA 1710 [52] Travel Time 90%	USFA [53] Response Time 90%
Suburban	6:43	10:20	5:00	1:30	5:12	1:20	4:00	10:59
Rural	11:18	19:30	13:00	1:30	13:00	1:20	4:00	10:59

Figure 19: NFPA 1720 Staffing and Response Time (Table 4.3.2)

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.

[51] CFAI. (2009). Fire & *emergency service self-assessment manual*, (8th ed.). Chantilly, Virginia: Author.
[52] 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.
[53] USFA. (August 2006). Structure fire response times: Topical fire research series, 5(7). Emmitsburg, Maryland: Author.
[54] National Fire Protection Association. (2010). 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*. Boston, MA: National Fire Protection Association.

Projected Growth

Albemarle County is experiencing modest growth, primarily in the county's development area. The population growth between now and 2040 indicate an almost 50% increase in population within the County to a total population of 154,814.[55] With this significant of a population increase in the next 23 years it is likely ACFR will continue to see an increased demand for fire rescue services.

Table 47: Projected Growth[56]

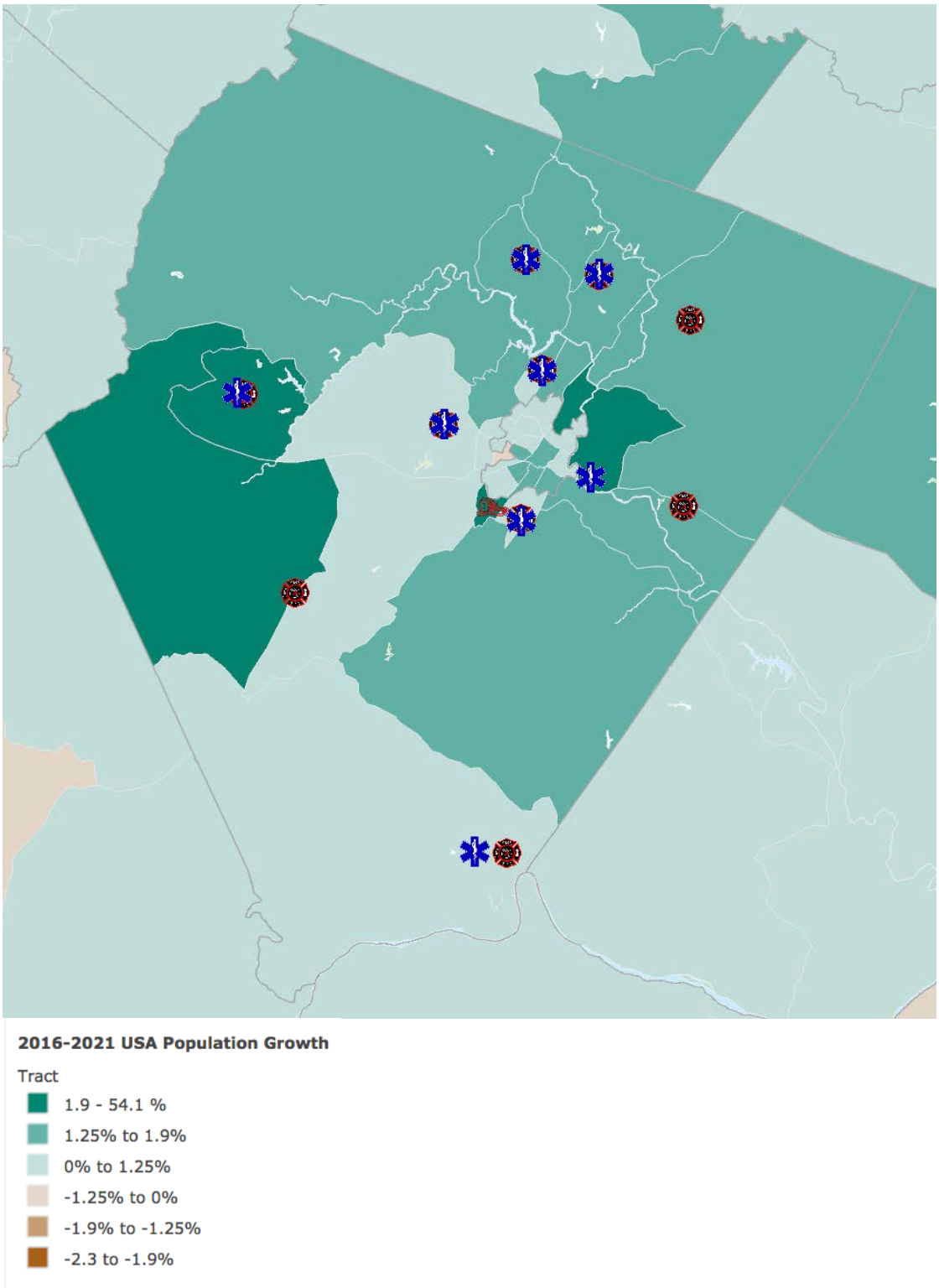
Area	2020	2030	2040
Albemarle County	115,642	134,196	154,814
Charlottesville	46,636	47,252	48,545

Growth is typically not experienced uniformly across large geographic areas. Graphically, projections between 2016 and 2021 anticipate that the population change is increasing with the greatest increases in the western portions of the District and in the general Pantops area. There are little to no reductions in population projected in this data set.

[55] Ibid.

[56] 2015 Albemarle County Comprehensive Plan accessed online at https://www.albemarle.org/upload/images/Forms_Center/Departments/Community_Development/Forms/Comp_Plan_Round_4/Table_of_Contents_final_6-10-15_LINKED.pdf

Figure 20: Annual Population Change 2016-2021



The Department boundaries are not expected to change other than through mergers or regional consolidation efforts. From this perspective, the desired system performance can

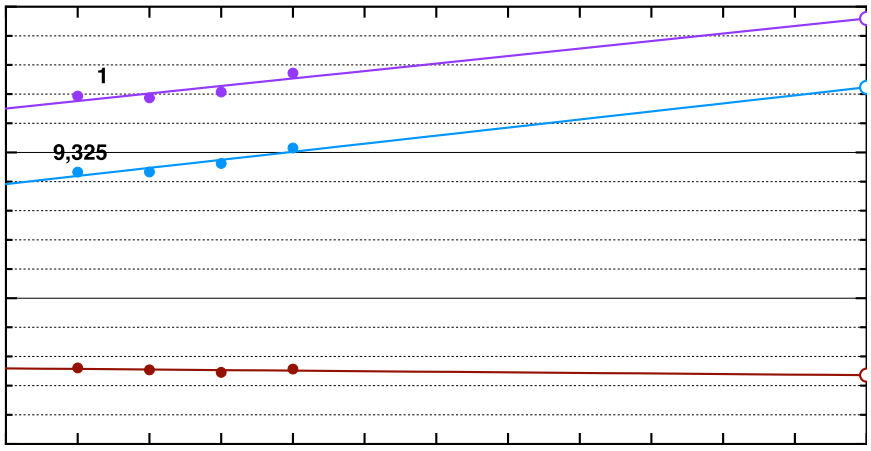
be designed and implemented without having to reposition optimized facilities in the future since the development area is well defined. This does not mean that additional resources may not be needed but that those resources could be added to existing or future optimized facilities. The information contained in this report can assist the Department in ensuring the correct number and location of those facilities to ensure the system is operating at its optimal performance.

Three years of historical call volume were utilized to identify any general trends in community demands for service. Similar to many communities, the overall call volume is increasing at approximately 2% per year.

Utilizing historic incident counts from 2012-2015 and a linear regression model, the Department is projected to see a net increase of 2,661 incidents per year by 2023. This assumes no changes in the current variables. The Department may have to reinvest or reallocate resources to meet the growing demands on the system in the future. A graphic representation of the historical and the projected growth is provided below. The projection calls for 3.0% increase of EMS incidents and a 0.8% decrease in FIRE incidents each year moving forward. Overall the projection shows a 22.3% increase in total incidents between 2012 and 2023, with all of the increase concentrated in the EMS discipline.

The decrease in FIRE incidents is likely attributable to the success of fire mitigation programs, while the increase in EMS incidents is attributable to the aging demographics of the County.

Figure 21: Changes to Incident Counts Projected to CY2023



Risk Assessment

Fire Suppression Services

Albemarle County Fire Rescue provides services for the suppression of fires using a minimum of ten fire stations, 19 fire engines fully equipped with water supply, hoses, portable ladders, and various tools such as axes. However, typically a maximum of 10 are staffed at any given time. In addition, four ladder trucks are deployed for operating at incidents where elevated fire streams and rescuing trapped victims from upper floors is needed. In addition to the volunteer fire departments and rescue squad chief officers, ACFR provides a minimum of one Battalion Chief assigned each day that can provide command and control activities at significant fires. There is other specialty apparatus dispersed across the county based on specialized needs and risks such as water tenders, utility vehicles, brush trucks and rescue vehicles. Finally, the Department provides response capabilities and personnel for specialized risks such as wildland fires.

Community Service Demands - Fire

In CY2017, the Department responded to a total of 13,038 requests for service, or dispatches. The number of fire related incidents were 2,426, which accounted for 18.6% of the dispatched incidents. The number of individual unit responses is more reflective of total department workload since many requests for service have more than one unit responding; with an average of 2.3 vehicles responding to fire related incidents and 1.8 responding to EMS related incidents. The tables and figures below summarize the Department's responses.

Table 48: Number of Calls, Number of Responses, and Total Busy Time by Program

Program	Number of Calls[1]	Number of Responses[2]	Average Responses per Call	Responses with Time Data[3]	Total Busy Hours	Average Busy Minutes per Response	Percentage of Total Busy Hours
Agency Assist	513	1,275	2.5	1,266	816.4	38.7	5.2
EMS	8,764	15,550	1.8	15,395	10,827.0	42.2	69.2
Fire	2,416	5,467	2.3	5431	2,379.8	26.3	15.2
Hazmat	197	597	3.0	592	251.3	25.5	1.6
Police-Related	420	914	2.2	906	499.2	33.1	3.2
Public Service	495	698	1.4	693	225.2	19.5	1.4
Rescue	207	1,050	5.1	1036	636.2	36.8	4.1
Total	**13,012**	**25,551**	**2.0**	**25,319**	**15,635.2**	**37.1**	**100.0**

[1]"Number of Calls" reflects an adjusted number of unique incidents to correspond with number of responses following the application of exclusion criteria, as noted in the Appendix, regardless of calculated busy time.
[2]"Number of Responses" reflects the total number of entries in the CAD data file following the application of exclusion criteria, as noted in the Appendix, regardless of calculated busy time.
[3]"Responses with Time Data" reflects the number of responses in the CAD data file with available "AlarmDateTime" values and "InServiceDateTime" values.

Fire related incidents are an aggregated category of the various final incident types available in the CAD data file. Table 49 provides details of these fire related incidents by nature of the call. "Fire Alarm" was the most frequent community demand (890/2426 or 36.7% of calls), followed by "Fire Motor Vehicle Crash No Injuries Fluids Down" (315/2426 or 13.0% of calls).

Table 49: Total Fire Related Calls by Nature of Call

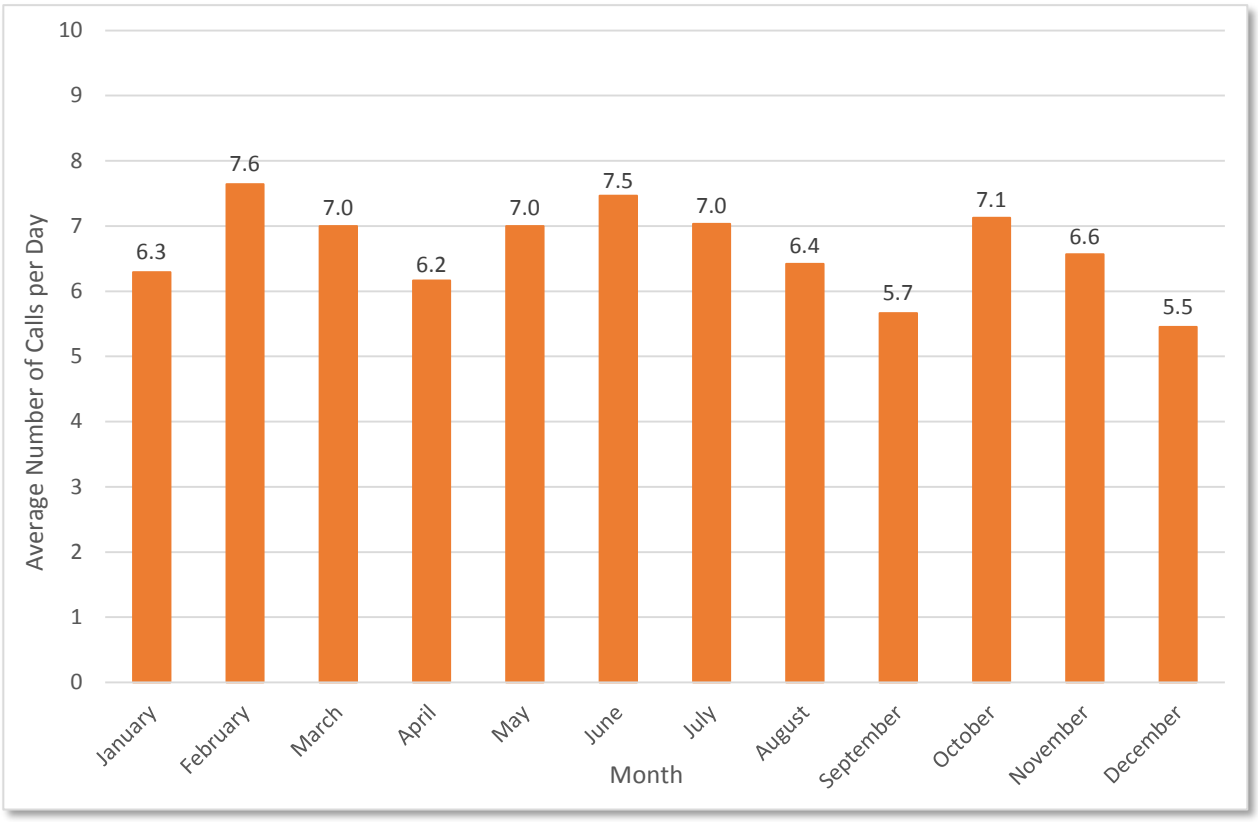
Nature of Call	Number of Calls	Percentage of Total Fire Service Demands
Fire Alarm	890	36.7
Fire Motor Vehicle Crash No Injuries Fluids Down	315	13.0
Tree Down	294	12.1
Brush Fire	229	9.4
Outdoor Smoke investigation - Non Brush Fire	106	4.4
Vehicle Fire	106	4.4
Smoke in Structure Commercial	50	2.1
Mutual Aid Request Fire	40	1.6
Structure Fire - Residential	40	1.6
Tree on Power Line	38	1.6
Transformer Fire	36	1.5
Structure Fire - Commercial	33	1.4
Smell of Smoke/Electrical Commercial	30	1.2
Water Hazard in Structure	30	1.2
Smell of Smoke/Electrical Residential	28	1.2
Smoke in Structure Residential	27	1.1
Chimney Fire - Residential	20	0.8
Lines Down	19	0.8
Unusual Odor	18	0.7
Appliance Fire Contained Residential	15	0.6
Elevator Emerg w/out Patient	11	0.5
Appliance Fire Contained Comm	10	0.4
Dumpster Fire	9	0.4
Trash Fire	9	0.4
Fire Threatening Residence	7	0.3
Bomb Threat	5	0.2
Fire Threatening Comm Building	4	0.2
Sparks from Outlet Commercial	3	0.1
Air Carrier Major Difficulty	1	0.0
Aircraft Crash	1	0.0
Single Engine Major Difficulty	1	0.0
Structure Fire - Commercial w/ Entrapment	1	0.0
Total	**2,426**	**100.0**

Temporal analyses were conducted to evaluate patterns in community demands for fire related services. These analyses examined the frequency of requests for service in 2017 by month, day of week, and hour of day. Results found that there was variability by month (Table 50; Figure 22). The three months with the most fire calls in descending order were: February (7.6 per day), June (7.5 per day), and October (7.1 per day). The three months with the fewest fire calls in ascending order were: December (5.5 per day), September (5.7 per day), and April (6.2 per day).

Table 50: Total Fire Related Calls and Average Calls per Day by Month

Month	Number of Calls	Average Calls per Day	Call Percentage
January	195	6.3	8.0
February	214	7.6	8.8
March	217	7.0	8.9
April	185	6.2	7.6
May	217	7.0	8.9
June	224	7.5	9.2
July	218	7.0	9.0
August	199	6.4	8.2
September	170	5.7	7.0
October	221	7.1	9.1
November	197	6.6	8.1
December	169	5.5	7.0
Total	**2,426**	**6.6**	**100.0**

Figure 22: Average Fire Related Calls per Day by Month

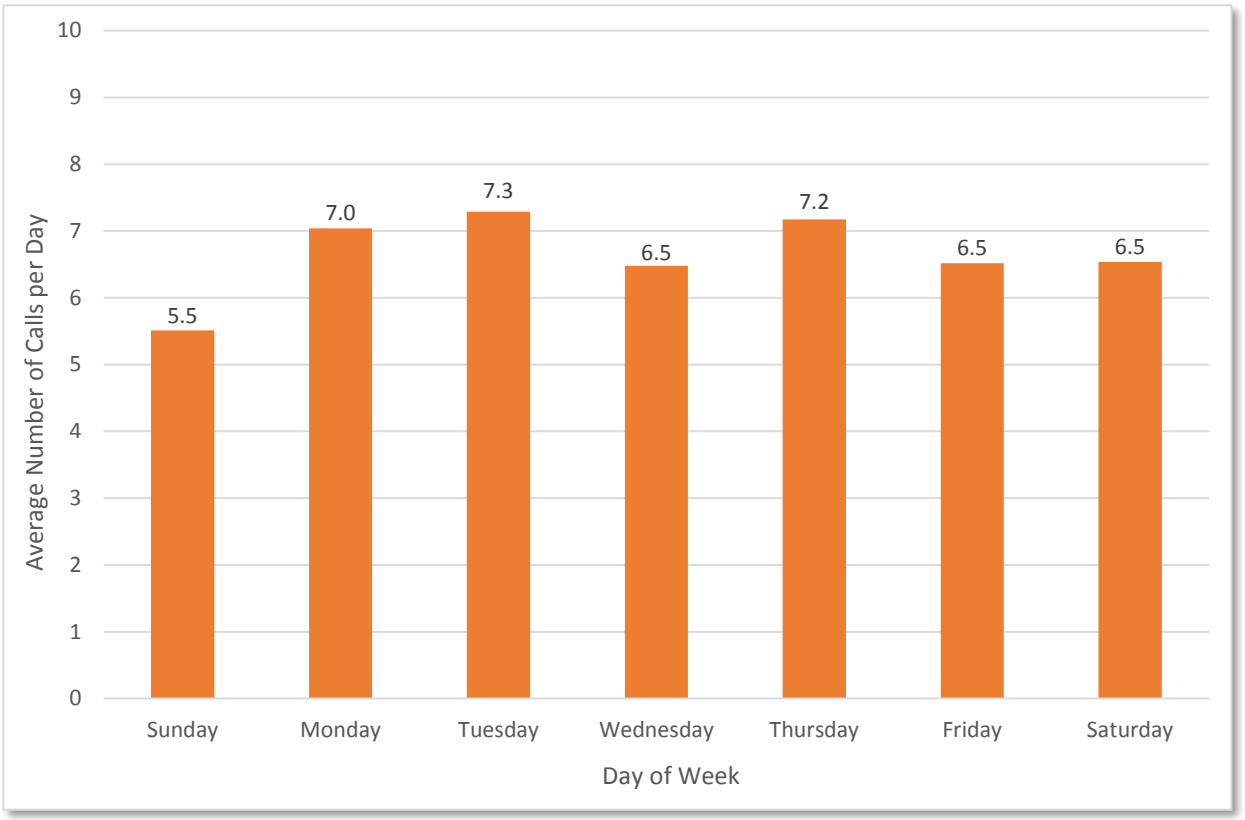


Similar analyses were conducted for fire related calls by day of week (Table 51; Figure 23). The data revealed that there is some variability in the demand for services by day of week. Tuesday had the highest frequency of requests for fire related services, averaging 7.3 calls per day and accounting for 15.6% of all fire related calls. Sunday had the lowest frequency of requests for fire related services, averaging 5.5 calls per day and accounting for 12.0% of all fire related calls.

Table 51: Total Fire Related Calls and Average Calls per Day by Day of Week

Day of Week	Number of Calls	Average Calls per Day	Call Percentage
Sunday	292	5.5	12.0
Monday	366	7.0	15.1
Tuesday	379	7.3	15.6
Wednesday	337	6.5	13.9
Thursday	373	7.2	15.4
Friday	339	6.5	14.0
Saturday	340	6.5	14.0
Total	**2,426**	**6.6**	**100.0**

Figure 23: Average Fire Related Calls per Day by Day of Week

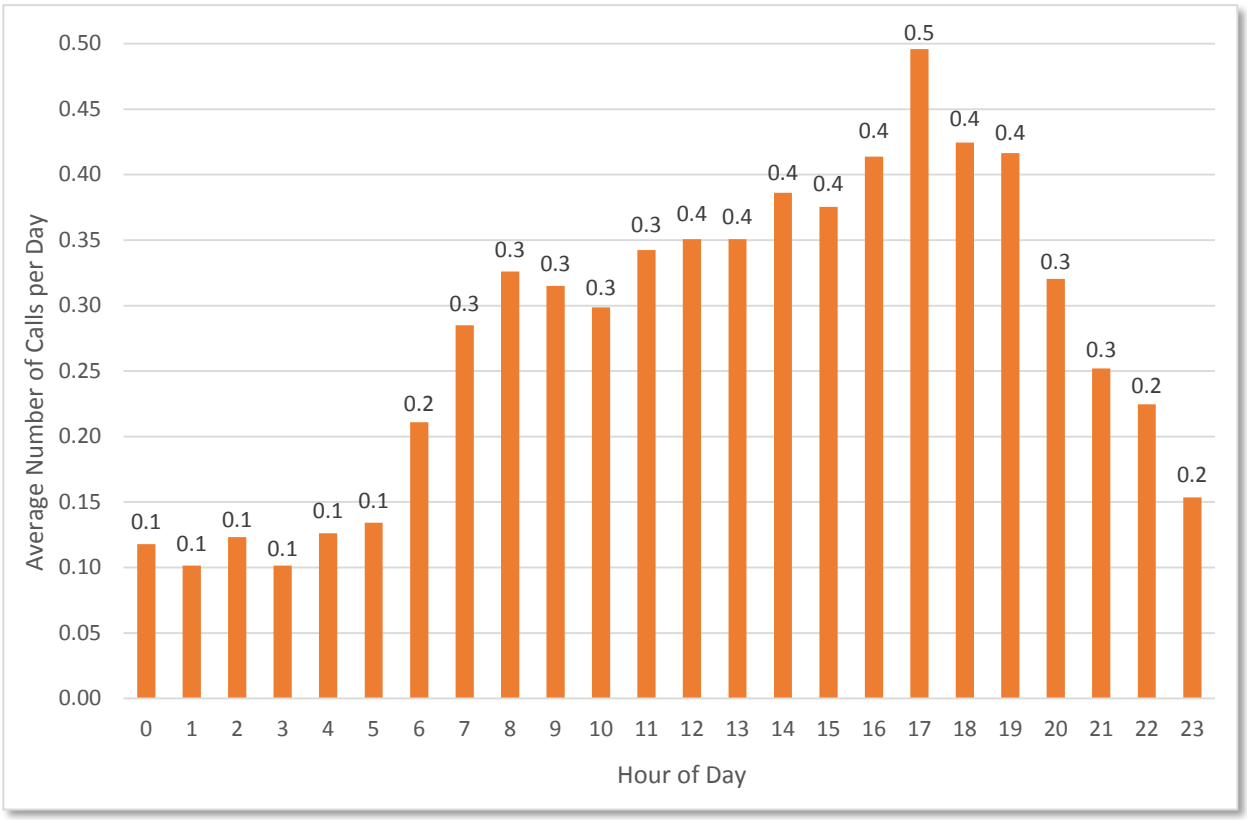


Fire related calls were also evaluated by hour of the day (Table 52; Figure 24). Some variability exists in the time of day that requests for fire related services were received. The highest demand for fire related services occurred between 1200 and 1900, where average number of calls per day during those hours ranged from 0.4 to 0.5 calls. Peak demand occurred at 1700. The hours from 0000 to 0500 had the lowest demands, where average number of calls per day for each of those hours was approximately 0.1.

Table 52: Total Fire Related Calls and Average Calls per Day by Hour of Day

Hour of Day	Number of Calls	Average Calls per Day	Call Percentage
0	43	0.1	1.8
1	37	0.1	1.5
2	45	0.1	1.9
3	37	0.1	1.5
4	46	0.1	1.9
5	49	0.1	2.0
6	77	0.2	3.2
7	104	0.3	4.3
8	119	0.3	4.9
9	115	0.3	4.7
10	109	0.3	4.5
11	125	0.3	5.2
12	128	0.4	5.3
13	128	0.4	5.3
14	141	0.4	5.8
15	137	0.4	5.6
16	151	0.4	6.2
17	181	0.5	7.5
18	155	0.4	6.4
19	152	0.4	6.3
20	117	0.3	4.8
21	92	0.3	3.8
22	82	0.2	3.4
23	56	0.2	2.3
Total	**2,426**	**6.6**	**100.0**

Figure 24: Average Fire Related Calls per Day by Hour of Day

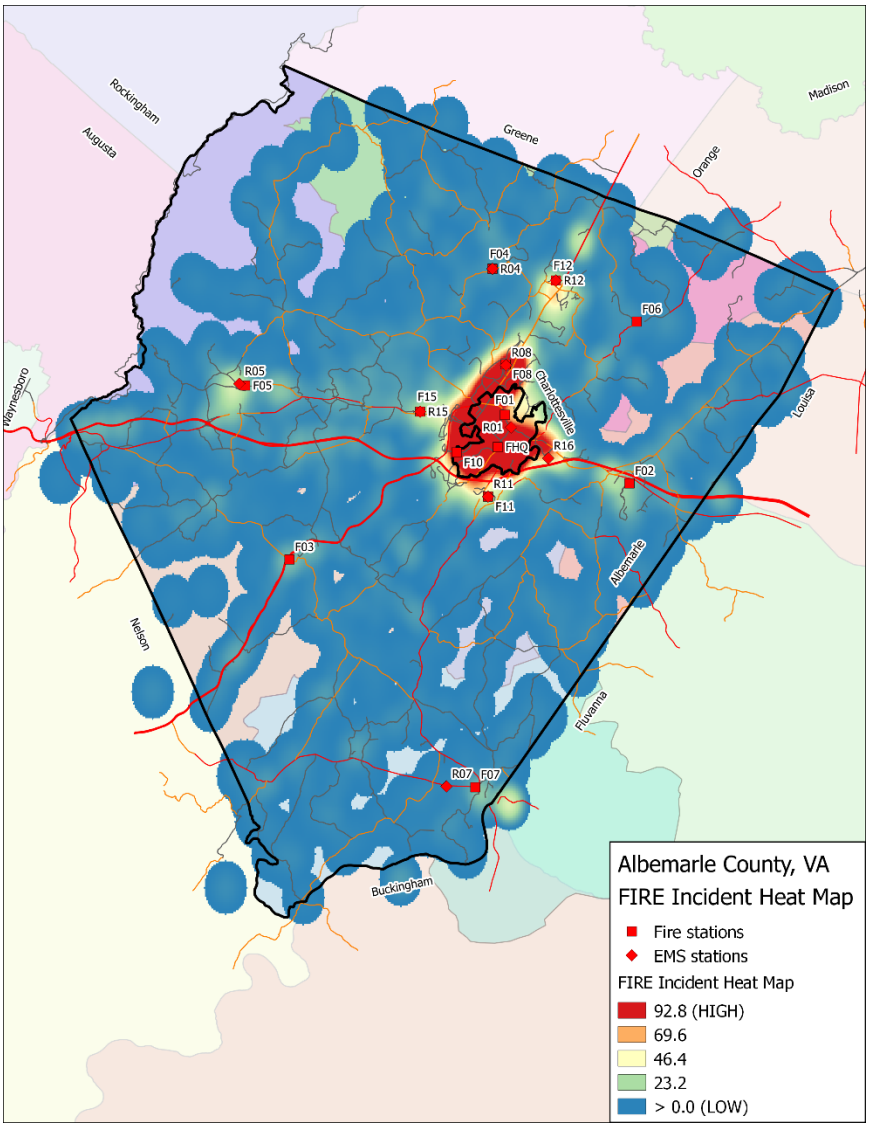


With respect to the fire related community demands, fires account for a smaller percentage of the fire related incidents. While it is no less important to prepare for the risk of fires, the frequency of need for these traditional services are in decline.

A geospatial analysis was conducted utilizing the community's historical service demand for requests for service in Fiscal Year 2017. These are for all incidents and not specifically any sub-determinant of fire risk. This analysis is provided below.

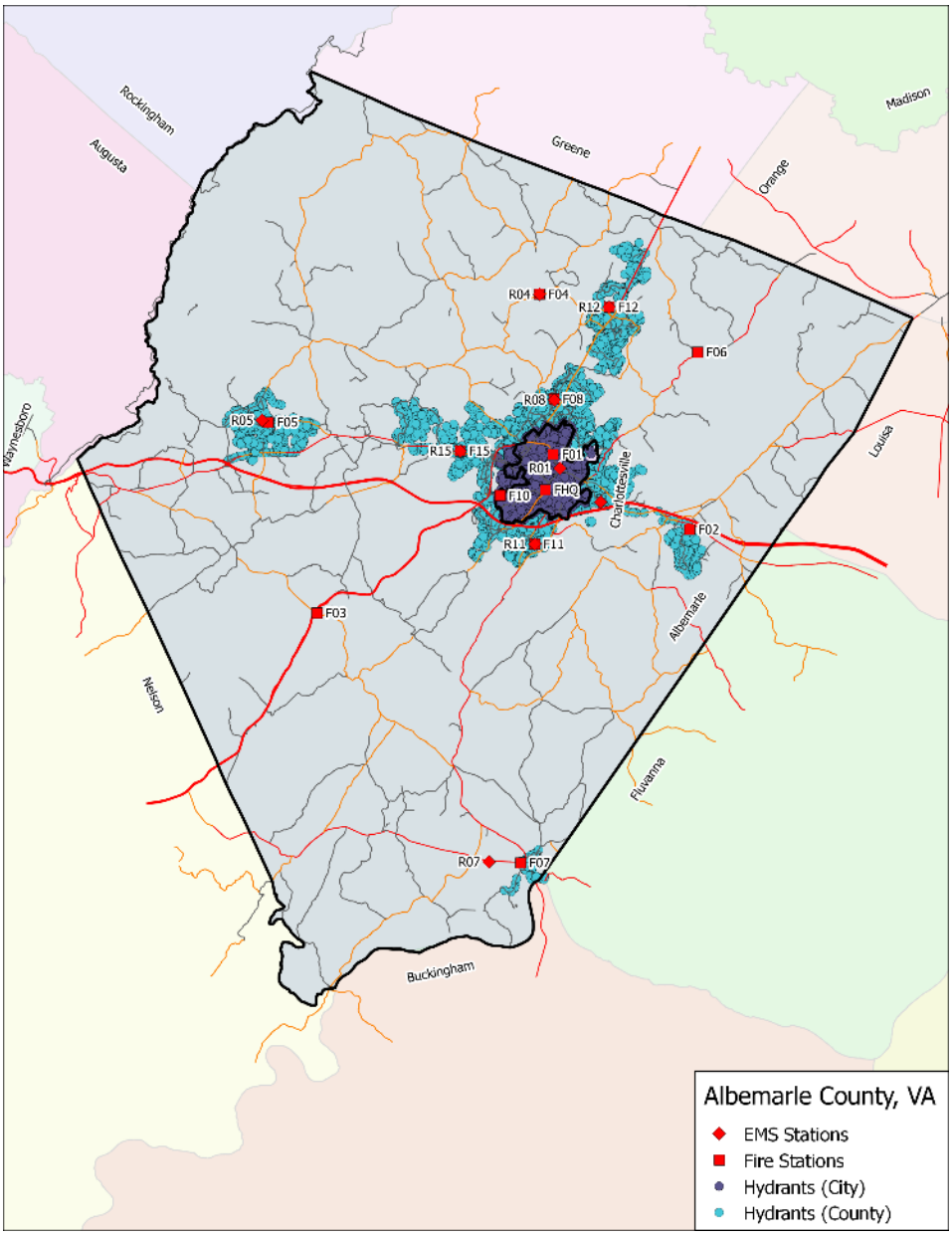
It is evident that the Department's historical risks are concentrated most heavily in the development areas within the county. When referring to the figure below, the higher the frequency of events, the darker the red color. Specifically, the higher concentrations of incidents are in station demand zones of station 8 and rescue 16. Station demand zones of station 6, 3 and 4 had the lowest concentration of historical risk.

Figure 25: Requests for Service for Fire Incidents – Fiscal Year 2015



While it is evident that the Department's historical risks are concentrated most heavily in the development areas within the county, it is also important to consider the infrastructure to combat fires if they occur. Albemarle County has a significant portion of its geography that does not have water infrastructure including fire hydrants. Since water is a significant component to providing fire suppression, in these areas firefighters must haul water to the fire incident to combat the fire. The operation of hauling water to a fire scene is more labor intensive and a significant logistic component of the fire operation. The presence of a water supply should be considered when determining the risk and planning for the departments operation. Below is a map of the hydrants with the county.

Figure 26: Fire Hydrants in Albemarle County



Community Risks - Fire

Occupancy risk was evaluated across the jurisdiction utilizing the most recent ISO batch reports.

The ISO Batch report provided specific building occupancy information for the needed fire flow, the number of stories, location, building construction, burning degree, and the presence of automatic sprinklers. Ultimately, a quantifiable risk-rating matrix was developed that categorized 745 occupancies within the jurisdiction into high, moderate, and low risks. The risk matrix is presented in the table below.

Due to the relatively higher demands for personnel and apparatus required for fire events that have a large square footage, higher elevation (stories), and specific types of occupancy and construction risks garnished the highest numeric values. Conversely, the presence of an automatic sprinkler system elicited a negative numeric value. In this manner, the fact that 96% of the fires are controlled with sprinkler activation is included into the matrix for a more realistic risk factor rating. The results of the risk assessment process categorized the 745 occupancies into 27 high-risk structures, 566 moderate structures, and 152 low risk structures.

Geospatial analyses were completed to map the locations of each of the commercial occupancies included in the risk matrix process and specifically overlaid within each of the fire station locations. This analysis lends validity to the risk assessment matrix and the process utilized by the Department as the concentration of risks is correlated with the historical demand for fire related services. The results of the geospatial analyses of high, moderate, and low risk structures are presented below as Figures 27, 28, and 29, respectively.

Occupancy level risks were distributed in two distinct manners. First, occupancy risk was categorized within each of the respective fire districts. While this is informative, more granular analyses requested to accommodate newly emerging areas such as Pantops, could not be completed because there was not a distinct and specific geographic area as existed with the established fire districts. Therefore, a second analysis was completed utilizing a 6-minute travel time polygon around each of the fire stations and the Pantops location to evaluate risk distribution from this lens. However, because not all occupancy risk is accounted for within 6-minutes of each station, the Fire District analysis is the more appropriate lens with the exception of discerning the risk distributed within Pantops. The final analysis utilized the 6-minute polygon for Pantops and all residual risk in the original Fire Districts remains assigned to Fire Station/District. The risk analysis is accurate for Pantops, but may have some of the Pantops risk distributed across the neighboring districts 2, 6, and 11 as well. A table summarizing the differences between the Districts v. 6-minute Station analyses is provided as Table 54 below.

Other fire related risks that were evaluated were mobile/transportation risks, wildland risks, and single/multi-family residential fire risks. The mobile/transportation and wildland risks were previously presented in the community risk profile. The single/multi-family residence structures are correlated with the population densities previously presented. Finally, the residential fire risk was categorized as low/moderate severity.

Table 53: Summary of Occupancy 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

Table 54: Comparison of District v. 6-Minute Analysis for Distribution of Risk

District	District Name	High	Moderate	Low	District Total	6-Minute Total	District Sum of High/Moderate Risks	6-Minute Sum of High/Moderate Risks	Net Distribution of High/Moderate Risk Utilized
F02	EAST RIVANNA	6	50	16	72	13	56	13	56
F03	NORTH GARDEN	0	24	0	24	13	24	13	24
F04	EARLYSVILLE	0	19	2	21	5	19	3	19
F05	CROZET	3	54	4	61	56	57	53	57
F06	STONY POINT	0	7	0	7	4	7	4	7
F07	SCOTTSVILLE	1	51	1	53	49	52	48	52
F08	SEMINOLE	8	182	82	272	261	190	179	190
F11	MONTICELLO	4	87	13	104	40	91	36	91
F12	HOLLYMEAD	2	34	18	54	38	36	24	36
F15	IVY	1	49	8	58	42	50	34	50
R16	Pantops[57]	5	60	21	86	86	0	65	65

[57] The Pantops Station R16 utilized the 6-Minute Travel Polygon. All other Districts utilize the currently existing district boundaries.

Geospatial analyses were completed to map the locations of each of the commercial occupancies included in the risk matrix process and specifically overlaid within each of the fire station locations identified.

When reviewing the output for high-risk occupancies, it is clear that the prospective risk is concentrated around the perimeter of the City of Charlottesville and the historical demand for services previously presented. From a broad perspective, this provides validation to the risk assessment process developed with the Department as well as the necessary deployment strategy to cover the historical demand for services. The results of the geospatial analyses of high, moderate, and low risk structures are presented in the figures below.

Moderate and low risk occupancies are more evenly distributed across the County and are more easily handled by the typical mitigation strategies and resource allocation while the high-risk occupancies require a higher concentration of personnel.

Figure 27: High Risk Occupancies by Station Demand Zone

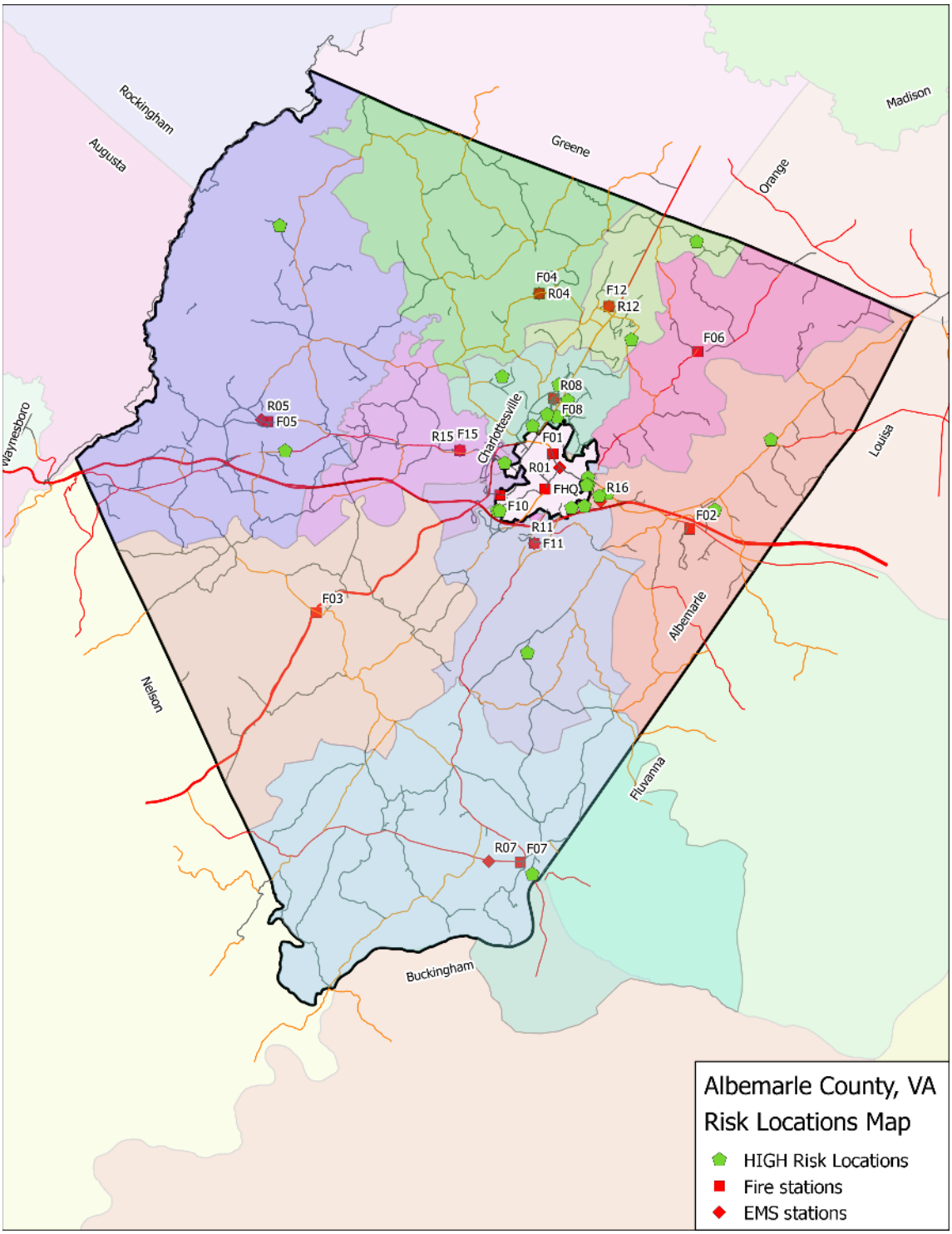


Figure 28: Moderate Risk Occupancies by Station Demand Zone

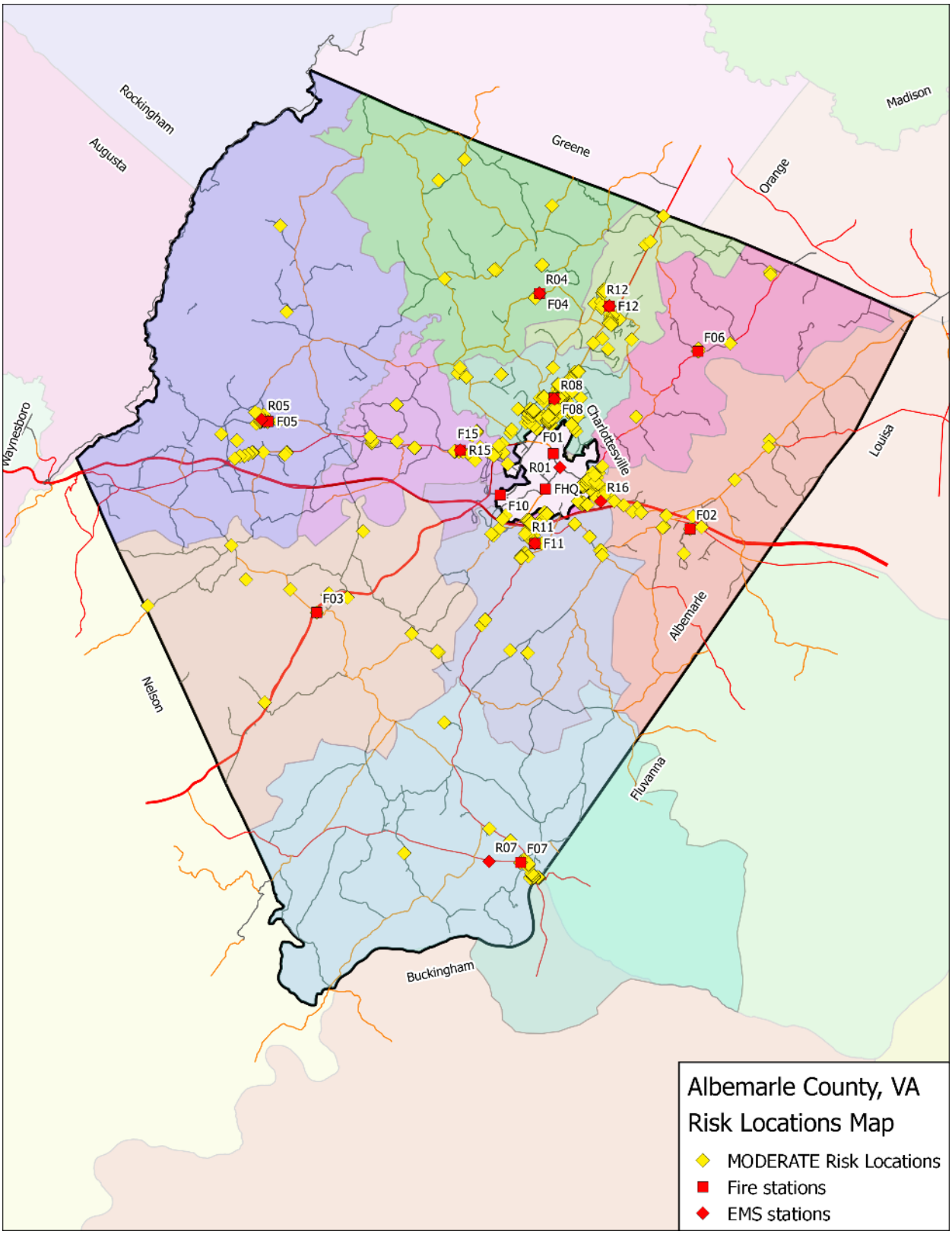
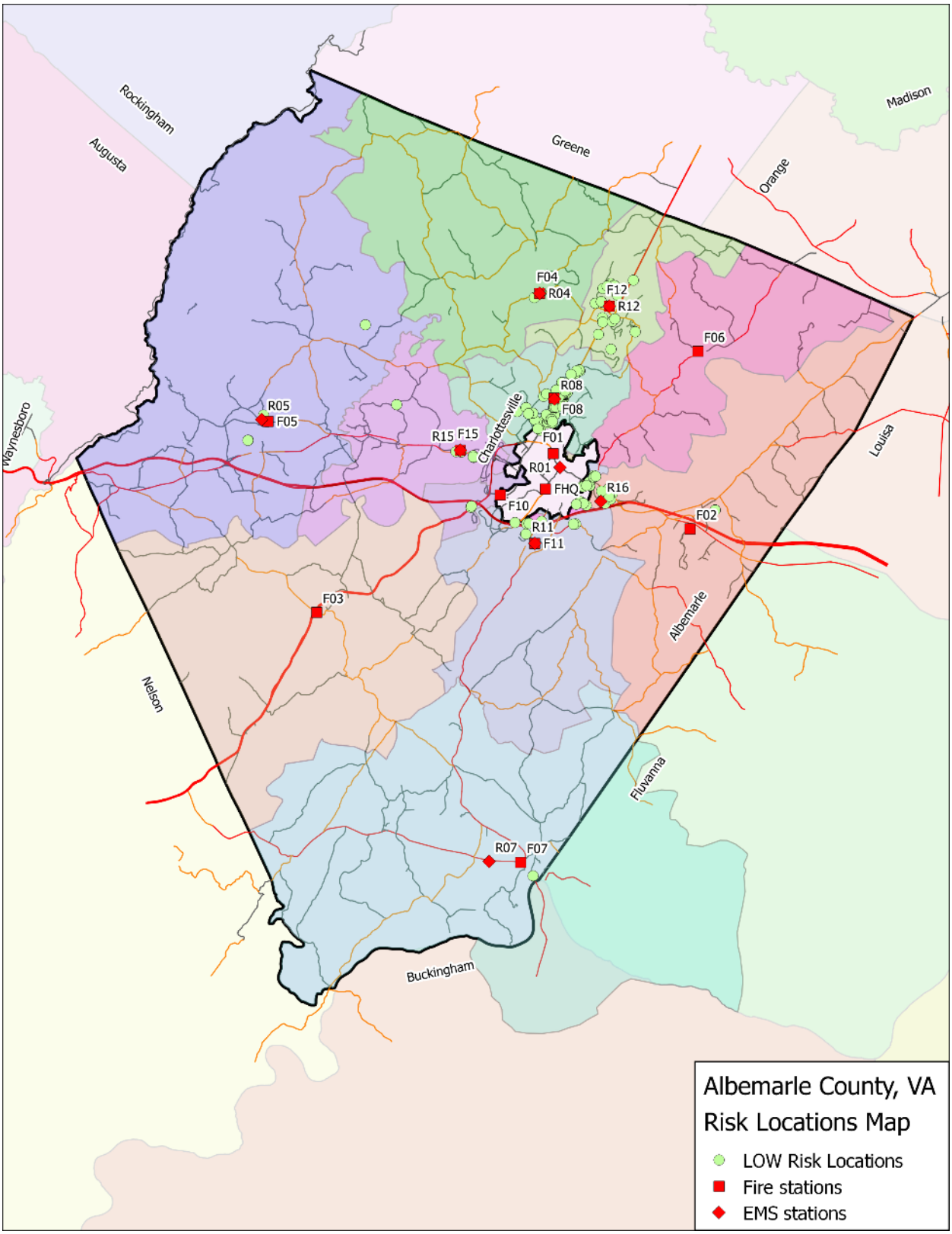


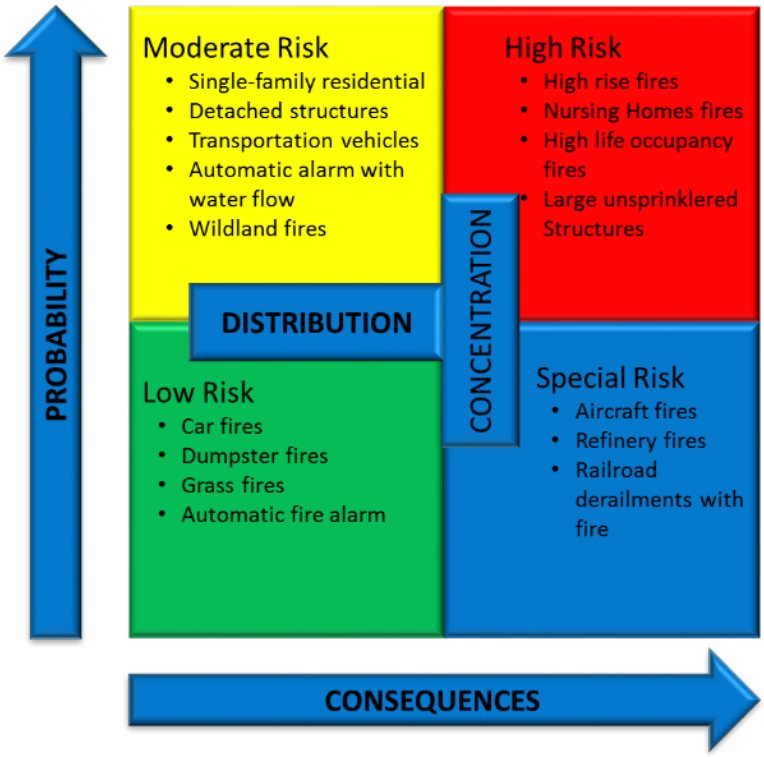
Figure 29: Low Risk Occupancies by Station Demand Zone



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. The resulting probability and consequence matrix is presented below.

Figure 30: Probability and Consequence Matrix for Fire Risk



Critical Task Analysis

The critical tasks were developed and reviewed by the Department's staff. Critical tasks were developed for low, moderate, and high-risk fire events. Low risk events that single engines responses would typically handle such as vehicle fires, dumpster fires, and residential automatic fire alarms. Moderate risk responses require additional resources to mitigate the event effectively and efficiently such as a 1 to 2 story residential structure. High-risk events required considerable resources to effectively and efficiently mitigate the events such as high occupancy or unprotected structures. The tables below provide the critical task development.

Critical tasks are best defined as the initial activities that must be accomplished to begin operations in a safe and effective manner and have the best opportunity to impact the ultimate outcome. The critical tasks are not the total of personnel needed on incidents, but rather the minimum number needed for initial actions. It is for this reason, that the departments' responses to each incident type and level may be greater than the critical tasks identified.

Table 55: Critical Tasks for Structure Fire in Development Area– Low/Unconfirmed Moderate Risk[58]

Critical Task	Needed Personnel
Command / Control	1
Investigation / Extinguishment	2
2-In-2-Out	2
Pump Operator	1
Total	**6**

Table 56: Development Area Apparatus and Personnel Requirements for Low / Unconfirmed Moderate Risk

Responding Units	Minimum Staffing
Chief Officer	1
Engine	3
Engine/Truck	3
Total Response Provided	**7**
Personnel Required by Critical Tasks	**6**

Table 57: Critical Tasks for Structure Fire in Rural Area– Low / Unconfirmed Moderate Risk

Critical Task	Needed Personnel
Command / Control	1
Investigation / Extinguishment	2
2-In-2-Out	2
Pump Operator	1
Portable Water Supply	1
Total	**7**

Table 58: Rural Area Apparatus and Personnel Requirements for Low / Unconfirmed Moderate Risk

Responding Units	Minimum Staffing
Chief Officer	1
Engine	3
Engine/Truck	3
Tanker	1
Total Response Provided	**8**
Personnel Required by Critical Tasks	**7**

Table 59: Critical Tasks for Confirmed Structure Fire in Development Area – Moderate Risks[59]

Critical Task	Needed Personnel
Command / Control	1
Safety Officer	1
Pump Operator	1
Fire Attack	2
Water Supply	2
Primary Search	2
Ventilation	2

[58] Examples may include unconfirmed structure fires, outside fires, vehicle fires, rubbish fires, and smoke odors
[59] Examples may include confirmed residential structure fires, responses to confirmed moderate risk, and responses to unconfirmed high risk.

