Town of Chapel Hill

North Carolina

November 2021

Fire Department

Station Location STUDY

Emergency Services Consulting International

Providing Expertise & Guidance that Enhances Community Safety

EXECUTIVE SUMMARY

The Chapel Hill Fire Department retained Emergency Services Consulting International (ESCI) to conduct a Fire Station Location Study. ESCI is an international firm providing specialized, high quality, and professional fire, EMS, police, and communications consulting services to organizations throughout the United States and Canada. ESCI, the consulting arm of the International Association of Fire Chiefs (IAFC), has been meeting the needs of emergency services providers since 1976. ESCI consistently provides innovative and sustainable recommendations readily understood by the public and useful to elected officials for setting sound public safety policy. Utilizing over 30 consultants nationwide who are leaders in their respective fields, ESCI provides consulting services to municipalities, districts, non-profit organizations, and the industrial and commercial community.

This document describes the Chapel Hill Fire Department's (CHFD) community risks, response resources, deployment strategies, and service levels. The document identifies and discusses response time objectives and standards for measuring the effectiveness of fire department services and the deployment of its resources. Additionally, recommendations are made to meet current demand, as well as increased services for the future, based on known and anticipated growth in population and needed services.

Station Location Study Methodology

The process involves ESCI consultants developing a work plan after reviewing the approved scope of work. ESCI consultants worked with Chapel Hill Fire Department (CHFD) staff to gain a comprehensive understanding of the organization's past, present, and future plans. Over a period of several months ESCI staff reviewed relevant background information and data about the CHFD service area, service delivery model, capital facilities, staffing models, and the Town's Strategic Goals and Objectives for FY 2020-2022. This information was evaluated against key concepts related to fire departments and national trends to identify best practices. Those identified best practices are aligned with standards and recommendations from the National Fire Protection Association (NFPA), the Insurance Services Office (ISO), the Center for Public Safety Excellence (CPSE), laws and regulations of the State of North Carolina, and other generally accepted practices for emergency services.

ESCI was able to establish a baseline assessment of current community risks and service delivery needs centered around the specialized and technical services provided by the Chapel Hill Fire Department. The purpose of this assessment was to identify risks, hazards, vulnerabilities, and threats in comparison to industry standards and best practices, to determine current and future fire station location needs. ESCI utilizes Geographic Information Systems (GIS) technology and analysis tools to visualize the data and provide additional information in the report.

The performance analysis and development of recommended strategies reviewed the location – allocation of current CHFD fire stations against the geographic road-network and topographical attributes of the community. Based on time intervals identified in the Standards of Response Coverage section of the Self-Assessment Manual published by the Commission on Fire Accreditation International strategies and recommendations were developed for CHFD to improve service.

Organizational Design

The organizational design of an emergency services agency is vitally important to the agency's ability to deliver services in an efficient and timely manner while providing the necessary level of safety and security to the members of the organization, whether career, part-time, paid-on-call, or volunteer. ESCI finds that the structure and function of the CHFD are consistent with the risk, demand, and services provided but will require enhancement in the near future. Recommendations for additional staffing based on current and future demand and occupancy changes are included.

Capital Facilities and Apparatus

If appropriate capital equipment is not available for the use by responders, a fire department cannot deliver services effectively. Two primary capital assets that are essential to the provision of emergency response are facilities and apparatus (response vehicles). CHFD maintains a balance of three basic resources that are needed to carry out its emergency mission: People, equipment, and facilities. Because firefighting is an extremely physical pursuit, the adequacy of personnel resources is a primary concern; but no matter how competent or numerous the firefighters are, the department will fail to execute its mission if it lacks sufficient fire apparatus distributed efficiently.

Stations 1, 3, and 4 are in poor condition and station 5 is in good condition as it relates to this analysis. Stations1, 3, and 4 need replacement soon and should be added to the Town capital improvement plan. Station 2 is a newer station and is still in excellent condition. Specific observations from the tour of each facility can be found in the station summaries.

