Report on the Fire Department Resource Allocation Analysis

RALEIGH, NORTH CAROLINA



February 14, 2020

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1 Introduction and Executive Summary

The Matrix Consulting Group was retained by the City of Raleigh to review and examine the personnel resource allocation of the Raleigh Fire Department. This document is the report of the project team's work that includes an analysis of staffing, response capabilities, and operational readiness of the department.

1 Scope of Work

The scope of this study included the assessment of the Fire Department operations, response capabilities, staffing, and other resources necessary for the delivery of services to the City. The scope of this project focused on the following elements:

- Evaluation of current response capabilities in comparison to best practices;
- Evaluation of current station locations and future station considerations;
- Evaluation of apparatus inventory and equipment;
- Evaluation of current service levels and performance;
- Development of appropriate performance objectives and measures;
- Evaluation of the RFD organizational structure, current and projected staffing.

The approaches used in this study were comprehensive as described below.

2 Approaches Utilized in the Study

To understand and evaluate service level issues facing the City, the project team undertook an assessment of the Fire Department. The principal approaches utilized by the project team in this study included, but were not limited to, the following:

- **Internal Interviews** members of the project team individually interviewed numerous executives, management, and supervisory staff of the City of Raleigh and Fire Department leadership.
- **Data Collection** the project team collected a wide variety of external and internal data documenting the structure, operations and organization, including:
 - Department staffing and scheduling
 - Documentation reflecting operations management

- Numerous output data points reflecting services provided
- Various other performance information
- **Reviews** Data was collected over the past several months and presented in interim deliverables. Throughout this process, the project team reviewed facts, findings, and conclusions through these interim deliverables with the Fire Department and the City.

The recommendations arising from this analytical process are summarized in the following section.

3 Summary of Recommendations

The following table provides a summary of recommendations made in this report. The report itself should be reviewed to understand the factual basis behind each recommendation as well as the analysis leading to each recommendation.

JUNIVIENDATIONS
Key Recommendations
ROVEMENTS
Increase the minimum staffing of seven engine companies from three personnel to four personnel to increase the resources necessary for maximum and high-risk structure fire responses. Begin with adding eight (8) FTE Firefighters to increase staffing of engines 1 and 13 in FY 2021. Monitor call demand and response performance annually to determine the need for additional resources.
Authorize three (3) additional FTE Deputy Fire Marshals in field inspections function to conduct follow-up inspections on violations found in existing occupancies. Continue to monitor growth in the City and add additional Deputy Fire Marshal (Inspectors) for each 750 occupancies requiring a mandatory inspection appetructed in the City

Key Findings	Key Recommendations
Plans Examiners are able to effectively handle their workload and meet established timelines for completing plan reviews.	Continue to monitor the growth in the City and an additional plans examination staff when submittals exceed 6,000 annually
Workloads are high for existing field inspectors in New Construction and the Fire Department has no representation on the City's Special Projects	Authorize one (1) additional FTE field inspector position and assign the position to work with the Special Projects Team.
Team.	Continue to monitor the growth in the City and add additional Deputy Fire Marshal (Inspectors) for each 1,250 new construction occupancies requiring an inspection.
The current level of staffing assigned to conduct life safety public education is low to ensure effective targeted messages can be provided to the community	Continue to develop the public safety education programs and increase exposure of fire and life safety programs to identified at risk groups in the City.
	Authorize three (3) FTE Senior Firefighter positions to conduct life safety education programs in the City and assign one to each of the inspection districts.
The Assistant Chief has too many direct reports and the frequent rotation of this position reduces the effectiveness of long-term planning and program implementation in the Division.	Authorize a FTE Division Chief position in the Office of the Fire Marshal.
TRAINING DIVISION	
The Training Division does not have appropriate instructor staffing levels to conduct academy or continuing education programs for fire, EMS and specialty teams.	Authorize seven (7) FTE Instructor positions for the Training Division with a variety of expertise to support all functional areas in the Division and minimize impact on the Operations Division to provide instructors.
There is no dedicated recruitment effort in the Fire Department to ensure a diverse pool of qualified candidates can be recruited to participate in new hire testing opportunities.	Authorize a FTE recruitment specialist for the Training Division that reports to the Academy Captain.
The workload and duties of the Assistant EMS Coordinator are excessive for a part-time position.	Convert the part-time Assistant EMS Coordinator to a full-time position.

SUMMARY OF RECOMMENDATIONS

Kev Findings	Key Becommendations
The Quality Assurance (QA) and Quality Improvement (QI) program does not have dedicated oversight and is performing below industry standards.	Authorize a FTE position focused on QA and QI of EMS services.
OFFICE OF THE FIRE CHIEF	
The Fire Chief has too many direct reports with eight (8) personnel reporting directly to the Chief.	Reassign the Technology and Planning Units to report to the Support Services Division.
The workload demands for the Engineer Planning Officer are too high.	Authorize an analytical position to assist the Engineer Planning Officer in carrying out complex assignments.
The current Safety Officer is focused on administrative functions and general safety initiatives in the Fire Department, but typically is not available to respond to emergency incidents requiring a Safety Officer position.	Authorize three (3) dedicated Safety Officers, one on each shift to respond to calls for service requiring a Safety Officer and investigate workplace accidents or incidents resulting in damage or injury.
SERVICES DIVISION	
Inventory control for supplies, equipment, and small tools can be improved. There is no clerical assistance for the Support Services Division making it difficult to manage the inventory.	Authorize two (2) clerical positions to the Support Services Division, one (1) in FY 2021 and one (1) in FY 2022 to provide clerical support and to assist in the management of inventory items.
Apparatus maintenance and repair services are short personnel based on the amount of apparatus and the repair work that is necessary to maintain an operational fleet.	Authorize two (2) additional mechanics to the Support Services Division to improve the maintenance and repair of apparatus, other motorized equipment and staff vehicles.

SUMMARY OF RECOMMENDATIONS

Projections

The following table provides the results of the detailed analysis of projected staffing needs for each position in the Fire Department through the year 2040.

Division	2020 Authorized	2025	2030	2035	2040
Chief's Office	9	8	10	13	13
Fire Marshal	38	47	48	49	49
Training	10.5	21	23	24	25
Operations	553	568	576	579	579
Services	12	24	25	27	27
Grand Total	622.5	668	682	692	693

2 Community Profile

This chapter provides an overview of the organization, governance, and general characteristics of the City of Raleigh.

1. Introduction

The City of Raleigh is located in the north central part of the State of North Carolina and serves as its Capital and as the county seat for Wake County. The area is served by Interstate 40 connecting to Interstate 440, 495, and 540. The City covers an area of about 142 square miles with an estimated 2018 population of 469,298 residents. Located in the city is North Carolina State University with an enrollment of about 34,000 students. The City is part of the Research Triangle Park that connects Raleigh, Durham and Chapel Hill, along with major universities: Duke University, University of North Carolina, NC State University, Wake Tech, Shaw University, Meredith College, William Peace University, Campbell University.

2. Climate

The climate for the region is described as a humid subtropical climate. Temperature ranges in the summer months are typically in the mid to high 80s and in the winter months the highs are generally in the upper 40s to low 50s. Rain in the area averages about 45 inches per year and snow averages about 7 inches per year. Tropical storms and hurricanes that develop in the Atlantic Ocean can also have an effect on the area depending on where they make landfall and the severity of the storms. The charts below illustrate the average temperature and precipitation for the area.







Average Precipitation

3. Demographic Profile

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American Fact Finder Data	2000	2010	2017
Estimated Raleigh Population	276,093	403,892	449,477
Median Age	30.9	31.9	33.1
Children Under Age 5	6.3%	7.2%	6.2%
Children Ages 5 to 19 years	18.7%	19.6%	19.4%
Persons Age 20 to 59 years	64.0%	61.0%	60.5%
Persons Age 60 and Over	11.0%	12.1%	13.9%
Families in Poverty	7.1%	10.1%	9.6%
Civilian Labor Force Unemployed	3.8%	5.0%	3.6%
Median Household Income	\$46,612	\$52,219	\$61,505
Employment Sectors:			
Education, Health Care, Soc. Svc.	18.8%	21.3%	21.0%
Retail Trade	11.0%	10.8%	10.5%
Professional, Scientific, Mgmt.	15.2%	16.4%	17.9%
Finance, Insurance, Real Estate	7.5%	7.6%	8.4%
Entertainment, Recreation, Food	9.0%	9.6%	10.6%
Construction	6.8%	6.7%	5.7%
Manufacturing	10.1%	7.7%	7.2%
Transportation, Warehousing, Util.	3.7%	3.5%	3.8%
Public Administration	5.8%	5.4%	5.1%
Other Services	4.2%	4.6%	4.5%
Wholesale	3.0%	2.9%	2.4%
Information	4.5%	3.2%	2.7%
Agriculture, Forestry, Fishing	0.4%	0.2%	0.2%

Raleigh Demographics

The population of Raleigh has increased approximately 62.8% since 2000 adding an estimated 173,384 residents. The median age has remained relatively constant with an

average of 33 years of age; however, the number of adults 60 and older has increased by 2.9% since 2000.

The map below illustrates the population density for the City based on the 2010 Census Data.



3 Fire Department Organization

This chapter provides an overview of the fire protection system organization including the structure and staffing of the Fire Department.

1 Organization

The Fire Department is formally established in Division I Article 6 Section 6.24 of the Raleigh Charter and General Ordinances of the City. Additional duties and requirements are found in Part 5, Chapter 2. The following chart is a general functional depiction of the structure of the Raleigh Fire Department.



The mission of the Raleigh Fire Department is to provide unselfish dedicated service. The vision of the department is to anticipate and prepare, while growing and empowering.

2 Office of the Fire Chief

The Chief provides overall direction, guidance and leadership for the Fire Department. The Chief has responsibility for every area of the department and ensures that all employees perform their jobs in accordance with the overall mission of the Department and in accordance with the established values. Reporting directly to the Chief are a Sr. Fiscal Analyst, Technology Supervisor, Planning Officer, Safety Officer and four Assistant Chiefs.

1. Organization

The following chart outlines the organization of the Chief's Office:



2. Staffing and Unit Descriptions

The following table provides the personnel and major tasks of staff assigned to the Chief's Office.

Unit/Division	Curr.	Auth.	Position	Unit Description
Chief	1	1	Chief	 Provides overall direction, guidance and leadership for the Fire Department.
Fiscal	1	1	Senior Fiscal Analyst – Finance Officer	 Fiscal provides accounting and budgeting support across the department.
	1	1	Senior Fiscal Specialist	Coordinates with division heads to plan the annual budget
	1	1	Administrative Technician	 Controls the budget by working with division managers to monitor their expenditures. Prepares departmental agenda items for the City Council. Coordinates updates and revisions to the department's business plan. Reviews and approves department wide expenditures and the procurement card program, in addition to assisting divisions with large procurements and contracts of vehicles and equipment. Manages departmental travel expenses. Oversees grant management and reporting. Assists division in hiring and processing personnel forms for civilian staff.
Technology	1	1	Technology Supervisor	Manages all information
	2	2	Senior Technology Specialist	the Fire Department, its facilities, vehicles, and equipment, including programming support, server and network maintenance, database administration, and software and hardware support.
Planning	1	1	Engineer – Planning Officer	 Prepares and manages the Capital Improvement Plan, including working with City Engineering Services to monitor the progress of capital projects. Prepares and manages vehicle replacement schedule.

Unit/Division	Curr.	Auth.	Position	Unit Description
				 Maintains and updates department wide policies and procedures. Write grants for fire education programs. Assists Fiscal in researching and applying for grants. Coordinates benchmarking data and serves as the liaison to other City departments. Performs research and geospatial analytics for strategic planning and special projects.
Safety	1	1	Battalion Chief – Safety Officer	 Reviews every call being run to assess the appropriateness of equipment and apparatus being dispatched. Responds to and monitors incidents for safety risks. Reviews fire vehicle accidents to identify opportunities to reduce and prevent future accidents. Oversees the department's fitness testing and health and wellness programs. Provides advice to the Chief on opportunities to improve the health and safety of fire personnel.

3 Office of the Fire Marshal

The Office of the Fire Marshal includes fire prevention activities, including: Plan Review, Inspections, Fire Investigations, and Public Education. The Office is led by an Assistant Chief that serves as the Fire Marshal. The Fire Marshal has seven (7) direct reports, including: Fire Investigation Captain, four (4) Assistant Fire Marshals and a Deputy Fire Marshal.

1. Organization

The following chart outlines the organization of the Office the Fire Marshal:



2. Staffing and Unit Descriptions

The following table provides the personnel and major tasks of the Office of the Fire Marshal staff.

Unit/Division	Curr.	Auth.	Position	Unit Description
Administration	1	1	Assistant Chief – Fire Marshal	 Responsible for the overall managerial oversight of the Office of the Fire Marshal. Direct reports are the Assistant Fire Marshals, Public Education Deputy Fire Marshal, Captain of Fire Investigations and Administrative Specialist. Responsible for the budgetary oversight of the Division. Serves on-call status every 4th week for multi-alarm responses and other significant activities such as injuries, hospitalizations, etc. Serves on City committees as needed. Attends Code Council and North Carolina Fire Marshal meetings. Conduct employee evaluations for assigned employees.
Administration	1	1	Captain – Fire Investigator	 Reports to the Assistant Fire Chief Serves as the chief investigator for the Department. Completes a separate evaluation to be added to the employee evaluation completed by their direct supervisor. Conducts peer review on reports. Assists with investigations as needed. Dispatched on all second alarm or higher fires and serves as a back-up investigator based on staffing or technical assistance that may be needed. Provides Quality control for all FireHouse fire reports.
Administration	1	1	Administrative Specialist	 Reports to the Assistant Fire Chief Handles the administrative duties for the Division. Greets the public and answers Division phone calls.

Unit/Division	Curr.	Auth.	Position	Unit Description
Field Inspections	3	3	Asst. Fire Marshal	 Reports to the Assistant Fire Chief. Serve in either the North, West or Southeast District and reports to the Assistant Chief. Supervises the inspectors assigned to their District. Develops inspection schedule for their assigned district. Coordinates Knox Box program. Coordinates the pre-plan program to ensure new construction projects are entered into the system. Creates and update policies for the Division Oversees the private hydrant program. Manages capital assets for the Division. Attends safety compliance meetings. Tracks training and certifications for Fire Marshal personnel. Conducts employee evaluations for assigned employees.
Field Inspections	19	20	Deputy Fire Marshal	 Conducts annual inspections of commercial occupancies according to the established inspection schedule. Conducts additional inspections based on engine company referrals from an emergency response. Each inspector is assigned a specific area of the City Train operations personnel in the functions formerly performed by shift inspectors. Enforces North Carolina Codes and City Ordinances. Conducts employee evaluations for assigned employees.

Unit/Division	Curr.	Auth.	Position	Unit Description
New Construction	1	1	Asst. Fire Marshal- New Construction	 Reports to the Assistant Fire Chief. Supervises the field inspectors for new construction. Answers technical questions from architects, engineers, builders and owners. Approves alternate means of method forms. Attends weekly Development Management Team meetings. Serves as the Fire Department representative on the City Manager EPI committee. Conducts employee evaluations for assigned employees.
New Construction	4	4	Dep. Fire Marshal - Plans Review	 Review site plans, new construction plans and grading plans through the CO process. Ensure plans are reviewed according to established timelines. Coordinate with Field Inspectors to ensure construction projects occur according to the requirements of the plan reviewed.
New Construction	5	5	Dep Fire Marshal – Field Inspections	 Reports to the Assistant Fire Marshal of New Construction. Conducts new construction inspections. Each inspector is assigned an area or specific projects based on expertise. Conducts after-hour inspections as needed. Works with contractors on Code requirements. Ensures proper documentation is uploaded to the compliance engine. Provides assistance to inspectors for existing buildings as needed.

Unit/Division	Curr.	Auth.	Position	Unit Description
Public Education	1	1	Dep. Fire Marshal – Fire Education	 Oversees the Fire Education program and report to the Assistant Fire Chief. Develop community risk reduction strategies. Develop community training plans for line personnel. Responsible for budget and inventory of public education supplies and programs. Plans public education events. Conducts employee evaluations for assigned employees. Organizes and plans Fire Prevention Week activities, the Holiday Express program and other educational events. Develops PSA's with local cable channel.
Public Education	1	1	Senior Firefighter – Public Educator This position is a borrowed position from Operations.	 Works with investigators on causes of fires to develop appropriate public education plans. Follows up tracking efforts to see results of public education programs. Develops training materials. Conducts public education classes and attends community events. Conducts community outreach. Utilizes media to reach public on critical life safety messages. Develops training materials using Target Solutions to ensure a consistent message with Operations personnel.

4 Operations Division

The Operations Division is led by an Assistant Chief who has five (5) direct reports including the Lieutenant Ops Chief Aide, three (3) Division Chiefs and an Administrative Specialist. The Division is responsible for providing emergency response to Fire, Emergency Medical Services, Hazardous Materials incidents, and Urban Search and Rescue (USAR) incidents in the City.

1. Organization

The following chart outlines the organization of the Operations Division:



2. Staffing and Unit Descriptions for the Operations Division

The following table provides the personnel and major tasks of staff for the Operations Division staff.

Unit/Division	Curr.	Auth.	Position	Unit Description
Administration	1	1	Assistant Chief	 Responsible for the overall managerial oversight of the Operations Division personnel. Direct reports are the three Division Chiefs, Lieutenant Ops Aide and Administrative Specialist. Responsible for the budgetary oversight of the Division. Serves on call status every 4th week for multi-alarm response. Serves as Incident Commander on large scale incidents. Ensures appropriate daily staffing of apparatus. Conducts strategic planning for the Operations Division. Authorizes transfers within the Operations Division. Operates the Emergency Operations Center (EOC) during major events. Conducts employee evaluations on assigned personnel. Serves on City committees as needed.
Administration	1	1	Lieutenant Ops Chief Aide	 Reports to the Assistant Chief of Operations. Maintains a tenure list of personnel related to current and former positions. Monitors the current promotional list for upcoming background checks. Assists with selection of assessors for upcoming assessment centers. Maintains Company assignment rosters. Maintains a list of current vacancies. Assists with data entry into the RMS system. Maintains FMLA, Workers Comp and modified duty lists. Develops staffing plan for Bike Team events. Responds with the Assistant Chief on emergency incidents.
Administration	1	1	Administrative Specialist	 Provides human resources and administrative support by: Managing department-wide personnel records.

Unit/Division	Curr.	Auth.	Position	Unit Description
				 Processing personnel forms for employee onboarding, transfers, and termination. Processing payroll and benefits forms. Overseeing the approval of timesheets and payroll. Processing workers compensation and vehicle accident claims.
Operations	3	3	Division Chief	 Reports to the Assistant Chief of Operations. Supervise the assigned Division Chief Aide and shift Battalion Chiefs. Responds to multi-alarm incidents as needed. Serves as Incident Commander as needed. Conducts employee evaluations for assigned employees.
Operations	3	0	Firefighter – Division Chief Aide	 Reports to the Division Chief. Drives the Division Chief to emergency calls Serves as an assistant to the Division Chief on emergency incidents.
Operations	15	15	Battalion Chief	 Manages the Battalion, typically 6 to 9 companies. Schedules personnel for each of the stations in the Battalion. Responds to calls for service and is the Incident Commander.
Operations	117	117	Captain	 Manages the Engine or Ladder Company. Acts as the Battalion Chief when necessary. Responds to calls for service and acts as the Incident Commander in the absence of the Battalion Chief. Conducts employee evaluations for assigned employees.
Operations	129	129	Lieutenant	 Designated driver or operator of the apparatus. Performs routine maintenance checks on the apparatus. Acts as the Captain in the absence of the Captain.

Unit/Division	Curr.	Auth.	Position	Unit Description
Operations	283	286	Firefighter/Firefighter First Class/Senior Firefighter	 Responds to calls for service. Performs routine maintenance checks of the equipment on the apparatus.

5 Services Division

The Services Division is led by an Assistant Chief that has a single direct report, the Division Chief of Services. This Division is responsible for the maintenance and oversight of the Fire Department fleet and facilities.

(1) Organization

The following chart outlines the organization of the Services Division:



(2) Staffing and Unit Descriptions

The following table provides the personnel and major tasks of the Services Division staff.

Unit/Division	Curr.	Auth.	Position	Unit Description
Administration	1	1	Assistant Chief	 Manages the Services Division to include apparatus maintenance, facility maintenance, and supplies.
Administration	1	1	Division Chief	 Assists the Assistant Chief in the management of the Services Division. Manages the garage supervisor. Manages the facility maintenance and repairs. Manages the supplies inventory and purchasing of supplies. Conducts employee evaluations for assigned employees.
Facility Maintenance	1	1	Lieutenant – Facility Manager	 Oversees facility maintenance including structural components and interior components such as appliances. Oversees the exterior maintenance of facilities such as the landscaping.
Facility Maintenance	1	1	Fire Services Assistant	 Maintains inventories of uniforms and small tool supplies. Maintains the personal protective equipment (PPE) rotation and purchases new PPE as scheduled.
Facility Maintenance	1	1	Fire Services Coordinator	 Maintains station supplies and manages vendors to provide supplies to the stations. Handles the supply requests from the stations. Handles small tool maintenance such as Self-Contained Breathing Apparatus (SCBA) testing.
Garage	1	1	Garage Supervisor	 Oversees the apparatus repair and maintenance facility. Maintains the schedule for preventive maintenance of all motorized and non- motorized apparatus and vehicles. Oversees the parts warehouse. Conducts employee evaluations for assigned employees.
Garage	5	5	Fire Equipment Mechanic	 Completes repairs to apparatus. Performs preventive maintenance service as scheduled.

Unit/Division	Curr.	Auth.	Position	Unit Description
Garage	1	1	Inventory Specialist	 Maintains parts inventory for apparatus. Researches and maintains vendor lists. Receives parts and supplies from deliveries. Tracks budget and credit card purchases.

6 Training Division

The Training Division is responsible for training, career development and the coordination of Hazmat, Urban Search and Rescue (USAR), Emergency Medical Services (EMS) and Logistics. The Assistant Chief has two (2) direct reports, including a Division Chief and an Administrative Specialist.

(1) Organization

The following chart outlines the organization of the Training Division:



(2) Staffing and Unit Descriptions

The following table lists the personnel and major tasks of the Training Division staff.

Unit/Division	Curr.	Auth.	Position	Unit Description
Administration	1	1	Assistant Chief	 Responsible for the overall management of the Training Division. Administrative Specialist and Division Chief are direct reports. Responsible for the budgetary oversight of the Division. Serves on call status every 4th week for multi-alarm response. Serves on City committees as needed. Conduct employee evaluations for assigned employees.
Administration	1	1	Administrative Specialist	 Reports to the Assistant Chief, but in practice, works with the Division Chief whose office is in the Training Center. Handles administrative duties for the Division. Greets people entering the training center and answers Division phones. Takes notes at weekly staff meetings. Maintains the budget for the Division. Assists with administrative needs of the various Program Managers. Assists with needs related to hiring and promotional processes. Handles all aspects of the NEO GOV program for Fire related to hiring and promotions.
Administration	1	1	Division Chief	 Reports to the Assistant Chief. Supervises the five Captains and Lieutenant assigned to the Division. Conducts employee evaluations on assigned personnel. Provides direct support to training events and programs as needed. Serves on City committees as needed. Meets with new academy students to welcome and provide guidance. Attends weekly staff meetings downtown. Conducts employee evaluations for assigned employees.

Unit/Division	Curr.	Auth.	Position	Unit Description
Academy	1	1	Captain – Academy Training	 Reports to the Division Chief. Develop the hiring schedule when an academy is approved. Attends or schedules other personnel to attend recruiting events. Ensures website is updated with current recruitment information. Updates candidate selection manual as needed. Organizes communication efforts with City Communications Department. Ensures rooms are reserved for candidate testing. Schedules and conducts PAR sessions. Coordinates hiring process from scheduling interviews to making final job offers and scheduling new employee orientations. Orders needed academy supplies and equipment. Schedules academy classes. Prepares packets for State testing.
Career Development	1	1	Captain – Career Development	 Reports to the Division Chief Oversees the Apparatus Operator Program. Oversees in-service training programs. Assists with selection of promotional supplies. Assists with administering Lieutenant and Captain promotional exams. Coordinates and assists with planning Officer Development Training programs. Maintains and revises the Career Development Manual. Attends promotional ceremonies. Serves as point of contact for Office of the State Fire Marshal (OSFM) audit.

Unit/Division	Curr.	Auth.	Position	Unit Description
Hazmat	1	1	Captain – Hazmat Coordinator	 Reports to the Division Chief Provides managerial oversight of the Department's hazmat program. Manage the City hazmat budget. Manage the NC regional response team program. Manage the NC RRT revolving account for emergency response. Manage hazmat related grants. Prepare bid requests as needed. Ensures appropriate initial and continuing education training for hazmat personnel and operations personnel. Ensure compliance with County and State regulations. Purchase needed supplies and equipment. Attend regional and committee meetings as needed. Serves on State CERT committee.
USAR	1	1	Captain – USAR Coordinator	 Reports to the Division Chief. Manages all aspects of the Urban Search and Rescue (USAR) team. Prepares and manages the USAR budget. Coordinates quarterly team training. Manages the regional task force. Attends quarterly Technical Advisory Group meetings. Purchases and maintains supplies and equipment for the team. Attends annual State USAR conference. Serves as the Task Force Leader in the event of a State activation. Oversees City Technical Rescue and Helicopter Rescue Teams. Schedules the monthly City Technical Rescue Team training events.

Unit/Division	Curr.	Auth.	Position	Unit Description
EMS	1	1	Captain – EMS Coordinator	 Supervises the Deputy EMS Coordinator and Assistant EMS Coordinator. Responsible for medical training and continuing education for the Department. Oversee recertification of EMT's. Maintains certification as a Level II Coordinator from the Office of Emergency Medical Services. Ensures instructors maintain proper certifications. Develops training policies, programs and schedules. Conducts research and development with staff on EMS programs. Serves as a liaison with the local health department. Manages OSHA 1910 pathogen program. Manages FD special response bike team. Manages Department Fitness Program. Conducts employee evaluations for assigned employees.
EMS	1	1	Firefighter – Deputy EMS Coordinator	 Reports to the EMS Coordinator. Assists with the implementation of medical training and continuing education. Assists with EMT recertification efforts. Assists with development of training policies, programs and materials. Assists in instruction at academies. Develops and maintains medical supply budget. Serves as alternate infectious control officer. Serves as liaison with Wake Tech for instructions CISD incident debriefing. Develops training manuals specific to the Department. Maintains compliance for EMT and EMS instructors through Target Solutions. QA and QI on all Code Blue EMS reports.

Unit/Division	Curr.	Auth.	Position	Unit Description
EMS	0.5	0.5	Assistant EMS Coordinator	 Reports to the EMS Coordinator. Part-Time Position. Assists the Deputy EMS Coordinator with the implementation of medical training and continuing education for the Department. Orders and distributes supplies and tracks EMS supply inventory. Assists with distribution of CE supplies. Tracks requests for services.
Logistics	1	1	Lieutenant – Logistics Coordinator	 Reports to the EMS Coordinator Responsible for ensuring facilities and equipment are working properly at the training center. Builds props for training events. Assists with logistics related to academy classes and promotional testing.