Critical Task	Needed Personnel
EMS / Medical	2
Rapid Intervention Crew (RIC)	3
Total	**16**

Table 60: Development Area Apparatus and Personnel Requirements for Confirmed Structure Fire - Moderate Risk

Responding Units	Minimum Staffing
Chief Officer	1
Safety Officer	1
Engine	3
Engine/Truck	3
Engine	3
Engine	3
Medic/Ambulance	2
Total Response Provided	**16**
Personnel Required by Critical Tasks	**16**

Table 61 Critical Tasks for Confirmed Structure Fire in Rural Area – Moderate Risks

Critical Task	Needed Personnel
Command / Control	1
Safety Officer	1
Pump Operator	1
Fire Attack	2
Water Supply	8
Primary Search	2
Ventilation	2
EMS / Medical	2
Rapid Intervention Crew (RIC)	3
Total	**22**

Table 62 Rural Area Apparatus and Personnel Requirements for Confirmed Structure Fire - Moderate Risk

Responding Units	Minimum Staffing
Chief Officer	1
Safety Officer	1
Engine	3
Engine/Truck	3
Engine	3
Engine	3
Engine	3
Medic/Ambulance	2
Tanker	1
Tanker	1
Tanker	1
Total Response Provided	**22**
Personnel Required by Critical Tasks	**22**

Table 63: Critical Tasks in the Development Area – Confirmed Structure Fire – High Risk

Critical Task	Needed Personnel
Command / Control	1
Safety Officer	1
Fire Attack	4
Water Supply	2
Pump Operator	1
Search	4
Ventilation	4
RIC	3
Aerial Operations	2
EMS / Medical	2
Safety	1
Total	**24**

Table 64: Development Area Apparatus and Personnel Requirements for Confirmed Structure Fire - High Risk

Responding Units	Minimum Staffing
Chief Officer	1
Safety Officer	1
Engine	3
Engine	3
Engine	3
Engine	3
Engine	3
Ladder/Tower	3
Ladder/Tower	3
Medic/Ambulance	2
Total Response Provided	**25**
Personnel Required by Critical Tasks	**24**

Table 65: Critical Tasks in the Rural Area – Confirmed Structure Fire – High Risk

Critical Task	Needed Personnel
Command / Control	1
Safety Officer	1
Fire Attack	4
Water Supply	9
Pump Operator	1
Search	4
Ventilation	4
RIC	3
Aerial Operations	2
EMS / Medical	2
Total	**31**

Table 66: Rural Area Apparatus and Personnel Requirements for Confirmed Structure Fire - High Risk

Responding Units	Minimum Staffing
Chief Officer	1
Safety Officer	1
Engine	3
Engine	3
Engine	3
Engine	3
Engine	3
Engine	3
Ladder/Tower	3
Ladder/Tower	3
Medic/Ambulance	2
Tanker	1
Tanker	1
Tanker	1
Tanker	1
Total Response Provided	**32**
Personnel Required by Critical Tasks	**31**

Table 67: Critical Tasks for All Risk Levels and All Areas - Fire Alarms

Critical Task	Needed Personnel
Investigation	3
Total	**3**

Table 68: Apparatus and Personnel Requirements for All Risk Levels and All Areas

Responding Units	Minimum Staffing
Engine/Truck	3
Total Response Provided	**3**
Personnel Required by Critical Tasks	**3**

Emergency Medical Services

The Albemarle County Fire Rescue system provides a full line of emergency medical services (EMS) from Basic Life Support (BLS) first response through Advanced Life Support (ALS) transport. Department personnel are trained at varying levels from Emergency Medical Technicians (EMTs) through paramedic. ACFR, Charlottesville Albemarle Rescue, Western Albemarle Rescue, Earlysville, and Scottsville Rescue provide the ambulance transport within the county. Some of the fire departments provide varying levels of first response.

The Charlottesville – UVA – Albemarle County 9-1-1 emergency communications center and primary public safety answering point (PSAP) obtains basic information and dispatches the appropriate resources. The 911 emergency communications center is working to implement a medical call screening and pre-arrival instruction that is consistent with industry best practices.

There are varying levels of first response models by the fire departments across the county, which are determined by each department. One volunteer department does not respond to medicals unless specifically requested but they have a rescue squad based within a mile of their fire station. Other stations respond to most medicals or significant medical calls. In total, the department wholly participates in the delivery of EMS. Finally, the ACFR system participates in mutual aid agreements with the surrounding municipalities and departments.

Community Service Demands

The majority of the community's requests for services are for emergency medical services. In total, approximately 69.2% of all Department requests for services are for EMS. A summary of all dispatched calls in calendar year 2017 is provided again below.

Table 69: Number of Calls, Number of Responses, and Total Busy Time by Program

Program	Number of Calls[1]	Number of Responses[2]	Average Responses per Call	Responses with Time Data[3]	Total Busy Hours	Average Busy Minutes per Response	Percentage of Total Busy Hours
Agency Assist	513	1,275	2.5	1,266	816.4	38.7	5.2
EMS	8,764	15,550	1.8	15,395	10,827.0	42.2	69.2
Fire	2,416	5,467	2.3	5431	2,379.8	26.3	15.2
Hazmat	197	597	3.0	592	251.3	25.5	1.6
Police-Related	420	914	2.2	906	499.2	33.1	3.2
Public Service	495	698	1.4	693	225.2	19.5	1.4
Rescue	207	1,050	5.1	1036	636.2	36.8	4.1
Total	**13,012**	**25,551**	**2.0**	**25,319**	**15,635.2**	**37.1**	**100.0**

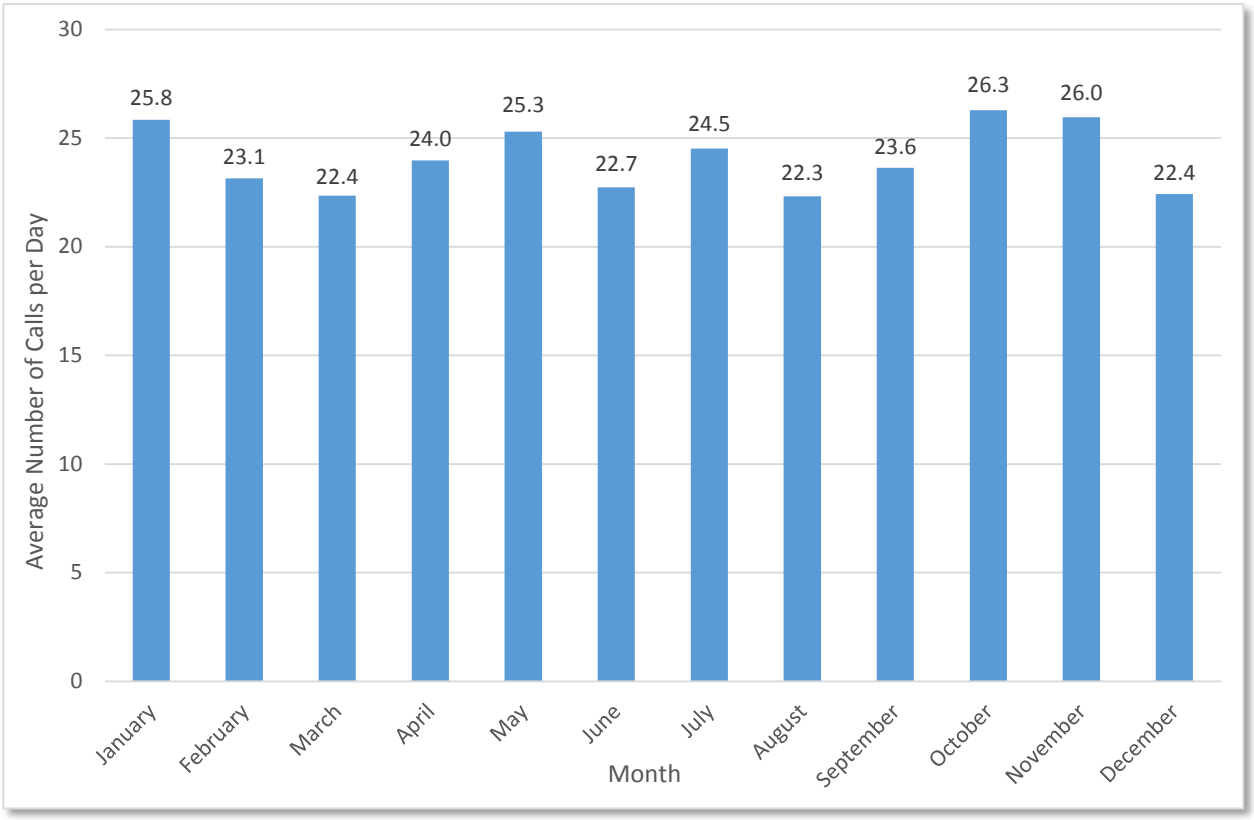
[1]"Number of Calls" reflects an adjusted number of unique incidents to correspond with number of responses following the application of exclusion criteria, as an Appendix to the data report, regardless of calculated busy time.
[2]"Number of Responses" reflects the total number of entries in the CAD data file following the application of exclusion criteria, as noted in the Appendix of the data report, regardless of calculated busy time.
[3]"Responses with Time Data" reflects the number of responses in the CAD data file with available "AlarmDateTime" values and "InServiceDateTime" values.

Temporal analyses were conducted to evaluate patterns in community demands for EMS related services. These analyses examined the frequency of requests for service in 2017 by month, day of week, and hour of day. Results found that there was variability by month (Table 70; Figure 31). The three months with the most EMS calls in descending order were: October (26.3 per day), November (26.0 per day), and January (25.8 per day). The three months with the least EMS calls in ascending order were: August (22.3 per day), March (22.4 per day), and December (22.4 per day).

Table 70: Total EMS Related Calls and Average Calls per Day by Month

Month	Number of Calls	Average Calls per Day	Call Percentage
January	801	25.8	9.1
February	648	23.1	7.4
March	693	22.4	7.9
April	719	24.0	8.2
May	784	25.3	8.9
June	682	22.7	7.8
July	760	24.5	8.7
August	692	22.3	7.9
September	709	23.6	8.1
October	815	26.3	9.3
November	779	26.0	8.9
December	695	22.4	7.9
Total	**8,777**	**24.0**	**100.0**

Figure 31: Average EMS Related Calls per Day by Month

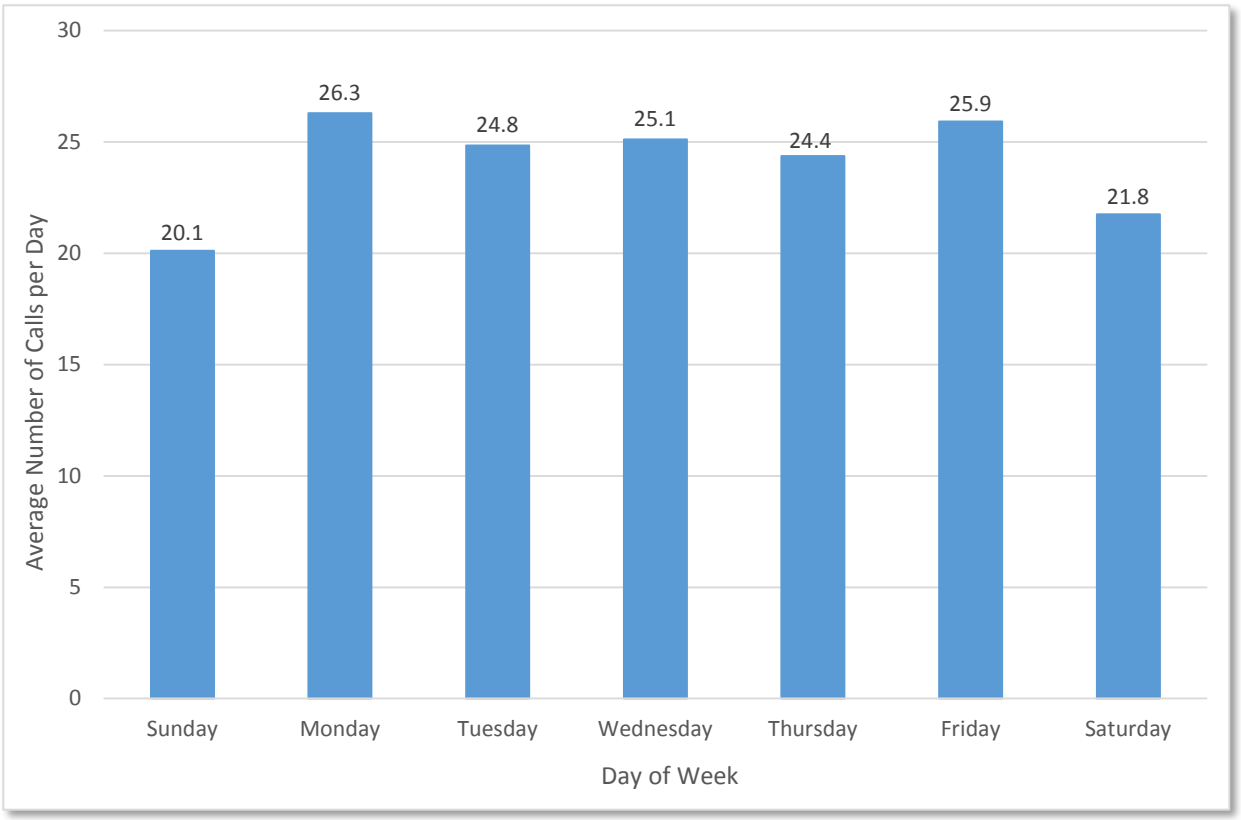


Similar analyses were conducted for EMS related calls by day of week (Table 71; Figure 32). The data revealed that there is some variability in the demand for services by day of week. Monday had the highest frequency of requests for EMS related services, averaging 26.3 calls per day and accounting for 15.6% of all EMS related calls. Sunday had the lowest frequency of requests for EMS related services, averaging 20.1 calls per day and accounting for 12.1% of all EMS related calls.

Table 71: Total EMS Related Calls and Average Calls per Day by Day of Week

Day of Week	Number of Calls	Average Calls per Day	Call Percentage
Sunday	1,066	20.1	12.1
Monday	1,367	26.3	15.6
Tuesday	1,292	24.8	14.7
Wednesday	1,306	25.1	14.9
Thursday	1,267	24.4	14.4
Friday	1,348	25.9	15.4
Saturday	1,131	21.8	12.9
Total	**8,777**	**24.0**	**100.0**

Figure 32: Average EMS Related Calls per Day by Day of Week

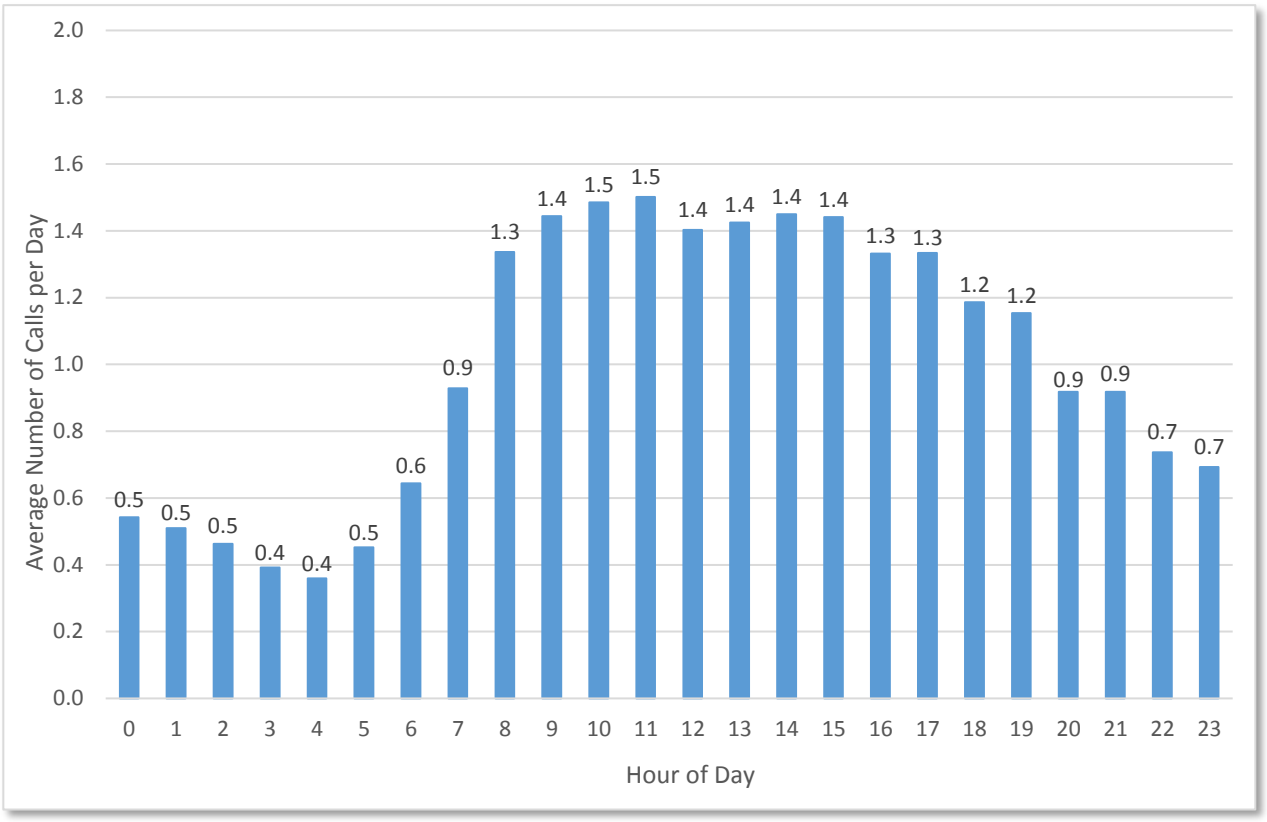


EMS related calls were also evaluated by hour of the day (Table 72; Figure 33). Variability exists in the time of day that requests for EMS related services were received. The highest demand for EMS related services occurred between 0900 and 1500, where average number of calls per day ranged from 1.4 to 1.5. Peak demand occurred at 1100 hours. The hours from 0000 to 0500 had the lowest demands, where average number of calls per day for each of those hours ranged from 0.4 to 0.5.

Table 72: Total EMS Related Calls and Average Calls per Day by Hour of Day

Hour of Day	Number of Calls	Average Calls per Day	Call Percentage
0	198	0.5	2.3
1	186	0.5	2.1
2	169	0.5	1.9
3	143	0.4	1.6
4	131	0.4	1.5
5	165	0.5	1.9
6	235	0.6	2.7
7	339	0.9	3.9
8	488	1.3	5.6
9	527	1.4	6.0
10	542	1.5	6.2
11	548	1.5	6.2
12	512	1.4	5.8
13	520	1.4	5.9
14	529	1.4	6.0
15	526	1.4	6.0
16	486	1.3	5.5
17	487	1.3	5.5
18	433	1.2	4.9
19	421	1.2	4.8
20	335	0.9	3.8
21	335	0.9	3.8
22	269	0.7	3.1
23	253	0.7	2.9
Total	**8,777**	**24.0**	**100.0**

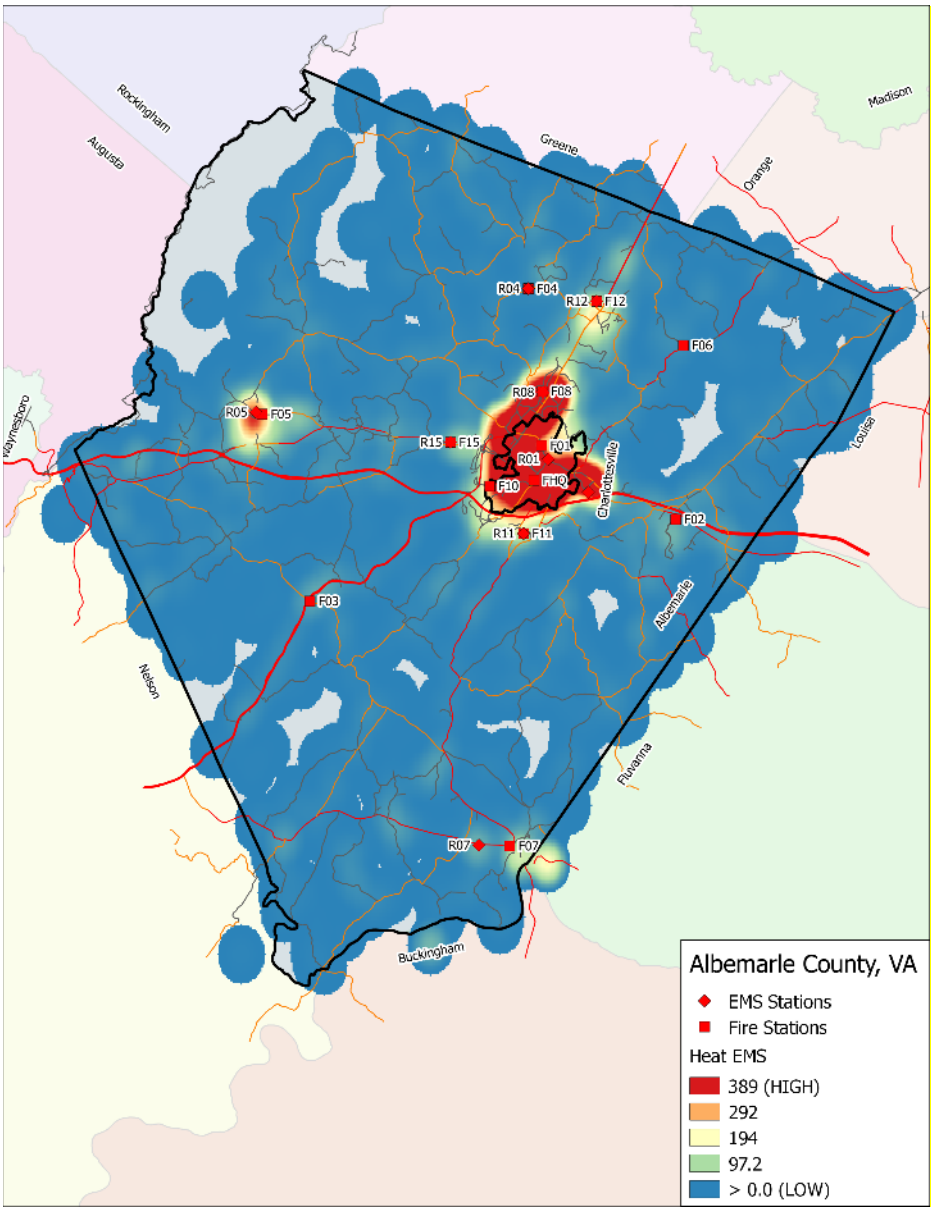
Figure 33: Average EMS Related Calls per Day by Hour of Day



ACFR units made a total of 15,395 vehicle responses to EMS incidents. The total time on task was 10,827 hours, and the average time on task was 42:12. Medic 8 was the most utilized unit; with a unit hour utilization (UHU) of 0.243.

Geospatial analyses were completed on all EMS incidents. The GIS analyses mapped historical call volume with the station locations identified. When reviewing the maps, the darker the shade (red) the greater frequency of calls. For example, the greatest density of EMS calls for this period is disproportionately found in station 8 and 16 demand zones. The EMS demand map is presented below.

Figure 34: EMS Demand Map



Community Risks

The Albemarle County Fire Rescue Department is located within Commonwealth of Virginia and has a 2016 estimated population of 106,878 and a population density of nearly 137 per square mile according to the US Census Bureau.

Utilizing the collective US Census data for the County, approximately 5.3% of the population is under 5 years of age and 17.7% of the population is more than 65 years of age. These two groups are noted as the United States Fire Administration (USFA) designates these groups

as high risk for injury or death from fire. A summary provided by the US Census QuickFacts is provided below.[60]

Table 73: Summary of Population QuickFacts from US Census

People QuickFacts	Albemarle County	Virginia
Population estimates, July 1, 2016, (V2016)	106,878	8,411,808
Persons under 5 years, percent, July 1, 2016	5.3%	6.1%
Persons under 18 years, percent, July 1, 2016	20.3%	22.2%
Persons 65 years and over, percent, April 1, 2010	17.7%	14.6%

Data provided by the Virginia Department of Health was utilized to describe some of the community risks associated with illness and injuries. The 2013 leading cause of illness and injury mortality in Albemarle County is cancer followed by coronary heart disease and cerebral vascular disease. Unintentional deaths due to fire and smoke are incorporated into the unintentional accidents. A summary of these results is reproduced below from the Virginia Department of Health

[60] US Census, Estimates. Retrieved from https://www.census.gov/quickfacts/fact/table/albemarlecountyvirginia/PST045216

Figure 35: Leading Causes of Mortality in Albemarle County compared to Thomas Jefferson Planning District and the Commonwealth of Virginia 2013[61]

	Vital Event	Albemarle County	Thomas Jefferson	Virginia
All Deaths	Total Deaths All Ages	789	1,878	62,309
	Total Deaths Rate	577.7 <	659.5 <	720.1
	Malignant Neoplasms (Cancer) Deaths	178	436	14,348
	Malignant Neoplasms (Cancer) Rate	134.6 <	150.8	161.3
	Diseases of Heart Deaths	151	393	13,543
	Diseases of Heart Rate	107.2 <	135.9 <	155.9
	Cerebrovascular Diseases Deaths	43	94	3,278
	Cerebrovascular Diseases Rate	30.2	33.2	38.5
	Chronic Lower Respiratory Diseases Deaths	43	107	3,168
	Chronic Lower Respiratory Diseases Rate	32.1	37.3	37.2
	Unintentional Injury Deaths	33	89	2,794
	Unintentional Injury Rate	26.4	33.6	33.0
	Alzheimer's Disease Deaths	27	59	1,634
	Alzheimer's Disease Rate	18.2	20.7	19.6
	Diabetes Mellitus Deaths	12	33	1,618
	Diabetes Mellitus Rate	9.2 <	11.0 <	18.3
	Nephritis and Nephrosis Deaths	11	37	1,547
	Nephritis and Nephrosis Rate	8.0 <	13.0	18.0
	Septicemia Deaths	28	64	1,464
	Septicemia Rate	27.2	26.6 >	17.7
	Influenza and Pneumonia Deaths	21	44	1,430
	Influenza and Pneumonia Rate	13.7	15.0	16.8
	Suicide Deaths	12	30	1,047
	Suicide Rate	8.8	11.4	12.2
	Chronic Liver Disease Deaths	4	15	836
	Chronic Liver Disease Rate	3.2 <	5.3 <	8.9
	Primary Hypertension & Renal Disease Deaths	8	19	629
	Primary Hypertension & Renal Disease Rate	5.8	6.7	7.2
Population	2013 Census Population	103,000	240,864	8,260,405
	Female Population Ages 10-19	7,732	15,033	518,354

It is important to note that even though Albemarle County is home to a large University the statistics do not show a spike in categories that some university communities see due to the risky behavior that some college students engage in such as binge drinking. A 2012 strategic plan released by the University of Virginia shows significant efforts by the University to curb

[61] Virginia Health Department, accessed online at https://www.vdh.virginia.gov/HealthStats/Albemarle13.htm

those risky behaviors which have resulted in an 83% reduction in injuries and 81% decrease in DUI's between 2001 and 2010.[62]

According to the National Institute on Alcohol Abuse and Alcoholism[63]:

> Virtually all college students experience the effects of college drinking – whether they drink or not. The problem with college drinking is not necessarily the drinking itself, but the negative consequences that result from excessive drinking. About four out of five college students drink alcohol. About half of college students who drink, also consume alcohol through binge drinking. Each year, drinking affects college students, as well as college communities, and families. Nationally, the consequences of drinking include:
>
> - Death: 1,825 college students between the ages of 18 and 24 die each year from alcohol-related unintentional injuries.
> - Assault: More than 690,000 students between the ages of 18 and 24 are assaulted by another student who has been drinking.
> - Sexual Abuse: More than 97,000 students between the ages of 18 and 24 are victims of alcohol-related sexual assault or date rape.
> - Injury: 599,000 students between the ages of 18 and 24 receive unintentional injuries while under the influence of alcohol.
> - Health Problems/Suicide Attempts: More than 150,000 students develop an alcohol-related health problem and between 1.2 and 1.5 percent of students indicate that they tried to commit suicide within the past year due to drinking or drug use.

Probability/Consequence of EMS Risk

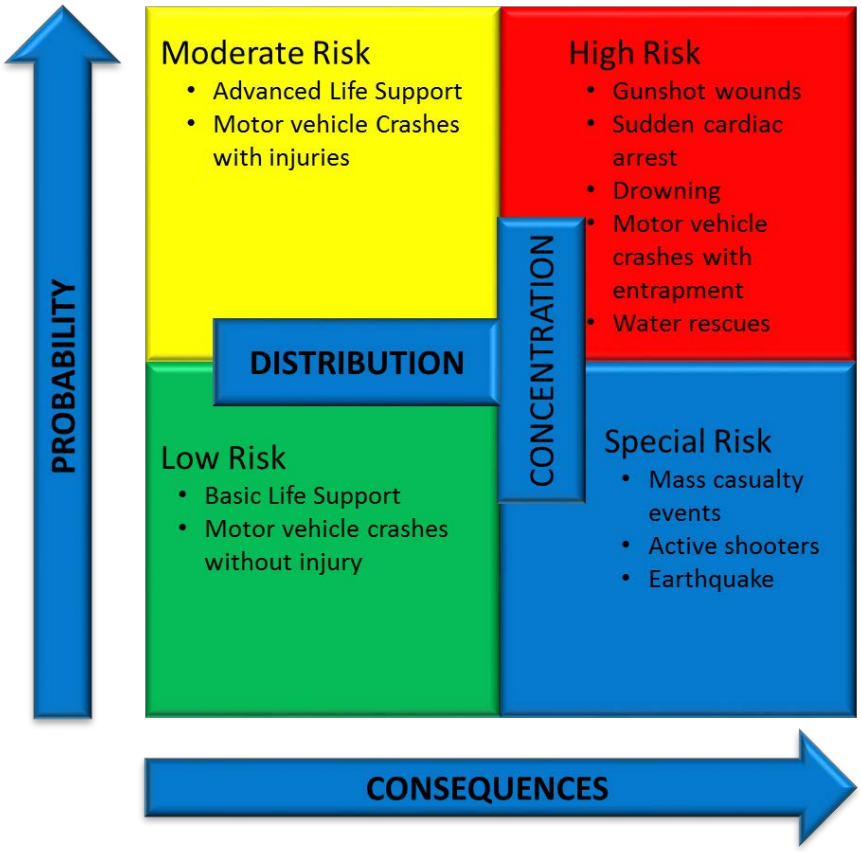
The probability and consequence process used for the EMS risk assessment is derived by the call taking process and call typing at the dispatch center. These call typing determinants are the framework for ensuring the appropriate EMS response within Albemarle County.

The analysis evaluates the probability and consequence of EMS incidents. The results are presented below.

[62] University of Virginia Biennial Report, accessed online at http://gordiecenter.studenthealth.virginia.edu/sites/gordiecenter.studenthealth.virginia.edu/files/2010-12-biennial-report.pdf

[63] National Institute on Alcohol Abuse and Alcoholism accessed at https://www.niaaa.nih.gov/alcohol-health/special-populations-co-occurring-disorders/college-drinking

Figure 36: Probability and Consequence Matrix for EMS Risk



Critical Task Analysis

To align resource allocation and risk for emergency medical services a critical task analysis was completed. Results found that the most efficient and effective utilization of resources is to send the most efficient resources to the level of risk and patient acuity identified. Therefore, low risk events may receive a single EMS resource while a high-risk incident may receive a single EMS resource and support. As a matter of pre-determined dispatch, high risks required multiple resources to effectively mitigate the identified risk. The tables below reflect call types and resource allocations.

Table 74: Emergency Medical Incident - Low Risk (BLS)[64]

Critical Task	Needed Personnel
Patient Care / Assessment / Transport	2
Total	**2**

[64] Examples of Low Risk BLS incidents may include incidents classified at the BLS level such as ground level falls, sick person, or non-acute back pain

Table 75: Resource Allocation for EMS - Low Risk (BLS)

Responding Units	Minimum Staffing
Medic/Ambulance Unit	2 (3)
Total Response Provided	**2 (3)**
Personnel Required by Critical Tasks	**2**

Table 76: Emergency Medical Incident – Moderate Risk (ALS)[65]

Critical Task	Needed Personnel
Patient Care / Assessment	2
Patient Transport	1
Total	**3**

Table 77: Resource Allocation for EMS - Moderate Risk (ALS)

Responding Units	Minimum Staffing
Medic/Ambulance Unit	2 (3)
Engine/Truck when Ambulance is at 2	3
Total Response Provided	**3 to 5**
Personnel Required by Critical Tasks	**3**

Table 78: Emergency Medical Incident – High Risk ALS[66]

Critical Task	Needed Personnel
Patient Care / Assessment	3
Treatment and Transport	2
EMS Supervisor	1
Total	**6**

Table 79: Resource Allocation for EMS – High Risk (ALS)

Responding Units	Minimum Staffing
Medic/Ambulance Unit	2 (3)
Engine/Truck	3
EMS Supervisor	1
Total Response Provided	**6 (7)**
Personnel Required by Critical Tasks	**6**

Table 80: Motor Vehicle Crash Without Injuries - Low Risk

Critical Task	Needed Personnel
Hazard abatement	3
Total	**3**

Table 81: Resource Allocation for MVC without Injuries - Low Risk

Responding Units	Minimum Staffing
Engine/Truck	3
Total Response Provided	**3**
Personnel Required by Critical Tasks	**3**

[65] Moderate Risk ALS incidents would include ALS level incidents such as chest pain, difficulty breathing, anaphylaxis etc.
[66] Examples of High Risk EMS incidents may include Cardiac Arrests, Penetrating Wounds, and multiple ALS patients

Table 82: Motor Vehicle Crash with Injuries – Moderate Risk

Critical Task	Needed Personnel
Patient Care / Assessment	2
Hazard Abatement	3
Total	**5**

Table 83: Resource Allocation for Motor Vehicle Crash with Injuries – Moderate Risk

Responding Units	Minimum Staffing
Medic/Ambulance Unit	2 (3)
Engine/Truck	3
Total Response Provided	**5 (6)**
Personnel Required by Critical Tasks	**5**

Table 84: Traffic Collision with Extrication / Fire - High Risk

Critical Task	Needed Personnel
Patient Care	2
Stabilization	2
Extrication	2
Charged Line	1
Command/Control	1
Total	**8**

Table 85: Resource Allocation for EMS – High Risk (ALS)

Responding Units	Minimum Staffing
Medic/Ambulance Unit	2 (3)
Engine	3
Engine / Truck	3
Total Response Provided	**8 (9)**
Personnel Required by Critical Tasks	**8**

Hazardous Materials Services

Albemarle County is in an area that has hazardous materials risk potentials from both fixed facilities and transportation of materials. The Department utilizes a collaborative approach between the City of Charlottesville and the ACFR system. The hazardous materials response is like other low frequency but high-risk incidents where the city and county both have resources committed to ensure there will be the appropriate resources dispatched. The City of Charlottesville received a regional grant to develop the hazardous materials response. The ACFR system has previously been limited to mitigating spills through basic containment procedures, while the City of Charlottesville provided the more technical response from their station 10. ACFR has now committed more resources and has 25 personnel trained to the hazardous materials technician level that can provide the higher level of mitigation. The City of Charlottesville has well-established hazardous materials response while the ACFR system is still developing. The future response for hazardous materials incidents within Albemarle County appears to be more integrated.

Community Service Demands

Fortunately for the Department, the Community's demand for mitigating hazardous materials or non-fire hazardous conditions is low. These categories accounted for 197 incidents in CY2017, and 597 unit responses.

Table 86: Number of Calls, Number of Responses, and Total Busy Time by Program

Program	Number of Calls[1]	Number of Responses[2]	Average Responses per Call	Responses with Time Data[3]	Total Busy Hours	Average Busy Minutes per Response	Percentage of Total Busy Hours
Agency Assist	513	1,275	2.5	1,266	816.4	38.7	5.2
EMS	8,764	15,550	1.8	15,395	10,827.0	42.2	69.2
Fire	2,416	5,467	2.3	5431	2,379.8	26.3	15.2
Hazmat	197	597	3.0	592	251.3	25.5	1.6
Police-Related	420	914	2.2	906	499.2	33.1	3.2
Public Service	495	698	1.4	693	225.2	19.5	1.4
Rescue	207	1,050	5.1	1036	636.2	36.8	4.1
Total	**13,012**	**25,551**	**2.0**	**25,319**	**15,635.2**	**37.1**	**100.0**

[1]"Number of Calls" reflects an adjusted number of unique incidents to correspond with number of responses following the application of exclusion criteria, as an Appendix to the data report, regardless of calculated busy time.
[2]"Number of Responses" reflects the total number of entries in the CAD data file following the application of exclusion criteria, as noted in the Appendix of the data report, regardless of calculated busy time.
[3]"Responses with Time Data" reflects the number of responses in the CAD data file with available "AlarmDateTime" values and "InServiceDateTime" values.

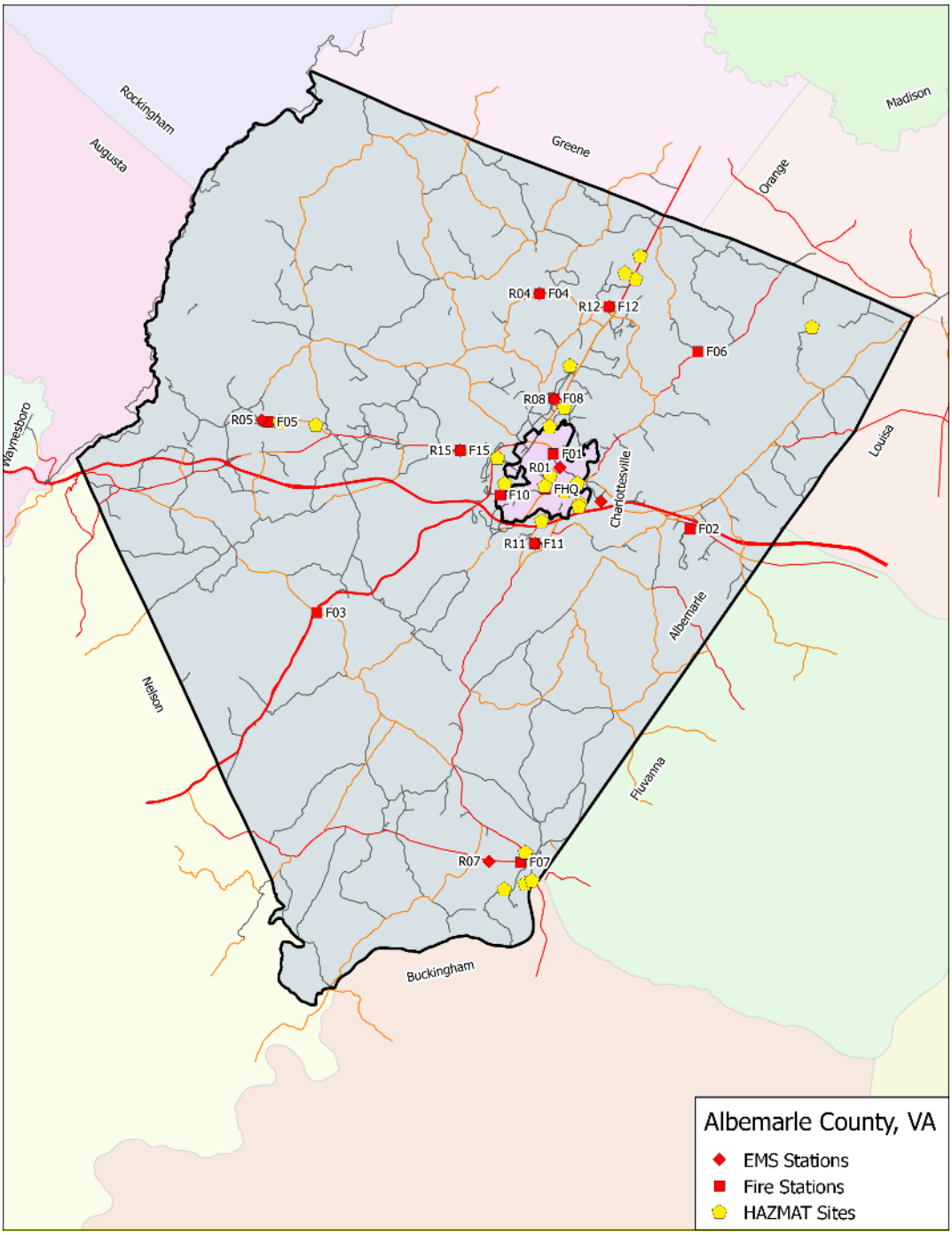
The small number of incidents in the HazMat categories means that no useful geo-temporal predictions regarding HazMat incidents can be projected from the historic data.

Community Risks

The County and the Department have existing hazardous materials risks between the fixed facilities and the transportation routes to move materials.

A geospatial representation of the requests for hazardous materials fixed facilities is provided below. The distribution of facilities is generally distributed throughout the development areas of the County. Due to the relatively low frequency of hazardous materials incidents, the geospatial analysis does not suggest a more appropriate location to deploy resources for hazardous materials.

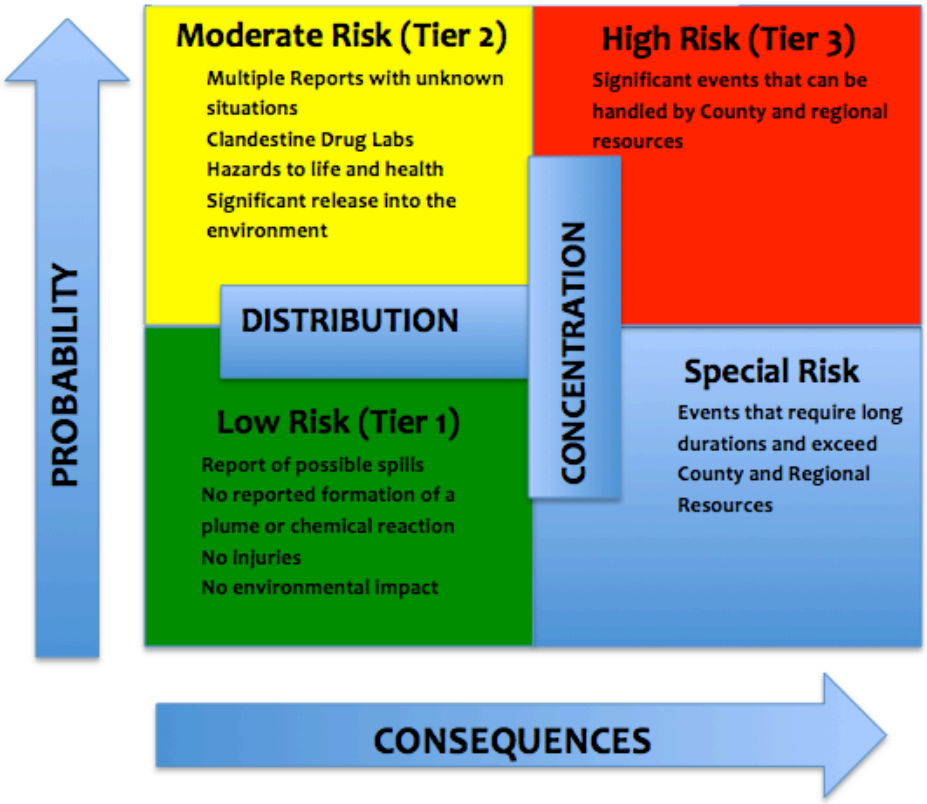
Figure 37: Hazardous Materials Sites



Probability/Consequence of Hazardous Materials Risk

All hazardous materials events are relatively low frequency as compared to other community service demands but the consequence of events could be significant. A probability and consequences risk matrix was developed and is presented below.

Figure 38: Probability and Consequences Hazardous Materials Risk Matrix



Critical Task Analysis

The Department staff analyzed the critical tasks required for the mitigation of the various hazardous materials risks in the community. Critical tasks for low, moderate, and high risk events are presented as well as the resources allocated to each event below.

Table 87: Level 1 Hazardous Materials Event - Low Risk[67]

Critical Task	Needed Personnel
Command / Control	1
Investigate	2
Total	**3**

[67] Examples of low risk hazardous materials events may include invests, small spills, and other first responder and operations level incidents

Table 88: Resource Allocation for Level 1 Hazardous Materials Event – Low Risk

Responding Units	Minimum Staffing
Engine/Truck	3
Total Response Provided	**3**
Personnel Required by Critical Tasks	**3**

Table 89: Level 2 Hazardous Materials Event - Moderate Risk[68]

Critical Task	Needed Personnel
Command / Control	1
Safety Officer	1
Entry Team (Technicians)	2
Decon (1 Technician)	2
Back Up Team (Technicians)	2
Isolate and Deny Entry / Evacuation	2
Medical / Ambulance	2
Total	**12**

Table 90: Resource Allocation for Level 2 Hazardous Materials Event – Moderate Risk

Responding Units	Minimum Staffing
Chief Officer	1
Safety Officer	1
Engine	3
Engine/Truck	3
Hazmat Technician Unit	3
Medic/Ambulance	2
Total Response Provided	**13**
Personnel Required by Critical Tasks	**12**

Table 91: Level 3 Hazardous Materials Event - High Risk[69]

Critical Task	Needed Personnel
Incident Command	1
Incident Safety	1
HazMat Group Supervisor (Technician)	1
HazMat Safety (Technician)	1
Entry Team Leader (Technician)	1
Entry Team (Technician)	3
Backup Team (Technician)	2
Decon (1 Technician)	3
Research (Technician)	1
Medical (1 Technician)	2
Support / Personnel	2
Total	**18**

[68] Moderate level risks may include incidents that require hazmat technicians, Level A entry protection, and technical research capabilities for incidents that exceed first responder and operations level capabilities.
[69] High-level risks may include incidents that require significantly more hazardous materials expertise and capabilities, large evacuations, and/or long duration events that necessity relief.

Table 92: Resource Allocation for Level 3 Hazardous Materials Event – High risk

Responding Units	Minimum Staffing
Chief Officer	1
Safety Officer	1
Engine	3
Engine	3
Engine	3
Hazmat Technical Rescue Team	6
Medic/Ambulance	2
Total Response Provided	**19**
Personnel Required by Critical Tasks	**19**

Rescue Services

Technical Rescue services are provided in a very collaborative manner. ACFR has a rescue squad at Monticello station 11, which is cross-staffed with the Engine 111 personnel. Western Albemarle Rescue Squad (WARS) has a rescue truck and trained personnel and CARS provides a squad. The County is currently pursuing an automatic aid agreement with the city of Charlottesville to respond to technical rescue calls anywhere in the county. Between ACFR, WARS, CARS, and potentially Charlottesville there is equipment and trained personnel to respond to the low frequency but high-risk technical rescue calls. The technical rescue response includes high angle, low angle, collapse, trench and confined space incidents.

Water rescue in Albemarle County is provided between ACFR, Charlottesville Albemarle Rescue Squad (CARS), Scottsville Fire and WARS. All the previously mentioned agencies have staff trained in water rescue and will respond to any water rescue incident within the county. The physical resources for water rescue are also distributed throughout the county to ensure a rapid response to time critical water rescue incidents.

Community Service Demands

Similar to the analyses for hazardous materials, the demand for technical rescue services is low in relation to the primary service areas. In calendar year 2017, there were 207 rescue incidents dispatched and a total of 1,050 vehicle movements. With the improved economy, the Department is experiencing an upswing in building, so there is potential risk for high angle rescues, trench emergencies, and structural collapses. Due to the relatively low community demand for services temporal analyses would not produce intuitive results for decision-making. Therefore, no additional analytical assessments were conducted.

Table 93: Number of Calls, Number of Responses, and Total Busy Time by Program

Program	Number of Calls[1]	Number of Responses[2]	Average Responses per Call	Responses with Time Data[3]	Total Busy Hours	Average Busy Minutes per Response	Percentage of Total Busy Hours
Agency Assist	513	1,275	2.5	1,266	816.4	38.7	5.2
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Public Service	495	698	1.4	693	225.2	19.5	1.4
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Total	**13,012**	**25,551**	**2.0**	**25,319**	**15,635.2**	**37.1**	**100.0**

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[3]"Responses with Time Data" reflects the number of responses in the CAD data file with available "AlarmDateTime" values and "InServiceDateTime" values.

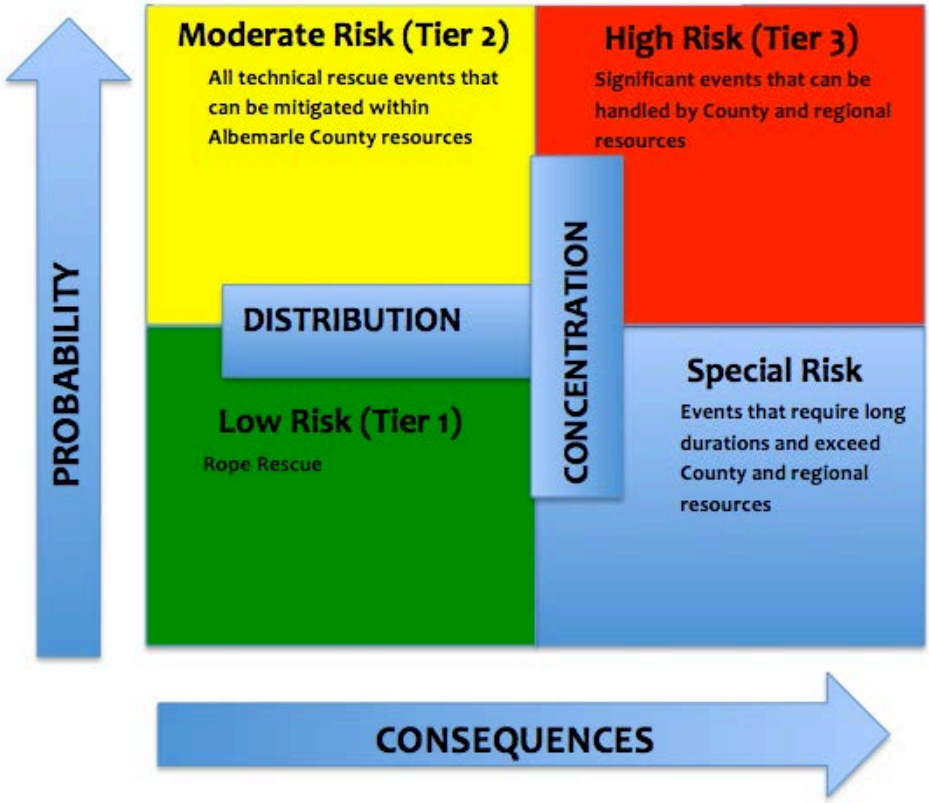
Community Risks

Albemarle County resides within the Commonwealth of Virginia. As a mixed-density (Urban, Suburban, and Rural) jurisdiction the Department has some risk potential for technical rescue incidents due to outdoor recreational activities and waterways, construction demands, ongoing repair to infrastructure, transportation routes, and active railways.

Probability/Consequence of Technical Rescue Risk

All technical rescue events are relatively low frequency as compared to other community service demands. A probability and consequences risk matrix was developed and is presented below.

Figure 39: Probability and Consequences Technical Rescue Risk Matrix



Critical Task Analysis

Critical tasks for moderate and high risk events are presented as well as the resources allocated to each event. The figures below represent the critical tasks.