Appropriately designed and maintained facilities are critical to a fire department's ability to provide services promptly and with the appropriate deployment of assets. ESCI observed and reviewed fire stations operated by CHFD. Many of the buildings are not in compliance with recommendations from the National Fire Protection Association's (NFPA) standard for life safety initiatives.

The following figure provides an overview of CHFD stations and facilities and is followed by detailed findings for each facility in the *Capital Facilities and Apparatus* section of the study.

CHFD Station	Age	Rated Condition	Number of Apparatus	No. of Apparatus Bays	Minimum Staffing
Fire Station 1	58 Years	Poor	2	3 Back-in	4
Fire Station 2	3 Years	Excellent	3	3 Back-in	6
Fire Station 3	51 Years	Poor	2	2 Back-in	3
Fire Station 4	39 Years	Poor	2	2 Back-in	4
Fire Station 5	20 Years	Good	1	2 Back-in	3

Fire Station Apparatus/Vehicles

ESCI evaluated the apparatus and vehicles used by CHFD to accomplish their mission and provide necessary services to the community. Fire suppression apparatus, aerial apparatus (commonly called ladder trucks), special operations and support units, and some command vehicles are unique and expensive pieces of equipment customized to operate for a specific community and defined mission. Other than its firefighters, officers, and support staff, emergency apparatus and vehicles are the next most important resource in a fire department that have a direct impact on service delivery.

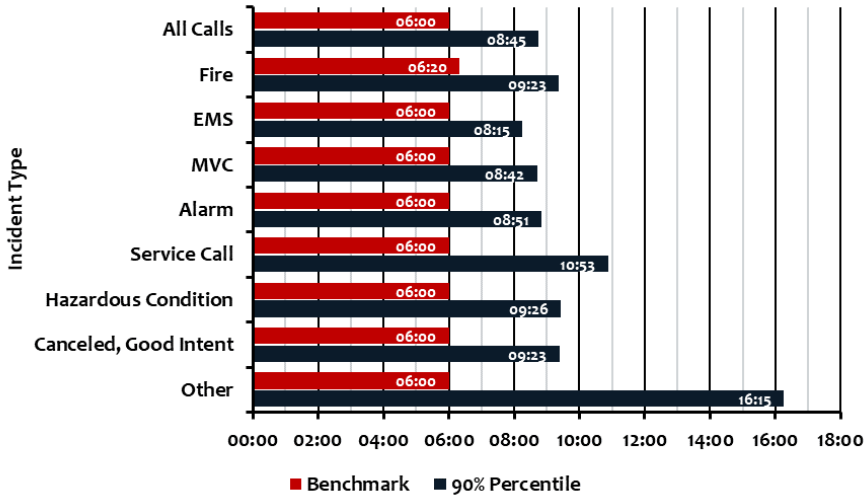
Apparatus must be in good condition, regularly maintained, and configured in a way that ensures reliable, safe, and effective deployment and operations at emergency incidents. As a result, most fire apparatus are very expensive to purchase and maintain and offer little flexibility in use and reassignment to other missions. Additionally, older vehicles tend to increase maintenance costs and can potentially have a negative impact upon response reliability as units experience increased breakdowns and longer out-of-service times. Based on the age and size of the CHFD fleet a necessary funding mechanism to ensure appropriate replacement is recommended. A detailed evaluation of CHFD apparatus is included in the *Capital Facilities and Apparatus* section of the study.

Service Delivery and Response Performance

Response performance criteria and actual service delivery performance are analyzed in detail, providing information with which the department can develop future deployment methodologies and identify desired levels of response performance and staffing.