7 Physical Resources

Service to the City of Raleigh is provided from twenty-eight fire stations using five battalions. The following map illustrates the locations of the fire stations.



The Fire Department utilizes career personnel for the staffing of the department. As is typical for career departments, each apparatus has a minimum staff in which to operate. Overall, the department operates with a daily minimum staffing of 133 personnel across the 28 fire stations. Stations 6 and 11 are currently being renovated and are not operational. The apparatus and personnel have been temporarily moved to other stations until the renovations are complete. Station 22 is also using a temporary facility as shown on the map. The table below displays the current minimum staffing for each apparatus.

	Battalion 1								
Station	Address	Unit	Minimum Staffing						
19	4209 Spring Forest Road	Battalion 1	1						
		Engine 19	3						
22	10231 Falls of the Neuse Road	Engine 22	3						
	(temporary station)								
25	2740 Wakefield Crossing	Engine 25	3						
	(moved from Station 22)	Ladder 5	4						
		Haz Mat 4	Cross Staffed/Ladder 5						
27	5916 Buffaloe Road	Engine 27	3						
		Haz Mat 5	Cross Staffed/Engine 27						
28	3500 Forestville Road	Engine 28	3						
		Mini 1	Cross Staffed/Engine 28						
		Air 2	Cross Staffed/Engine 28						
		Battalion 2							
Station	Address	Unit	Minimum Staffing						
3	13 South East Street	Engine 3	3						
7	2100 Glascock Street	Squad 7	3						
		Mini 2	Cross Staffed/Squad 7						
	(moved from Station 11)	Engine 11	3						
10	2711 Sanderford Road	Engine 10	3						
12	4306 Poole Road	Battalion 2	1						
		Engine 12	3						
		Ladder 8	4						
21	2651 Southall Road	Engine 21	3						
		Water Rescue	Cross Staffed/Engine 21						
26	3929 Barwell Road	Engine 26	3						
		Battalion 3							
Station	Address	Unit	Minimum Staffing						
1	220 South Dawson Street	Engine 1	3						
		Engine 13	3						
		Ladder 4	4						
2	263 Pecan Street	Engine 2	3						
		Haz Mat 1	Cross Staffed/Engine 2						
5	300 Oberlin Road	Engine 5	3						
	(moved from Station 6)	Engine 6	3						
8	5001 Western Blvd.	Battalion 3	1						
		Haz Mat 3	Cross Staffed/Engine 8						
		Air 1	Cross Staffed/Engine 8						
		Engine 8	3						
14	4220 Lake Boone Trail	Squad 14	3						
		Mini 3	Cross Staffed/Squad 14						
20	1721 Trailwood Drive	Engine 20	3						
		Ladder 7	4						

Raleigh Fire Department Station and Apparatus Staffing

		Battalion 4	
Station	Address	Unit	Minimum Staffing
17	4601 Pleasant Valley Road	Engine 17	3
		Ladder 3	4
18	8200 Morgans Way	Battalion 4	1
		Engine 18	3
23	8312 Pinecrest Road	Engine 23	3
		Ladder 9	4
24	10440 Fossil Creek Court	Engine 24	3
		Ladder 6	4
29	12117 Leesville Road	Engine 29	3
		Haz Mat 4	Cross Staffed/Engine 29
		RRT4	Cross Staffed/Engine 29
		Battalion 5	
Station	Address	Unit	Minimum Staffing
4	121 Northway Court	Engine 4	3
		Ladder 1	4
6	2601 Fairview Road	Engine 6	Temporarily at Station 5
9	4465 Six Forks Road	Battalion 5	1
		Engine 9	3
11	2925 Glenridge Road	Engine 11	Temporarily at Station 7
		Ladder 2	Temporarily at Station 15
15	1815 Spring Forest Road	Engine 15	3
	(Moved from Station 11)	Ladder 2	4
16	5225 Lead Mine Road	Engine 16	3
		Rescue 1	5
		Trench Rescue	Cross Staffed/Rescue 1

8 Historical Workload

The Fire Department responds to emergency and non-emergency calls for service. The following tables illustrate the activities of the Department grouped by the type of call or detail as provided by the Fire Department from their Records Management System (RMS).

Calls for Service by Type											
	2016	2017	2018	Total	Pct.						
Auto Accidents	2 574	2 634	2 576	7 784	6.4%						
Medical Calls	20 229	20,372	22 073	62 674	51.2%						
Total Medical and Auto Accidents	22,803	23.006	24.649	70,458	57.5%						
Alarm – Activation	4,135	4.212	4,723	13.070	10.7%						
Alarm – False	169	169	120	458	0.4%						
Alarm – Malfunction	1,396	1,190	1,356	3,942	3.2%						
Mutual Aid	2	, 1	, 1	4	0.0%						
Other Type Fire	228	213	142	583	0.5%						
Smoke Scare	215	184	194	593	0.5%						
Structure Fire	191	176	222	589	0.5%						
Vegetation/Brush/Debris Fires	545	588	471	1,604	1.3%						
Vehicle Fire	236	209	217	662	0.5%						
Total Fire Calls	7,117	6,942	7,446	21,505	17.6%						
Rescue Calls - Extrication	240	240	254	734	0.6%						
Rescue Calls – Other	1,229	1,244	822	3,295	2.7%						
Rescue Calls – Search	2	0	0	2	0.0%						
Rescue Calls – Water	29	11	17	57	0.0%						
Total Rescue Calls	1,500	1,495	1,093	4,088	3.3%						
Dispatched/Canceled	4,062	4,035	4,121	12,218	10.0%						
Good Intent Calls	695	805	857	2,357	1.9%						
Hazardous Condition	1,459	1,186	1,157	3,802	3.1%						
Hazardous Materials	14	8	13	35	0.0%						
Overpressure Rupture	89	48	55	192	0.2%						
Severe Weather Alerts	48	16	13	77	0.1%						
Service Calls	2,415	2,627	2,714	7,756	6.3%						
Total Other Type of Calls	8,782	8,725	8,930	26,437	21.6%						
Total Calls for Service	40,202	40,168	42,118	122,488							

As shown above, medical calls account for the majority of calls for service at 57% of the call volume. Over the three-year period shown, overall calls for service are trending upwards with rescue calls as the only category that has a downward trend. These trends provide a view to future workloads of the operations division and allows for the projection of calls for service.

The following table displays the total number of calls for service, based on the RMS data handled by the department by each hour and day of the week for the calendar years 2016 through 2018:

Calls for Service by Hour and Weekday (2016 – 2018)											
Hour	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Total			
12 am	690	502	485	454	462	523	621	3,737			
1 am	640	448	386	399	410	427	618	3,328			
2 am	608	375	336	358	351	407	540	2,975			
3 am	499	337	299	330	304	344	433	2,546			
4 am	427	315	293	290	284	317	363	2,289			
5 am	359	353	339	316	316	356	334	2,373			
6 am	396	470	466	470	455	440	402	3,099			
7 am	490	685	668	644	604	627	485	4,203			
8 am	556	797	800	825	808	745	620	5,151			
9 am	680	926	903	871	868	864	743	5,855			
10 am	776	964	992	962	1,004	1,001	810	6,509			
11 am	888	1,064	1,015	990	1,039	1,012	900	6,908			
12 pm	864	1,026	1,045	1,033	976	996	995	6,935			
1 pm	835	1,009	999	990	939	992	914	6,678			
2 pm	838	962	1,003	968	989	950	888	6,598			
3 pm	811	958	909	942	1,019	1,011	919	6,569			
4 pm	784	925	968	934	947	966	870	6,394			
5 pm	885	1,029	1,036	1,011	1,047	1,014	900	6,922			
6 pm	893	1,037	994	957	991	971	1,032	6,875			
7 pm	859	853	902	872	954	941	930	6,311			
8 pm	789	829	804	787	855	892	904	5,860			
9 pm	720	709	706	721	807	853	894	5,410			
10 pm	642	688	642	612	668	748	775	4,775			
11 pm	569	541	572	555	577	692	755	4,261			
Total	16,498	17,802	17,562	17,291	17,674	18,089	17,645	122,561			

The department responded to 122,561 calls for service from 2016 through 2018. The workloads varied by time of day and day of week. Most notably, the call volume was heaviest 9:00 am - 7:00 pm, peaking at the noon hour. This pattern is typical for many fire departments.

Based on the data in the previous table, the following chart further illustrates the calls for service by hour of the day.



Based on the data, the busiest time was noon with 4 am being the least busy time of day. A significant increase in calls is seen during the 7 am hour with the number of calls continuing to steadily rise to the 11 am hour, then plateaus through the 6 pm hour when it begins to drop off.
The following map provides a spatial view of the calls for service for the past three years based on the RMS data.



As shown, there are pockets of call concentrations in various sections of the City, but the downtown area accounts for the heaviest call volumes overall.

4 Emergency Service System Dynamics

In making decisions about the emergency services system, it is important for the leadership of Raleigh to understand the science behind the location of resources, the deployment strategies of those resources, and other parts necessary to form an effective emergency services system. For many years the Insurance Services Office (ISO) had set the standard for deployment through their Public Protection Classification system. This system was designed to provide insurers a basis for setting insurance rates and to limit their exposure to large losses and catastrophic events. While these efforts provided a good starting point, there is much more for the leadership to know while making decisions about the emergency services in Raleigh.

Nationally, the National Fire Protection Association (NFPA), Commission for Public Safety Excellence (CPSE), American Heart Association (AHA), United States Fire Administration (USFA), Underwriters Laboratories (UL), Factory Mutual (FM), National Institutes of Standards and Technology (NIST), and Insurance Services Office (ISO) have put considerable effort into data collection, analysis, and the eventual development of performance objectives for the delivery of fire and emergency medical services. This effort is critical for local governments making decisions about deployment and location of emergency resources. The objectives promoted for Fire/Rescue and EMS providers have their basis derived from research that has been conducted in these two critical issues:

- What is the key point in a fire's "life" for gaining control of the blaze while minimizing the impact on the structure of origin and on those structures around it?
- What is the impact of the passage of time on survivability for victims of cardiac arrest?

The next sections explain the decision points for these factors. It begins with the analysis, followed by how the Raleigh Fire Department compares to the standards

1 Emergency Medical Services

Delivery of emergency medical services is a function of the emergency services system to be considered. Emergency medical calls are rising in Raleigh, and the types of calls are wide ranging. However, as a part of a community's healthcare system, one of the primary factors in the design of the emergency medical response is the ability to deliver basic CPR and defibrillation to victims of cardiac arrest. The graph below demonstrates the survivability of cardiac patients as related to time from onset:



This graph illustrates that the chances of survival of sudden cardiac arrest diminish approximately 10% for each minute that passes before the initiation of CPR and/or defibrillation. These dynamics are the result of extensive studies of the survivability of patients suffering from cardiac arrest. While the demand for services in EMS is wide ranging, the survival rates for full arrests are often utilized as benchmarks for response time standards as they are more readily evaluated because of the ease in defining patient outcomes (a patient either survives or does not). This research results in the recommended objective of provision of basic life support (BLS) within 4-minutes of notification and the provision of advanced life support (ALS) within 8 minutes of notification.

Considering the response time continuum, the response time goal for emergency services is to provide BLS within 6 minutes of the onset of the incident (including detection, dispatch and travel time) and ALS within 10 minutes. This is often used as the foundation for a two-tier system where fire resources function as first responders with additional (ALS) assistance provided by responding ambulance units and personnel.

Additionally, recent research is beginning to show the impact and efficacy of rapid deployment of automatic defibrillators to cardiac arrests. This research – conducted in King County (WA), Houston (TX) and as part of the OPALS study in Ontario, Canada – shows that the AED can be the largest single contributor to the successful outcome of a cardiac arrest – particularly when accompanied by early delivery of CPR. It is also important to note that these medical research efforts have been focused on a small fraction of the emergency responses handled by typical EMS systems – non-cardiac events make up the large majority of EMS and total system responses and this research

does not attempt to address the need for such rapid (and expensive) intervention on these events.

2 Fire Suppression Services

The chart that follows, shows a typical "flashover" curve for interior structure fires based on data from NFPA, ISO, and the NIST. The point in time represented by the occurrence of "flashover" is critical because it defines when all the contents of a room become involved in the fire. This is also the point at which a fire typically shifts from "room and contents" to a "structure" fire – involving a wider area of the building and posing a potential risk to the structures surrounding the original location of the fire.



Note that this illustration depicts a fire from the moment of inception – not from the moment that a fire is detected or reported. This demonstrates the importance of early detection and fast reporting as well as rapid dispatch of responding units. This also shows the critical need for a rapid (and sufficiently staffed) initial response – by quickly initiating the attack on a fire, "flashover" can be averted. The points below describe the major changes that occur at a fire when "flashover" occurs:

• It is the end of time for effective search and rescue in a room involved in the fire.

It means the likely death of any person trapped in the room – either civilian or firefighter.

- After this point in a fire is reached, portable extinguishers can no longer have a successful impact on controlling the blaze. Only larger diameter fire hoses will have enough water supply to affect a fire after this point.
- The fire has reached the end of the "growth" phase and has entered the fully developed phase. During this phase, every combustible object is subject to the full impact of the fire.
- This also signals the changeover from "contents" to "structure" fire. This is also the beginning of collapse danger for the structure. Structural collapse begins to become a major risk at this point and reaches the highest point during the decay stage of the fire (after the fire has been extinguished).

It should be noted that not every fire will reach flashover – and that not every fire will "wait" for the 8-minute mark to reach flashover. A quickly responding fire crew can do things to prevent or delay the occurrence of flashover. These options include:

- Use of a master stream device, using a handline through a window, or other "fast attack" methodology.
- Ventilating the room to allow hot gases to escape before they can cause the ignition of other materials in the room.
- Not ventilating a room under some circumstances this will stifle a fire and prevent flashover from occurring.

Each of these techniques requires the rapid response of appropriately trained fire suppression resources that can safely initiate these actions. In the absence of automatic fire suppression systems, access to interior fires can again be limited by a safety requirement related to staffing levels. OSHA and related industry standards require the presence of at least 2-firefighters on the exterior of a building before entry can be made to a structure in which the environment has been contaminated by a fire, unless there is an immediate threat to life. Staffing levels also impact property damage, loss of business, and other economic impacts such as utilities, sales and income tax, and property taxes.

The results of the research efforts previously noted have been utilized by communities and first responders, often on their own with no single reference, to develop local response time and other performance objectives. However, there are four major sources of information to which responders and local policymakers can refer when determining the most appropriate response objectives for their community:

- The Insurance Services Office (ISO) provides basic information regarding distances between fire stations. However, this "objective" does little to recognize the unique nature of every community's road network, population, calls for service, call density, etc.
- The National Fire Protection Association (NFPA) promulgated a document entitled: "NFPA 1710: Objective for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments." This document (NFPA 1710) was published in 2001 and generated a great deal of dialogue and debate – which is still ongoing.
- The Commission on Fire Accreditation International (CFAI) in its "Objectives of Coverage" manual, places the responsibility for identifying "appropriate" response objectives on the locality. These objectives should be developed following a comprehensive exercise in which the risks and hazards in the community are compared to the likelihood of their occurrence.
- The American Heart Association (AHA) provides information on the response to cardiac events, the preferred methods of treatment, and the timing of the delivery of the medical care and treatment.

The next section examines the issue of response times.

3 Response Time

Response time to an emergency or call for assistance has been broken down into measurable and non-measurable segments. The response time continuum begins when the state of normalcy changes to a recognizable emergency. The following chart outlines the cascade of events that occurs once an emergency starts or is recognized. Those highlighted points represent hard data or that which is quantitative versus soft data or that which is subjective and unknown.



The highlighted points in the chart above represent three segments that can be used for evaluation; call processing, turnout time, and travel time. Each of these components represent a different point in the response time continuum and through their measurement and evaluation, areas for improvement can be identified. Below are the definitions for the three components:

- Call Processing is the defined as beginning when the call taker answers the call and ends with the dispatching of appropriate emergency services.
- Turnout Time is defined as beginning when the emergency service receives the call and is on the apparatus responding (wheels rolling) to the call.
- Travel Time is defined as beginning when the apparatus and personnel begin the response (wheels rolling) and ends once on location of the emergency (wheels stopped).

The National Fire Protections Association (NFPA), Center for Public Safety Excellence (CPSE), and the Insurance Services Office (ISO) offered reference points for communities to follow relative to fire service responses; however, only NFPA 1710 offers any specificity. It is important to note that the performance objectives (in terms of response times) provided in the NFPA 1710 document are derived from the basic research previously described. These include the following (all are taken from section

4.1.2.1 of NFPA 1710):

- One minute four seconds (64 seconds) for the processing of an incoming emergency phone call, including the completion of the dispatching of fire response units.
- "One minute twenty seconds (80 seconds) for turnout time for fire related incidents." This is also called reflex time, reaction time, "out-the-chute" time, etc. This is the time that elapses between dispatch and when the units are actively responding.
- "One minute (60 seconds) for turnout time for emergency medical incidents." This is also called reflex time, reaction time, "out-the-chute" time, etc. This is the time that elapses between dispatch and when the units are actively responding to an emergency medical incident.
- "Four minutes (240 seconds) or less for the arrival of the first arriving engine company at a fire suppression incident and/or 8 minutes (480 seconds) or less for the deployment of a full first-alarm assignment at a fire suppression incident."
- "Four minutes (240 seconds) or less for the arrival of a unit with first responder or higher-level capability at an emergency medical incident."
- "Eight minutes (480 seconds) or less for the deployment of a full first-alarm assignment at a fire suppression incident."
- In section 4.1.2.4, NFPA 1710 goes on to state: "The fire department shall establish a performance objective of not less than 90 percent for the achievement of each response time objective specified in 4.1.2.1"
- The American Heart Association (AHA) does not promulgate or identify performance objectives; it does however, provide the background information and motivation for the responses to cardiac arrest and other health related issues.

It is also critical to note that these time objectives apply to emergency calls for service – there is nothing in the NFPA documents (nor in any other objective) that suggests that communities cannot establish a differential response to calls for service determined to be non-emergency in nature. In the response timetables included below, non-emergency responses were removed; only emergency responses are included.

The expression of response time has changed. In years past the measurement was

expressed as an average of time. This essentially represents how the system or department is performing 50% of the time and is not a true reflection of how a department is performing. With the research that has been performed in developing performance standards and practices, the use of fractal time has become the best practice in the measurement and presentation of response time components. Fractal response time measures how often (as a percent of calls) a department can perform within each response time component. The NFPA and CPSE use the 90th percentile as the standard to meet for benchmark and baseline criteria.

Previously the Center for Public Safety Excellence had defined benchmark and baseline response times for each of the three components. They have since determined they are not a standard making organization and decided to leave the establishment of response time standards to others. However, their body of work is significant and has been used by numerous communities across the country to assist with determining what baseline services should be for a community.

The definitions for the criteria of each service area are defined in the table below. CPSE also gives a community a range of acceptable performance standards from "Baseline", minimally accepted performance or to "Benchmark", fully compliant with best practices. CPSE had previously set the following performance standards for urban, suburban and rural areas:

	1 st Unit	2 nd Unit	1 st Alarm Balance	Performance				
Benchmark	4 minutes	8 minutes	8 minutes	90%				
Bacalina	5 minutes/12	10 minutes 24	10 minutes/24	0.0%				
Daseillie	seconds	seconds	seconds	90 /0				
Suburb	an: Population dens	ity between 500 and	d 1,000 per square n	nile				
Benchmark	5 minutes	8 minutes	10 minutes	90%				
Pacalina	6 minutes/30	10 minutes/24	12 minutoo	0.0%				
Daseillie	seconds	seconds	13 minutes	90%				
Rural: Population density of less than 500 per square mile								
Benchmark	10 minutes	14 minutes	14 minutes	90%				
Baseline	12 minutos	18 minutes/12	18 minutes/12	0.0%				
	13 minutes	seconds	seconds	50%				

Service Area/Population Density Response Travel Time Standards Urban: Population density of over 1,000 per square mile

4 Effective Response Force

There are several tasks, which must occur simultaneously, to adequately combat different types of fires. The absence of adequate personnel to perform these tasks requires each task to be prioritized and completed in chronological order. These fire ground tasks

include command, scene safety, search and rescue, water supply, fire attack, pump operations, ventilation, back up, and rapid intervention.

An initial full alarm assignment should be able to provide personnel to accomplish the following tasks:

- Establish incident command outside of the hazard area. This will allow coordination and direction of the incoming emergency response personnel and apparatus. A minimum of one person should be dedicated to this task.
- Establish an uninterrupted water supply of at least 400 gallons per minute for 30 minutes. Once established the supply line can be maintained by the pump operator to ensure uninterrupted water supply. A minimum of one person is assigned to this task that can then assume support role.
- Establish an effective water flow rate of 300 gallons per minute. This will be supplied to a minimum of two hand lines each operating at a minimum flow of 100 gallons per minute. Each hand line must have two individuals assigned with one serving as the attack line and the other as a back-up line.
- Provision of one support person to handle the hydrant hookup, utility control, forcible entry, and assist in deploying fire hose lines.
- Establish a search and rescue team. Each team will consist of a minimum of two.
- Establish a ventilation team. Each team will consist of a minimum of two personnel.
- Establish an initial rapid intervention team (RIT). Each RIT team shall consist of a minimum of two properly trained and equipped personnel.

Critical tasking will vary depending on the size and nature of the incident. The Center for Public Safety Excellence (CPSE) provides a suggestive list of tasks that need to be completed at a fire situation based on the risk. A similar list is provided within the NFPA 1710 document. The CPSE analysis, from the 8th edition, is summarized in the table below showing the minimum required personnel to mitigate the initial emergency response requirements by occupancy risk:

Critical Task	Maximum Risk	High Risk	Moderate Risk	Low Risk
Attack Line	4	4	4	2
Search and Rescue	4	2	2	0
Ventilation	4	2	2	0
Backup Line	2	2	2	2
Rapid Intervention	2	2	0	0
Pump Operator	1	1	1	1
Water Supply	1*	1*	1*	1*
Support (Utilities)	1*	1*	1*	1*
Command	1	1	1	1
Safety Officer	1	1	1	1
Salvage/Overhaul	2	0	0**	0
Command Aid	1	1	0	0
Operations Chief	1	1	0	0
Logistics	1	0	0	0
Planning	1	0	0	0
Staging Officer	1	1	0	0
Rehabilitation	1	1	0	0
Division Supervisors	2	1	0	0
High-rise Evacuation	10	0	0	0
Stairwell Support	10	0	0	0
Total Personnel	50-51	21-22	14-15	8-9

Critical Tasks for the Effective and Efficient Control of Structural Fires (CPSE)

*Tasks can be performed by the same individual **Task can be performed by the attack crew

It is interesting to note that the four-person companies discussed in some areas of NFPA 1710 are not maintained in the description of primary tasks to be accomplished on the fire ground - recognition that the requirements of the response in the field are dynamic and do not fit neatly into size and shape of any particular response configuration. These objectives apply to the initial and follow-up response for reported structure fires. The document does not suggest that this response be mounted for all incidents.

It is incumbent upon the fire department to have a response plan in place to ensure enough personnel are on scene to accomplish the stated critical tasks in a timely fashion. Structure fires are very labor-intensive incidents with any number of factors, such as weather, making the task that much more difficult.

Adding to the critical tasks and staffing issues is the OSHA requirement of two in – two out in 1910.134(g)(4). This regulation states that if entry into an Immediately Dangerous to Life and Health (IDLH) atmosphere is necessary, two firefighters must enter together and remain in contact with each other. In addition, there must be two firefighters located outside the IDLH atmosphere for potential rescue if needed. This is a mandatory requirement.

The concept of an effective response force carries through for other responses by the fire department. A task analysis for emergency medical calls analyzes three different types of calls or patient conditions. These three types of calls usually require the most effort on the part of the response team. Other calls or patient types can generally be handled with two or three personnel. Many times, especially in trauma calls, there are multiple patients. The table below outlines the tasks for handling these critical patients and the number of responders it may require for a successful outcome. It is important to note that some tasks are accomplished by the same personnel, so the total is not simple addition of the positions noted.

Critical Task	Cardiac Arrest	Stroke	Multi-System Trauma
Patient Assessment	2 per patient	2 per patient	2 per patient
Airway Management/Intubation	2 per patient	2 per patient	2 per patient
Cardiac Defibrillation	1	N/A	N/A
CPR	1	N/A	N/A
EKG Monitoring	1	1	1
IV/Pharmacology	1	1	1
Splint/Bandage/Immobilization	N/A	N/A	1
Patient Lifting/Packaging	2-4	2-4	2-4
Medical Information Collection	1	1	1
Total per Patient	6 - 8	5 - 7	6 - 8

Critical Tasks for Effective Patient Care

The tables below outline the critical tasks for an effective response force for other responses, including hazardous materials and technical rescue incidents.

Critical Tasks for Hazardous Materials

Critical Task	High Risk	Low Risk
Command/Safety	2	1
Liaison	1	1
Decontamination	4	4
Research Support	2	1
Team Leader, Entry Team, Backup Team	6	6
Total Personnel	15	13

Critical Task	No Hydrants	With Hydrants
Command/Safety	1	1
Pump Operations	1	1
Attack Line	2	2
Structure Protection	3	2
Water Supply	1	0
Tender Operator	2	0
Exposure Lines	2	0
Total Personnel	12	6

Critical Tasks for Initial Wildland Urban Interface Fires

Critical Tasks for Technical Rescue Incidents	,
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Critical Task	Swift Water	High/Low Angle	Confined Space	Trench
Command/Safety	1	1	2	2
Rescue Team	3	2	2	2
Backup Team	2	2	2	2
Patient Care	2	2	2	3
Rope Tender	2	0	0	0
Upstream Spotter	2	0	0	0
Downstream Safety	2	0	0	0
Rigger	0	1	1	0
Attendant	0	1	1	0
Ground Support	0	4	4	0
Edge Person	0	1	0	0
Shoring	0	0	0	5
Total Personnel	14	14	14	14

In technical rescue incidents, the personnel must be specifically trained to handle these types of calls for service. These training programs are highly specialized and not all personnel are trained to the levels required to be certified for the operation.

5 Evaluation of Deployment and Performance

This chapter compares and evaluates the deployment and performance of the Fire Department as it relates to the performance objectives outlined and described in the previous chapter.

1 Evaluation of Response Time Performance Factors

Records Management System (RMS) data for calendar years 2016, 2017, and 2018 was examined and evaluated. The data is not without issues such as coding problems, transcription errors, and equipment failures. The project team uses the following mechanism to address these issues.

Only qualified data is used to calculate response time and any related components. To be considered the data must meet the following criteria:

- The incident must have been unique
- The incident must have involved at least one fire department unit being dispatched to the call.
- Calls that are missing data are not used in the computations for call processing, turnout time, travel time, or call duration.
- Any call with usually long times or times sorted incorrectly (arrived before dispatch time) were removed.
- Non-emergency responses are removed; only emergency responses are included.

After filtering the data using the methodology outlined above, the remaining incidents represent the response time for calls for service handled by the Fire Department.