Table 94: Tier 1 Technical Rescue Incident - Low Risk –Tier 1

Critical Task	Needed Personnel
Command / Control	1
Rescue	3
Access and Stabilization	3
Medical	2
Total	**9**

Table 95: Resource Allocation for Tier 1 Technical/Water Rescue Event– Low Risk

Responding Units	Minimum Staffing
Chief Officer	1
Engine/Truck	3
Engine/Truck	3
Medic/Ambulance	2
Total Response Provided	**9**
Personnel Required by Critical Tasks	**9**

Table 96: Tier 2 Technical Rescue Incident - Moderate Risk – Tier 2

Critical Task	Needed Personnel
Command / Control	1
Safety Officer	1
Technical Rescue Technicians	3
Operations	6
Medical	2
Total	**13**

Table 97: Resource Allocation for Tier 2 Hazardous Materials Event – Moderate Risk

Responding Units	Minimum Staffing
Chief Officer	1
Safety Officer	1
Engine	3
Engine/Truck	3
Tech/Water Rescue Technician Unit(s)	3
Medic/Ambulance	2
Total Response Provided	**13**
Personnel Required by Critical Tasks	**13**

Table 98: Tier 3 Technical Rescue Incident - High Risk – Tier 3

Critical Task	Needed Personnel
Incident Commander	1
Incident Safety Officer	1
Rescue Group Supervisor (Technician)	1
Rescue Safety Officer (Technician)	1
Entry Team Leader (Technician)	1
Entry Team (Technician)	2
Backup Team (Technician)	2
Air Systems (Technician)	1
Communications Systems (Technician)	1
Support	3
Medical	2
Total	**16**

Table 99: Resource Allocation for Tier 2 Hazardous Materials Event – Moderate Risk

Responding Units	Minimum Staffing
Chief Officer	1
Safety Officer	1
Engine	3
Engine/Truck	3
Tech/Water Rescue Technician Unit(s)	6
Medic/Ambulance	2
Total Response Provided	**16**
Personnel Required by Critical Tasks	**16**

REVIEW OF SYSTEM PERFORMANCE

The first step in determining the current state of the Albemarle County Fire Rescue'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 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 manual recognition or the choice to request assistance.

Therefore, the Albemarle County Fire Rescue system utilizes quantifiable "hard" data points to measure and manage system performance. These elements include alarm processing, turnout time, travel time, and the time spent on-scene. An example of the cascade of events and the elements of performance utilized by the Department is provided in the figure below.[70]

Detection

Is defined as the element of time between the time an event occurs, someone detects it and the emergency response system has been notified. This is typically accomplished by calling the 911 Public Safety Answering Point (PSAP). Albemarle County's PSAP is the consolidated Charlottesville-University of Virginia-Albemarle County Emergency Communications Center (Comm Center) which provides services for both police and fire communications.

Call Processing

This is the element of time measured between when Comm Center answers the 911 call, processes the information, and subsequently dispatches Department resources. The call processing times for the Albemarle County Fire Rescue (ACFR) system are reported to be well less than 60 seconds for both the average and 90th percentile, which in *Fitch's*

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

experience is uncommon and very swift. While the ACFR system call processing times are very swift, the Charlottesville Fire Department (CFD) processing times appear to be more in line with *Fitch's* experience being reported between the 60 and 120 second mark for the average and 90th percentile. This difference in times between ACFR and CFD may be a product of the processes used in the emergency communications center and how the computer aided dispatch (CAD) system is used. There may need to be additional evaluation and validation done to determine the process used to report the call processing times for the ACFR system.

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.

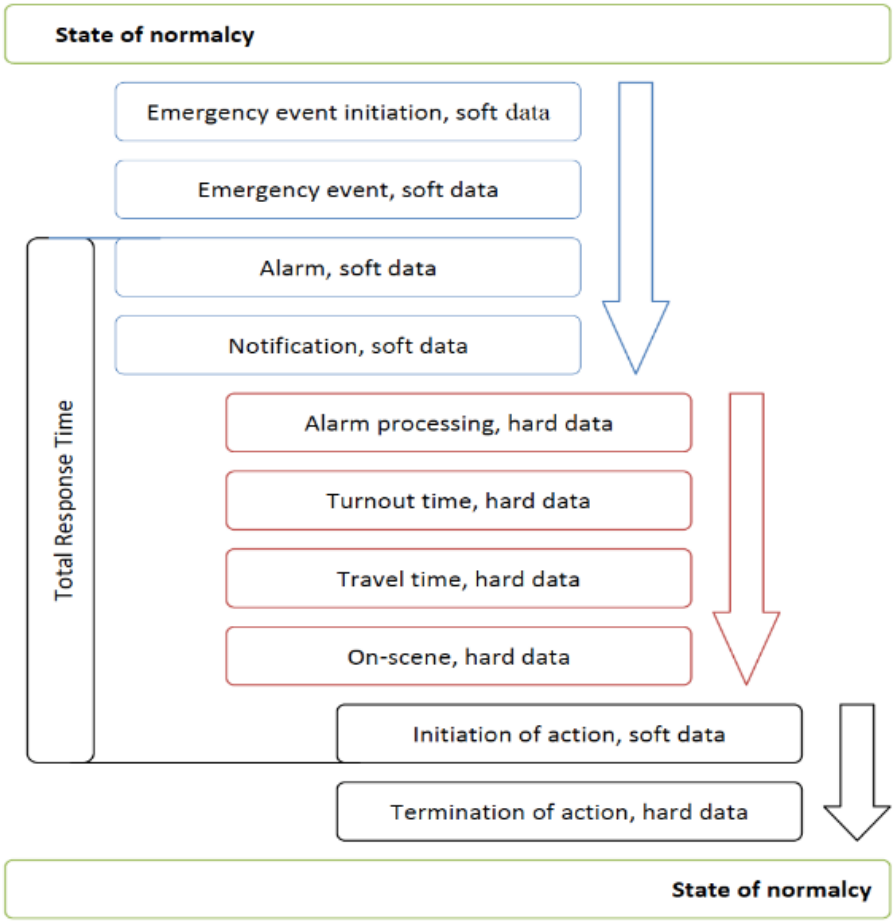
Travel Time

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 is the total time required to arrive on-scene beginning with the emergency communications center answering the phone request for service and the time that the units arrive on-scene.

Figure 40: Cascade of Events



Response Time Continuum

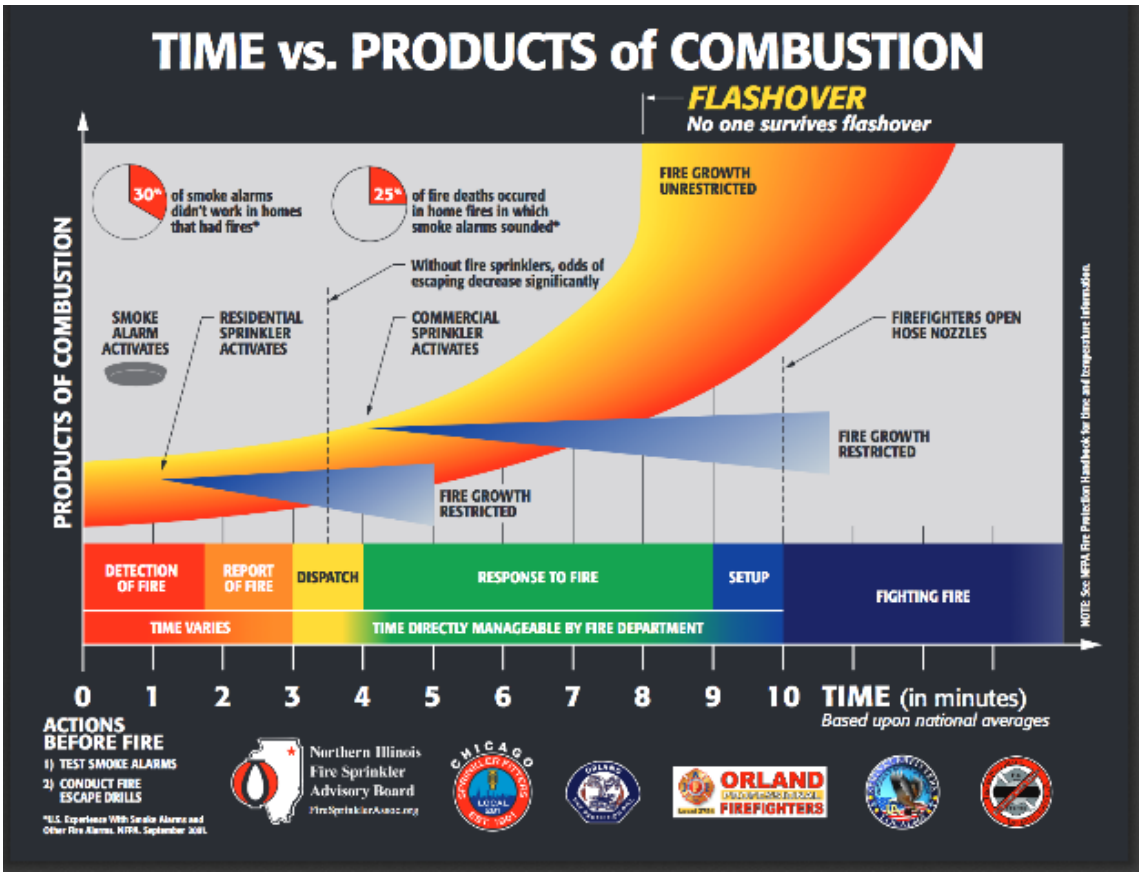
Fire

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 below.[71]

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

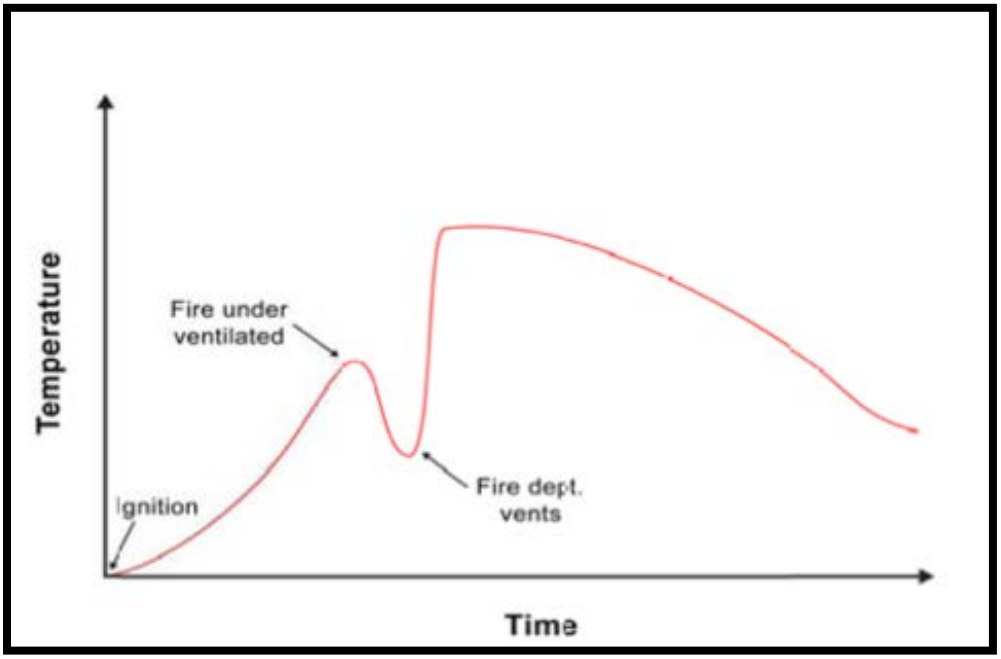
Figure 41: Example of Traditional Time Temperature Curve



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 below.[72]

[72] UL/NIST Ventilation Controlled Time Temperature Curve. Retrieved from http://www.nist.gov/fire/fire_behavior.cfm

Figure 42: Ventilation Controlled Time Temperature Curve



EMS

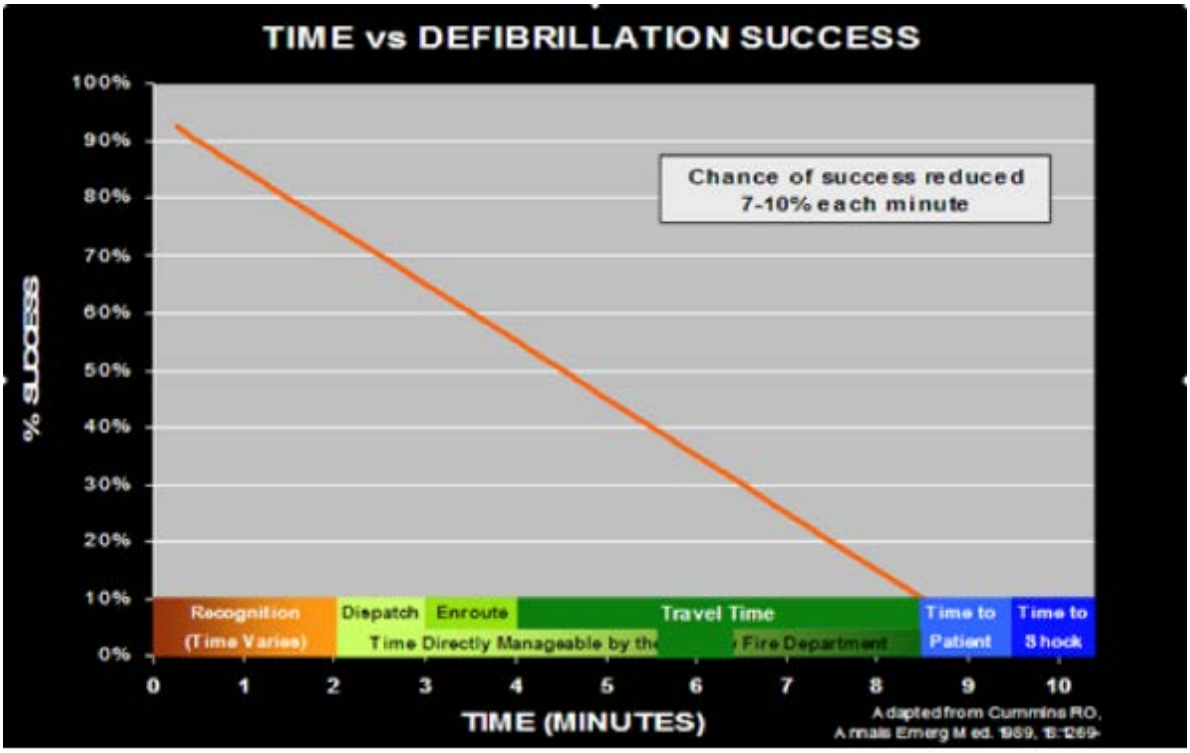
The effective response to Emergency Medical Service (EMS) incidents also has a direct correlation to the ability to respond within a specified period. However, unlike structure fires, responding to EMS incidents introduces considerable variability in the level of clinical acuity. From this perspective, 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.[73] The 12-minute upper threshold is only the upper limit of the available 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.[74]

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 below. 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.

[73] 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.
[74] 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.

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 [75] 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 43: Cascade of Events for Sudden Cardiac Arrest with Shockable Rhythm



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 Demand Zones

Each of the fire and EMS demand zones were compared for factors that would impact the distribution of resources. While the geographic analysis is a quality surrogate measure, there are times that the complexity of the roadway system may provide additional challenges. Albemarle County has a significant variation in its road network given the county contains very desolate rural areas all the way through a very urban environment.

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

Each district has an assigned geographic area that is utilized by the Department for all response and planning efforts. The individual districts vary in geographic size, measured risk, and community demand for services. A map of the current Districts is provided as Figure 44.

Additionally, each district area was evaluated utilizing GIS analyses to measure the relative geographic size and the distribution of high, moderate, and low risks as previously presented. The number of measured risks varies from seven to 272 and the square mileage varies from 21 square miles to nearly 187 square miles. This degree of variation demonstrates the uniqueness to the entire county area and suggests that a multi-faceted, or differentiated, approach is needed in mitigation and response strategies.

Table 100: Comparison of Geographic Area and Risk Distribution by District

Station	District	Miles^2	High Risks	Moderate Risks	Low Risks	Total Risks
F02	EAST RIVANNA	83.60	6	50	16	72
F03	NORTH GARDEN	110.84	0	24	0	24
F04	EARLYSVILLE	78.30	0	19	2	21
F05	CROZET	145.53	3	54	4	61
F06	STONY POINT	51.24	0	7	0	7
F07	SCOTTSVILLE	186.52	1	51	1	53
F08	SEMINOLE	21.03	8	182	82	272
F11	MONTICELLO	57.29	4	87	13	104
F12	HOLLYMEAD	23.33	2	34	18	54
F15	IVY	33.56	1	49	8	58

As expected with the variability in response districts, the historical performance for each district varies as well. The geospatial analyses were validated through a review of annual historical performance across each of the fire demand zones. The historical travel time performance for each fire station demand zones is provided as Figure 51 below. Comparisons are provided for the relative variations in performance across the deployment configurations of 24/7 coverage, MFDAY coverage, and the SSEVE coverage. Data for first arriving unit travel time by agency/district is provided as Figure 45 below.

Since the travel time (drive time) remains a surrogate for the distribution of calls, the variation in the customer's service isn't uncovered until an analysis of the turnout time is considered. Turnout time is analyzed in a subsequent section on system performance.

Figure 44: Albemarle County First Due District Boundaries

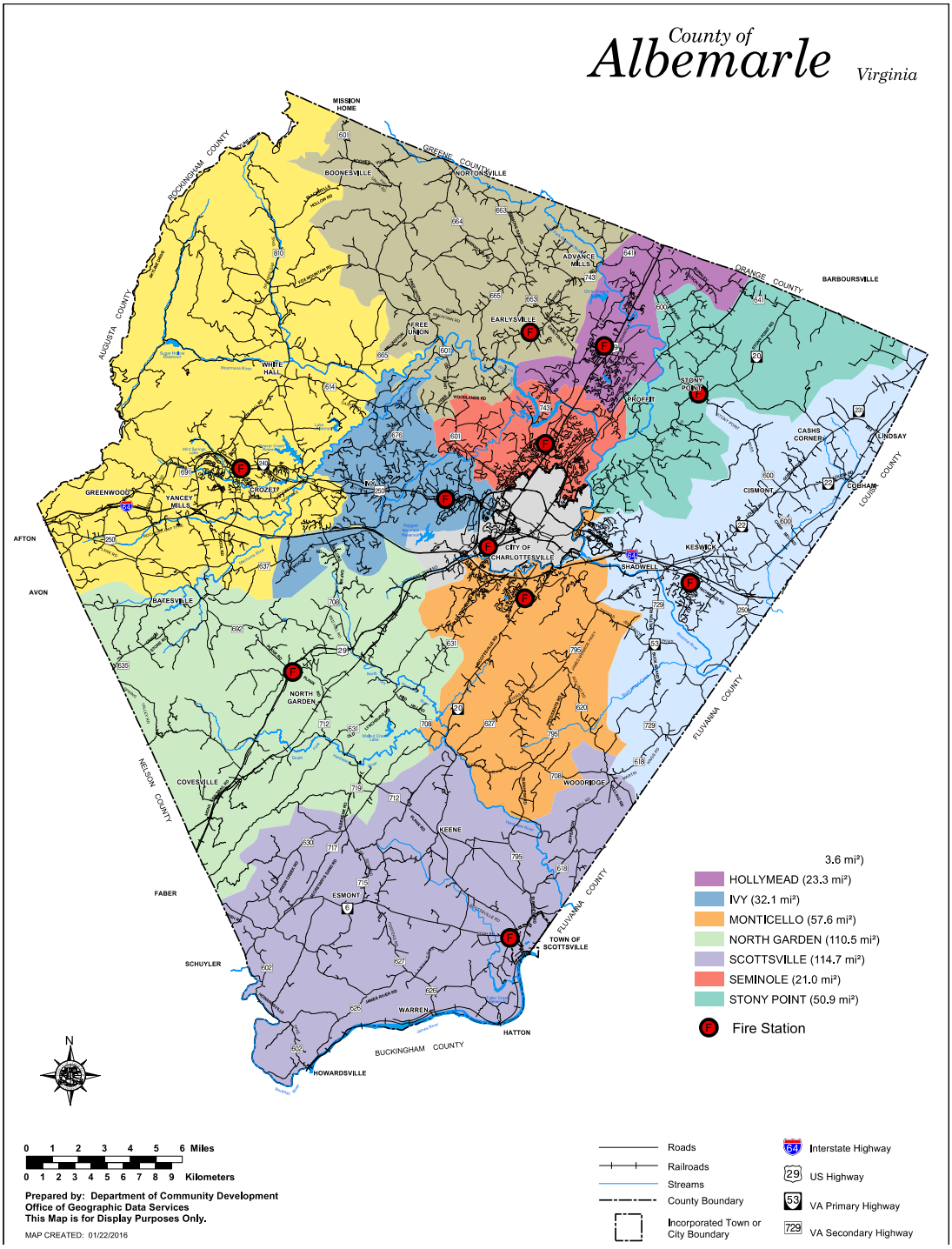
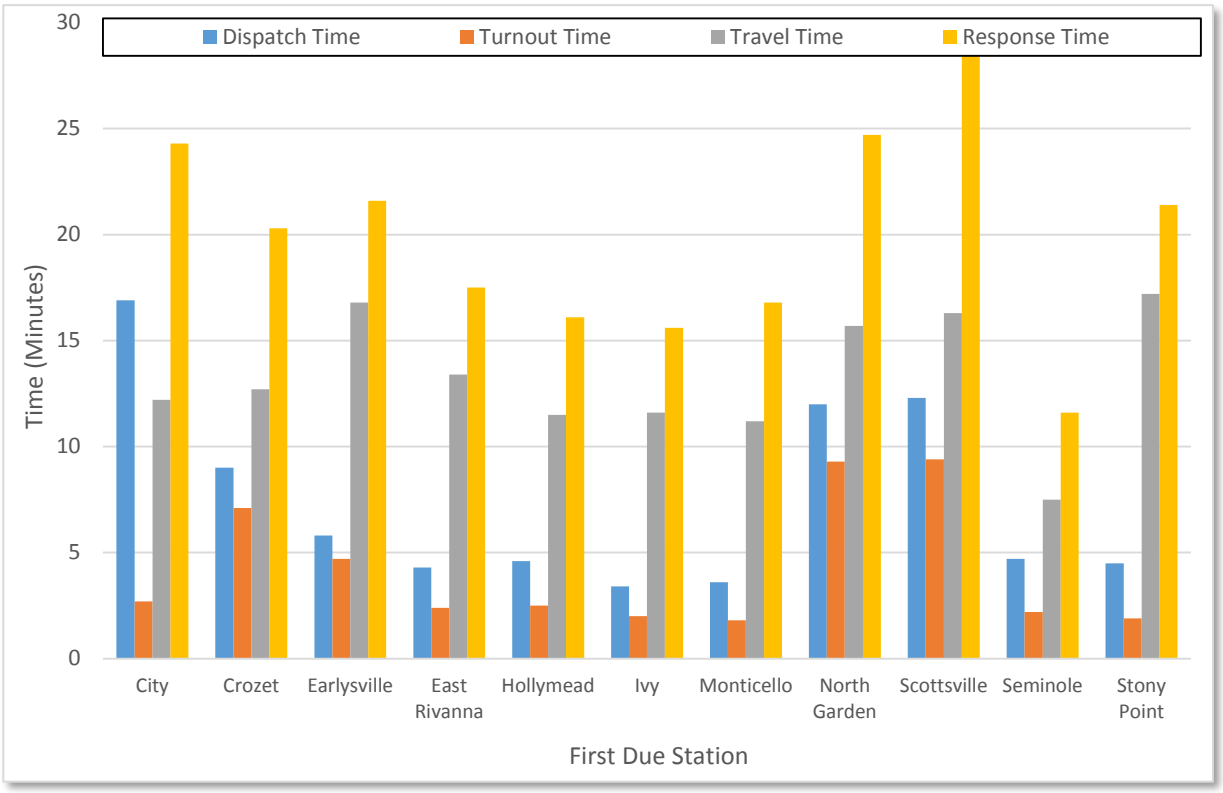


Figure 45: 90th Percentile First Arrival Performance in Minutes - Fire First Due Station



Finally, the Rescue/Ambulance program provides varied coverage between days of week and time of day as well. While this variability may impact the performance capabilities, from a planning perspective, the adopted process is to combine the relative risks and demands of both the Rescue Stations and the Fire Stations to make determinations of appropriate resource configurations following the established fire/district boundaries.

However, the current Rescue/Ambulance response zone configurations between MFDAY and SSEVE are provided as Figures 46 and 47, respectively. During the times of MFDAY, ACFR has a total of eight ambulances and on SSEVE there are five. However, the configurations vary considerably from dedicated staff to unstaffed and from Advanced Life Support (ALS) capability to Basic Life Support Capability (BLS). The CARS (R01) provides services as well during the SSEVE times and at times respond anywhere in the county. Individual performance for EMS travel time is provided for reference as Figure 48.

Figure 46: Rescue/Ambulance Response Areas MFDAY

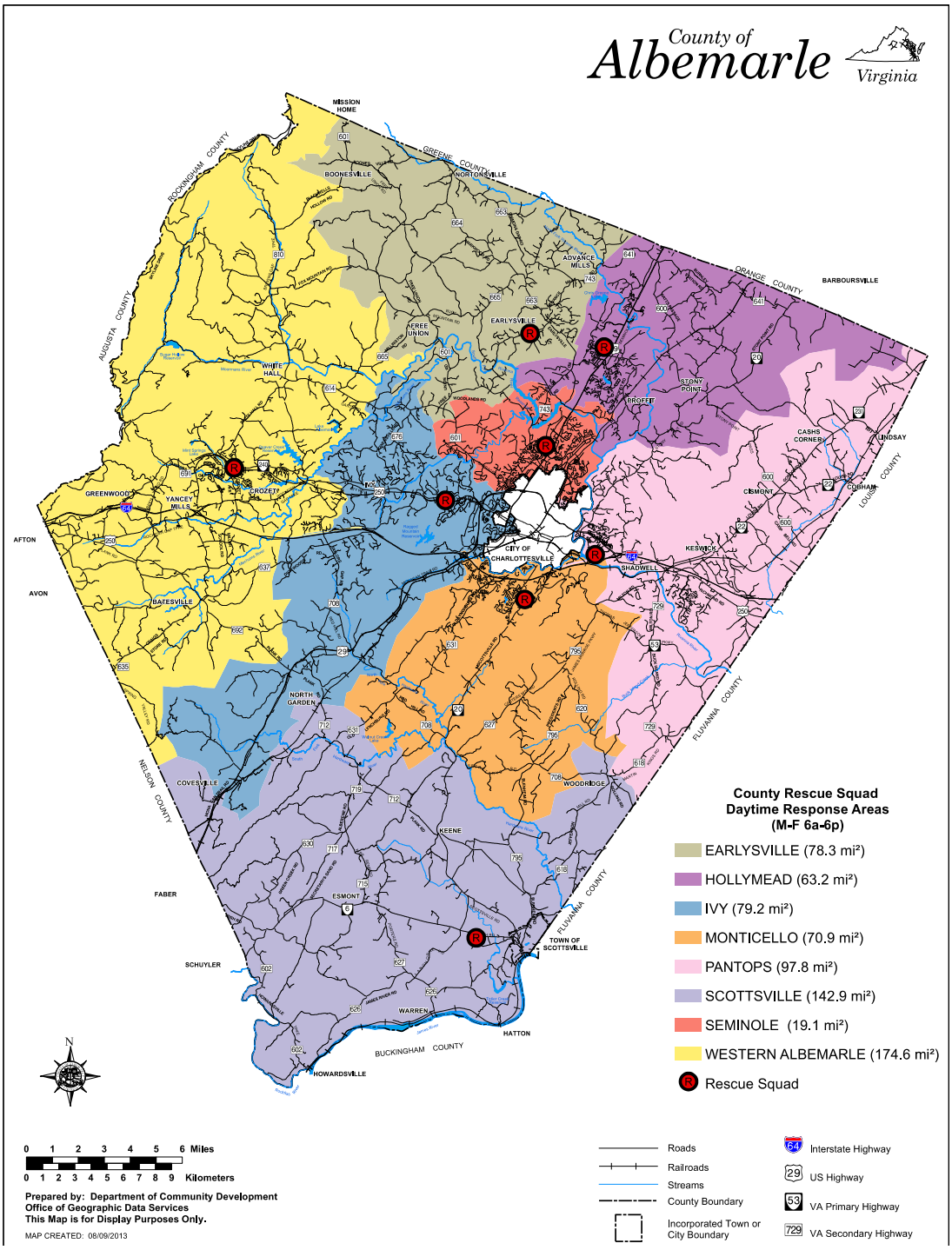


Figure 47: Rescue/Ambulance Response Areas for Nights and Weekends

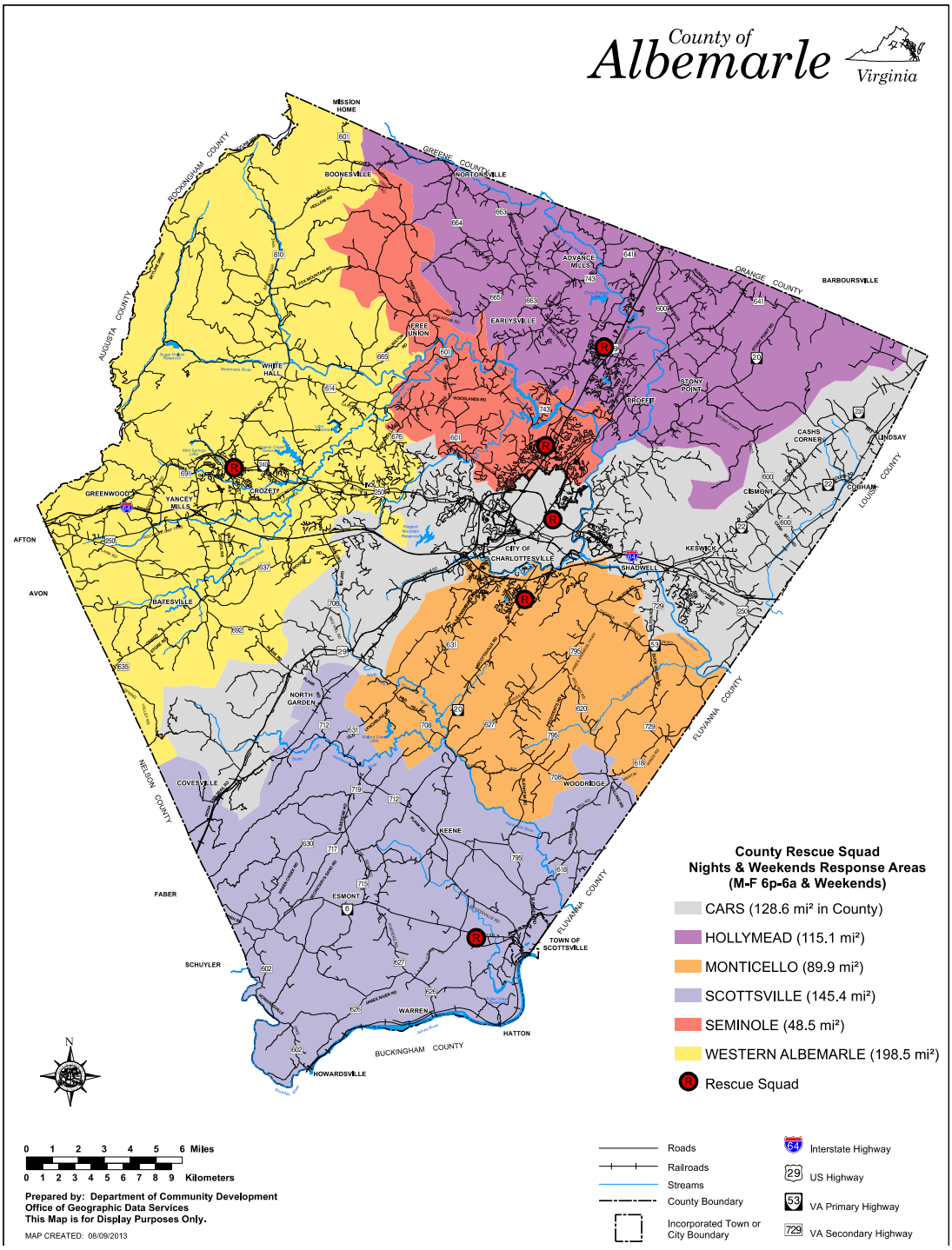


Figure 48: 90th Percentile First Arrival Performance in Minutes - EMS MFDAYLIGHT First Due Station

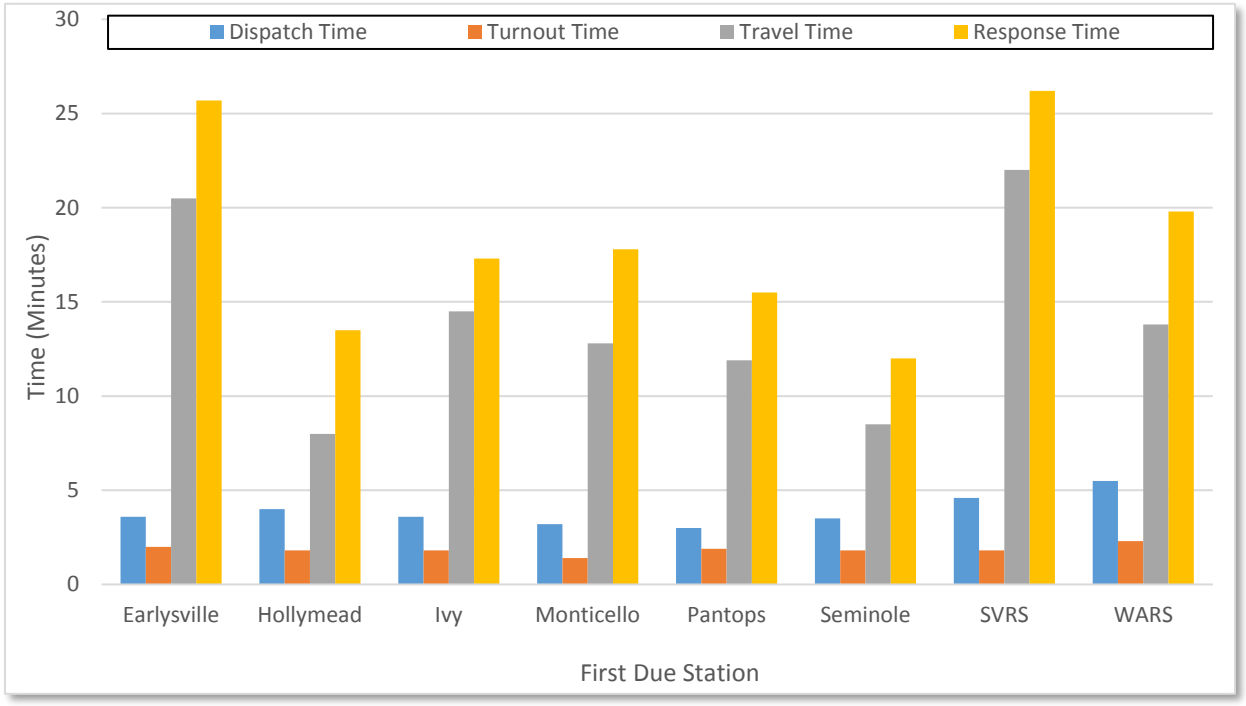
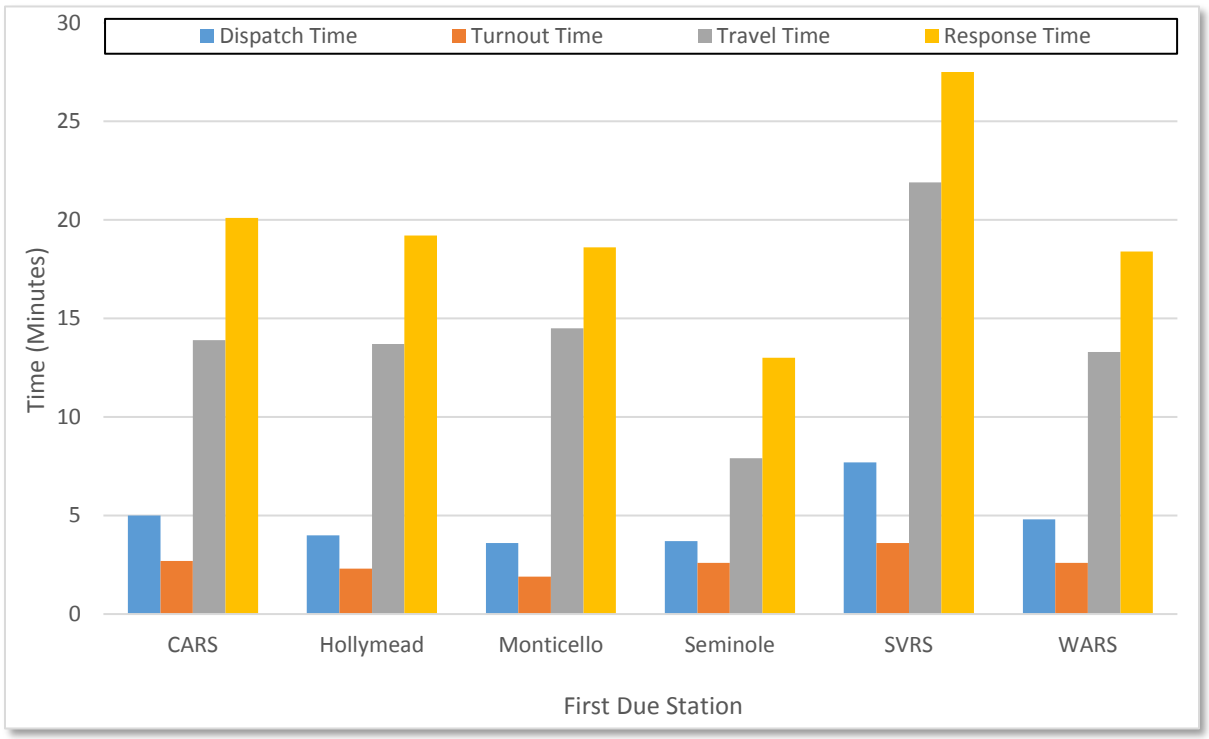


Figure 49: 90th Percentile First Arrival Performance in Minutes - EMS WEEKEND/EVENING First Due Station



Comparison of Workloads by Demand Zone

Another method for assessing the effectiveness of the distribution model is to analyze the demand for services across the distribution model. Workload is assessed at the station demand zone level by call volume and by response volume. For the purposes of these analyses, all calls were classified as either Fire or EMS only. Station demand zones were based upon "FireFirstDue," "RescueFirstDueDay," and "RescueFirstDueNight" entries in the CAD data file. Call volume reflects the number of incoming calls assigned to a first due station, whether or not a unit assigned to the first due station responded. Similarly, response volume reflects the number of responses made to incoming calls assigned to a first due station, whether or not these responses were made by units assigned to the first due station. Percent of department workload is calculated based on number of responses.

Analyses illustrate that Seminole was the top demand zone, requiring 21.4% of ACFR's total responses to fire related calls, 25.5% of ACFR's total responses to EMS related calls during the MFDAYLIGHT (MFD) period, and 26.0% of ACFR's total responses to EMS related calls during the WEEKEND/EVENING (W/E) period. Crozet was the second highest demand zone for fire related calls, requiring 13.8% of ACFR's total responses to fire related calls. Pantops was the second highest demand zone for EMS related calls during the MFD period, requiring 17.7% of ACFR's total responses to EMS related calls during this time period. WARS was the second highest demand zone for EMS related calls during the W/E period, requiring 21.3% of ACFR's total responses to EMS related calls during this time period.

Figure 50: Department Workload by Station Demand Zone – Fire First Due Station

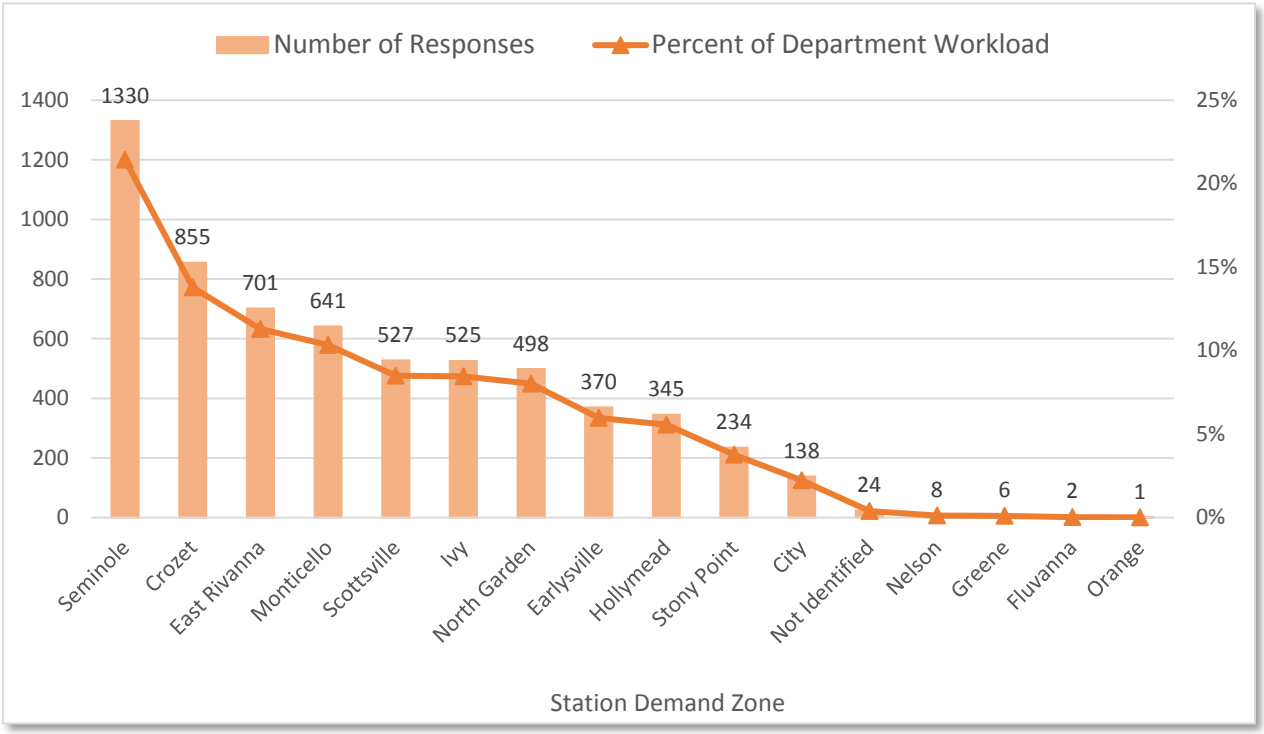


Figure 51: Department Workload by Station Demand Zone – EMS MFDAYLIGHT First Due Station

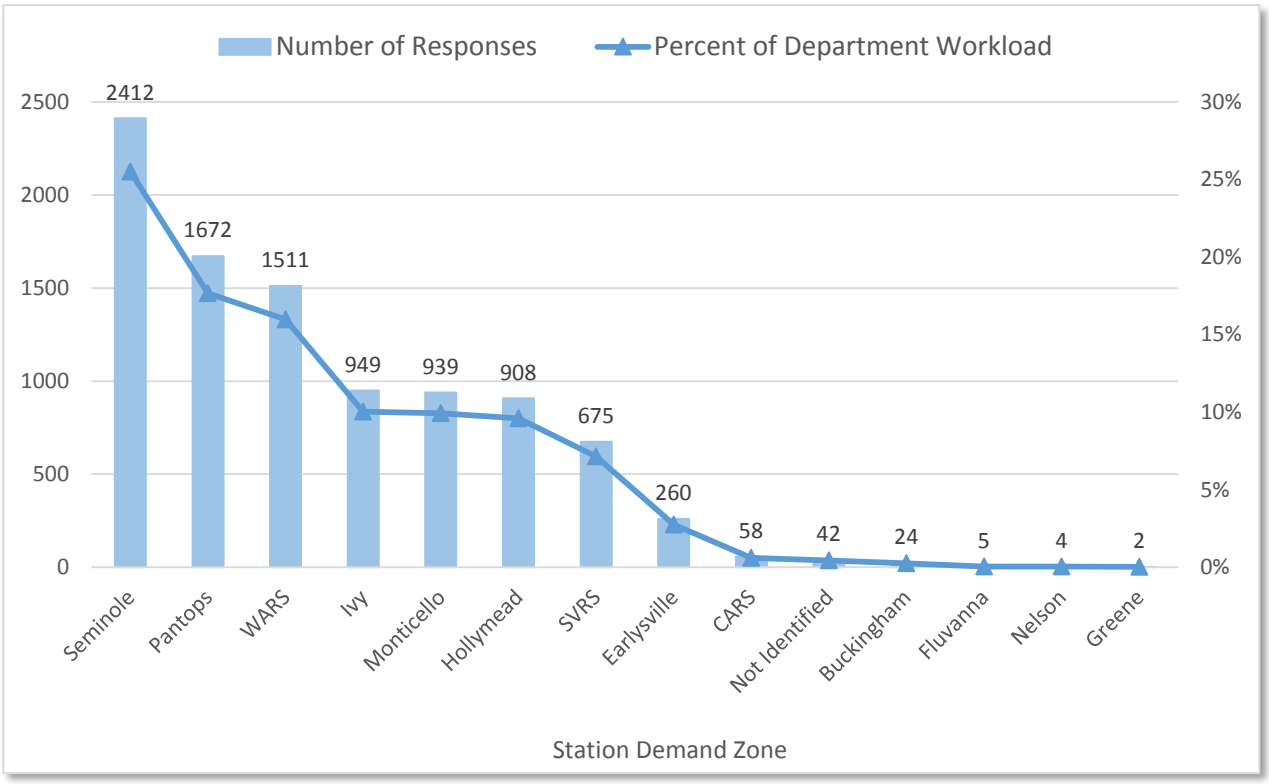
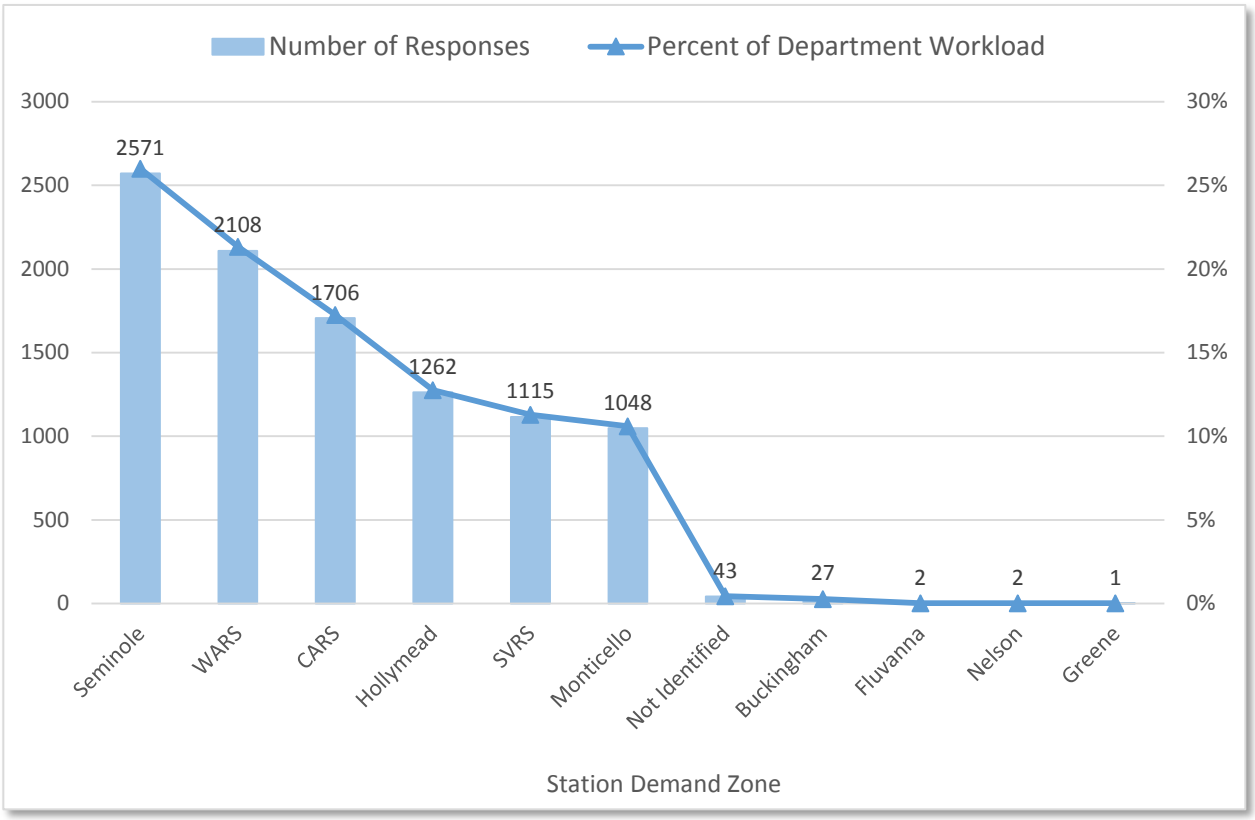


Figure 52: Department Workload by Station Demand Zone – EMS WEEKEND/EVENING First Due Station



Finally, workload by station demand zone and program was analyzed for both comparative purposes as well as for introspection into potential system failures (Table 101 through Table 27). For the purposes of these analyses, all calls were first classified as either Fire or EMS only to be able to associate the relevant "FireFirstDue," "RescueFirstDueDay," and "RescueFirstDueNight" entries in the CAD data file as the station demand zones. Calls were then further classified into expanded program areas under those two categories.

For calls originally classified as Fire to associate a "FireFirstDue" entry as the station demand zone, Seminole had the highest demand for services related to fire (1,133/5,416 responses; 20.9%), hazmat (151/589 responses; 25.6%), and rescue (26/40 responses; 65.0%) calls. Crozet had the second highest demand for services related to fire (707/5,416 responses; 13.1%), hazmat (113/589 responses; 19.2%), and rescue (7/40 responses; 17.5%) calls. Crozet had the highest demand for services related to agency assist (11/59 responses; 18.6%) and public service (17/101 responses; 16.8%) calls.

Table 101: Number of Responses by Station Demand Zone and Program - Fire First Due Station

Station Demand Zone	Program					
	Agency Assist	Fire	Hazmat	Public Service	Rescue	Total
City	8	113	13	3	1	138
Crozet	11	707	113	17	7	855
Earlysville	1	334	25	10	0	370
East Rivanna	0	616	77	8	0	701
Fluvanna	0	2	0	0	0	2
Greene	0	6	0	0	0	6
Hollymead	0	269	61	14	1	345
Ivy	7	473	37	8	0	525
Monticello	9	570	47	15	0	641
Nelson	0	8	0	0	0	8
North Garden	8	478	9	3	0	498
Orange	0	1	0	0	0	1
Scottsville	3	488	31	5	0	527
Seminole	6	1,133	151	14	26	1,330
Stony Point	6	198	21	4	5	234
Not Identified	0	20	4	0	0	24
Total	**59**	**5,416**	**589**	**101**	**40**	**6,205**

For calls originally classified as EMS and occurring during the MFDAYLIGHT period to associate a "RescueFirstDueDay" entry as the station demand zone, Seminole had the highest demand for services related to agency assist (135/505 responses; 26.7%), EMS (1,987/7,754 responses; 25.6%), police-related (84/371 responses; 22.6%), and public service (167/331 responses; 50.5%) calls. Hollymead had the highest demand for services related to fire calls as the EMS first due station, due to "Air Carrier Major Difficulty" calls (14/22 responses; 63.6%). Ivy had the highest demand for services related to rescue calls (95/475 responses; 20.0%).

Table 102: Number of Responses by Station Demand Zone and Program - EMS MFDAYLIGHT First Due Station

Station Demand Zone	Program							
	Agency Assist	EMS	Fire[1]	Hazmat	Police-Related	Public Service	Rescue	Total
Buckingham	0	16	0	0	5	3	0	24
CARS	15	35	1	0	6	1	0	58
Earlysville	8	209	0	0	4	8	31	260
Fluvanna	0	5	0	0	0	0	0	5
Greene	0	0	0	0	0	0	2	2
Hollymead	59	707	14	0	54	20	54	908
Ivy	71	715	0	3	47	18	95	949
Monticello	65	784	2	0	37	16	35	939
Nelson	0	1	0	0	0	0	3	4
Pantops	55	1,452	1	0	55	21	88	1,672
Seminole	135	1,987	4	0	84	167	35	2,412
SVRS	44	542	0	0	15	15	59	675
WARS	49	1,269	0	0	59	61	73	1,511
Not Identified	4	32	0	0	5	1	0	42
Total	**505**	**7,754**	**22**	**3**	**371**	**331**	**475**	**9,461**

[1]CAD call types of "Air Carrier Major Difficulty" and "Elevator Emerg w/out Patient" were originally classified as "ResponseType" EMS in the CAD data file, and retained as EMS response types for the first wave of classifications into either Fire or EMS categories in order to determine the appropriate first due station variable to use (i.e., "FireFirstDue, "RescueFirstDueDay," or "RescueFirstDueNight"); these call types were later classified into the program area Fire, however, during the second wave of classifications.

For calls originally classified as EMS and occurring during the WEEKEND/EVENING period to associate a "RescueFirstDueNight" entry as the station demand zone, Seminole had the highest demand for services related to agency assist (201/711 responses; 28.3%), EMS (2,104/7,796; 27.0%), and public service (123/266 responses; 46.2%) calls. CARS had the highest demand for services related to fire calls as the EMS first due station, due to "Aircraft Crash" calls (21/29 responses; 72.4%). CARS also had the highest demand for services for police-related (153/543 responses; 28.2%) and rescue (155/535 responses; 29.0%) calls.