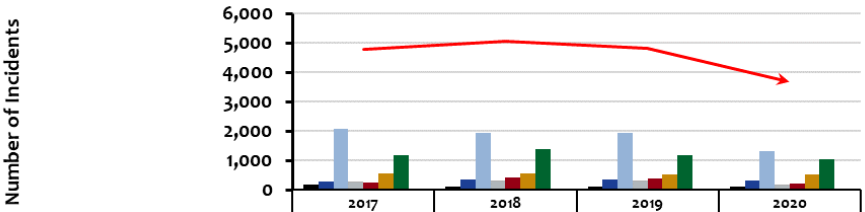
In analyzing response performance, ESCI generates percentile measurements of response time performance. The use of percentile measurement using the components of response time follows the recommendations of industry best practices. The best practices are derived from the Center for Public Safety Excellence (CPSE), Standards of Cover document and 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*.

The following figure provides the overall total response time performance for CHFD. This combines all components of the response—from 911 call until arrival on the scene. Performance ranged from 8 minutes, 15 seconds for emergency medical incidents to 8 minutes, 42 seconds for motor vehicle collisions. The overall performance was 8 minutes, 45 seconds. The entire performance breakdown according to applicable standards can be found in the Service Delivery and Performance section of the study.



Emergency Response Demand Type and Frequency

The demand for services is the primary determinant for managing all emergency services organizations. These service demand elements are the key indicators in conducting periodic studies and analysis to make adjustments to resource distribution and concentration. In the Service Demand section of the report, historical demand and the associated trends within the data are presented and examined for further discussion. The following figure displays CHFD's historical service-demand by year, call-type, and frequency. CHFD is a high performing all-risk fire department that handles multiple types of emergencies and provides services that address identified risk elements within the community. The department responded to 4,773 incidents in 2017, 5,050 in 2018, 4,814 in 2019 and 3,693 incidents in 2020. Calls for service were less in 2020 than previous years due to a decrease in demand because of the COVID 19 pandemic. This significant decrease in 2020 is similar to that found in departments throughout the nation. However, the call load for the current 2021 year is returning back to pre-COVID-19 numbers. As is typically found, a high percentage of incidents are emergency medical calls (39.5% of the total for 2017-2020). The following figure lists CHFD's emergency calls by incident type and frequency for 2018.



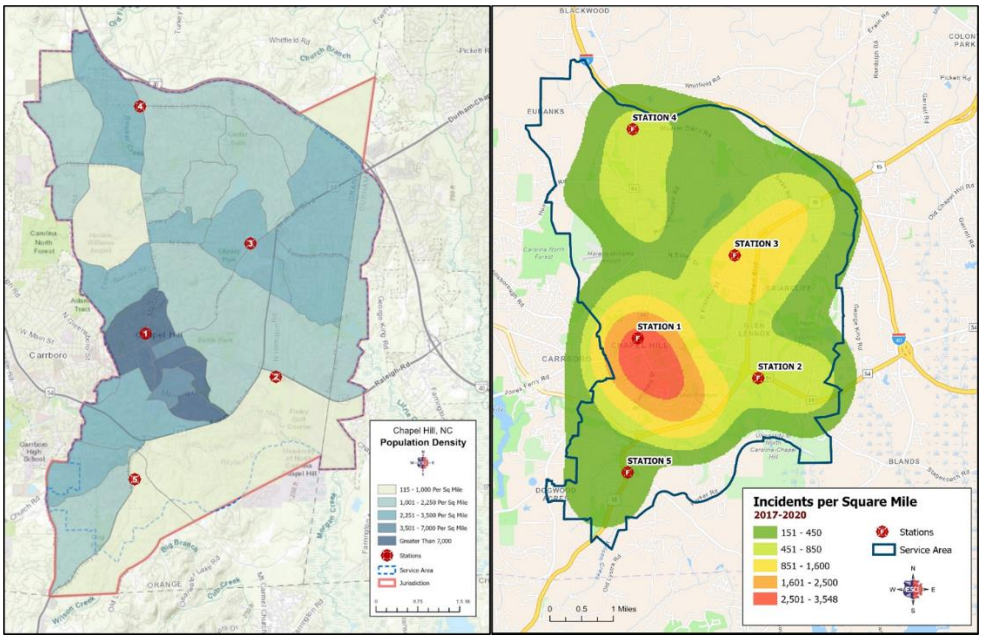
	2017	2018	2019	2020
Fire (100)	184	108	118	101
Hazardous Condition (200, 400)	268	336	335	322
EMS (300 except 322-324)	2,068	1,944	1,920	1,313
MVC (322-324)	279	297	324	191
Service Call (500)	229	428	388	197
Canceled, Good Intent (600)	546	538	532	513
Alarm (700)	1,178	1,385	1,190	1,051
Other (800, 900)	21	14	7	5
Total	4,773	5,050	4,814	3,693