Benchmark and baseline time are used in the following sections. Benchmark time is defined as the standard or point of reference from which performance is measured. In terms of response time, it represents the national best practice as defined by the National Fire Protection Association (NFPA) standards. The baseline time is defined as the point of reference that is normally acceptable to the residents. Baseline time has been established as 70% of the benchmark response time based on the Commission for Public Safety Excellence (CPSE) guidance. Comparing the two response time performance

objectives allows the Fire Department to measure improvements to the various components.

Fractal response time is expressed as a percentage of calls that are handled within a given time frame. 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 specifies a performance objective of not less than 90% for the achievement of the response time component.

2 Turnout Time

Turnout time is a measurable time segment that begins when the emergency service receives the call and is on the apparatus responding (wheels rolling) to the call. NFPA 1710: Objective for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments in section 4.1.2.1.1 provides the following performance objectives for turnout time:

- "One minute twenty seconds (80 seconds) for turnout time for fire and special operations."
- "One minute (60 seconds) for turnout time for emergency medical services."

The table below illustrates the performance for the Fire Department as compared to the benchmark performance objectives noted in NFPA 1710.

System Performance with 90% fractal time									
		2016		2017		2018			
EIVIS C	alls	Performance	Variance	Performance	Variance	Performance	Variance		
Benchmark	1:00	1:53	0:53	1:50	0:50	1:52	0:52		
	Avg.:	1:11		1:09		1:10			
Fire Ca	alls								
Benchmark	1:20	1:50	0:30	1:49	0:29	1:55	0:35		
	Avg.:	1:06		1:07		1:10			

Raleigh Fire Department Turnout Time

The times are shown in two formats, the average and the 90th fractal time. The average response time is an average of the turnout time for the calls evaluated. The benchmark time shown is a measurement using a 90% fractal time and represents the goal or industry

best practice. For example, the turnout time benchmark is 60 seconds at 90% of the time for emergency medical calls and the Raleigh Fire Department has a turnout time of 1:52 90% of the time in 2018. The column marked as variance represents the difference between the benchmark and the actual performance. For example, in 2018 the department was 52 seconds over the benchmark of 1 minute for EMS calls.

To further illustrate the turnout time for the Fire Department, the tables below illustrate the turnout time for each apparatus using the same benchmark performance objectives.

Unit Performance - Benchmark Objectives										
Lloit	Bonchmark	2016	2016 2017			2018	3			
Unit	Denchimark	Performance	Variance	Performance	Variance	Performance	Variance			
Engine	1:00	1:41	0:41	1:35	0:35	1:39	0:39			
1	Avg.	0:59		0:52		0:54				
Engine	1:00	1:59	0:59	2:23	1:23	1:59	0:59			
2	Avg.	1:17		1:36		1:18				
Engine	1:00	1:42	0:42	1:47	0:47	1:51	0:51			
3	Avg.	1:05		1:09		1:10				
Engine	1:00	2:00	1:00	1:53	0:53	1:53	0:53			
4	Avg.	1:17		1:10		1:08				
Engine	1:00	1:53	0:53	1:50	0:50	1:51	0:51			
5	Avg.	1:12		1:11		1:08				
Engine	1:00	1:56	0:56	2:00	1:00	2:01	1:01			
6	Avg.	1:10		1:11		1:14				
Engine	1:00	1:51	0:51	1:50	0:50	1:58	0:58			
8	Avg.	1:05		1:05		1:07				
Engine	1:00	1:57	0:57	1:41	0:41	1:50	0:50			
9	Avg.	1:08		0:59		1:08				
Engine	1:00	1:54	0:54	1:54	0:54	1:43	0:43			
10	Avg.	1:09		1:09		1:09				
Engine	1:00	1:48	0:48	1:45	0:45	1:44	0:44			
11	Avg.	1:10		1:07		1:08				
Engine	1:00	1:48	0:48	1:45	0:45	1:38	0:38			
12	Avg.	1:08		1:07		1:06				
Engine	1:00	2:04	1:04	1:50	0:50	2:00	1:00			
13	Avg.	1:11		1:04		1:08				
Engine	1:00	1:47	0:47	1:42	0:42	1:47	0:47			
15	Avg.	1:08		1:07		1:08				

Turnout Time Emergency Medical Calls

Lloit	Popohmork	2016	6	2017	7	2018	3
Unit	Denchinark	Performance	Variance	Performance	Variance	Performance	Variance
Engine	1:00	1:49	0:49	1:46	0:46	1:48	0:48
16	Avg.	1:15		1:12		1:16	
Engine	1:00	1:41	0:41	1:40	0:40	2:02	1:02
17	Avg.	1:06		1:06		1:19	
Engine	1:00	1:46	0:46	1:51	0:51	1:51	0:51
18	Avg.	1:12		1:10		1:09	
Engine	1:00	1:48	0:48	1:41	0:41	1:47	0:47
19	Avg.	1:08		1:06		1:08	
Engine	1:00	1:41	0:41	1:36	0:36	1:48	0:48
20	Avg.	1:04		1:01		1:06	
Engine	1:00	1:49	0:49	1:50	0:50	1:53	0:53
21	Avg.	1:14		1:12		1:14	
Engine	1:00	1:57	0:57	1:59	0:59	1:47	0:47
22	Avg.	1:16		1:15		1:07	
Engine	1:00	1:55	0:55	1:58	0:58	2:05	1:05
23	Avg.	1:15		1:15		1:18	
Engine	1:00	1:51	0:51	1:33	0:33	2:21	1:21
24	Avg.	1:12		1:03		1:20	
Engine	1:00	2:08	1:08	2:16	1:16	2:18	1:18
25	Avg.	1:21		1:26		1:31	
Engine	1:00	2:04	1:04	2:02	1:02	2:07	1:07
26	Avg.	1:22		1:17		1:18	
Engine	1:00	2:19	1:19	2:20	1:20	2:27	1:27
27	Avg.	1:30		1:32		1:32	
Engine	1:00	1:47	0:47	2:01	1:01	2:17	1:17
28	Avg.	1:07		1:16		1:21	
Engine	1:00	2:17	1:17	2:01	1:01	2:07	1:07
29	Avg.	1:26		1:18		1:24	
Ladder	1:00	1:52	0:52	1:37	0:37	2:17	1:17
1	Avg.	1:07		1:02		1:41	
Ladder	1:00	1:49	0:49	1:47	0:47	1:32	0:32
2	Avg.	1:05		1:04		0:58	
Ladder	1:00	1:50	0:50	1:45	0:45	1:50	0:50
3	Avg.	1:05		1:05		1:04	
	1:00	1:44	0:44	1:37	0:37	2:00	1:00

Linit	Donohmark	2016		2017		2018	
Unit	Denchmark	Performance	Variance	Performance	Variance	Performance	Variance
Ladder 4	Avg.	0:56		0:53		1:01	
Ladder	1:00	1:53	0:53	1:48	0:48	1:56	0:56
5	Avg.	1:10		1:05		1:16	
Ladder	1:00	2:01	1:01	1:48	0:48	1:47	0:47
6	Avg.	1:04		0:55		0:58	
Ladder	1:00	2:08	1:08	1:46	0:46	2:04	1:04
7	Avg.	1:17		1:07		1:15	
Ladder	1:00	2:05	1:05	2:04	1:04	1:52	0:52
8	Avg.	1:00		1:12		1:11	
Ladder	1:00	2:20	1:20	1:29	0:29	3:29	2:29
9	Avg.	1:23		0:52		1:19	
Rescue	1:00	1:59	0:59	1:36	0:36	1:40	0:40
1	Avg.	1:08		1:00		1:04	
Squad 7	1:00	1:49	0:49	1:43	0:43	1:42	0:42
Squad /	Avg.	1:09		1:05		1:06	
Squad	1:00	1:50	0:50	1:53	0:53	1:51	0:51
14	Avg.	1:13		1:15		1:15	

Unit Performance - Benchmark Objectives

Turnout Time Fire Related Calls

Linit	Linit Developments		2016		7	2018	
Unit	Denchinark	Performance	Variance	Performance	Variance	Performance	Variance
Engine	1:20	1:56	0:36	1:48	0:28	1:48	0:28
1	Avg.	1:08		1:03		1:01	
Engine	1:20	2:09	0:49	2:28	1:08	2:06	0:46
2	Avg.	1:23		1:39		1:28	
Engine	1:20	1:55	0:35	1:59	0:39	1:56	0:36
3	Avg.	1:13		1:16		1:14	
Engine	1:20	1:58	0:38	1:56	0:36	2:01	0:41
4	Avg.	1:19		1:13		1:18	
Engine	1:20	2:12	0:52	2:07	0:47	2:09	0:49
5	Avg.	1:23		1:20		1:43	
	1:20	2:11	0:51	2:03	0:43	2:06	0:46

Turnout Time Fire Related Calls

Linit	Donohmark	2016	6	2017	7	2018	3
Unit	Denchmark	Performance	Variance	Performance	Variance	Performance	Variance
Engine 6	Avg.	1:23		1:21		1:23	
Engine	1:20	1:55	0:35	1:59	0:39	2:00	0:40
8	Avg.	1:08		1:09		1:13	
Engine	1:20	2:00	0:40	1:51	0:31	2:07	0:47
9	Avg.	1:09		1:07		1:15	
Engine	1:20	1:53	0:33	1:49	0:29	1:54	0:34
10	Avg.	1:10		1:11		1:22	
Engine	1:20	1:59	0:39	1:54	0:34	2:07	0:47
11	Avg.	1:17		1:15		1:20	
Engine	1:20	1:51	0:31	1:49	0:29	1:53	0:33
12	Avg.	1:09		1:08		1:13	
Engine	1:20	2:09	0:49	1:59	0:39	2:16	0:56
13	Avg.	1:18		1:10		1:17	
Engine	1:20	1:59	0:39	1:52	0:32	2:00	0:41
15	Avg.	1:15		1:14		1:19	
Engine	1:20	2:08	0:48	1:59	0:39	2:04	0:44
16	Avg.	1:23		1:20		1:23	
Engine	1:20	1:52	0:32	1:57	0:37	2:02	0:42
17	Avg.	1:12		1:15		1:22	
Engine	1:20	2:03	0:43	1:55	0:35	2:11	0:51
18	Avg.	1:20		1:15		1:17	
Engine	1:20	1:56	0:36	1:53	0:33	1:59	0:39
19	Avg.	1:13		1:11		1:16	
Engine	1:20	1:53	0:33	1:50	0:30	2:01	0:41
20	Avg.	1:13		1:10		1:15	
Engine	1:20	1:59	0:39	1:54	0:34	1:59	0:39
21	Avg.	1:16		1:15		1:19	
Engine	1:20	2:11	0:51	2:02	0:42	2:11	0:51
22	Avg.	1:26		1:21		1:21	
Engine	1:20	2:11	0:51	2:13	0:53	2:13	0:53
23	Avg.	1:26		1:26		1:28	
Engine	1:20	1:56	0:36	1:44	0:24	2:26	1:06
24	Avg.	1:15		1:09		1:26	
	1:20	2:09	0:49	2:06	0:46	2:20	1:00

Turnout Time Fire Related Calls

Unit	Popohmork	2016	6	2017		2018	
Unit	Denchinark	Performance	Variance	Performance	Variance	Performance	Variance
Engine 25	Avg.	1:23		1:22		1:32	
Engine	1:20	2:00	0:40	1:54	0:34	2:20	1:00
26	Avg.	1:16		1:16		1:26	
Engine	1:20	2:14	0:54	2:15	0:55	2:35	1:15
27	Avg.	1:31		1:31		1:38	
Engine	1:20	2:01	0:41	2:05	0:45	2:24	1:04
28	Avg.	1:15		1:18		1:30	
Engine	1:20	2:08	0:48	2:13	0:53	2:33	1:13
29	Avg.	1:24		1:26		1:39	
Ladder	1:20	2:14	0:54	2:03	0:43	2:15	0:55
1	Avg.	1:25		1:22		1:28	
Ladder	1:20	2:05	0:45	1:59	0:39	2:02	0:42
2	Avg.	1:19		1:17		1:13	
Ladder	1:20	2:13	0:53	2:08	0:48	2:12	0:52
3	Avg.	1:26		1:26		1:24	
Ladder	1:20	2:00	0:40	1:57	0:37	2:06	0:46
4	Avg.	1:10		1:08		1:58	
Ladder	1:20	2:16	0:56	2:14	0:54	2:30	1:10
5	Avg.	1:32		1:28		1:34	
Ladder	1:20	2:12	0:52	2:04	0:44	2:28	1:08
6	Avg.	1:25		1:22		1:44	
Ladder	1:20	2:16	0:56	2:10	0:50	2:27	1:07
7	Avg.	1:30		1:29		1:36	
Ladder	1:20	2:19	0:59	2:13	0:53	2:21	1:01
8	Avg.	1:28		1:31		1:30	
Ladder	1:20	2:28	1:08	2:05	0:45	2:55	1:35
9	Avg.	1:38		1:24		2:27	
Rescue	1:20	2:12	0:52	2:01	0:41	1:57	0:37
1	Avg.	1:18		1:13		1:14	
Squad 7	1:20	1:55	0:35	1:51	0:31	1:49	0:29
Squau /	Avg.	1:13		1:12		1:14	
Squad	1:20	1:56	0:36	1:58	0:38	2:05	0:45
14	Avg.	1:17		1:17		1:23	

There have been numerous national discussions about the measurement of turnout time as it relates to the benchmark times shown above. These discussions have centered around the ability of the personnel to safely disengage from non-emergency tasks and move to an emergency response. Adding to the discussion is the design of a fire station and the ease of accessing the apparatus and the time of day. While the discussion continues about this measurement, the table below illustrates the turnout time as a baseline using the same principles as the baseline travel time or 70% of the benchmark time. For example, the benchmark time of 60 seconds for medical calls will have a baseline time of 78 seconds.

	System Performance											
EMS Calls		2016		20-	2017		18					
		Performance	Variance	Performance	Variance	Performance	Variance					
Baseline	1:18	1:53	0:35	1:50	0:32	1:52	0:34					
	Avg.:	1:11		1:09		1:10						
Fire C	Calls											
Baseline	1:44	1:50	- 0:06	1:49	- 0:05	1:55	- 0:11					
	Avg.:	1:06		1:07		1:10						

Raleigh Fire Department Turnout Time System Performance

The times are shown in two formats, the average and the 90th fractal time. The average response time is an average of the turnout time for the calls evaluated. The baseline time shown is a measurement using a 90% fractal time and represents that which is acceptable to the community. For example, the turnout time baseline is 1:18 at 90% of the time for emergency medical calls and the Raleigh Fire Department has a turnout time of 1:52 90% of the time in 2018. The column marked as variance represents the difference between the baseline and the actual performance. For example, in 2018 the department was 34 seconds over the baseline time of 1:55 90% of the time. The variance in this instance is 2 seconds under the baseline time of 1:57. As shown, the benchmark turnout time performance time is about 50 seconds over the industry best practice for EMS calls and 30 seconds of baseline performance expectations for EMS calls, but within 30 seconds of baseline performance turnout time for EMS calls and at or under the acceptable levels identified as baseline turnout time for fire calls.

To further illustrate the turnout time for the Fire Department, the tables below illustrate the turnout time for each apparatus using the same baseline performance objectives.

	Unit	onionnanoo	Baconno Obje			
Raseline	2016	5	2017	7	2018	3
Dasenne	Performance	Variance	Performance	Variance	Performance	Variance
1:18	1:41	0:23	1:35	0:17	1:39	0:21
Avg.	0:59		0:52		0:54	
1:18	1:59	0:41	2:23	1:05	1:59	0:41
Avg.	1:17		1:36		1:18	
1:18	1:42	0:24	1:47	0:29	1:51	0:33
Avg.	1:05		1:09		1:10	
1:18	2:00	0:42	1:53	0:35	1:53	0:35
Avg.	1:17		1:10		1:08	
1:18	1:53	0:35	1:50	0:32	1:51	0:33
Avg.	1:12		1:11		1:08	
1:18	1:56	0:38	2:00	0:42	2:01	0:43
Avg.	1:10		1:11		1:14	
1:18	1:51	0:33	1:50	0:32	1:58	0:40
Avg.	1:05		1:05		1:07	
1:18	1:57	0:39	1:41	0:23	1:50	0:32
Avg.	1:08		0:59		1:08	
1:18	1:54	0:36	1:54	0:36	1:43	0:25
Avg.	1:09		1:09		1:09	
1:18	1:48	0:30	1:45	0:27	1:44	0:26
Avg.	1:10		1:07		1:08	
1:18	1:48	0:30	1:45	0:27	1:38	0:20
Avg.	1:08		1:07		1:06	
1:18	2:04	0:46	1:50	0:32	2:00	0:42
Avg.	1:11		1:04		1:08	
1:18	1:47	0:29	1:42	0:24	1:47	0:29
Avg.	1:08		1:07		1:08	
1:18	1:49	0:31	1:46	0:28	1:48	0:30
Avg.	1:15		1:12		1:16	
1:18	1:41	0:23	1:40	0:22	2:02	0:44
Avg.	1:06		1:06		1:19	
1:18	1:46	0:28	1:51	0:33	1:51	0:33
Avg.	1:12		1:10		1:09	
1:18	1:48	0:30	1:41	0:23	1:47	0:29
Avg.	1:08		1:06		1:08	
1:18	1:41	0:23	1:36	0:18	1:48	0:30
	Baseline 1:18 Avg. 1:18	Baseline 2016 Performance 1:18 1:41 Avg. 0:59 1:18 1:59 Avg. 1:17 Avg. 1:17 Avg. 1:12 Avg. 1:05 Avg. 1:01 Avg. 1:17 Avg. 1:16 Avg. 1:17 Avg. 1:17 Avg. 1:16 Avg. 1:17 Avg. 1:16 Avg. 1:17 Avg. 1:16 Avg. 1:01 Avg. 1:03 Avg. 1:03 Avg. 1:04 Avg. 1:04 Avg. 1:04 Avg. 1:04 Avg. 1:05 Avg. 1:04 Avg. 1:04 Avg. 1:04 Avg. 1:05 Avg. 1:05 Avg. 1:04	Baseline2010PerformanceVariance1:181:410:23Avg.0:590:41Avg.1:590:41Avg.1:170:24Avg.1:160:24Avg.1:170:24Avg.1:160:34Avg.1:170:34Avg.1:170:34Avg.1:160:34Avg.1:160:34Avg.1:160:34Avg.1:170:34Avg.1:160:34Avg.1:170:34Avg.1:160:34Avg.1:170:34Avg.1:181:48Avg.1:190:34Avg.1:18 <td< th=""><th>Baseline20162017PerformanceVariancePerformance1:181:410:231:35Avg.0:590:521:181:590:412:23Avg.1:171:361:181:420:241:47Avg.1:050:421:53Avg.1:160:351:50Avg.1:171:101:111:181:150:331:50Avg.1:121:131:131:181:510:331:50Avg.1:101:111:181:510:331:51Avg.1:051:161:54Avg.1:021:131:181:540:301:41Avg.1:101:021:031:181:480:301:45Avg.1:101:021:021:181:480:301:45Avg.1:161:121:121:181:410:231:40Avg.1:161:121:121:181:420:311:46Avg.1:131:461:23Avg.1:161:121:41Avg.1:131:461:41Avg.1:161:121:41Avg.1:131:461:121:141:480:311:41Avg.1:161:121:121:181:460:281:14Avg.<td< th=""><th>Baselie201Car201PerformaneVariancePerformaneVariance1:181:140:231:15Ave0:550:111:15Ave1:160:021:15Ave1:160:020:02Ave1:160:020:02Ave1:160:020:02Ave1:160:020:02Ave1:170:020:02Ave1:160:030:02Ave1:170:030:02Ave1:180:030:02Ave1:160:030:02Ave1:160:030:02Ave1:160:030:02Ave1:180:030:03Ave1:160:030:02Ave1:180:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:</th><th>Baseline201620172018PerformanceVariancePerformancePerformance11:1811:410:2311:350:11Avg.0:590:412:230:01Avg.11:190:412:230:02Avg.11:120:2410:2911:1811:1811:420:2410:1911:1911:1811:200:14210:1911:1011:1811:020:14211:1011:1011:1811:030:0311:0111:1011:1811:150:0311:1011:1111:1811:150:0311:1011:1111:1811:1510:3311:1011:1111:1811:1510:3911:1111:1211:1811:1610:3311:1511:1111:1811:1911:1111:1211:1211:1811:1611:1111:1211:1211:1811:1410:3311:1511:1211:1811:1410:2411:1211:1211:1811:1410:2311:1211:1211:1811:1410:2311:1211:1211:1811:1410:2311:1211:1211:1811:1410:2311:1211:1211:1811:1410:2311:1211:1211:1811:1410:2311:1211:1211:1811:1411:1211:1211:12</th></td<></th></td<>	Baseline20162017PerformanceVariancePerformance1:181:410:231:35Avg.0:590:521:181:590:412:23Avg.1:171:361:181:420:241:47Avg.1:050:421:53Avg.1:160:351:50Avg.1:171:101:111:181:150:331:50Avg.1:121:131:131:181:510:331:50Avg.1:101:111:181:510:331:51Avg.1:051:161:54Avg.1:021:131:181:540:301:41Avg.1:101:021:031:181:480:301:45Avg.1:101:021:021:181:480:301:45Avg.1:161:121:121:181:410:231:40Avg.1:161:121:121:181:420:311:46Avg.1:131:461:23Avg.1:161:121:41Avg.1:131:461:41Avg.1:161:121:41Avg.1:131:461:121:141:480:311:41Avg.1:161:121:121:181:460:281:14Avg. <td< th=""><th>Baselie201Car201PerformaneVariancePerformaneVariance1:181:140:231:15Ave0:550:111:15Ave1:160:021:15Ave1:160:020:02Ave1:160:020:02Ave1:160:020:02Ave1:160:020:02Ave1:170:020:02Ave1:160:030:02Ave1:170:030:02Ave1:180:030:02Ave1:160:030:02Ave1:160:030:02Ave1:160:030:02Ave1:180:030:03Ave1:160:030:02Ave1:180:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:</th><th>Baseline201620172018PerformanceVariancePerformancePerformance11:1811:410:2311:350:11Avg.0:590:412:230:01Avg.11:190:412:230:02Avg.11:120:2410:2911:1811:1811:420:2410:1911:1911:1811:200:14210:1911:1011:1811:020:14211:1011:1011:1811:030:0311:0111:1011:1811:150:0311:1011:1111:1811:150:0311:1011:1111:1811:1510:3311:1011:1111:1811:1510:3911:1111:1211:1811:1610:3311:1511:1111:1811:1911:1111:1211:1211:1811:1611:1111:1211:1211:1811:1410:3311:1511:1211:1811:1410:2411:1211:1211:1811:1410:2311:1211:1211:1811:1410:2311:1211:1211:1811:1410:2311:1211:1211:1811:1410:2311:1211:1211:1811:1410:2311:1211:1211:1811:1410:2311:1211:1211:1811:1411:1211:1211:12</th></td<>	Baselie201Car201PerformaneVariancePerformaneVariance1:181:140:231:15Ave0:550:111:15Ave1:160:021:15Ave1:160:020:02Ave1:160:020:02Ave1:160:020:02Ave1:160:020:02Ave1:170:020:02Ave1:160:030:02Ave1:170:030:02Ave1:180:030:02Ave1:160:030:02Ave1:160:030:02Ave1:160:030:02Ave1:180:030:03Ave1:160:030:02Ave1:180:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:030:03Ave1:190:	Baseline201620172018PerformanceVariancePerformancePerformance11:1811:410:2311:350:11Avg.0:590:412:230:01Avg.11:190:412:230:02Avg.11:120:2410:2911:1811:1811:420:2410:1911:1911:1811:200:14210:1911:1011:1811:020:14211:1011:1011:1811:030:0311:0111:1011:1811:150:0311:1011:1111:1811:150:0311:1011:1111:1811:1510:3311:1011:1111:1811:1510:3911:1111:1211:1811:1610:3311:1511:1111:1811:1911:1111:1211:1211:1811:1611:1111:1211:1211:1811:1410:3311:1511:1211:1811:1410:2411:1211:1211:1811:1410:2311:1211:1211:1811:1410:2311:1211:1211:1811:1410:2311:1211:1211:1811:1410:2311:1211:1211:1811:1410:2311:1211:1211:1811:1410:2311:1211:1211:1811:1411:1211:1211:12

Unit Performance - Baseline Objectives

		2016	6	2017	7	2018	3
Unit	Baseline	Performance	Variance	Performance	Variance	Performance	Variance
Engine 20	Avg.	1:04		1:01		1:06	
Engine	1:18	1:49	0:31	1:50	0:32	1:53	0:35
21	Avg.	1:14		1:12		1:14	
Engine	1:18	1:57	0:39	1:59	0:41	1:47	0:29
22	Avg.	1:16		1:15		1:07	
Engine	1:18	1:55	0:37	1:58	0:40	2:05	0:47
23	Avg.	1:15		1:15		1:18	
Engine	1:18	1:51	0:33	1:33	0:15	2:21	1:03
24	Avg.	1:12		1:03		1:20	
Engine	1:18	2:08	0:50	2:16	0:58	2:18	1:00
25	Avg.	1:21		1:26		1:31	
Engine	1:18	2:04	0:46	2:02	0:44	2:07	0:49
26	Avg.	1:22		1:17		1:18	
Engine	1:18	2:19	1:01	2:20	1:02	2:27	1:09
27	Avg.	1:30		1:32		1:32	
Engine	1:18	1:47	0:29	2:01	0:43	2:17	0:59
28	Avg.	1:07		1:16		1:21	
Engine	1:18	2:17	0:59	2:01	0:43	2:07	0:49
29	Avg.	1:26		1:18		1:24	
Ladder	1:18	1:52	0:34	1:37	0:19	2:17	0:59
1	Avg.	1:07		1:02		1:41	
Ladder	1:18	1:49	0:31	1:47	0:29	1:32	0:14
2	Avg.	1:05		1:04		0:58	
Ladder	1:18	1:50	0:32	1:45	0:27	1:50	0:32
3	Avg.	1:05		1:05		1:04	
Ladder	1:18	1:44	0:26	1:37	0:19	2:00	0:42
4	Avg.	0:56		0:53		1:01	
Ladder	1:18	1:53	0:35	1:48	0:30	1:56	0:38
5	Avg.	1:10		1:05		1:16	
Ladder	1:18	2:01	0:43	1:48	0:30	1:47	0:29
6	Avg.	1:04		0:55		0:58	
Ladder	1:18	2:08	0:50	1:46	0:28	2:04	0:46
7	Avg.	1:17		1:07		1:15	
	1:18	2:05	0:47	2:04	0:46	1:52	0:34

Unit Performance - Baseline Objectives

Linit	Deceline	2016	6	2017	7	2018	3
Unit	Daseime	Performance	Variance	Performance	Variance	Performance	Variance
Ladder 8	Avg.	1:00		1:12		1:11	
Ladder	1:18	2:20	1:02	1:29	0:11	3:29	2:11
9	Avg.	1:23		0:52		1:19	
Rescue	1:18	1:59	0:41	1:36	0:18	1:40	0:22
1	Avg.	1:08		1:00		1:04	
Caused 7	1:18	1:49	0:31	1:43	0:25	1:42	0:24
Squad /	Avg.	1:09		1:05		1:06	
Squad	1:18	1:50	0:32	1:53	0:35	1:51	0:33
14	Avg.	1:13		1:15		1:15	