Table 103: Number of Responses by Station Demand Zone and Program - EMS WEEKEND/EVENING First Due Station

Station Demand Zone	Program							
	Agency Assist	EMS	Fire[1]	Hazmat	Police-Related	Public Service	Rescue	Total
Buckingham	0	22	0	0	0	0	5	27
CARS	166	1,185	21	0	153	26	155	1,706
Fluvanna	1	0	0	0	0	0	1	2
Greene	0	1	0	0	0	0	0	1
Hollymead	76	1,019	0	0	69	36	62	1,262
Monticello	62	879	1	2	46	17	41	1,048
Nelson	0	2	0	0	0	0	0	2
Seminole	201	2,104	7	3	96	123	37	2,571
SVRS	64	881	0	0	69	18	83	1,115
WARS	137	1,678	0	0	103	46	144	2,108
Not Identified	4	25	0	0	7	0	7	43
Total	**711**	**7,796**	**29**	**5**	**543**	**266**	**535**	**9,885**

[1]CAD call types of "Aircraft Crash" and "Elevator Emerg w/out Patient" were originally classified as "ResponseType" EMS in the CAD data file, and retained as EMS response types for the first wave of classifications into either Fire or EMS categories in order to determine the appropriate first due station variable to use (i.e., "FireFirstDue, "RescueFirstDueDay," or "RescueFirstDueNight"); these call types were later classified into the program area Fire, however, during the second wave of classifications.

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 program area and total unit time on task for these service categories in 2015. 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.[76] In other words this recommendation would have personnel spend no more than eight (8) hours per day on emergency incidents. These

[76] International Association of Firefighters. (1995). Emergency *Medical Services: A Guidebook for Fire-Based Systems.* California, DC: Author. (p. 11)

thresholds take into consideration the necessity to accomplish non-emergency activities such as training, health and wellness, public education, and fire and community risk reduction 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 0.30, 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 0.30 as an indication to add additional resources.[77] 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 0.30 as the upper limit in their standards of cover due to the necessity to accomplish other non-emergency activities.[78]

Unit Hour Utilization (UHU) is a reliable measure of workload and community demand for staffed units; response units that rely on non-career staff to respond have many more variables. In those units with non-career staff unit hour utilization will not be as important of a measure. Non-career units may be better measured using turnout times, number of times there is no staff or limited staff response and total call volumes as a non-career station likely cannot sustain responding to 8 hours' worth of emergency calls every day.

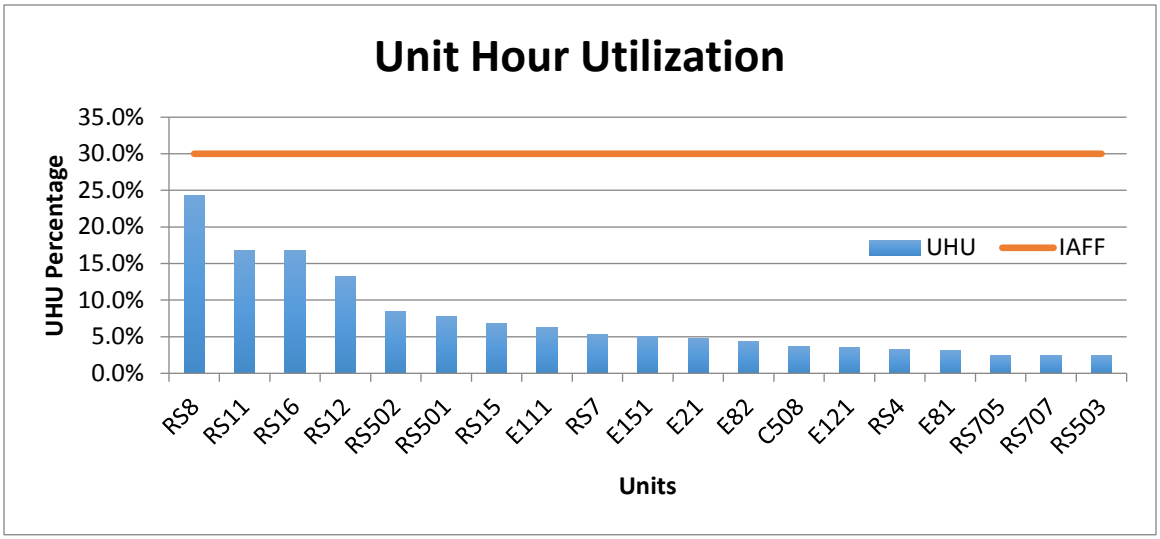
Within the ACFR system Medic 8 and Medic 16 are the most utilized units. Most of the EMS units had higher utilization than the fire apparatus, which is logical given the higher demand within the county for EMS services and that there are less EMS stations than there are fire stations. It is also important to note that while many fire units may first respond to EMS calls prior to the ambulance arrival, the length of the emergency calls or time on task is higher for the ambulances as in many instances they are transporting a patient to the hospital which takes a longer period of time. Many of the specialized resources such as hazardous materials, technical rescue, water tenders and reserve units are some of the least used units as the demand is not nearly as high for those types of resources but are important resources when they are needed.

Emergency related workload is a factor of community demands for service and is not a reflection of internal policies or non-emergency duties. Any changes to the current system would require workload to be redistributed across the deployed units. For example, if Medic 12 were no longer utilized, Medic 4, Medic 8 and other units would assume much of the workload. However, this analysis demonstrates that considerable capacity exists to absorb additional work in the staffed units with the exception of Medic 8, Medic 16, and Medic 11 in

[77] Illinois Fire Chiefs Association. (2012). An *Assessment of Deployment and Station Location: Rolling Meadows Fire Department.* Rolling Meadows, Illinois: Author. (pp. 54-55)
[78] Castle Rock Fire and Rescue Department. (2011). Community *Risk Analysis and Standards of Cover.* Castle Rock, Colorado: Author. (p. 58)

the not too distant future. At the current workload utilization rates, ACFR should have limited impact on their level or readiness or system performance.

Figure 53: Unit Hour Utilization



Description of First Arriving Unit Performance

Additional analyses related to the response characteristics of first arriving units were conducted. The analyses in this first section focused on emergency (lights and sirens) responses from primary front-line units arriving first on scene, irrespective of station demand zone, for all distinct incidents. Call status as emergency or non-emergency was assigned per call type by ACFR and was based on "CADCallType" from the CAD data file. Units were identified as primary front-line units by ACFR. Due to the restriction of these analyses to select responses and units, maximum available sample size for these analyses is 10,589.

To first recap the data presented: ACFR had an overall average dispatch time of 2.8 minutes, and a dispatch time of 4.4 minutes at the 90th percentile (Table 104). Overall, ACFR had an average turnout time of 1.4 minutes, and a turnout time of 2.4 minutes at the 90th percentile. A total of 40.5% of calls experienced turnout times of one minute or less, and 84.0% of calls experienced turnout times of two minutes or less (Figure 54). The overall average travel time was 6.8 minutes; performance at the 90th percentile for travel time was 13.2 minutes. A total of 17.4% of calls experienced travel times of three minutes or less, and 32.2% of calls experienced travel times of four minutes or less (Figure 55). The average response time was 10.8 minutes; performance at the 90th percentile for response time was 18.6 minutes.

Table 104: Description of First Arriving Unit Emergency Response Performance in Minutes

Measure	Average	90th Percentile	Sample Size
Dispatch Time	2.8	4.4	10,589
Turnout Time	1.4	2.4	10,410
Travel Time	6.8	13.2	10,410
Response Time	10.8	18.6	10,589

Figure 54: Distribution of Turnout Time of First Arriving Unit

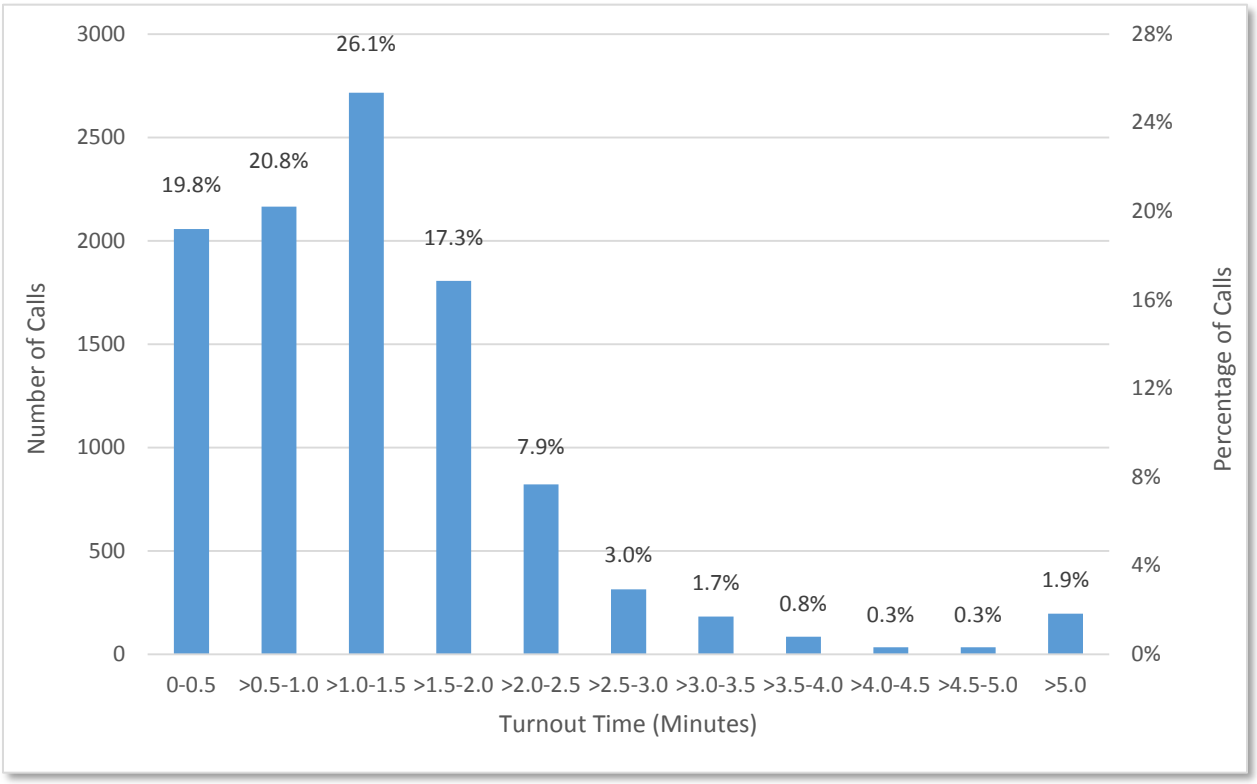
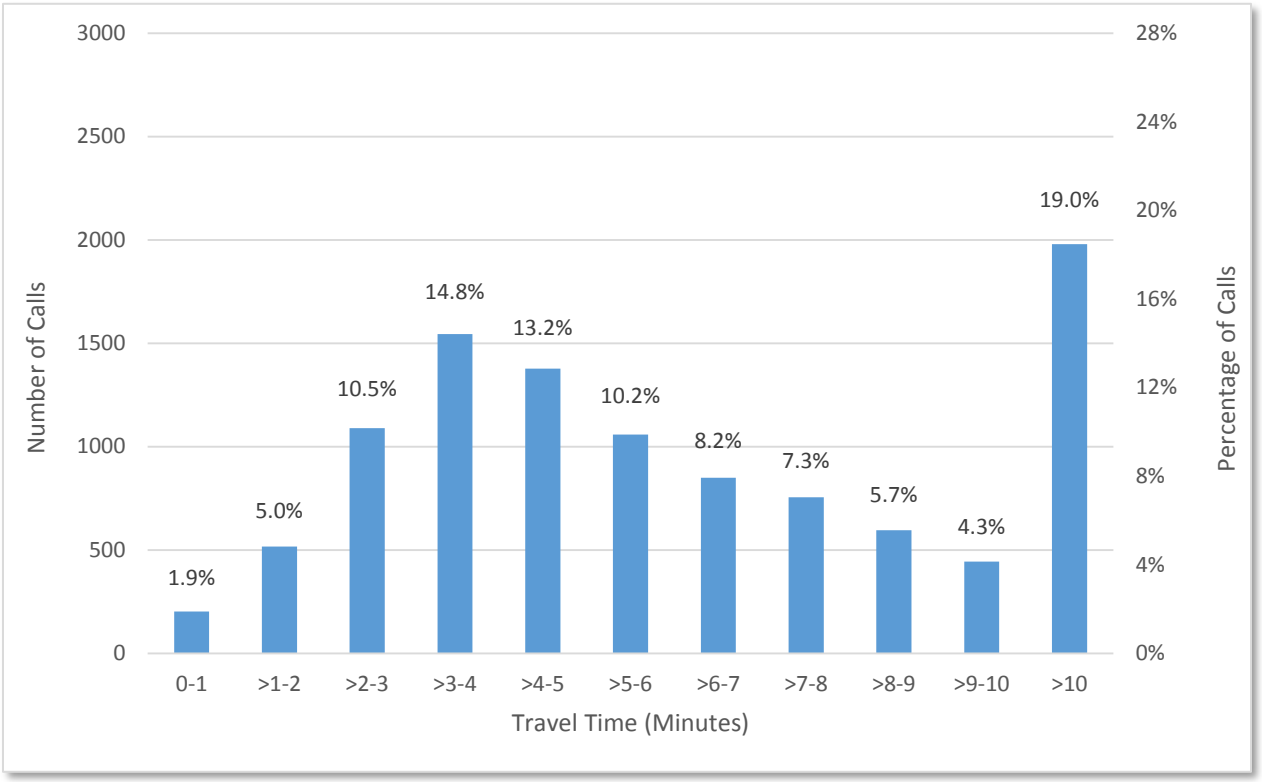


Figure 55: Distribution of Travel Time of First Arriving Unit



National recommendations provide differentiation between EMS and fire/special operations incidents. For example, the best practice for an EMS incident is a turnout time of 60 seconds or less 90% of the time. Due to the necessity to don personal protective equipment prior to responding to fire related incidents, best practices provide either 80 seconds (NFPA) or 90 seconds (CFAI) or less at the 90th percentile for turnout times associated with fire calls. Therefore, turnout time and travel time is also reported by the major program areas of EMS and fire.

For EMS incidents, ACFR had an average turnout time of 1.3 minutes, and a turnout time of 2.3 minutes at the 90th percentile. A total of 41.1% of calls experienced turnout times of one minute or less, and 85.4% of calls experienced turnout times of two minutes or less (Figure 56). The average travel time for EMS incidents was 6.8 minutes; performance at the 90th percentile for travel time was 13.3 minutes. A total of 17.8% of calls experienced travel times of three minutes or less, and 32.9% of calls experienced travel times of four minutes or less (Figure 57). The average response time for EMS calls was 10.5 minutes; performance at the 90th percentile for response time was 18.2 minutes.

For fire related incidents, ACFR had an average turnout time of 1.6 minutes, and a turnout time of 3.0 minutes at the 90th percentile. A total of 37.6% of calls experienced turnout times of one minute or less, and 78.3% of calls experienced turnout times of two minutes or less (Figure 58). The average travel time for fire related incidents was 6.6 minutes; performance

at the 90th percentile for travel time was 12.2 minutes. A total of 17.4% of calls experienced travel times of three minutes or less, and 31.6% of calls experienced travel times of four minutes or less (Figure 59). The average response time for fire related calls was 10.7 minutes; performance at the 90th percentile for response time was 18.2 minutes.

Figure 56: Distribution of Turnout Time for EMS Incidents

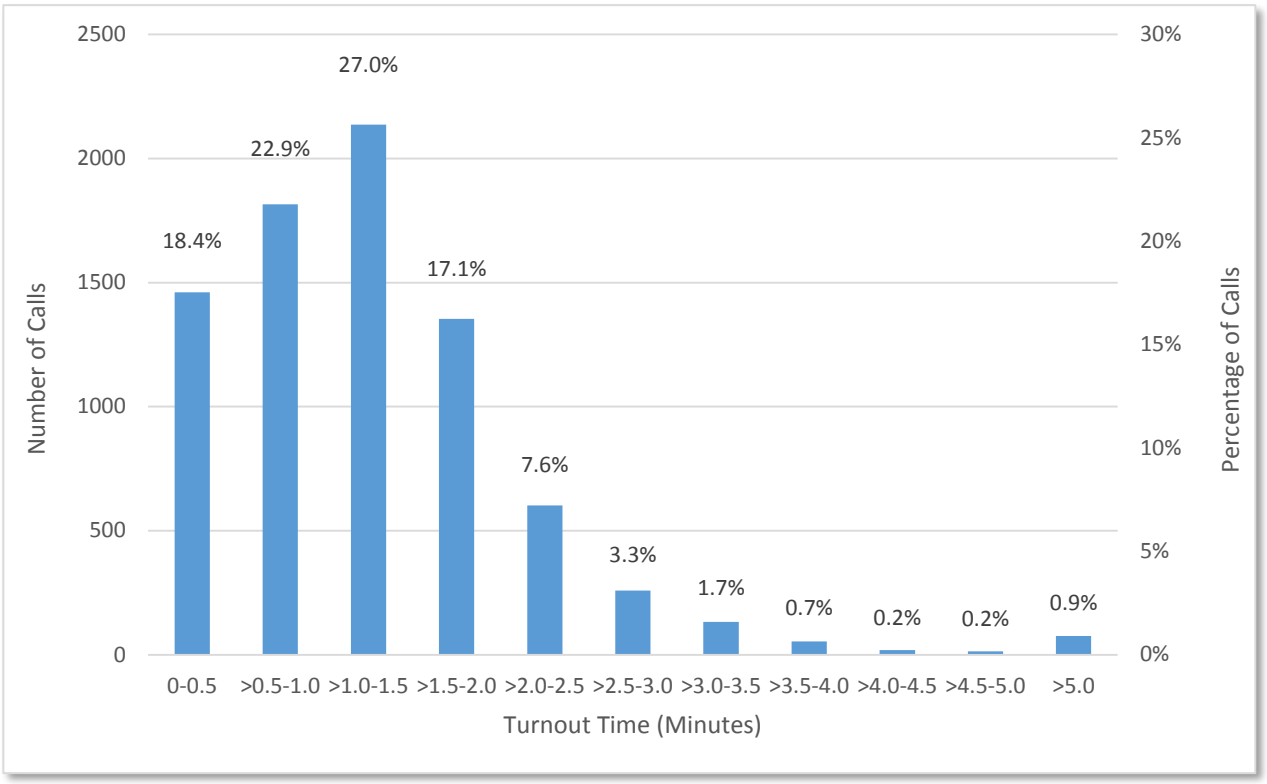


Figure 57: Distribution of Travel Time for EMS Incidents

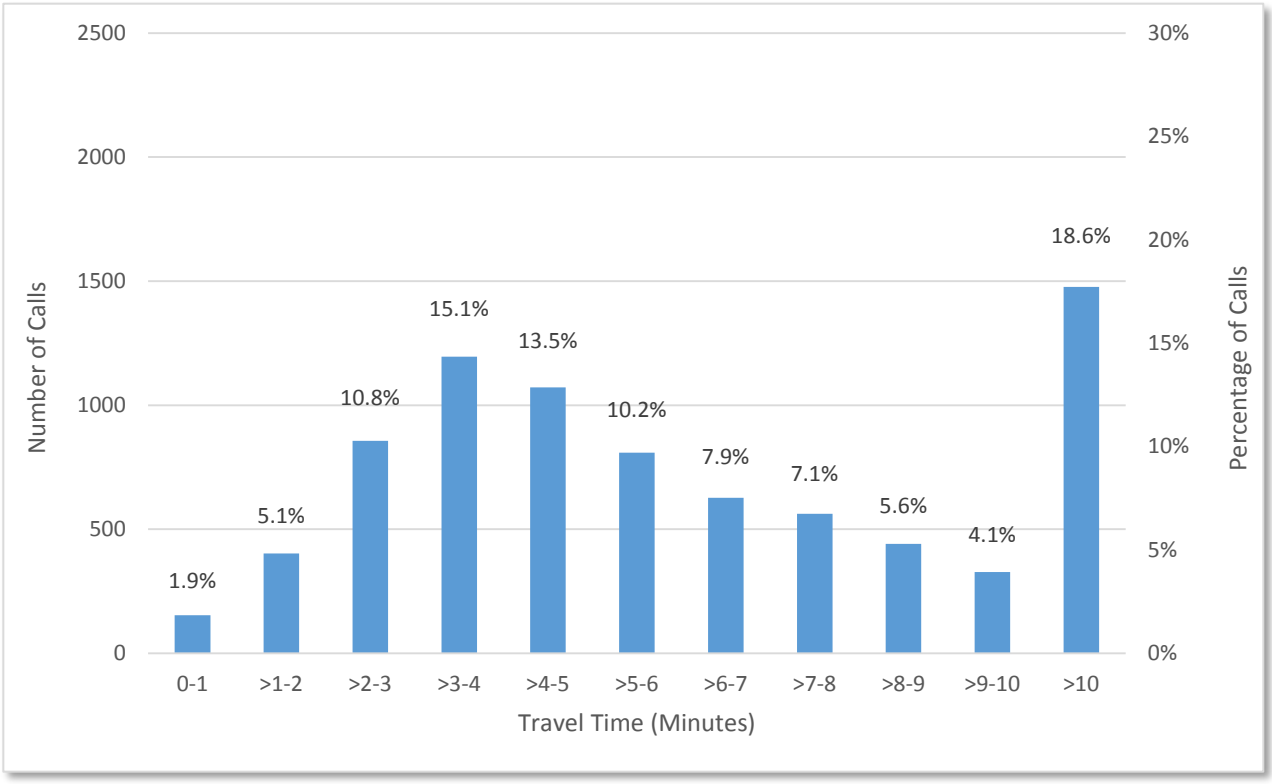


Figure 58: Distribution of Turnout Time for Fire Related Incidents

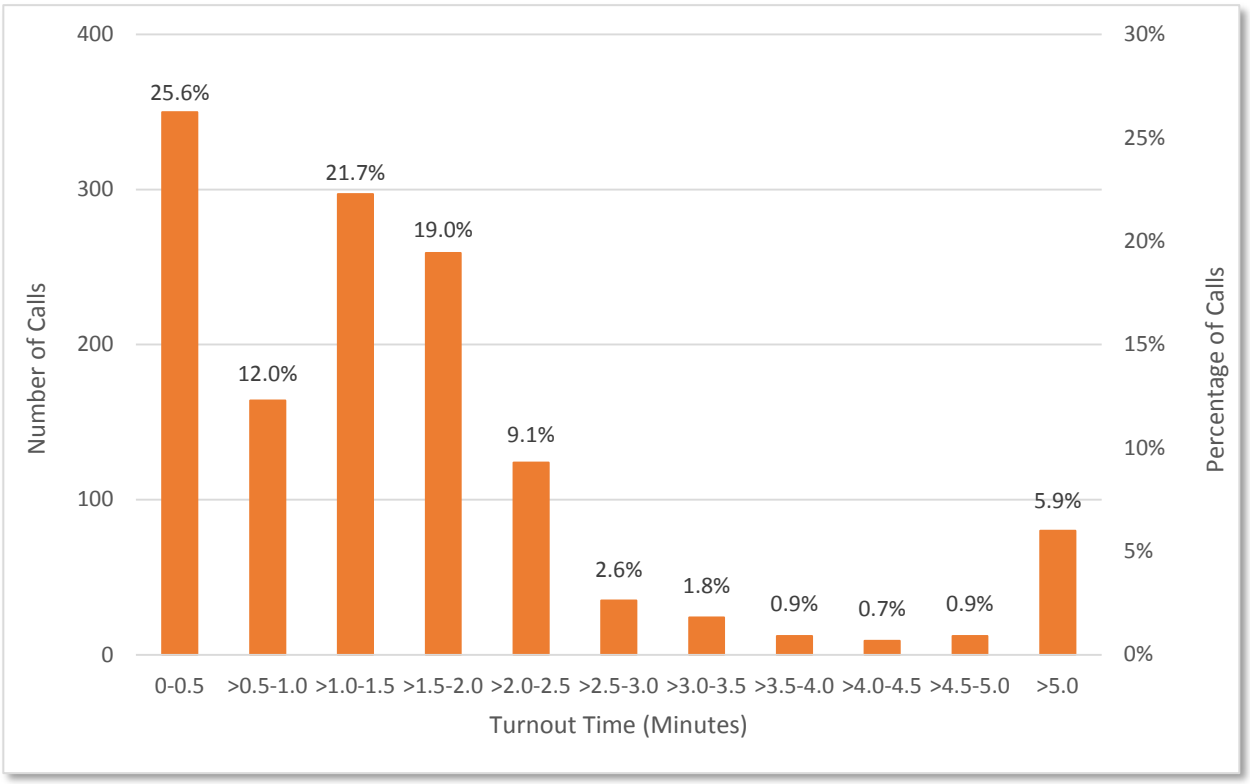
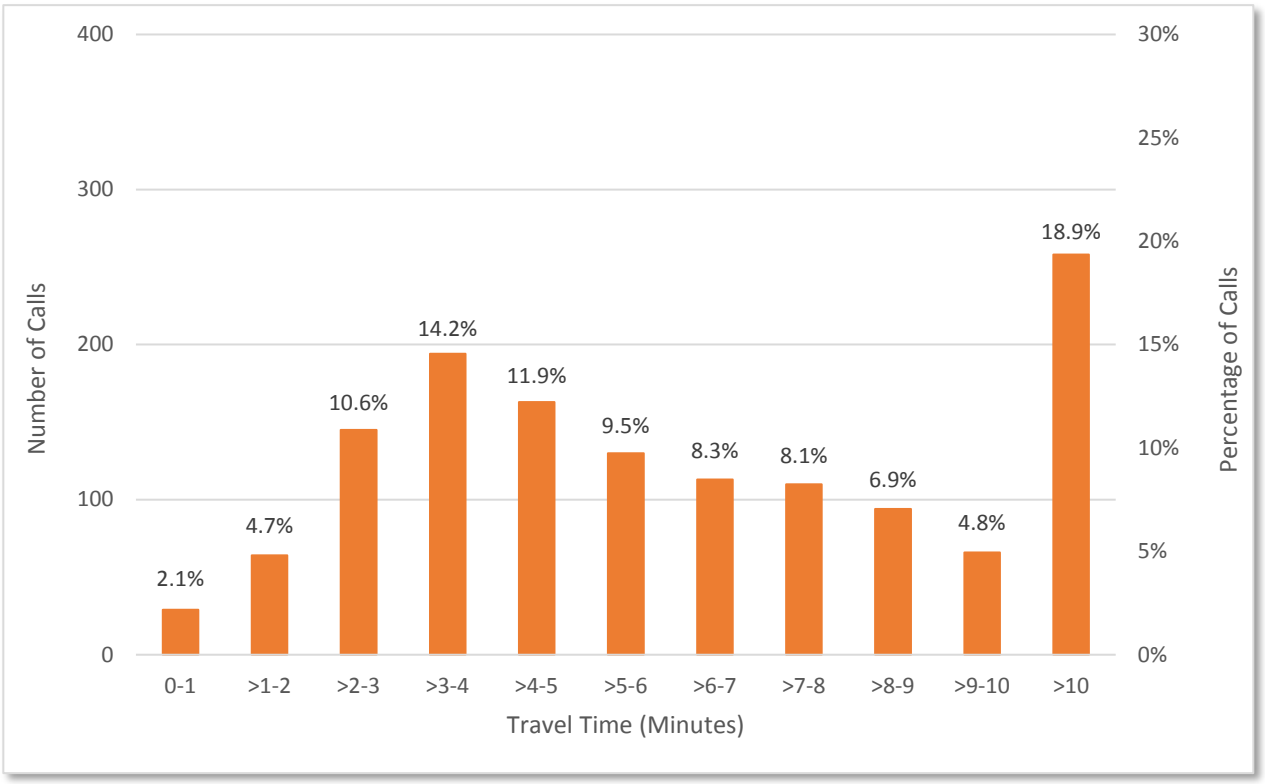


Figure 59: Distribution of Travel Time for Fire Related Incidents



First Arriving Unit Response Time by Station Demand Zone

Further analyses were conducted by station demand zone to measure the performance of the first arriving primary front-line units to emergency calls in each demand zone by "FireFirstDue" for fire related calls, by "RescueFirstDueDay" for EMS related calls during the MFDAYLIGHT period, and by "RescueFirstDueNight" for EMS related calls during the WEEKEND/EVENING period, regardless of where the unit is assigned or originated. Performance times are reported at both the average and 90th percentile values.

With respect to turnout time for fire related calls, first arriving primary front-line units responding to calls in the demand zone for fire first due station Stony Point had the lowest average turnout time at 0.9 minutes (1.9 minutes at the 90th percentile; Table 105; 106; Figure 60; Figure 61). First arriving primary front-line units responding to calls in the demand zone for fire first due station North Garden had the highest average turnout time at 4.0 minutes (9.3 minutes at the 90th percentile).

With respect to travel time for fire related calls, first arriving primary front-line units responding to calls in the demand zone for fire first due station Seminole had the lowest average travel time at 4.4 minutes (7.5 minutes at the 90th percentile). First arriving primary front-line units responding to calls in the demand zone for fire first due station Scottsville had the highest average travel time at 9.5 minutes (16.3 minutes at the 90th percentile).

Table 105: Average First Arrival Performance in Minutes – Fire First Due Station

First Due Station	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size[1]
City	5.8	1.7	7.4	14.3	40
Crozet	4.6	2.3	7.1	14.0	168
Earlysville	2.6	2.0	9.3	13.7	85
East Rivanna	2.6	1.3	8.4	12.2	198
Hollymead	2.1	1.5	6.0	9.5	103
Ivy	4.2	1.3	6.8	12.3	164
Monticello	2.4	1.1	6.5	9.8	196
North Garden	5.6	4.0	8.4	17.9	65
Scottsville	6.1	3.0	9.5	18.3	73
Seminole	2.7	1.3	4.4	8.2	430
Stony Point	2.6	0.9	9.1	12.7	43
Total[2]	**3.3**	**1.6**	**6.7**	**11.5**	**1,574**

[1]Sample sizes depicted represent the total number of first arrivals made by ACFR primary front-line units during 2017 per first due station noted; sample sizes corresponding to individual table values may be slightly lower due to missing time data such that the sum of average dispatch, turnout, and travel times may not equal average response time.

[2]Responses associated with station demand zones Fluvanna (n=1), Greene (n=2), Nelson (n=3), and Not Identified (n=3) are not presented individually in the table, but are included in the total values.

Table 106: 90th Percentile First Arrival Performance in Minutes - Fire First Due Station

First Due Station	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size[1]
City	16.9	2.7	12.2	24.3	40
Crozet	9.0	7.1	12.7	20.3	168
Earlysville	5.8	4.7	16.8	21.6	85
East Rivanna	4.3	2.4	13.4	17.5	198
Hollymead	4.6	2.5	11.5	16.1	103
Ivy	3.4	2.0	11.6	15.6	164
Monticello	3.6	1.8	11.2	16.8	196
North Garden	12.0	9.3	15.7	24.7	65
Scottsville	12.3	9.4	16.3	28.8	73
Seminole	4.7	2.2	7.5	11.6	430
Stony Point	4.5	1.9	17.2	21.4	43
Total[2]	**6.2**	**3.1**	**12.3**	**18.9**	**1,574**

[1]Sample sizes depicted represent the total number of first arrivals made by ACFR primary front-line units during 2017 per first due station noted; sample sizes corresponding to individual table values may be slightly lower due to missing time data.

[2]Responses associated with station demand zones Fluvanna (n=1), Greene (n=2), Nelson (n=3), and Not Identified (n=3) are not presented individually in the table, but are included in the total values.

Figure 60: Average First Arrival Performance in Minutes - Fire First Due Station

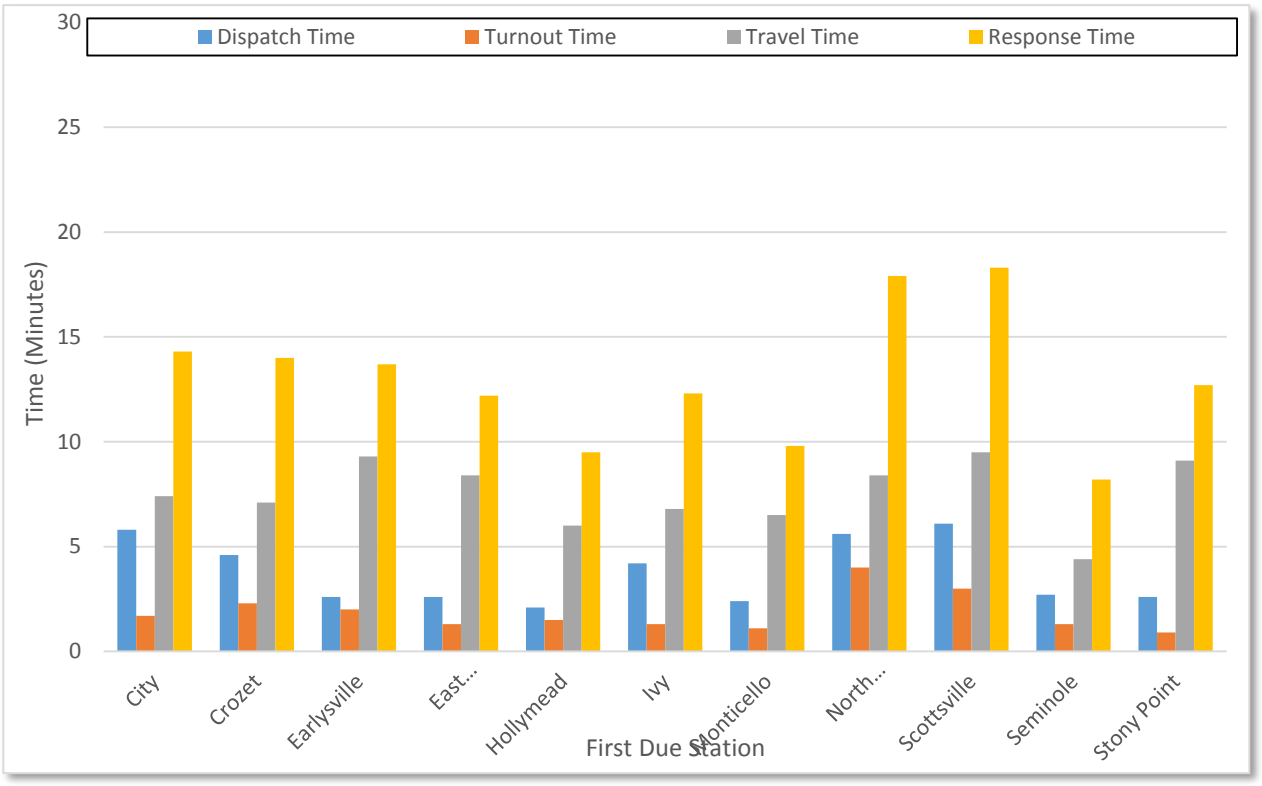
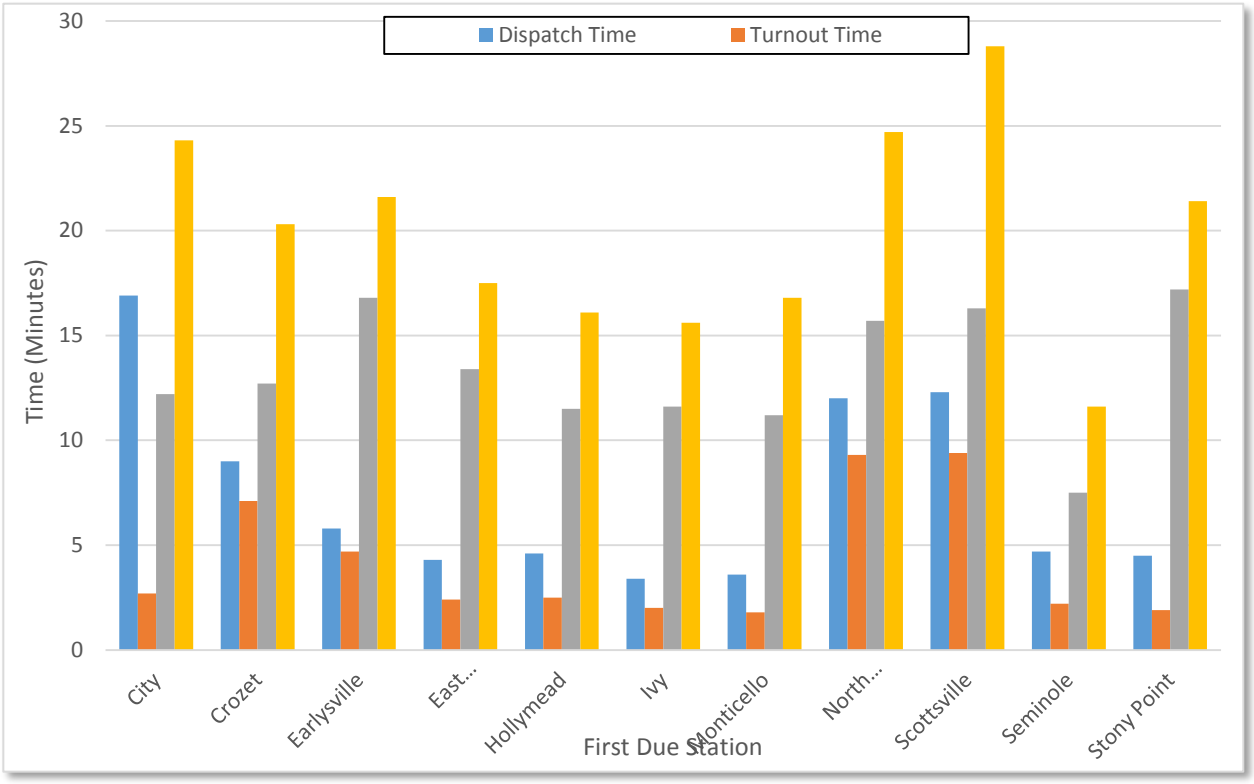


Figure 61: 90th Percentile First Arrival Performance in Minutes - Fire First Due Station



With respect to turnout time for EMS related calls during the MFDAYLIGHT period, first arriving primary front-line units responding to calls in the demand zone for rescue day first due station Monticello had the lowest average turnout time at 0.9 minutes (1.4 minutes at the 90th percentile; 107; Table 108; Figure 62; Figure 63). First arriving primary front-line units responding to calls in the demand zone for rescue day first due station Earlysville had the highest average turnout time at 1.4 minutes (2.0 minutes at the 90th percentile).

With respect to travel time for EMS related calls during the MFDAYLIGHT period, first arriving primary front-line units responding to calls in the demand zone for rescue day first due stations Hollymead and Seminole had the lowest average travel time at 5.0 minutes (8.0 minutes at the 90th percentile for Hollymead and 8.5 minutes at the 90th percentile for Seminole). First arriving primary front-line units responding to calls in the demand zone for rescue day first due station SVRS had the highest average travel time at 12.7 minutes (22.0 minutes at the 90th percentile).

Table 107: Average First Arrival Performance in Minutes – EMS MFDAYLIGHT First Due Station

First Due Station	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size[1]
Earlysville	3.3	1.4	11.3	15.8	131
Hollymead	3.0	1.1	5.0	9.0	443
Ivy	2.4	1.2	7.5	11.1	382
Monticello	2.5	0.9	6.3	9.7	469
Pantops	2.0	1.0	6.9	9.8	892
Seminole	2.4	1.1	5.0	8.5	1,314
SVRS	3.0	1.1	12.7	16.2	325
WARS	3.1	1.2	6.6	10.7	611
Total[2]	**2.6**	**1.1**	**6.7**	**10.2**	**4,605**

[1]Sample sizes depicted represent the total number of first arrivals made by ACFR primary front-line units during 2017 per first due station noted; sample sizes corresponding to individual table values may be slightly lower due to missing time data such that the sum of average dispatch, turnout, and travel times may not equal average response time.

[2]Responses associated with station demand zones Buckingham (n=8), CARS (n=14), Fluvanna (n=2), Greene (n=1), Nelson (n=1), and Not Identified (n=12) are not presented individually in the table, but are included in the total values.

Table 108: 90th Percentile First Arrival Performance in Minutes - EMS MFDAYLIGHT First Due Station

First Due Station	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size[1]
Earlysville	3.6	2.0	20.5	25.7	131
Hollymead	4.0	1.8	8.0	13.5	443
Ivy	3.6	1.8	14.5	17.3	382
Monticello	3.2	1.4	12.8	17.8	469
Pantops	3.0	1.9	11.9	15.5	892
Seminole	3.5	1.8	8.5	12.0	1,314
SVRS	4.6	1.8	22.0	26.2	325
WARS	5.5	2.3	13.8	19.8	611
Total[2]	**3.8**	**1.9**	**12.6**	**17.5**	**4,605**

[1]Sample sizes depicted represent the total number of first arrivals made by ACFR primary front-line units during 2017 per first due station noted; sample sizes corresponding to individual table values may be slightly lower due to missing time data.

[2]Responses associated with station demand zones Buckingham (n=8), CARS (n=14), Fluvanna (n=2), Greene (n=1), Nelson (n=1), and Not Identified (n=12) are not presented individually in the table, but are included in the total values.

Figure 62: Average First Arrival Performance in Minutes - EMS MFDAYLIGHT First Due Station

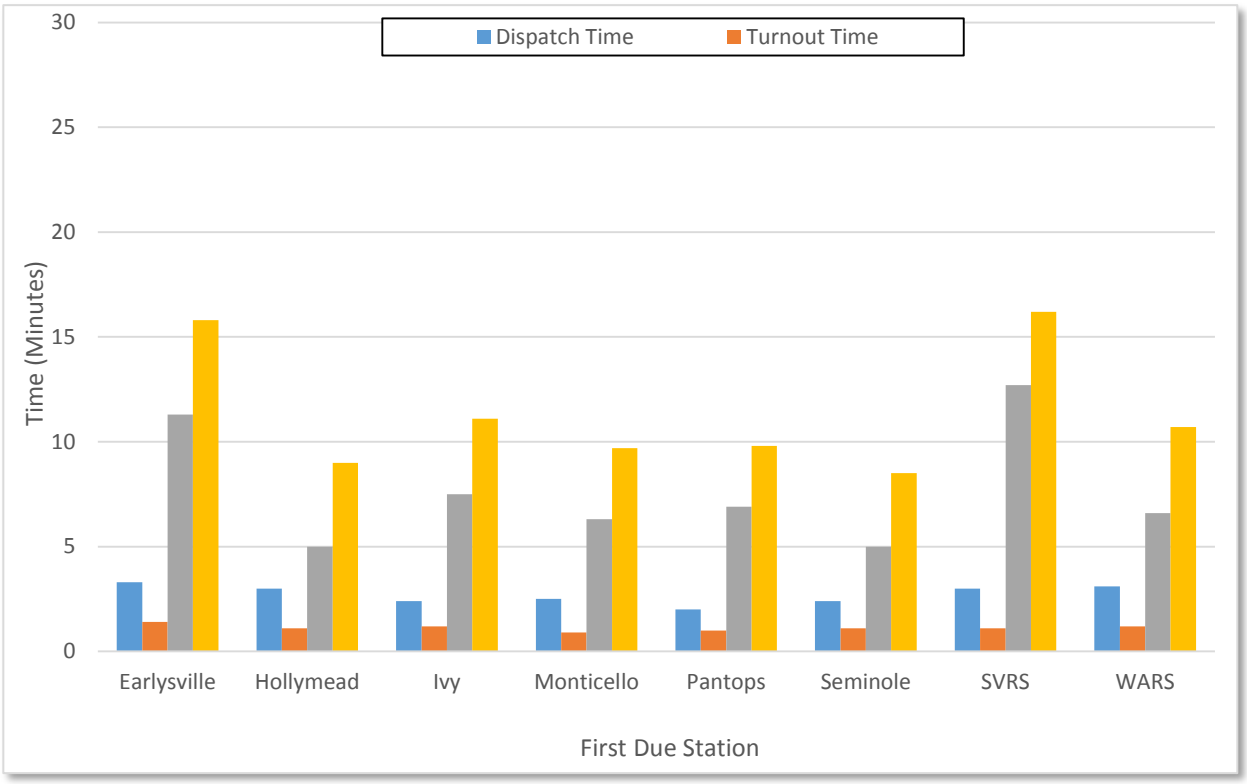
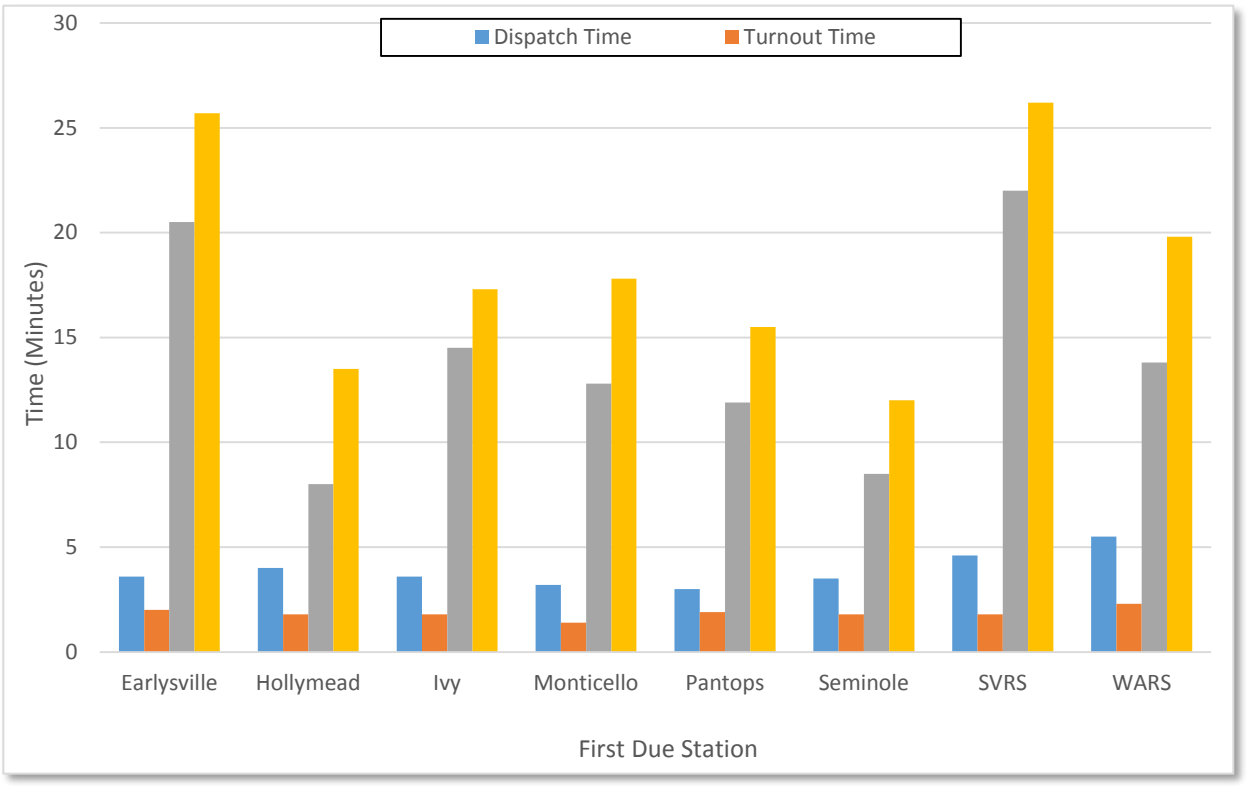


Figure 63: 90th Percentile First Arrival Performance in Minutes - EMS MFDAYLIGHT First Due Station



With respect to turnout time for EMS related calls during the WEEKEND/EVENING period, first arriving primary front-line units responding to calls in the demand zone for rescue night first due station Monticello had the lowest average turnout time at 1.1 minutes (1.9 minutes at the 90th percentile; Table 109; Table 110; Figure 64; Figure 65). First arriving primary front-line units responding to calls in the demand zone for rescue night first due station SVRS had the highest average turnout time at 2.0 minutes (3.6 minutes at the 90th percentile).

With respect to travel time for EMS related calls during the WEEKEND/EVENING period, first arriving primary front-line units responding to calls in the demand zone for rescue night first due station Seminole had the lowest average travel time at 4.9 minutes (7.9 minutes at the 90th percentile). First arriving primary front-line units responding to calls in the demand zone for rescue night first due station SVRS had the highest average travel time at 11.9 minutes (21.9 minutes at the 90th percentile).

Table 109: Average First Arrival Performance in Minutes – EMS WEEKEND/EVENING First Due Station

First Due Station	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size[1]
CARS	3.4	1.6	7.8	12.7	670
Hollymead	2.8	1.4	7.2	11.4	586
Monticello	2.5	1.1	7.3	10.9	573
Seminole	2.5	1.5	4.9	8.8	1,272
SVRS	3.5	2.0	11.9	16.9	460
WARS	2.7	1.5	6.7	10.7	814
Total[2]	**2.8**	**1.5**	**7.0**	**11.2**	**4,410**

[1]Sample sizes depicted represent the total number of first arrivals made by ACFR primary front-line units during 2017 per first due station noted; sample sizes corresponding to individual table values may be slightly lower due to missing time data such that the sum of average dispatch, turnout, and travel times may not equal average response time.
[2]Responses associated with station demand zones Buckingham (n=14), Fluvanna (n=2), Greene (n=1), and Not Identified (n=17) are not presented individually in the table, but are included in the total values.

Table 110: 90th Percentile First Arrival Performance in Minutes - EMS WEEKEND/EVENING First Due Station

First Due Station	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size[1]
CARS	5.0	2.7	13.9	20.1	670
Hollymead	4.0	2.3	13.7	19.2	586
Monticello	3.6	1.9	14.5	18.6	573
Seminole	3.7	2.6	7.9	13.0	1,272
SVRS	7.7	3.6	21.9	27.5	460
WARS	4.8	2.6	13.3	18.4	814
Total[2]	**4.4**	**2.6**	**13.9**	**19.5**	**4,410**

[1]Sample sizes depicted represent the total number of first arrivals made by ACFR primary front-line units during 2017 per first due station noted; sample sizes corresponding to individual table values may be slightly lower due to missing time data.

[2]Responses associated with station demand zones Buckingham (n=14), Fluvanna (n=2), Greene (n=1), and Not Identified (n=17) are not presented individually in the table, but are included in the total values.