Incident Types

Population Density and Service Demand

The primary driver of service demand is population numbers and density. ESCI looked at historical and three sources of future population projections to establish a range of population increases that should be utilized in a manner that matches the conditions on the ground. For purposes of analyzing population density, ESCI uses the density as recorded by the U.S. Census Bureau for 2020 within each census block—the smallest unit of division within the census data. The population density in some areas of the jurisdiction is as high as 7,000 people per square mile.

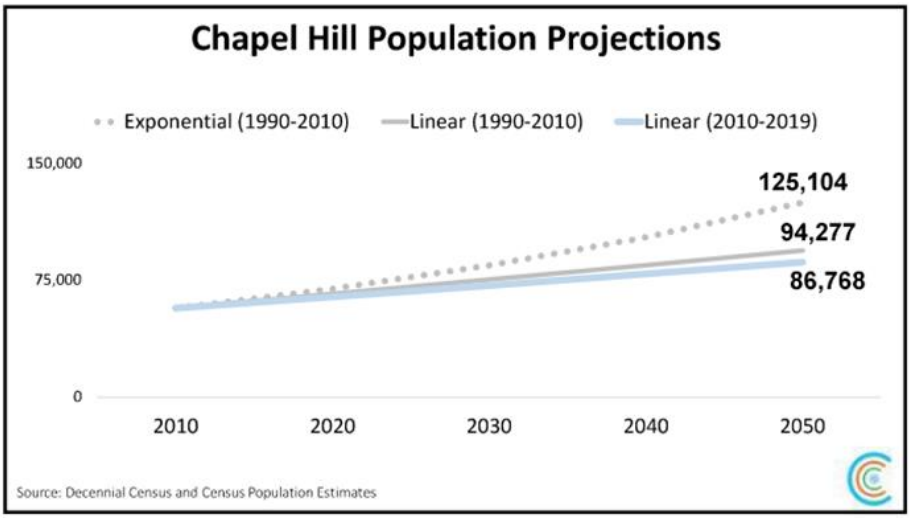
The population density for Chapel Hill is illustrated below, with color changes from lighter to darker coinciding with population density changes from lower to higher. Additionally, the service demand for 2017-2020 discussed above is offered for comparison.



Future Population Projections

ESCI researched the historical and future projections from available comprehensive growth plans and the U.S. Census Bureau to develop an overview of historical population representations and future population expectations to provide decision makers with accurate estimates to aid the planning process. Population projections are estimates of the population for future dates. They are typically based on an estimated population consistent with the most recent decennial census. ESCI considered the population growth projections offered by the 2020 State of the Community Data Book who based projections strictly on previous mathematical growth rates, and do not include adjustments for amount of developable land; economic trends or conditions; current land use policies; and/or other similar factors. Their projections are similar to the U.S Census Bureau and predict the population could reach roughly 125,104 by 2050. These predictions use 2.0% for exponential growth, 926 people per year for linear from 1990-2010, and 364 people per year for linear growth during 2010-2019. These numbers are then applied for consolidated growth projections through 2050.

The following figure represents the expected growth Chapel Hill can expect and should use for planning purposes.