Unit Performance - Baseline Objectives

Turnout Time Fire Related Calls Unit Performance - Baseline Objectives

Data base in a performance Variance Performance Variance Performance Variance Performance Variance Engine 1:44 1:56 0:12 1:48 0:04 1:48 0:04 Engine 1:44 2:09 0:25 2:28 0:44 2:06 0:22 Avg. 1:23 1:39 1:28 0:12 Engine 1:44 1:55 0:11 1:59 0:15 1:56 0:12 Avg. 1:13 1:16 1:14 1:14 1:14 1:14 Engine 1:44 1:58 0:14 1:16 0:12 2:01 0:17 4 Avg. 1:19 1:13 1:18 1:18 1:18 Engine 1:44 2:12 0:28 2:07 0:23 2:09 0:25 5 Avg. 1:23 1:20 1:43 1:18 1:18 Engine 1:44 2:11 0:27 2:03 0:19 1:13 <th>Linit</th> <th>Racolino</th> <th colspan="2">2016</th> <th colspan="2">2017</th> <th colspan="2">2018</th>	Linit	Racolino	2016		2017		2018	
Engine 1:44 1:56 0:12 1:48 0:04 1:48 0:04 1 Avg. 1:08 1:03 1:01 1:01 Engine 1:44 2:09 0:25 2:28 0:44 2:06 0:22 2 Avg. 1:23 1:39 1:28 1:28 1:28 Engine 1:44 1:55 0:11 1:59 0:15 1:56 0:12 Avg. 1:13 1:16 0:12 2:01 0:17 Engine 1:44 1:58 0:14 1:56 0:12 2:01 0:17 4 Avg. 1:19 1:13 1:18 1:18 1:18 Engine 1:44 2:12 0:28 2:07 0:23 2:09 0:25 5 Avg. 1:23 1:20 1:33 1:33 1:33 Engine 1:44 2:10 0:11 1:53 0:11 1:33 6 Avg. 1:03	Unit	Daseime	Performance	Variance	Performance	Variance	Performance	Variance
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Engine	1:44	1:56	0:12	1:48	0:04	1:48	0:04
Engine 1:44 2:09 0:25 2:28 0:44 2:06 0:22 Avg. 1:23 1:39 1:28 1:28 Engine 1:44 1:55 0:11 1:59 0:15 1:56 0:12 Avg. 1:13 1:16 0:15 1:56 0:12 Engine 1:44 1:58 0:14 1:56 0:12 2:01 0:17 4 Avg. 1:13 0:14 1:56 0:12 2:01 0:17 4 Avg. 1:19 0:14 1:56 0:12 2:01 0:17 4 Avg. 1:23 2:03 0:12 2:09 0:25 5 Avg. 1:23 1:24 1:23 1:23 1:23 Engine 1:44 1:55 0:11 1:59 0:15 2:00 0:16 6 Avg. 1:23 1:23 1:23 1:23 1:23 Engine 1:44 1:59	1	Avg.	1:08		1:03		1:01	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Engine	1:44	2:09	0:25	2:28	0:44	2:06	0:22
Engine 31:441:550:111:590:151:560:12Avg.1:131:161:161:141:17Engine 41:441:580:141:560:122:010:17Avg.1:191:131:131:181:181:18Engine 51:442:120:282:070:232:090:25Avg.1:231:201:201:431:43Engine 61:442:110:272:030:192:060:226Avg.1:231:211:211:231:211:23Engine 81:441:550:111:590:152:000:1681:441:550:111:590:152:070:2391:441:530:091:071:151:20Engine 101:441:530:091:490:051:540:1010Avg.1:101:111:221:201:231:24Engine 111:441:530:151:540:102:070:23Engine 111:441:530:151:540:101:22Engine 111:441:590:151:201:24111:241:151:201:241:23Engine 111:441:590:151:540:10111:241:151:151:201:24Engine<	2	Avg.	1:23		1:39		1:28	
3 Avg. 1:13 1:16 1:14 Engine 1:44 1:58 0:14 1:56 0:12 2:01 0:17 4 Avg. 1:19 1:13 1:13 1:18 1:18 Engine 1:44 2:12 0:28 2:07 0:23 2:09 0:25 5 Avg. 1:23 1:20 1:43 1:43 1:43 Engine 1:44 2:11 0:27 2:03 0:19 2:06 0:22 6 Avg. 1:23 1:21 1:23 1:23 1:23 Engine 1:44 1:55 0:11 1:59 0:15 2:00 0:16 8 Avg. 1:08 1:09 1:13 1:13 1:13 Engine 1:44 1:53 0:09 1:49 0:05 1:54 0:10 9 Avg. 1:10 1:11 1:22 1:11 1:20 Engine 1:44 1:59	Engine	1:44	1:55	0:11	1:59	0:15	1:56	0:12
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	3	Avg.	1:13		1:16		1:14	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Engine	1:44	1:58	0:14	1:56	0:12	2:01	0:17
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	4	Avg.	1:19		1:13		1:18	
5 Avg. 1:23 1:20 1:43 Engine 1:44 2:11 0:27 2:03 0:19 2:06 0:22 6 Avg. 1:23 1:21 1:23 1:23 0:16 0:26 0:22 6 Avg. 1:23 1:21 1:23 1:23 1:23 0:16 0:16 0:16 0:16 0:16 0:16 0:16 0:16 0:17 0:207 0:23 0:13 0:10 0:16 0:17 0:13 0:207 0:23 0:207 0:23 0:207 0:23 0:207 0:23 0:10 0:10 0:10 0:10 0:10 0:10 0:10 0:10 0:10 0:10 0:10 0:10 0:207 0:233 0:10 0:10 0:10 0:10 0:10 0:10 0:10 0:10 0:10 0:10 0:10 0:11 0:120 0:123 0:11 0:120 0:123 0:120 0:123 0:120 0:123 0:120 <th< th=""><th>Engine</th><th>1:44</th><th>2:12</th><th>0:28</th><th>2:07</th><th>0:23</th><th>2:09</th><th>0:25</th></th<>	Engine	1:44	2:12	0:28	2:07	0:23	2:09	0:25
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	5	Avg.	1:23		1:20		1:43	
6Avg.1:231:211:23Engine 81:441:550:111:590:152:000:16 $Avg.$ 1:081:091:091:130:072:070:2391:442:000:161:510:072:070:2391:441:530:091:490:051:540:10Engine 101:441:530:091:490:051:540:10Engine 101:441:590:151:540:102:070:2311Avg.1:171:151:101:201:20	Engine	1:44	2:11	0:27	2:03	0:19	2:06	0:22
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	6	Avg.	1:23		1:21		1:23	
8Avg.1:081:091:13Engine 91:442:000:161:510:072:070:239Avg.1:091:071:150:101:15Engine 101:441:530:091:490:051:540:10Engine 101:441:590:151:540:102:070:2311Avg.1:171:151:101:20	Engine	1:44	1:55	0:11	1:59	0:15	2:00	0:16
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	8	Avg.	1:08		1:09		1:13	
9 Avg. 1:09 1:07 1:15 Engine 10 1:44 1:53 0:09 1:49 0:05 1:54 0:10 Home 10 1:44 1:53 0:09 1:49 0:05 1:54 0:10 Engine 10 1:44 1:59 0:15 1:54 0:10 2:07 0:23 Engine 11 Avg. 1:17 1:15 1:20	Engine	1:44	2:00	0:16	1:51	0:07	2:07	0:23
Engine 10 1:44 1:53 0:09 1:49 0:05 1:54 0:10 Avg. 1:10 1:11 1:22 1:22 Engine 11 1:44 1:59 0:15 1:54 0:10 2:07 0:23 11 Avg. 1:17 1:15 1:20 1:20	9	Avg.	1:09		1:07		1:15	
10 Avg. 1:10 1:11 1:22 Engine 1:44 1:59 0:15 1:54 0:10 2:07 0:23 11 Avg. 1:17 1:15 1:20	Engine	1:44	1:53	0:09	1:49	0:05	1:54	0:10
Engine 1:44 1:59 0:15 1:54 0:10 2:07 0:23 11 Avg 1:17 1:15 1:20	10	Avg.	1:10		1:11		1:22	
11 Avg 1:17 1:15 1:20	Engine	1:44	1:59	0:15	1:54	0:10	2:07	0:23
	11	Avg.	1:17		1:15		1:20	

l Init	Baseline	2016		2017		2018	
Unit	Daseillie	Performance	Variance	Performance	Variance	Performance	Variance
Engine	1:44	1:51	0:07	1:49	0:05	1:53	0:09
12	Avg.	1:09		1:08		1:13	
Engine	1:44	2:09	0:25	1:59	0:15	2:16	0:32
13	Avg.	1:18		1:10		1:17	
Engine	1:44	1:59	0:15	1:52	0:08	2:00	0:16
15	Avg.	1:15		1:14		1:19	
Engine	1:44	2:08	0:24	1:59	0:15	2:04	0:20
16	Avg.	1:23		1:20		1:23	
Engine	1:44	1:52	0:08	1:57	0:13	2:02	0:18
17	Avg.	1:12		1:15		1:22	
Engine	1:44	2:03	0:19	1:55	0:11	2:11	0:27
18	Avg.	1:20		1:15		1:17	
Engine	1:44	1:56	0:12	1:53	0:09	1:59	0:15
19	Avg.	1:13		1:11		1:16	
Engine	1:44	1:53	0:09	1:50	0:06	2:01	0:17
20	Avg.	1:13		1:10		1:15	
Engine	1:44	1:59	0:15	1:54	0:10	1:59	0:15
21	Avg.	1:16		1:15		1:19	
Engine	1:44	2:11	0:27	2:02	0:18	2:11	0:27
22	Avg.	1:26		1:21		1:21	
Engine	1:44	2:11	0:27	2:13	0:29	2:13	0:29
23	Avg.	1:26		1:26		1:28	
Engine	1:44	1:56	0:12	1:44	0:00	2:26	0:42
24	Avg.	1:15		1:09		1:26	
Engine	1:44	2:09	0:25	2:06	0:22	2:20	0:36
25	Avg.	1:23		1:22		1:32	
Engine	1:44	2:00	0:16	1:54	0:10	2:20	0:36
26	Avg.	1:16		1:16		1:26	
Engine	1:44	2:14	0:30	2:15	0:31	2:35	0:51
27	Avg.	1:31		1:31		1:38	
Engine	1:44	2:01	0:17	2:05	0:21	2:24	0:40
28	Avg.	1:15		1:18		1:30	
Engine	1:44	2:08	0:24	2:13	0:29	2:33	0:49
29	Avg.	1:24		1:26		1:39	

Turnout Time Fire Related Calls Unit Performance - Baseline Objectives

Lloit	Pagalina	2016	6	2017	7	2018	3
Unit	Daseillie	Performance	Variance	Performance	Variance	Performance	Variance
Ladder	1:44	2:14	0:30	2:03	0:19	2:15	0:31
1	Avg.	1:25		1:22		1:28	
Ladder	1:44	2:05	0:21	1:59	0:15	2:02	0:18
2	Avg.	1:19		1:17		1:13	
Ladder	1:44	2:13	0:29	2:08	0:24	2:12	0:28
3	Avg.	1:26		1:26		1:24	
Ladder	1:44	2:00	0:16	1:57	0:13	2:06	0:22
4	Avg.	1:10		1:08		1:58	
Ladder	1:44	2:16	0:32	2:14	0:30	2:30	0:46
5	Avg.	1:32		1:28		1:34	
Ladder	1:44	2:12	0:28	2:04	0:20	2:28	0:44
6	Avg.	1:25		1:22		1:44	
Ladder	1:44	2:16	0:32	2:10	0:26	2:27	0:43
7	Avg.	1:30		1:29		1:36	
Ladder	1:44	2:19	0:35	2:13	0:29	2:21	0:37
8	Avg.	1:28		1:31		1:30	
Ladder	1:44	2:28	0:44	2:05	0:21	2:55	1:11
9	Avg.	1:38		1:24		2:27	
Rescue	1:44	2:12	0:28	2:01	0:17	1:57	0:13
1	Avg.	1:18		1:13		1:14	
Sauce 7	1:44	1:55	0:11	1:51	0:07	1:49	0:05
Squad /	Avg.	1:13		1:12		1:14	
Squad	1:44	1:56	0:12	1:58	0:14	2:05	0:21
14	Avg.	1:17		1:17		1:23	

Turnout Time Fire Related Calls Unit Performance - Baseline Objectives

3 Distribution of Resources

Distribution is the measure of getting initial resources to an emergency to begin mitigation efforts. This is measured in a variety of ways including percentage of square miles of the response area, percentage of road miles in the response area, and travel time. The Insurance Services Office (ISO) has used road miles for many years advocating one and a half miles for an engine company and two and a half miles for a ladder company. With the advent of GIS technology and improved computer aided dispatch (CAD) systems, the use of actual travel time is another more accurate measure for the distribution of resources.

The tables below illustrate the benchmark and baseline travel time for the Raleigh Fire Department. The first table uses the benchmark travel time of 4 minutes and the second table compares the travel time to the baseline performance objective of 5 minutes and 12 seconds.

System Performance										
2016 2017 2018										
		Performance	Variance	Performance	Variance	Performance	Variance			
Benchmark	4:00	5:09	1:09	5:06	1:06	5:20	1:20			
	Avg.:	2:57		2:55		3:12				
	Raleigh Fire Department Travel Time									
			System F	Performance						
		2016	6	2017	,	2018	;			
		Performance	Variance	Performance	Variance	Performance	Variance			
Baseline	5:12	5:09	- 0:03	5:06	- 0:06	5:20	0:08			
	Avg.:	2:57		2:55		3:12				

Raleigh Fire Department Travel Time

The times are shown in two formats, the average and the 90th fractal time. The average response time is an average of the travel time for the calls evaluated. The benchmark time shown is a measurement using a 90% fractal time and represents the goal or industry best practice. For example, the travel time benchmark is 4 minutes at 90% of the time for calls for service and the City of Raleigh has a travel time of 5:20 90% of the time in 2018. The column marked as variance represents the difference between the benchmark and the actual performance. For example, in 2018 the department was 1 minute and 20 seconds over the benchmark of 4 minutes. Using the same data for 2018 the Department was 8 seconds over the baseline travel time of 5 minutes and 12 seconds that represents the acceptable levels of response. Using the travel time component as a measurement, the distribution of fire suppression resources in the City is within industry

recommendations. As shown, the benchmark travel time is about 1 minute over the industry best practice, but generally at or under the acceptable levels identified as baseline travel time.

To further illustrate the travel time for the Fire Department, the tables below illustrate the travel time for each apparatus using the same performance objectives involving calls for service in the City.

Company Travel Time

Unit Performance - Benchmark Objectives											
Unit	Benchmark	2016	6	2017	7	2018	3				
Offic	Benonmark	Performance	Variance	Performance	Variance	Performance	Variance				
Engine	4:00	4:41	0:41	4:21	0:21	4:26	0:26				
1	Avg.	2:18		2:11		2:18					
Engine	4:00	5:57	1:57	6:07	2:07	6:22	2:22				
2	Avg.	2:58		3:00		3:33					
Engine	4:00	4:16	0:16	4:22	0:22	4:42	0:42				
3	Avg.	2:30		2:27		2:45					
Engine	4:00	5:16	1:16	5:10	1:10	5:41	1:41				
4	Avg.	2:52		2:58		3:17					
Engine	4:00	4:49	0:49	4:27	0:27	4:56	0:56				
5	Avg.	2:35		2:28		2:44					
Engine	4:00	5:03	1:03	5:11	1:11	6:37	2:37				
6	Avg.	3:03		3:04		3:34					
Engine	4:00	5:47	1:47	5:43	1:43	5:53	1:53				
8	Avg.	3:19		3:10		3:27					
Engine	4:00	5:02	1:02	5:08	1:08	5:17	1:17				
9	Avg.	2:39		2:40		3:04					
Engine	4:00	4:55	0:55	5:06	1:06	5:25	1:25				
10	Avg.	2:43		2:52		3:11					
Engine	4:00	5:31	1:31	5:18	1:18	5:46	1:46				
11	Avg.	3:02		3:02		3:20					
Engine	4:00	5:19	1:19	5:19	1:19	5:48	1:48				
12	Avg.	3:05		3:04		3:30					
Engine	4:00	4:26	0:26	4:19	0:19	4:35	0:35				
13ັ	Avg.	2:25		2:19		2:33					
Engine	4:00	5:07	1:07	5:08	1:08	5:25	1:25				
15	Avg.	2:52		2:56		3:52					
	4:00	5:23	1:23	5:16	1:16	5:51	1:51				

Matrix Consulting Group

Lloit	Ronchmark	2016	3	2017	7	2018	3
Unit	Denchimark	Performance	Variance	Performance	Variance	Performance	Variance
Engine 16	Avg.	3:06		3:01		3:28	
Engine	4:00	5:07	1:07	4:52	0:52	5:04	1:04
17	Avg.	2:53		2:45		2:53	
Engine	4:00	4:59	0:59	4:41	0:41	5:23	1:23
18	Avg.	2:58		2:47		3:07	
Engine	4:00	5:01	1:01	4:54	0:54	5:25	1:25
19	Avg.	2:48		2:48		3:08	
Engine	4:00	5:40	1:40	5:07	1:07	5:39	1:39
20	Avg.	3:14		3:01		3:34	
Engine	4:00	5:42	1:42	5:37	1:37	5:49	1:49
21	Avg.	3:25		3:20		3:48	
Engine	4:00	6:02	2:02	6:18	2:18	6:30	2:30
22	Avg.	3:22		3:33		3:35	
Engine	4:00	5:30	1:30	5:48	1:48	5:51	1:51
23	Avg.	2:58		3:08		3:35	
Engine	4:00	5:41	1:41	5:08	1:08	5:18	1:18
24	Avg.	3:14		3:02		3:11	
Engine	4:00	6:07	2:07	5:32	1:32	6:19	2:19
25	Avg.	3:22		2:59		3:34	
Engine	4:00	5:51	1:51	5:38	1:38	6:09	2:09
26	Avg.	3:22		3:20		3:47	
Engine	4:00	5:58	1:58	6:00	2:00	6:59	2:59
27	Avg.	2:59		2:56		3:31	
Engine	4:00	5:55	1:55	5:45	1:45	6:14	2:14
28	Avg.	3:07		3:12		3:29	
Engine	4:00	5:49	1:49	5:23	1:23	6:24	2:24
29	Avg.	3:02		2:50		2:59	
Ladder	4:00	6:26	2:26	5:58	1:58	7:30	3:30
1	Avg.	2:04		1:48		2:54	
Ladder	4:00	6:24	2:24	6:16	2:16	7:25	3:25
2	Avg.	2:04		2:03		2:52	
Ladder	4:00	6:40	2:40	6:30	2:30	7:07	3:07
3	Avg.	2:42		2:30		2:41	
Ladder	4:00	6:14	2:14	5:53	1:53	7:13	3:13
4	Avg.	2:23		2:10		2:41	

Company Travel Time Unit Performance - Benchmark Objectives

Linit	Benchmark	2016		2017		2018	
Onit		Performance	Variance	Performance	Variance	Performance	Variance
Ladder 5	4:00	6:18	2:18	6:31	2:31	9:02	5:02
	Avg.	2:05		2:03		3:14	
Ladder 6	4:00	6:04	2:04	5:39	1:39	6:00	2:00
	Avg.	2:51		2:32		3:11	
Ladder	4:00	6:48	2:48	6:30	2:30	8:00	4:00
7	Avg.	2:29		2:19		2:51	
Ladder 8	4:00	6:34	2:34	6:07	2:07	7:18	3:18
	Avg.	2:28		2:16		2:56	
Ladder 9	4:00	6:20	2:20	6:16	2:16	7:47	3:47
	Avg.	2:15		2:06		3:01	
Rescue 1	4:00	4:33	0:33	3:55	- 0:05	8:23	4:23
	Avg.	0:55		0:52		2:34	
Squad 7	4:00	4:49	0:49	4:50	0:50	5:06	1:06
	Avg.	2:28		2:29		2:46	
Squad 14	4:00	5:27	1:27	5:34	1:34	5:54	1:54
	Avg.	2:33		2:34		2:52	

Company Travel Time Unit Performance - Benchmark Objectives

Company Travel Time Unit Performance - Baseline Objectives

Lloit	Baseline	2016		2017		2018	
Onit		Performance	Variance	Performance	Variance	Performance	Variance
Engine	5:12	4:41	- 0:31	4:21	- 0:51	4:26	- 0:46
1	Avg.	2:18		2:11		2:18	
Engine	5:12	5:57	0:45	6:07	0:55	6:22	1:10
2	Avg.	2:58		3:00		3:33	
Engine	5:12	4:16	- 0:56	4:22	- 0:50	4:42	- 0:30
3	Avg.	2:30		2:27		2:45	
Engine	5:12	5:16	0:04	5:10	- 0:02	5:41	0:29
4	Avg.	2:52		2:58		3:17	
Engine	5:12	4:49	- 0:23	4:27	- 0:45	4:56	- 0:16
5	Avg.	2:35		2:28		2:44	
Engine	5:12	5:03	- 0:09	5:11	- 0:01	6:37	1:25
6	Avg.	3:03		3:04		3:34	
Engine	5:12	5:47	0:35	5:43	0:31	5:53	0:41
8	Avg.	3:19		3:10		3:27	
	5:12	5:02	- 0:10	5:08	- 0:04	5:17	0:05

Linit	Baseline 2016		2017		2018		
Unit	Daseillie	Performance	Variance	Performance	Variance	Performance	Variance
Engine 9	Avg.	2:39		2:40		3:04	
Engine	5:12	4:55	- 0:17	5:06	- 0:06	5:25	0:13
10	Avg.	2:43		2:52		3:11	
Engine	5:12	5:31	0:19	5:18	0:06	5:46	0:34
11	Avg.	3:02		3:02		3:20	
Engine	5:12	5:19	0:07	5:19	0:07	5:48	0:36
12	Avg.	3:05		3:04		3:30	
Engine	5:12	4:26	- 0:46	4:19	- 0:53	4:35	- 0:37
13	Avg.	2:25		2:19		2:33	
Engine	5:12	5:07	- 0:05	5:08	- 0:04	5:25	0:13
15	Avg.	2:52		2:56		3:52	
Engine	5:12	5:23	0:11	5:16	0:04	5:51	0:39
16	Avg.	3:06		3:01		3:28	
Engine	5:12	5:07	- 0:05	4:52	- 0:20	5:04	- 0:08
17	Avg.	2:53		2:45		2:53	
Engine	5:12	4:59	- 0:13	4:41	- 0:31	5:23	0:11
18	Avg.	2:58		2:47		3:07	
Engine	5:12	5:01	- 0:11	4:54	- 0:18	5:25	0:13
19	Avg.	2:48		2:48		3:08	
Engine	5:12	5:40	0:28	5:07	- 0:05	5:39	0:27
20	Avg.	3:14		3:01		3:34	
Engine	5:12	5:42	0:30	5:37	0:25	5:49	0:37
21	Avg.	3:25		3:20		3:48	
Engine	5:12	6:02	0:50	6:18	1:06	6:30	1:18
22	Avg.	3:22		3:33		3:35	
Engine	5:12	5:30	0:18	5:48	0:36	5:51	0:39
23	Avg.	2:58		3:08		3:35	
Engine	5:12	5:41	0:29	5:08	- 0:04	5:18	0:06
24	Avg.	3:14		3:02		3:11	
Engine	5:12	6:07	0:55	5:32	0:20	6:19	1:07
25	Avg.	3:22		2:59		3:34	
Engine	5:12	5:51	0:39	5:38	0:26	6:09	0:57
26	Avg.	3:22		3:20		3:47	
Engine	5:12	5:58	0:46	6:00	0:48	6:59	1:47
27	Avg.	2:59		2:56		3:31	

Company Travel Time Unit Performance - Baseline Objectives

Lloit	Baseline	2016		2017		2018	
Unit		Performance	Variance	Performance	Variance	Performance	Variance
Engine	5:12	5:55	0:43	5:45	0:33	6:14	1:02
28	Avg.	3:07		3:12		3:29	
Engine	5:12	5:49	0:37	5:23	0:11	6:24	1:12
29	Avg.	3:02		2:50		2:59	
Ladder	5:12	6:26	1:14	5:58	0:46	7:30	2:18
1	Avg.	2:04		1:48		2:54	
Ladder	5:12	6:24	1:12	6:16	1:04	7:25	2:13
2	Avg.	2:04		2:03		2:52	
Ladder	5:12	6:40	1:28	6:30	1:18	7:07	1:55
3	Avg.	2:42		2:30		2:41	
Ladder 4	5:12	6:14	1:02	5:53	0:41	7:13	2:01
	Avg.	2:23		2:10		2:41	
Ladder 5	5:12	6:18	1:06	6:31	1:19	9:02	3:50
	Avg.	2:05		2:03		3:14	
Ladder	5:12	6:04	0:52	5:39	0:27	6:00	0:48
6	Avg.	2:51		2:32		3:11	
Ladder	5:12	6:48	1:36	6:30	1:18	8:00	2:48
7	Avg.	2:29		2:19		2:51	
Ladder	5:12	6:34	1:22	6:07	0:55	7:18	2:06
8	Avg.	2:28		2:16		2:56	
Ladder	5:12	6:20	1:08	6:16	1:04	7:47	2:35
9	Avg.	2:15		2:06		3:01	
Rescue	5:12	4:33	- 0:39	3:55	- 1:17	8:23	3:11
1	Avg.	0:55		0:52		2:34	
Squad 7	5:12	4:49	- 0:23	4:50	- 0:22	5:06	- 0:06
Squau /	Avg.	2:28		2:29		2:46	
Squad	5:12	5:27	0:15	5:34	0:22	5:54	0:42
14	Avg.	2:33		2:34		2:52	

Company Travel Time Unit Performance - Baseline Objectives

A review of the individual companies allows for an examination of any areas that are well outside the department wide performance. This is particularly true for the Engine Companies as these units are typically the first arriving units. Ladder Companies and the Rescue Company typically respond to multi-alarm incidents or are support units to the Engine Companies. In terms of the baseline travel time performance, Engine 6 and Engine 22 are more than 1 minute over the baseline travel time for 2018. This is likely due to their stations being closed for renovation work.

The maps below provide a spatial view of the travel time, both benchmark and baseline, using the Raleigh fire station locations as the starting point. The drive time isochrones are generated using a digital road network with existing speed limits, traffic laws, and a general pattern of traffic flow factored into the equation. Stations 6 and 11 are currently being rebuilt and Station 22 has been moved from its original location. The maps that follow do not have the drive times for Stations 6 and 11 and shows Station 22 in its temporary location.



Without Stations 6 and 11 in the middle of the City there is a significant gap in this area in terms of travel time. Station 22, in its temporary location, also leaves a significant gap in coverage.



As in the previous map, the three stations leave a gap in the coverage with the baseline travel time performance objectives. Once those stations are back in operation, the travel time improves as illustrated in the baseline travel time map below.



4 Concentration of Resources

Concentration is generally described as the ability of the Fire Department to get the appropriate number of personnel and resources to the scene of an emergency to effectively mitigate the incident. There are two parts to this component: an effective response force and the amount of time to get the resources in place.