Figure 64: Average First Arrival Performance in Minutes - EMS WEEKEND/EVENING First Due Station

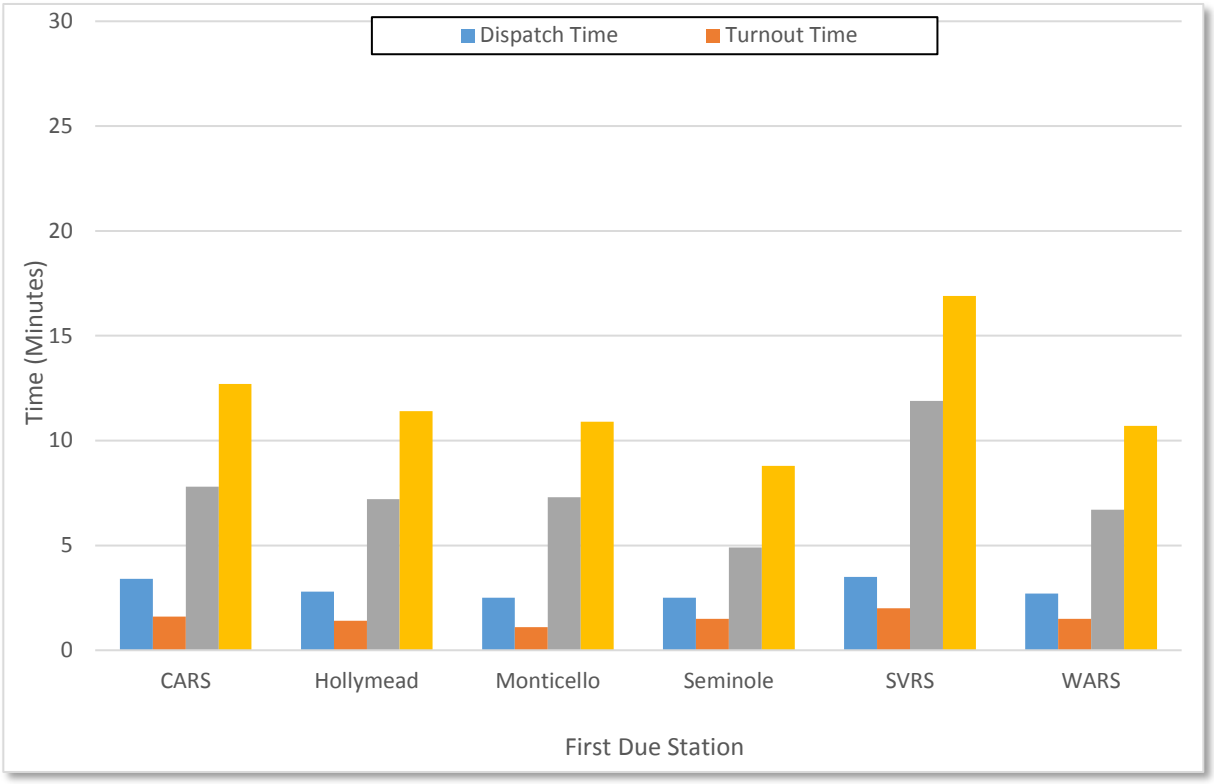
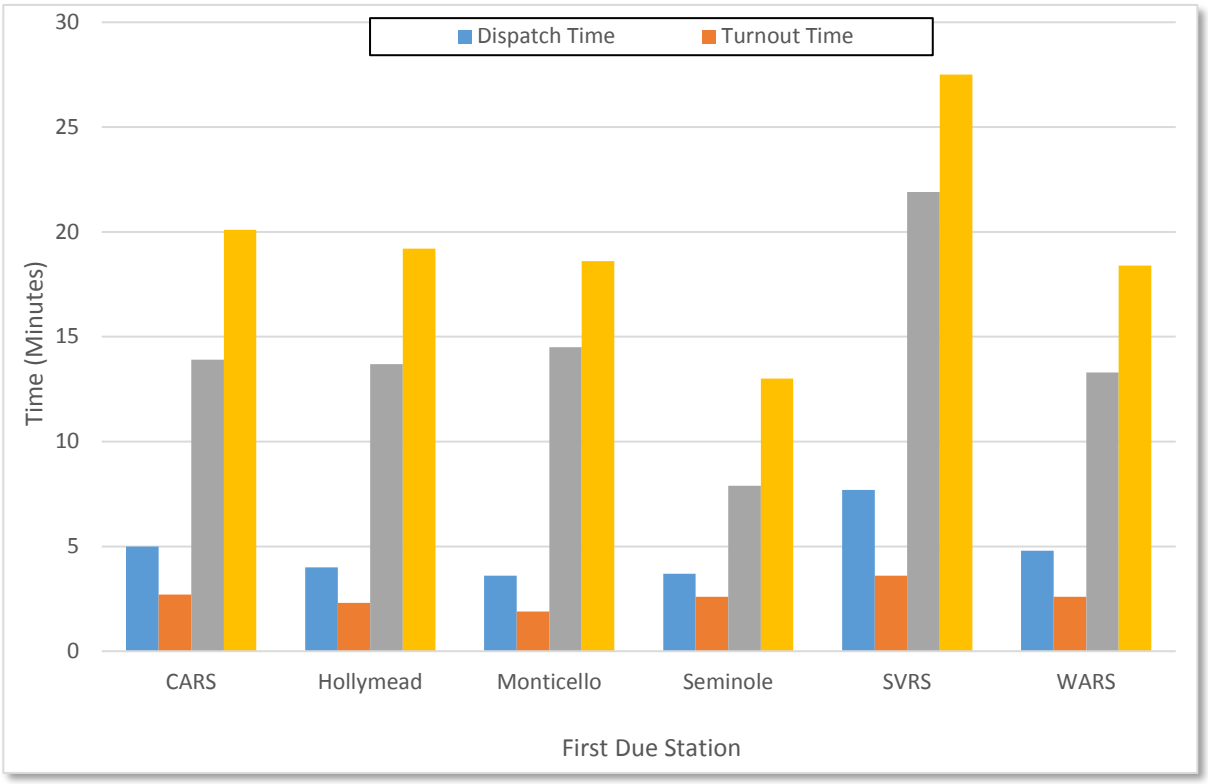


Figure 65: 90th Percentile First Arrival Performance in Minutes - EMS WEEKEND/EVENING First Due Station



Concentration Factors

Concentration of Risks by Demand Zone

Analyses were conducted to describe and measure the relative concentration of risks in each of the fire station demand zones. Therefore, a station demand zone 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 demand zone 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 demand zone, the number of high and moderate-risk occupancies, and the impact of simultaneous events in each station demand zone. 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 111: Station Demand Zone Risk Concentration Matrix

Station FDZ	Community Demand	Call Concurrency	High/Moderate Risk Occupancies	Total Risk Score	Risk Rating
F02	2	2	2	4.90	Low
F03	2	2	1	3.46	Low
F04	2	3	1	4.95	Low
F05	2	2	2	4.90	Low
F06	1	1	1	1.22	Low
F07	2	2	2	4.90	Low
F08	10	10	4	81.24	Maximum
F11	6	6	2	28.14	Moderate
F12	6	7	1	30.41	Moderate
F15	4	6	2	19.80	Moderate
R16[79]	6	10	2	45.52	High

[79] R16 (Pantops) risk distribution was based on a 6-minute travel time. All other Stations/Districts utilized the full existing boundaries.

Districts/Stations 4, 11, 12, and 15 have collocated Fire and EMS units. In this manner the stations are already homogenized for the distribution of risk, community demand, and prospective risk. However, Districts 5, 7, and 8 operate more independently than the other stations and districts. Therefore, in an effort to capture an accurate portrayal of the combined risk in these planning areas, a second analysis combined R5/F5, R7/F7, and R8/F8. Results indicate a considerably elevated risk profile when the totality of the risk is evaluated.

In total the station level risk profile resulted in two High-risk areas in the combined F5/R5 and the Pantops area and a Maximum risk area for the combined F8/R8 area. Additionally, the combined F7/R7, F11, F12, and F15 areas resulted in moderate risk ratings. All other areas were determined to be a low-risk response area.

Table 112: Station Demand Zone Risk Concentration Matrix with Combined Fire & Rescue

Station FDZ	Community Demand	Call Concurrency	High/Moderate Risk Occupancies	Total Risk Score	Risk Rating
F02	2	2	2	4.90	Low
F03	2	2	1	3.46	Low
F04	2	3	1	4.95	Low
F5/R5	10	9	2	66.42	High
F06	1	1	1	1.22	Low
F7/R7	6	7	2	32.43	Moderate
F8/R8	10	10	4	81.24	Maximum
F11	6	6	2	28.14	Moderate
F12	6	7	1	30.41	Moderate
F15	4	6	2	19.80	Moderate
R16[80]	6	10	2	45.52	High

[80] R16 (Pantops) risk distribution was based on a 6-minute travel time. All other Stations/Districts utilized the full existing boundaries.

Table 113: Summary of Station Fire Demand Zone 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

***** *Definitions for Occupancy Risk Type were provided as part of the full risk assessment previously.*

These analyses result in a three-dimensional model that illustrates the representativeness of each of the variables as they contribute to each station's risk profile. For example, one station may score heavily in potential risk and have moderate or low demand for services and another station may have little potential risk but have high demand and call concurrency that drives the necessity for a greater concentration of resources.

Graphic representations of the three axis risk matrices are provided below. When reviewing these radar figures, the larger the shaded area, the greater the risk. In addition, each axis is labeled so that the reader can determine the relationship between the risk drivers for each station area.

Figure 66: Station 2 Risk Profile

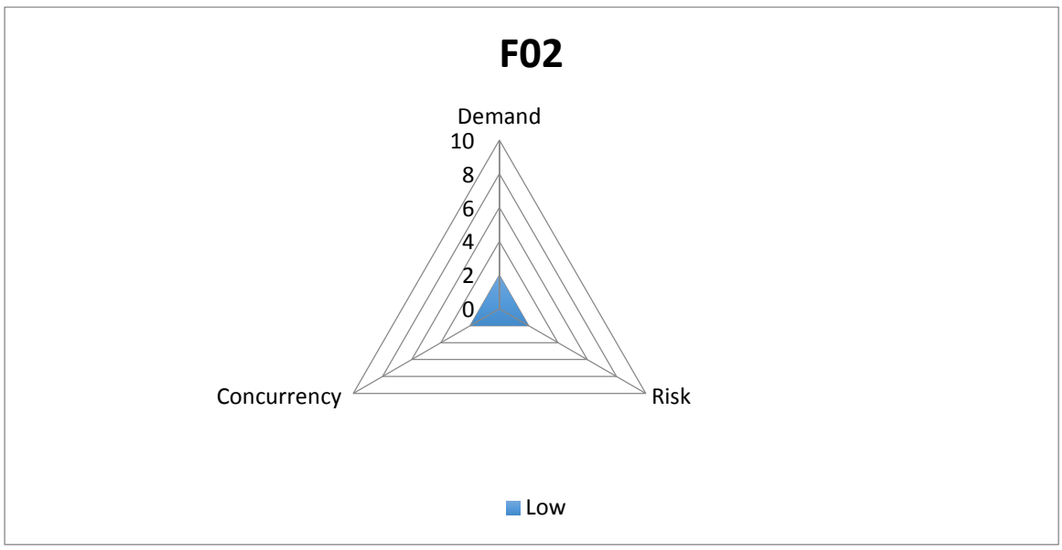


Figure 67: Station 3 Risk Profile

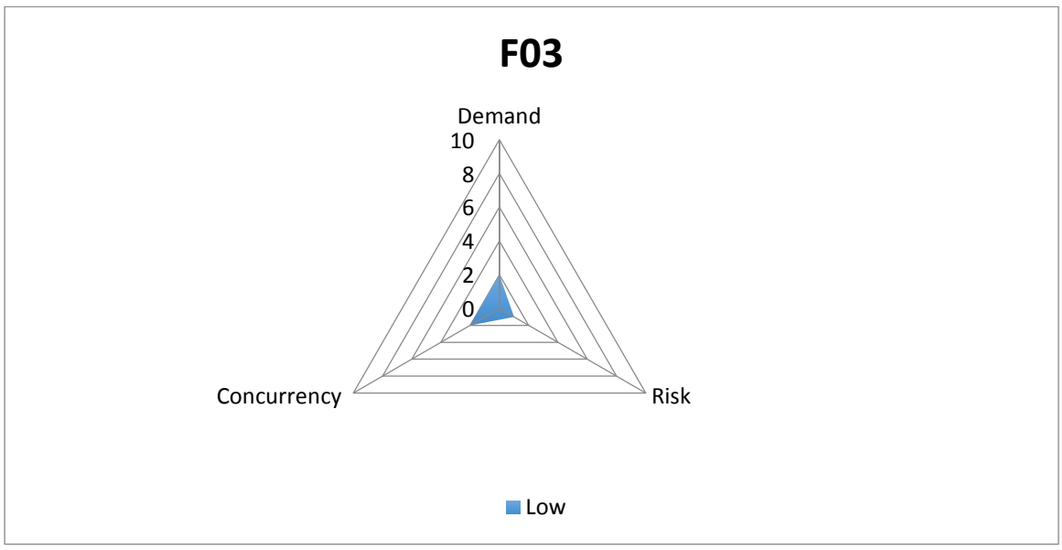


Figure 68: Station 4 Risk Profile

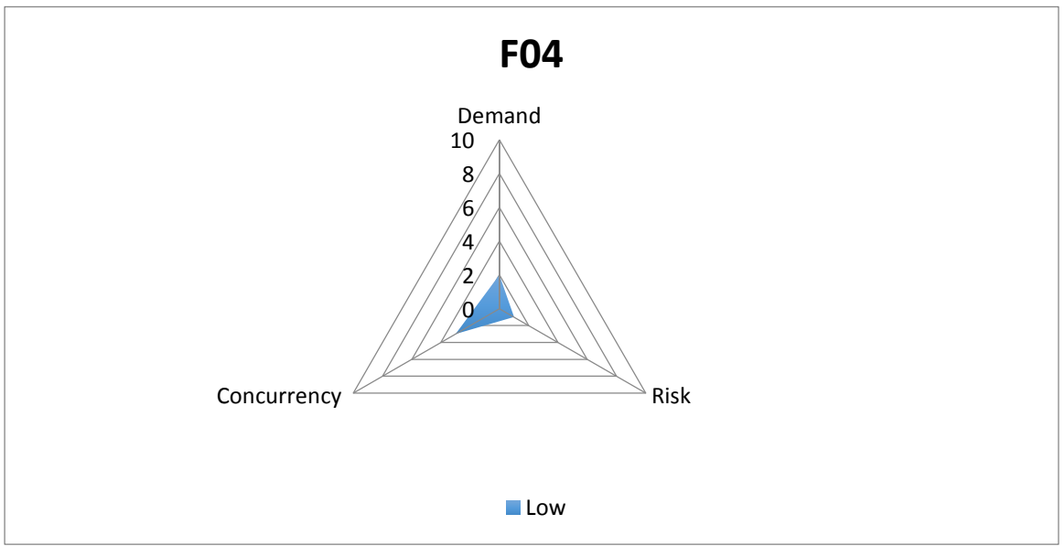


Figure 69: Station 6 Risk Profile

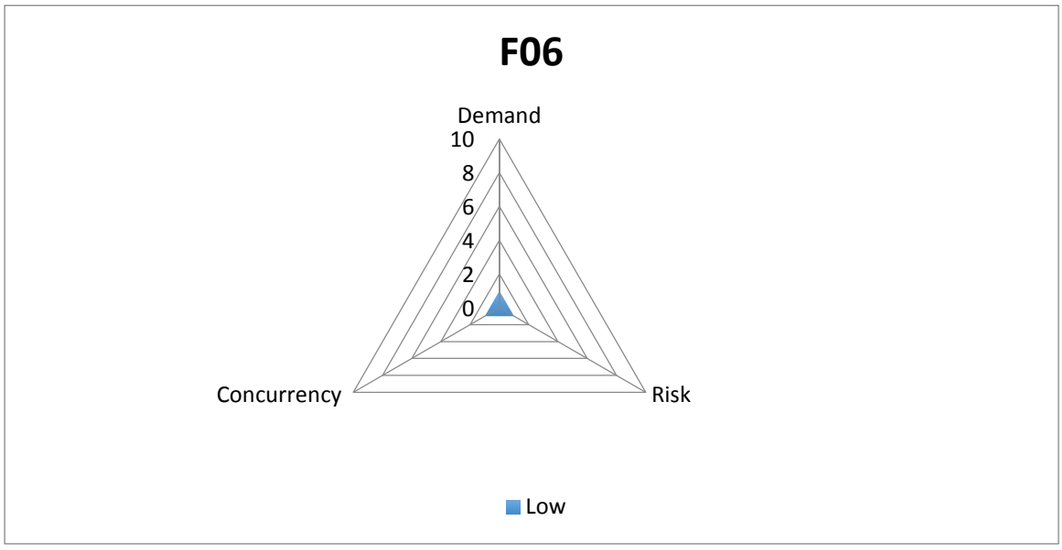


Figure 70: Station 11 Risk Profile

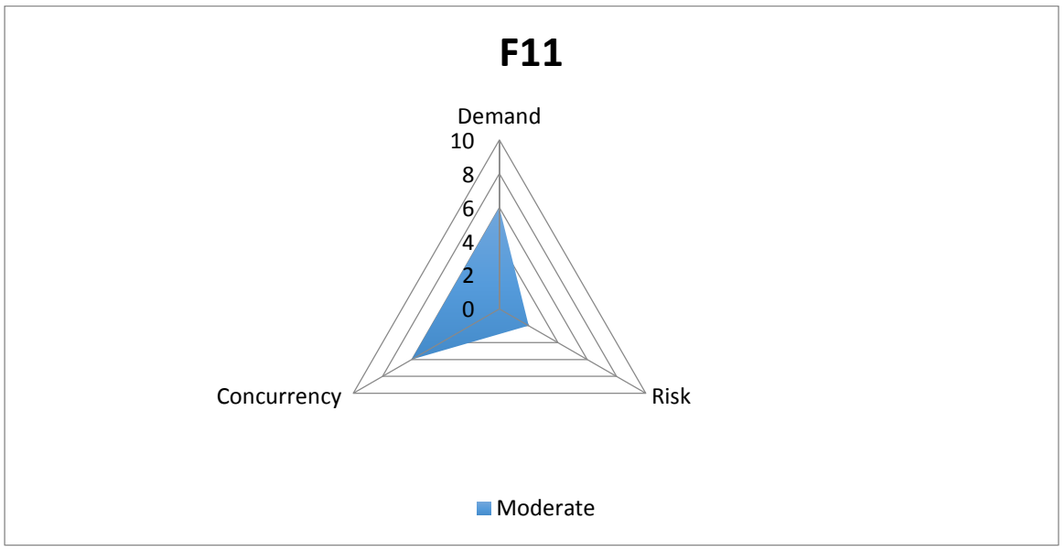


Figure 71: Station 12 Risk Profile

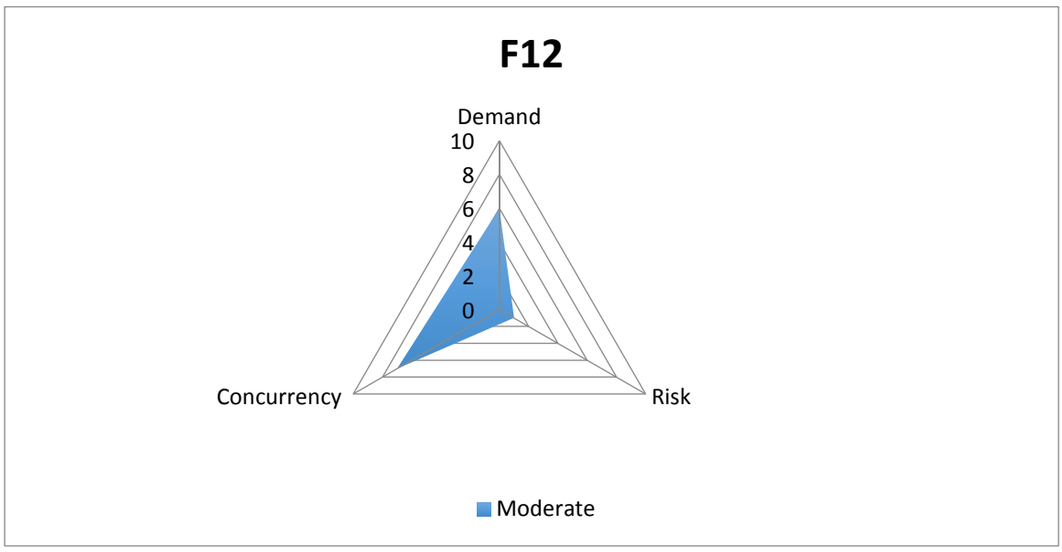


Figure 72: Station 15 Risk Profile

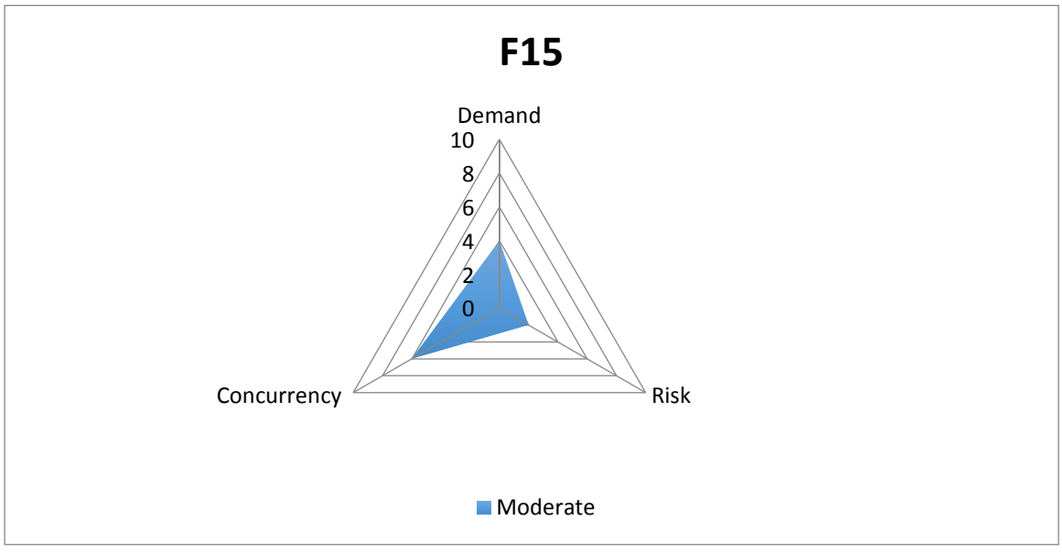


Figure 73: Combined F5/R5 Risk Profile

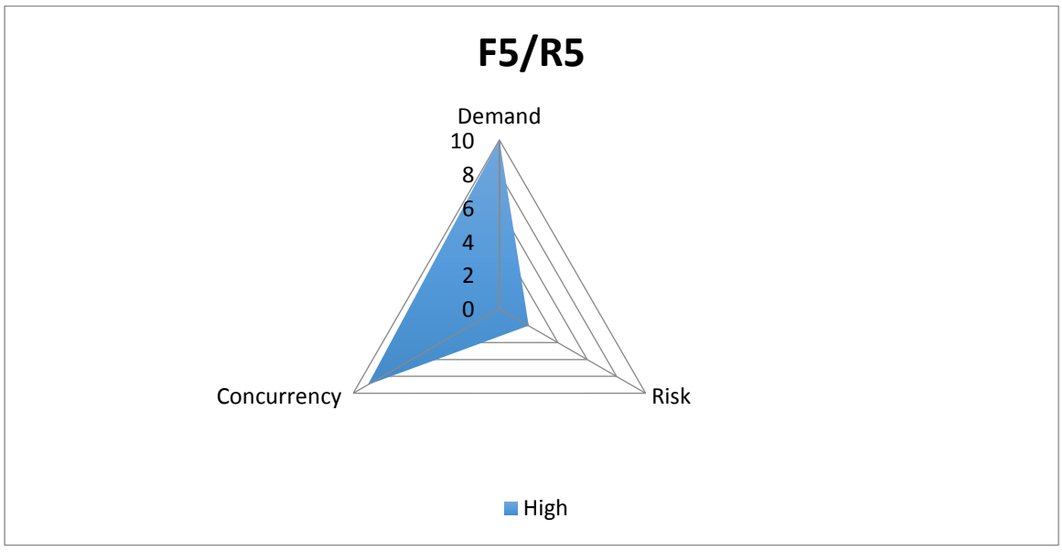


Figure 74: Combined F7/R7 Risk Profile

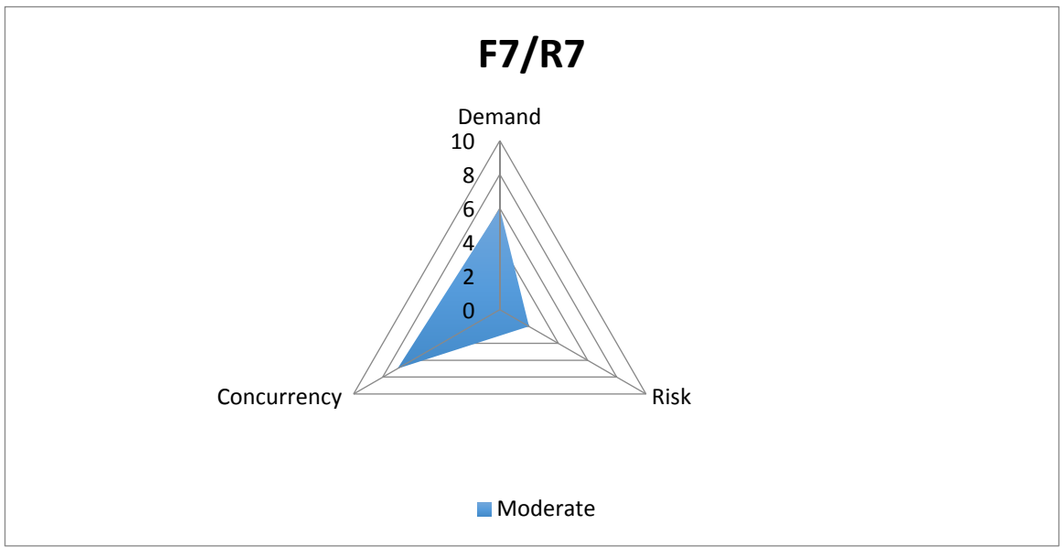


Figure 75: Combined F8/R8 Risk Profile

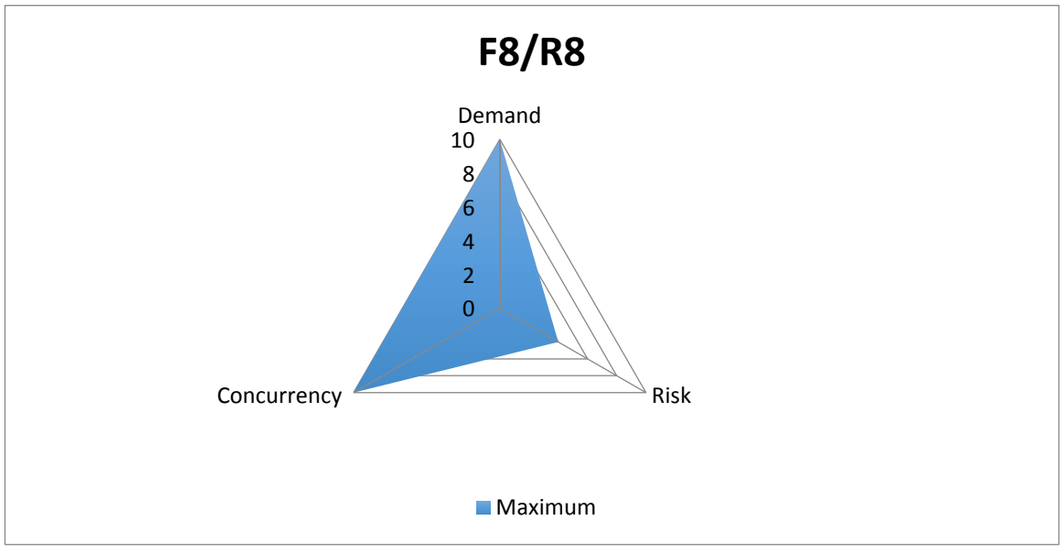
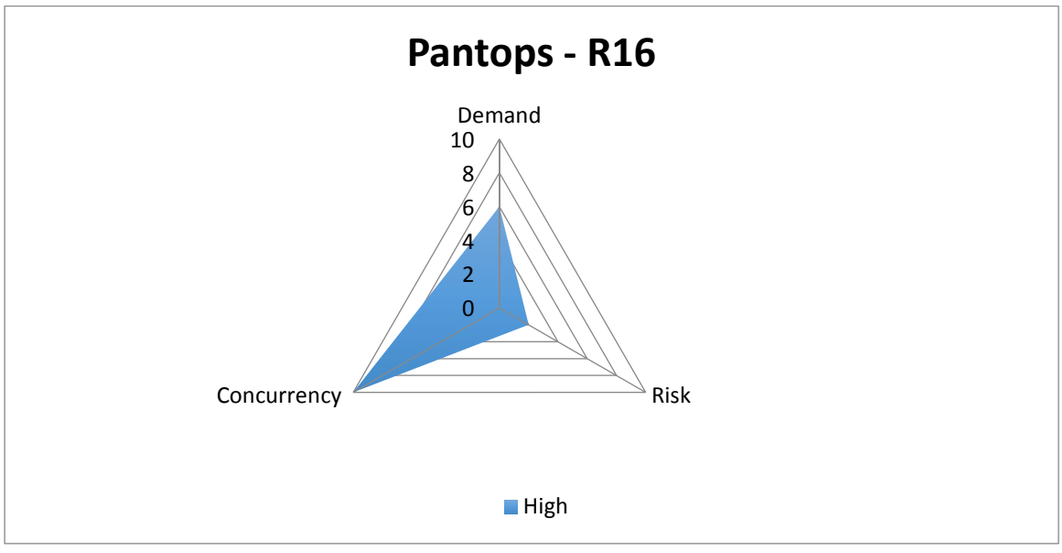


Figure 76: Station 16-Pantops Risk Profile



Concentration of Resources

The station fire demand zone risk matrices demonstrate that the risk associated with the Department is generally low/moderate in nature and the demand can be appropriately handled within the umbrella of the current distribution model. Three high/moderate-risk FDZ's 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. In general, the distribution model that currently exists is capable of addressing the low 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.

The following resource allocation is recommended to achieve a 6-minute Development Area travel time and a 15-minute Rural Area travel time. These resources are assumed to be staffed, or can be staffed within adopted performance standards, irrespective of personnel employment status. Additional or supplemental resources can be provided similar to the current process. These recommendations are for the minimum initial first arriving apparatus.

Table 114: Station Deployment and Risk Concentration Summary

Station FDZ	Engine	Ladder	Rescue/Medic	Total Risk Score	Station Risk Concentration Identification
F02	1		1[a]	4.90	Low
F03	1		1[a]	3.46	Low
F04	1		1[a]	4.95	Low
F5/R5	1	1	2	66.42	High
F06	1		1[a]	1.22	Low
F7/R7	1		1[a]	32.43	Moderate
F8/R8	1	1	2	81.24	Maximum
F11	1		1	28.14	Moderate
F12	1		1	30.41	Moderate
F15	1		1[a]	19.80	Moderate
R16[81]	1[82]		1[a]	45.52	High

Note: a=cross staffed unit

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 the community's specific risks and the willingness to assume risk.

Analyses of performance for station demand zones were based on an examination of travel times by *any* unit arriving on scene in response to a structure fire call in the station's area identified as first due for fire related calls. Analyses were not restricted to primary front-line units.

While fire first due station North Garden and had times for units arriving up to 16th to the scene, table data are presented up to the 10th arrival only for all station demand zones. In select cases, small or zero sample sizes precluded calculation or presentation of performance metrics. For this reason, limited figure data are presented.

[81] R16 (Pantops) risk distribution was based on a 6-minute travel time. All other Stations/Districts utilized the full existing boundaries.
[82] Pantops is expected to increase call volume to over 2,500 calls in the coming years and after system adjustments and will likely require a full time engine and ambulance once the call volume exceeds the threshold.

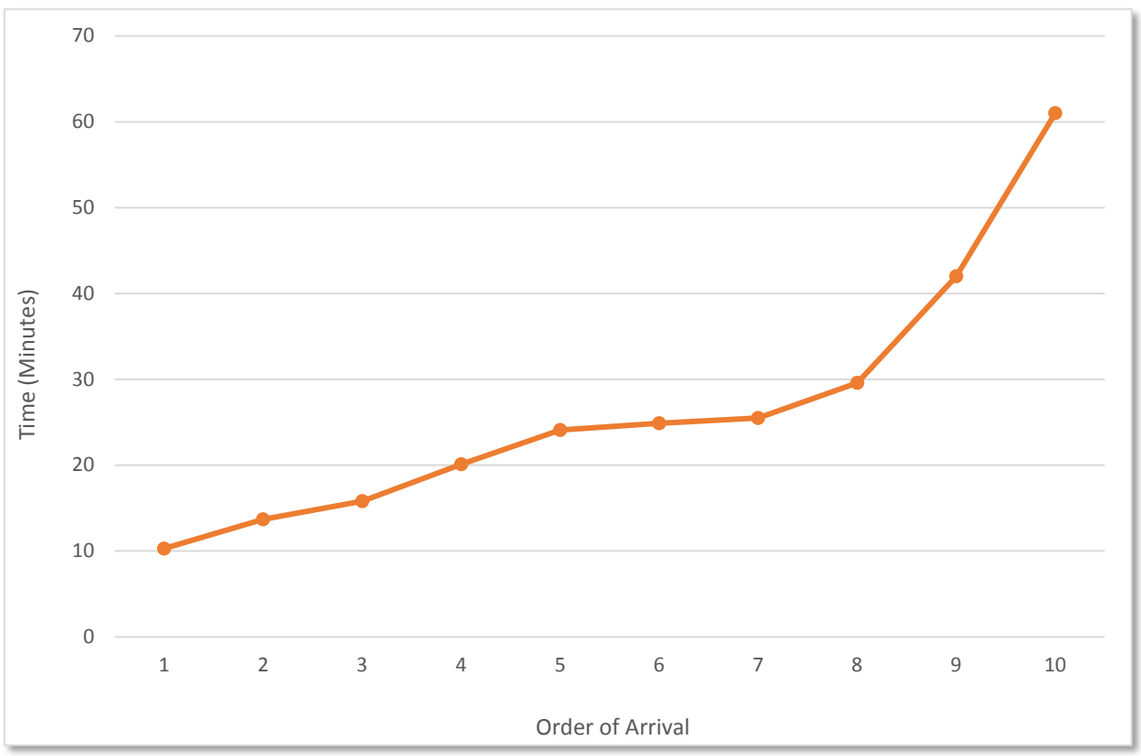
Table 115: Structure Fire: Average Travel Time in Minutes for ERF by First Due Station

First Due Station	Order of Arrival									
	1	2	3	4	5	6	7	8	9	10
City	4.6	8.1	8.9	8.6	--	--	--	--	--	--
Crozet	6.3	10.4	9.4	11.9	--	--	--	--	--	--
Earlysville	7.2	9.7	11.5	17.1	14.1	12.5	19.2	19.4	19.4	21.6
East Rivanna	5.8	7.9	9.6	10.9	14.8	11.5	10.3	17.2	29.8	28.1
Hollymead	5.6	7.0	11.6	9.7	14.1	14.8	15.6	20.5	--	--
Ivy	6.7	9.1	10.8	12.7	14.4	12.6	13.5	13.5	--	--
Monticello	5.2	8.1	12.5	13.1	11.1	20.7	20.6	23.8	21.3	27.1
North Garden	7.9	10.7	9.3	15.3	16.2	17.0	14.1	25.5	26.0	29.5
Scottsville	6.6	10.8	11.5	14.1	23.6	27.6	25.1	--	--	--
Seminole	3.7	4.2	5.1	7.8	6.0	8.3	13.7	12.9	30.3	47.6
Stony Point	7.6	9.0	7.7	12.1	12.8	15.6	--	--	--	--
Total	**5.4**	**7.6**	**8.8**	**11.3**	**12.2**	**14.0**	**15.7**	**18.0**	**24.2**	**28.1**

Table 116: Structure Fire: 90th Percentile Travel Time in Minutes for ERF by First Due Station

First Due Station	Order of Arrival									
	1	2	3	4	5	6	7	8	9	10
City	--	--	--	--	--	--	--	--	--	--
Crozet	--	--	--	--	--	--	--	--	--	--
Earlysville	--	--	--	--	--	--	--	--	--	--
East Rivanna	--	--	--	--	--	--	--	--	--	--
Hollymead	--	--	--	--	--	--	--	--	--	--
Ivy	--	--	--	--	--	--	--	--	--	--
Monticello	10.8	15.0	--	--	--	--	--	--	--	--
North Garden	--	--	--	--	--	--	--	--	--	--
Scottsville	--	--	--	--	--	--	--	--	--	--
Seminole	5.8	6.7	8.0	12.9	12.4	--	--	--	--	--
Stony Point	--	--	--	--	--	--	--	--	--	--
Total	**10.3**	**13.7**	**15.8**	**20.1**	**24.1**	**24.9**	**25.5**	**29.6**	**42.0**	**61.0**

Figure 77: 90th Percentile ERF Travel Performance for Structure Fires Overall



While it is best practice to measure performance to the 90th percentile, it is important to acknowledge that the number of calls drops significantly from the first unit to the second and beyond. The low frequency of occurrences introduces more variability in the data. The data shows that many of the ACFR stations are meeting or close to meeting the CFAI baseline of 13 minutes in the suburban area and 18 minutes 12 seconds in the rural areas for

the arrival of an effective response force[83]. In order for ACFR to meet the CFAI's effective response force benchmarks additional investment in the system will be necessary in order to provide the depth for an effective response force of 10 minutes in the suburban areas and 18 minutes for the rural area. The 2017 data is presented below.[84]

Table 117: Structure Fire: Sample Size for ERF Analysis by First Due Station

First Due Station	Order of Arrival									
	1	2	3	4	5	6	7	8	9	10
City	7	4	2	2	0	0	0	0	0	0
Crozet	9	9	3	3	0	0	0	0	0	0
Earlysville	7	6	5	4	4	3	3	3	2	2
East Rivanna	7	7	7	7	6	3	3	2	2	2
Hollymead	7	7	5	4	2	2	2	2	1	1
Ivy	9	8	5	5	3	3	3	2	1	1
Monticello	20	16	9	6	5	4	2	2	2	2
North Garden	6	6	6	4	4	3	2	2	2	2
Scottsville	9	7	6	4	3	2	2	1	1	1
Seminole	36	30	26	17	13	9	7	6	3	2
Stony Point	2	3	3	3	3	2	0	0	0	0
Total	**119**	**103**	**77**	**59**	**43**	**31**	**24**	**20**	**14**	**13**

Finally, a geospatial analysis was completed for the jurisdiction as a whole with each fire and rescue squad station identified. This analysis mapped the travel time utilizing existing road miles, infrastructure, and impedance at 10, 13, and 18-minute increments. The eight-minute travel time threshold is recommended as best practice and 10 minutes and 24 seconds is afforded as the baseline performance for the accreditation model offered by the Commission on Fire Accreditation International (CFAI)[85]. Similarly, the CFAI affords a 13-minute travel time for suburban areas and 18-minutes in rural areas.[86] When referring to the following maps, the darker the shading (purple) the higher the density of units capable of arriving within the given time frame. The 10, 13, and 18-minute drive time bleed maps are provided below as Figures 78, 79, and 80, respectively.

Overall, the ERF coverage is reasonable in and around the development areas where the greatest historical demand exists. The areas in the perimeters of the county are most prone to be challenged since they do not benefit from concentric response zones.

[83] Commission on Fire Accreditation International, Interpretive Guide for the 9th edition of the Fire and Emergency Services Self-Assessment Manual, Authored by Center for Public Safety Excellence, Chantilly, Virginia, September 2015. Page 99.
[84] Ibid.
[85] CFAI. (2016). Fire & Emergency Service Self-Assessment Manual: Interpretation Guide, 9th (ed.). Chantilly, Virginia: Author. (p. 99)
[86] Ibid.

Figure 78: 10-Minute ERF – All Current Stations

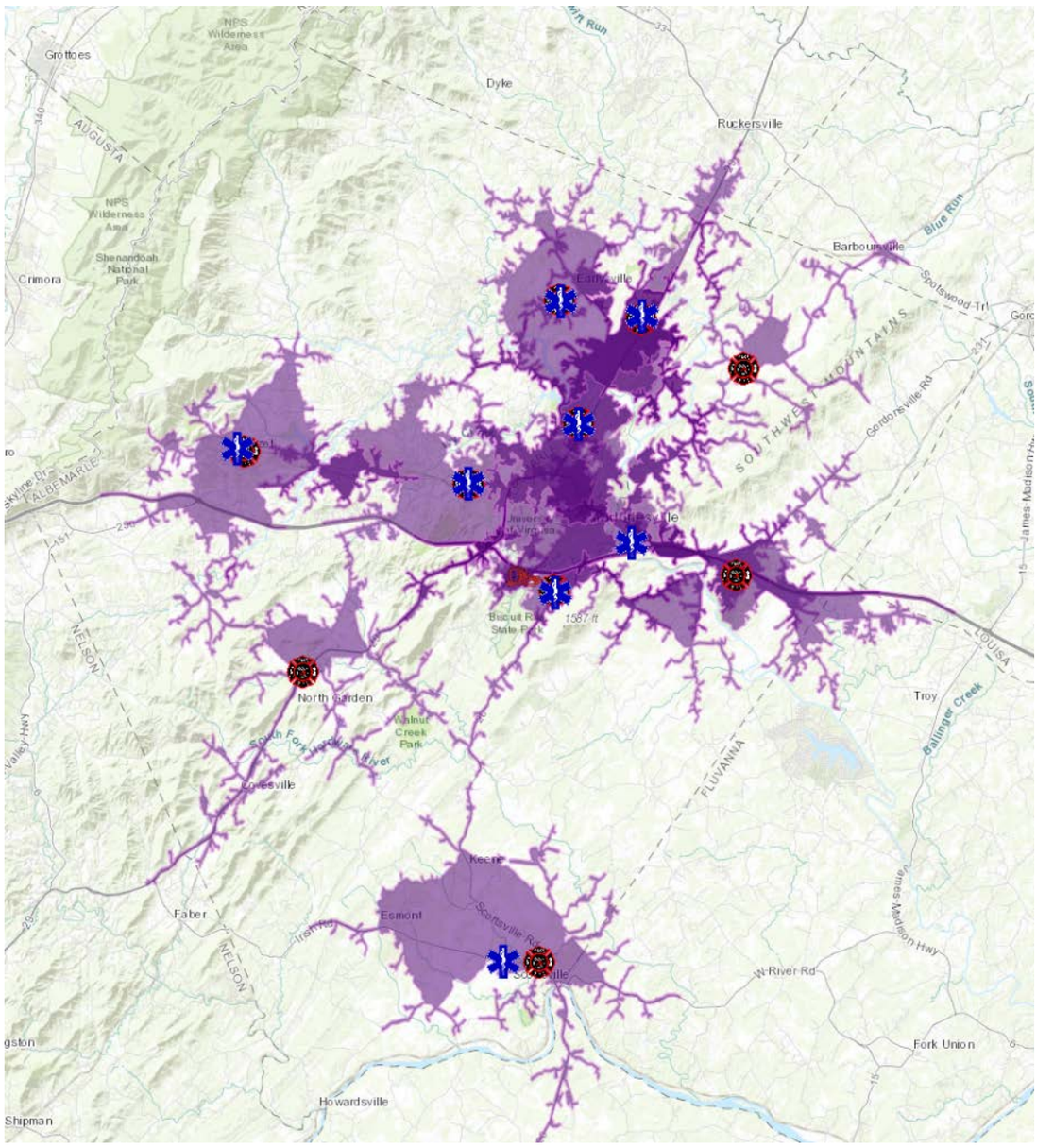


Figure 79: 13-Minute ERF from All Current Stations

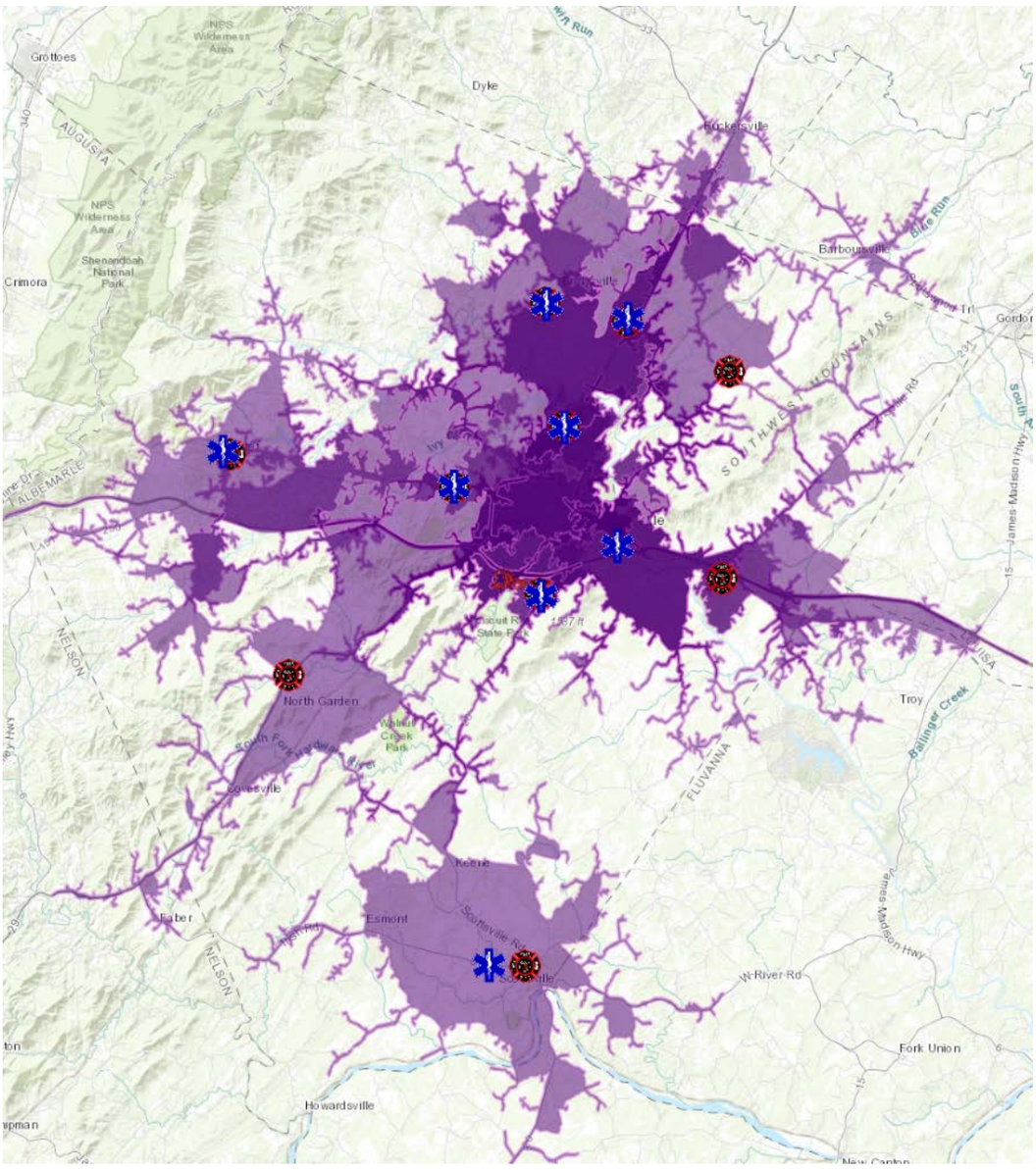
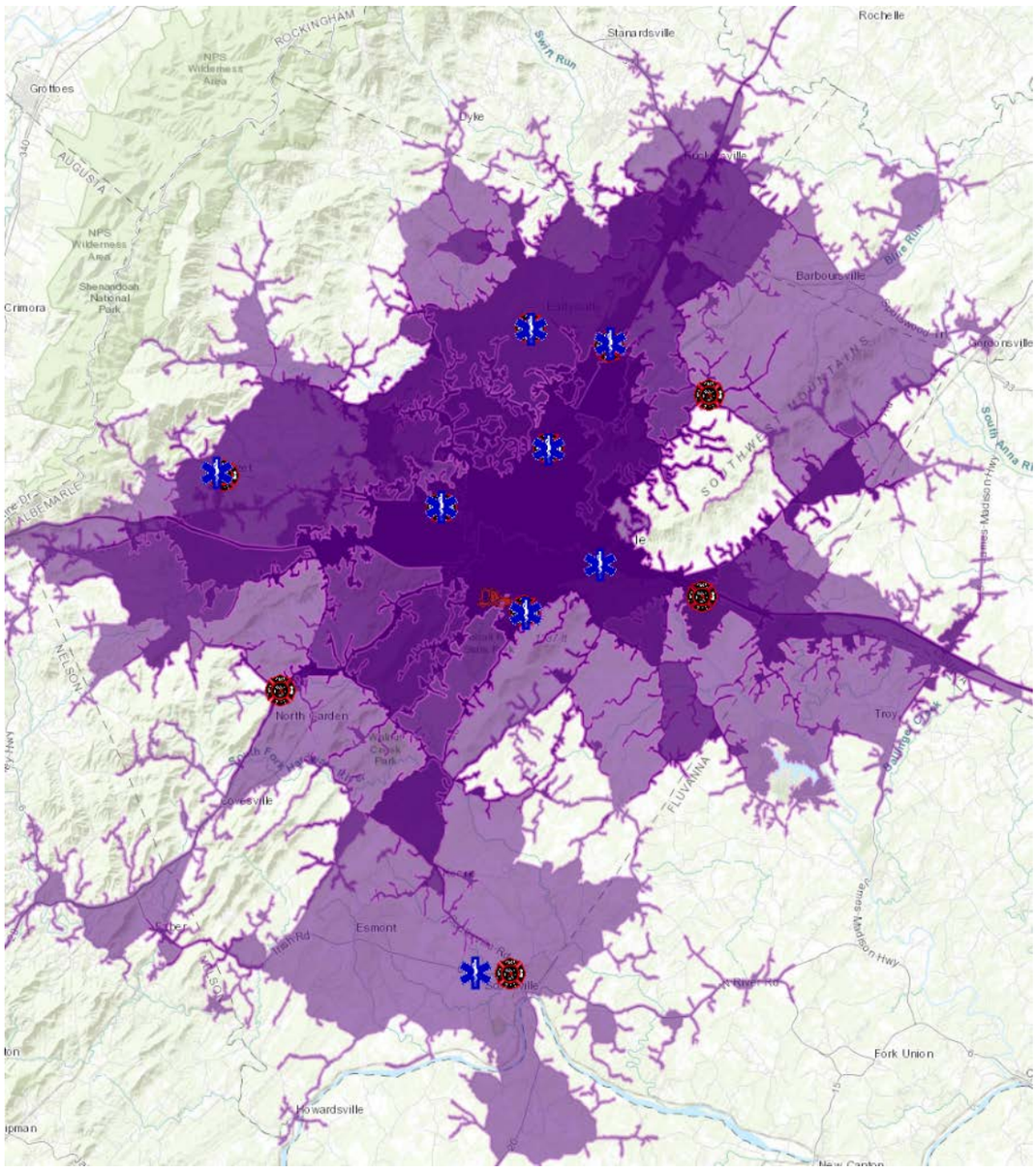


Figure 80: 18-Minute ERF from All Current Stations



Reliability Factors

Percentage of Department Compliance

The first step in assessing the reliability of the deployment model or system performance is to examine the department's availability to handle the requests for service from within the department's jurisdiction. These analyses utilized the original "FRITS_Final_Incidents_2017" and "FRITS_Final_Apparatus_2017" CAD data files with no exclusions applied. These data files included incidents and responses associated with the agencies "Albemarle County Tier" and "Charlottesville City Tier."

There were 14,360 unique incidents in the data files associated with the jurisdiction "Albemarle"; 12,537 of these incidents had an associated "IncidentNumberAlbemarle," indicating an overall ACFR compliance rate of 87.3% for 2017. The 1,823 remaining calls occurring in the Albemarle jurisdiction were handled by the agency "Charlottesville City Tier," and included responses from units assigned to "CARS" and "City." These calls included 1,746 EMS calls and 77 fire calls (Table 118).

Table 118: Calls in the Albemarle Jurisdiction Handled by the Charlottesville City Tier

Nature of Call	Number of Calls
EMS	**1,746**
Abdominal Pain	57
Alarm for Police Response	1
Allergic Reaction Ambulance Level	2
Allergic Reaction Trauma Level	4
Animal Bite Ambulance Level	2
Animal Complaint/Investigation	1
Assault Trauma Level	1
Assist Agency	572
Assist Citizen	3
Back Pain	28
Breathing Problems	38
Burns Ambulance Level	2
Cardiac Arrest	4
Chest Pain	30
Choking Ambulance Level	4
Cold Exposure Ambulance Level	1
Diabetic Ambulance Level	6
Diabetic Trauma Level	2
Drowning Out of Water Ambulance Level	1
Drunk in Public	1
Elevator Emerg w/out Patient	3
Eye Injury	1
F/R MVC Minor/Unknown Injuries	13
F/R MVC Motorcycle/ATV	3
F/R MVC Pedestrian Struck	9
F/R MVC Significant Impact No Entrapment	1
Fall Ambulance Level	259
Fall Trauma Level	11
Heat Exposure Ambulance Level	3
Hemorrhage	30
Injured Person Ambulance Level	58
Injured Person Medic Level	3
Injured Person Trauma Level	4
Lockout - Vehicle or Residential	2
Lost/Found Property	2

Nature of Call	Number of Calls
Medical Alarm	23
Mental Person	1
Motor Vehicle Crash No Injuries	2
Mutual Aid Request Rescue	3
OB/Pregnancy Ambulance Level	4
Obvious Death	2
Overdose Ambulance Level	39
Overdose Medic Level	3
PD MVC Minor/Unknown Injuries	3
Psychiatric Ambulance Level	8
Psychiatric Trauma Level[1]	1
Public Service	54
Seizure Ambulance Level	7
Seizure Medic Level	12
Shoplifting	1
Sick Person Ambulance Level	250
Sick Person Trauma Level	47
Special RS Access Issue	1
Special RS Vertical	1
Standby Emergency	1
Standby Routine	28
Stroke Ambulance Level	13
Stroke Trauma Level	21
Unconscious Ambulance Level	9
Unconscious Medic Level	8
Unknown Problem/Man Down	41
Welfare Check	1
Fire	**77**
Bomb Threat	3
Fire Alarm	30
Fire Assist PD	1
Fire Motor Vehicle Crash No Injuries Fluids Down	9
Fire Public Service Call	1
Gas Leak - Propane/ LP/ Etc.	11
Hazmat 0	2
Lines Down	1
Smell of Smoke/Electrical Commercial	2
Smoke in Structure Commercial	2
Structure Fire - Commercial	1
Suspicious Package	9
Transformer Fire	1
Tree on Power Line	1
Unusual Odor	1
Vehicle Fire	2
Total	**1,823**

[1]Edited; original entry is reported as Psychiatric Trauma Level."