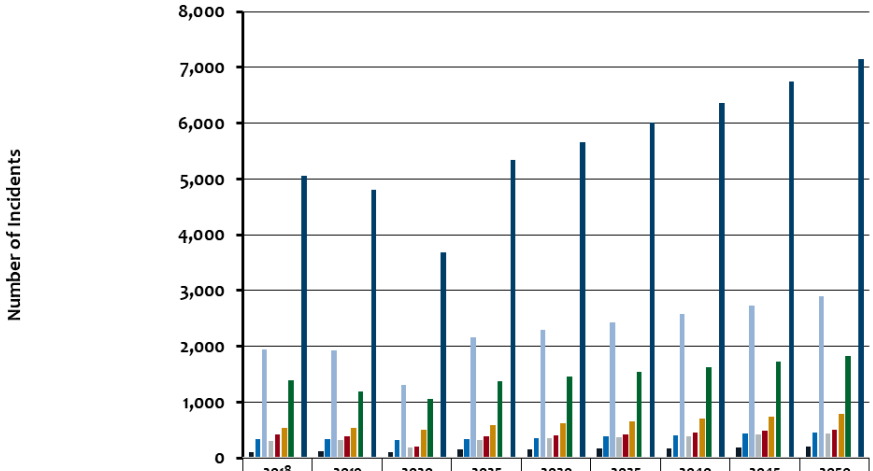


Service Demand Projections

After examining the current conditions and population projections, it is essential to look at future service demand to identify elements of the system that are too far away to respond to anticipated service demand in a timely manner or will be stressed or overutilized. Once these elements are known, data-driven triggers can be established to determine when additional, or reallocated resources are required to meet established response and outcome standards.

Examination of CHFD incident data reveals that service demand decreased from 2017 to 2020. This further suggests that population-based projections are appropriate for these service demand projections, given no major change in the CHFD services provided. Thus, it is anticipated that future CHFD service demands will follow similar patterns. However, if and when the identified future growth takes place, a subsequent increase in service demand will be realized and move the service projections toward the maximum projection.

Based on this assumption, ESCI was able to develop a range of projected increase in service demand—calls for service—from 2018 to 2050. This range was then compared to historical records to determine a projected increase in service demand, based on a comparison of population-based and historically-based service projections, as shown in the following figure. It is important to note that these projections are conservative based on the unknown impact of COVID-19 on calls for service during 2020 and the return demand for service post COVID-19 pandemic as the data is not available yet.



	2018	2019	2020	2025	2030	2035	2040	2045	2050
Fire (100)	108	118	101	150	159	168	178	189	200
Hazardous Condition (200, 400)	336	335	322	343	363	385	408	433	458
EMS (300 except 322-324)	1,944	1,920	1,313	2,166	2,296	2,433	2,579	2,733	2,896
MVC (322-324)	297	324	191	329	348	369	391	415	439
Service Call (500)	428	388	197	382	404	429	454	481	510
Canceled, Good Intent (600)	538	532	513	590	625	663	703	745	789
Alarm (700)	1,385	1,190	1,051	1,371	1,453	1,539	1,632	1,729	1,832
Other (800, 900)	14	7	5	15	16	17	18	19	21
Total	5,050	4,814	3,693	5,346	5,665	6,004	6,363	6,743	7,147

Incident Types

Community Risk Analysis

As part of the Station Location Study, a community risk analysis was conducted that provided an assessment of potential risks present in the service area. Physical, economic, and demographic data is utilized to assess the hazards and risks threatening the community. These risks can include natural hazards associated with climate and topography, population and demographics, technological and human-caused hazards, types of structures and their intended uses, and the type of service and transportation infrastructure. This includes exposure to natural and human-made disasters. Of the potential hazards that pose a risk to the Town of Chapel Hill, the risk assessment included in this report identifies several because of the likelihood of everyday occurrence and/or potential consequences.

Community hazards were divided into broad categories, as follows: Structure Fires, Non-structure Fires, EMS-Medical Assist, Rescue, Hazardous Materials, Natural Hazards, Technological Hazards, and Human Hazards. These categories represent an accurate spectrum of the current and anticipated risks seen within the Town of Chapel Hill. These vulnerabilities drive the services and capabilities that the CHFD must maintain throughout the service area.