1. First Alarm Assignment Travel Time

Distribution is based on getting the first resource to the location of the call, the concentration part of the model is the travel time to get the balance of the effective response force to the location of the call. Much like the distribution of resources, the concentration is dependent on the population density. It is not reasonable or financially possible for a rural area to have the same concentration of resources that is in an urban setting.

(2) Evaluation of the Concentration of Resources

Records Management System (RMS) data for calendar years 2016, 2017, and 2018 was examined and evaluated for the table below. To be considered for inclusion, the following conditions were required to be met:

- The incident must have building fire as the incident type.
- All the units dispatched must have an enroute time and an arrival time recorded. It was assumed if the unit did not arrive on scene that it was cancelled.

To be considered as meeting the concentration, both, the travel time and a minimum of 14 personnel had to arrive on location. The number of personnel is based on a moderate structure fire risk and the critical task previously outlined. Apparatus staffing was counted as shown in the table below.

Raleigh Staffing

Unit	Personnel
Chief Officers	1
Engine Companies	3
Ladder Companies	4
Rescue Company	5
Squad Companies	3
The table below represents the 379 structure fire calls for the three years combined and evaluated for the concentration of resources.

Raleigh Fire Department

14 Personnel	D	istribution	Concentration			
	Time	Percent Met	Time	Percent Met		
Benchmark	4:00	86.3%	8:00	87.1%		
Baseline	5:12	97.1%	10:24	96.8%		

The Fire Department met the benchmark travel time 86.3% of the time and the baseline travel time was met 97.1% of the time for the building fire incidents evaluated. For the concentration, the Fire Department had 14 personnel on location within the benchmark performance objective 87.1% of the time and within the baseline performance objective 96.8% of the time.

The response plan for the Raleigh Fire Department to a moderate risk structure fire includes 4 Engine Companies, 2 Ladder Companies, a Rescue or Squad Company, and 2 Battalion Chiefs for a total of 25 to 27 personnel. Using the same criteria as above, the table below illustrates the performance, 239 calls evaluated, for the past three years with at least 25 personnel arriving on the scene.

Raleigh Fire Department

25 Doroonnol	D	istribution	Concentration			
25 Personnei	Time	Percent Met	Time	Percent Met		
Benchmark	4:00	91.2%	8:00	23.8%		
Baseline	5:12	99.2%	10:24	52.7%		

For distribution, the Fire Department met the benchmark travel time 91.2% of the time and the baseline travel time was met 99.2% of the time. For concentration, the Fire Department had 25 personnel on location within the benchmark travel time 23.8% of the time and 52.7% of the time within the baseline performance objective.

The map below illustrates the concentration of resources with an 8-minute benchmark travel time based on the fire station locations and using the same staffing parameters noted in the table above.



This assumes the resources are responding from their respective stations. Station 6 and 11 are included here as these stations will return to operation. However, these two stations represent 10 personnel for the response. The central sections of the City are well covered, and moving to the edges of the City, the number of personnel able to reach a scene in 8 minutes drops off.

The map below illustrates the concentration of resources with a 10 minute 24 second baseline travel time based on the fire station locations and using the same staffing parameters noted in the table above.



Within the central sections of the City, the concentration of resources is well defined with at least 38 personnel able to arrive within the baseline travel time and along the I-440 corridor to the north. However, this map also uses Station 6 and 11, accounting for 10 personnel, in the response.

5 Deployment Contributing Factors

The concept of distribution and concentration of resources can be influenced by other contributing factors including unit hour utilization and concurrent calls for service.

1. Unit Hour Utilization

Unit hour utilization is another mechanism to measure the workload of a fire protection system. This measures the amount of time units are responding to and handling calls for service. Unit hour utilization is calculated by taking the total hours the unit is committed to an incident divided by the total available hours. Expressed as a percentage, it identifies the amount of time the unit is committed to calls for service, but more importantly, the amount of time the unit is available. Within the framework of the 90th percentile performance standards, the amount of available time can have an impact in meeting that standard. If utilization rates are too high, the units are often unavailable for immediate response. The table below illustrates the unit hour utilization for the past three years with the average call duration for each.

	2016				2017		2018		
	Hours	Pct.	Avg. Call	Hours	Pct.	Avg. Call	Hours	Pct.	Avg. Call
Engine 12	848:08:51	9.7%	19:44	973:19:13	11.1%	22:47	930:23:36	10.6%	21:15
Engine 11	823:58:05	9.4%	19:51	834:18:52	9.5%	19:38	863:15:13	9.9%	18:55
Engine 19	792:48:24	9.1%	20:40	765:36:32	8.7%	19:00	804:50:52	9.2%	18:50
Engine 8	786:55:10	9.0%	21:28	916:16:26	10.5%	25:02	804:39:33	9.2%	21:30
Engine 15	756:56:21	8.6%	19:21	760:13:19	8.7%	18:34	786:30:41	9.0%	18:32
Engine 3	797:37:40	9.1%	17:30	851:20:32	9.7%	18:49	762:07:40	8.7%	17:08
Squad 7	660:48:41	7.5%	18:35	711:59:32	8.1%	19:36	717:54:58	8.2%	17:55
Engine 10	634:01:25	7.2%	21:17	596:54:55	6.8%	23:05	676:53:00	7.7%	24:02
Engine 2	643:49:06	7.3%	19:56	641:05:22	7.3%	21:37	659:59:46	7.5%	20:40
Engine 16	716:46:03	8.2%	24:25	721:34:58	8.2%	22:47	653:11:23	7.5%	19:55
Engine 9	599:44:42	6.8%	22:20	658:55:17	7.5%	23:29	649:59:14	7.4%	21:14
Engine 21	623:09:07	7.1%	25:05	576:59:47	6.6%	23:24	588:12:21	6.7%	20:45
Engine 1	637:56:58	7.3%	18:46	693:55:49	7.9%	20:20	581:33:16	6.6%	17:34
Ladder 2	571:18:02	6.5%	16:16	611:23:12	7.0%	17:23	568:37:00	6.5%	16:39
Ladder 5	347:01:28	4.0%	18:29	306:42:56	3.5%	18:12	544:44:05	6.2%	28:18
Engine 22	524:34:20	6.0%	23:38	495:39:16	5.7%	21:33	538:29:07	6.1%	21:45
Engine 20	594:11:17	6.8%	21:02	595:18:32	6.8%	22:05	534:36:15	6.1%	18:42
Squad 14	599:01:45	6.8%	21:34	576:29:30	6.6%	20:02	498:41:03	5.7%	18:34
Ladder 4	528:52:00	6.0%	14:18	536:55:55	6.1%	14:24	481:53:58	5.5%	12:33
Engine 17	498:40:44	5.7%	22:50	530:12:21	6.1%	23:49	479:44:57	5.5%	21:20
Engine 13	474:03:30	5.4%	19:33	465:23:28	5.3%	21:05	438:26:04	5.0%	18:21
Engine 4	503:35:54	5.7%	22:11	494:59:20	5.7%	23:15	423:26:26	4.8%	20:15
Engine 18	481:53:10	5.5%	25:34	447:23:20	5.1%	22:59	420:12:24	4.8%	21:22
Engine 26	371:05:31	4.2%	23:20	490:23:17	5.6%	30:00	412:40:35	4.7%	23:22
Engine 28	369:31:12	4.2%	27:51	570:28:52	6.5%	42:34	411:56:14	4.7%	26:47
Engine 5	359:29:58	4.1%	20:21	436:12:46	5.0%	20:08	396:21:50	4.5%	18:13
Engine 23	315:13:26	3.6%	23:39	312:14:29	3.6%	22:26	343:54:22	3.9%	24:41

Raleigh Fire Department Unit Hour Utilization

	2016				2017			2018			
	Hours	Pct.	Avg. Call	Hours	Pct.	Avg. Call	Hours	Pct.	Avg. Call		
Engine 25	295:56:28	3.4%	21:52	326:54:55	3.7%	21:15	343:48:26	3.9%	21:54		
Engine 24	348:12:08	4.0%	23:43	332:24:36	3.8%	21:59	340:51:49	3.9%	21:58		
Engine 27	242:04:19	2.8%	20:02	330:18:04	3.8%	25:36	316:28:27	3.6%	21:24		
Ladder 3	321:37:15	3.7%	18:37	398:51:36	4.6%	21:44	314:17:23	3.6%	16:22		
Engine 6	520:29:13	5.9%	23:29	429:32:31	4.9%	25:18	309:30:03	3.5%	21:03		
Ladder 7	307:58:19	3.5%	17:26	349:16:54	4.0%	21:01	293:23:45	3.3%	16:20		
Rescue 1	311:13:35	3.6%	15:12	337:25:35	3.9%	16:13	289:55:00	3.3%	13:27		
Ladder 8	225:04:59	2.6%	23:05	296:25:09	3.4%	30:43	282:51:30	3.2%	16:49		
Ladder 1	294:37:33	3.4%	17:15	274:15:20	3.1%	17:00	271:45:50	3.1%	17:00		
Engine 29	253:36:32	2.9%	34:16	253:29:08	2.9%	35:32	232:11:52	2.7%	31:10		
Ladder 6	133:02:53	1.5%	21:28	130:26:41	1.5%	20:33	143:57:23	1.6%	20:37		
Ladder 9	56:15:56	0.6%	14:52	105:35:41	1.2%	28:32	95:30:31	1.1%	20:41		

Raleigh Fire Department Unit Hour Utilization

Five engine companies are at or are approaching 10% utilization rates in 2018 and are consistently in the range for the past three years. Engines 8, 11, 12, 15, and 19 are approaching or are at a 10% utilization rate. These same companies have been increasing in travel time for the same three-year period. However, the travel time increases have been slight increases; for example Engine 12 went from a travel time of 5 minutes 19 seconds in 2017 to 5 minutes 48 seconds in 2018 - an increase of 29 seconds. Once the utilization rates are at or near 10%, the trends need to be monitored more closely to ensure the travel time does not deteriorate and fall below expectations.

2. Concurrent Calls for Service

It is not uncommon for a fire protection system to have multiple requests for service occurring simultaneously. The larger the system the more frequently this will occur. With the appropriate resources this can be handled efficiently. The tables below illustrate the concurrent calls, two or more calls, for the fire protection system for the past three years separated by Battalion. The second table for each Battalion illustrates the concurrent calls for three years combined by time of day.

Calls	2016	2017	2018	Total	%	
1	3,707	3,939	4,047	11,693	66.74%	
2	1,376	1,495	1,637	4,508	25.73%	
3	322	343	387	1,052	6.00%	
4	58	61	86	205	1.17%	
5	8	9	16	33	0.19%	
6	4	2	2	8	0.05%	
7+	8	11	1	20	0.11%	
Total	5,483	5,860	6,176	17,519	100%	

Hour	1	2	3	4	5	6	7+	Total
12 am	383	87	1					471
1 am	311	81	10	1			1	404
2 am	279	57	11					347
3 am	281	50	3	1				335
4 am	256	34	4					294
5 am	312	46	7					365
6 am	390	84	6	1				481
7 am	424	164	22					610
8 am	511	204	45	7	3			770
9 am	559	212	65	7	3			846
10 am	614	249	71	15	1	1		951
11 am	607	259	66	12	1		1	946
12 pm	622	320	75	12	1		3	1,033
1 pm	596	319	83	11	4			1,013
2 pm	617	265	48	11	1	1	2	945
3 pm	579	267	76	9		1	3	935
4 pm	572	253	72	12	2		3	914
5 pm	604	279	96	23	3	2	1	1,008
6 pm	598	313	83	25	7	1	1	1,028
7 pm	569	274	63	25	4		1	936
8 pm	571	205	54	16	1	1		848
9 pm	554	211	44	9	1	1	2	822
10 pm	490	156	32	6			1	685
11 pm	394	119	15	2	1		1	532
Total	11,693	4,508	1,052	205	33	8	20	17,519

Calls	2016	2017	2018	Total	%
1	5,471	5,361	5,427	16,259	51.4%
2	3,371	3,345	3,613	10,329	32.6%
3	1,176	1,107	1,385	3,668	11.6%
4	292	329	401	1,022	3.2%
5	81	76	113	270	0.9%
6	23	14	25	62	0.2%
7+	15	5	18	38	0.1%
Total	10,429	10,237	10,982	31,648	100%

Hour	1	2	3	4	5	6	7+	Total
12 am	668	286	62	13	3		2	1,034
1 am	607	257	60	6				930
2 am	522	215	35	6	1			779
3 am	453	191	25	3	1			673
4 am	449	155	34	7	2			647
5 am	445	176	14	11		1		647
6 am	558	236	58	14	2			868
7 am	636	339	103	28	7	1		1,114
8 am	714	410	119	33	9			1,285
9 am	736	508	173	40	11	3	2	1,473
10 am	800	519	167	45	22	4	3	1,560
11 am	817	563	192	72	14	2	1	1,661
12 pm	809	605	239	62	11	9	3	1,738
1 pm	749	592	243	63	7	2	3	1,659
2 pm	754	558	229	89	17	2	3	1,652
3 pm	732	564	268	59	24	7	2	1,656
4 pm	759	594	238	83	21	4	3	1,702
5 pm	755	619	259	80	29	7	3	1,752
6 pm	705	629	261	71	33	10	9	1,718
7 pm	749	510	224	79	15	2	1	1,580
8 pm	778	564	169	43	12	3	1	1,570
9 pm	703	485	191	40	11		1	1,431
10 pm	679	401	176	46	14	3	1	1,320
11 pm	682	353	129	29	4	2		1,199
Total	16,259	10,329	3,668	1,022	270	62	38	31,648

Calls	2016	2017	2018	Total	%
1	5,344	5,448	5,630	16,422	53.0%
2	3,193	3,198	3,292	9,683	31.3%
3	1,198	1,098	1,184	3,480	11.2%
4	315	293	342	950	3.1%
5	110	64	83	257	0.8%
6	45	15	28	88	0.3%
7+	62	7	26	95	0.3%
Total	10,267	10,123	10,585	30,975	100%

Hour	1	2	3	4	5	6	7+	Total
12 am	659	330	110	26	7	2	1	1,135
1 am	597	303	105	27	6	4	2	1,044
2 am	592	262	69	21	4		1	949
3 am	511	150	34	3				698
4 am	426	166	25	2				619
5 am	409	137	18	2	2			568
6 am	472	173	40	4		1		690
7 am	649	252	63	18	4	4		990
8 am	690	386	144	26	9	6	4	1,265
9 am	726	489	161	40	7	2	2	1,427
10 am	743	504	242	54	27	5	1	1,576
11 am	800	596	239	62	10	6	6	1,719
12 pm	803	565	232	85	14	3	5	1,707
1 pm	777	520	206	46	9	5	8	1,571
2 pm	807	566	195	60	13	5	4	1,650
3 pm	765	533	182	51	5	6	3	1,545
4 pm	711	467	207	56	20	6	9	1,476
5 pm	816	560	222	65	28	4	14	1,709
6 pm	826	543	225	84	26	7	4	1,719
7 pm	763	494	221	79	22	4	9	1,592
8 pm	755	498	168	48	20	8	9	1,506
9 pm	744	404	160	31	12	4	4	1,359
10 pm	703	427	117	25	8	4	2	1,286
11 pm	678	358	95	35	4	2	3	1,175
Total	16,422	9,683	3,480	950	257	88	36	30,975

Calls	2016	2017	2018	Total	%
1	2,977	3,122	3,189	9,288	73.0%
2	942	939	938	2,819	22.1%
3	150	163	187	500	3.9%
4	43	20	22	85	0.7%
5	13	1	9	23	0.2%
6	2	0	0	2	0.0%
7+	8	1	1	10	0.1%
Total	4,135	4,246	4,346	12,727	100%

Hour	1	2	3	4	5	6	7+	Total
12 am	280	63	14					357
1 am	242	32	7					281
2 am	216	39	7					262
3 am	226	29	2	1				258
4 am	186	20	2					208
5 am	205	34	1					240
6 am	250	33	3					286
7 am	379	64	6	3				452
8 am	413	108	12					533
9 am	419	159	25	5	1			609
10 am	532	164	31	12				739
11 am	527	190	46	7	2			772
12 pm	529	151	31	4	1		2	718
1 pm	489	174	28	6	2			699
2 pm	476	155	45	13	3			692
3 pm	478	183	38	1	4			704
4 pm	453	214	38	4	2			711
5 pm	491	208	38	6	2	1	1	747
6 pm	468	208	36	8	1		2	723
7 pm	507	162	23	5				697
8 pm	452	139	26	4	3	1	1	626
9 pm	398	122	24	3	1		1	549
10 pm	351	94	10	2	1		1	459
11 pm	321	74	7	1			2	405
Total	9,288	2,819	500	85	23	2	10	12,727

Calls	2016	2017	2018	Total	%
1	4,999	5,073	5,187	15,259	51.5%
2	3,166	3,080	3,235	9,481	32.0%
3	1,160	1,086	1,095	3,341	11.3%
4	370	351	335	1,056	3.6%
5	106	78	111	295	1.0%
6	44	21	32	97	0.3%
7+	55	11	33	99	0.3%
Total	9,900	9,700	10,028	29,628	100%

Hour	1	2	3	4	5	6	7+	Total
12 am	489	197	41	6	5		1	739
1 am	478	156	33					667
2 am	473	143	16	4				636
3 am	421	143	15	1				580
4 am	389	108	21					518
5 am	403	120	19	8	1	1		552
6 am	527	195	38	6	4			770
7 am	589	323	83	27	7	1	2	1,032
8 am	691	406	138	40	18	2		1,295
9 am	714	511	189	56	21	2	5	1,498
10 am	761	601	208	90	19	3	1	1,683
11 am	776	628	244	103	34	15	7	1,807
12 pm	725	590	299	98	14	4	4	1,734
1 pm	733	616	241	112	21	5	6	1,734
2 pm	778	551	223	66	25	8	7	1,658
3 pm	777	591	257	72	19	5	6	1,727
4 pm	769	524	204	57	13	10	9	1,586
5 pm	716	618	265	61	18	10	16	1,704
6 pm	776	566	219	76	29	7	13	1,686
7 pm	744	500	178	51	14	7	9	1,503
8 pm	695	413	132	43	17	4	1	1,305
9 pm	664	400	123	37	6	6	8	1,244
10 pm	589	312	69	32	10	6	4	1,022
11 pm	582	269	86	10		1		948
Total	15,259	9,481	3,341	1,056	295	97	99	29,628

For the most part, each Battalion can handle its calls for service. The table below illustrates the concurrent calls as a percentage of total calls. Over the three-year period, Battalion 5 had 5 or more calls occurring about 1.7% of the time.

	3 or more Calls	4 or more Calls	5 or more Calls
Battalion 1	7.5%	1.5%	0.3%
Battalion 2	16.0%	4.4%	1.2%
Battalion 3	15.7%	4.5%	1.4%
Battalion 4	4.9%	0.9%	0.3%
Battalion 5	16.5%	5.2%	1.7%

Concurrent Calls by Battalion

Similar to the unit hour utilization, this statistical measure looks to the reliability of resources. If there are too many calls occurring concurrently, the resources are not available to respond to the call for service meaning another resource should be added. For Raleigh about 85% of the time there are no more than two calls occurring in each Battalion leaving two or three resources (stations) available in the Battalion for another call. Engines 11 and 15 are in Battalion 5 and both companies are approaching 10% utilization rates and have increasing travel times averaging 20 to 30 seconds over the past three years. Battalion 5 has a higher instance of call concurrence, meaning this area may need additional resources once the travel time extends beyond acceptable levels.

6 Strategic Improvement Opportunities

During this study several opportunities for improvement were identified. Some of those are related to the growth of the community, while others are gaps in service levels. This chapter provides recommendations intended to provide improvements to the fire protection system within the City and surrounding area.

1 Performance Objectives

Service levels for a fire protection system are usually measured using response time to calls for service. As noted previously, this is due to the effects unfriendly fires can have on property and to the delivery of emergency medical services. Gaps in the service levels are generally identified using these performance objectives and these objectives should be monitored on a regular basis. Turnout time and travel time are those response time components that are manageable by the Fire Department and by which a fire protection system is measured.

1. Turnout Time

There are several factors that will influence the turnout time for apparatus including the station layout. Such considerations include stairs, detour to restroom, policy for signaling enroute, opening the bay doors, policy for gathering response information, and the personal protective gear that must be donned. In any case, formally establishing turnout time performance objectives provides direction to the employees and establishes the expectations of their performance. As well, the public understands and knows what to expect from their fire services.

The table below illustrates the turnout time for the past three years, derived by combining the last three-years of turnout time data using the same filtering mechanisms as previously noted. It is shown as a fractal time ranging from 90% to 70% for emergency medical calls and fire-related calls.

Raleigh Baseline Turnout Time

	90%	80%	70%	Avg.
Turnout Time - EMS	1:52	1:34	1:22	1:10
Turnout Time - Fire	2:02	1:44	1:32	1:16

For the past three years combined turnout time for medical calls was 1 minute and 52 seconds for 90% of the calls and 1 minute and 34 seconds for 80% of the calls.

This table illustrates the achievable incremental improvement to the turnout time segment of the response time continuum. For example, improving the 90% fractal time from 1 minute and 52 seconds to 1 minute and 34 seconds represents a 10% improvement. As well, reducing the 90% fractal time to 1 minute and 22 seconds would represent a 20% improvement. Incremental improvements are measurable and provide a baseline to measure those improvements.

Recording the time a unit begins its response is a function of the dispatch center and the dispatcher handling the call. The process is for the unit to notify the dispatcher of the response and the dispatcher then records or time stamps the enroute time. It is possible for the dispatcher to be handling several issues simultaneously resulting in a delay in the recording of the enroute time. It is also possible for the unit to be delayed in notifying the dispatcher of the response due to other radio traffic or other issues that may be occurring simultaneously. The times and variances illustrated above is the first step to identify any issues or problems with how response times and unit performance is currently captured and reported. The next step is to establish guidelines for accurately capturing the turnout time performance and identify those times when the turnout time is beyond established thresholds. This will allow for the evaluation of the problem, identify if it is a data issue, an operational issue, or other technical problem and get the process further refined to improve the reliability of the data.

As illustrated previously, the RFD is performing below benchmark performance standards. This is controllable and improving performance should be a priority for the Department. Improvement to the turnout time component can take several forms. Some departments have installed timers in the station at the apparatus bay doors that indicate the amount of time that has elapsed since the dispatch was received. This allows the

crews to instantly see their turnout time performance and according to some departments has helped to improve their turnout time. Also requiring the on-duty crews to place their gear at or on the apparatus instead of leaving it in lockers or other location within the station can improve efficiency in the turnout process.

Other remedies include the posting of turnout time by station and by shift. This allows the company officer to see the results and work to improve the turnout time of his or her units. Some departments have instituted a process to hold the company officer accountable for excessively long turnout times by creating a written report as to why the turnout time was excessive. This could be established using the current baseline turnout time as a trigger point to generate a time variance report.

Another option is to establish a standard operating procedure as to when a unit is to place themselves enroute. For example, one shift will place themselves enroute from the living quarters while another shift will place themselves enroute once they are on the truck. Still yet, another shift may wait until they have cleared the bay doors, all of which will vary the reported turnout time and possibly skew the data related to actual performance. Establishing a procedure will improve the accuracy of the data.

The use of the mobile data terminal (MDT) to place a unit enroute electronically records the enroute time, eliminating the need for the dispatcher to place a unit enroute. Busier communications centers can delay the recording of an enroute time for a unit as there may be multiple units calling or other calls that may take priority. Using the MDT is not without its issues either. It does not allow the other units in the system to hear that a unit is in fact responding. For example, there are multiple units responding to a fire call and the officer in charge needs to know what units are responding and with MDT's the only way to see responses is to look at the computer screen, which is not a safe option while driving. Reliability issues with the MDT system can also pose another hurdle. Questions of has the MDT connected to the system properly and has the MDT recorded the enroute or on scene keystroke. There are some departments that will mark the units enroute on the MDT and then announce themselves over the radio, so all personnel know what unit is responding. It does create a dual action, but it also enables the capture of the true enroute time.

Recommendations:

Formally establish procedures to record the time when units are enroute to a call identifying the point in the process they are to record the time.

Formally establish a baseline performance objective for turnout times of 78 seconds tor emergency medical calls 90% of the time.

Formally establish a baseline performance objective for turnout times of 1 minute and 44 seconds to fire related calls 90% of the time.

Work with the communications center to ensure the procedures and processes are adequate for capturing accurate time stamps.

Install timers in the stations at the apparatus doors to indicate the elapsed time from dispatch.

Post the turnout time performance monthly by station and by shift at each station for the crews to see their performance.

2. Concentration of Resources

(1) Current Staffing Levels

The Operations Division has 28 fire stations in 5 Battalions to deliver services to the City. Overall management of the Division is handled by an Assistant Chief and three Division Chiefs. Operationally, 15 Battalion Chiefs handle the day to day operations with the staffing as outlined below:

	Capta	ins	Lieuter	nants	Firefigl	nters
	Authorized	Current	Authorized	Current	Authorized	Current
Battalion 1	18	18	18	18	47	42
Battalion 2	21	21	24	22	66	58
Battalion 3	27	27	30	30	66	64
Battalion 4	24	24	27	27	45	42
Battalion 5	27	27	30	30	62	60
	117	117	129	127	286	266

Operational Staffing

(2) Analysis of Staffing Levels

As previously outlined, there are critical tasks that need to be completed to effectively and efficiently mitigate an incident. The table below is a summary of the personnel needed for the various risk types.

	Maximum Risk	High Risk	Moderate Risk	Low Risk				
Total Personnel	50-51	21-22	14-15	8-9				
	Critical Tas	sks for Effective Patie	nt Care					
	Cardiac Arrest Stroke Multi-System Trauma							
Total per Patient	6 - 8	5 - 7	6 - 8					
	Critical Ta	sks for Hazardous Ma	aterials					
	High Risk	Low Risk						
Total Personnel	15	13						
	Critical Tasks for I	nitial Wildland Urban	Interface Fires					
	Non-Hydrant	With Hydrants						
Total Personnel	12	6						
Critical Tasks for Technical Rescue Incidents								
	Swift Water	High/Low Angle	Confined Space	Trench				
Total Personnel	14	14	14	14				

Critical Tasks for the Effective and Efficient Control of Structural Fires

The issue for the Fire Department is the number of personnel for high rise operations and the older building stock in the downtown section of the City. From a structure fire risk profile, these buildings will be maximum risk and high-risk structures requiring a minimum initial response force of up to 50 personnel to effectively deal with a working fire in these structures. Additionally, the downtown section of the City has numerous older buildings, some of which are being renovated. These types of buildings present a unique challenge to the fire service that requires a larger response. For 2nd alarm and greater alarm fires, there will be the need for additional personnel beyond the initial response force. The map below illustrates the number of personnel arriving on the scene of a call for service within the baseline travel time of 10 minutes and 24 seconds.



There is a small section of Station 1 in the downtown area that can achieve the number of personnel required for a maximum risk structure fire. Other areas can achieve a large number of personnel primarily along the interstate highways in the City.