Units assigned to CARS made 2,794 responses to 1,781 calls in the Albemarle jurisdiction without ACFR units; units assigned to City made 927 responses to 532 calls in the Albemarle jurisdiction without ACFR units (see Table 119 through Table 122 for additional call details related to month, day of week, hour of day, and time period; see Table 123 through Table 125 for call details by first due station). There were 490 calls in the Albemarle jurisdiction wherein one or more units assigned to CARS and to City responded without ACFR units.

Table 119: Total Calls by Month - CARS and City Units without ACFR Units

Month	Number of Calls	
	CARS	City
January	151	41
February	165	51
March	140	48
April	163	49
May	139	46
June	120	36
July	135	35
August	112	34
September	176	48
October	180	63
November	180	49
December	120	32
Total	**1,781**	**532**

Table 120: Total Calls by Day of Week - CARS and City Units without ACFR Units

Day of Week	Number of Calls	
	CARS	City
Sunday	374	53
Monday	216	80
Tuesday	197	76
Wednesday	187	78
Thursday	203	89
Friday	217	77
Saturday	387	79
Total	**1,781**	**532**

Table 121: Total Calls by Hour of Day - CARS and City Units without ACFR Units

Hour of Day	Number of Calls	
	CARS	City
0	95	27
1	93	26
2	73	12
3	49	6
4	63	13
5	44	14
6	27	11
7	45	21
8	64	27
9	71	25
10	64	29
11	55	27
12	70	31
13	63	31
14	55	24
15	67	31
16	68	31
17	67	27
18	126	20
19	137	23
20	115	21
21	100	22
22	79	14
23	91	19
Total	**1,781**	**532**

Table 122: Total Calls by Time Period - CARS and City Units without ACFR Units

Time Period	Number of Calls	
	CARS	City
MFDAYLIGHT	325	258
WEEKEND/EVENING	1,456	274
Total	**1,781**	**532**

As noted previously, there were 14,360 unique incidents in the data files associated with the jurisdiction "Albemarle"; 12,537 of these incidents had an associated "IncidentNumberAlbemarle," indicating an overall ACFR compliance rate of 87.3% for 2017. The 1,823 remaining calls occurring in the Albemarle jurisdiction were handled by the agency "Charlottesville City Tier," and included responses from units assigned to "CARS" and "City."

However, for the 77 fire related calls to which an ACFR unit did not respond, a City unit was first due for 72 of these 77 calls; for the 1,455 EMS related calls during the WEEKEND/EVENING period to which an ACFR unit did not respond, a CARS unit was first due for 1,088 of these 1,455 calls. If these calls are removed from compliance considerations, given that the system planned for CARS and City units to respond under these circumstances, then ACFR responded to 12,537 of 13,195 calls (95.0%) wherein units from ACFR stations were assigned as first due.

Table 123: Total Calls by Fire First Due Station - CARS and City Units without ACFR Units

First Due Station	Number of Calls	
	CARS	City
City	62	72
Ivy	3	4
Seminole	0	1
Total	**65**	**77**

Table 124: Total Calls by EMS MFDAYLIGHT First Due Station - CARS and City Units without ACFR Units

First Due Station	Number of Calls	
	CARS	City
Ivy	264	206
Monticello	4	0
Pantops	5	0
Seminole	6	1
Not Identified	1	0
Total	**280**	**207**

Table 125: Total Calls by EMS WEEKEND/EVENING First Due Station - CARS and City Units without ACFR Units

First Due Station	Number of Calls	
	CARS	City
CARS	1,070	243
Hollymead	4	0
Monticello	48	0
Seminole	303	4
SVRS	7	0
WARS	3	0
Not Identified	1	1
Total	**14,36**	**248**

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 a call within the assigned demand zone. This analysis utilized all dispatched calls within any station demand zone reported in the CAD data file, and the performance included responses from all units in ACFR's jurisdiction. Station demand zones were based upon "FireFirstDueID," "RescueFirstDueDayID," and

"RescueFirstDueNightID" or "FireFirstDue," "RescueFirstDueDay," and "RescueFirstDueNight" entries in the CAD data file, and calls were classified as either Fire or EMS to associate with a first due station. Table and figure data are presented twice for each variable set—once to depict first due compliance separately by specific station ID (e.g., F02 East Rivanna and R02 East Rivanna; relevant tables and figures are marked with the Roman numeral I), and once to depict first due compliance in a combined manner (e.g., F02 + R02 = East Rivanna; tables and figures are marked with the Roman numeral II). Overall, first due stations responded with one or more units to 9,670 of 11,880 calls (81.4%) occurring in ACFR specified demand zones.

Table 126: First Due Compliance by Station Demand Zone – Number of Calls for Fire First Due Station II

Station Demand Zone	Responding Unit's Assigned Station																
	ACFR	Berkmar	Crozet	Earlysville	East Rivanna	Hollymead	Ivy	Monticello	North Garden	Pantops	Scottsville	Seminole	Stony Point	SVRS	WARS	Total[1]
City	9	1	0	1	4	1	47	40	1	1	0	16	3	0	1	92
Crozet	36	0	310	6	3	4	75	4	18	0	0	5	1	0	10	319
Earlysville	25	0	5	137	3	27	8	2	0	0	0	18	10	0	0	150
East Rivanna	57	0	0	0	306	6	10	68	4	4	0	24	20	1	0	329
Fluvanna	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
Greene	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	3
Hollymead	36	2	0	27	3	157	6	4	0	0	0	29	12	0	0	181
Ivy	46	2	33	11	2	9	256	28	7	0	0	23	1	0	2	276
Monticello	80	0	0	1	64	8	37	298	5	2	7	21	4	2	1	334
Nelson	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	4
North Garden	20	0	9	0	9	0	14	16	164	0	9	5	0	2	0	166
Orange	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Scottsville	16	0	0	0	7	1	4	32	27	1	184	3	1	15	1	189
Seminole	120	23	2	17	7	91	54	13	1	0	0	536	4	0	0	576
Stony Point	11	0	0	0	5	4	2	4	0	0	0	5	85	0	0	87
Not Identified	1	0	1	1	1	2	1	0	2	0	1	7	0	0	0	14
Total	**457**	**28**	**362**	**203**	**416**	**311**	**514**	**509**	**229**	**8**	**203**	**692**	**142**	**20**	**15**	**2723**

[1]"Total" values may not equal the sum of the cell values across columns per row because units from multiple stations may have responded to a call within the given station demand zone.

Figure 81: Percentage of First Due Compliance by Station Demand Zone – Fire First Due Station I

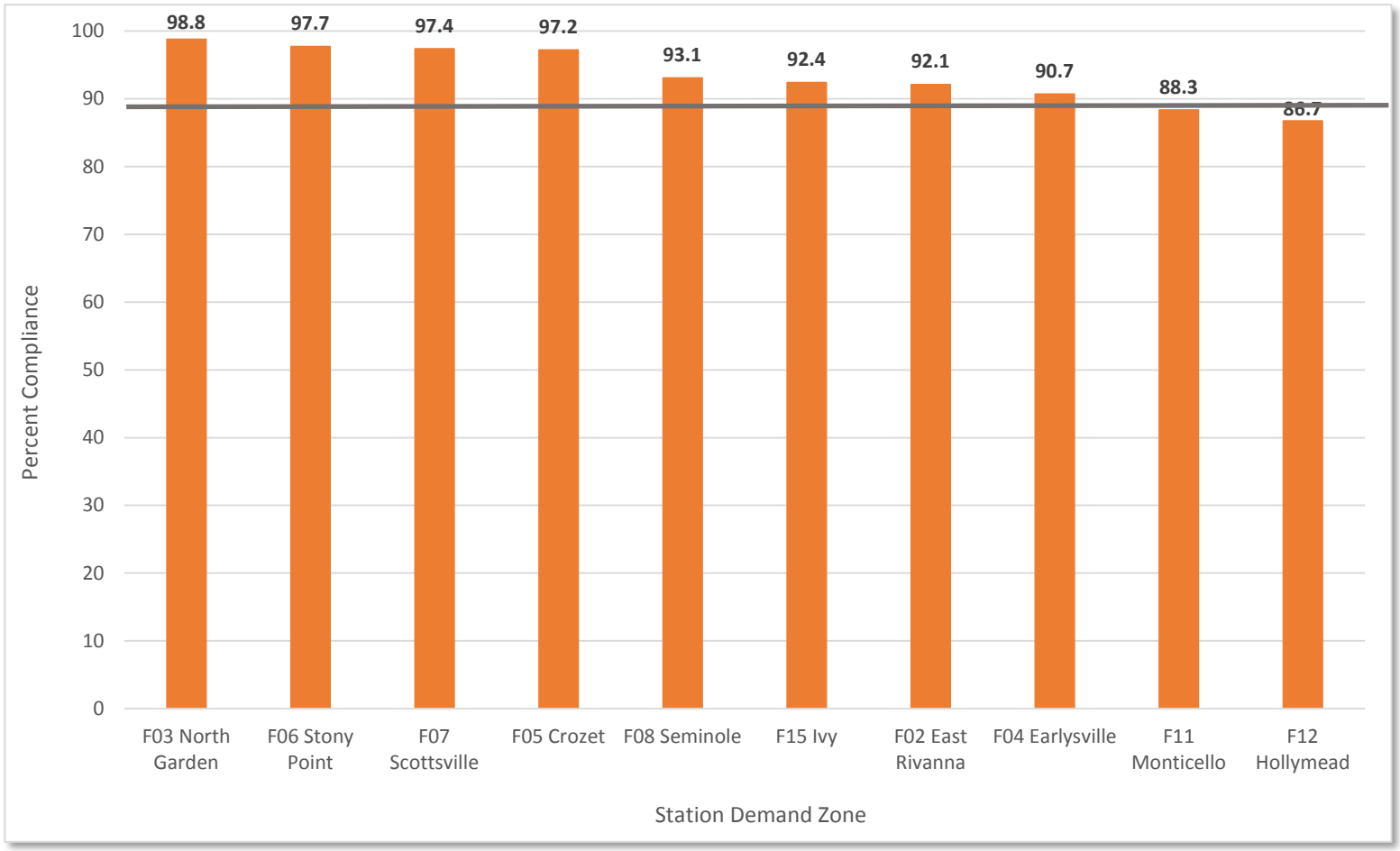
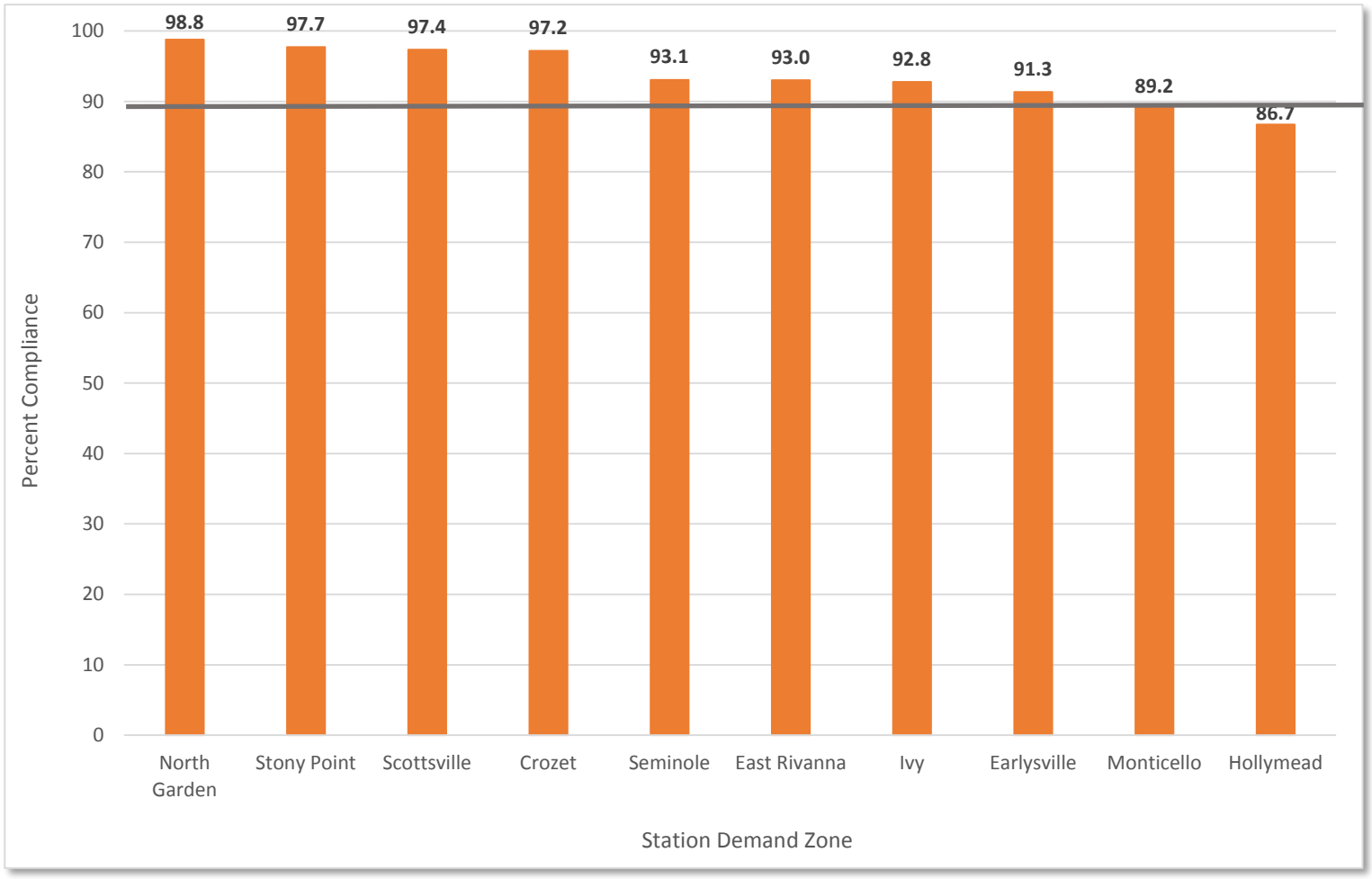


Figure 82: Percentage of First Due Compliance by Station Demand Zone – Fire First Due Station II



For calls originally classified as EMS and occurring during the MFDAYLIGHT period to associate a "RescueFirstDueDayID" entry as the station demand zone, WARS had the highest rate of compliance, responding with one or more units to 650 of 682 calls (95.3%) when it was the first due station for EMS related calls. All other stations had compliance rates below 90% for EMS related calls during the MFDAYLIGHT period in 2017. R08 Seminole had the lowest rate of compliance, responding with one or

more units from R08 Berkmar to 924 of 1474 calls (62.7%) when it was the first due station. One or more units from F08 Seminole responded to 664 calls when R08 Seminole was the first due station, and one or more units from RS12 Hollymead responded to 243 calls when R08 Seminole was the first due station. For calls originally classified as EMS and occurring during the MFDAYLIGHT period to associate a "RescueFirstDueDay" entry as the station demand zone to combine entries.

Table 127: First Due Compliance by Station Demand Zone – Number of Calls for EMS MFDAYLIGHT First Due Station II

	Responding Unit's Assigned Station															
Station Demand Zone	ACFR	Berkmar	Crozet	Earlysville	East Rivanna	Hollymead	Ivy	Monticello	North Garden	Pantops	Scottsville	Seminole	Stony Point	SVRS	WARS	Total[1]
Buckingham	0	0	0	0	0	0	0	0	0	0	5	0	0	10	0	**10**
CARS	7	8	0	1	1	5	5	12	0	1	0	8	0	2	2	**41**
Earlysville	22	17	0	133	0	37	7	0	0	1	0	11	0	1	2	**149**
Fluvanna	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	**2**
Greene	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	**2**
Hollymead	55	37	0	89	4	384	9	7	0	7	1	28	63	1	1	**465**
Ivy	52	38	9	6	3	21	372	54	86	8	0	19	0	7	21	**436**
Monticello	61	10	0	1	15	18	38	454	26	55	4	3	2	28	3	**513**
Nelson	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	**3**
Pantops	62	59	0	7	332	32	31	241	0	724	0	7	74	16	1	**967**
Seminole	97	924	0	31	1	260	241	28	0	39	0	664	1	4	2	**1474**
SVRS	19	4	0	0	5	1	14	69	41	5	89	1	0	311	2	**367**
WARS	13	3	107	1	0	0	72	5	29	0	0	0	0	0	650	**682**
Not Identified	4	6	0	0	0	2	7	4	2	1	0	7	0	2	0	**16**
Total	**393**	**1106**	**116**	**269**	**361**	**761**	**796**	**874**	**184**	**842**	**100**	**748**	**140**	**384**	**686**	**5127**

[1]"Total" values may not equal the sum of the cell values across columns per row because units from multiple stations may have responded to a call within the given station demand zone.

Figure 83: Percentage of First Due Compliance by Station Demand Zone – EMS MFDAYLIGHT First Due Station I

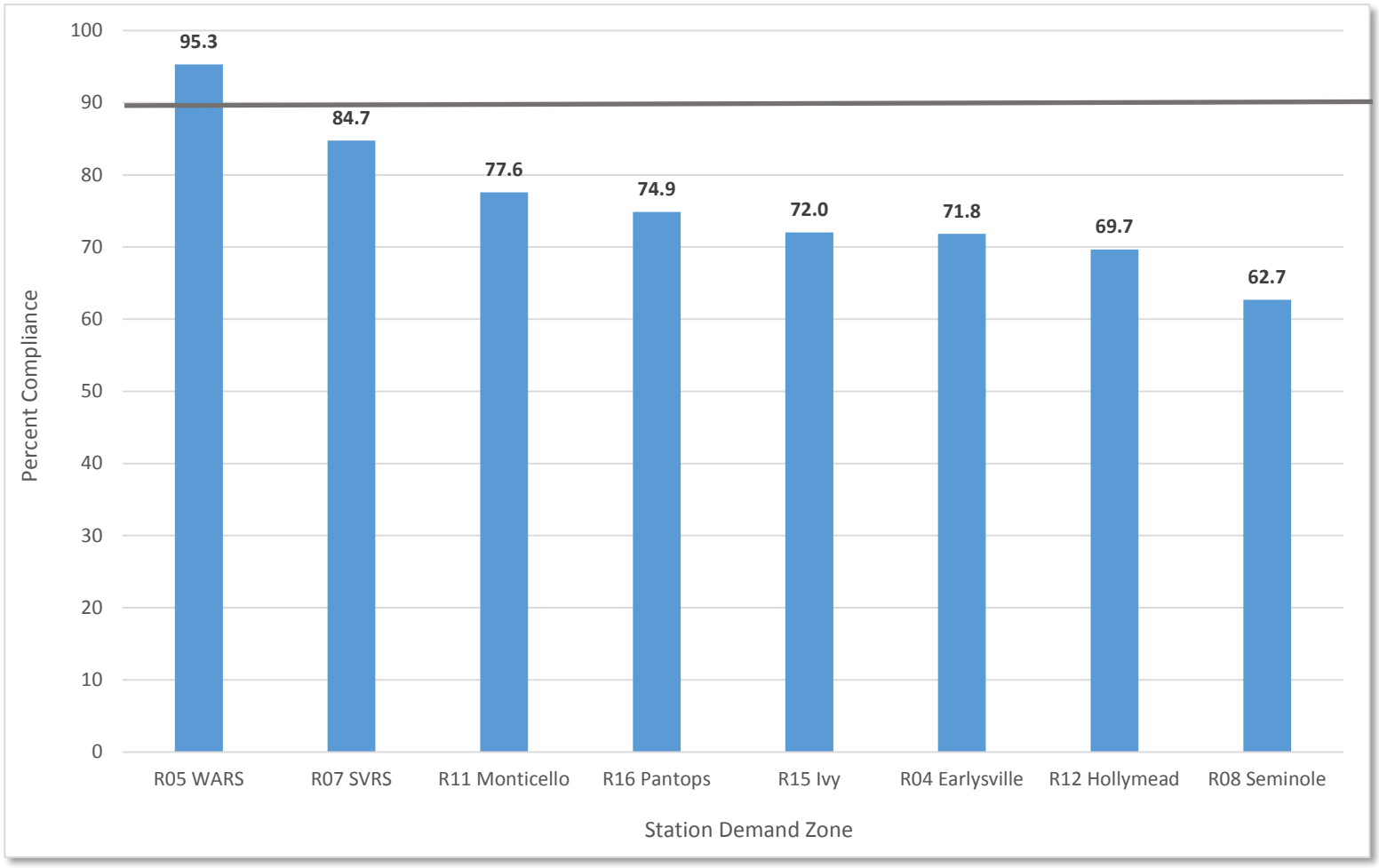
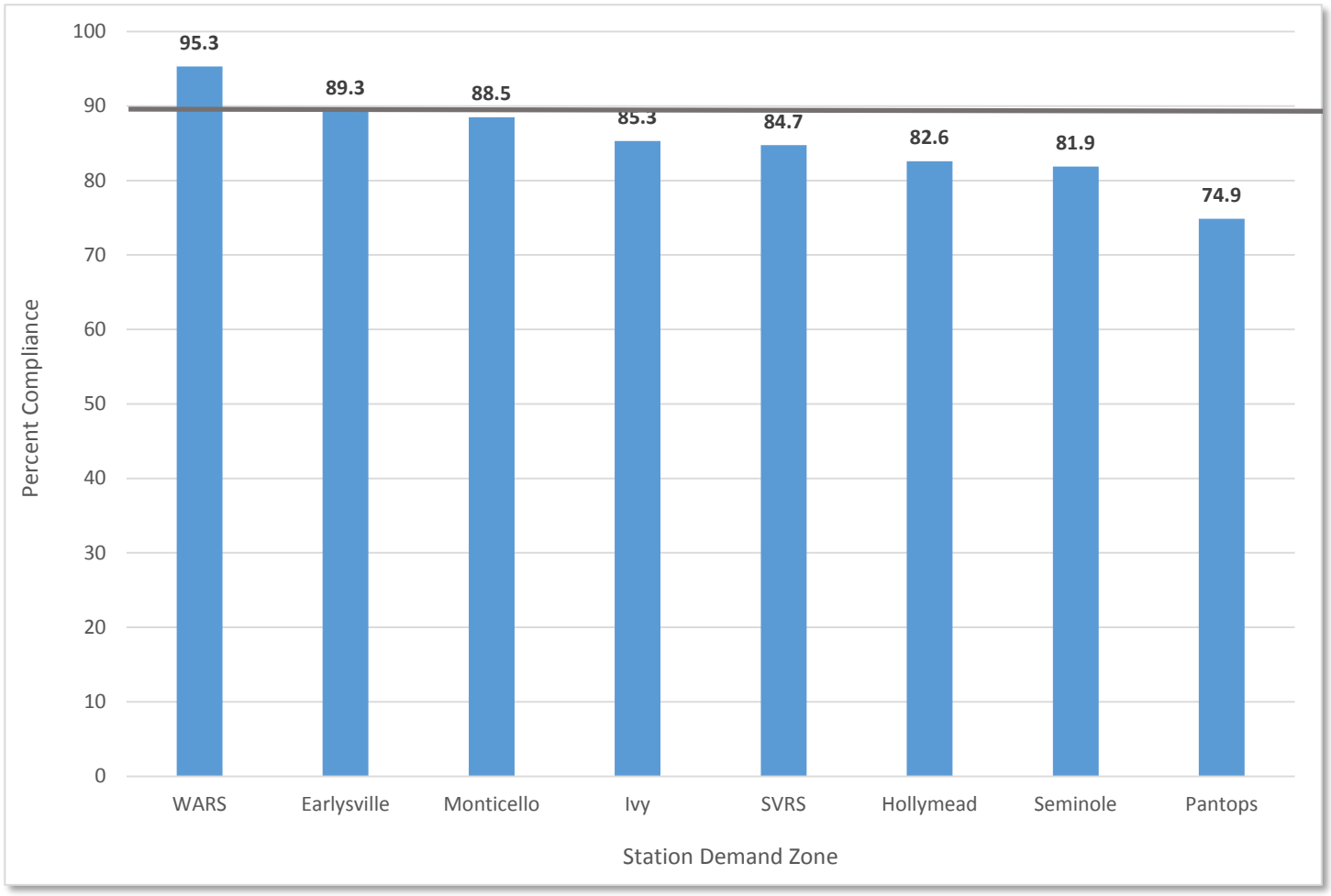


Figure 84: Percentage of First Due Compliance by Station Demand Zone – EMS MFDAYLIGHT First Due Station II



For calls originally classified as EMS and occurring during the WEEKEND/EVENING period to associate a "RescueFirstDueNightID" entry as the station demand, R05 WARS had the highest rate of compliance, responding with one or more units to 869 of 913 calls (95.2%) when it was the first due station for EMS related calls. All other stations had compliance rates < 90%. While R05 WARS responded with one or more units to 95.2% of calls in its demand zone, F05 Crozet responded with

one or more units to 131 calls when R05 WARS was the first due station for EMS related calls during the WEEKEND/EVENING period. For calls originally classified as EMS and occurring during the WEEKEND/EVENING period to associate a "RescueFirstDueNight" entry as the station demand zone to combine entries.

Table 128: First Due Compliance by Station Demand Zone – Number of Calls for EMS WEEKEND/EVENING First Due Station II

	Responding Unit's Assigned Station															
Station Demand Zone	ACFR	Berkmar	Crozet	Earlysville	East Rivanna	Hollymead	Ivy	Monticello	North Garden	Pantops	Scottsville	Seminole	Stony Point	SVRS	WARS	Total[1]
Buckingham	2	0	0	0	0	0	0	1	0	0	4	0	0	15	0	**15**
CARS	68	64	5	9	331	13	218	278	126	14	4	85	43	11	18	**903**
Fluvanna	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	**2**
Greene	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	**1**
Hollymead	66	63	1	113	5	576	1	8	1	0	0	15	77	0	6	**653**
Monticello	37	16	1	0	32	1	16	613	30	4	6	1	4	16	0	**638**
Nelson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**1**
Seminole	97	1153	0	43	3	104	29	11	0	0	0	731	1	0	5	**1492**
SVRS	23	4	0	0	1	0	5	256	39	0	151	0	0	420	6	**524**
WARS	19	2	131	6	2	1	105	12	50	0	0	4	0	0	869	**913**
Not Identified	2	9	1	1	0	6	2	1	0	0	1	9	0	2	1	**20**
Total	**314**	**1311**	**139**	**172**	**376**	**702**	**376**	**1180**	**246**	**18**	**166**	**845**	**125**	**464**	**906**	**5162**

[1]"Total" values may not equal the sum of the cell values across columns per row because units from multiple stations may have responded to a call within the given station demand zone.

Figure 85: Percentage of First Due Compliance by Station Demand Zone – EMS WEEKEND/EVENING First Due Station I

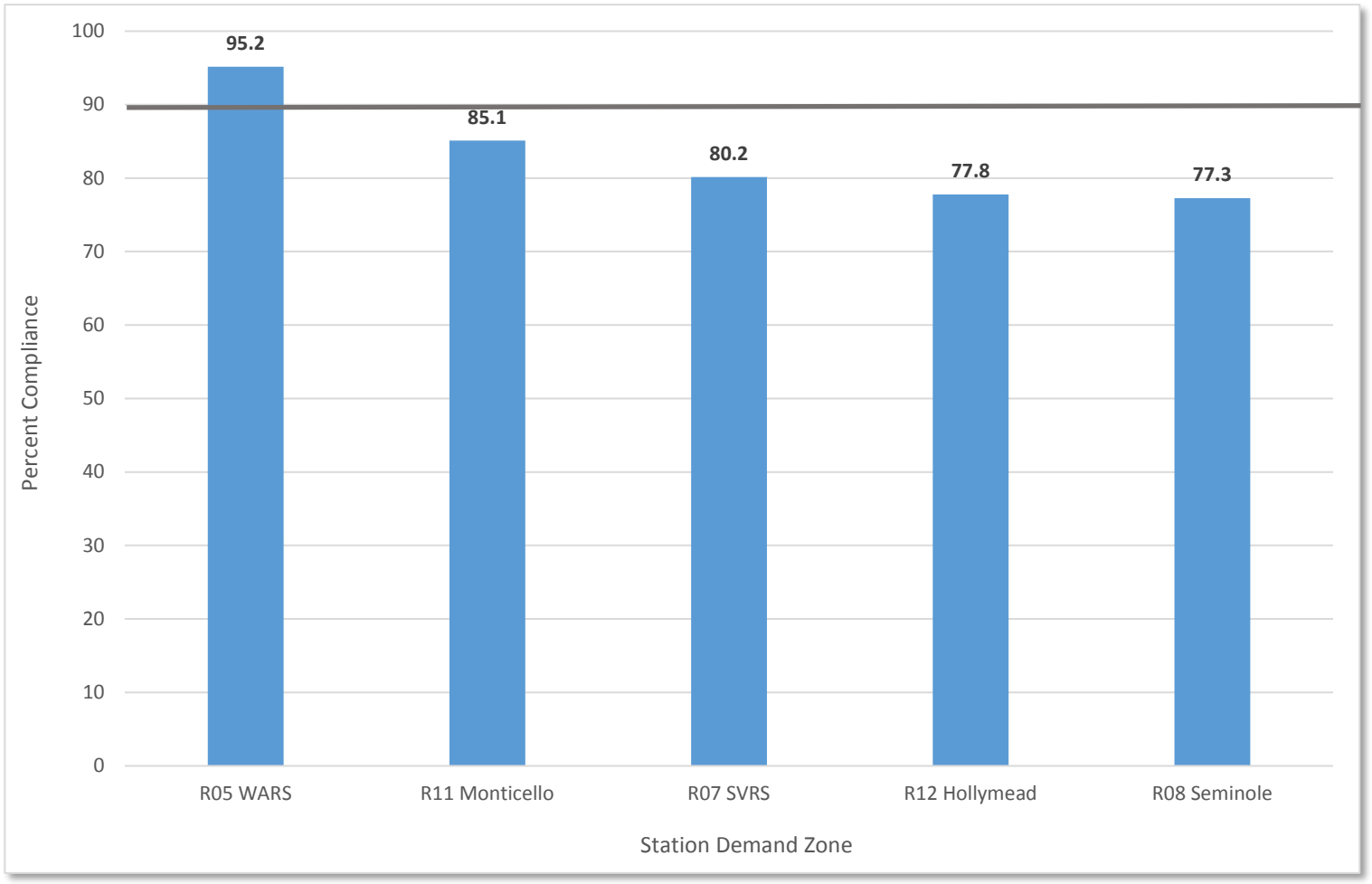
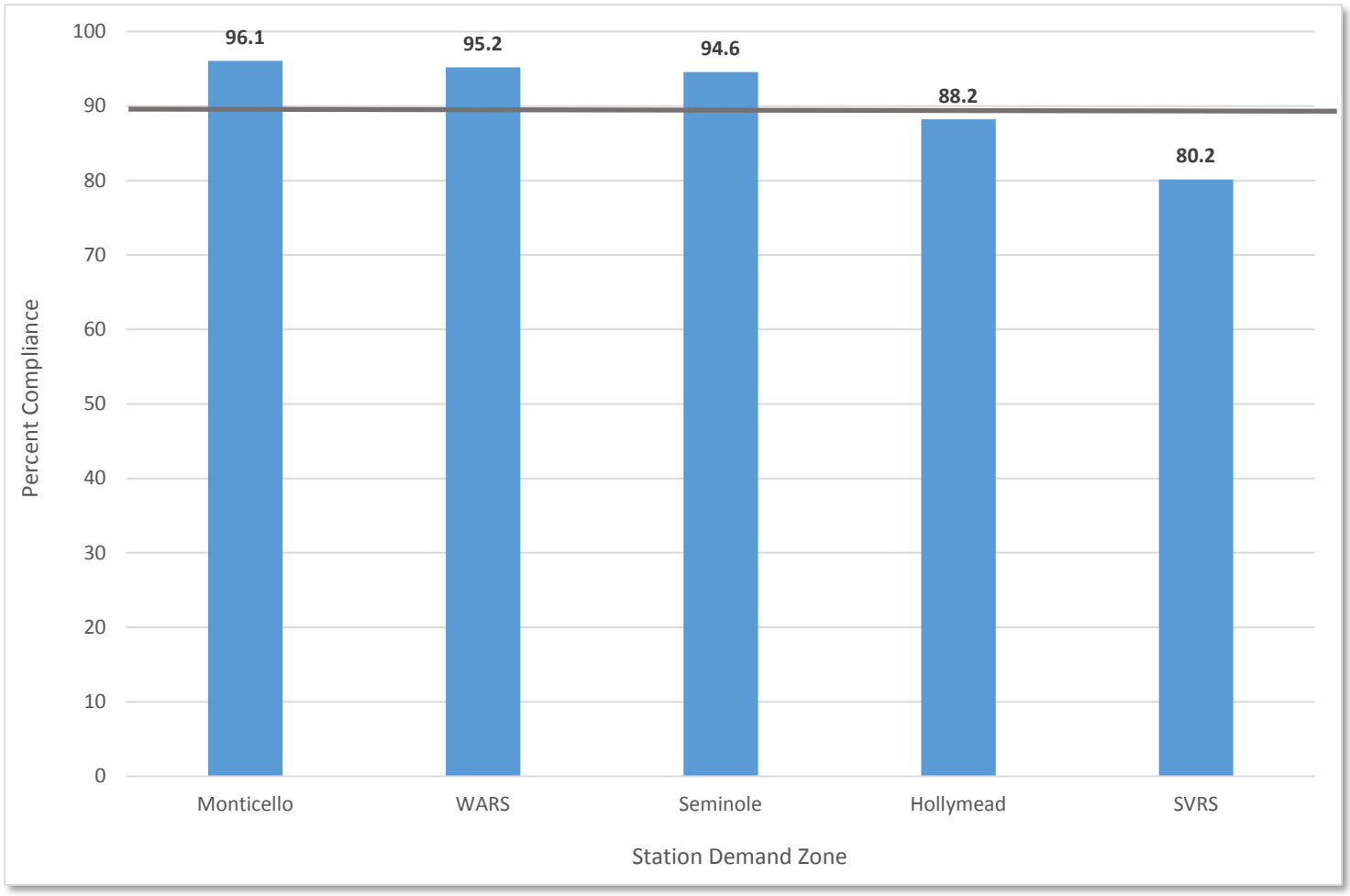


Figure 86: Percentage of First Due Compliance by Station Demand Zone – EMS WEEKEND/EVENING First Due Station II



Overlapped or Simultaneous Call Analysis

Overlapped or simultaneous calls are defined as another call being received for a first due station while one or more calls are already ongoing for the same first due station. For example, if there is an ongoing call in station 1's zone wherein all units have not yet been cleared, and another request for service occurs in station 1's zone, those two calls would be captured as overlapped calls. Understanding the percentage of overlapped calls will help to determine the number of units to staff for each station. In general, the larger the call volume for a first due station, the greater the likelihood of overlapped calls occurring. The distribution of the demand throughout the day will impact the chance of having overlapped calls. Additionally, the duration of a call plays a significant role; the longer it takes to clear a request, the greater the likelihood of having an overlapping request.

Results for these analyses are reported by fire first due station, EMS MFDAYLIGHT first due station, and EMS WEEKEND/EVENING first due station. Note that for calls in any of these three categories, overlapped calls represent any call classified in its respective category overlapping with another call only in its respective category. For example, during 2017, Crozet was assigned as the fire first due station for 319 fire related calls. At least one ACFR unit was still out on the call (i.e., not yet returned to service) for nine of these 319 calls when another fire related call was received for Crozet as the fire first due station. Similarly, during 2017, Earlysville was assigned as the first due rescue during MFDAYLIGHT for 149 EMS related calls. At least one ACFR unit was still out on the call for nine of these 149 calls when another EMS related call was received for Earlysville as the MFDAYLIGHT rescue first due station.

As fire first due stations, Monticello and North Garden had the highest percentage of overlapped calls during 2017 for fire related calls (4.2%; Table 129; Figure 87). For MFDAYLIGHT rescue first due stations, Seminole had the highest percentage of overlapped calls during 2017 for EMS related calls (34.3%; Table 130; Figure 88). For WEEKEND/EVENING rescue first due stations, Seminole also had the highest percentage of overlapped calls during 2017 for EMS related calls (15.4%; Table 131; Figure 89).

Table 129: Overlapped Calls by First Due Station - Fire First Due Station

First Due Station	Overlapped Calls	Total Calls	Percentage of Overlapped Calls
Crozet	9	319	2.8
Earlysville	1	150	0.7
East Rivanna	11	329	3.3
Hollymead	5	181	2.8
Ivy	3	276	1.1
Monticello	14	334	4.2
North Garden	7	166	4.2
Scottsville	7	189	3.7
Seminole	19	576	3.3
Stony Point	0	87	0.0

Figure 87: Percentage of Overlapped Calls by First Due Station - Fire First Due Station

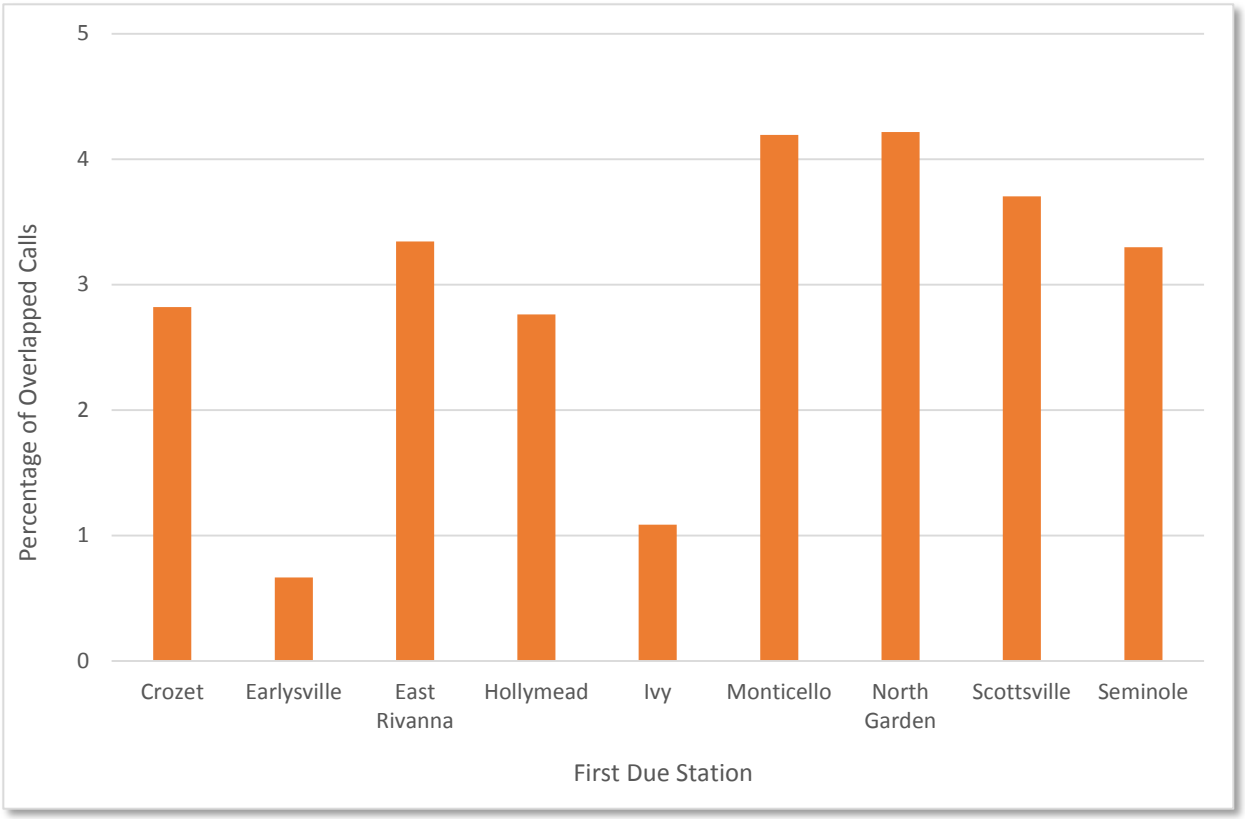


Table 130: Overlapped EMS Calls by First Due Station – EMS MFDAYLIGHT First Due Station

First Due Station	Overlapped EMS Calls	Total Calls	Percentage of Overlapped EMS Calls
CARS	0	41	0.0
Earlysville	9	149	6.0
Hollymead	72	465	15.5
Ivy	65	436	14.9
Monticello	69	513	13.5
Pantops	238	967	24.6
Seminole	506	1,474	34.3
SVRS	61	367	16.6
WARS	138	682	20.2

Figure 88: Percentage of Overlapped EMS Calls by First Due Station - EMS MFDAYLIGHT First Due Station

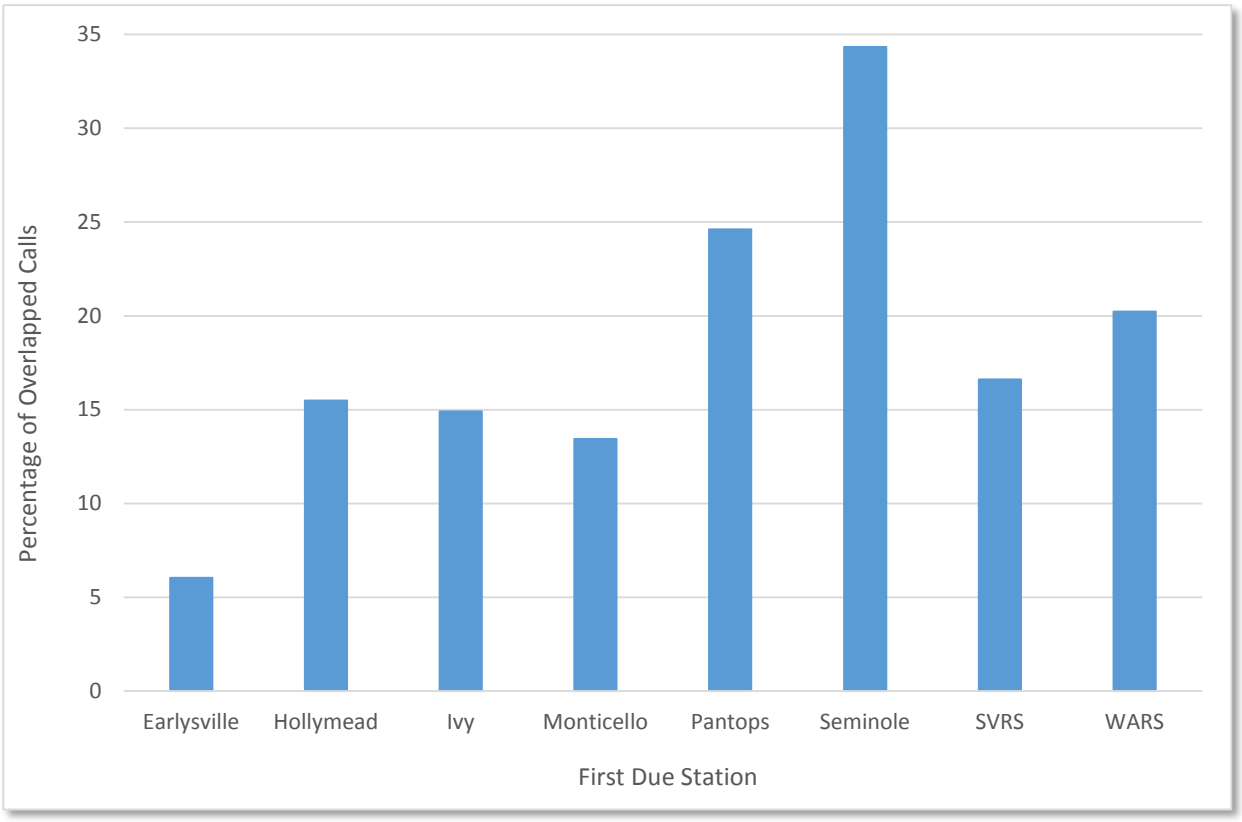
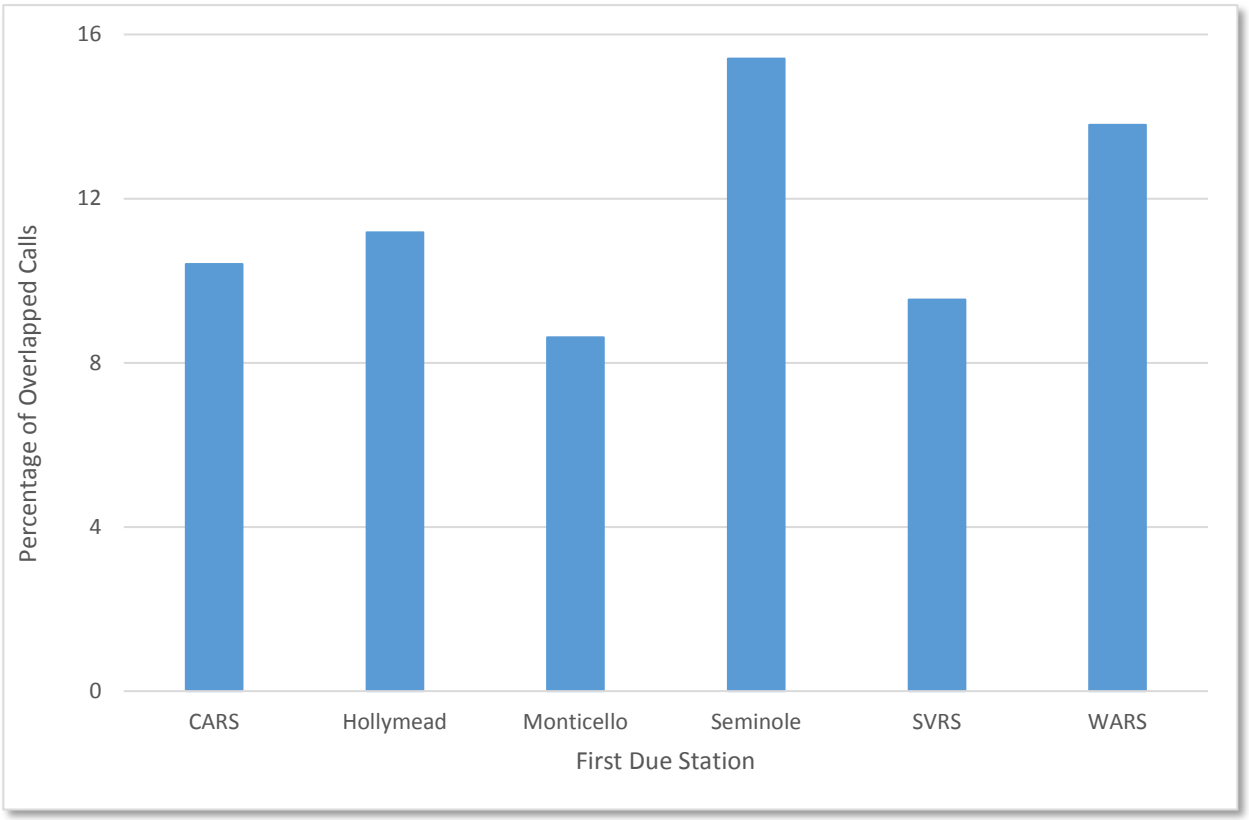


Table 131: Overlapped Fire Calls by First Due Station - EMS WEEKEND/EVENING First Due Station

First Due Station	Overlapped Fire Calls	Total Calls	Percentage of Overlapped Fire Calls
CARS	94	903	10.4
Hollymead	73	653	11.2
Monticello	55	638	8.6
Seminole	230	1,492	15.4
SVRS	50	524	9.5
WARS	126	913	13.8

Figure 89: Percentage of Overlapped Fire Calls by First Due Station - EMS WEEKEND/EVENING First Due Station



PERFORMANCE OBJECTIVES AND MEASUREMENT

The Commission on Fire Accreditation International utilizes a tiered system for performance measurement; benchmarks and baselines, respectively. Benchmark objectives are stretch goals that help to establish a pathway for future planning. In other words, benchmarks are goals that are not intended to be currently met.

In contrast, baselines objectives are designed to establish the base level of services that the agency can manage performance against. Baseline objectives are intended to be currently met and maintained as a minimum, or baseline, level of service. In other words, baseline objectives are the guaranteed level of service provided.

Performance Objectives – Benchmarks

Fire Suppression Services Program – Low/Moderate Risk – Development Area

For 90 percent of all structure fires in the *Development Area*, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 6 minutes in all areas. The first-due unit for all risk levels shall be capable of: providing 750 gallons of water and 1,500 gallons per minute (gpm) pumping capacity; initiating command; requesting additional resources; establishing a back-up line and advancing an attack line, flowing a minimum of 150 gpm; containing the fire; rescuing at-risk victims; and performing salvage operations. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the public.

For 90 percent of all moderate structure fires in the *Development Area*, the total response time for the arrival of the effective response force (ERF), staffed with 18 firefighters and officers, shall be: 10 minutes in all areas. The ERF shall be capable of: establishing command; appointing a site safety officer; providing an uninterrupted water supply; advancing an attack line and a backup line for fire control; complying with the Occupational Safety and Health Administration (OSHA) requirements of two-in and two-out; completing forcible entry; searching and rescuing at-risk victims; ventilating the structure; controlling utilities; and performing salvage and overhaul. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the general public.

Fire Suppression Services Program – High Risk - Development Area

For 90 percent of all structure fires in the *Development Area*, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 6 minutes and in all areas. The first-due unit for all risk levels shall be capable of: providing 750 gallons of water and 1,500 gallons per minute (gpm) pumping capacity; initiating command; requesting additional resources; establishing a back-up line and advancing an attack line, flowing a minimum of 150 gpm; containing the fire; rescuing at-risk victims; and performing salvage

operations. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the public.

For 90 percent of all high risk structure fires in the *Development Area*, the total response time for the arrival of the effective response force (ERF), staffed with 21 firefighters and officers, shall be: 10 minutes in all areas. The ERF shall be capable of: establishing command; appointing a site safety officer; providing an uninterrupted water supply; advancing an attack line and a backup line for fire control; complying with the Occupational Safety and Health Administration (OSHA) requirements of two-in and two-out; completing forcible entry; searching and rescuing at-risk victims; ventilating the structure; controlling utilities; and performing salvage and overhaul. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the general public.

Fire Suppression Services Program – Low/Moderate Risk – Rural Area

For 90 percent of all structure fires in the *Rural Area*, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 15 minutes and 30 seconds in all areas. The first-due unit for all risk levels shall be capable of: providing 750 gallons of water and 1,500 gallons per minute (gpm) pumping capacity; initiating command; requesting additional resources; establishing a back-up line and advancing an attack line, flowing a minimum of 150 gpm; containing the fire; rescuing at-risk victims; and performing salvage operations. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the public.

For 90 percent of all moderate structure fires in the *Rural Area*, the total response time for the arrival of the effective response force (ERF), staffed with 18 firefighters and officers, shall be: 18 minutes in all areas. The ERF shall be capable of: establishing command; appointing a site safety officer; providing an uninterrupted water supply; advancing an attack line and a backup line for fire control; complying with the Occupational Safety and Health Administration (OSHA) requirements of two-in and two-out; completing forcible entry; searching and rescuing at-risk victims; ventilating the structure; controlling utilities; and performing salvage and overhaul. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the general public.

If the area requires portable water, an additional six personnel are required for a total ERF of 24 firefighters.

Fire Suppression Services Program – High Risk – Rural Area

For 90 percent of all structure fires in the *Rural Area*, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 15 minutes and 30 seconds in all areas. The first-due unit for all risk levels shall be capable of: providing 750 gallons of water and 1,500 gallons per minute (gpm) pumping capacity; initiating command;

requesting additional resources; establishing a back-up line and advancing an attack line, flowing a minimum of 150 gpm; containing the fire; rescuing at-risk victims; and performing salvage operations. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the public.

For 90 percent of all high risk structure fires in the *Rural Area*, the total response time for the arrival of the effective response force (ERF), staffed with 21 firefighters and officers, shall be: 18 minutes in all areas. The ERF shall be capable of: establishing command; appointing a site safety officer; providing an uninterrupted water supply; advancing an attack line and a backup line for fire control; complying with the Occupational Safety and Health Administration (OSHA) requirements of two-in and two-out; completing forcible entry; searching and rescuing at-risk victims; ventilating the structure; controlling utilities; and performing salvage and overhaul. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the general public.

If the area requires portable water supply, an additional seven personnel are required for a total ERF of 25 firefighters.

Emergency Medical Services Program – Development Area

For 90 percent of all first responder EMS responses in the *Development Area,* the total response time for the arrival of the first-due unit, staffed with a minimum of 2, shall be: 6 minutes in all areas. The first-due unit shall be capable of: assessing scene safety and establishing command; sizing-up the situation; conducting an initial patient assessment; obtaining vitals and patient's medical history; initiating mitigation efforts within one minute of arrival; providing first responder medical aid including automatic external defibrillation (AED); and assisting transport personnel with packaging the patient.