Recommendations & Strategies

The analysis has undeniably confirmed that the current fire stations are appropriately located based on population and call demand, and that the greatest need faced by CHFD now and in the foreseeable future is not the addition of another fire station(s). Rather, the greatest need indicated by the evaluation is the construction of new fire stations to replace worn and end of life stations as well as the addition of firefighters and response units in the existing stations. To help the organization navigate through the process, the following discussion further defines the short- and long-term strategies that ESCI has identified.

The recommendations and strategies are listed in the following figure, summarized in the pages that follow, and detailed in the *Recommendations & Strategies* section of this study.

Short Term Strategies	Adopted	Completed	Target Date
Response Performance Reporting			
Implement processes to reduce call processing times. The single most cause of delay in the CHFD system has been identified as call processing time. (OC911 handles call processing and dispatch for CHFD) Overall call processing performance for CHFD was 3 minutes, 24 seconds. The NFPA 1221 standard for this performance measure is 60 seconds at the 90th percentile.			

Short Term Strategies	Adopted	Completed	Target Date
Collect accurate and complete response time data for all units assigned to an incident. These times should include call processing and turnout times. This may require working with Orange County 911 Communications to implement Automatic Vehicle Locator (AVL) technology and Mobile Data Terminals (MDT) in the apparatus reporting directly to the Computer Aided Dispatch System (CAD).			
Conduct regular reporting of turn out times with on-going analyses of turnout time delays. Current CHFD includes turnout time as part of the performance measures.			
Expand the incident reporting capability to include geographical distribution working with the Town GIS unit. Include graphical data in annual report.			
Response Deployment			
Place an additional aerial ladder truck in service at Station 3 to maximize aerial ladder truck capabilities. Address the current risk profile and aerial master stream and rescue capabilities within the Town. (This recommendation needs to take ISO requirements for a reserve ladder truck under consideration.)			
Determine structures that require additional effective response force personnel and plan for automatic aid to accomplish the adopted ERF. ERF compliance should be monitored and compared against the NFPA 1710 requirement of 28 personnel on scene within eight minutes of travel time.			
Define fire target hazards and determine what is the necessary ERF for these hazards. This may require conducting a critical task analysis.			
Long Term Strategies	**Adopted**	**Completed**	**Target Date**
Recommendation 1			
Develop and fund an appropriate long-range fire station replacement plan.			
Recommendation 2			
Set minimum staffing based on an Emergency Response Force (ERF) of 17 firefighters.			
Recommendation 3			
Place an additional aerial ladder truck in service at Fire Station 3.			

Short Term Strategies	Adopted	Completed	Target Date
Recommendation 4			
Develop and fund an appropriate long-range apparatus purchasing and replacement plan.			
Recommendation 5			
Establish Funding to Construct a New Training Facility.			

Conclusion

Based on information obtained throughout this process, our assessment is that CHFD has strong leadership and an innovative vision. The department is functioning at a high level commensurate with community expectations. While there is always room for improvement, the department is serving the citizens of Chapel Hill well. The fire department is commended for undertaking this project to initiate a formal plan for future service delivery.

The report referenced in this executive summary provides a considerable amount of technical data, much of which was provided by the Chapel Hill Fire Department and the Town of Chapel Hill and allows the reader to gain a clear understanding of the services provided by CHFD as well as an indication of how those services may be provided in the future. This document is intended to provide department personnel and policymakers with information from which to make informed, data-driven decisions about the future deployment of resources and services in the CHFD service area.

ESCI is confident that the analysis, findings, and recommendations in the report will provide the Town of Chapel Hill and the CHFD with a successful road map for the future. As these goals and enhancements are realized, and the Town continues to grow in size and stature, the citizens of Chapel Hill will continue to receive an exceptional level of service and protection from the dedicated men and women of the Chapel Hill Fire Department.