Improving the concentration of resources will require the addition of personnel. The current staffing plan has a minimum staffing of four firefighters for a Ladder Company and three firefighters on an Engine Company. Increasing the minimum staffing on the Engine Companies to four firefighters improves the response capabilities in this area.

Stations 1, 2, 3, 5, 7 and 20 are the six stations that encompass the downtown area and Dorothea Dix Park. NC State University is also within the boundaries of these six stations. The minimum staffing of these stations is shown in the table below.

Existing Minimum Staffing	Proposed Minimum Staffing	Projected Year
3	4	2021
3	4	2021
4	4	
3	4	2025
3	4	2022
3	4	2022
3	4	2026
3	4	2025
4	4	
	Existing Minimum Staffing 3 4 3 3 3 3 3 3 3 3 4 3 4	Existing Minimum StaffingProposed Minimum Staffing343434343434343444

Minimum Staffing Changes

The existing minimum staffing for these six stations is 29 personnel. Increasing the minimum staffing of the Engine Companies shown above from 3 personnel to 4 personnel, increases the overall minimum staffing of this group of companies to 36 personnel. Staffing changes to these companies not only helps increase the available resources to the downtown area but also improves the availability of resources to other areas along the outskirts of the downtown area. The map below illustrates the concentrations of resources with the additional staffing.



The additional personnel added to those seven companies improves the concentration of resources over a wider section of the downtown area. This is the area that is projected to have a larger number of maximum and high-risk structures in the form of high-rise buildings. Increasing the number of personnel in this area will provide the resources necessary to effectively mitigate the incidents. Additionally, there is improvement to other areas in terms of personnel and resources - the corridor to the west through the NC State Campus and along the I-40 and I-440 corridors. These areas have also been active in new commercial development.

The first step to ensuring an effective response force is the completion of Stations 6 and 11 renovation and rebuild. While these stations are not within the downtown core, they are critical in terms of achieving and maintaining appropriate travel time and the effective

response force performance and support to the fire protection system. Station 6 has been under construction for the past three years and having an effect on the response time to the area to the north of the downtown area. Station 11 is also in the same area along I-440 and will have an effect on the response time and effective response force performance. Both stations contribute a total of ten personnel to the effective response for the area.

The next step is to add personnel to the seven companies in a phased approach based on the development of the area and the increase in high rise structures. The table below outlines this phased approach.

Steps	Timing	Additional On-Duty Staff
Step 1	3 High Rise Buildings	Add 2 Firefighters
Step 2	6 High Rise Buildings	Add 1 Firefighter
Step 3	9 High Rise Buildings	Add 1 Firefighter
Step 4	12 High Rise Buildings	Add 1 Firefighter
Step 5	15 High Rise Buildings	Add 1 Firefighter
Step 6	18 High Rise Buildings	Add 1 Firefighter

Recommended Personnel Additions and Timing

This plan increases the staffing of these six stations with every three high-rise structures occupied. In the first step, as recommended in the 2020 staffing plan, 2 personnel are added to account for the existing inventory of high-rise structures and the older construction found in the downtown area. Adding additional personnel according to this approach, allows the City to ensure that when there is a build out of the area, resources are added as it occurs.

In the previous chapter, the unit hour utilization rates were projected. The following table highlights those companies that are projected to be at or over capacity in the next 20 years.

Unit	2018	2020	2025	2030	2035	2040
Engine 12	10.6%	11.4%	12.4%	13.3%	14.3%	15.3%
Engine 11	9.9%	10.9%	11.8%	12.7%	13.7%	14.6%
Engine 19	9.2%	10.2%	11.1%	11.9%	12.8%	13.7%
Engine 8	9.2%	9.6%	10.4%	11.2%	12.0%	12.8%
Engine 15	9.0%	9.8%	10.6%	11.4%	12.3%	13.1%
Engine 3	8.7%	9.7%	10.5%	11.4%	12.2%	13.0%
Squad 7	8.2%	9.2%	10.0%	10.7%	11.5%	12.3%
Engine 10	7.7%	7.9%	8.5%	9.2%	9.9%	10.5%
Engine 2	7.5%	7.8%	8.4%	9.1%	9.7%	10.4%
Engine 16	7.5%	9.0%	9.8%	10.5%	11.3%	12.0%
Engine 9	7.4%	8.4%	9.1%	9.8%	10.5%	11.2%
Engine 21	6.7%	8.0%	8.7%	9.4%	10.1%	10.7%
Engine 1	6.6%	7.7%	8.3%	9.0%	9.6%	10.3%
Ladder 2	6.5%	7.0%	7.6%	8.2%	8.8%	9.4%

Unit Hour Utilization Projection

These rates are based on the projected call volume and uses the current average time for each call. As the committed time approaches and exceeds 10%, there is the likelihood the unit will not be capable of meeting a 90% performance objective increases, due to the fact that more than 10% of the time a unit from another station must respond to handle calls while the unit is engaged in emergency response activity. These increases in utilization rates and a corresponding increase in response time may indicate the need for an additional engine company to be added to the station. This will require the fire protection system to be reassessed at regular intervals to ensure the system is performing as desired.

Recommendations:

Increase the minimum staffing of seven engine companies in the downtown area from three personnel to four personnel to increase the resources necessary for maximum and high-risk structure fire responses based on the phased-in schedule to be distributed to these stations. Begin with adding eight (8) FTE Firefighters to increase staffing of engines 1 and 13 in FY 2021.

Completion of the renovations to and rebuilding of Stations 6, 11, and 22 is imperative to ensure adequate resources are available for the fire protection system.

Monitor call demand and response performance to determine the need for additional resources.

7 Office of the Fire Marshal

This chapter of the report provides the project team's evaluation of the overall staffing and organization of the Office of the Fire Marshal, which is responsible for conducting plan reviews, conducting new construction and recurring occupancy inspections, maintaining plan review and inspection records, conducting life safety education programs, and investigating suspicious fires in the City of Raleigh.

1 Current Staffing Levels

The Office of the Fire Marshal has four (4) operational units, each with specific job responsibilities. These include: Administration, Field Inspections, New Construction and Fire Education. The Assistant Chief (Fire Marshal) provides the overall direction and management of the division.

The following sections provide the current staffing and analysis of the staffing needs related to each area of the Office of the Fire Marshal.

(1) Administration

Administration consists of the Assistant Chief (Fire Marshal), Captain (Fire Investigator) and Administrative Specialist.

Position	Authorized	Filled
Assistant Chief (Fire Marshal)	1	1
Captain (Fire Investigator)	1	1
Administrative Specialist	1	1
Total Personnel	3	3

As illustrated above, a total of three (3) personnel are assigned to the administrative unit of the Office of the Fire Marshal.

(2) Field Inspections

The Field Inspections unit consists of three (3) Assistant Fire Marshals and 20 Deputy Fire Marshal's assigned to field inspections. The responsibility for inspections is broken down geographically with an Assistant Fire Marshal assigned to the West, Southeast and North portions of the City. The Following table illustrates the authorized and current staffing levels.

Position	Authorized	Filled
Assistant Fire Marshal	3	3
Deputy Fire Marshal	20	19
Total Personnel	23	22

As illustrated above, the Field Inspections unit is currently authorized 23 personnel with current staffing levels at 22 personnel.

(3) New Construction

The New Construction unit consists of one (1) Assistant Fire Marshal, four (4) Deputy Fire Marshal (Plans Examiner) and five (5) Deputy Fire Marshal Field Inspections. The following table illustrates the authorized and current staffing levels.

Position	Authorized	Filled
Assistant Fire Marshal	1	1
Deputy Fire Marshal (Plans Examiner)	4	4
Deputy Fire Marshal (Field Inspections)	5	5
Total Personnel	10	10

As illustrated above, the New Construction unit is currently authorized and staffed with10 personnel.

(4) Public Education

The Public Education unit consists of one (1) Deputy Fire Marshal and one (1) Senior Firefighter that is borrowed from the Operations Division. The Following table illustrates the authorized and current staffing levels.

Position	Authorized	Filled
Deputy Fire Marshal	1	1
Senior Firefighter	1	1
Total Personnel	2	2

As illustrated above, the Public Education unit is currently staffed with two (2) personnel.

2 Analysis of Staffing Levels

To assess the adequacy of staffing levels in the Office of the Fire Marshal, the project team utilized a number of quantitative and qualitative indicators and obstructions, which

were used to determine the appropriate staffing levels for providing fire prevention services in the City of Raleigh. The findings related to the workload indicators are as follows:

- The Office of the Fire Marshal has developed a "dashboard" to measure performance against established objectives
- Plan reviews are occurring according to established timelines 99.3% of the time.
- New construction inspections are occurring within one (1) business day of request over 99% of the time.
- There are between 8,500 12,100 mandated State required fire inspections annually. The Department completed all mandated inspections in 2018. These occupancies fall on either a 1, 2, or 3-year cycle.
- The field inspectors have not conducted follow-up inspections due to the focus on meeting State mandates. Currently there are over 30,000 violations requiring a follow-up inspection.
- The spans of control for the Assistant Chief (Fire Marshal) are excessive at 7:1, which does not allow for long term planning for the Division.
- There is no representation from the Office of the Fire Marshal on the City's Special Projects Team.
- There is only one (1) permanently assigned life safety educator in the Division. A Senior Firefighter is being borrowed from Operations to assist in public education efforts.

1. Administration

Nationally recognized best practice for span of control in highly technical and professional positions is to limit direct reports typically from five (5) to six (6) positions, There are seven (7) direct reports assigned to the Assistant Chief (Fire Marshal). The span of control is being stretched, which causes the Fire Marshal to allocate too much time to supervising and supporting day to day operations with little time to focus on longer-term and strategic planning for the Division. There is also the issue of frequent rotation among the Assistant Chiefs. These positions are rotated every three years, which makes consistency in leadership and planning in the Fire Marshal's Office difficult, as it is difficult to plan and

implement programs in this period of time. Adding a Division Chief (Fire Marshal) position would both reduce the span of control to the Fire Marshal to three (3) direct reports and allow more consistency for long term planning and program implementation. This would also align the structure of the Office of the Fire Marshal with that of the other Divisions in the Fire Department.

The following chart illustrates the organizational structure with the addition of the Division Chief position:



Recommendation:

Authorize a FTE Division Chief position in the Office of the Fire Marshal

2. Field Inspections

Using the number of inspections conducted as a workload indicator varies by agency. This is due to the fact that as the complexity and size of the occupancies vary, each will require a different amount of time to inspect properly. The project team evaluated the mandated inspections conducted by RFD prevention personnel in FY 2017, 2018 and 2019 and used the three-year average to determine appropriate staffing levels. Target workloads are based on our experience working with hundreds of agencies across the United States. For Raleigh, these were on the lower end of typical targets due to the fact

that each building is counted as an inspection, regardless of the number of occupancies inspected in the building.

				Matrix		
Inspection/Permit Type	FY 2017 Conducted	FY 2018 Conducted	FY 2019 Conducted	Target per Staff	Current Staff	Staff Needed
Mandated Inspections	12,071	9,364	8,437	750	20	19.91
Re-Inspections	1,679	2,763	4,734	3,000	0	2.04
Total Inspections	13,750	12,127	13,171	3,740	20	21.94

As illustrated above, there is currently the need for 20 inspectors to be able to effectively handle the target of 750 building inspections annually. It is important to note that this is a total building envelope target, regardless of the number of occupancies in the building. Records also indicated a total of over 30,000 open violations that require re-inspection or an average of 10,000 violations annually. A single occupancy may have any number of violations, which accounts for this total. Follow-up inspections are not as time consuming as initial mandated inspections as re-inspections are targeted to specific violations and not all occupancies in a building will need to be inspected. Current field inspectors were able to average follow-up inspections on 3,059 of the 10,000 average open violations over the 3-year period. This leaves approximately 6,900 open violations requiring a follow-up inspection. Using the figures above, there is a need for an additional 2.3 inspectors to conduct follow-up inspections. The project team recommends the addition of three (3) field inspectors to conduct these follow-up inspections.

Recommendations:

The City should authorize three (3) additional FTE Deputy Fire Marshals to the field inspection function to conduct follow-up inspections on violations found in existing occupancies.

Continue to monitor the growth in the City and add an additional Deputy Fire Marshal (Inspector) for each 750 occupancies requiring a mandatory inspection constructed in the City.

3. New Construction

For the New Construction unit, the workload measures include the number of plan reviews and inspections of new construction in the City. The complexity of the construction project will vary the time required to conduct a plan review and the number of inspections required of life safety and fire systems during the construction process.

(1) Plans Examiners

The following table illustrates the number of plan checks conducted in FY's 2017, 2018 and 2019:

				Matrix		
	FY 2017	FY 2018	FY 2019	Target per	Current	Staff
Plan Reviews	Conducted	Conducted	Conducted	Staff	Staff	Needed
Plan Reviews	5,613	4,880	5,287	1,300	4	4.05

As illustrated above, the plans examiner personnel averaged 5,260 plan checks each year during the 3-year period. With a target of 1,300 plan checks per reviewer annually, this equates to a need for 4.05 plans examiners. The current staffing of 4 is adequate to meet the needs of the Department. Also, the data illustrates that plans are reviewed according to established timelines nearly 100% of the time, which indicates the staff are able to handle the workload.

Recommendation:

Continue to monitor the growth in the City and add an additional plans examination staff when submittals exceed 6,000 annually.

(2) New Construction Inspectors

The following table illustrates the number of new construction inspections conducted in FY's 2017, 2018 and 2019 by the Raleigh Fire Department.

Category	FY 2017 Conducted	FY 2018 Conducted	FY 2019 Conducted
Approved	3,695	4,140	4,439
Conditional Approval	2,550	2,311	2,348
Rejected	215	289	278
Roll	220	47	88
Total	6,460	6,740	7.065

				Matrix		
	FY 2017	FY 2018	FY 2019	Target per	Current	Staff
New Construction	Conducted	Conducted	Conducted	Staff	Staff	Needed
Inspections	6,460	6,740	7,065	1,250	5	5.4

As illustrated above, the new construction inspection personnel averaged 6,755 new construction inspections each year over the 3-year period. A benchmarking target of 1,250 inspections per new construction inspector was used to determine the required staffing level for these positions. This equation resulted in the need for 5.4 new construction inspectors.

The City has formed a "Special Projects Team" in response to the demand from the developers in the City to provide more timely review services for critical projects to allow them to be "fast tracked" through the permit, plan review and inspection process. As, illustrated previously, there is the need for a partial additional New Construction Inspector based on the current demand for services. Adding this position, and having it responsible for working with the Special Projects Team will ensure the Fire Department is represented on this team and will ensure these projects are able to have representation from all key areas of the City to ensure these projects receive the highest priority. This would alleviate the current inspectors from having to inspect these occupancies and therefore reduce their workload to more manageable levels, allowing for quality inspections in a timely fashion.

Recommendations:

The City should authorize one (1) additional FTE Deputy Fire Marshal to the field inspection function in New Construction and assign this position to work with the Special Projects Team

Continue to monitor the growth in the City and add an additional Deputy Fire Marshal (Inspector) for each 1,250 new construction occupancies requiring a mandatory inspection that are constructed in the City.

4. Public Education

America Burning was published in 1973, and in that report, public education was identified as a major goal for the national fire service. It wasn't until the late 1980's that a few departments became active in the public education and then life safety education became more widespread in latter part of the 1990's. The annual fire loss data clearly illustrates that the increased delivery of these programs along with stricter fire codes has resulted in the reduction of the incidence of fires and life loss due to fire in the country.

In Raleigh, the programming for public education encompasses a variety of individual programs targeting children in schools and the senior citizen members of the community. The delivery of these programs is managed by the Deputy Fire Marshal and delivered by the Deputy Fire Marshal and a Senior Firefighter borrowed from the Operations Division.

The following training topics were presented by Public Education in 2016, 2017 and 2018:

Catagory	2016 Conducted	2017 Conducted	2018 Conducted	3-year
	Conducted	Conducted	Conducted	Average
Buckle Bear	0	0	1	0
Burn Prevention	7	4	6	6
Calling 9-1-1	25	24	16	22
Disaster Preparedness	6	5	1	4
Display	54	75	58	62
Falls	0	9	7	5
Fire Evacuation Drill	9	2	1	4
Fire Extinguisher	4	11	8	8
First Aid/CPR	1	3	2	2
General Fire Safety	125	211	112	149
Public Relations	51	88	62	67
Remembering When	2	7	1	3
Residential Survey	0	0	0	0
Residential Fire Sprinklers	0	0	0	0
Risk Watch	0	0	0	0
Safety Device Installation	5	95	135	78
Special Event	70	56	44	57
Start Safe	0	0	0	0
Station Tour	63	105	85	84
Stranger Safety	0	0	0	0
Vehicle Safety	0	0	0	0
Water Safety	1	0	2	1
Other	12	18	3	11
Total	435	713	544	564

As illustrated above, the fire prevention personnel are engaging the community in a number of topics. General fire safety and station tours were the most common education topics presented over the three-year period.

Category	2016 Conducted	2017 Conducted	2018 Conducted	3-Year Average
Business	42	44	31	39
Civic Group	50	65	41	52
Daycare	51	75	67	64
Healthcare Worker	4	11	0	5
Industrial	2	7	2	4
General Public	119	183	139	147
Religious Group	15	41	12	23
School	79	85	66	77
Senior Group	10	10	10	10
Special Interest	31	39	27	32
Youth Group	28	37	19	28
Mass Media	4	117	6	42
Total	435	714	420	523

The next table illustrates the types of groups programs were presented to each year:

As illustrated above, the general public and school groups were the most common groups presented to over the three-year period.

Finally, the age of participants is illustrated in the following table for each of the three years:

Age Group	2016 Conducted	2017 Conducted	2018 Conducted	3-Year Average
0-4 Years (Pre-School)	12,796	12,058	10,467	11,774
5 – 10 Years (Elementary)	21,349	14,246	16,163	17,253
11-13 (Middle School)	11,431	6,825	6,703	8,320
14-18 (High School)	12,065	6,524	4,594	7,728
19-61 (Adult)	19,897	23,552	28,279	23,909
62+ (Senior)	9,905	23,552	3,834	12,430
Total Participants	87,443	86,757	70,040	81,413

As illustrated, the public education effort had direct contact with approximately 81,413 residents each year since 2016. The majority of contacts occur during school events, public displays and special events. The adult age group had the highest contact and high school aged children the lowest contact.

One area that stands out as an improvement opportunity is the lack of a Juvenile Fire Setter program. This program works closely with youth that have intentionally set fires to provide customized intervention based educational programs to prevent a reoccurrence of the behavior. Successful programs involve the family and include topics such as fire safety education, fire science, consequences of setting fires, burn injuries and decision making. Also, as the senior community grows it will be important to develop educational

topics specific to seniors, such as cooking fires, falls and assistance to ensure their homes are a safe environment for them to live. The Department would benefit from analyzing the types of incidents causing emergency response and develop specific public education programs to reduce their occurrence.

For a metropolitan city such as Raleigh, the budgeting of a single public fire educator is not a common practice. This program should be enhanced over the next several years to ensure specific, targeted life safety education can occur across the community. Assigning a Senior Firefighter to each of the service areas assigned to fire inspectors would greatly enhance the ability for direct contact across the City. This would also allow the Deputy Fire Marshal to focus on developing life safety education programs, scheduling classes and working to enhance the social media presence related to life safety education.

Recommendations:

Continue to develop the public safety education programs and increase exposure of the fire and life safety programs to identified at risk groups in the City.

Authorize three (3) FTE Senior Firefighter positions to conduct life safety education in the City and assign one to each of the inspection districts.

8 Training Division

This chapter of the report provides the project team's evaluation of the overall staffing and organization of the Training Division, which is responsible for providing academy training, career development and the coordination of Hazmat, Urban Search and Rescue (USAR), Emergency Medical Services (EMS) and Logistics for the Fire Department

1 Current Staffing Levels

The Training Division has seven (7) operational units, each with specific job responsibilities. These include: Administration, Academy Training, Career Development, Hazardous Materials, Logistics, Urban Search and Rescue and Emergency Medical Services. The Assistant Chief provides the overall direction and management of the division.

The following sections provide the current staffing and analysis of the staffing needs related to each area of the Training Division.

(1) Administration

Administration consists of the Assistant Chief, Division Chief and Administrative Specialist.

Position	Authorized	Current
Assistant Chief	1	1
Division Chief	1	1
Administrative Specialist	1	1
Total Personnel	3	3

As illustrated above, a total of three (3) personnel are assigned to the administrative unit of the Training Division.

(2) Academy Training

The Academy Training unit consists of a Captain who is responsible for the hiring aspects and preparing for and coordinating the annual fire academy taught by the Raleigh Fire Department. This position is assisted during the Academy by six (6) personnel, typically Fire Lieutenants or Captains that are borrowed from the Operations Division for seven (7) months each year.

Position	Authorized	Current
Captain	1	1
Total Personnel	1	1

As illustrated above, the Academy unit is currently authorized one (1) full time position.

(3) Career Development

The Career Development unit consists of one (1) Captain. This position is responsible for overseeing the Apparatus Operator training program, in-service training, officer development training, administering the promotional exams for Captains and Lieutenants and maintaining the career development manual. The Following table illustrates the authorized and current staffing levels.

Position	Authorized	Current
Captain	1	1
Total Personnel	1	1

As illustrated above, the Career Development unit is currently authorized one (1) full time position.

(4) Hazardous Materials

The Hazardous Materials unit consists of one (1) Captain. This position is responsible for the managerial oversight of the Department's Hazmat program and the Regional response team program. The Following table illustrates the authorized and current staffing levels.

Position	Authorized	Current
Captain	1	1
Total Personnel	1	1

As illustrated above, the Hazmat unit is currently authorized one (1) full time position.

(5) Urban Search and Rescue

The Urban Search and Rescue (USAR) unit consists of one (1) Captain. This position is responsible for the managerial oversight of the Department's Urban Search and Rescue Team and coordination of quarterly team training. The position also manages the regional USAR task force and serves as the task force leader on State activations. The Following table illustrates the authorized and current staffing levels.

Position	Authorized	Current
Captain	1	1
Total Personnel	1	1

As illustrated above, the USAR unit is currently authorized one (1) full time position.

(6) Emergency Medical Services

The Emergency Medical Services (EMS) unit consists of one (1) Captain, one (1) Firefighter and a part-time Assistant EMS Coordinator. This unit is responsible for implementing EMS initial training and continuing education, recertification of Department EMT's, Quality Assurance reviews on Code Blue EMS reports, annual fitness evaluations and Distribution of EMS supplies to the stations The Following table illustrates the authorized and current staffing levels.

Position	Authorized	Current
Captain (EMS Coordinator)	1	1
Firefighter (Deputy EMS Coordinator)	1	1
Assistant EMS Coordinator	.5	.5
Total Personnel	2.5	2.5

As illustrated above, the EMS unit is currently authorized 2 full time positions with an additional part-time staff serving as Assistant EMS Coordinator.

(7) Logistics

The Logistics unit consists of one (1) Lieutenant. This position is responsible for ensuring the facilities and equipment at the training center are properly maintained, building training props and assisting with logistic efforts related to academy classes, continuing education and promotional testing. The Following table illustrates the authorized and current staffing levels.

Position	Authorized	Current
Lieutenant	1	1
Total Personnel	1	1

As illustrated above, the Logistics unit is currently authorized one (1) full time position.

2 Analysis of Staffing Levels

To assess the adequacy of staffing levels in the Training Division, the project team utilized a number of indicators, which were used to determine what impacts there are in appropriately staffing the Training Division to ensure appropriate services can be provided to personnel in the Fire Department. These indicators led to the following findings.

- The Department is a Basic Education Institution (BEI) in the State and required to use internal instructors to teach courses. Currently the Department contracts with Wake Technical College to assist in teaching EMS courses.
- The Department schedules one eight-month academy each fiscal year.
- The Training Division borrows six (6) personnel from the Operations Division to teach in the academy for seven (7) months each fiscal year. These positions are typically at the Lieutenant or Captain rank.
- EMS personnel are currently only conducting Quality Assurance reviews on Code Blue EMS reports. High acuity calls, not Code Blue, are not reviewed for quality of care.
- Career development teaches driver operator and Officer I and II courses. There are limited leadership training opportunities in the Department.
- The Department is providing internet-based training through Target Solutions, which averages 14,800 hours of training for personnel each month.
- There is no formal recruiting effort in place in the Raleigh Fire Department

1. Instructor Staffing

A review of the various units of the Training Division indicated that the units are functioning well in terms of working together to ensure basic services are provided. But there are opportunities to enhance the consistency and quality of services in the Division. Staff in the Training Division have adopted a team focus to ensure they can deliver high quality training programs in the Department. They work well together and provide assistance between units as needed. The overall management of the various units in training is working well. The main issues are related to the impact the Training Unit is having on the Operations Division by borrowing personnel to teach classes for each of

the Units and the use of outside contract instructors.

The project team evaluated the impact on the Operations Division for each of the units to the extent data was available. The following table illustrates this impact:

Unit	Annual Hourly Impact	FTE
Academy	7,840	3.8
Career Development	3,636	1.7
EMS	2,688	1.3
USAR	288	0.1
Hazmat	328	0.2
Total Impact	14,780	7.1

As illustrated above, there is currently the need for 7 FTE instructors in addition to the existing personnel assigned to Training to teach the Academy and continuing education efforts in the Department. These instructors should be sworn personnel with a variety of expertise as needed to train in the various areas of the Division.

Recommendation:

The City should authorize seven (7) instructors for the Training Division. These positions should have a variety of expertise to ensure they can support all the functional training areas to minimize the impact on the Operations Division to provide instructors.

2. Recruiting

Recruiting the right personnel is a critical need of modern fire departments. This takes a focused effort and is currently the role of the Academy Captain as an ancillary duty. There is no focused attention to recruiting for the Fire Department to attract a diverse and qualified workforce. This is in direct contrast to the Police Department, which has dedicated recruiting personnel to attend job fairs and attract applicants.

The best way to reach diverse populations is with direct engagement, which requires more work and capacity than is currently available to the Academy Captain. Staffing in this area will allow the Department to focus targeted efforts, such as social media campaigns, neighborhood outreach and identifying underrepresented populations to target recruitment efforts to events focused on these potential employees.

The City of Raleigh should consider adding a recruitment specialist to the Fire Department to improve this critical area and ensure a diverse candidate pool can be attracted to test
for employment. This position should report to the Academy Captain and can provide assistance with the onboarding of personnel and academy preparation.

Recommendation:

The City should authorize a recruitment specialist for the Training Division. This position should report to the Academy Captain.

3. Emergency Medical Services

Beyond the instructors needed to support the initial and continuing EMS education in the Department, there are two additional staffing needs to improve the effectiveness of this unit.

(1) Assistant EMS Coordinator

The Assistant EMS Coordinator is currently a part-time position that assists with implementation of medical training, orders EMS supplies and medications, distributes EMS supplies to the stations, manages the supply and medication inventory and assists with logistics related to the EMS bike team for City functions.

Upgrading this position would increase the hours available from the current 19.75 to 40 hours per week or an additional 20.25 hours each week. This would allow additional services such as Infectious Control, critical incident debriefing and conducting the annual FIT testing, which has been transferred from the Services Unit.

The scope and importance of the duties of this position exceed what can be accomplished effectively by a part-time employee. A full-time person would allow improved controls on the medical supply inventory as there would be availability for any emergency supply needs on a daily basis. This position would also be available to assist as needed with other demands of the EMS unit.