For 90 percent of all ALS EMS responses in the *Development Area,* the total response time for the arrival of the first-due unit, staffed with a minimum of 2, shall be: 6 minutes in all areas. The first-due unit shall be capable of: assessing scene safety and establishing command; sizing-up the situation; conducting an initial patient assessment; obtaining vitals and patient's medical history; initiating mitigation efforts within one minute of arrival; providing ALS medical aid and other critical and invasive procedures; and patient transportation. This may be a minimum of 1, if a BLS ambulance is the first arrival and an ALS chase car is utilized.

For 90 percent of all high-risk responses in the *Development Area,* the total response time for the arrival of the effective response force, with a minimum of 4, shall be: 8 minutes in all areas. In addition to first responder and ALS capabilities, the ERF shall be capable of mitigating high-risk medical incidents such as sudden cardiac arrest, penetrating trauma wounds, advanced airway interventions and other high risk or labor-intensive critical interventions as well as patient transportation.

Emergency Medical Services Program – Rural Area

For 90 percent of all first responder EMS responses in the *Rural Area,* the total response time for the arrival of the first-due unit, staffed with a minimum of 2, shall be: 15 minutes and 30 seconds in all areas. The first-due unit shall be capable of: assessing scene safety and establishing command; sizing-up the situation; conducting an initial patient assessment; obtaining vitals and patient's medical history; initiating mitigation efforts within one minute of arrival; providing first responder medical aid including automatic external defibrillation (AED); and assisting transport personnel with packaging the patient.

For 90 percent of all ALS EMS responses in the *Rural Area,* the total response time for the arrival of the first-due unit, staffed with a minimum of 2, shall be: 15 minutes and 30 seconds in all areas. The first-due unit shall be capable of: assessing scene safety and establishing command; sizing-up the situation; conducting an initial patient assessment; obtaining vitals and patient's medical history; initiating mitigation efforts within one minute of arrival; providing ALS medical aid and other critical and invasive procedures; and patient transportation. This may be a minimum of 1, if a BLS ambulance is the first arrival and an ALS chase car is utilized.

For 90 percent of all high-risk responses in the *Rural Area,* the total response time for the arrival of the effective response force, with a minimum of 4, shall be: 18 minutes in all areas. In addition to first responder and ALS capabilities, the ERF shall be capable of mitigating high-risk medical incidents such as sudden cardiac arrest, penetrating trauma wounds, advanced airway interventions and other high risk or labor-intensive critical interventions as well as patient transportation.

Hazardous Materials Services Program

For 90 percent of all hazardous materials response incidents in the *Development Area*, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 6 minutes in all areas. The first-due unit shall be capable of: establishing command; sizing up and assessing the situation to determine the presence of a potential hazardous material or explosive device; determining the need for additional resources; estimating the potential harm without intervention; and begin establishing a hot, warm, and cold zone.

For 90 percent of all hazardous materials response incidents in the *Rural Area*, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 15 minutes and 30 seconds in all areas. The first-due unit shall be capable of: establishing command; sizing up and assessing the situation to determine the presence of a potential hazardous material or explosive device; determining the need for additional resources; estimating the potential harm without intervention; and begin establishing a hot, warm, and cold zone.

For 90 percent of the moderate hazardous materials response incidents in the D*evelopment Area*, the total response time for the arrival of the effective response force (ERF) including the hazardous materials response team, staffed with 18 firefighters and officers, shall be: 12 minutes in all areas. The ERF shall be capable of: appointing a site safety officer; and providing the equipment, technical expertise, knowledge, skills, and abilities to mitigate a hazardous materials incident in accordance with department standard operating guidelines.

For 90 percent of the moderate hazardous materials response incidents in the *Rural Area*, the total response time for the arrival of the effective response force (ERF) including the hazardous materials response team, staffed with 18 firefighters and officers, shall be: 18 minutes in all areas. The ERF shall be capable of: appointing a site safety officer; and providing the equipment, technical expertise, knowledge, skills, and abilities to mitigate a hazardous materials incident in accordance with department standard operating guidelines.

Rescue Services Program

For 90 percent of all technical and water rescue incidents in the *Development Area*, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 6 minutes in all areas. The first-due unit shall be capable of: establishing command; sizing up to determine if a technical rescue response is required; requesting additional resources; and providing a minimum of basic life support to any victim without endangering response personnel.

For 90 percent of all technical and water rescue incidents in the *Rural Area*, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 15 minutes and 30 seconds in all areas. The first-due unit shall be capable of: establishing command; sizing up to determine if a technical rescue response is required; requesting additional resources; and providing a minimum of basic life support to any victim without endangering response personnel.

For 90 percent of the technical rescue incidents in the *Development Area*, the total response time for the arrival of the effective response force (ERF), staffed with 18 firefighters and officers including the technical response team, shall be: 12 minutes all areas. The ERF shall be capable of: appointing a site safety officer; establishing patient contact; staging and apparatus set up; providing technical expertise, knowledge, skills, and abilities during technical and water rescue incidents; and providing a minimum advance life support.

For 90 percent of the technical rescue incidents in the *Rural Area*, the total response time for the arrival of the effective response force (ERF), staffed with 18 firefighters and officers including the technical response team, shall be: 18 minutes all areas. The ERF shall be capable of: appointing a site safety officer; establishing patient contact; staging and apparatus set up; providing technical expertise, knowledge, skills, and abilities during technical and water rescue incidents; and providing a minimum advance life support.

Summaries of the Department's benchmark objectives are presented below.

Table 132: Summary of Albemarle County Fire Rescue Benchmark Objectives for Development Area

Measured at the 90th Percentile		Suppression	EMS	HazMat	Tech Rescue
Call Processing	Pick-up to Dispatch	1:00	1:00	1:00	1:00
Turnout	Turnout Time 1st Unit	1:00	1:00	1:00	1:00
	Turnout Time for ERF	1:00	1:00	1:00	1:00
Travel	Travel Time 1st Due	4:00	4:00	4:00	4:00
	Travel Time ERF	8:00	8:00	10:00	10:00
Total Response Time	Total Response Time 1st Due	6:00	6:00	6:00	6:00
	Total Response Time ERF	10:00	10:00	12:00	12:00

Table 133: Summary of Albemarle County Fire Rescue Benchmark Objectives for Rural Area

Measured at the 90th Percentile		Suppression	EMS	HazMat	Tech Rescue
Call Processing	Pick-up to Dispatch	1:00	1:00	1:00	1:00
Turnout	Turnout Time 1st Unit	1:30	1:30	1:30	1:30
	Turnout Time for ERF	1:30	1:30	1:30	1:30
Travel	Travel Time 1st Due	13:00	13:00	13:00	13:00
	Travel Time ERF	15:30	15:30	15:30	15:30
Total Response Time	Total Response Time 1st Due	15:30	15:30	15:30	15:30
	Total Response Time ERF	18:00	18:00	18:00	18:00

Performance Objectives – Baselines

Fire Suppression Services Program – Low/Moderate Risk – Development Area

For 90 percent of all structure fires in the *Development Area*, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 9 minutes and 30 seconds in all areas. The first-due unit for all risk levels shall be capable of: providing 750 gallons of water and 1,500 gallons per minute (gpm) pumping capacity; initiating command; requesting additional resources; establishing a back-up line and advancing an attack line, flowing a minimum of 150 gpm; containing the fire; rescuing at-risk victims; and performing salvage operations. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the public.

For 90 percent of all moderate structure fires in the *Development Area*, the total response time for the arrival of the effective response force (ERF), staffed with 18 firefighters and officers, shall be: 14 minutes in all areas. The ERF shall be capable of: establishing command; appointing a site safety officer; providing an uninterrupted water supply; advancing an attack line and a backup line for fire control; complying with the Occupational Safety and Health Administration (OSHA) requirements of two-in and two-out; completing forcible

entry; searching and rescuing at-risk victims; ventilating the structure; controlling utilities; and performing salvage and overhaul. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the general public.

Fire Suppression Services Program – High Risk - Development Area

For 90 percent of all structure fires in the *Development Area*, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 9 minutes and 30 seconds in all areas. The first-due unit for all risk levels shall be capable of: providing 750 gallons of water and 1,500 gallons per minute (gpm) pumping capacity; initiating command; requesting additional resources; establishing a back-up line and advancing an attack line, flowing a minimum of 150 gpm; containing the fire; rescuing at-risk victims; and performing salvage operations. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the public.

For 90 percent of all high risk structure fires in the *Development Area*, the total response time for the arrival of the effective response force (ERF), staffed with 21 firefighters and officers, shall be: 14 minutes in all areas. The ERF shall be capable of: establishing command; appointing a site safety officer; providing an uninterrupted water supply; advancing an attack line and a backup line for fire control; complying with the Occupational Safety and Health Administration (OSHA) requirements of two-in and two-out; completing forcible entry; searching and rescuing at-risk victims; ventilating the structure; controlling utilities; and performing salvage and overhaul. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the general public.

Fire Suppression Services Program – Low/Moderate Risk – Rural Area

For 90 percent of all structure fires in the *Rural Area*, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 23 minutes in all areas. The first-due unit for all risk levels shall be capable of: providing 750 gallons of water and 1,500 gallons per minute (gpm) pumping capacity; initiating command; requesting additional resources; establishing a back-up line and advancing an attack line, flowing a minimum of 150 gpm; containing the fire; rescuing at-risk victims; and performing salvage operations. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the public.

For 90 percent of all moderate structure fires in the *Rural Area*, the total response time for the arrival of the effective response force (ERF), staffed with 18 firefighters and officers, shall be: 26 minutes in all areas. The ERF shall be capable of: establishing command; appointing a site safety officer; providing an uninterrupted water supply; advancing an attack line and a backup line for fire control; complying with the Occupational Safety and Health Administration (OSHA) requirements of two-in and two-out; completing forcible entry; searching and rescuing at-risk victims; ventilating the structure; controlling utilities;

and performing salvage and overhaul. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the general public.

If the area requires portable water, an additional six personnel are required for a total ERF of 24 firefighters.

Fire Suppression Services Program – High Risk – Rural Area

For 90 percent of all structure fires in the *Rural Area*, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 23 minutes in all areas. The first-due unit for all risk levels shall be capable of: providing 750 gallons of water and 1,500 gallons per minute (gpm) pumping capacity; initiating command; requesting additional resources; establishing a back-up line and advancing an attack line, flowing a minimum of 150 gpm; containing the fire; rescuing at-risk victims; and performing salvage operations. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the public.

For 90 percent of all high risk structure fires in the *Rural Area*, the total response time for the arrival of the effective response force (ERF), staffed with 21 firefighters and officers, shall be: 26 minutes in all areas. The ERF shall be capable of: establishing command; appointing a site safety officer; providing an uninterrupted water supply; advancing an attack line and a backup line for fire control; complying with the Occupational Safety and Health Administration (OSHA) requirements of two-in and two-out; completing forcible entry; searching and rescuing at-risk victims; ventilating the structure; controlling utilities; and performing salvage and overhaul. These operations shall be done in accordance with departmental standard operating procedures while providing for the safety of responders and the general public.

If the area requires portable water supply, an additional seven personnel are required for a total ERF of 25 firefighters.

Emergency Medical Services Program – Development Area

For 90 percent of all first responder EMS responses in the *Development Area,* the total response time for the arrival of the first-due unit, staffed with a minimum of 2, shall be: 9 minutes and 30 seconds in all areas. The first-due unit shall be capable of: assessing scene safety and establishing command; sizing-up the situation; conducting an initial patient assessment; obtaining vitals and patient's medical history; initiating mitigation efforts within one minute of arrival; providing first responder medical aid including automatic external defibrillation (AED); and assisting transport personnel with packaging the patient.

For 90 percent of all ALS EMS responses in the *Development Area,* the total response time for the arrival of the first-due unit, staffed with a minimum of 2, shall be: 9 minutes and 30 seconds in all areas. The first-due unit shall be capable of: assessing scene safety and

establishing command; sizing-up the situation; conducting an initial patient assessment; obtaining vitals and patient's medical history; initiating mitigation efforts within one minute of arrival; providing ALS medical aid and other critical and invasive procedures; and patient transportation. This may be a minimum of 1, if a BLS ambulance is the first arrival and an ALS chase car is utilized.

For 90 percent of all high-risk responses in the *Development Area,* the total response time for the arrival of the effective response force, with a minimum of 4, shall be: 11 minutes and 30 seconds in all areas. In addition to first responder and ALS capabilities, the ERF shall be capable of mitigating high-risk medical incidents such as sudden cardiac arrest, penetrating trauma wounds, advanced airway interventions and other high risk or labor-intensive critical interventions as well as patient transportation.

Emergency Medical Services Program – Rural Area

For 90 percent of all first responder EMS responses in the *Rural Area,* the total response time for the arrival of the first-due unit, staffed with a minimum of 2, shall be: 23 minutes in all areas. The first-due unit shall be capable of: assessing scene safety and establishing command; sizing-up the situation; conducting an initial patient assessment; obtaining vitals and patient's medical history; initiating mitigation efforts within one minute of arrival; providing first responder medical aid including automatic external defibrillation (AED); and assisting transport personnel with packaging the patient.

For 90 percent of all ALS EMS responses in the *Rural Area,* the total response time for the arrival of the first-due unit, staffed with a minimum of 2, shall be: 23 minutes in all areas. The first-due unit shall be capable of: assessing scene safety and establishing command; sizing-up the situation; conducting an initial patient assessment; obtaining vitals and patient's medical history; initiating mitigation efforts within one minute of arrival; providing ALS medical aid and other critical and invasive procedures; and patient transportation. This may be a minimum of 1, if a BLS ambulance is the first arrival and an ALS chase car is utilized.

For 90 percent of all high-risk responses in the *Rural Area,* the total response time for the arrival of the effective response force, with a minimum of 4, shall be: 26 minutes in all areas. In addition to first responder and ALS capabilities, the ERF shall be capable of mitigating high-risk medical incidents such as sudden cardiac arrest, penetrating trauma wounds, advanced airway interventions and other high risk or labor-intensive critical interventions as well as patient transportation.

Hazardous Materials Services Program

For 90 percent of all hazardous materials response incidents in the *Development Area*, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 9 minutes and 30 seconds in all areas. The first-due unit shall be capable of: establishing command; sizing up and assessing the situation to determine the presence of a potential hazardous material or explosive device; determining the need for additional

resources; estimating the potential harm without intervention; and begin establishing a hot, warm, and cold zone.

For 90 percent of all hazardous materials response incidents in the *Rural Area*, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 23 minutes in all areas. The first-due unit shall be capable of: establishing command; sizing up and assessing the situation to determine the presence of a potential hazardous material or explosive device; determining the need for additional resources; estimating the potential harm without intervention; and begin establishing a hot, warm, and cold zone.

For 90 percent of the moderate hazardous materials response incidents in the D*evelopment Area*, the total response time for the arrival of the effective response force (ERF) including the hazardous materials response team, staffed with 18 firefighters and officers, shall be: 16 minutes and 30 seconds in all areas. The ERF shall be capable of: appointing a site safety officer; and providing the equipment, technical expertise, knowledge, skills, and abilities to mitigate a hazardous materials incident in accordance with department standard operating guidelines.

For 90 percent of the moderate hazardous materials response incidents in the *Rural Area*, the total response time for the arrival of the effective response force (ERF) including the hazardous materials response team, staffed with 18 firefighters and officers, shall be: 28 minutes in all areas. The ERF shall be capable of: appointing a site safety officer; and providing the equipment, technical expertise, knowledge, skills, and abilities to mitigate a hazardous materials incident in accordance with department standard operating guidelines.

Rescue Services Program

For 90 percent of all technical and water rescue incidents in the *Development Area*, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 9 minutes and 30 seconds in all areas. The first-due unit shall be capable of: establishing command; sizing up to determine if a technical rescue response is required; requesting additional resources; and providing a minimum of basic life support to any victim without endangering response personnel.

For 90 percent of all technical and water rescue incidents in the *Rural Area*, the total response time for the arrival of the first-due unit, staffed with 2 firefighters and 1 officer, shall be: 23 in all areas. The first-due unit shall be capable of: establishing command; sizing up to determine if a technical rescue response is required; requesting additional resources; and providing a minimum of basic life support to any victim without endangering response personnel.

For 90 percent of the technical rescue incidents in the *Development Area*, the total response time for the arrival of the effective response force (ERF), staffed with 18 firefighters and officers including the technical response team, shall be: 16 minutes and 30 seconds all areas.

The ERF shall be capable of: appointing a site safety officer; establishing patient contact; staging and apparatus set up; providing technical expertise, knowledge, skills, and abilities during technical and water rescue incidents; and providing a minimum advance life support.

For 90 percent of the technical rescue incidents in the *Rural Area*, the total response time for the arrival of the effective response force (ERF), staffed with 18 firefighters and officers including the technical response team, shall be: 28 minutes all areas. The ERF shall be capable of: appointing a site safety officer; establishing patient contact; staging and apparatus set up; providing technical expertise, knowledge, skills, and abilities during technical and water rescue incidents; and providing a minimum advance life support.

Summaries of the Department's baseline objectives are presented below.

Table 134: Summary of Albemarle County Fire Rescue Baseline Objectives for Development Areas

Measured at the 90th Percentile		Suppression	EMS	HazMat	Tech Rescue
Call Processing	Pick-up to Dispatch	2:00	2:00	2:00	2:00
Turnout	Turnout Time 1st Unit	1:30	1:30	1:30	1:30
	Turnout Time for ERF	1:30	1:30	1:30	1:30
Travel	Travel Time 1st Due	6:00	6:00	6:00	6:00
	Travel Time ERF	10:30	10:30	13:00	13:00
Total Response Time	Total Response Time 1st Due	9:30	9:30	9:30	9:30
	Total Response Time ERF	14:00	14:00	16:30	16:30

Table 135: Summary of Albemarle County Fire Rescue Baseline Objectives for Rural Areas

Measured at the 90th Percentile		Suppression	EMS	HazMat	Tech Rescue
Call Processing	Pick-up to Dispatch	2:00	2:00	2:00	2:00
Turnout	Turnout Time 1st Unit	6:00	6:00	6:00	6:00
	Turnout Time for ERF	6:00	6:00	6:00	6:00
Travel	Travel Time 1st Due	15:00	15:00	15:00	15:00
	Travel Time ERF	18:00	18:00	20:00	20:00
Total Response Time	Total Response Time 1st Due	23:00	23:00	23:00	23:00
	Total Response Time ERF	26:00	26:00	28:00	28:00

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 has established 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 will consist of the following department members (TBD) and will have the responsibility of continuously monitoring changes in risk, community service demands, and department performance in each program area, demand zone, and/or risk category.

- Chair – Division Chief
- Member – SOC Representative
- Member – Fire Prevention/Community Risk Reduction Representative
- Member – Rescue/EMS Representative
- Member – Fire Chiefs Association

Performance Evaluation and Compliance Strategy

Albemarle County Fire Rescue 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 demand zone and by program area. Measures for the effective response force by each program area, demand zone, 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.

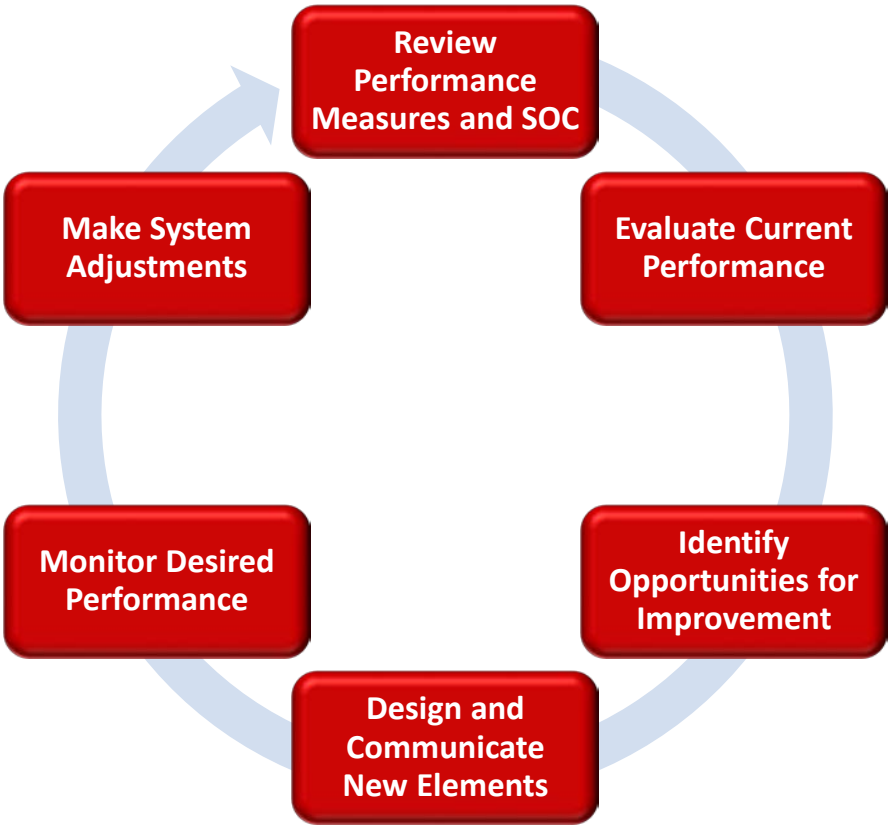
Compliance Verification Reporting

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 Manager and/or the Board of Supervisors and available to the community annually.

Constant Improvement Strategy

The Department utilizes the following conceptual model to facilitate both compliance and continuous improvement.

Figure 90: 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 outcome measures, both the Department and the County's 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 Department's unique risks. However, there are areas that have been identified that the Department could make incremental system adjustments to improve.

General Observations

Data

The department has a myriad of data resources, however, some of the data elements are not aligned well with "new" data requirements of a risk-based process included in this SOC. An effort to improve the data within the system will assist in ensuring the organization continues to provide a high level of service based on documented risk, demand and performance.

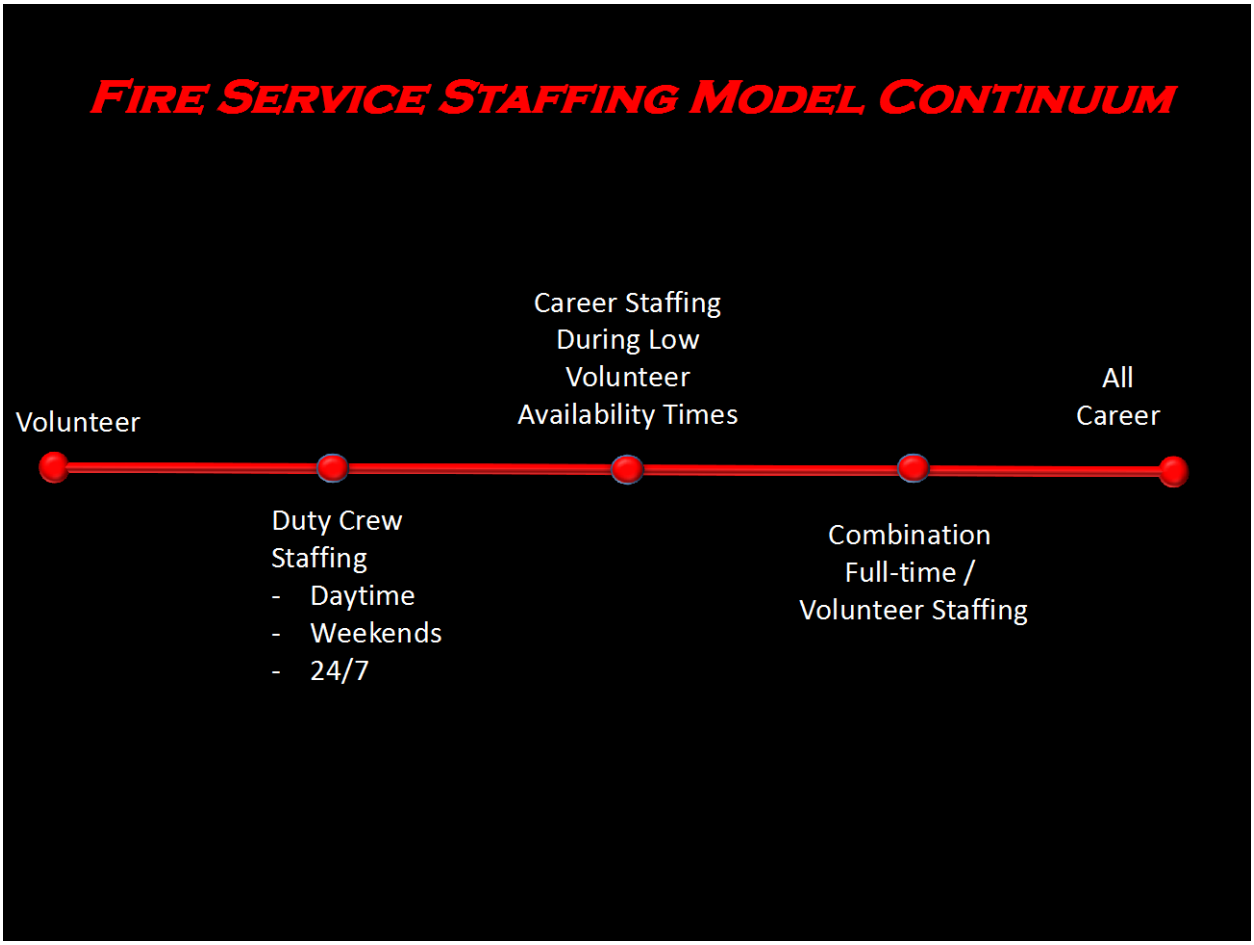
- Charlottesville/UVA/Albemarle County Emergency Communications Center does not currently prioritize EMS calls using a recognized Medical Priority Dispatch System (MPDS) that is approved and evaluated by a Medical Director and used in alignment with the Albemarle County Fire Rescue System. This would allow the department to measure the acuity, severity, of calls for service. The department can then use the acuity and severity of calls for service to send a more tailored response in the most appropriate response mode.

- Expand the data entry into the Records Management System (RMS). Additional data such as the number of personnel and trained personnel per responding vehicle can be tracked in the RMS. This additional data will allow the department to monitor system performance against critical tasks identified in this SOC document. The department could also track the number of non-responses by station to ensure that all the stations are providing reliable service to the citizens.

Staffing Challenges

Albemarle County Fire Rescue has a very diverse staffing model that has served the citizens very well. The system utilizes fire and rescue staffs that are completely volunteer all the way through paid career staff as shown in the image below. While the model has served the system well and there has been a calculated addition of career staff when necessary there are specific needs within the system with regards to staffing. Most of the volunteer stations are having challenges with recruitment and or retention which is a national issue and ACFR is no exception. The volunteer departments impacted are either running short of their authorized 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. ACFR has taken steps by supporting recruitment and retention as a system. The addition of the Volunteer Services Division Chief has provided much greater communication and trust amongst the volunteer departments within the ACFR system. The cost of turnover should be quantified to determine when the cost of recruitment and training exceeds the contribution that is provided with the current model.

Figure 91: Fire Service Staffing Model Continuum



ACFR should provide service level expectations and benchmarks throughout the system. ACFR 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 ACFR 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 image shows above there are a number of 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. Many of the volunteer stations staff the stations on evening and weekends but not all volunteer stations are providing that level of service. Four of the stations have paid career staff during the daylight hours while the volunteer staff provides response coverage on the evening and weekend hours. Additional volunteer stations may need either daytime or evening and weekend coverage by paid career staff or a combination of volunteer and paid career staff. ACFR 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 image below between capital costs, operating costs, available resources, risk tolerance, community expectations and desired reliability. ACFR like many departments in the country may need to look to invest in career staff when volunteer staffs are no longer able to reliably respond to the community demands and expectations.

Figure 92: Finding Balance in Fire Service Staffing

Evaluation of Risk

The risk-based approach utilized in the development of this study was derived from the available occupancy level data provided by ISO. While this is an excellent database available for the County and Department to utilize, it is a 3rd party data source that may not be available long-term. In addition, occupancies may exist in the County that were not individually evaluated for a variety of reasons such as timing of reviews, changes in occupancy, no individual property owner requests, or the relative size of the building. Therefore, two recommendations are offered:

- The Department is encouraged to build upon the risk analysis developed during this study by having each planning area evaluating occupancies in their territories and ensures that they are included in the planning assessment.
    - Could be accomplished over a 2 to 3 year period.
- The Department is encouraged to develop the desired assessment variables internally, and begin to capture these variables through the normal fire inspection and review cycles so that the Department can rely on an internal data source for future standard of cover updates.
    - Could be accomplished over a 3 to 5 year period.

System Alignment

As the ACFR system continues to provide service through several different organizations and models it will be important that the service is provided as a system rather than disparate organizations that are just co-located within the County's boundaries.

- Continue to provide initial fire and EMS training. This ensures that all new staff within the system are trained in the same way.
- Look to standardize the check off process for all new staff across the system regardless of the organization. Some stations use the ACFR check off process while others have their own version. Standardizing the check off will ensure a standard set of competencies across the system.
- ACFR may benefit from providing standardized continuing education to both fire and rescue staff across the system. Currently each department provides their own continuing education, ACFR could provide the continuing education to ensure the entire system has a common level of ongoing proficiency and operating knowledge.
- ACFR should create common operating procedures throughout the system. This should include the minimum number of trained personnel necessary to respond with a particular type of apparatus. This will ensure the appropriate number of trained personnel arrive on the scene to accomplish the critical tasks necessary to mitigate the emergency incident. This operational alignment will allow the different departments to work together more seamlessly and ensure that all personnel are following the safest and best practices. The system alignment should also include a common response to the same incident type across the county. It may be prudent to break up those common responses based on developed or rural areas but it should standardize the response that is received to ensure the efficient use of resources within the system. For example, some fire stations respond to certain medicals while others do not.
- ACFR contributes operating funds to each of the volunteer stations and should ensure that it gets a copy of each stations audit annually. ACFR does not have any control of the use of funds once it makes the contribution to each volunteer station and the audit is a way to ensure the County's funds are used in a responsible manner.

Internal Performance Goals

The Department had established goals for system performance prior to the completion of this SOC through the development and adoption of the Comprehensive Plan. The data analyses reveals that the average response time performance in the *rural* areas generally meets the Comp Plan goals, but the performance in the *Development* areas falls short. The data is intended to be a total of both turnout and travel times. Therefore, this comparison is calculated from the time that the stations/units are dispatched until arrival.

Table 136: Response Intervals Rural and Development Areas

CompPlan Area	Response Category	Response Intervals by All Agencies	
		Average [hh:mm:ss]	Comp Plan Goal (Avg)
Rural	FIRE	10:36	13:00
Rural	EMS	11:36	13:00
Development	FIRE	6:18	5:00
Development	EMS	6:12	4:00

It is important to recognize that the internal performance is measured as the "average" and includes the turnout time in the calculation. The GIS assessment focuses on the travel time independently of dispatch and turnout and is measured at the 90th percentile. Therefore, consumers of this report must clearly understand the unit of measure before drawing conclusions.

The individual station demand zones performance provides understanding of the compartmentalized performance. This SOC is intended to establish baseline and benchmark (goals) performance objectives for Albemarle Fire Rescue.

Observations and remedies:

- The community and department would benefit from evaluating internal performance objectives and re-establishing goals and objectives that have a uniform unit of measure and are obtainable.
- Prior to the completion of this SOC the department did not utilize a separate baseline performance and a desired goal system.
- The department could impact the total response time in most instances with the improvement of call processing and crew turnout time.
- Turnout time performance is typically within personnel and management control.
- The Department may benefit from a full communications center review in an effort to identify gaps from best practices and opportunities for improvement.
- It is recommended that the County and Department codify a travel time goal for the 90th percentile for the *Development* areas.
- It is recommended that the County and Department codify a travel time goal at the 90th percentile in the *Rural* areas.
- It is recommended that the County and Department codify a travel time baseline objective for the 90th percentile for the *Development* areas.
- It is recommended that the County and Department codify a travel time baseline objective at the 90th percentile in the *Rural* areas.

Developing a System of Standards to Guide Performance Management

The Albemarle County Fire 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 ACFR 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. For example, some areas may have full-time ambulances during the day and nothing in the evening.

Through the County's lens, the services provided are not commensurate across the jurisdiction. It is both reasonable and a best practice to recognize that differentiate deployment plans may exist between rural areas and metropolitan or urban areas. However, variability still exists between stations as one station may have staffed apparatus and another station has to call in personnel from home. Similarly, some stations elect not to fully participate in EMS and others do.

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 order 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 Albemarle 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, ACFR 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 ACFR 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.

Table 137: Summary of Recommended Baseline Service Objectives by Comp Plan Area

Type of Measure	Performance Metric	Development	Rural[87]	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	≥3 Firefighters	≥3 Firefighters	Daily
	Minimum Ambulance Staffing[88]	≥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/District 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

Fire and EMS Training

The Albemarle County Fire Rescue currently provides initial fire and EMS training for both career and volunteer members across the county. After the initial training the individual fire company or rescue squad performs the initial competency check off based on their organizations expectations. Then each individual fire company or rescue squad provides their own continuing education training.

Below are the base level industry standards for continuing education:

- Firefighter 240 hours annually (Insurance Service Office)
- 18 multi-company training sessions (Insurance Service Office)
- Emergency Medical Technician 40 hours bi-annually (National Registry of EMT's)
- Paramedic 60 hours bi-annually (National Registry of EMT's)
- Defensive Driving/Apparatus Operator 12 hours annually (best practice/National Fire Protection Association)
- Hazardous Materials 8 hours annually (best practice/National Fire Protection Association)
- OSHA/Mandated Training 8 hours annually (state/federal regulations)

[87] If Rural Stations are staffed 24-7 career personnel the Turnout Time should be equal to the Development area.
[88] If an ALS Chase car is utilized, it will satisfy the response time and capability requirements. However, depending on the staffing configuration, this could require additional personnel.

The continuing education requirements can be onerous and intensive. A coordinated solution from Albemarle County Fire Rescue can provide a consistent level of proficiency across the entire system. This coordination can include the initial competency check off to ensure that everyone within the system is held to the same standards.

Much of the above training could be accomplished by purchasing and implementing an online learning management system (LMS) as a force multiplier. By using online LMS flexibility for the student/staff member is introduced while still assuring the required content is covered. In lieu of an online LMS this training would need to be conducted in a traditional classroom or similar method which would require much more staff to meet the above standards. The other benefit is that the in-person training is used for the hands-on training and more complex training.

The current staff within the training division is focused on initial training for entry-level firefighters and EMS personnel. There is not capacity in the current configuration to provide continuing education to the existing staff throughout the system. An additional 2 full-time instructors would allow the implementation of a coordinated continuing education program across the county to ensure that everyone is kept up to the competencies necessary to provide a seamless response system. These additional instructors would need to be supplemented by additional staff based on the training provided. Some high-risk training sessions need a lower student to instructor ratio to ensure the training is conducted safely and the learning objectives are accomplished. The use of part-time, volunteer and full-time staff on overtime are the most effective means to assist those training division staff during training sessions that require additional instructors. Additionally, this inclusiveness in the training development and delivery will increase buy-in and reinforce the system culture.

As changes to the system are made, an evaluation should be made on the resource needs of the training division. The two most significant factors that affect the training division is the number of personnel that need to maintain competence and secondly the number of personnel hired that need initial training, which is directly tied to the recruitment/retention within the department. As those two factors change the division should be evaluated and resourced appropriately to provide the training necessary. Finally, it is anticipated that there will be a greater demand for training division resources as the support for competency and qualification based staffing requirements are phased in.

Logistics

Currently the Albemarle County Fire Rescue Department provides some logistical support to the fire rescue system throughout the county. For example, the department provides the personal protective equipment to all staff throughout the county. After the initial issue of equipment, it is up to the individual staff member and fire company to bring the equipment to headquarters if it needs to be washed or repaired. There is an opportunity to provide additional logistical support to the entire system. Uniforms, station supplies and personal

protective equipment maintenance are examples of the additional support that the department could provide throughout the county.

The county has seen success with similar implementations with the coordinated vehicle maintenance and the initial issue of personal protective equipment. This proposed coordinated approach could help control costs, provide consistency and reduce the burden on the volunteer and line staff. The approach can also ensure that personal protective equipment is cared for as recommended by the manufacturer and safer for the responders. Currently these processes are handled either individually or by the fire company or rescue squad.

Managing Capital Costs and Fire and Rescue/EMS Collaboration

Volunteer systems, or systems that have a strong origin in volunteerism, typically have robust capital assets. However, as systems begin to transition into combination systems, and in some cases more towards career staffing, the capital needs continue to decline. Albemarle is no exception. It is recommended that ACFR continue to monitor capital asset procurement strategies and attrition equipment in proportion with the services provided.

ACFR is encouraged to explore options that reduce capital expenditures for facilities where possible. Overall, the system works collaboratively with each other; however, there are some exceptions that offer an opportunity for improvement and cost containment. Some reluctance remains in the system to integrate career personnel with volunteer personnel and fire personnel with rescue squad personnel. It is understood that through a variety of lenses there are seemingly compelling reasons to maintain such separation, however, the County is encouraged to a stronger leadership role and find manners and methods to have greater integration.

The following example is not intended as criticism of any one individual or agency, but rather an illustration of the need for greater integration. The County invested significantly in a multi-million dollar remodel for Fire Station 8 and then subsequently built another million-dollar facility on the same property to house the firefighter paramedics on Rescue 8. When reviewing the culture that drives such decisions, it was articulated that there was hesitancy to integrate full-time career firefighters and rescue personnel (R8) with the volunteer firefighting staff in the evenings. However, during the day ACFR full-time career firefighters staff the station when volunteerism is most challenged. There are times, when volunteers are at the station during the day and integrate with the career staff well. In addition, the full time firefighter rescue crews (R8) are certified, trained, qualified, and managed by the same ACFR as the daytime crews.

While it is obvious that culture and identity are important elements that shape decision making, it is recommended that efforts to alleviate concerns and change the culture be expended by all parties. In addition, it is recommended that other strategies be explored that could account for some of the concerns, but reduce capital investment for apparatus

and locations in such close proximity. For example, some agencies have designed split floor plans to separate living spaces. Finally, two distinct locations reduce the efficiency and potential for cross-staffing some of the units that may be enjoyed at other stations where fire and rescue is better integrated.

Evaluation of Recommended Internal Performance Objectives

The previous section demonstrated the agreement between the historical performance data and the GIS modeling with respect to the ability to meet the adopted performance objectives articulated in the Comp Plan. However, it is important to note that the Comp Plan utilizes average performance of both turnout and travel combined and the GIS modeling and national best practices utilize the 90th percentile for drive time only. Therefore, internal performance objectives are offered to identify the most parsimonious station configuration to achieve the quickest response time available. These recommendations continue to partition service areas between the *Development* and *Rural* areas.

6-Minute Travel time for the Development Areas including Charlottesville

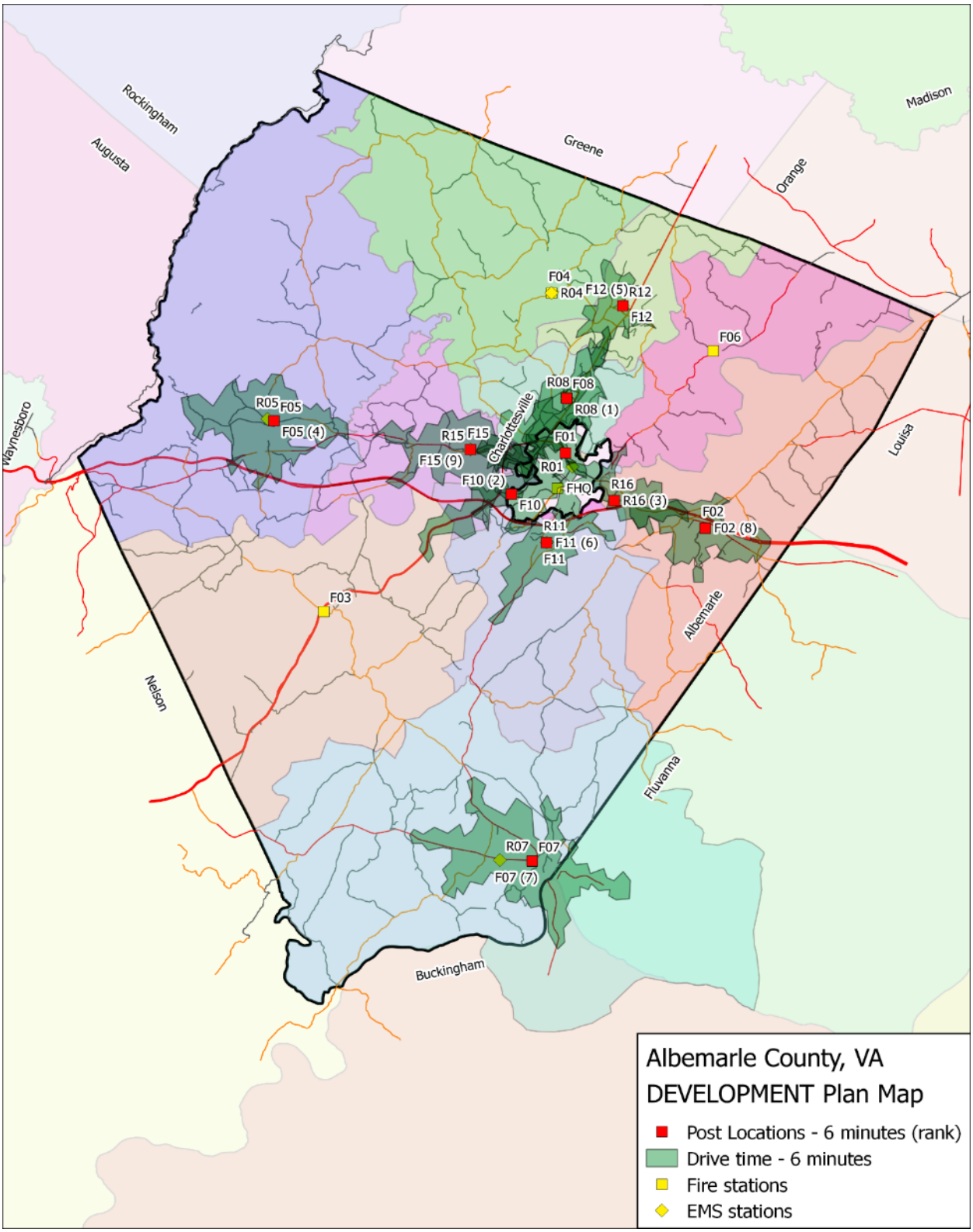
Considering a 6-minute travel time in the *Development* area, the (green) shading indicates the estimated travel time capabilities from the existing road networks. The darker the (green) shading, the more overlap exists between response capabilities within the current configuration. Finally, the number 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, Station 8 contributes the most to the overall success of the system and Station 15 contributes the least. However, as illustrated, eight (8) Albemarle stations and Charlottesville Fire Station 10 would be needed to achieve a six (6) minute response time to 90% of the incidents. Results of this analysis are presented as Table 138 and Figure 93 below.

In both instances, the yellow diamonds and squares that identify existing Fire and Rescue Squad stations, are not needed to achieve the desired response in the development area. However, those existing stations may be necessary for rural coverage and will be discussed as part of the rural coverage analysis.

Table 138: Marginal Fire and EMS Station Contribution ACFR Stations for 6-Minute Travel Time Developed Area

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	F08	3,182	3,182	37.07%
2	F10	1,404	4,586	53.42%
3	R16	1,216	5,802	67.59%
4	F05	838	6,640	77.35%
5	F12	374	7,014	81.71%
6	F11	329	7,343	85.54%
7	F07	196	7,539	87.83%
8	F02	106	7,645	89.06%
9	F15	68	7,713	89.85%
10	F01	44	7,757	90.37%
11	FHQ	27	7,784	90.68%

Figure 93: Drive Time Bleed Maps for 6-Minutes Travel Time in Development Areas from Existing Stations



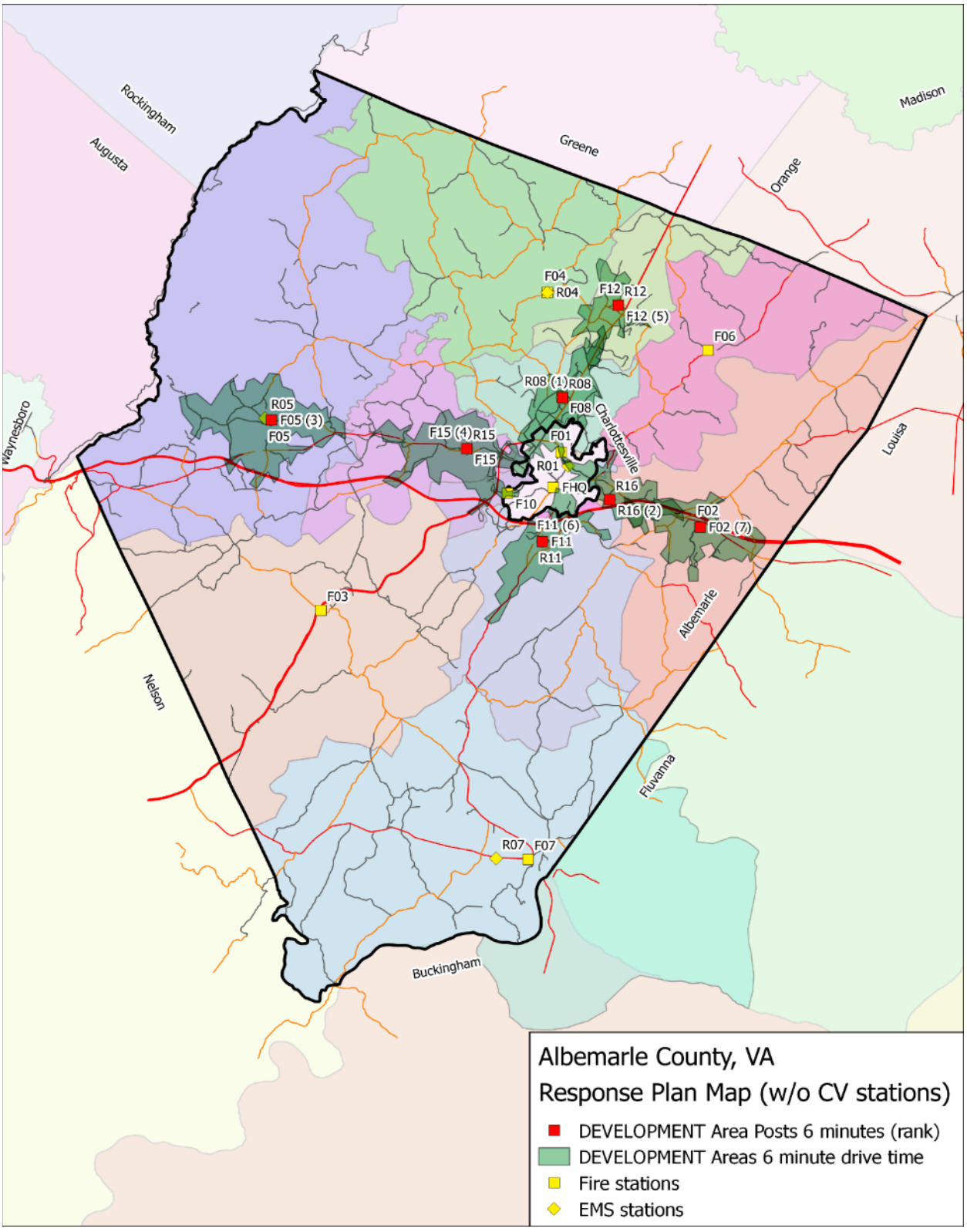
6-MinuteTravel Time in the Development Area only Albemarle County Stations

The 6-minute travel time modeling suggests that a 7-station configuration, without considering the Charlottesville locations, would only achieve a travel time of 6-minutes or less to 79.4% of the incidents in the *Development* area. This scenario would require two less stations than the 6-minute scenario previously presented, however, it would underperform the 90th percentile by approximately 10%.

Table 139: Marginal Fire and EMS Station Contribution ACFR Stations for 6-Minute Travel Time Development Area

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	F08	3,182	3,182	37.94%
2	R16	1,216	4,398	52.43%
3	F05	838	5,236	62.42%
4	F15	615	5,851	69.75%
5	F12	374	6,225	74.21%
6	F11	329	6,554	78.14%
7	F02	106	6,660	79.40%

Figure 94: 6-Minute Travel Time Bleed Map for the Development Areas with Current ACFR Stations Only



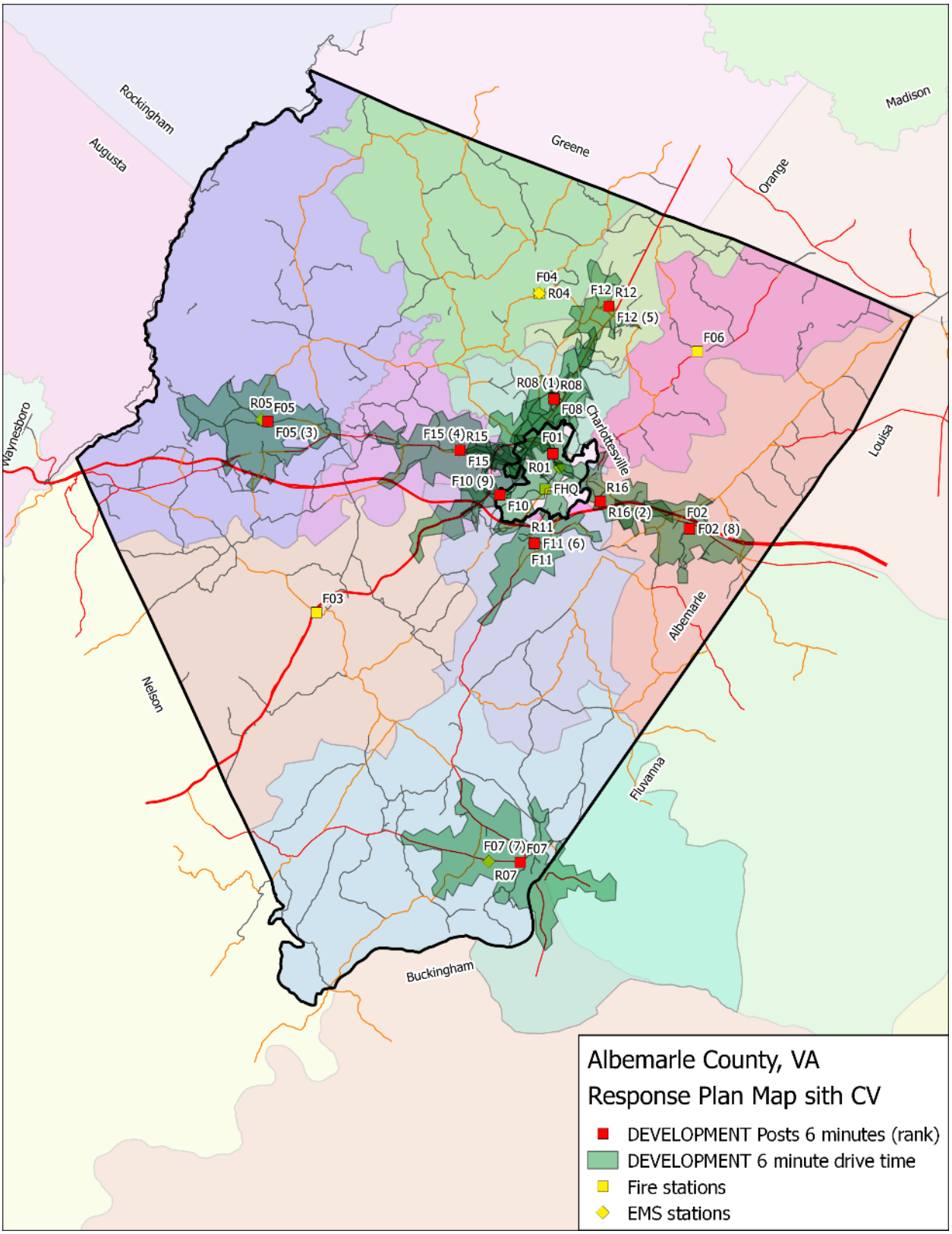
6-MinuteTravel Time in the Development Area with Charlottesville Relief

The 6-minute travel time modeling suggests that a 9 to 10-station configuration, without considering the Charlottesville locations until Albemarle Fire Rescue has exhausted their capability, would achieve a travel time of 6-minutes or less to 90% of the incidents in the *Development* area. This model would achieve the same performance as including Charlottesville in a primary response model, but slightly reduces the anticipated increase in call volume to CFD from 1,404 to 857.

Table 140: Marginal Fire and EMS Station Contribution ACFR Stations for 6-Minute Travel Time Development Area and Charlottesville Fire Stations in Relief

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	F08	3,182	3,182	37.07%
2	R16	1,216	4,398	51.23%
3	F05	838	5,236	61.00%
4	F15	615	5,851	68.16%
5	F12	374	6,225	72.52%
6	F11	329	6,554	76.35%
7	F07	196	6,750	78.63%
8	F02	106	6,856	79.87%
9	F10	857	7,713	89.85%
10	F01	44	7,757	90.37%

Figure 95: 6-Minute Travel Time Bleed Map for the Development Areas with ACFR and CFD in Relief



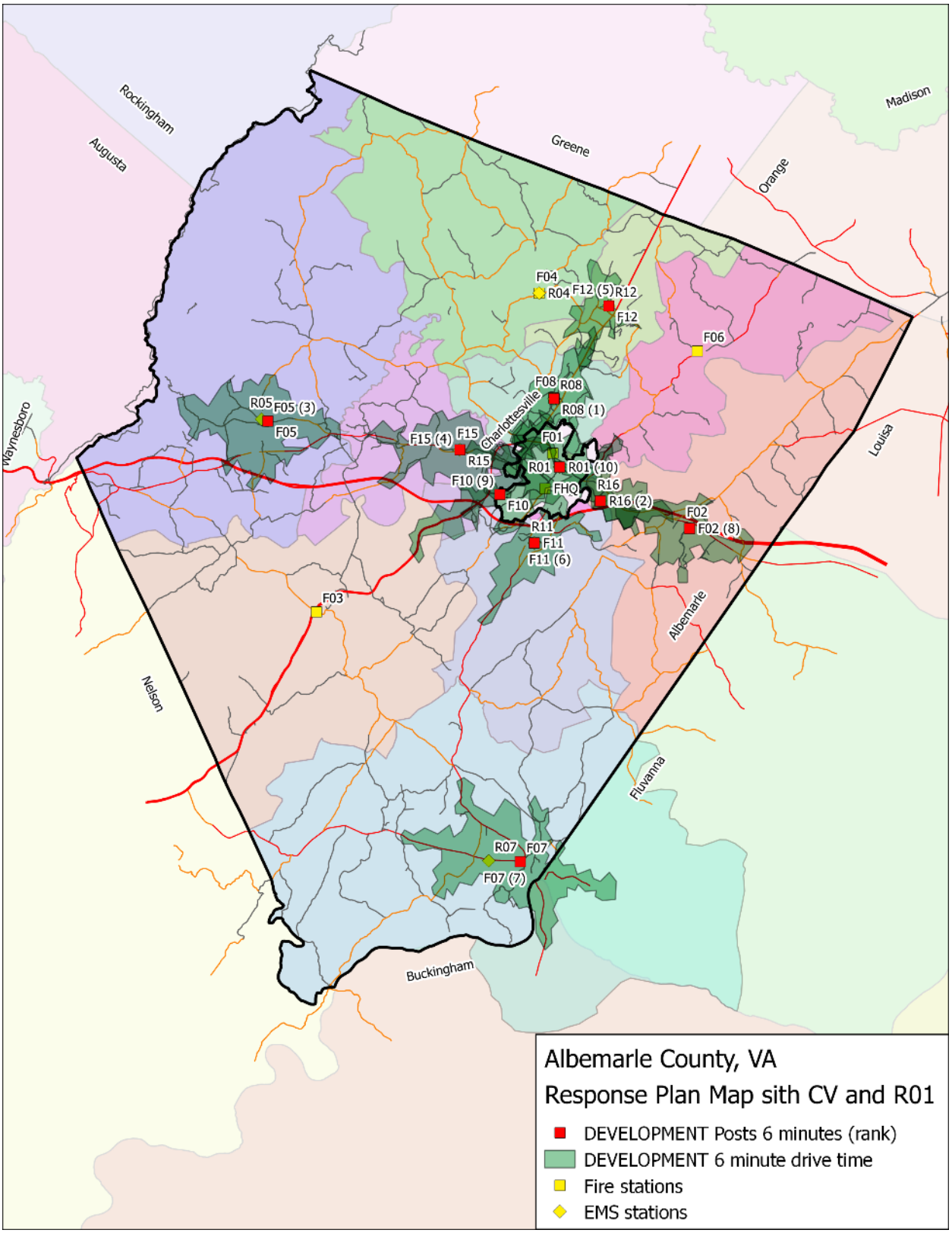
6-MinuteTravel Time in the Development Area with CFD and CARS in Relief

The 6-minute travel time modeling suggests that a 9 to 10-station configuration, without considering the Charlottesville or CARS locations until Albemarle Fire Rescue has exhausted their capability, would achieve a travel time of 6-minutes or less to 90% of the incidents in the *Development* area. This model would achieve the same performance as including Charlottesville in a primary response model, but slightly reduces the anticipated increase in call volume to CFD from 1,404 to 857. The anticipated CARS commitment would only be approximately 2%.

Table 141: Marginal Fire and EMS Station Contribution ACFR Stations for 6-Minute Travel Time Development Area and Charlottesville Fire Stations and CARS in Relief

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	F08	3,182	3,182	37.07%
2	R16	1,216	4,398	51.23%
3	F05	838	5,236	61.00%
4	F15	615	5,851	68.16%
5	F12	374	6,225	72.52%
6	F11	329	6,554	76.35%
7	F07	196	6,750	78.63%
8	F02	106	6,856	79.87%
9	F10	857	7,713	89.85%
10	R01	165	7,878	91.78%

Figure 96: 6-Minute Travel Time Bleed Map for the Development Areas with ACFR and CFD and CARS in Relief



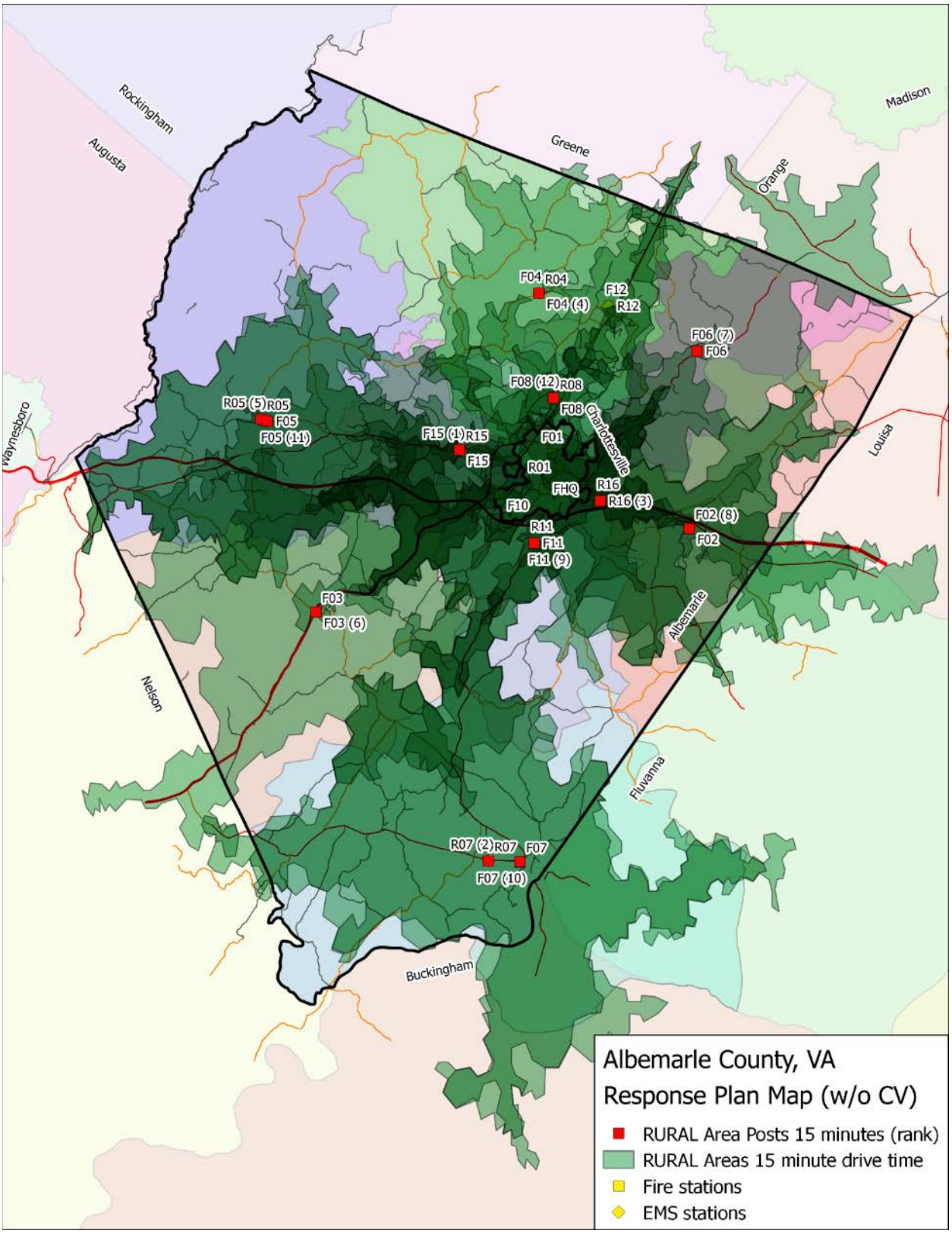
15-Minute Travel time for the Rural Areas

Considering a 15-minute travel time in the *Rural* area, 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 Figure 97, Station 15 contributes the most to the overall success of the system and Station 8 contributes the least. However, as illustrated, nine (9) Albemarle stations would be needed to achieve a 15-minute response time to approximately 90% of the incidents. Results of this analysis are presented as Table 142 and Figure 97 below.

Table 142: Marginal Fire and EMS Station Contribution ACFR Stations for 15-Minute Travel Time Rural Area

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	F15	1,878	1,878	37.15%
2	R07	839	2,717	53.75%
3	R16	489	3,206	63.42%
4	F04	448	3,654	72.28%
5	R05	376	4,030	79.72%
6	F03	259	4,289	84.85%
7	F06	171	4,460	88.23%
8	F02	47	4,507	89.16%
9	F11	26	4,533	89.67%
10	F07	7	4,540	89.81%
11	F05	1	4,541	89.83%
12	F08	1	4,542	89.85%

Figure 97: 15-Minutes Travel Time Bleed Map for Rural Areas from Existing Stations



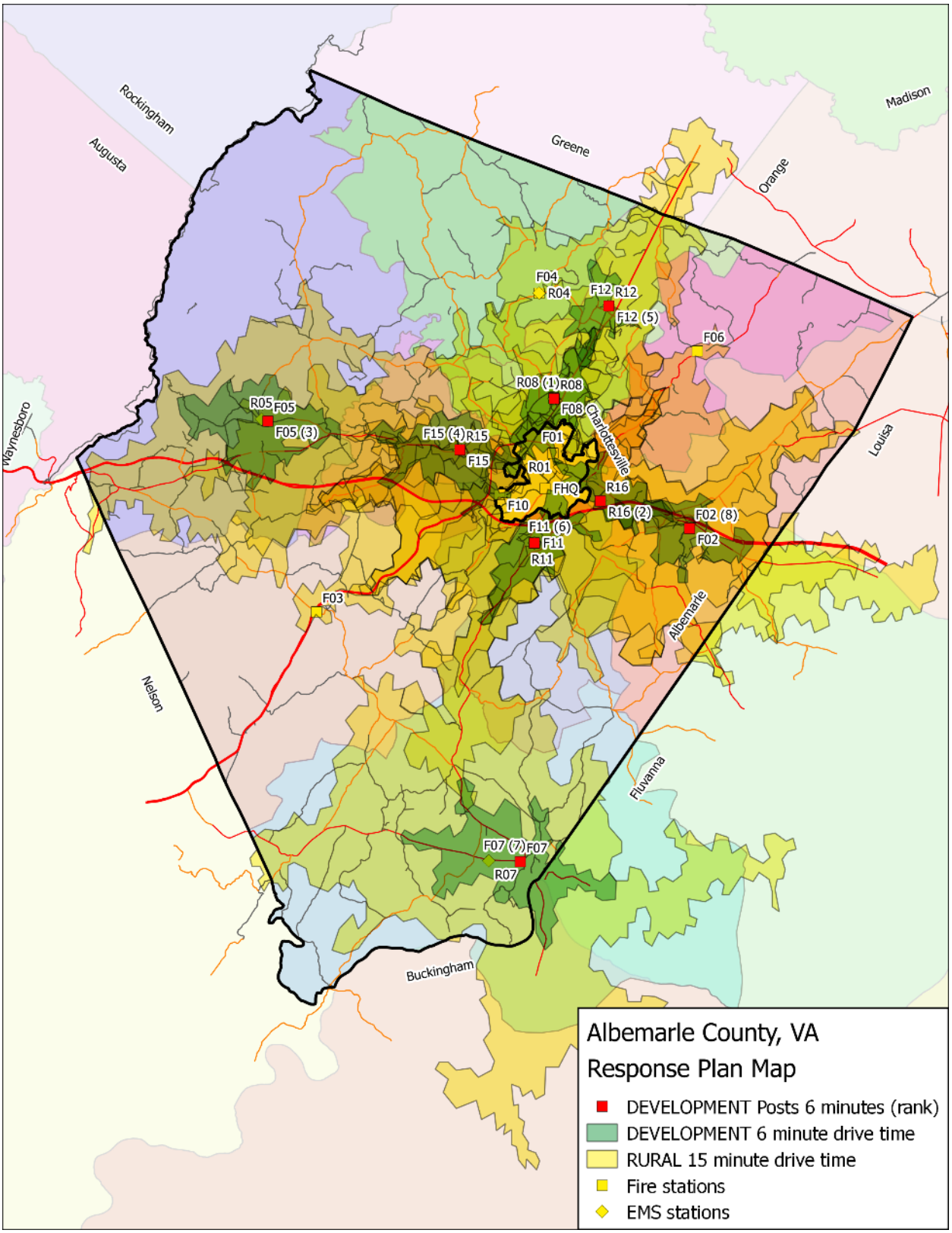
15-Minute Travel Time for the Rural Areas with Only Development Stations and 7

Considering a 15-minute travel time in the *Rural* area, the stations required to meet the *Development* area commitments, can also respond to the adjacent rural areas within a 15-minute travel time. Analyses demonstrate that 65.44% of the *Rural* incidents could be covered exclusively of the *Development* area stations and nearly 80% (79.9%) with the addition of F07/R07. When reviewing the map, all of the areas not shaded represent 20% of the rural incidents.

Table 143: Marginal Fire and EMS Station Contribution Development Area Stations plus F07/R07 for 15-Minute Travel Time Rural Area

Rank	Station Number	Station Capture	Total Capture	Percent Capture
1	F15	1,878	1,878	37.15%
2	F07	817	2,695	53.31%
3	R16	491	3,186	63.03%
4	F05	368	3,554	70.31%
5	F12	359	3,913	77.41%
6	F11	77	3,990	78.93%
7	F02	30	4,020	79.53%
8	F08	19	4,039	79.90%

Figure 98: 15-Minutes Travel Time Bleed Map for Rural Areas from Existing Development Stations and 7



Optimized Station Distribution Plans

6-MinuteTravel Time in the Development Area

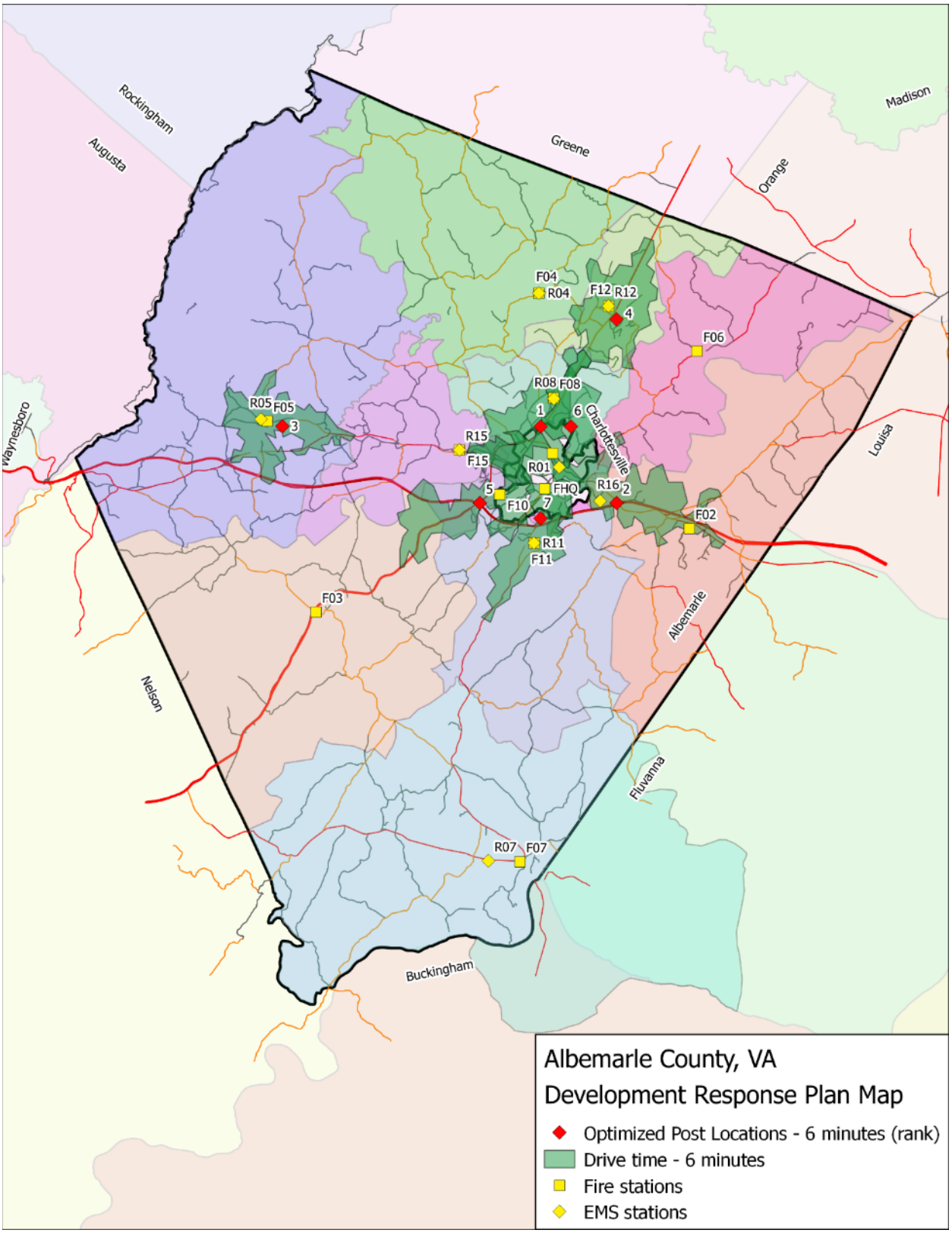
Analyses were completed to develop an optimized station distribution model for a 6-minute *Development* area. This evaluation suggests, that an optimized 7-station model can provide for greater than 90% effectiveness covering all incidents within 6-minutes in the urban areas. A graphic illustration is presented below.

This optimized station model is well aligned with the risk matrices developed by station/district area. For example, the high-risk stations identified are stations F8/R8, F5/R5, and R16. Station 8 is the highest risk area and is the number one station location, Pantops is the second best location, and Crozet is the 3rd best location.

Stations are placed for many different reasons, and not all of them are grounded in operational necessity. Following this analysis, one can reasonably conclude that the only optimized locations that are distinctly different from the current station location plans may be the recommended "Station with the Priority Ranking 5" if the County and City elect not to collaborate for Station 10's location in Charlottesville.

However, since the comp plan designated areas will likely remain stable, when it is time to rebuild a station these locations may deserve appropriate consideration to incrementally improve performance and potentially reduce the capital investment as this model requires two less fixed facilities than the current station locations.

Figure 99: Optimized Station Deployment Plan – 6-Minute Development Area Travel Time



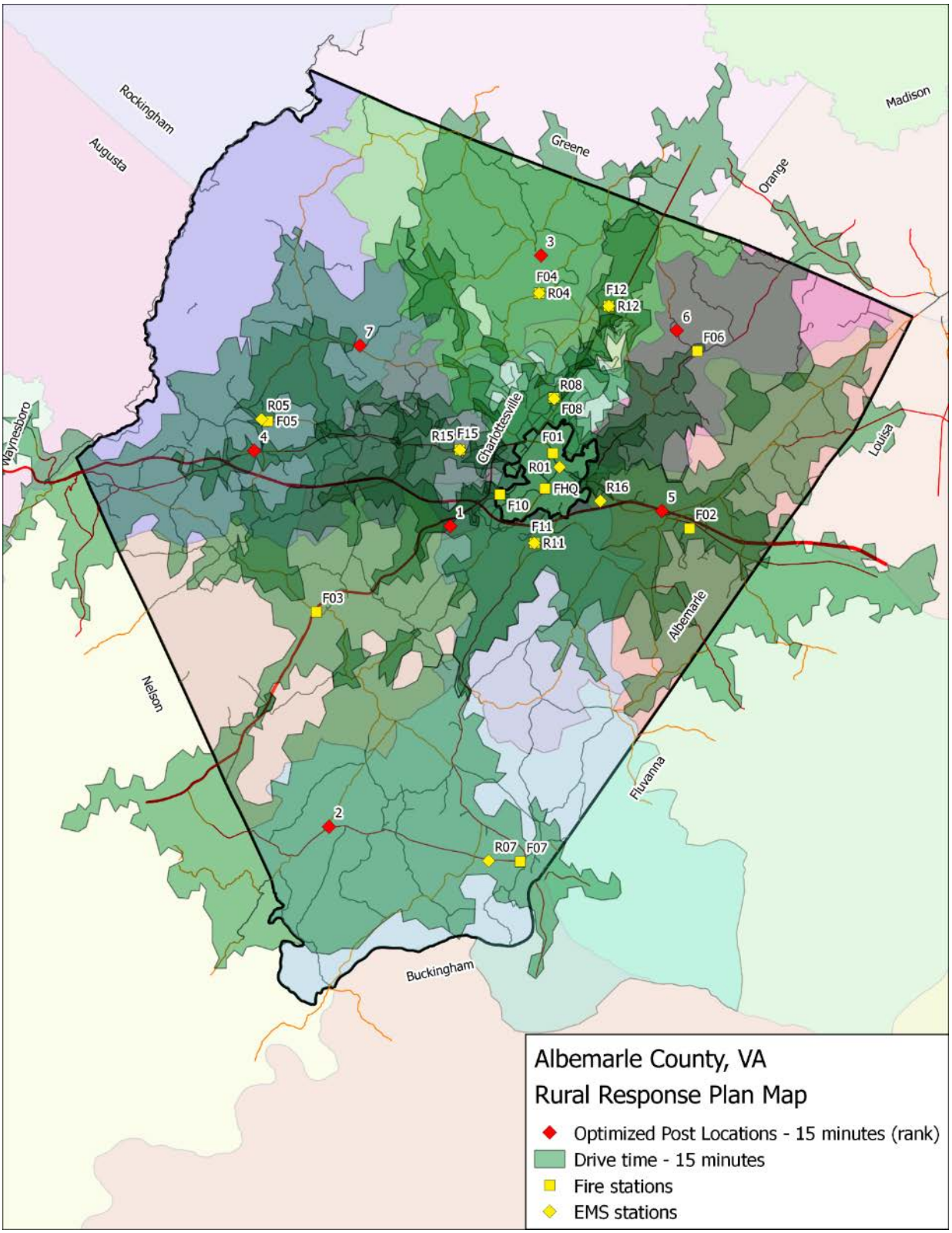
15-Minute Travel Time in the Rural Area

Analyses were completed to develop an optimized station distribution model for a 15-minute travel time in the *Rural* areas. This evaluation suggests, that an optimized 7-station model can provide for greater than 90% effectiveness covering all incidents within 15-minutes or less travel time. In comparison, the current 8-station configuration achieved 15 minutes or less approximately 90% of the time.

When evaluating this model, significant alterations to the rural stations are considered. For example, new stations are contemplated as locations 2 and 7. The new location number 1, is in close proximity to the new location number 5 in the previous analysis of the 6-minute travel time. This indicates that the station location serve both the development and rural areas well from a single location.

A graphic illustration is presented below.

Figure 100: Optimized Station Deployment Plan – 15-Minute Travel Time in the Rural Areas



Alternative Staffing and Deployment Strategies

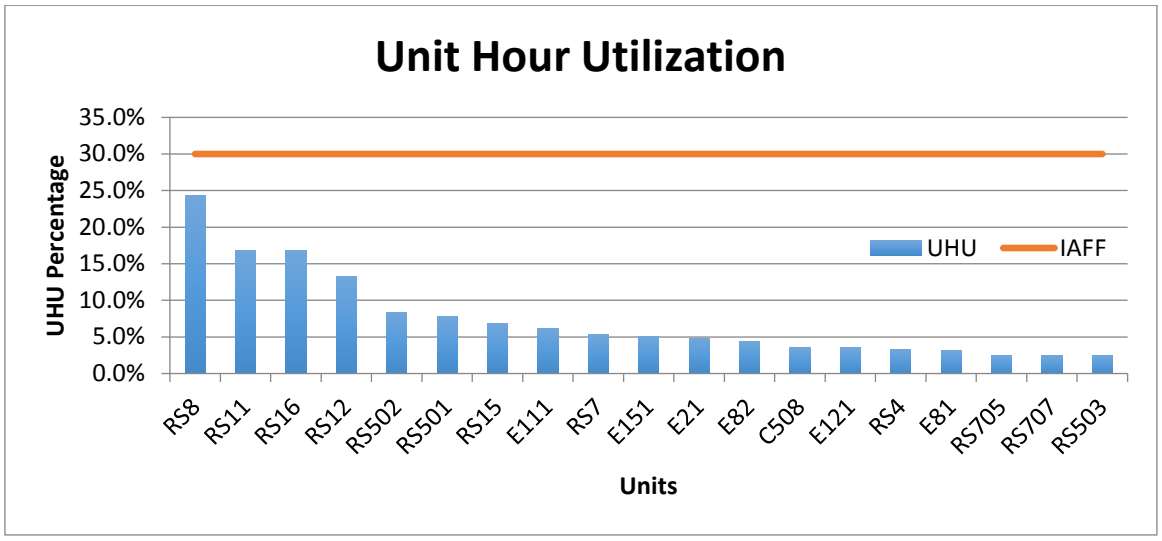
Consideration of Unit Hour Utilization – Workload on EMS Units

While the previous analyses presented the most efficient stations and locations, the analysis didn't specifically contemplate individual unit workload. It is our recommendation that the system perform with a maximum of 0.25 to 0.30 Unit Hour Utilization (UHU) on any 24-hour crew assignments.

Examining the UHU table below, Medic 8 is nearing the recommended 0.25 threshold for 24-hour units. It is recommended that the Department consider alternatives to either redistribute workload, add an additional resource to the district, or alternative schedules to the 24-hour shift.

When considering the risk matrices developed for the ACFR, an additional Medic Unit at Station R8/F8 would be recommended to assist with workload, community demands, call concurrency, and concentration for risk. Therefore, all subsequent alternative staffing and deployment strategies include this recommendation for a second rescue at Fire/EMS area F8/R8.

Table 144: Albemarle County Staffed Unit Hour Utilizations (UHU)



Alternative Staffing and Deployment Plans for Consideration

As the expectations for service, development, and community demands continue to change, the system must continue to adapt. Two alternatives were developed for the County's consideration. It is understood that the Department may have to make changes to the potential alternatives to account for the political, cultural, and fiscal environments.

First, a resource allocation and staffing matrix was developed following the risk-based approach utilized. This matrix only addresses the typical major apparatus in the deployment

plan and is not intended to provide opinion on other equipment such as squads, brush trucks, water rescue equipment, etc. When reviewing station deployment and risk concentration summary, it does not specifically identify whether the units are staffed with career or volunteer personnel, just that they should be staffed for the maximum analyzed outcomes.

Table 145: Station Deployment and Risk Concentration Summary

Station FDZ	Engine	Ladder	Rescue/Medic	Total Risk Score	Station Risk Concentration Identification
F02	1		1[a]	4.90	Low
F03	1		1[a]	3.46	Low
F04	1		1[a]	4.95	Low
F5/R5	1	1	2	66.42	High
F06	1		1[a]	1.22	Low
F7/R7	1		1[a]	32.43	Moderate
F8/R8	1	1	2	81.24	Maximum
F11	1		1 and 1[a]	28.14	Moderate
F12	1		1 and 1[a]	30.41	Moderate
F15	1		1[a]	19.80	Moderate
R16[89]	1[90]		1[a]	45.52	High

Note: a=cross staffed unit

Optimized staffing models were completed to improve or validate ACFR's current staffing strategies. In all cases, the current ACFR staffing strategies were at the most efficient relief factors. First, the department should be complemented on their attention to detail and quality management practices. Second, all alternative models are developed as derivatives of the current staffing plan and assume optimized staffing levels throughout.

Alternative 1 – Fully Staffed Integrated Combination Model

In this alternative, all fire stations are staffed with 3-person 24-hour crews and cross staff an ambulance with the following exceptions. Rescue 5 – continues to operate in the current manner but ACFR will staff a 3-person fire engine and cross staff an ambulance to improve second due and greater performance. Fire Station 8 does not change the current day crew format, but an additional 2 firefighters 24/7 are staffed for the second rescue at R8.

The intended strategy is to ensure baseline services in a highly reliable manner, and integrate fully with the volunteer agencies. In this manner, no reduction in volunteer

[89] R16 (Pantops) risk distribution was based on a 6-minute travel time. All other Stations/Districts utilized the full existing boundaries.
[90] Pantops is expected to increase call volume to over 2,500 calls in the coming years and after system adjustments and will likely require a full time engine and ambulance once the call volume exceeds the threshold.

services is intended or implied. Similarly, in any area where the volunteer agency can continue to meet or exceed the adopted performance measures, should be encouraged to continue to function at that high level and the County would continue to support where possible and reduce the budget burden accordingly.

Table 146: Alternative 1 – Fully Staffed Integrated Combination Model

Station FDZ	Engine	Ladder	Rescue/Medic	Total Day Staffing	Total 24-Hour Staffing
F02	1		1[a]	0	3
F03	1		1[a]	0	3
F04	1		1[a]	0	3
F5/R5	1	1	2[91]	0	3
F06	1		1[a]	0	3
F7/R7	1		1[a]	0	3
F8/R8	1	1	2	3[92]	4
F11	1		1 and 1[a]	0	5
F12	1		1 and 1[a]	0	5
F15	1		1[a]	5	3
R16[93]	1[94]		1[a]	5	3
ACFR BC				0	1
Net Costs	$2,6882,888[95]		Total Personnel	9[96]	39

Note: a=cross staffed unit

Alternative 2 – Differentiated Model based on Population Density and Performance

In this alternative, all fire stations are staffed with 3-person 24-hour crews and cross staff an ambulance with the following exceptions. Following the data, risk, and GIS analyses previously presented, Stations 3, 4, and 6 could function as all volunteer stations. In this manner the 6-day personnel assigned to Station 4 and 6 could be reallocated to other stations. Rescue 5 – continues to operate in the current manner but ACFR will staff a 3-person fire engine and cross staff an ambulance to improve second due and greater performance. Fire Station 8 does not change the current day crew format, but an additional 2 firefighters 24/7 are staffed for the second rescue at R8.

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[91] Intended for R5 to operate as it does today with an integrated cross-staffed ambulance at F5 by ACFR.
[92] Fire Station 8 is intended to function as it does today with ACFR personnel during the day and all volunteer at night.
[93] R16 (Pantops) risk distribution was based on a 6-minute travel time. All other Stations/Districts utilized the full existing boundaries.
[94] Pantops is expected to increase call volume to over 2,500 calls in the coming years and after system adjustments and will likely require a full time engine and ambulance once the call volume exceeds the threshold.
[95] Costs are for illustrative purposes to demonstrate the relative change to the status quo. A flat rate of $38,727 was used for each FTE.
[96] This would be 13-day crew less the 4 positions that are accounted for in the 24-hour shift schedule.

The intended strategy is to ensure baseline services in a highly reliable manner, and integrate fully with the volunteer agencies. In this manner, no reduction in volunteer services is intended or implied. Similarly, in any area where the volunteer agency can continue to meet or exceed the adopted performance measures, should be encouraged to continue to function at that high level and the County would continue to support where possible and reduce the budget burden accordingly.

Table 147: Alternative 2 – Fully Staffed Integrated Combination Model

Station FDZ	Engine	Ladder	Rescue/Medic	Total Day Staffing	Total 24-Hour Staffing
F02	1		1[a]	0	3
F03	1		0	0	0
F04	1		0	0	0
F5/R5	1	1	2[97]	0	3
F06	1		0	0	0
F7/R7	1		1[a]	0	3
F8/R8	1	1	2	3[98]	4
F11	1		1 and 1[a]	0	5
F12	1		1 and 1[a]	0	5
F15	1		1[a]	5	3
R16[99]	1[100]		1[a]	5	3
ACFR BC				0	1
Net Costs	$1,402,077[101]		Total Personnel	9[102]	30

Note: a=cross staffed unit

Long-Term Sustainability of the Models Presented

It is important to understand that the distribution models are restrictive to the geographic limitations of the jurisdiction and the historical demand for services. Therefore, the number of stations is descriptive of the number of fixed facilities required from which to deploy resources. These analyses do not specifically describe the concentration of resources required at each fire and EMS station facility to adequately handle the demand for services. For example, some stations may require two or more units in order to handle the demand for services.

[97] Intended for R5 to operate as it does today with an integrated cross-staffed ambulance at F5 by ACFR.
[98] Fire Station 8 is intended to function as it does today with ACFR personnel during the day and all volunteer at night.
[99] R16 (Pantops) risk distribution was based on a 6-minute travel time. All other Stations/Districts utilized the full existing boundaries.
[100] Pantops is expected to increase call volume to over 2,500 calls in the coming years and after system adjustments and will likely require a full time engine and ambulance once the call volume exceeds the threshold.
[101] Costs are for illustrative purposes to demonstrate the relative change to the status quo. A flat rate of $38,727 was used for each FTE.
[102] This would be 13-day crew less the 4 positions that are accounted for in the 24-hour shift schedule.

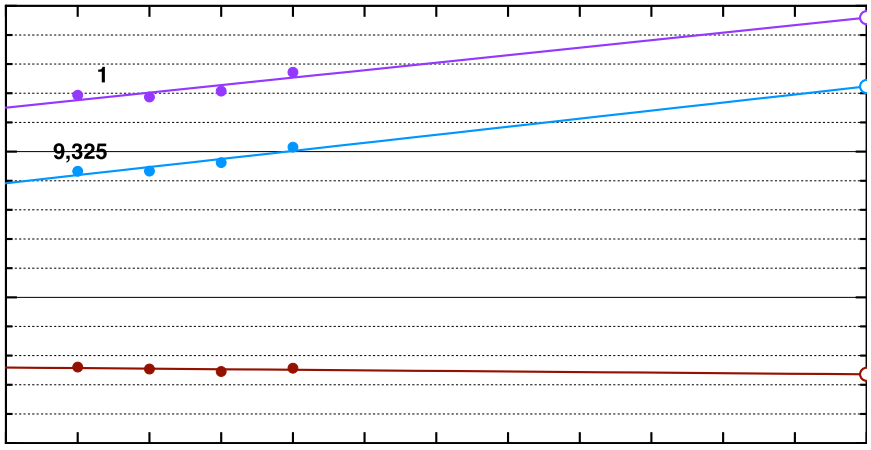
With respect to the long-term sustainability of the deployment models presented here, the models will remain accurate for as long as the jurisdictions' overall coverage area has not expanded. In other words, as the square mileage remains, then the deployment strategy will be sustainable indefinitely with respect to the coverage area. As other variables such as population density or changes in socioeconomic status change over time, there may be a need for a higher concentration of resources necessary to meet the growing demand for services, but not additional stations. The most prominent reason that the geographic distribution model would need to be updated is for changes in traffic impedance that significantly limit the historical average travel speed. Monitoring travel time performance, system reliability, and call concurrency will provide timely feedback for changes in the environment that could impact the distribution model.

Projected Growth

Three years of historical call volume were utilized to identify any general trends in community demands for service. Similar to many communities, the overall call volume is increasing at approximately 2% per year.

Utilizing a forecasting model based on the 2012-2015 call data the Department is predicted to see close to a 3,000-call increase by 2023. This assumes no changes in the current variables. The Department may have to reinvest or reallocate resources to meet the growing demand in the future to meet the future system demand. A graphic representation of the historical and the forecasted growth is provided below. The forecast calls for 1-2% increase in call volume each year moving forward, the demand may outpace the forecast as 2013 had a decrease in call volume that slowed the future forecast. Overall the forecast shows a 21% increase in total calls between 2012 and 2023.

Figure 101: Changes to Incident Counts Projected to CY2023

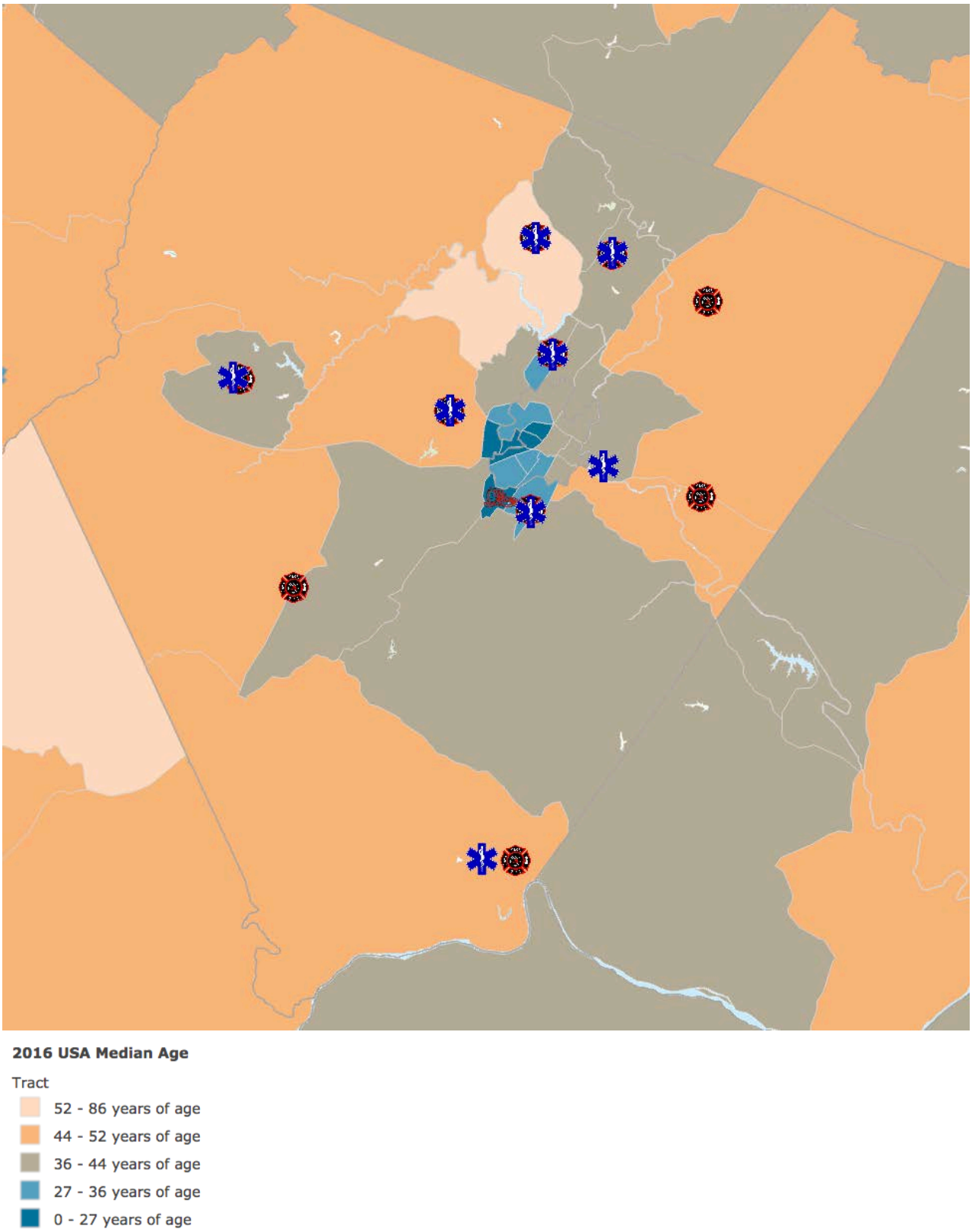


Assuming that future demands may not be reasonably distributed across the various stations in the system, the system will require a redistribution of workload and ultimately reinvestment in resources to meet the growing demand. While the system should be evaluated continuously for performance and desired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

Population Characteristics

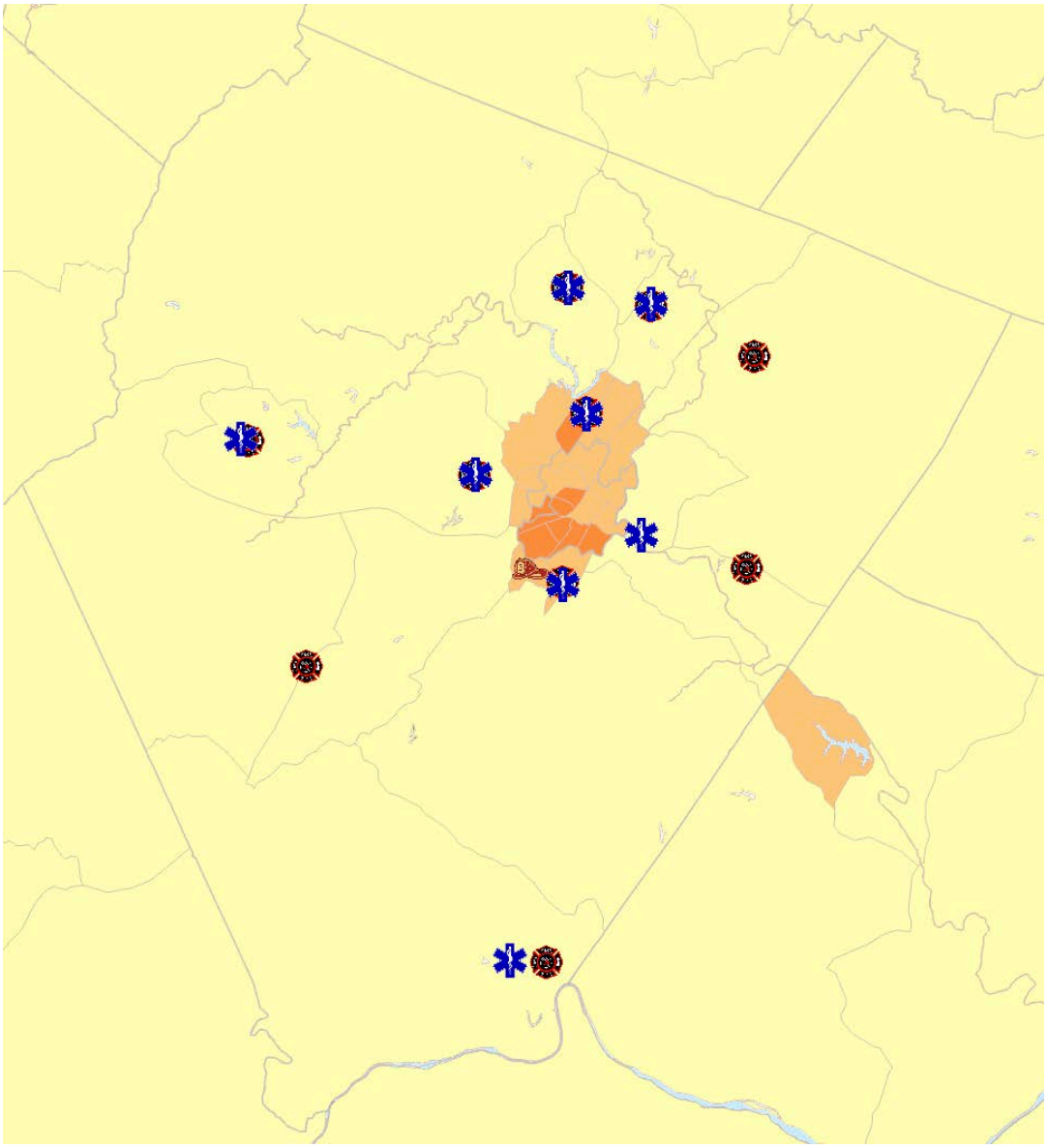
Generally, older populations and very young populations are considered to be most vulnerable to the frequency and incidents of fire. In addition, older populations historically utilize EMS services with greater frequency. It is important to understand, what field crews often recognize intuitively, is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

Figure 102: Median Age - 2016



The population density in the County is largely of a rural density of less than 1,000 people per square mile with some urban/suburban concentrations.

Figure 103: Population Density by Census Block - 2016



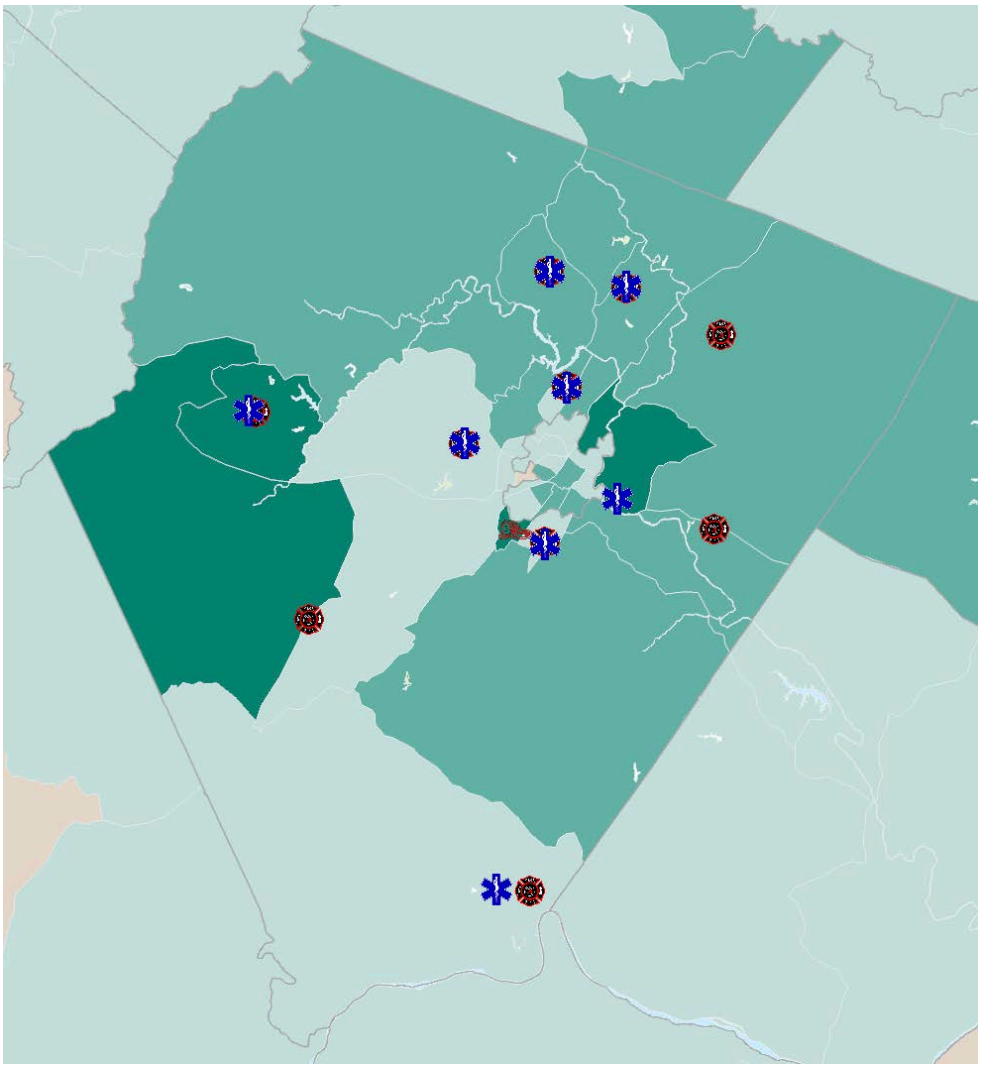
2016 USA Population Density

Tract

- 116,000 - 618,125 people per sq mi
- 22,000 - 116,000 people per sq mi
- 4,000 - 22,000 people per sq mi
- 1,000 - 4,000 people per sq mi
- 0 - 1,000 people per sq mi

Growth is typically not experienced uniformly across large geographic areas. Graphically, projections between 2016 and 2021 anticipate that the population change is increasing with the greatest increases in the western portions of the District and in the general Pantops area. There are little to no reductions in population projected in this data set.

Figure 104: Annual Population Change 2016-2021



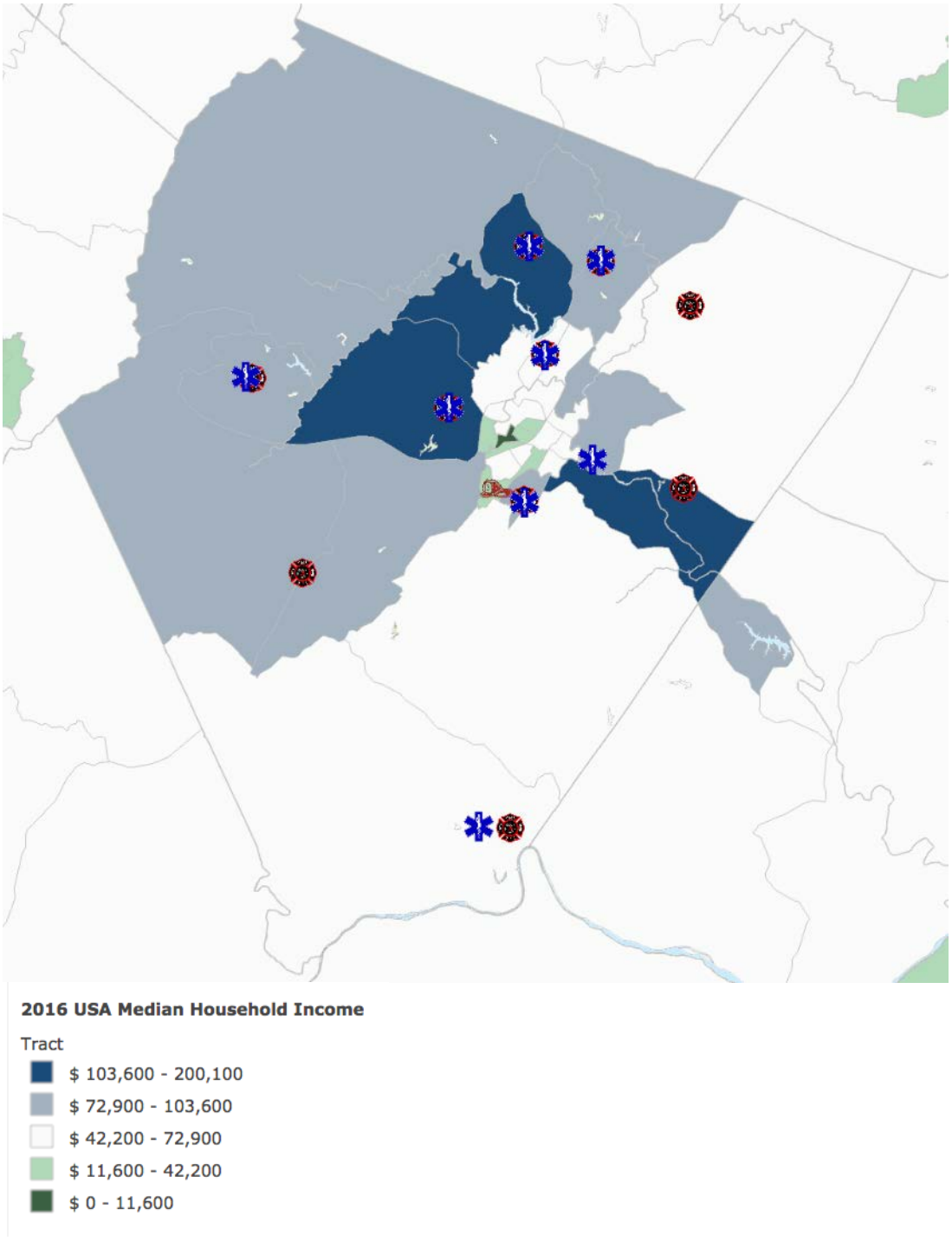
2016-2021 USA Population Growth

Tract

- 1.9 - 54.1 %
- 1.25% to 1.9%
- 0% to 1.25%
- -1.25% to 0%
- -1.9% to -1.25%
- -2.3 to -1.9%

Finally, 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. The national median income is estimated at approximately $54,000.

Figure 105: Median Household Income -2016



Suggested Implementation Process

As the County and the ACFR system contemplates future adaptations, a summary of a generalized implementation process is provided in priority order:

1. Add a second ambulance at R8
2. Meet, confer, and establish a system of performance measures that will either maintain or shape the future service delivery expectations
3. Add an Engine 24/7 at Pantops with capabilities to cross staff the ambulance at non-peak hours.
4. Meet, confer, and establish a phased-in approach of the desired deployment strategy for future planning and budgeting purposes
5. Ensure that the back-office, training, support, and logistics are appropriate to meet the demands of any desired alternatives.

Attachment A

Data Report

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