Recommendation:

The City should convert the current part-time Assistant EMS Coordinator to a fulltime position.

(2) Quality Assurance and Improvement

Currently Quality Assurance (QA) reviews occur only on Code Blue EMS reports. These are incidents involving cardiac or respiratory arrest. There are a number of other high acuity EMS calls that should receive a QA review. These include:

- Serious life-threatening trauma
- Shootings
- Stabbings
- Stroke/CVA
- Automobile extrications
- Chest pain
- Psychological/Suicide

To be effective, the QA/QI process should focus on identifying issues with the quality of care and developing improvement opportunities to improve patient care and outcomes. The focus should not be on punitive measures, but rather developing educational opportunities to improve the quality of care in the delivery of EMS services in the City by having a dedicated position focused on QA and QI. In fact, a May 2018 article in Prehospital Emergency Care Magazine, found that 71% of agencies providing prehospital care had dedicated personnel to the QA and QI function. In order to ensure reports are thoroughly reviewed and quality improvement practices can be implemented, the Raleigh Fire Department should have a position dedicated to this critical function.

Recommendation:

The City should authorize a full-time position focused on quality assurance and improvement of EMS services.

9 Office of the Fire Chief

This chapter of the report provides the project team's evaluation of the overall staffing and organization of the Fire Administration, which is responsible for providing overall guidance and leadership for the Fire Department.

1 Current Staffing Levels

Within the Fire Administration and the Office of the Fire Chief there are five (5) units, each with specific job responsibilities. These include fiscal, information and computer technology, planning, safety, and four (4) Assistant Chiefs that manage the four major Divisions.

The following sections provide the current staffing and analysis of the staffing needs related to each area of the Fire Administration.

1. Fiscal Unit

The Fiscal unit of the Chief's Office consists of the Finance Officer (Senior Fiscal Analyst), supported by a Senior Fiscal Specialist and an Administrative Technician.

Position	Authorized	Current
Senior Fiscal Analyst	1	1
Senior Fiscal Specialist	1	1
Administrative Technician	1	1
Total Personnel	3	3

As illustrated above, a total of three (3) personnel are assigned to the fiscal unit of the Office of the Fire Chief.

2. Information and Computer Technology

This unit of the Chief's Office consists of the Technology Supervisor and two Senior Technology Specialists supported by a Senior Fiscal Specialist and an Administrative Technician.

Position	Authorized	Current
Technology Supervisor	1	1
Senior Technology Specialists	2	2
Administrative Technician	1	1
Total Personnel	4	4

As illustrated above, a total of four (4) personnel are assigned to the computer technology unit of the Office of the Fire Chief.

3. Planning

The Planning unit of the Chief's Office consists of an Engineer – Planning Officer and is responsible for providing a range of administrative and analytical support for the department.

Position	Authorized	Current
Engineer – Planning Officer	1	1
Total Personnel	1	1

As illustrated above, the Planning unit is currently authorized one (1) full time position.

4. Safety

The Safety Unit has one full-time Safety Officer assigned to the Chief's Office. The Safety Officer is responsible for overseeing the department's health and safety program, including assessing the appropriateness of equipment, apparatus, and staffing deployed to incidents, responding to and monitoring safety risks at incidents, and monitoring fitness testing and employee health and wellness programs.

Position	Authorized	Current
Battalion Chief – Safety Officer	1	1
Total Personnel	1	1

As illustrated above, the Safety unit is currently authorized one (1) full time position.

2 Analysis of Staffing Levels

1. Administrative

As previously noted, nationally recognized best practice for span of control in highly technical and professional positions is to limit direct reports typically to five (5) to six (6) positions. The span of control is being stretched to the limit within the Office of the Fire Chief. In this instance, the Fire Chief has eight direct reports, including four Assistant Chiefs. Each of the Assistant Chiefs are responsible for four major functions of the Fire Department.

The most logical move would be to reassign the Technology Unit and the Planning Unit to the Services Division. This would reduce the number of direct reports for the Fire Chief from eight to six making it more manageable. Both of these units have more of a support role to the mission of the Fire Department and would fit well into the Support Services Division. Within the Services Division, the Assistant Chief has one direct report and the Division Chief has four direct reports.

The realigned organization chart for the Fire Chief's Office follows:



The realigned organization chart for the Support Services Division:



Recommendation:

The City should assign the Information and Computer Technology Unit and the Planning Unit to the Services Division to realign the span of control to manageable levels.

2. Fiscal Unit

This unit provides budget and accounting support for the Fire Department. For the budget, they coordinate with the Assistant Chiefs, Division Chiefs, and others to plan the annual budget. Once the planning and submission is completed, they also work with the various Chiefs to monitor and control the expenditures as it relates to the budget.

All purchasing in the Fire Department is managed by this group. They review all purchase requests and assist with the purchases of larger items including contracts to purchase vehicles and equipment. Procurement cards used by the Department, a program that helps to control spending, are managed by this group as well.

Grants, donations, and other similar types of funding are administered by this group. Grant applications are completed and submitted and then, once awarded, managed by this group through to their completion. They generate any reports necessary in compliance with the grants or other forms of funding outside the normal budget.

This group provides assistance with human resources functions in the hiring and processing of new hires. In addition, they provide support for the compilation and preparation of agenda items for the City Council, update and revise the department business plan, and manage all travel expenses for the department.

The unit reported they are able to manage their workload, and other department personnel did not report concerns over the performance of the Fiscal Unit negatively impacting department operations. Based on current policies and processes, the staffing level in the Fiscal Unit seems to be adequate to perform existing duties.

3. Information and Computer Technology

This section is responsible for maintaining the information technology systems of the Fire Department, along with maintaining the records management systems and related functions. This includes all information technology services support for the department, including its facilities, vehicles, equipment, including hardware and software. Staff provide service and network maintenance, programming support, and database administration, in addition to managing and responding to requests for assistance submitted through a digital help desk. In 2018 there were 3,154 requests for assistance from the digital help desk.

The digital help desk requests in 2018 amounts to about 132 requests per specialist a month. Technology staff indicated they were adequately staffed to handle their workload, and other personnel in the department did not report any concerns over the performance of the Technology Unit as it might relate to their staffing levels. Based on current processes and comments, the staffing level in the Technology Unit seems to be adequate to perform existing duties

4. Planning

Responsibilities for this unit include managing the Capital Improvement Plan in coordination with City Engineering Services, managing the vehicle replacement schedule, updating department wide policies and procedures, assisting the Fiscal unit with grant

applications, managing the department's business plan, and conducting analytical and geospatial assessments for strategic planning.

The current workload for this position is technical in nature and stretches across several platforms and different skill sets. Managing the capital improvement program and vehicle replacement schedule is one area and then handle the geospatial assessments is a different skill set. In addition, there is a review process for the administrative and operational procedures that requires about 30 policies per year to be reviewed. These functions can be somewhat time consuming as there are numerous other individuals that are involved in the processes. Adding an analytical position would aid in the workflow and streamline some of the processes.

Recommendation:

Authorize an analytical position to assist the Planning Officer in carrying out complex analytical assignments

5. Safety

Safety initiatives began in the early 1990s and continue to be in the forefront of the fire service. The safety initiative began with operations at emergency scenes and now includes fire station safety, health and wellness programs, including heart and respiratory health. The most recent initiative is cancer prevention that includes several operational procedures to reduce the exposure to cancer causing agents.

Cancer initiatives include turnout gear washing, gross decontamination at the scene of the emergency, and clean apparatus cabs where the turnout gear and self-contained breathing apparatus is stowed in a separate compartment. All of these programs are managed by the department Safety Officer.

A part of the critical tasks for the response to emergency calls for service includes a safety officer. In some smaller incidents, such as an auto accident response or other single company response, this role is retained by the incident commander. Once the response involves multiple companies and the incident grows larger and more complex, a dedicated safety officer must be assigned the role. It is also possible to have multiple safety officers on the same incident depending on the complexity and size of the incident. The table below illustrates the type and number of incidents that a dedicated safety officer would typically respond.

Potential Safety Officer Calls				
	2016	2017	2018	Total
Structure Fire	191	176	222	589
Rescue Calls - Extrication	240	240	254	734
Hazardous Materials	14	8	13	35
Rescue Calls - Water	29	11	17	57
Total Calls	474	435	506	1,415

Current staffing of this position does not allow for the safety officer to respond to these incidents. In fact, based on the RMS data, the Safety Officer responded to one call in 2016, one call in 2017, and two calls in 2018. Within the current response protocol of the Fire Department, either the Incident Commander retains this responsibility or must remove someone from another task to handle the safety aspects.

To provide coverage for a single shift it will require 1.3 people based on the average paid time off provided by the City. The calculation is illustrated below.

Three Platoon Work Schedule

Single Position		
123	Shifts for one Position	
12	Sick Leave	
0.5	Petty Leave	
4	Other Leave (workers com, jury, FMLA, Military)	
15	Paid Time Off - Avg.	

- 91.5 Shifts Available to work
- 1.3 People to cover 123 shifts

This translates to having 1.3 FTE's per shift for each position to ensure adequate coverage. These positions would report to the Safety Officer as shown in the revised Administrative Organizational Chart. These positions would also be available to assist the Safety Officer with other administrative duties and functions.



Recommendation:

Authorize three (3) FTE Safety Officers, one on each shift, to respond to calls for service and to support the Fire Department Safety Officer with monitoring and investigating accidents or incidents causing damage or injury.

10 Services Division

This chapter of the report provides the project team's evaluation of the overall staffing and organization of the Services Division, which is responsible for providing maintenance and supplies to the department.

1 Current Staffing Levels

The Services Division has three (3) operational units, each with specific job responsibilities. These include: Facilities, Supplies, and Apparatus and Equipment. The Assistant Chief provides the overall direction and management of the division.

The following sections provide the current staffing and analysis of the staffing needs related to each area of the Services Division.

1. Facilities

The Facilities unit within the Services Division consists of a Lieutenant – Facilities Manager and is responsible for managing the maintenance and repairs to the physical facilities operated by the Fire Department.

Position	Authorized	Current
Lieutenant – Facilities Manager	1	1
Total Personnel	1	1

As illustrated above, the Facilities unit is currently authorized one (1) full time position.

2. Supplies

The Supplies unit within the Services Division consists of a Fire Services Assistant and Fire Services Coordinator. The unit is responsible for managing the inventory of uniforms, protective gear and station supplies used by the Department.

Position	Authorized	Current
Fire Services Assistant	1	1
Fire Services Coordinator	1	1
Total Personnel	2	2

As illustrated above, the Supplies unit is currently authorized two (2) full time positions.

3. Apparatus and Equipment

The Apparatus and Equipment unit within the Support Services Division consists of a Garage Supervisor, five mechanics, and an inventory specialist.

Position	Authorized	Current
Garage Supervisor	1	1
Fire Equipment Mechanic	5	5
Inventory Specialist	1	1
Total Personnel	7	7

As illustrated above, the Apparatus and Equipment unit is currently authorized seven (7) full time positions.

2 Analysis of Staffing Levels

1. Facilities

The Department has 28 fire stations, a support services facility, a training facility, and administrative facilities and offices. Maintenance and repairs for these facilities include structural components, interior components that also includes appliances, and exterior items such as landscaping. Work requests and orders are submitted through a computer management system. The work orders and requests are then managed by the Facility Manager to ensure all requested items are repaired or otherwise resolved.

Additionally, the Division works with the City Engineering Services Department regarding all renovations and new construction of Departmental facilities. The City has been renovating and rebuilding fire stations over the past few years and currently there are three stations being rebuilt. This includes demolition of the existing structure and a newly constructed building in its place. The Assistant Chief and Division Chief handle most of these issues.

2. Supplies

Within this section there are several functions including station supplies, minor tools and equipment for apparatus, and uniforms and turnout gear for the personnel. Included in the station supplies are small furniture items and general supplies used in the station.

Equipment for apparatus includes items such as self-contained breathing apparatus, thermal imaging cameras, nozzles, hose, and portable ladders. Uniforms and personal protective equipment (PPE) items are also purchased and maintained by this section. Typically, 125 sets of PPE are replaced annually plus an additional 50 sets that are purchased for destroyed gear and promotions.

A small warehousing area is utilized for uniforms, PPE, station supplies, and other small equipment items. Additional storage and warehousing are available using storage containers scattered throughout the complex. Inventory of all items is done twice a year with one being an informal count and the second one in June being a formal count of everything. Inventory control duties are split between the Fire Services Coordinator and the Fire Services Assistant. Light duty personnel, if available, will work on the inventory controls. However, there are times when there is no one available to provide assistance to employees needing supplies or equipment and no control or accounting for what may be taken or for what purpose.

For the general station supplies, the fire department uses an outside vendor to maintain those supplies and includes inventory controls and delivery of those supplies. This system works well for the Department and reduces the time necessary for someone to maintain the station inventory and deliver those supplies to the station.

To put the supplies section into perspective, they average about 2,200 requests per year from the stations. This averages 14 requests per day and each request may have as many as 12 or more items for supplies, small equipment items, or maintenance items. This requires an individual to acquire the items, perform the necessary inventory controls, and deliver these items or services to the station for each of the average 14 requests per day.

3. Administrative Support

In the Facilities Unit and the Supplies Unit there are three (3) FTE's to manage these functions and provide services to the Fire Department. There is no clerical or administrative support for any of the functions in either of these units. All financial reports, maintenance reports, and other clerical functions are currently handled by the individuals responsible for the various functions. As previously noted, inventory controls are not well managed and need to be improved.

The addition of two (2) clerical or administrative support positions would support the Division as a whole. This will allow for better inventory controls, improve records

management, including testing and maintenance records, and improve financial reporting and controls.

Recommendation:

Authorize two FTE clerical positions to the Support Services Division, one in FY 2021 and one in FY 2022, to provide administrative support and to assist in the management of inventory items.

4. Apparatus and Equipment

The Fire Department operates a diverse fleet that includes large fire apparatus, pickups, utility vehicles, vans, sedans, support equipment, landscape equipment, trailers, and various rescue tools.

Maintenance of fire apparatus, specialized vehicles, and trailers utilized by the fire department is handled by five mechanics, a garage supervisor, and an inventory specialist. Maintenance for the staff vehicles is outsourced to allow the mechanics to concentrate on the larger apparatus. For the larger apparatus, there is a six-month service and an annual service. The six-month service is generally a mechanism for the mechanic to physically see the truck, clear any deferred repairs, and to inspect the truck for other deficiencies. These typically take one to two days to perform. The annual service is the same as the six-month service except all the fluids are changed and major repairs are also handled. Annual service procedures could take a couple of days up to a couple of weeks depending on the number and severity of the repairs. Ladder trucks could take four days to four weeks depending on the repairs. The schedule is generally 10 trucks per month, 5 for a six-month service and 5 for an annual service.

The on-call mechanic for the weekends and weeknights utilizes overtime to provide the service on an as needed basis. There is no mechanism for a mobile mechanic to provide service to the apparatus in the stations.

A. Staffing

A process known as vehicle equivalent unit (VEU) calculation is used to equate the level of effort required to maintain dissimilar types of vehicles to a passenger car, which is given a baseline VEU of 1.0. Our work with other fleet organizations has shown that a VEU of 1.0 is equal to between 10 and 15 annual maintenance labor hours, depending upon a number of factors unique to each organization. All other types of vehicles are allocated a VEU value based on their relationship to a passenger car. For example, an emergency services vehicle (such as a police/fire car or light truck) is given a VEU of 2.5. This means that these vehicles on average require more than double the annual maintenance hours of an administrative passenger car. This is due to all of the accessory equipment and electronics that are added to emergency vehicles, the severe nature of their use, and the relative high amount of idling.

For this project, we assigned a VEU for each make and model of vehicle. The 96 active vehicles in the fleet total 667 VEUs. Therefore, the Support Services Division is responsible for maintaining a fleet that is the equivalent of 667 sedans. The following table summarizes the VE calculations:

Туре	Units	VEU/Unit	Tot VEU
Ladders/Pumpers	54	10	540
Rescues	8	6	48
Cars and Light Trucks	30	2.5	75
Misc. Equipment	4	1	4
Total	96		667

Vehicle Equivalent Units per Vehicle Type

The next step in our analysis is to determine the number of labor hours required to maintain one VEU. The baseline is 10 hours per year, but adverse or challenging conditions can increase this to 15 or in extreme situations even more. Conversely, good conditions can drive labor demand down by a material level.

In making a determination relative to where an organization falls on the range of hours per VEU, we consider a number of factors that are unique to the fleet. These factors include fleet age and condition, usage levels, overall operating environment, and other factors. For the Fire Department, we determined the labor factor required to properly maintain the fleet is 15 hours per VEU. Our assessment is based on the following considerations:

- Utilization levels in an emergency services fleet are high and the type of use is severe.
- The apparatus is becoming more sophisticated with the various safety features and electronic requirements from the manufacturers and the standards the apparatus is required to meet.

• Technological changes to the engine and drivetrain have increased the workload such as the diesel exhaust fluid (DEF) systems.

Once we have calculated the number of VEUs in an organization's fleet we need to assess the productivity of maintenance staff. While a fleet mechanic's salary is based on 2,080 hours per year (52 weeks x 40 hours per week), only approximately 1,430 labor hours per year (69% of annual hours) are available to perform actual maintenance work (the remaining payroll hours are lost to vacation, sick time, holidays and indirect time such as training and meetings). Therefore, a fleet mechanic can be assigned a total of about 95 VEUs per year (1,430 hours available per year divided by 15 hours per VEU). The following table shows how we calculate this figure.

Payroll Days/Hours/Year	260/2,080	
Hours paid but not at work	Days/Year	Hours/Year
Holidays	12	96
Vacation	15	120
Sick Leave	12	96
Other leave (workers comp, jury, FMLA, Military, etc.)	4	32
Total Paid Time Off	43	344
Hours at Wark but Nat in the Shan		
Reason	Davs/Year	Hours/Year
	- Duys/Tear	10013/1001
Training	5	40
Meetings	5	40
Admin paperwork	5	40
Total Indirect/Day	15	120
Hours in the Chan but Not Working on Vahieles During Stands		
Hours in the Shop but Not working on vehicles During Standa	ru o nr. Day	
Reason	Hours/Day	Hours/Year
Breaks	0.5	108.5
Cleanup/Waiting	0.3	78
Total Indirect/Day	0.8	186.5
Total Expected Direct Hours % Direct		1,430 69%

Mechanic Productive Hours

The following table provides a summary of the staffing analysis described in the preceding paragraphs. Labor demand of 3,124 is the number of hours required to provide maintenance services to the fleet (Total VEU x 15 labor hours per unit).

	Hours	FTE
Labor Demand	10,005	7.0
Base Labor Available	7,148	5.0
Deficit	2,858	2.0

Summary of Staffing Requirements

The Fire Department has been filling this gap for the past several years by outsourcing the work on the staff vehicles in order to concentrate on the apparatus and larger vehicles in the fleet.

Deferred repairs are generally handled during one of the two service intervals. These items can extend the amount of time the units are out of service for the scheduled maintenance appointments. A mobile mechanic is an option to handle these smaller items and to minimize the down time during the scheduled maintenance. It would also allow for other maintenance issues to be corrected letting the units to remain in service.

The addition of two new mechanics will improve the turnaround times for repairs on apparatus and allow the new and existing mechanics to take over the servicing of staff vehicles, which is currently outsourced.

Recommendation:

Authorize two additional mechanics to the Support Services Division to improve the maintenance and repair of apparatus and other motorized equipment, including staff vehicles.

11 Projections

This chapter provides background information related to the anticipated development and growth of the City of Raleigh. As well, the potential increases in the workload of the Fire Department.

1 Introduction of the Projections Methodology

Raleigh has experienced significant growth over the past decade and is expected to continue to grow over the next 20 years, primarily with a combination of infill and mixed-use development, along with new single-family developments outside of the core downtown, University, and Dorothea Dix Park areas.

The following sections provides a plan for the department over the 20-year planning horizon by projecting future fire protection needs based on current recommended staffing and forecasted service needs. Followed by the specific staffing levels that the Raleigh Fire Department will need to maintain its desired service level to the community.

(1) Data Collected to Conduct the Projections Analysis

The project team collected data from a number of sources in order to project both population and service needs over the next decade, including the following:

- 2010 U.S. Census data at the individual block level, which includes both population and housing unit figures.
- 2016 American Community Survey (ACS) prepared by the U.S. Census Bureau at the block group level of geography, including estimates for population and housing units.
- Population projection models for the City of Raleigh, Capital Area Metropolitan Planning Organization (CAMPO), and Triangle J Council of Governments.
- Permits issued for both residential and non-residential construction, running from 2016 to 2018.
- 2016 2018 computer aided dispatch (CAD) data, which includes geographic point coordinates to spatially isolate concentrations of community-generated calls for service.
- 2016 2018 call data, which includes addresses.

- Fire Battalion areas and station locations.
- GIS (geographic information system) shapefiles showing current land use and zoning designations.

The data collected was integrated into a GIS (geographic information systems) format in order to spatially analyze historical, current, and future growth trends.

(2) Establishing a Common Level of Geography

For the planning analysis to be accurate and ultimately successful, it is critical that, as much as possible, individual service environments are projected based on service environments that similar to one another. Development and change may have vastly different implications for law enforcement service demand from one part of the city to another, which makes it necessary to identify and isolate where these differences exist.

To begin with, however, almost all of the data elements utilized in the analysis exist at different levels of geography, for instance:

- **Census:** Tracts, block groups, blocks
- **Zoning/land use:** Block or neighborhood, excludes street areas
- **Point layers:** Calls for service incidents from CAD data, crime occurrences, permitting data
- **Fire Battalion geographic zones:** Fire station locations, Battalion assignments
- **Plat/neighborhood:** Preliminary plat plans and concept plans
- **Overall:** U.S. Census annual estimates, Planning and Development Department projections

The process of developing projections centers on making connections between each of the data elements. Consequently, the analysis requires that the data be transformed into a common set of geography, from which the different elements can be compared and tabulated.

The project team understands that Raleigh has experienced continued growth in the downtown urban core, along with growth around NC State University, and is seeing an uptick of redevelopment and new growth around Dorothea Dix Park and the North Hills area. Much of this development is mixed use with a broad mix of retail, office, and

residential features. Furthermore, much of the new development is multi-story structures, with some buildings exceeding 10-stories.

Finally, the project team confirmed with City Planning Department staff that the City is working on expanding the bus rapid transit routes. Bus rapid transit routes would initially focus on connecting the downtown area to NC State University, the North Hills area (capital boulevard), and to the east of downtown. Rapid transit lines are proposed along existing corridors and includes areas that are expected to continue to see infill and new development.

The process of developing projections centers around making connections between each of the data elements. Consequently, the analysis requires that the data be transformed into a common set of geography, from which the different elements can be compared and tabulated.

The project team elected to use battalions, as they shared the most in common across all types of datasets and provided for a familiar frame of reference. However, even within individual battalions, service environments can often vary extensively. For instance, Battalion 5 includes a diverse mix of land use with a combination of single family residential, but is experiencing mixed use and tall multi-story buildings. Growth impacts may occur rapidly in one area, while remaining neutral in the other. Based on recent and expected development trends, the project team used the current district boundaries as the basis for developing future workload and staffing needs.

The following map provides an overview of the different planning areas established by the project team:



(3) Analysis of Projected Population Growth

While the data we received includes credible and defensible estimates for population at an overall level, it does not necessarily tie into the level of geography selected for the analysis – fire battalion subdivisions. The project team was provided with relevant historic permit data for Raleigh at the address level, which allowed future growth trends to be applied to each battalion. Therefore, the project team utilized most recent U.S. Census data and historical housing units to determine the current percentage of population in each battalion. This calculation was used to determine the baseline population for each battalion.

Raleigh has experienced significant growth since the last census in 2010. The U.S. Census Bureau estimated Raleigh's population to be 469,298 in 2018. The projected

population for Raleigh in 2040 is 683,036. The following tables project population by fire battalions to 2040.

Projected Population by Battalion									
	2020	2030	2040	+ / - %					
Battalion 1	95,229	111,343	127,470	33.86%					
Battalion 2	104,509	126,107	146,465	40.15%					
Battalion 3	78,605	103,835	125,251	59.34%					
Battalion 4	109,143	113,243	121,968	11.75%					
Battalion 5	122,689	142,052	161,881	31.94%					
Total	510,175	596,580	683,035	33.88%					

Over the 20-year planning horizon, the population is projected to grow 33.88%, totaling 683,000 residents. Battalion 2 is projected to grow the greatest, approximately a 59% increase in population by 2040 and Battalion 4 the least with a 12% increase.

The table below illustrates the projected population density for each of the Battalions. By 2040 the population densities are projected to be in excess of 4,000 residents in all five battalions.

Projected Population Density by Battalion

	Sq. Miles	2020	2025	2030	2035	2040
Battalion 1	24.8	3,834	4,159	4,484	4,809	5,133
Battalion 2	29.7	3,518	3,816	4,114	4,412	4,711
Battalion 3	23.0	3,416	3,705	3,995	4,284	4,573
Battalion 4	36.3	3,007	3,261	3,516	3,771	4,026
Battalion 5	35.3	3,481	3,775	4,070	4,365	4,660

However, population is not a sole driver of workload as the downtown population is much higher during the weekday as it is primarily office space, state owned property, and commercial development.

(4) Calls for Service Rates by Planning Area

As population totals change in each area, the previous three years of calls for service are highly predictive of the next year's total, relative to the magnitude of growth and development taking place. Using the calls for service rates for the past three years, an average annual rate is used to forecast the calls for service for the future. The average annual rate was established using the calls for service as a percentage of the population. Based on this, the current call volume equals 8.9% of the population of the City of Raleigh. The calls for service for each Battalion was used to establish a percentage of the total calls as illustrated in the table below.

	Pct. of Total Calls	2020	2025	2030	2035	2040
Battalion 1	14.3%	6,467	7,015	7,563	8,111	8,659
Battalion 2	25.8%	11,684	12,674	13,663	14,653	15,644
Battalion 3	25.3%	11,436	12,404	13,373	14,342	15,311
Battalion 4	10.4%	4,699	5,097	5,494	5,893	6,291
Battalion 5	24.2%	10,939	11,865	12,791	13,718	14,645
Total		45,225	49,055	52,885	56,717	60,549

Projected Calls for Service by Battalion

Calls for service are projected to increase proportionally to the population projections through the year 2040. By 2040, a total of 60,500 calls for service are expected to be received by the fire department. Battalions 2 and 3 are expected to have the higher call volumes with Battalion 5 right behind over the next 20 years.

(5) **Projected Workload Contributing Factors**

In addition to the calls for services, unit hour utilization is another factor to consider. This is the amount of time units are committed to calls and may not be available for the next call. As the committed time approaches and exceeds 10%, the likelihood the unit will not be capable of meeting the 90% performance objective increases.

The table below projects the unit hour utilization for each company for the next 20 years. Using the average call duration for the past three years and the number of projected calls, the time committed to calls is annualized. This is then divided by the number of hours in the year to arrive at the percentage of time the unit is committed to calls for service.

Unit	2018	2020	2025	2030	2035	2040
Engine 12	10.6%	11 4%	12 4%	13.3%	14 3%	15.3%
Engine 11	9.9%	10.9%	11.8%	12.7%	13.7%	14.6%
Engine 19	9.2%	10.2%	11.1%	11.9%	12.8%	13.7%
Engine 8	9.2%	9.6%	10.4%	11.2%	12.0%	12.8%
Engine 15	9.0%	9.8%	10.6%	11.4%	12.3%	13.1%
Engine 3	8.7%	9.7%	10.5%	11.4%	12.2%	13.0%
Squad 7	8.2%	9.2%	10.0%	10.7%	11.5%	12.3%
Engine 10	7.7%	7.9%	8.5%	9.2%	9.9%	10.5%
Engine 2	7.5%	7.8%	8.4%	9.1%	9.7%	10.4%
Engine 16	7.5%	9.0%	9.8%	10.5%	11.3%	12.0%
Engine 9	7.4%	8.4%	9.1%	9.8%	10.5%	11.2%
Engine 21	6.7%	8.0%	8.7%	9.4%	10.1%	10.7%
Engine 1	6.6%	7.7%	8.3%	9.0%	9.6%	10.3%
Ladder 2	6.5%	7.0%	7.6%	8.2%	8.8%	9.4%
Ladder 5	6.2%	4.9%	5.3%	5.8%	6.2%	6.6%
Engine 22	6.1%	6.8%	7.3%	7.9%	8.5%	9.1%
Engine 20	6.1%	7.2%	7.8%	8.4%	9.1%	9.7%
Squad 14	5.7%	6.6%	7.2%	7.7%	8.3%	8.8%
Ladder 4	5.5%	6.5%	7.0%	7.6%	8.1%	8.7%
Engine 17	5.5%	6.2%	6.8%	7.3%	7.8%	8.4%
Engine 13	5.0%	5.8%	6.2%	6.7%	7.2%	7.7%
Engine 4	4.8%	5.6%	6.1%	6.6%	7.0%	7.5%
Engine 18	4.8%	5.6%	6.1%	6.6%	7.0%	7.5%
Engine 26	4.7%	5.5%	6.0%	6.5%	6.9%	7.4%
Engine 28	4.7%	5.3%	5.7%	6.2%	6.6%	7.1%
Engine 5	4.5%	5.2%	5.7%	6.1%	6.5%	7.0%
Engine 23	3.9%	4.0%	4.4%	4.7%	5.1%	5.4%
Engine 25	3.9%	4.2%	4.5%	4.9%	5.2%	5.6%
Engine 24	3.9%	4.3%	4.7%	5.0%	5.4%	5.7%
Engine 27	3.6%	3.7%	4.0%	4.3%	4.6%	4.9%
Ladder 3	3.6%	4.4%	4.8%	5.2%	5.6%	6.0%
Engine 6	3.5%	4.2%	4.5%	4.9%	5.3%	5.6%
Ladder 7	3.3%	4.0%	4.4%	4.7%	5.0%	5.4%
Rescue 1	3.3%	4.0%	4.3%	4.6%	5.0%	5.3%
Ladder 8	3.2%	4.9%	5.3%	5.7%	6.1%	6.5%
Ladder 1	3.1%	3.3%	3.6%	3.9%	4.2%	4.5%
Engine 29	2.7%	2.4%	2.6%	2.8%	3.0%	3.2%
Ladder 6	1.6%	1.8%	1.9%	2.1%	2.2%	2.4%
Ladder 9	1.1%	1.2%	1.3%	1.4%	1.5%	1.6%

Unit Hour Utilization Projection

The highlighted areas indicate the unit hour utilization is at or above 10% of the time the unit is available. As the utilization increases and the response time decreases for that unit, an additional company may be necessary to handle the call volume. This need should be determined when units are no longer able to meet stated travel time

performance objectives at the 85th percentile as that indicates new resources need to be deployed to improve performance according to the Center for Public Safety Excellence (CPSE).

2 Projected Operations Staffing Needs

The concentration of resources is the most important issue facing the Fire Department currently versus initial travel time performance and unit utilization rates. This is especially true for high-rise and mid-rise operations. From a structure fire risk profile, these buildings require an initial response force of up to 50 personnel. New construction and development are anticipated in and around the downtown core including the University and Dorothea Dix Park area. To provide the number of personnel needed to assemble an effective response force, staffing in the stations around the downtown area should be increased as these buildings are occupied.

The table below illustrates the staffing levels for the seven companies in the area.

Station and Company	Existing Minimum Staffing	Proposed Minimum Staffing
Station 1		
Engine 1	3	4
Engine 13	3	4
Ladder 4	4	4
Station 2		
Engine 2	3	4
Station 3		
Engine 3	3	4
Station 5		
Engine 5	3	4
Station 7		
Squad 7	3	4
Station 20		
Engine 20	3	4
Ladder 7	4	4

Minimum Staffing Changes

Essentially, this plan increases the staffing of these six stations with every three high-rise structures occupied. This additional staffing ensures adequate concentration of personnel to effectively mitigate emergencies in the existing inventory of high-rise structures and the older construction found in the downtown area. Adding personnel in a synchronized

fashion as new high-rise occupancies are constructed and occupied allows the City to ensure there is adequate emergency response forces available as development occurs. The timing of the staffing additions is based on the occupancy of the high-rise buildings. For example, the Dorothea Dix Park area may not be built for several years or it may be fast-tracked and built quickly. The timing of the staffing increases is designed to be in conjunction with the building completion and occupancy.

	2020	2025	2030	2035	2040
Battalion 1	86	86	86	86	86
Battalion 2	103	106	106	109	109
Battalion 3	129	132	138	138	138
Battalion 4	104	104	104	104	104
Battalion 5	119	119	119	119	119
Total	541	547	553	556	556

Projected 20 Year Staffing Needs in Operations

3 Comprehensive Staffing Projections Needs

The service needs projections have provided the basis of the methodology used to determine staffing needs of core functions that scale directly with service needs, including firefighters, lieutenants and captains, as well as fire prevention. From this important foundation, the staffing needs for every other department function are then able to be developed. The majority of these projections are interrelated to the staffing needs of operations and fire prevention, either through changes to service needs, or as a result of organizational/support factors. It is critical that the process of developing projections for the entire department be done position by position, rather than scale the department as a whole, given that the factors contributing to an individual position's staffing needs are unique and different from those of another position.

As detailed previously in the chapter, five primary scaling factors are involved in determining how the staffing needs for an individual role change as growth occurs in the jurisdiction. The needs for an individual position may be based on:

• Service needs and related workloads (e.g., operations staffing scales to the community risk profile, call for service workloads, travel time performance and unit utilization).

- Relationship to workloads created by other positions (e.g., support workloads increase as staffing increases).
- Spans of control and management responsibilities (e.g., command and supervisory staffing is set by achieving a targeted span of control).
- Size of command/division or organization (e.g., human resources staffing needs based on number of positions in the department they support).
- Non-scalable (e.g., there is only one Fire Chief).

Using these scaling factors, the projection analysis determines the staffing levels needed over the next twenty years. The following pages contain this analysis, provide an overview of the projection factors utilized for each position in calculating needs through the year 2040. The table also includes the current authorized number of positions.

In reviewing the projections, it should be noted that the positions highlighted in a **green font** are new positions for the Department and those highlighted in blue are transferred positions.

Projected Staffing – Office of the Chief

Unit	Employee Classification	Projection Factors	2020 Authorized	2025	2030	2035	2040
OFFICE OF	THE CHIEF						
Chief	Chief	Executive position; does not scale.	1	1	1	1	1
Fiscal	Senior Fiscal Analysist	Executive position; does not scale.	1	1	1	1	1
Fiscal	Senior Financial Specialist	Unique role; scales based on size of the agency	1	1	2	2	2
Fiscal	Administrative Tech	Unique role; does not directly scale.	1	1	2	2	2
Technology	Technology Supervisor	Unique role; scales based on Span of Control	1	0	0	0	0
Technology	Senior Technology Specialist	Unique role; scales based on size of the agency	2	0	0	0	0
Planning	Engineer Planning Officer	Unique role; does not directly scale.	1	0	0	0	0
Safety	Safety Officer	Unique role; does not directly scale.	1	4	4	7	7
OFFICE OF	THE CHIEF TOTAL		9	8	10	13	13
CFS Increase				8.47%	16.94%	25.41%	33.80%

Projected Staffing – Office of the Fire Marshal

Unit	Employee Classification	Projection Factors	2020 Authorized	2025	2030	2035	2040
OFFICE OF THE	FIRE MARSHAL						
Admin	Assistant Chief	Executive position; does not scale.	1	1	1	1	1
Admin	Division Chief	Executive position; does not scale.	0	1	1	1	1
Admin	Administrative Specialist	Unique role; does not directly scale.	1	1	1	1	1
Admin	Captain - Fire Investigator	Management position; scalable based on the number of direct reports.	1	1	1	1	1
Field Inspections	Asst. Fire Marshal	Unique role; scales based on Span of Control	3	4	4	4	4
Field inspections	Deputy Fire Marshal	Scales to workload and number of staff.	20	24	25	26	26
New Construction	Asst. Fire Marshal	Unique role; scales based on Span of Control	1	1	1	1	1
New Construction	Deputy Fire Marshal - Pans Examiner	Scales to workload and number of staff.	4	4	4	4	4
New Construction	Deputy Fire Marshal - Field Inspections	Scales to workload and number of staff.	5	6	6	6	6
Public Education	Deputy Fire Marshal	Unique role; scales based on Span of Control	1	1	1	1	1
Public Education	Senior Firefighter	Scales to workload and number of staff.	1	3	3	3	3
OFFICE OF THE	FIRE MARSHAL TOTA	L	38	47	48	49	49
CFS Increase				8.47%	16.94%	25.41%	33.80%

Projected Staffing – Training Division

Unit	Employee Classification	Projection Factors	2020 Authorized	2025	2030	2035	2040
TRAINING							
Administration	Assistant Chief	Executive officer position; scales at 1 per division.	1	1	1	1	1
Administration	Division Chief	Executive officer position; scales at 1 per division.	1	1	1	1	1
Administration	Administrative Specialist	Support position; scales at 1 per Division.	1	1	1	1	1
Academy	Captain	Management position; scales at 1 per team.	1	1	1	1	1
Career Development	Captain	Management position; scales at 1 per team.	1	1	1	1	1
Hazmat	Captain	Management position; scales at 1 per team.	1	1	1	1	1
Logistics	Lieutenant	Management position; scales at 1 per team.	1	1	1	1	1
USAR	Captain	Management position; scales at 1 per team.	1	1	1	1	1
EMS	Captain	Management position; scales at 1 per team.	1	1	1	1	1
EMS	Deputy EMS Coordinator	Elective priority; scales based on level of coverage/enforcement desired as a proactive unit.	1	1	1	1	1
EMS	Assistant EMS Coordinator	Scales to supervisory spans of control. Spans of control range between 6 and 9 subordinates.	0.5	1	1	1	1

Unit	Employee Classification	Projection Factors	2020 Authorized	2025	2030	2035	2040
EMS	QA/QI Coordinator	Scales to the workload demands of the Division	0	1	2	2	2
Recruitment	Recruitment Specialist	Scales to the workload demands of the Division	0	1	2	2	2
Instruction	Instructors	Scales to the workload demands of the Division	0	8	8	9	10
TRAINING T	OTAL		10.5	21	23	24	25
CFS Increase			8.47%	16.94%	25.41%	33.80%	8.47%

Projected Staffing – Operations

Unit	Employee Classification	Projection Factors	2020 Authorized	2025	2030	2035	2040
OPERATIO	DNS						
Admin	Assistant Chief	Executive officer position; scales at 1 per division.	1	1	1	1	1
Admin	Admin Specialist	Executive officer position; scales at 1 per division.	1	1	1	1	1
Admin	Lieutenant - Chiefs Aide	Executive officer position, scales at one per Assistant Chief.	1	1	1	1	1
Admin	Division Chief	Executive officer position, scales at one per shift	3	3	3	3	3
Admin	Firefighter Chief Aide	Scales at one per Division Chief	3	3	3	3	3
BATTALION	ONE						
Admin	Battalion Chief	Executive officer position; scales at 1 per shift.	3	3	3	3	3
Supervisor	Captain	Supervisor Scales at one per assigned apparatus	18	18	18	18	18
Supervisor	Lieutenant	Supervisor Scales at one per assigned apparatus	18	18	18	18	18
Operations	Firefighter	Elective priority; scales based on level of coverage desired at the District station.	46	46	46	46	46
BATTALION	TWO						
Admin	Battalion Chief	Executive officer position; scales at 1 per shift.	3	3	3	3	3

Unit	Employee Classification	Projection Factors	2020 Authorized	2025	2030	2035	2040
Supervisor	Captain	Supervisor Scales at one per assigned apparatus	21	21	21	21	21
Supervisor	Lieutenant	Supervisor Scales at one per assigned apparatus	24	24	24	24	24
Operations	Firefighter	Elective priority; scales based on level of coverage desired at the District station.	58	61	61	64	64
BATTALION	THREE						
Admin	Battalion Chief	Executive officer position; scales at 1 per shift.	3	3	3	3	3
Supervisor	Captain	Supervisor Scales at one per assigned apparatus	27	27	27	27	27
Supervisor	Lieutenant	Supervisor Scales at one per assigned apparatus	30	30	30	30	30
Operations	Firefighter	Elective priority; scales based on level of coverage desired at the District station.	65	77	85	85	85
BATTALION	FOUR						
Admin	Battalion Chief	Executive officer position; scales at 1 per shift.	3	3	3	3	3
Supervisor	Captain	Supervisor Scales at one per assigned apparatus	24	24	24	24	24
Supervisor	Lieutenant	Supervisor Scales at one per assigned apparatus	27	27	27	27	27
Operations	Firefighter	Elective priority; scales based on level of coverage desired at the District station.	53	53	53	53	53
BATTALION	FIVE						

Unit	Employee Classification	Projection Factors	2020 Authorized	2025	2030	2035	204
Admin	Battalion Chief	Executive officer position; scales at 1 per shift.	3	3	3	3	3
Supervisor	Captain	Supervisor Scales at one per assigned apparatus	27	27	27	27	27
Supervisor	Lieutenant	Supervisor Scales at one per assigned apparatus	30	30	30	30	30
Operations	Firefighter	Elective priority; scales based on level of coverage desired at the District station.	61	61	61	61	61
OPERATIONS TOTAL		553	568	576	579	579	
CFS				8.47%	16.94%	25.41%	33.80%

Increase

Projected Staffing – Services Staffing

Unit	Employee Classification	Projection Factors	2020 Authorized	2025	2030	2035	2040
SUPPORT SE	RVICES						
Administration	Assistant Chief	Executive officer position; scales at 1 per division.	1	1	1	1	1
Administration	Division Chief	Executive officer position; scales at 1 per division.	1	1	1	1	1
Support	Clerical	Support position, scales on workload	0	2	2	3	3
Facilities	Lieutenant	Support position; scales at 1 per Division.	1	1	1	1	1
Facilities	Fire Services Assistant	Support position, scales on workload	1	2	2	3	3
Facilities	Fire Services Coordinator	Support position, scales on workload	1	2	2	2	2
Garage	Supervisor	Supervisor, scales by span of control	1	1	1	1	1
Garage	Mechanic	Support position, scales on workload	5	7	8	8	8
Garage	Inventory Specialist	Support position, scales on workload	1	2	2	2	2
Technology	Technology Supervisor	Unique role; scales based on Span of Control	0	1	1	1	1
Technology	Senior Technology Specialist	Unique role; scales based on size of the agency	0	2	2	2	2

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Planning	Engineer Planning Officer	Unique role; does not directly scale.	0	1	1	1	1	
Planning	Planning Analyst	Unique role; does not directly scale.	0	1	1	1	1	
SERVICES	TOTAL		12	24	25	27	27	
CFS Increase				8.47%	16.94%	25.41%	33.80%	
Summary	of	Proj	ected	Staffing				
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Division	2020 Authorized	2025	2030	2035	2040
Chief's Office	9	8	10	13	13
Fire Marshal	38	47	48	49	49
Training	10.5	21	23	24	25
Operations	553	568	576	579	579
Services	12	24	25	27	27
Grand Total	622.5	668	682	692	693

Appendix – Results of the Employee Survey

As part of the Matrix Consulting Group's study for the City of Raleigh, the project team distributed an anonymous survey to Fire Department employees in order to gauge their opinions on a variety of topics relevant to the study. This survey generally asked two types of questions:

- **Respondent Demographic Questions:** Respondents were asked to indicate their current work assignment and level within the organization.
- **Multiple Choice Questions:** Respondents were presented with a number of multiple-choice questions, or statements where respondents indicated their level of agreement or disagreement with the statement.

The survey was distributed electronically to all Raleigh Fire Department employees in September 2019. A total of 496 responses were received for an 83% response rate.

1. Summary of Key Findings

While a more detailed analysis can be found in the sections below, the following bullet points summarize the key findings of the responses received to this survey:

Organizational Structure

- The current organizational structure and spans of control are appropriate.
- The expectations and needs of the community are generally met.

Training

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- Fire training programs provide the necessary skills to effectively perform job duties.

• Technology and Equipment

- Fire respondents have adequate equipment and technology to perform duties, however improvements can be made.

Staffing

- Respondents feel the department as a whole does not have the staff to meet performance objectives and take on extra work, while opinion on backlog management is split among divisions.

• Workload

- There has been a significant increase in workload and respondents feel they cannot handle more work.

The following sections provide greater details on survey responses.

2. Survey Respondent Demographics

While the survey was anonymous, it asked respondents to indicate their current rank and work assignment. These responses are used later in the survey to show differences in opinion between different respondent groups. The following tables and charts show the responses received to each of these questions.

(1) Respondent Rank

The first question asked respondents what their current rank is. The following chart and table detail the responses received. The following chart and table detail the responses received.





Response	Count	Percentage
Assistant / Division / Battalion Chief	22	4%
Captain	116	23%
Lieutenant	103	21%
Firefighter	214	43%
Assistant / Deputy Fire Marshal	24	5%
Staff - Other	17	3%
Total	496	100%

Firefighters are the most common (43%) survey respondent, while Captain (23%) and Lieutenant (21%) are the next two ranks with the most respondents.

(2) Respondent Divisions.

The next question asked respondents about their current Division they are assigned to in the department. The following chart and table detail the responses received.



What Division are you currently assigned?

A strong majority (88%) of respondents are in the Operations	Division,	while	12% of
respondents are assigned to the Administration, Fire Marshal,	Services,	and	Training
Divisions.			

496

Total

100%

3. Multiple Choice Questions

The following sections present the results of the multiple-choice questions asked to survey respondents.

(1) Raleigh Fire Department as A Whole

The next section of the survey asked respondents to indicate their level of agreement or disagreement with statements about the Fire Department. The response options were "strongly agree" (SA), "agree" (A), "disagree" (D), and "strongly disagree" (SD), and "No Opinion" (N/O). Respondents could also opt out of responding to the statement, in which case they were not counted among the responses received for that statement.

(1.1) The Current Organizational Structure and Spans of Control are Appropriate.

The table below shows responses received to statements about the organizational structure.

#	Statement	SA	Α	D	SD	N/O
1	The current organizational structure is appropriate for our Department.	12%	64%	14%	7%	3%
2	Spans of control are adequate in our Department.	11%	60%	19%	8%	2%

Respondents generally feel the organizational structure is appropriate and spans of control is adequate, however, some improvements can be made.

- Respondents feel the organizational structure is appropriate for the **Department:** Most (76%) respondents agree with <u>Statement #1</u> and feel the current organizational structure is appropriate.
- The spans of control are generally adequate, with some disagreement: Most (71%) respondents agree with <u>Statement #2</u> and feel the spans of control are adequate, while 27% disagreed.

(1.2) Community Expectations and Needs are Generally Met.

The table below shows responses received to statements about meeting community needs and expectations to response times.

#	Statement	SA	Α	D	SD	N/O
3	We are able to meet the expectations of the community in our response time to emergency / high priority incidents.	15%	57%	20%	5%	3%
6	Our department is able to provide preventative services that meet the needs of the community.	13%	61%	18%	3%	6%

Respondents generally feel meeting community expectations for response times and policing efforts are appropriate.

- **Community expectations to response times are generally met:** Most (72%) respondents feel the department is able to meet the community expectation for response times, with a quarter (25% in) disagreement, including 41% of those that indicated being ranked an Assistant / Division / Battalion Chief.
- The department is able to provide preventative services that meet the community's needs: A majority (74%) of respondents agree with <u>Statement #6</u> and find the Department is able to provide preventative services that meet the needs of the community.

(1.3) Fire Training Programs Provide Necessary Skills to effectively perform job duties.

The table below shows responses received to a statement about training.

#	Statement	SA	Α	D	SD	N/O
4	Current training programs provide me with the necessary skills to effectively do my job.	15%	65%	14%	4%	2%

The heaviest concentration of responses to these statements fell to the "agree" and "strongly agree" categories. A strong majority (80%) of respondents feel the current training program provides the necessary skills to effectively do their job.

(1.4) Fire Operations are Effective.

The table below shows responses received to a statement about operations.

#	Statement	SA	Α	D	SD	N/O
7	The operations of the Fire Department divisions are effective.	12%	67%	14%	3%	4%

Fire operations are generally effective: 79% of respondents feel the operations of the department are effective, while 17% indicated some level of disagreement.

(1.5) Respondents Have Adequate Equipment and Technology to Perform Duties, However Improvements Can Be Made.

The table below shows responses received to statements about equipment and technology.

#	Statement	SA	Α	D	SD	N/O
5	Equipment necessary to complete our duties is always available and in working condition.	10%	55%	27%	5%	3%
8	We are provided adequate technology resources to effectively perform our duties.	9%	55%	26%	7%	2%

The heaviest concentration of responses to these statements fell in the "agree" and categories.

- Respondents feel they have the equipment to perform duties, but can use more: Most (65%) respondents generally feel they have the equipment necessary to complete duties, while some (32%), including 45% of those that indicated being ranked a Lieutenant disagreed with this statement.
- Respondents feel they have the technology to perform duties, but can use more: A majority (64%) indicated they feel they have the adequate technology to effectively perform duties. One-third (33%) of respondents indicated they feel technology can improve, including 55% of those that indicated being ranked Assistant / Division / Battalion Chief.

(2) Division Specific Statements Related to Operations

The following table shows the total responses from all divisions received to statements about the specific division the respondents work in.

(2.1) Respondents From All Divisions Feel They Does Not Have the Staff to Meet Performance Objectives and Take on Extra Work, While Opinion on Backlog Management Is Split Among Divisions.

The following table shows the responses from all respondents.

#	Statement	SA	Α	D	SD	N/O
1	We have adequate staffing in our Division to meet performance objectives.	1%	9%	41%	47%	2%
2	We have a manageable backlog of work in our Division.	3%	46%	29%	8%	15%
3	We have the capacity to take on extra work in our Division.	2%	15%	51%	27%	6%

Respondents generally feel that there is a lack of adequate staffing across the organization and in their division, but have a manageable backlog of work.

- **Respondents feel their department lacks adequate staffing:** Strong majority (88%) of respondents disagreed with <u>Statement #1</u> and feel the department lacks the adequate staffing to meet performance objectives.
- Opinion on the ability to manage a backlog of work is split: A plurality (49%) feel their division is unable to manage the backlog of work in their division. 37% of all respondents feel backlog is unmanageable, including 79% of Assistant / Deputy Fire Marshal's, suggesting their workload is heavier than other ranks.
- There is no capacity to take on extra work: A majority (78%) of respondents disagreed with <u>Statement #3</u> and feel their division does not have the capacity to take on extra work.
- (2.2) Operations Staff Feel Their Division Does Not Have The Staff to Meet Performance Objectives and Manage Backlogs, but Cannot Take on Extra Work.

The following table shows the responses received from those respondents that indicated they are in the Operations Divisions to the same statements.

#	Statement	SA	Α	D	SD	N/O
1	We have adequate staffing in our Division to meet performance objectives.	0%	9%	41%	48%	1%
2	We have a manageable backlog of work in our Division.	3%	50%	26%	6%	16%
3	We have the capacity to take on extra work in our Division.	1%	16%	51%	25%	6%

- **Respondents feel their division is inadequately staffed:** An overwhelming majority (89%) of respondents that indicated some level of disagreement with <u>Statement #1</u> and feel their division is not adequately staffed.
- **The Operations division is generally able to manage the backlog of work:** A majority (53%) feel the division is able to manage the backlog of work in their division. 32% feel the backlog is not manageable, including 45% of Assistant / Division / Battalion Chief's, suggesting their backlog workload may be heavier than other ranks.
- There is no capacity to take on extra work: Similar to the department as a whole, Operations staff generally disagreed (76%) with <u>Statement #3</u> and feel their division does not have the capacity to take on extra work.

The responses to these questions generally align with those of the department as a whole.

(2.3) Administration, Fire Marshal, Services, and Training Divisions Indicated Not Having the Adequate Staff to Meet Performance Objectives, Manage Backlogs and Cannot Take on Extra Work.

The following table shows the responses received to the same statements from those respondents that indicated they are in the Administration, Fire Marshal, Services, and Training Divisions.

#	Statement	SA	Α	D	SD	N/O
1	We have adequate staffing in our Division to meet performance objectives.	3%	10%	42%	40%	5%
2	We have a manageable backlog of work in our Division.	5%	15%	50%	23%	7%
3	We have the capacity to take on extra work in our Division.	5%	5%	48%	38%	3%

- **Respondents feel their division lacks adequate staffing:** A strong majority (82%) of respondents indicated some level of disagreement with <u>Statement #1</u> and feel the department lacks the adequate staffing to meet performance objectives.
- **Respondents feel unable to manage the backlog of work:** A majority (73%) feel the division is unable to manage the backlog of work in their division.
- There is no capacity to take on extra work: A strong majority (86%) of respondents disagreed with <u>Statement #3</u> and feel their division does not have the capacity to take on extra work.

These responses align with the overall responses received from the department.

(3) Workload

This section or statements focused on recent changes in workload, overtime, and ability to handle increased tasks.

(3.1) Respondent Feel There Has Recently Been An Increase in Workload And Cannot Handle More Work.

The following table shows responses received to statements about the specific division the respondents work in.

#	Statement	SA	Α	D	SD	N/O
1	There has been a significant increase in my workload the past two (2) years.	26%	47%	15%	0%	12%
2	I am not required to work excessive amounts of overtime.	18%	60%	10%	4%	8%
3	I could easily handle more work given the available time.	2%	26%	45%	15%	12%

Most respondents have seen a significant increase in workload, but do not feel that they are required to work excessive amounts of overtime. Given their current workload, respondents feel they cannot handle more work given the available time.

• There has been a significant increase in workload: A majority (73%) of respondents agreed with <u>Statement #1</u>, indicating they feel there has been an increase in workload.

- **Respondents feel they are not required to work excessive overtime**. Most (78%) respondents agreed with <u>Statement #2</u> indicating they are not required work excessive overtime.
- **Respondents cannot handle more work given the available time:** A majority (60%) of respondents disagree with <u>Statement #3</u> and feel they do not have the capacity to take on extra work. However, 28% disagree, and feel they are able to handle more work given the available time, 41% of which indicated being Firefighters.